ILLINOIS NUTRIENT LOSS REDUCTION STRATEGY

Biennial Report 2023

Illinois Department of Agriculture

Illinois Environmental Protection Agency

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

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Biennial Report 2023

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Find definitions of specific agricultural nutrient loss reduction practices – such as cover crop, filter strip, denitrifying bioreactor, buffer, no-till, wetland, water and sediment control basin and more – in the Field Office Technical Guide by the Natural Resources Conversation Service which is available online at efotg.sc.egov.usda.gov/#/state/IL/documents. Select Section 4, and then select Conservation Practice Standards & Support Documents.

Cover Photo: Lake Defiance at Moraine Hills State Park. By Holly Hudson, Chicago Metropolitan Agency for Planning.

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GLOSSARY
OF ACRONYMS AND ABBREVIATIONS

AWQPF	*Agriculture Water Quality Partnership Forum*
BMP	*Best management practice*
CREP	*Conservation Reserve Enhancement Program*
CRP	*Conservation Reserve Program*
CSP	*Conservation Stewardship Program*
DMR	*Discharge monitoring report*
EPA	*Environmental Protection Agency*
EQIP	*Environmental Quality Incentives Program*
FSA	*Farm Service Agency*
GIGO	*Green Infrastructure Grant Opportunities Program*
HAB	*Harmful algal bloom*
HUC-8	*Hydrologic Unit Codes with eight digits*
ICGA	*Illinois Corn Growers Association*
IDNR	*Illinois Department of Natural Resources*
IDOA	*Illinois Department of Agriculture*
IDOT	*Illinois Department of Transportation*
IFB	*Illinois Farm Bureau*
IFCA	*Illinois Fertilizer & Chemical Association*
IPPA	*Illinois Pork Producers Association*
MGD	*Million gallons per day*
MRBI	*Mississippi River Basin Healthy Watersheds Initiative*
MRTN	*Maximum Return To Nitrogen*
MS4	*Municipal Separate Storm Sewer System*
MWRDGC	*Metropolitan Water Reclamation District of Greater Chicago*
NARP	*Nutrient Assessment Reduction Plan*
NASS	*National Agricultural Statistics Service*
NLRS	*Nutrient Loss Reduction Strategy*
NPDES	*National Pollutant Discharge Elimination System*
NRCS	*Natural Resources Conservation Service*
NREC	*Nutrient Research & Education Council*
NWQI	*National Water Quality Initiative*
PCM	*Precision Conservation Management*
PFC	*Partners for Conservation*
RCPP	*Regional Conservation Partnership Program*
SAFE	*State Acres for Wildlife Enhancement*
STAR	*Saving Tomorrow's Agriculture Resources*
SWCD	*Soil and Water Conservation District*
TMDL	*Total maximum daily load*
TNC	*The Nature Conservancy*
UMCW	*Upper Macoupin Creek Watershed*
USDA	*United States Department of Agriculture*
USGS	*United States Geological Survey*
WASCOB	*Water and sediment control basin*
WBP	*Watershed-based plan*
WPCLP	*Water Pollution Control Loan Program*
WQIP	*Water Quality Improvement Program*
WREP	*Wetland Reserve Enhancement Partnership*
WRP	*Water reclamation plant*

CHAPTER 1
EXECUTIVE SUMMARY

The Illinois Nutrient Loss Reduction Strategy, NLRS, is a statewide, collaborative effort working to reduce the amount of nutrients, particularly nitrogen and phosphorus, entering Illinois waterways. The 2023 Biennial Report details the efforts and investments made by NLRS partners and stakeholders across the state to reduce nutrient loss from the agricultural, point source, and urban stormwater sectors in 2021–22. The report also serves as an update to the original 2015 strategy.

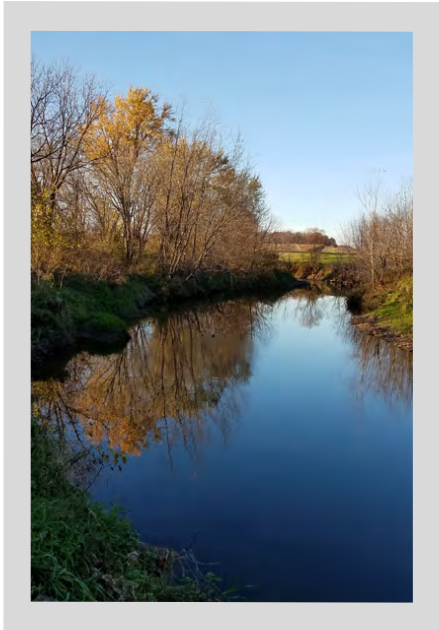


Photo courtesy of Amanda Christenson, Illinois Extension

The 2023 Biennial Report provides updated water quality measures for 2021 and 2022, outlines practice implementation in the agriculture, point source and urban stormwater sectors, and offers forward-looking recommendations. Partner organizations from across the state and across sectors remained devoted to reducing nutrient loss and advancing strategy implementation. The NLRS partnership continues to engage with its partners and stakeholders in overcoming practice implementation barriers, exploring innovative nutrient loss reduction practices, supporting research endeavors, and raising awareness about the importance of water quality in Illinois and beyond.

The long-term objective of the strategy is a 45% reduction in total phosphorus and total nitrogen loads originating in Illinois, with interim targets of a 15% decrease in nitrate-nitrogen and a 25% decrease in total phosphorus by 2025. Nutrient levels in Illinois waterways continued to increase in 2021 and 2022 compared to baseline measurements, and the NLRS partnership anticipates the strategy will

> *"Nutrient levels in Illinois waterways continued to increase in 2021 and 2022 compared to baseline measurements."*

likely fall short of its 2025 interim goals, particularly for phosphorus. This is despite multi-sector investments in resources and practices that support nutrient loss reduction across the state.

Nutrient load increases are driven by a variety of factors, such as increased streamflow, legacy nutrients, nutrient management, and other unknown sources. The effects of climate change are also contributing factors. Despite the continued implementation of nutrient loss reduction practices across sectors, barriers remain. Particularly, the agriculture sector requires a swifter and more extensive adoption of conservation practices to meet the established goals.

The Illinois NLRS fosters a partnership to improve water quality within and downstream of Illinois to reduce the hypoxic zone in the Gulf of Mexico. Illinois' strategy emphasizes the need for additional investments in human and capital resources to facilitate outreach, education, and implementation of best management practices on land and in wastewater treatment facilities.

Details about the creation of the Illinois NLRS, its contributors, and its goals are available in chapter 2 of the report. More information about the strategy and a digital version of this report are available online at go.illinois.edu/NLRS.

2021–22 Updates

This report is the fourth update to the Illinois NLRS and provides the public with information on the strategy's implementation. The strategy continues to be guided by the NLRS Steering Committee, comprised of the Illinois Environmental Protection Agency, Illinois EPA, Illinois Department of Agriculture, IDOA, and University of Illinois Extension, with input and feedback from the Policy Working Group and several other stakeholder groups and councils.

Water Quality

The Illinois Nutrient Loss Reduction Strategy's development and implementation is guided by research and the best available science. The original science assessment was established in the 2015 NLRS. It identified water quality conditions, determined critical watersheds, recommended reduction practices for each sector, and proposed scenarios to reach the reduction targets. The assessment is updated in each biennial report with the latest metrics and research to track progress toward the established reduction goals and to identify gaps in the understanding of nutrient dynamics that warrant further research.

Statewide nutrient levels are still higher than interim targets, with phosphorus being a significant concern. The 2017–21 five-year average nitrate-nitrogen loads increased 4.8%, and total phosphorus loads increased 35%, compared to the 1980–1996 baseline (Figure 1.1). River flow, or water yield, was 23% higher than the baseline. The five-year averages for nitrate-nitrogen loads, total phosphorus loads, and streamflow all decreased in 2017–21 compared to the previous 2016-20 averages of 16.2%, 42%, and 30% above baseline.

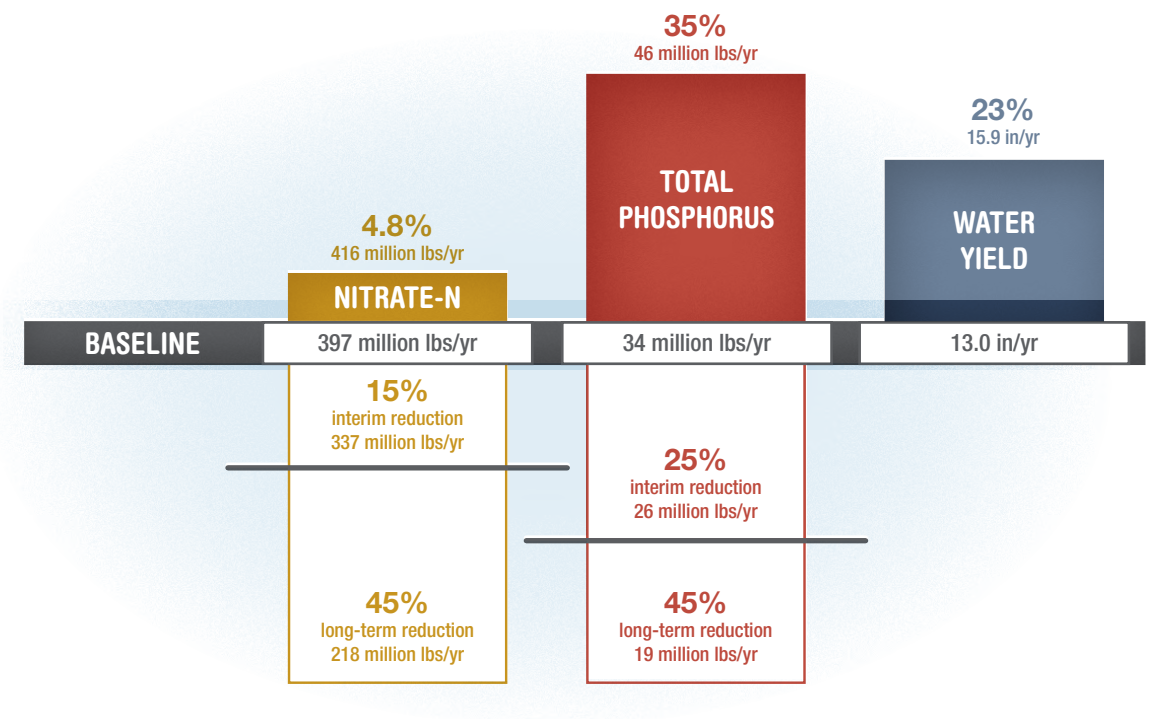


Figure 1.1 *Quantities and percent increases of recent five-year averages (2017–21) of nitrate-nitrogen, total phosphorus, and water yield relative to baseline and to interim and long-term NLRS goals in Illinois.*

Greater runoff and drainage associated with climate change tend to increase river loads and, therefore, more implementation will be needed to achieve the strategy's water quality goals."

Statewide nitrate-nitrogen and total phosphorus loads have been highly correlated with water yield, which itself is highly correlated with precipitation. The most recent five-year nutrient load averages, 2017–21, were influenced by unusually high precipitation and river flows during this period. Since 2008, the five-year average water yields have been higher than the baseline water yield. Greater runoff and drainage associated with climate change tend to increase river loads and, therefore, more implementation will be needed to achieve the strategy's water quality goals.

Agriculture Sector

For 2021–22, 60 identified agriculture-related programs were administered by both government agencies and non-governmental organizations. These programs aim to guide producers in establishing practices and methods to reduce nutrient losses. In 2022, agriculture partner organizations reported more than 186 full-time staff members engaged in activities related to implementing the strategy, with a collective expenditure of nearly $51 million.

Agricultural Outreach:

- 110,000 attendees at 940 events focused on reducing nutrient loss
- $51 million spent on strategy related activities in 2021–22

The agricultural community is a firm believer in education and outreach to foster voluntary implementation of conservation practices that not only reduce nutrient loss from crop fields, but also align with farmer production goals. Between 2021–22, the agriculture sector organized more than 940 outreach events related to nutrient loss, attracting more than 110,000 participants. This is the highest participation reported since the strategy's inception in 2015. Information on nutrient management, cover crops, and other practices that reduce nutrient loss was shared at a variety of outreach activities, including field days and online media and meetings. The Nutrient Loss Reduction Podcast, produced by Illinois Extension since 2019, has been a notable initiative, featuring 48 episodes and more than 10,000 downloads by the end of 2022.

10,000+

total downloads of the Nutrient Loss Reduction Podcast's 48 episodes.

55%

of farmers, a 28% increase from 2020, are somewhat to very knowledgeable about the NLRS.

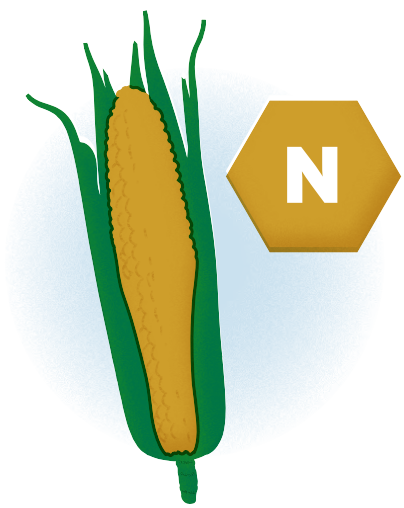
– *National Agricultural Statistics Service, 2022 Illinois NLRS survey*

Nitrogen

fertilizer methods on corn acres:

- 76% of 2021 corn acres used the Maximum Return To Nitrogen rate.
- Corn fertilization timing: 25% fall/winter, 35% fall-spring split, 40% in spring
- 85% used nitrogen inhibitors for fall/winter-applied anhydrous ammonia, 83% for spring-applied.

– *National Agricultural Statistics Service, 2022 Illinois NLRS survey*



A 2022 survey by the National Agricultural Statistics Service provided insights into farmer awareness and strategy implementation levels. Of the surveyed farmers, 55% reported to have knowledge about the strategy, an increase from 43% in 2020. The survey also highlighted adoption rates of fertilization practices for the 11 million acres of corn planted in 2021. The nitrogen fertilization methods were reported by the farmers as:

- 76% managed using the Maximum Return To Nitrogen, MRTN.
- Corn fertilization timing: 25% fall/winter, 35% fall-spring split, 40% spring.
- 85% used nitrogen inhibitor for fall/winter-applied anhydrous ammonia, 83% used nitrogen inhibitor for spring-applied.

Data from the Conservation Technology Information Center's Operational Tillage Information System, OpTIS 3.0, indicated 71% of cropland acres in Illinois are managed using conservation tillage which leaves 15% or more residue.

During 2021–22, farmers implemented numerous conservation projects through a variety of financial assistance programs including IDOA's Partners for Conservation, PFC, and Fall Covers for Spring Savings programs, Illinois EPA's Section 319 Non-Point Source Pollution Control Program, and multiple U.S. Department of Agriculture Natural Resources Conservation Service programs. The PFC and the Section 319 programs tracked nutrient reductions associated with the applied practices. Combined, those programs kept nearly 73,000 pounds of nitrogen and more than 30,000 pounds of phosphorus from the agricultural

73,000

pounds of nitrogen and **30,000 pounds of phosphorus** were kept out of waterways through agricultural conservation projects cost-shared by IDOA and Illinois EPA.

Retailer-applied acres: 91% of respondents applied anhydrous ammonia after the fall application date recommended by University of Illinois.

– *The Illinois Fertilizer & Chemical Association, 2018–21 4R Metric Survey season averages*

52.7%

of rivers near Illinois cropland have grass buffers which were identified using satellite imagery.

71%

of cropland uses conservation tillage.

– *CTIC OpTis 3.0 data*

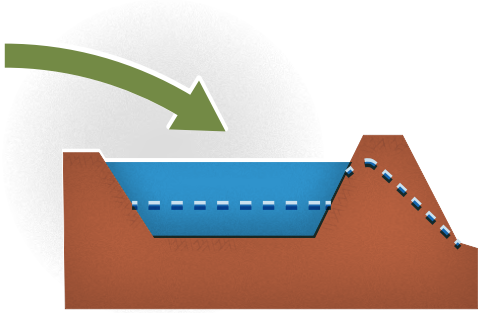
sector out of waterways. Given the combined efforts of all the agriculture conservation programs, it is likely the nutrient reductions are higher than the reported figures.

The Illinois Fertilizer & Chemical Association led a series of fall and spring surveys over four years, 2018-22, focused on nutrient management practices. Fall surveys reported a four-season average of 91% of respondents who applied anhydrous ammonia after the fall application date recommended by University of Illinois. This method was used across 9.6 million acres. Also, an average of 90% of respondents indicated that fall-applied anhydrous ammonia included a labeled nitrification inhibitor. On average, 78% of total nitrogen rates were applied using Maximum Return To Nitrogen rates.

Grass buffers of at least 30 feet on both banks were present next to half of the waterways, rivers, and tributaries adjacent to cropland in Illinois, covering an area of 62,200 acres. Another 2.7%, 3,300 acres, were grass buffered on one bank. A fifth, 21.4%, were entirely unbuffered, indicating an opportunity to expand stream buffers by 26,700 acres in Illinois.

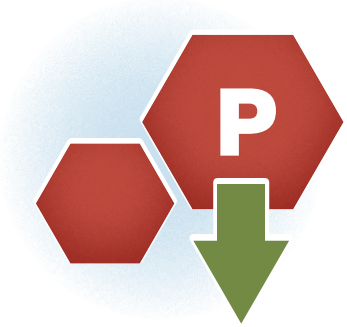
The University of Illinois NLRS science team employs a process to determine which agricultural conservation practices should be recommended by the strategy. Practice proposals are submitted to the team for review, and the team determines whether the practice should be included as an NLRS recommendation. In 2022, water and sediment control basins were added as a recommended practice. This practice involves constructing an earthen embankment across a minor drainageway to capture sediment. It is estimated that implementing this practice can lead to a 60% reduction in total phosphorus. There are now 15 agricultural conservation practices recommended by the Illinois NLRS.

A new NLRS practice recommendation includes a water and sediment control basin that **can prevent 60% of phosphorus loss.**



34%

reduction in total phosphorus discharges, surpassing strategy interim goals.



While there is ongoing adoption of voluntary agricultural conservation practices, the current pace is not sufficient to meet the strategy's interim reduction goals. While there is a clear need to accelerate the implementation of practices that reduce nutrient losses, funding is an ongoing challenge. Programs like the USDA NRCS Environmental Quality Incentives Program and Conservation Stewardship Program have backlogs amounting to over $60 million unfunded applications statewide. The IDOA's Fall Cover for Spring Savings program reported 22,700 acres of cover crop applications that could not be funded in 2022 due to a lack of cost-share. There continues to be a pressing need for more resources for technical assistance training, system wide staffing, and cost-sharing to support conservation practice implementation in Illinois.

Point Source Sector

A point source is any site of discharge into a waterway, such as municipal sewage treatment facilities and industrial wastewater treatment facilities. By 2022, the point source sector exceeded the strategy's 25% interim total phosphorus reduction goal for 2025, by reducing phosphorus discharges by 6.2 million pounds, a 34% decline since 2011. This achievement is largely due to compliance with Illinois EPA's National Pollutant Discharge Elimination System, NPDES, permit program which mandates treatment facility improvements and optimizations. The initial 2015 NLRS science assessment identified phosphorus loss from the point source sector as a priority because, at that time, the sector contributed almost half of the statewide total for phosphorus loss.

In 2021–22, the point source sector documented investments of over $237.7 million to further reduce total phosphorus loads. This included $191.8 million allocated

101

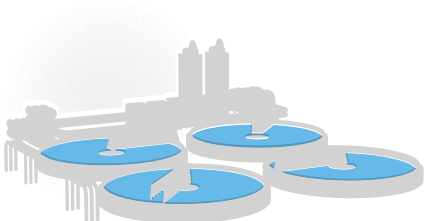
major municipal facilities discharged an annual average phosphorus concentration of 1 mg/L or less in 2022. Of these facilities, 46 are meeting 0.5 mg/L or less.

38%

of major municipal wastewater facilities have phosphorus limits.

67

facilities are developing Nutrient Assessment Reduction Plans. Another 89 are developing NARPs as part of a watershed group.



to 13 projects funded by the Water Pollution Control Loan program. This low-interest loan program is offered by Illinois EPA through the State Revolving Fund and supports upgrades in wastewater treatment facilities, green infrastructure, urban stormwater treatment, and the management of combined and sanitary sewer overflows.

As of 2022, 38% of major municipal wastewater treatment facilities were meeting total phosphorus limits of 1 mg/L or lower. Facilities had also developed and submitted 210 nutrient reduction optimization studies and nutrient reduction feasibility studies since 2018.

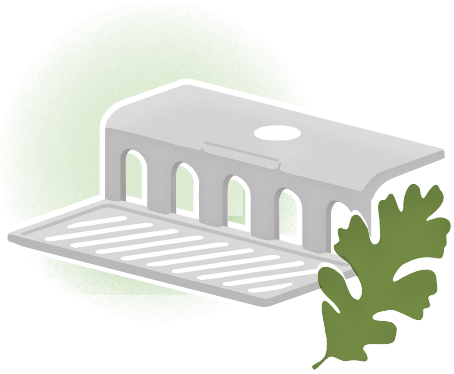
More facilities have reduced their nutrient discharge in recent years. In 2022, 101 of the 211 major municipal facilities reported an average annual total phosphorus concentration of 1 mg/L or less, while 46 of these facilities averaged 0.5 mg/L or less. By comparison, in 2020, 90 facilities reported an average of 1 mg/L or less, with 31 averaging 0.5 mg/L or less.

Nutrient Assessment Reduction Plans, NARPs, are permit requirements for major facilities discharging into waterbodies that are impaired or at risk of nutrient over-enrichment, known as eutrophication. Currently, 67 facilities are developing plans for phosphorus reduction measures. Another 89 facilities are developing NARPs as part of a watershed group.

The point source sector has been proactive in outreach and education. In 2021–22, the sector organized 18 events, including field days, presentations, workshops, and conferences, reaching 4,320 stakeholders and professionals in wastewater management, as reported by the Illinois Association of Wastewater Agencies.

70%

of communities with Municipal Separate Storm Sewer Systems sweep streets and collect leaves annually.



14

new stormwater practice projects were funded by the Illinois EPA Section 319.

1.2 million

gallons of stormwater were kept out of waterways through 11 Illinois EPA Green Infrastructure Grant program funded projects.

With more facilities expected to comply with NPDES permit limits, further reductions in total phosphorus are expected in the coming years.

Urban Stormwater Sector

Stormwater runoff consists of rainfall and snowmelt flowing off impervious surfaces in developed areas, such as roads and sidewalks. This runoff carries pollutants, notably phosphorus and nitrogen, into waterways. Projects aimed at managing urban stormwater help improve water quality by reducing the volume of runoff entering waterways and by reducing duration and intensity of floods.

Efforts to reduce nutrient loss from urban stormwater continue to grow. The Illinois EPA awarded 11 grants totaling $5 million through the Green Infrastructure Grant Opportunities program in 2021. With an additional $4 million from local matching funds, the total investments reached $9 million. As of 2022, five of these projects were either fully or partially completed. The projects retain an estimated 1.2 million gallons of stormwater, reducing annual pollutants by an estimated 1,005 pounds of nitrogen and 318 pounds of phosphorus. An additional 14 urban stormwater best management practices were installed in 2021–22 through the Illinois EPA's Section 319 grant program. These practices reduced total nitrogen by 4,192 pounds and total phosphorus by 1,033 pounds.

The Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, invested nearly $1.45 million in 2021 on stormwater management through its Green Infrastructure program. These projects provided more than half a million gallons of retention capacity.

IllinoisGroundwork.org offers green infrastructure resources.

Over 8,900

participants attended 121 stormwater outreach events in 2021–22

To enhance tracking efforts, a new publicly available Green Infrastructure Inventory tool has been introduced. This tool maps the location and type of almost 2,000 stormwater best management practices installed across Illinois.

An analysis of the Municipal Separate Storm Sewer System annual inspection reports indicates that 70% of communities provide street sweeping and leaf collection at least annually, which helps to reduce phosphorus discharge via storm sewers. Additionally, 28% of these communities offer rain barrel incentive programs.

Other partners in urban stormwater management reported investments nearing $4 million in 2021–22. Various NLRS partners led 121 outreach activities, connecting with nearly 9,000 people. These activities emphasized reducing nutrient losses from public and private property. One notable new initiative is the Illinois Groundwork website, illinoisgroundwork.org, which offers green infrastructure research, tools, and resources to Illinois stormwater professionals, local leaders, and the public.

Adaptive Management

Nutrient pollution has neither a single source nor a single solution. This makes versatility, fluidity, and collaboration crucial tenets of the Illinois Nutrient Loss Reduction Strategy. Adaptive management allows the strategy to be a living document focused on traditional and new technologies and practices. As our climate shifts, and as research and technological advancements emerge, the recommended approaches to achieve the strategy's goals will adapt accordingly.

Nutrient loads are still increasing, and there is an urgent need to continue supporting work in nutrient loss

research, public education, outreach and technical support, especially within the agriculture sector. While the strategy addresses nutrient loss on a statewide level, there is a growing emphasis on localized, watershed-specific initiatives. These initiatives attract investments from federal, state, and non-government partners. Locally led watershed-based planning remains a priority for meeting smaller-scale water quality goals. For example, the Illinois EPA has provided financial assistance for the development of 143 watershed-based plans since 2011. Moreover, numerous organizations are investing in research and incentive programs targeting specific watersheds.

The 2023 Biennial Report sheds light on upcoming research priorities, including studying phosphorus loss due to streambank erosion, analyzing nutrient loads at the watershed-level, and investigating 4R Strategy, cover crops, and edge-of-field practices. A deeper understanding of the causes of rising phosphorus loads, particularly in the Illinois River, is needed.

This report underscores the ongoing efforts across the agricultural, point source, and urban stormwater sectors. Yet, despite these efforts, nutrient levels remain higher than established goals. This is largely attributed to increased rainfall and storm events, among other factors, both controllable and uncontrollable.

On a positive note, the significant reduction in point source phosphorus has already exceeded the 2025 interim goal of a 25% decrease. While there is evident progress in the agricultural sector's adoption of recommended conservation practices, there is an urgent need to ramp up adoption of practices to meet the 2025 interim goals for nutrient loss reduction.

143

watershed-based plans
were developed since 2011 with Illinois EPA cost-share funding.

Conclusion

The Illinois NLRS partnership is diligently working to implement nutrient loss reduction strategies for point and non-point sources as detailed in the 2023 Biennial Report. At the current pace of implementation, the strategy's 2025 goals may not be achieved. There is a pressing need to enhance the voluntary adoption of agricultural conservation practices and to garner more community support at the watershed level. The agriculture, point source, and urban stormwater sectors all have crucial roles in reducing nutrient loss, each with its own set of unique challenges. Collaborative efforts and feedback from partner organizations remains pivotal to the success of the Illinois NLRS water quality and implementation goals.

While Illinois has a long journey ahead to meet its nutrient loss goals, these biennial reports consistently offer valuable insights that shape decisions, foster collaborations, and spur innovative solutions.

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Photo courtesy of Layne Knoche, Illinois Extension

Photo courtesy of Amanda Christenson, Illinois Extension

CHAPTER 2
INTRODUCTION

The Illinois Nutrient Loss Reduction Strategy, NLRS, is a statewide, collaborative effort working to reduce the amount of nutrients, particularly nitrogen and phosphorus, in Illinois waterways.This chapter outlines the NLRS and provides context for navigating the report.

The Illinois NLRS has two primary goals:

1. **To reduce the nutrient pollution that leaves Illinois via the Mississippi River; and**
2. **To improve the local water quality of streams, rivers, and lakes for Illinois residents.**

The Illinois Nutrient Loss Reduction Strategy

Illinois is one of 12 states that have developed nutrient strategies as members of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, also known as the Hypoxia Task Force. The U.S. Environmental Protection Agency created this task force and the 2008 Gulf Hypoxia Action Plan to address the hypoxic "dead zone" in the Gulf of Mexico. In 2011, the U.S. EPA recommended a strategy framework for states to meet the goals of the Gulf Hypoxia Action Plan. In 2015, Illinois established its strategy using this framework by partnering with science, technology, and industry experts to assess and reduce statewide nutrient loss. The Illinois NLRS is a living document that is updated and expanded every two years through biennial reports.

More information about the federal task force is available from the EPA at www.epa.gov/ms-htf.

Illinois established the Nutrient Loss Reduction Strategy by partnering with science, technology, and industry experts.

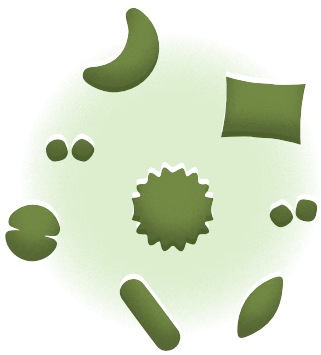
Where do excess nutrients come from?

Nutrient pollution is caused by excess nitrate-nitrogen and total phosphorus entering water bodies from various sources. Illinois contains a large amount of agricultural land and several major metropolitan areas, so the strategy focuses on reducing nutrients from three source sectors — point sources, agricultural sources, and urban stormwater sources — and collaborates with partners from each. The nitrogen and phosphorus contributions from each sector varies. The proportions of each sector's contributions were published in the original strategy in 2015.

Nutrients are often categorized by their point of origin – point source or non-point source. A point source is a readily identifiable input location where treated wastes are discharged from municipal or industrial facilities. A non-point source is an input that cannot be attributed to a single location, such as urban or agricultural runoff, and atmospheric deposition.

Why is nutrient pollution a problem?

Excess nitrogen and phosphorus cause algal blooms, leading to dead zones and harming aquatic life.



Excess nitrogen and phosphorus in waterways promote algal growth. As algal blooms decompose, they deplete oxygen levels in the water, resulting in hypoxia. Large hypoxic areas are often called "dead zones" because they cannot support normal populations of aquatic life. The largest dead zone in the U.S., and the second largest in the world, exists in the Gulf of Mexico near where the Mississippi River drains. The size of the hypoxic zone varies annually, with the most recent five-year average larger than 5,300 square miles. The Gulf Hypoxia Action Plan sets a five-year average hypoxic zone goal of 1,900 square miles by 2035. The National Oceanic and Atmospheric Administration calculates that the dead zone costs the U.S. seafood and tourism industries a combined $82 million a year.

Locally, excess nutrients can also impair drinking water quality, harm aquatic life, and limit recreational opportunities.

What are the goals?

The Illinois strategy sets interim and long-term goals to reduce the amount of nutrients that leave the state via the Mississippi River and contribute to the hypoxic zone in the Gulf of Mexico. Figure 2.1 compares the strategy's statewide 1980-96 baseline nutrient loads to the reduction goals and current nutrient loads. The interim goals are a 15% reduction of nitrate-nitrogen and a 25% reduction of total phosphorus by 2025, with a long-term goal of reducing both total phosphorus and total nitrogen levels by 45%.

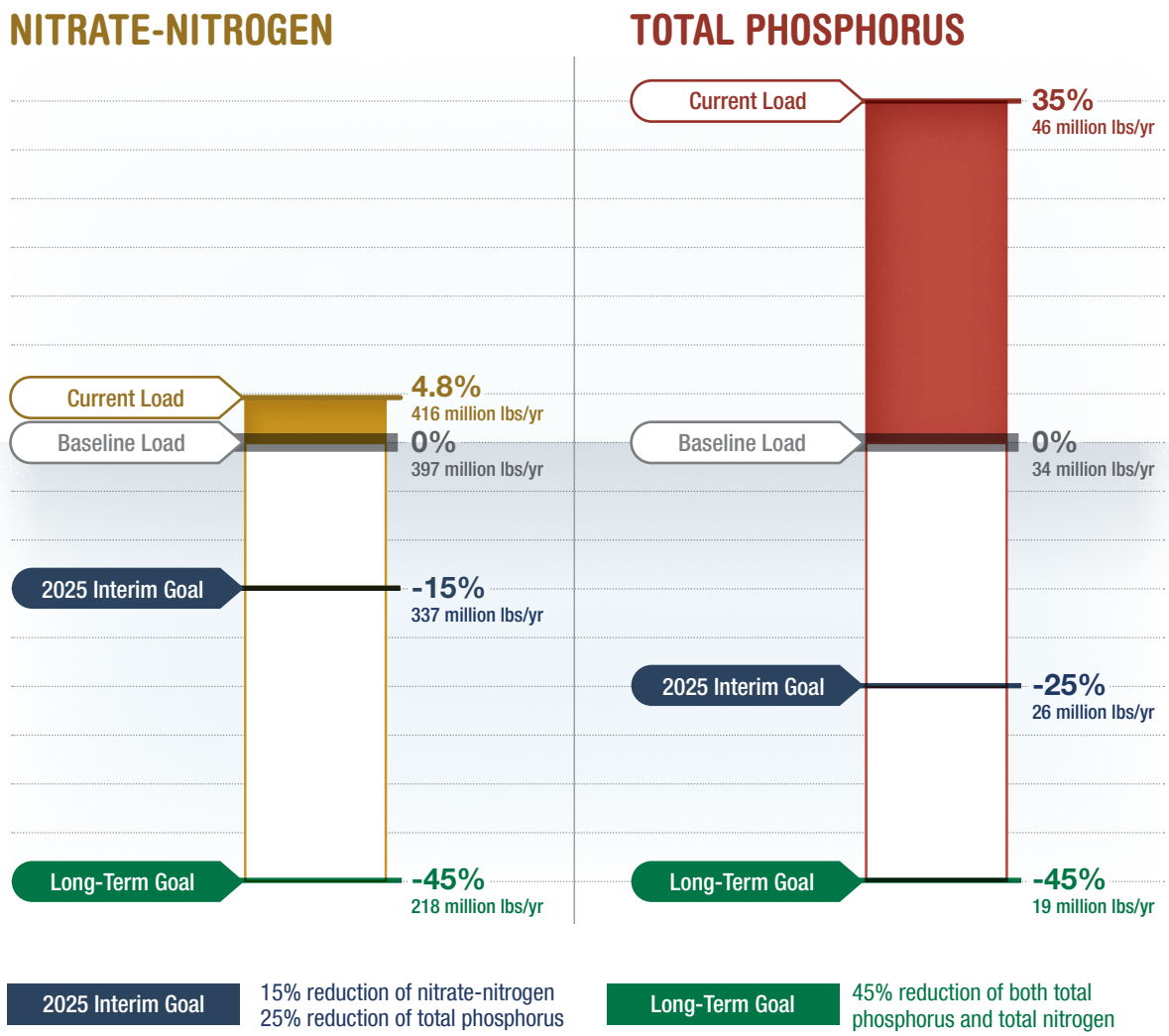


Figure 2.1. *Baseline nutrient loads compared to reduction goals and current loads*

Nutrient loads vary annually, so progress is measured based on five-year running averages. The reduction goals and five-year averages are measured against the baseline.

How is the strategy implemented?

The Illinois NLRS is science-based strategy that builds on existing programs to optimize nutrient loss reduction while promoting increased collaboration, research, and innovation in the private sector, academia, non-profits, wastewater agencies, and state and local governments. The strategy promotes the reduction of nutrients in a coordinated manner by recommending cost effective practical actions and best management practices.

The strategy does not call for new regulations. Instead, it outlines approaches to meet community and industry needs while reducing the negative impacts of nutrient loss on the environment, industry, and public health. Implementation of strategy recommendations relies on the work of stakeholder partners across the state, including agriculture commodity groups and producers; wastewater treatment plants; stormwater managers; and federal, state, county, and municipal governments.

Who is involved?

The strategy is developed and implemented through a partnership between the Illinois Environmental Protection Agency, Illinois EPA, Illinois Department of Agriculture, IDOA, and University of Illinois Extension, and a multi-stakeholder Policy Working Group.

A steering committee, comprised of staff members from Illinois EPA, IDOA, and University of Illinois Extension, has several responsibilities. The committee coordinates and facilitates Policy Working Group, subgroup meetings, and an annual conference; collects and manages metrics data and partner contributions following the strategy's logic model; coordinates the Science Team's agricultural conservation practice evaluation process; provides leadership for the source sectors; and develops the biennial report. All steering agencies contribute programming and funding to support the strategy, as do NLRS partners statewide. A team of scientists from the U.S. Geological Survey and University of Illinois also provides updated water quality measurements and an assessment for each biennial report.

The Policy Working Group, which developed the strategy in 2015, has representatives from federal and state agencies, agricultural organizations, wastewater treatment agencies, non-governmental organizations, and industries. This collaborative approach between stakeholders is one of the strengths of the Illinois strategy. The group explores funding opportunities, identifies needed legislative initiatives, networks with appropriate groups and individuals, and identifies adaptive management adjustments and updates to the strategy.

In addition, other multi-stakeholder groups were created to address implementation of the strategy and monitor progress toward strategy goals. Additional subgroups have also been formed to address specific tasks, such as data tracking and education. More information about all working groups is available in chapter 7 of this report.

Measuring Implementation and Strategy Progress

The strategy calls for a biennial report that outlines steps made toward reaching Illinois nutrient loss reduction goals and serves as a mechanism to update the strategy. Quantifying nutrient load reduction efforts requires the coordinated efforts and cooperation of stakeholder partners who provide content and data. Each report is authored by multiple contributors representing NLRS stakeholders. Chapters are reviewed by the Steering Committee, Policy Working Group, Urban Stormwater Working Group, and Science Team. Please notify the NLRS team of any errors in this report by emailing nlrs@illinois.edu.

The most up-to-date version of this report, previous reports, and other information about the Illinois NLRS are available on the Illinois EPA website at go.illinois.edu/NLRS.

Logic Model

To help measure progress, each report follows a logic model to track current measures of nutrient loads and updated implementation efforts across each sector in Illinois. The strategy's logic model established four types of indicators — resources, outreach, land and facilities, and water — to measure change (Figure 2.2). It was adapted from the Iowa Nutrient Reduction Strategy and introduced in the first update to the Illinois biennial report in 2017. These metrics provide a standardized protocol for evaluating progress by tracking year-to-year changes and longer trends.

Data for resources and outreach measures are primarily provided through voluntary reports from strategy partners. Data for land and facilities measures are compiled from available sources. Water measure data comes from sources provided by U.S. Geological Survey and University of Illinois researchers.

Figure 2.2. *The NLRS Logic Model*

Resource Measures

The logic model starts with resource measures, which refer to financial investments. These include funding, grants, and the staff who administer them.

Outreach Measures

Outreach leads to shifts in people's knowledge, attitudes, behavior, and investment. Outreach measures include field days, presentations, conferences, meetings, news media content, social media, newsletters, awards, and surveys.

Land and Facilities Measures

The land and facilities measures are physical changes on the land that can affect water quality. These include the adoption of best management practices, such as agricultural conservation practices, upgrades to wastewater treatment facilities, and stormwater management practices.

Water Measures

Water measures are based on nutrient loads and yields.

Navigating this Report

The strategy communicates its progress and challenges to the public via biennial reporting. This fourth biennial report covers implementation activities in 2021–22 and recommendations for future actions. Some information from outside the reporting years may be provided for context. A glossary of industry terms and a list of acronyms can be found in the preface. The related data for some figures are available online in Appendix G.

Online Appendices

Additional information is available in the following online appendices at go.illinois.edu/NLRS.

- Ⓐ ***Partner Data***
- Ⓑ ***Illinois EPA Watershed-Based Plans***
- Ⓒ ***NRCS At a Glance 2021-22***
- Ⓓ ***FSA Variables and Land Measures***
- Ⓔ ***Partner Updates***
- Ⓕ ***NASS Report and Questionnaire***
- Ⓖ ***Companion Data***
- Ⓗ ***NARP Requirements***

Photo courtesy Greg McIsaac, University of Illinois

SCIENCE ASSESSMENT UPDATE
Key Points

Statewide nutrient levels remained elevated above interim target levels, especially for phosphorus.

Both nitrate-nitrogen and total phosphorus five-year average statewide loads increased 4.8% and 35% compared to the baseline. Streamflow was 23% higher than baseline. However, the five-year state nutrient load averages decreased in 2017-21 compared to the previous 2016-20 average.

Nutrient loads in subwatersheds vary widely across Illinois compared to the baseline measurements. More research is needed to understand contributing factors besides streamflow, including nutrient management, changes in population, hydrology, and legacy nutrients.

Nitrate-Nitrogen and Total Phosphorus River Loads: Starting with the 2023 NLRS report, statewide nutrient loads were estimated using rescaled data from U.S. Geological Survey continuous monitoring stations.

Additional Research Updates

Nitrate-nitrogen loads in the Lower Rock River doubled between the 1980–96 and 2015–19 reporting periods. Increased precipitation and water yield were likely contributing factors. Extensive groundwater in the watershed may interact with the river to delay water and nitrate movement from farm fields to the river.

Most of the increased phosphorus loads came from the Lower Mainstem subwatershed. Between 1989–96 and 2015–19, this section **shifted** from being a net sink to a net source of phosphorus.

A University of Illinois Urbana-Champaign researcher is working to quantify streambank erosion and the encumbered loads of phosphorus to streams and rivers in order to account for this non-point, non-agricultural (i.e., non-fertilizer or in-field erosion) source of phosphorus.

The U.S. Geological Survey selected the Illinois River Basin as one of 10 Integrated Water Science basins nationwide for a decade-long intensive study to improve understanding of water quality and availability for human and ecological use under a changing climate.

The Illinois Nutrient Loss Reduction Strategy Science Team determined that water and sediment control basins would be added to the list of recommended NLRS practices.

CHAPTER 3
SCIENCE ASSESSMENT UPDATE

The Illinois Nutrient Loss Reduction Strategy's, NLRS, development and implementation is driven by science. The original science assessment was established in the 2015 Illinois NLRS to identify water quality conditions, critical watersheds, reduction practices for each sector, and scenarios to reach the reduction goals. This report serves as the fourth biennial update to the original strategy. It includes updated metrics for 2021 and 2022, tracks progress toward the established reduction goals, and shows gaps in understanding of nutrient dynamics that warrant further research. The following science assessment update is provided by Tim Hodson, U.S. Geological Survey; Gregory McIsaac, University of Illinois Department of Natural Resources and Environmental Sciences; Andrew Margenot, University of Illinois Department of Crop Sciences; Jim Dunker, U.S. Geological Survey; and an agricultural water quality NLRS Science Team comprised of University of Illinois researchers.

More information about monitoring, progress, scenario updates, and plans are available in chapter 8.

Nitrate-Nitrogen and Total Phosphorus River Loads

By Timothy O. Hodson, U.S. Geological Survey

Nitrate-nitrogen and total phosphorus loads from the major rivers draining Illinois were updated through the 2021 water year using U.S. Geological Survey, USGS, and Illinois Environmental Protection Agency, Illinois EPA, monitoring stations (Figure 3.1). Beginning with the 2023 biennial update to the Illinois Nutrient Loss Reduction Strategy, nutrient loads were estimated using data from the USGS continuous monitoring stations (U.S. Geological Survey, 2023) rather than the original Illinois EPA monitoring stations. To maintain consistency with previous biennial report updates, the loads from the new sites were rescaled to match the original drainage areas (Table 3.1). As before, the statewide nutrient load was estimated by summing the loads of the eight major rivers, adjusting for out-of-state contributions and unmonitored areas.

The Illinois Nutrient Loss Reduction Strategy is science-driven, featuring new metrics for 2021 and 2022, progress tracking, and identification of nutrient research gaps.

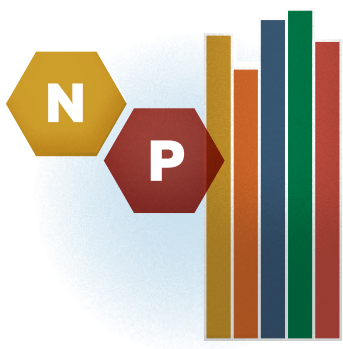


Figure 3.1. *Watershed map depicting USGS and Illinois EPA monitoring stations used to estimate the statewide nitrate-nitrogen and total phosphorus loads. The monitored watersheds are shown in green and the monitoring stations by the orange triangles.*

Methods

Prior to water year 2020, nutrient loads were estimated at Illinois EPA sampling sites (Table 3.1) using Weighted Regression on Time, Discharge, and Season, WRTDS, to estimate total phosphorus and linear interpolation to estimate nitrate-nitrogen (Hirsch, et al., 2015; IEPA, IDOA, and University of Illinois Extension, 2015 and 2021). To account for loads coming from out-of-state, the loads in the Illinois and Vermilion rivers were reduced by 16% and 7%, respectively. The loads in the Rock River at Rockton, near the Wisconsin border, were subtracted from the load at Joslin to isolate the Illinois portion of the Rock River. After these adjustments, the total monitored area represents 69.7% of the land area of Illinois. Therefore, to estimate the statewide load, the total load was multiplied by 1.435, which is the ratio of the total area to the monitored area. The resulting loads estimates for nitrate-nitrogen and total phosphorus are shown in the figures and tables that follow.

Table 3.1. *Monitoring stations used to estimate the statewide nitrate-nitrogen and total phosphorus loads prior to 2020*

River System	Gage Location	Illinois EPA ID	USGS ID	Drainage Area (square mile)	Drainage Area in Illinois (%)	% of Illinois Represented
Big Muddy	Murphysboro	N-12	05599490	2,159	100	3.8
Embarras	Ste. Marie	BE-07	03345500	1,516	100	2.7
Green	Geneseo	PB-04	05447500	1,003	100	1.8
Illinois	Valley City	D-32	05586100	26,743	84	39.9
Kaskaskia	Venedy Station	O-20	05594100	4,393	100	7.8
Little Wabash	Carmi	C-23	03381500	3,102	100	5.5
Rock	Joslin	P-04	05446500	9,549	43	7.3
Rock	Rockton	P-15	05437500	6,363	13	1.4
Vermilion	Danville	BP-01	03339000	1,290	93	2.1

Beginning with water year 2020, methods were modified to use data from the USGS continuous monitoring sites located at or near the original sampling sites (Hodson, et al., 2022). Table 3.2 describes the new monitoring stations, including scaling factors representing the change in drainage area from the original sampling site. Loads from the continuous sites were multiplied by their respective scaling factor before applying the total-land-to-monitored-land adjustments.

Loads from the continuous monitoring sites were estimated using covariate-based Bayesian imputation (Hodson, et al. 2021), which fills gaps in the concentration data by using available surrogate data: other parameters that correlate with the parameter of interest, such as the monitored parameters (Table 3.2), streamflow, or season. Daily loads were estimated from the gap-filled concentration data by multiplying the

Photo courtesy of Gregory McIsaac, University of Illinois

daily loads by streamflow and by a unit conversion factor. Loads from the continuous monitoring sites are available in Hodson et al., 2022. For comparison, estimated annual nutrient loads from long-term Illinois EPA and national sampling sites, including loads to the Gulf of Mexico, are available in Hodson, 2023, and Lee, 2022, respectively.

Table 3.2. *Continuous monitoring stations used to estimate the statewide nitrate-nitrogen and total phosphorus loads after 2020*

River System	Gage Location	USGS ID	Scaling Factor	Monitored Parameters as of 2022
Big Muddy	Murphysboro	05599490	1	Nitrate and turbidity
Embarras	Lawrenceville	03346500	0.65	Nitrate and turbidity
Green	Geneseo	05447500	1	Nitrate and turbidity
Illinois	Valley City	05586100	1	Nitrate, turbidity, orthophosphate, chlorophyl, dissolved oxygen, temperature, conductivity, and pH
Kaskaskia	New Athens	05594100	0.85	Nitrate, turbidity, orthophosphate
Little Wabash	Carmi	03381500	1	Nitrate and turbidity
Rock	Joslin	05446500	1	Nitrate and turbidity
Vermilion	Danville	03339000	1	Nitrate and turbidity

Unlike nitrate, for which there are reliable optical sensors to measure concentration in situ, total phosphorus was estimated from surrogates. Turbidity is often a good surrogate because a portion of phosphorus is bound to particulate matter. In agricultural watersheds, where the particulate-bound portion tends to be greater, turbidity tends to be a better surrogate for total phosphorus. However, where there is a substantial amount of dissolved phosphorus, such as downstream from urban areas, turbidity is a poorer surrogate. Past analysis by USGS assessed which monitoring sites would benefit most from additional data collection (Hodson, et al., 2021), resulting in the installation of orthophosphate analyzers on the Illinois and Kaskaskia rivers in 2022. This additional instrumentation should improve the accuracy of phosphorus loads estimates from those rivers.

Water Measures

The Illinois NLRS assesses progress toward reducing nutrient loss to Illinois waterways by comparing river loads of nitrate-nitrogen and total phosphorus from a five-year period against those of the 1980–96 baseline period. In general, Illinois nitrate-nitrogen and total phosphorus loads are highly correlated with water yield (Figures 3.2 and 3.3). From 2017–21, the nitrate-nitrogen load from Illinois was 416 million pounds per year, 4.8% greater than the baseline, and the total phosphorus load was 46 million pounds per year, 35% greater than the baseline (Table 3.3). Water yield during the same period was 23% greater than the baseline, in part due to high precipitation years in 2019 and 2020 and to higher precipitation years overall. The five-year average water yields have been greater than the baseline since 2008 (Figures 3.2 and 3.3), and that trend may continue into the foreseeable future. Greater runoff and drainage may have caused some of the increase in nutrient loads. However, if runoff and drainage were the only causes, then the changes in nutrient loads would have been more evenly distributed across the watersheds than is indicated by the data. Instead, certain watersheds (Tables 3.4 and 3.5) experienced much larger increases than others, and some have experienced decreased loads, indicating that other factors such as nutrient management, changes in population, hydrology, and "legacy" nutrients in the soil or streambed may be as important or more important than climate factors, such as long-term precipitation trends, in driving changes in loads (Figures 3.4–3.6). Distinguishing among these potential sources could be critical for assessing the effectiveness of NLRS-related efforts.

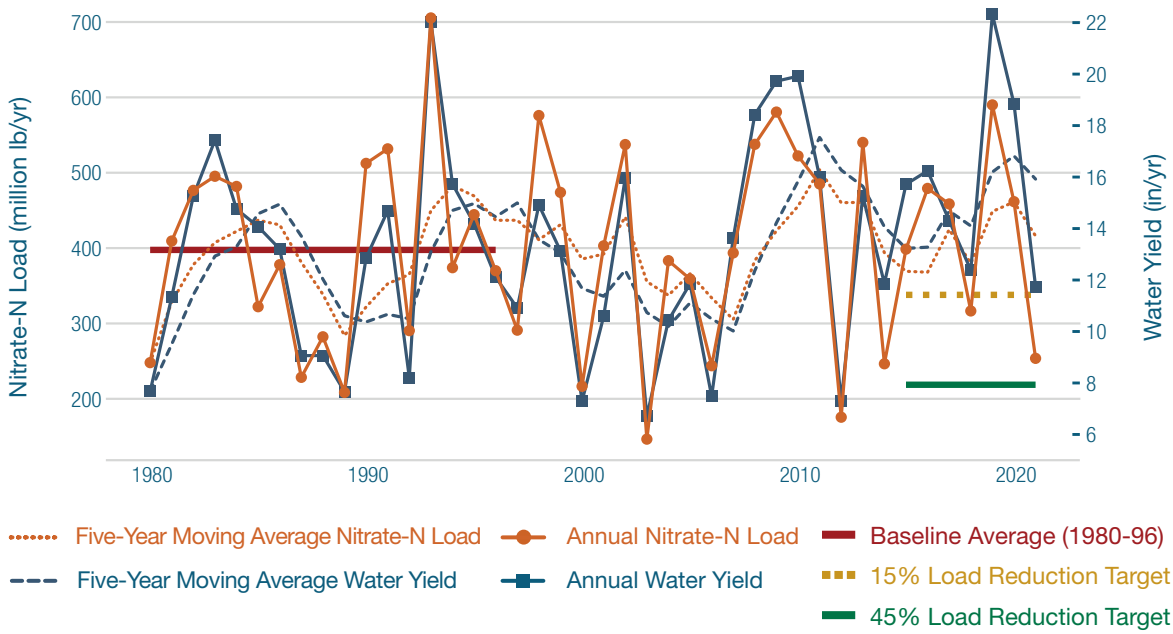


Figure 3.2. *Statewide estimated annual water yields, annual nitrate-nitrogen loads, five-year moving averages, and average load for the 1980–96 baseline period*

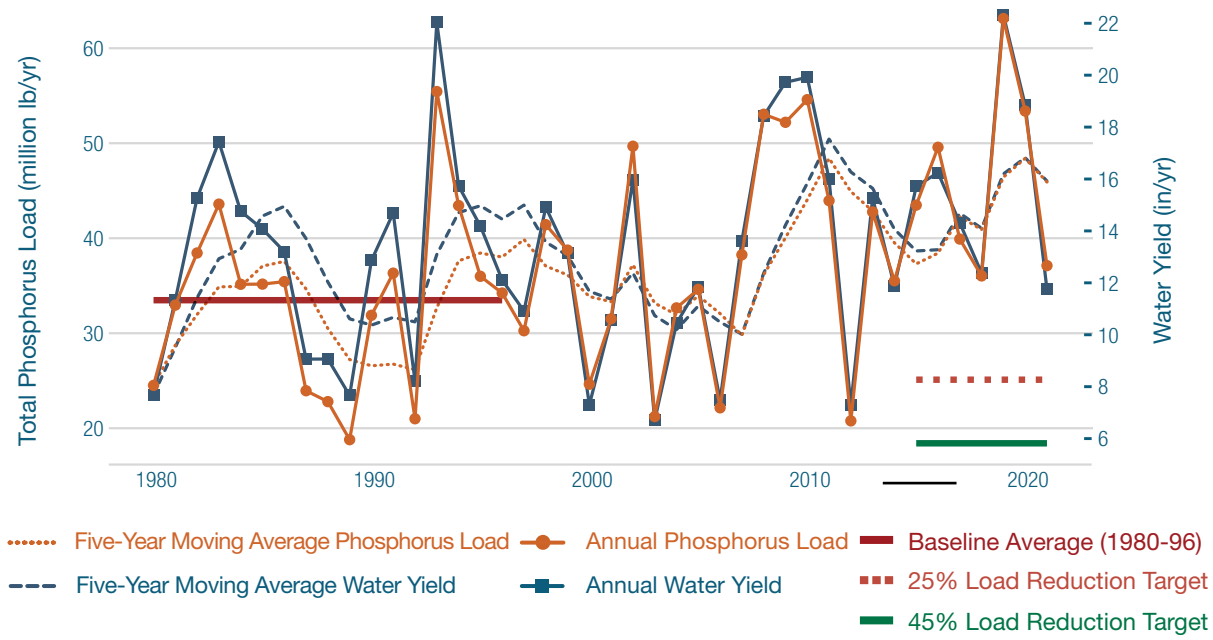


Figure 3.3. *Statewide estimated annual water yields, annual total phosphorus loads, five-year moving averages, and average load for the 1980–96 baseline period*

Table 3.3. *Statewide estimated water yield, nitrate-nitrogen load, and total phosphorus load for the 1980–96 baseline period and five recent five-year periods*

	1980-96 Baseline	2013–17		2014–18		2015–2019		2016–20		2017–21	
	Average Value	Average Value	% Change from Baseline	Average Value	% Change from Baseline	Average Value	% Change from Baseline	Average Value	% Change from Baseline	Average Value	% Change from Baseline
Nitrate-N Load (million lb/yr)	397	425	+7%	380	-4.4	448	+13%	461	+16.2%	416	+4.8%
Total Phosphorus Load (million lb/yr)	34	42	+23%	41	+20%	46	+35%	48	+42%	46	+35%
Water Yield (in/yr)	13	14.7	+13%	14.1	+9%	16.3	+25%	16.8	+30%	15.9	+23%

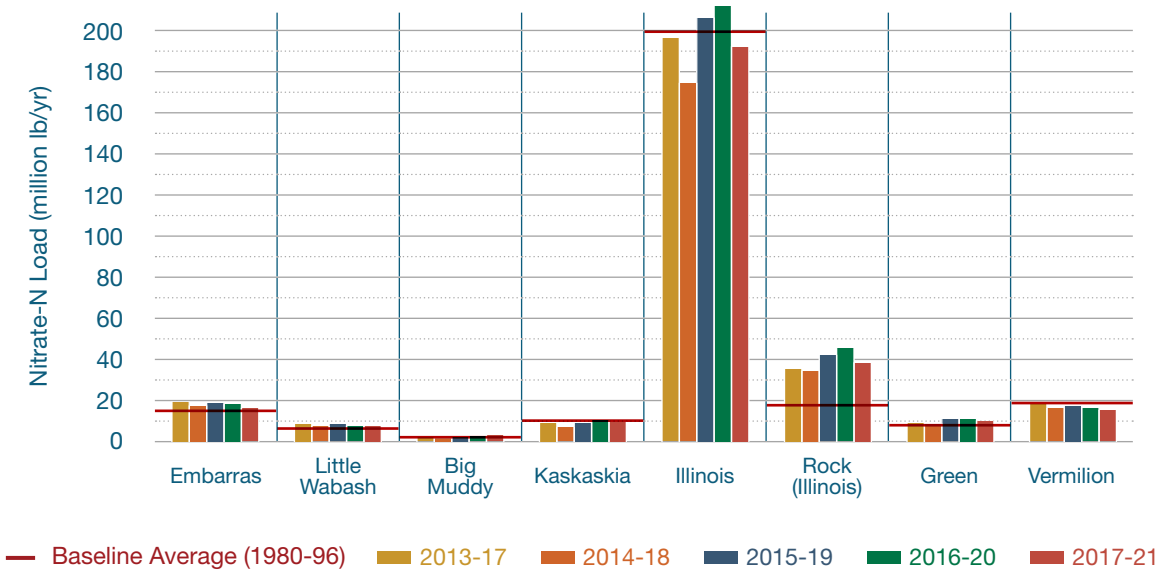


Figure 3.4. *Nitrate-nitrogen loads in eight major rivers draining Illinois during the 1980–96 baseline period and five recent five-year periods*

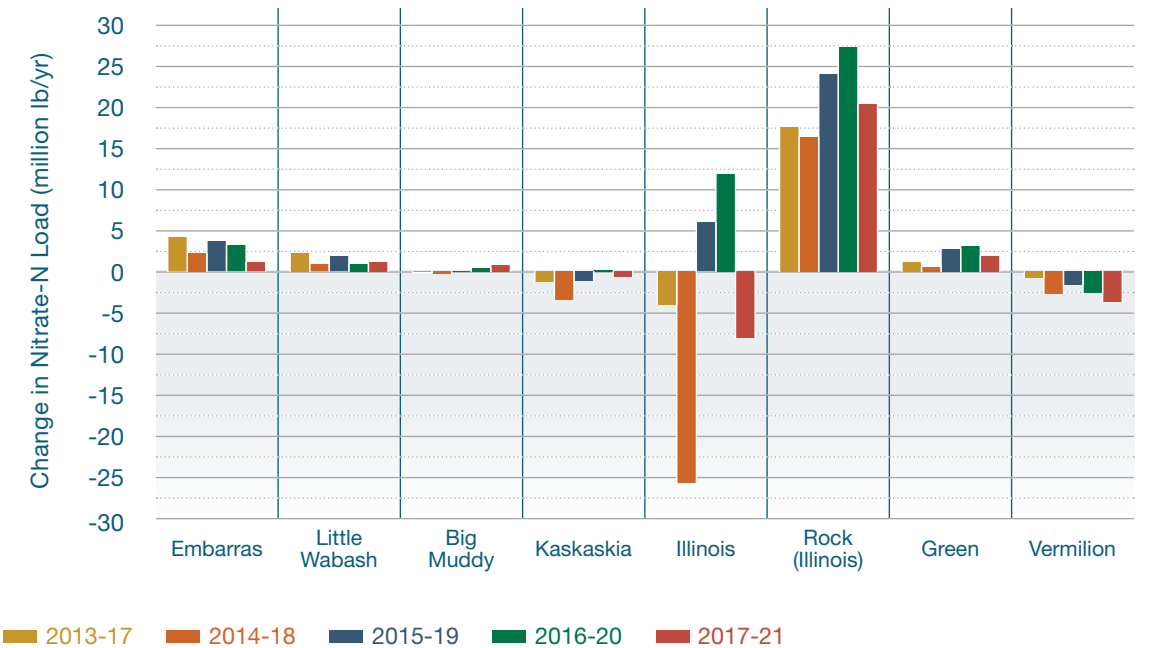


Figure 3.5. *Changes in nitrate-nitrogen loads in eight major rivers draining Illinois from five recent five-year periods compared to the 1980-96 baseline period*

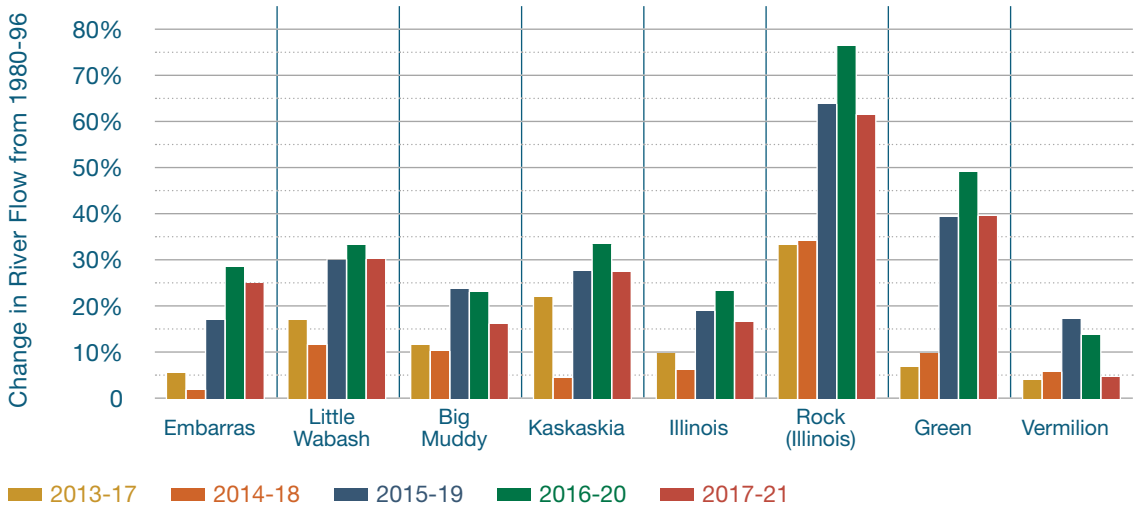


Figure 3.6. *Percent changes in river flow or water yield from the 1980–96 baseline period to five recent five-year periods in eight major rivers draining the state*

Relative to the 1980–96 baseline, the largest increase in nitrate-nitrogen load occurred in the Illinois portion of the Rock River, between Rockton and Joslin, where load increased 117% and streamflow increased 62% (Figures 3.5 and 3.6). A related watershed study investigating the nitrate trend in the Rock River in more detail is summarized in the next section of this chapter.

Table 3.4. *Monitoring stations used to estimate and evaluate the statewide nitrate-N yields*

River System	Monitoring Locations	1980-96	2013-17	2014-18	2015-19	2016-20	2017-21
		Pounds of nitrate-N per acre per year					
Big Muddy	Murphysboro	1.5	1.3	1.2	1.5	1.8	2.0
Embarras	Ste. Marie	15.3	19.5	17.6	19.0	18.6	16.5
Green	Geneseo	12.2	14.0	13.1	16.5	17.1	15.2
Illinois	Valley City	13.9	13.6	12.1	14.3	14.5	13.2
Kaskaskia	Venedy Station	3.6	3.1	2.4	3.2	3.7	3.4
Little Wabash	Carmi	3.1	4.3	3.6	4.1	3.6	3.7
Rock (Illinois portion)	Joslin-Rockton	8.6	17.3	16.6	20.3	22.1	18.7
Vermilion	Danville	24.3	23.3	20.7	22.2	20.9	19.6

Relative to the baseline period, the largest increase in total phosphorus load occurred in the Illinois River, where load increased 23%, and streamflow increased 17% (Figure 3.6). Compared to the Kaskaskia and Little Wabash rivers, the percentage increase of the Illinois River load was relatively small, but because the Illinois River is by far the largest watershed, it was the largest contributor to the statewide increase in phosphorus load (Figures 3.7 and 3.8). Results from a study investigating the sources of phosphorus in the Illinois River are summarized later in this chapter in the section Summary of Spatial and Temporal Variation in Phosphorus Loads in the Illinois River. The greatest percentage increases in phosphorus loads occurred in the Kaskaskia River, 102%, and the Little Wabash River, 86%, while streamflow from both rivers increased by 28% and 30%, respectively (Figure 3.6). The cause of the load increase has not yet been investigated.

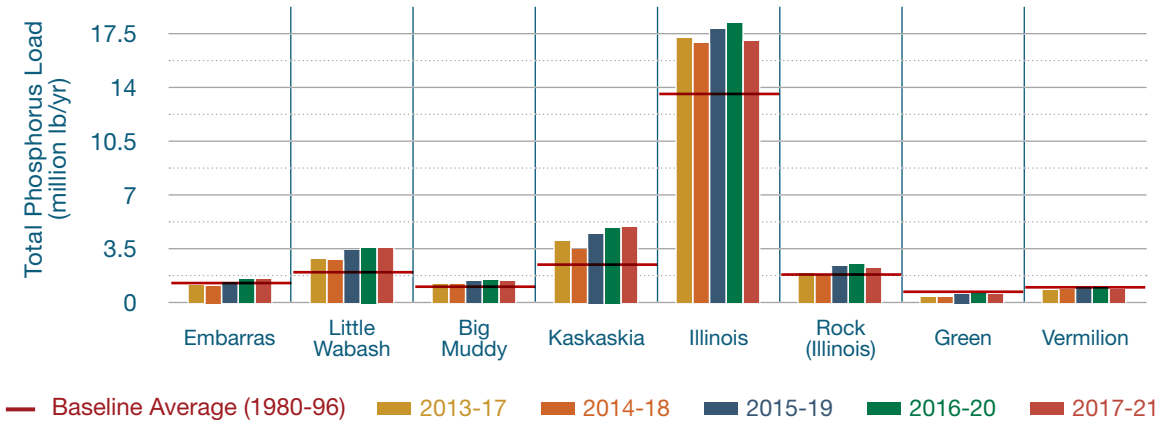


Figure 3.7. *Total phosphorus loads in eight major rivers draining Illinois during the 1980–96 baseline period and five recent five-year periods*

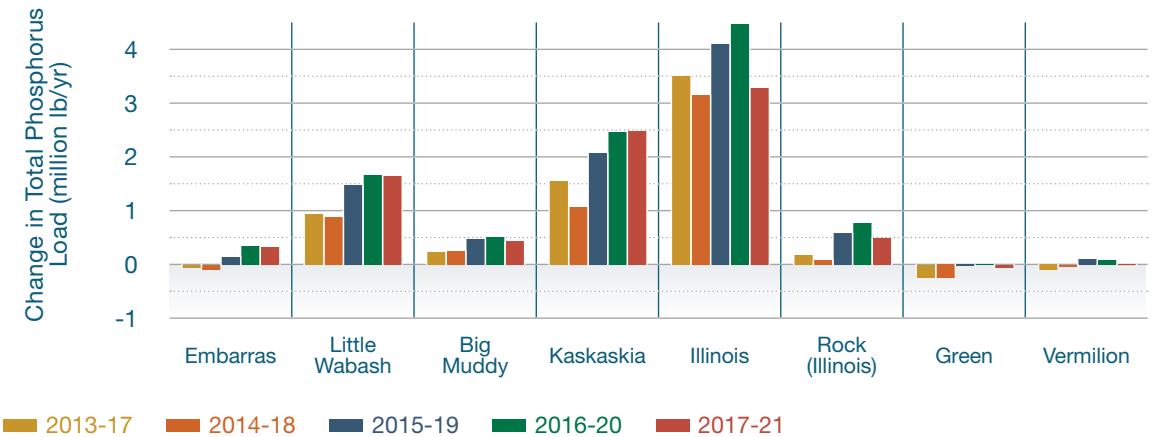


Figure 3.8. *Changes in total phosphorus loads in eight major rivers draining Illinois from five recent five-year periods compared to the 1980-96 baseline period*

Table 3.5. *Monitoring stations used to estimate and evaluate the statewide phosphorus yields*

River System	Monitoring Locations	1980-96	2013-17	2014-18	2015-19	2016-20	2017-21
		Pounds of total phosphorus per acre per five-year average					
Big Muddy	Murphysboro	0.69	0.86	0.87	1.02	1.06	1.00
Embarras	Ste. Marie	1.23	1.18	1.14	1.38	1.59	1.56
Green	Geneseo	0.97	0.60	0.59	0.93	0.98	0.89
Illinois	Valley City	0.95	1.19	1.17	1.24	1.25	1.17
Kaskaskia	Venedy Station	0.86	1.41	1.24	1.59	1.73	1.74
Little Wabash	Carmi	0.96	1.43	1.40	1.71	1.80	1.79
Rock (Illinois portion)	Joslin-Rockton	0.86	0.95	0.91	1.15	1.24	1.10
Vermilion	Danville	1.19	1.06	1.14	1.31	1.30	1.16

Overall, the pattern in Illinois is typical of the Mississippi River Basin, where both nutrient loads and flow to the Gulf of Mexico have remained above 1980–96 baseline levels. USGS and others are researching why loads in some watersheds have increased or not decreased despite substantial management efforts.

In all likelihood, a variety of factors, including climate change, "legacy" nutrients which cause lag times, and watershed management, contribute to varying extents across the state. Further research could help explain which of these factors are most important to riverine nutrient loads and inform more targeted and cost-effective reductions. Moreover, this information could affect how the Illinois NLRS assesses progress toward reducing nutrient loads from non-point sources; some nutrient reductions might be masked by legacy or climate effects and could be accounted for by other means.

See figures 8.1 and 8.2 in chapter 8 for nutrient loads information in context of the strategy goals.

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Nitrate-Nitrogen Loads in the Illinois Portion of the Rock River Basin

By Gregory McIsaac, University of Illinois Urbana-Champaign

Between the 1980–96 and 2015–19 reporting periods, nitrate-nitrogen loads in the Illinois portion of the Rock River between Rockton and Joslin more than doubled, resulting in the largest increase of any major Illinois river. Over the same period, nitrate-nitrogen loads from a major tributary to the Rock River — the Kishwaukee River monitored at Perryville — increased by only 5%. Thus, most of the increased load in the Rock River came from the section of the river downstream of Rockton and Perryville, referred to here as the Lower Rock River.

Nitrate-nitrogen yield from the Lower Rock River Basin during the 1980–96 baseline period was only 4.2 pounds of nitrogen per acre per year, which was much lower than other northern and central Illinois watersheds with similar land cover during the same baseline period. For instance, nitrate yields from the Kishwaukee River and Green River during this period were 17.1 and 12.2 pounds of nitrogen per acre per year, respectively. In the 1950s and '60s, when less nitrogen fertilizer was applied, nitrate-nitrogen yields from several northern Illinois watersheds monitored by the Illinois State Water Survey (Harmeson et al., 1973) generally ranged from 3–9 pounds of nitrogen per acre per year.

More recently, in 2015–19, nitrate-nitrogen yield from the Lower Rock River was 21.5 pounds of nitrogen per acre per year, a yield similar to other watersheds with comparable corn-soy acreage. Additionally, after major droughts that reduced corn yields (e.g., in 1988 and 2012), there was little change in nitrate yields in the Lower Rock River. However, other watersheds' nitrate yields were clearly elevated in years following major droughts (Lucey and Goolsby, 1993; Gentry et al., 2009; Loecke et al., 2017). A possible explanation is the existence of long groundwater flow paths that may have created long lag times between changes in watershed nitrogen inputs in the Lower Rock River nitrate loads. Long lag times can result from the presence of a large aquifer that interacts with the Lower Rock River system.

Researchers at the Illinois State Water Survey Groundwater Section calibrated the MODFLOW groundwater model to groundwater elevations measured in the Lower Rock River Basin starting in 1995. Based on this calibration and a variety of assumptions, average groundwater transit times varied across the basin, ranging from 5–50 years, with the shorter times occurring near the Lower Rock River and longer times occurring in remote sections of the watershed. While these transit times support a lag in nitrate reaching the river, the calibration might not adequately account for drier conditions in the 1980s, when groundwater levels were not measured. Periods of low rainfall would reduce recharge to the aquifer, result in longer groundwater transit times, and allow for increased nitrate loss through denitrification.

MODFLOW was also used to simulate nitrate flows to the Rock River using assumed concentrations in recharge water and denitrification rates. Initial results suggested that nitrate reaching the river through the groundwater could be relatively low and not explain the large increase in riverine nitrate load. However, this estimate was based on assumptions that may not accurately reflect conditions in the watershed and aquifer. Additional simulations may be conducted with a range of assumptions about aquifer recharge and denitrification rates. Additional groundwater and river sampling is needed to identify model assumptions that are most reflective of watershed and aquifer conditions and processes.

Increased precipitation and water yield were likely factors promoting increased nitrate load in the Rock River Basin from the 1980–96 baseline period to the 2015–19 period (Table 3.6). During 1980–96, water yields across the basin ranged from 10.7 inches per year at Rockton to 11.7 inches per year for the Kishwaukee River at Perryville. During 2015–19, water yields were between 2.6 and 8.1 inches per year greater than during 1980–96. The largest increase occurred in the Lower Rock River. This may have been due to the additional 8 inches of precipitation per year in this section of the watershed, the expansion of irrigated area from approximately 1.3% to 6.6% of the land area, greater groundwater discharge to the river, or a combination of these factors.

Table 3.6. *Average annual water yields and the percentage change (water year basis) for several locations and subwatersheds of the Rock River Basin for 1980–96 and 2015–19*

Watershed outlet or section	Water yield (in/yr)			Change (%)
	1980-96	2015-19	Change	
Rockton	10.7	15.7	+5.0	+45%
Kishwaukee R.	11.7	16.9	+5.2	+44%
Elkhorn Creek	11.5	14.1	+2.6	+23%
Joslin	10.9	16.5	+5.6	+52%
Joslin - Rockton	11.2	18.3	+7.1	+64%
Joslin - Rockton - Kishwaukee	10.9	19.0	+8.1	+75%

Additional factors that may have contributed to the increased nitrate-nitrogen load were also considered, such as a larger human population and reduced in-stream denitrification due to increased streamflow; however, these appeared to contribute very little additional nitrogen to the river loads. Estimated nitrogen

in livestock manure in the counties draining to the Lower Rock River peaked around 1960 and have since declined (Falcone, 2021). However, these county-level livestock manure nitrogen estimates would not capture the potential impact of spatially concentrated livestock operations that have occurred in recent decades. Finer spatial resolution of livestock production and manure application locations are needed to better understand whether this plays a role in the higher river nitrate loads.

The large increase in nitrate-nitrogen yields from the 1980–96 baseline period to the 2015–19 period appears to be due to a combination of factors. These include lag time between watershed land use and river nitrate concentrations, increased rainfall and water yield, expansion of irrigation, and expansion of corn-soybean acres. The low 1980–96 nitrate-nitrogen yields may have reflected land cover and agricultural practices in the 1960s and '70s. The 2015–19 nitrate yields in the Lower Rock River are in line with yields from other northern and central Illinois watersheds with similar levels of corn-soybean acres. If nitrate-nitrogen yields continue to increase in the future and exceed the nitrate yields from similar watersheds, this would suggest additional sources of nitrate that have not yet been identified.

Most conservation practices for reducing nitrogen losses that are applied in other corn-soy acres in Illinois (e.g., Maximum Return To Nitrogen, nutrient management, cover crops, etc.) are also applicable in the Rock River watershed. Saturated riparian buffers may be an exception since this practice does not perform well in sandy soils. Wood chip bioreactors would need plastic liners in sandy soils. Irrigation could be helpful in establishing fall cover crops in sandy soils, but applying irrigation water would add cost to establishing cover crops.

In addition to the common conservation practices focused on reducing cropland nitrogen loss, irrigation efficiency improvements could reduce nitrate movement to groundwater, and therefore to rivers, by eliminating unnecessary water application. Irrigators could also measure nitrate in their raw irrigation water and credit that nitrate in their fertilization management. Nitrate-nitrogen loss from seed corn production can be high due to relatively low removal of nitrogen in harvested seed (David et al., 2016; Gentry et al., 1998; Mitchell et al., 2000). Therefore, reducing nitrogen loss on these acres may be especially valuable. Expansion of riparian wetlands that interact with river water and reduce riverine nitrate concentrations could potentially provide nitrate load reductions in the near term regardless of groundwater lag times.

A lag time between activity on the landscape and nitrate loads in the river means that the benefits of nitrate loss reduction from conservation practice application in cropland may not reduce riverine nitrate loads for several years after implementation.

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Summary of Spatial and Temporal Variation in Phosphorus Loads in the Illinois River

By Gregory McIsaac, University of Illinois Urbana-Champaign

Of the eight major rivers in Illinois used to estimate Illinois statewide nutrient losses, the Illinois River is by far the largest and carries the largest total phosphorus load that leaves the state. Much of the total phosphorus load comes from the Chicago region, where more than half of the state's population resides. At the furthest downstream monitoring locations of Valley City and Florence, total phosphorus loads increased 39% from the 1989–96 period, to the 2015–19 period, despite reductions in point source total phosphorus discharges in the Chicago region and extensive efforts to reduce total phosphorus loads from non-point sources throughout the basin.

To identify where and why the total phosphorus load increases occurred, concentration and streamflow data from 41 locations (Figure 3.9) across the Illinois River Basin were compiled, and annual loads of total phosphorus, dissolved and particulate phosphorus, total and volatile suspended solids, chloride, sulfate, and nitrate were calculated (McIsaac et al., 2022). All loads were calculated using Weighted Regressions on Time, Discharge, and Season with Kalman filtering. Annual loads were also calculated for sites outside the Illinois River Basin and made publicly available as a USGS data release (Hodson, 2021). At many monitoring sites, routine measurement of total phosphorus concentrations began between 1982 and 1985. Additionally, the combination of regular concentration and flow measurements for the Mackinaw River were only available after the 1988 water year. Consequently, loads could not be consistently calculated across the Illinois River Basin for the full 1980–96 baseline period. Instead, average annual loads for the 1989–96 period were calculated and compared to the 2015–19 period; the latter period was the last five years for which data were available at the start of the project. The yields, or the load per unit area, and incremental yields, or the yield from the drainage area between two or more monitoring locations, were also calculated from the average annual loads.

For most Illinois River Basin subwatersheds, changes in incremental total phosphorus yields from the 1989–96 to 2015–19 periods were relatively small. Exceptions included Thorn Creek at Thornton (Cook County) and Addison Creek at Bellwood (western Cook and eastern DuPage counties) where there were large reductions (Figure 3.10). Large increases in total phosphorus yield were observed for the Lower Mainstem subwatershed (which is between Marseilles and Valley City and excludes monitored tributaries); the Sangamon River between Monticello and Riverton; and Kickapoo Creek at Waynesville in McLean County. For watersheds primarily composed of agricultural land cover and less than 9% developed or urban land, the change of total phosphorus yield was weakly correlated with the change in water yield.

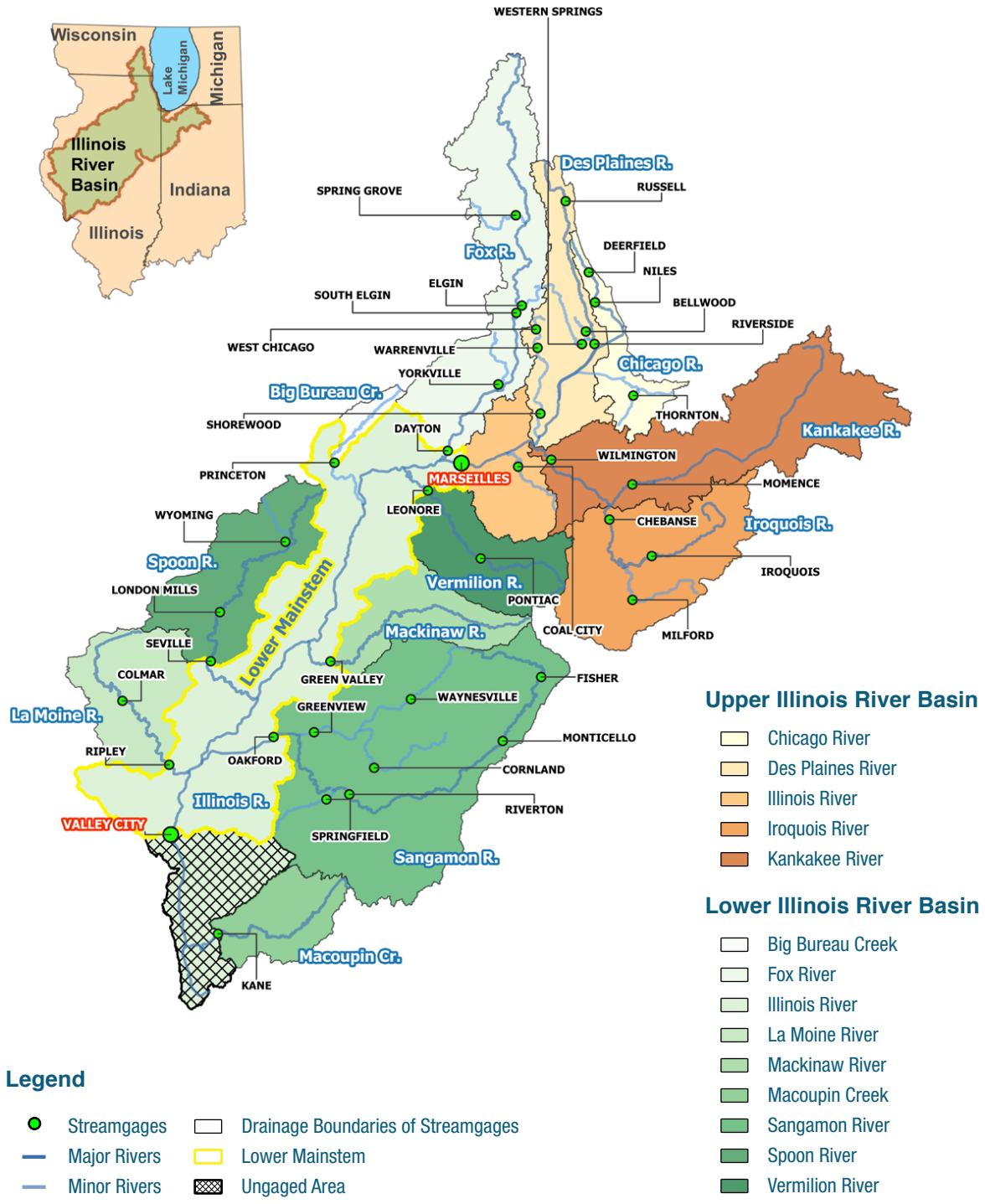

Figure 3.9. *Illinois River Basin, major subwatersheds, and monitoring locations. Taken from McIsaac et al., 2022.*

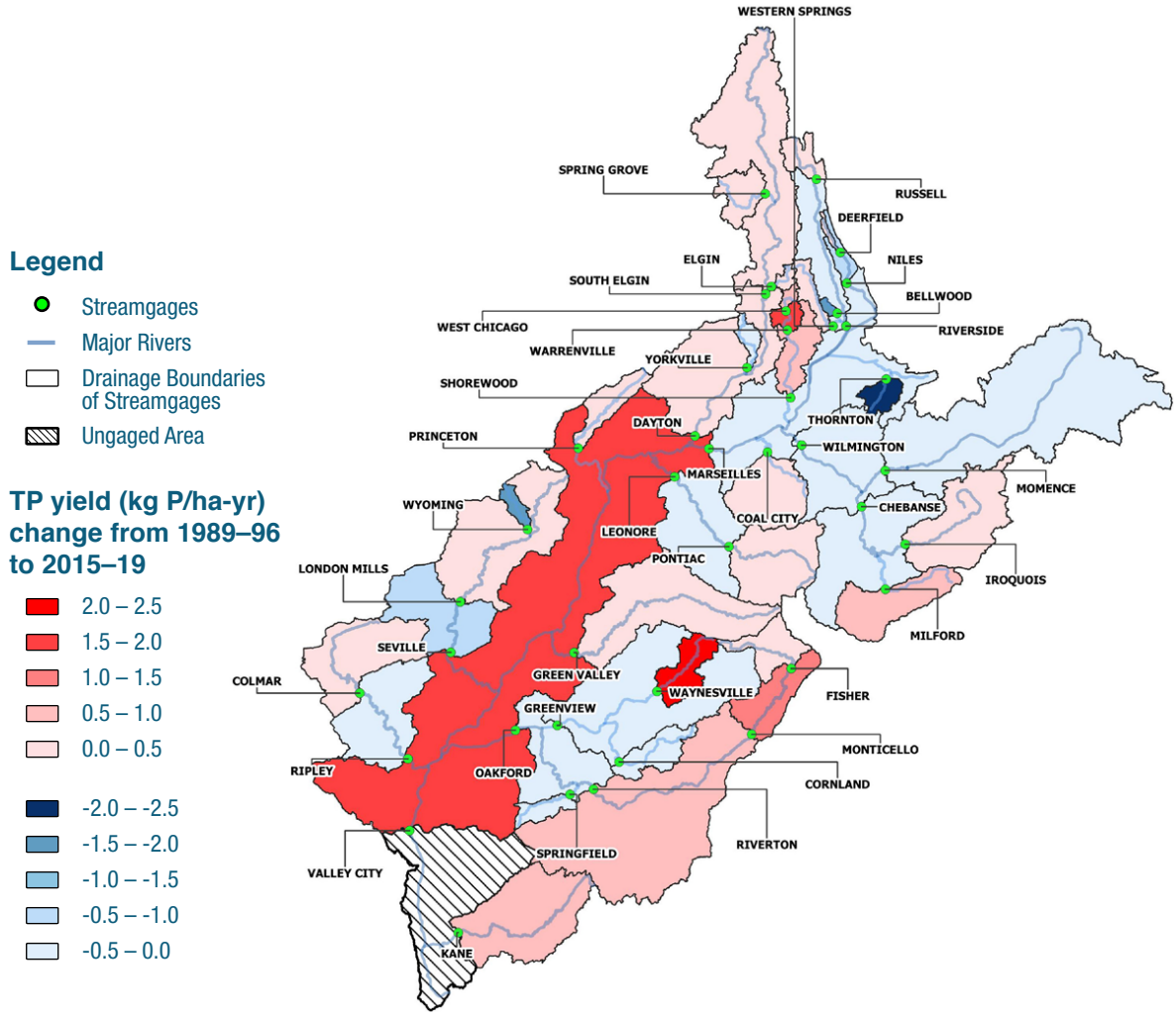

Figure 3.10. *Changes in incremental total phosphorus yields in kg P/ha/year from 1989–96 to 2015–19; 1 kg P/ha/yr is equal to 0.89 lb P/ac/yr. Figure adapted from McIsaac et al., 2022.*

Most (78%) of the increased total phosphorus load at Valley City and Florence came from the Lower Mainstem subwatershed. During 1989–96, more total phosphorus entered the Lower Mainstem than exited at Valley City, suggesting an accumulation of phosphorus in the Lower Mainstem subwatershed. The Lower Illinois River and its floodplain are very flat and accumulate sediment and associated phosphorus. From the 1989–96 period to the 2015–19 period, this section had shifted from being a net sink to a net source of phosphorus. The reasons for this shift are unknown, but correlations suggest several possible causative mechanisms, including increased dissolved phosphorus and chloride loads; reduced sulfate and nitrate concentrations influencing ionic strength and redox potential in the sediments; and increased volatile suspended solids loads at Valley City, which may indicate greater algal production and contribute to hypoxia in lower river sediments. Additional research is needed to determine the relative influence of these

mechanisms. The remaining 22% of the increased total phosphorus load at Valley City and Florence came from the Sangamon River Basin, where the increase was similar in magnitude to the increased phosphorus discharge from the Sanitary District of Decatur.

In many watersheds across the basin, dissolved phosphorus loads increased and particulate phosphorus and total suspended solids loads decreased from the 1989–96 to 2015–19 periods. A similar pattern has been observed in northwest Ohio (Jarvie et al., 2017) and may be a consequence of the adoption of conservation tillage and/or expansion of tile drainage. Conservation tillage reduces soil loss from cropland and can also reduce the incorporation of phosphorus fertilizer and manure into the soil. Higher concentrations of phosphorus at the soil surface contribute to increased loss of dissolved phosphorus in surface runoff. Tile drainage tends to reduce surface runoff, erosion, and particulate phosphorus loss from cropland. However, dissolved phosphorus can move through soil macropores to tiles and can be discharged from the tiles into drainage ditches and streams.

Dissolved phosphorus may be less likely to be deposited in the Lower Illinois River than particulate phosphorus. While some research indicates that increased chloride concentrations can promote phosphorus release from some sediments, the mechanism is unclear. High chloride concentrations have been shown to reduce zooplankton (Hintz et al., 2022), which may allow greater accumulation of phytoplankton and more extensive hypoxic and anoxic conditions in which phosphorus may be released from sediment.

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A Missing Piece of the Illinois Phosphorus Puzzle: Quantifying Statewide Streambank Erosion to Inform Effective Nutrient Loss Reduction Strategy

By Andrew Margenot, University of Illinois Urbana-Champaign

Streambank erosion is a significant but unquantified non-point source of phosphorus to total Illinois riverine export to the Mississippi River and thus the Gulf of Mexico. Recent work in Iowa suggests that at least one-third of state riverine phosphorus exports are due to streambank erosion (18-year average). However, the Illinois Nutrient Loss Reduction Strategy does not distinguish between agricultural and non-agricultural sources of non-point phosphorus. This leads to overestimated agricultural contributions, potential misdirection of mitigation resources, and likely inaccurate expectations on the magnitude and timescales of phosphorus loss reductions from Illinois. Quantifying streambank erosion and subsequent phosphorus loads — location and amount — is necessary for the accurate apportioning of sources of non-point phosphorus losses and to establish cost-effective mitigation strategies for successful loss reductions.

New research for 2019-24 is being supported by the Illinois Nutrient Research & Education Council. It is motivated by a fundamental question: How much of Illinois' total phosphorus export attributed to agricultural losses are in fact due to streambank erosion? The central hypothesis is that streambank erosion is likely a major non-point source of Illinois riverine total phosphorus export to the Mississippi River Basin. Given Illinois' lower cropland-to-stream ratio of 256 acres per mile versus Iowa's 366 acres per mile, as well as having more meandering streams, the phosphorus export load from streambank erosion in Illinois is expected to align with or even exceed what is reported for Iowa.

The overarching goal of this work is therefore to quantify streambank erosion and phosphorus losses across Illinois to develop a much needed, but currently absent, accounting of a non-point source of phosphorus that is not directly due to agriculture (i.e., not field erosion or fertilizer loss). Specifically, this work will:

- Quantify the extent and magnitude of long-term (decadal) streambank erosion across Illinois, including the 1980–96 period used as baseline by the Illinois NLRS;
- Assess short-term, fine-scale streambank erosion and its drivers at representative watersheds that capture the diversity of streams, soil, and landscape characteristics of Illinois;
- Develop estimates of statewide streambank phosphorus loads using assessments at representative HUC-8 watersheds.

This project will integrate soil science, hydrology, geomorphology, and remote sensing knowledge and approaches. It will also specifically quantify historical and contemporary streambank erosion within eight HUC-8 watersheds. These watersheds will be selected to cover Major Land Resource Areas, major river systems of Illinois, and available U.S. Geological Survey gaging stations which gather streamflow characteristics. This project will leverage artificial intelligence and big data analytics to quantify statewide historical streambank erosion by capitalizing on historical aerial imagery and LiDAR Digital Elevation Models, and by compiling information and data collected by numerous state, federal, and private sectors. Over the course of two years, this project will measure high-resolution assessments of streambank erosion and phosphorus loads by using erosion pins, streambank surveys, drone mapping, terrestrial laser scanners, smartphones, and streambank soil characterizations.

The results of this project will determine how much of the non-point source phosphorus export from Illinois is from streambank erosion. This is essential to establish scientifically sound, fair, and cost-effective phosphorus mitigation targets for the non-point source sector. Determining the quantity of phosphorus entering the state's riverways due to streambank erosion, which is a non-point source not directly due to agricultural contributions (e.g., not fertilizer or in-field erosion), is essential to achieving the Illinois NLRS targets of a 25% reduction in total phosphorus by 2025 and a final sustained reduction of 45%. This work is the first to measure statewide streambank erosion contributions to phosphorus losses in Illinois. It will establish a comprehensive and firm basis for informing management and policy of non-point source contributions to statewide phosphorus export. The results of this work are therefore directly relevant to the Illinois NLRS assessment by:

- Allowing attribution of phosphorus losses to agricultural and non-agricultural sources of non-point phosphorus
- Identifying which stream characteristics contribute to streambank erosion
- Providing stakeholders with calibrated methods (e.g., erosion pins and smartphone-based tools) to monitor streambank erosion.

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U.S. Geological Survey Illinois River Basin Integrated Water Science

By Jim Dunker, U.S. Geological Survey

The U.S. Geological Survey is planning to intensively study 10 Integrated Water Science, IWS, basins — medium-sized watersheds of 10,000–20,000 square miles and underlying aquifers — throughout the United States over the coming decade to improve understanding of water availability in a wide range of environmental, hydrologic, and landscape settings. Each IWS basin will be studied for 10 years, serving as a regional focus for high-density monitoring and cutting-edge research used to better understand and predict water availability (quantity, quality, and use) that may be extended to a region and ultimately to the nation.

Next Generation Water Observing Systems

The Next Generation Water Observing Systems, NGWOS, component in the Illinois River Basin began in October 2020, Fiscal Year 2021, FY21, engaging basin stakeholders on priority issues. Nutrients and harmful algal blooms, or HABs, were selected as the primary focus for monitoring efforts within the basin. The USGS Central Midwest Water Science Center began deploying Next Generation monitoring equipment in FY21 to expand the existing water quality monitoring network from 2-13 continuous monitoring super gages in the basin. Super gages provide enhanced spatial and temporal resolution of nutrient cycle processes in the basin and function as testbeds for new HABs monitoring technologies. In FY22, NGWOS nutrient and HABs monitoring spanned scales and technologies ranging from the discrete sampling of low-order streams and ditches to remotely sensed water quality from satellite imagery.

During FY23/calendar year 2023, USGS will continue to operate and maintain the expanded monitoring network in the Illinois River Basin and begin compiling the new data.

More information about Next Generation Water Observing System: Illinois River Basin | U.S. Geological Survey can be found at usgs.gov/mission-areas/water-resources/science/next-generation-water-observing-system-illinois-river-basin.

Integrated Water Availability Assessments

The Integrated Water Availability Assessments, IWAAs, component in the Illinois River Basin began in FY22 and will leverage NGWOS monitoring with IWAAs modeling to increase understanding and make forecasts of water availability (groundwater and surface water) for human and ecological use under a changing climate. Initial IWAAs modeling efforts use existing models such as MODFLOW, SWAT, SPARROW, and CE-QUAL-W2 to examine nutrient cycle and HABs processes and their relation to system hydrology. The experience, knowledge, and insights gained from these initial modeling efforts will

contribute to improving the following aspects of national hydrologic models:

- A better understanding of how to represent point and non-point sources of nutrients, nutrient transport processes, and the role of legacy nutrients;

- A better understanding of driving mechanisms for HABs in rivers and the drivers of algal toxin production.

In FY23, the USGS IWAAs team will continue to build out the initial modeling effort to identify data gaps and model issues early in the IWS 10-year basin cycle. This approach recognizes the shortcomings of existing models and will lead to the more efficient development of national-scale modeling, especially regarding temporally and spatially variable water quality constituents and loads to streams.

More information on IWAAs in the Illinois River Basin | U.S. Geological Survey can be found at usgs.gov/mission-areas/water-resources/science/integrated-water-availability-assessments-iwaas.

Photo courtesy of Jim Dunker, USGS

Illinois NLRS Science Team Proposed Practice Decisions

By the Illinois NLRS Science Team

The Illinois NLRS Science Team follows a formal evaluation procedure to adopt new conservation practices and update practice performance numbers, which can be found at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy.html.

In July 2022, partner organizations submitted two new proposals to the NLRS Steering Committee: one for floodplain wetlands and one for water and sediment control basins, WASCOBs. A third proposal was submitted to request an updated phosphorus loss reduction efficiency value to constructed wetlands, a previously adopted NLRS practice in Illinois. This was the first time an NLRS practice performance revision has been proposed.

Per the formal evaluation procedure, the NLRS Steering Committee first evaluated the proposals for completeness. The committee determined that all three proposals contained the information required for a full evaluation by the Science Team. Table 3.7 summarizes the decisions made during a series of virtual meetings in October and November 2022.

Table 3.7. *Summary of Illinois NLRS Science Team Proposed Practice Decisions*

Practice	Decision	Efficiency Number	Cost
Water and sediment control basins	Include as an NLRS practice	60% P loss reduction in non-tiled fields; 0% nitrate-N loss reduction	$64/ac/yr
Floodplain wetlands	Insufficient information	–	–
Updated P loss reduction efficiency for constructed wetlands	Insufficient information	–	–

Water and Sediment Control Basins

A water and sediment control basin, WASCOB, is an earthen embankment across the slope of a minor drainageway constructed to trap sediment. This conservation practice was originally submitted for the 2021 Biennial Report cycle and was recommended for resubmission to allow incorporation of known,

active research. The Science Team determined that WASCOBs should be included in the list of NLRS practices due to the inclusion of additional Illinois-based research in the proposal. They decided on a phosphorus loss reduction efficiency value of 60%, which was the mean value found in the literature review provided in the proposal. For reference, Iowa includes WASCOBs as a nutrient reduction practice at 85% phosphorus loss reduction value. The Science Team's more conservative conclusion was due to concerns over dissolved phosphorus loss from WASCOBs during rain events. Since this is a sediment control practice and evidence is lacking at this time for a nitrate-nitrogen loss reduction efficiency value, a 0% nitrate-nitrogen loss reduction efficiency value was adopted.

A cost estimate for this practice was calculated from Natural Resources Conservation Service, NRCS, data provided in the proposal and adopted at $64 per treated acre per year. This factored in installation costs (averaging $4,700), the expected practice life (10 years), and the average drainage area treated (10 acres). These data were converted into an equivalent annual cost per treated acre by multiplying the installation cost per treated acre by a 6% discount factor, then dividing by (1- (1+6%)^(-life)). Annual operation and maintenance costs were not added although such costs are assumed to exist. A primary tracking source for this practice is USDA NRCS. While NRCS cost-share contracts for WASCOBs stipulate operation and maintenance activities and standards, the payment schedules for these contracts do not allow for specific operation and maintenance payments for this practice.

Floodplain Wetlands

Insufficient information about this practice precluded inclusion at this time.

Updated Phosphorus Loss Reduction Efficiency for Constructed Wetlands

Insufficient information about this practice precluded inclusion at this time.

Updated NLRS Agriculture Conservation Practices List

The NLRS Science Team assessed the list of agriculture conservation practices to assign performance values based on each practice's ability to reduce nitrogen and/or phosphorus loss. The original science assessment established these approved NLRS practices. The team approved three new practices – saturated buffers, terraces, and water and sediment control basins – in 2021–22 and added them to the list of recommended practices. Table 3.8 is a combination of tables 3.11 and 3.14 from the original 2015 strategy report to display all of the nitrate-nitrogen and phosphorus reduction practices as well as the newly approved practices.

Table 3.8. *Agricultural conservation practices that reduce nitrogen and/or phosphorus loss*

Practice	N Reduction	P Reduction
In-field practices		
Cover Crops (grassed based)	30%	30% - 50% based on tillage choices
MRTN	10%	0%
Soil Test P	0%	7%
Conservation Tillage	0%	50% based on tillage choices
N inhibitor	10%	0%
50% Fall N / 50% Spring Preplant N	7.5% - 10%	0%
40% Fall N / 10% Preplant / 50% Sidedress	15% - 20%	0%
Spring only N	15% - 20%	0%
Terraces	0%	40%
WASCOBs	0%	60%
Edge-of-field practices		
Bioreactors	25%	0%
Wetlands	50%	0%
Saturated Buffers	40%	0%
Stream Buffers on all applicable crop land *(reduction only for water that interacts with active area)*	90%	25% - 50%
Land use change practices		
Perennial/Energy Crops	90%	50% - 90% based on tile drainage and tillage type

In 2021-22, the following researchers from University of Illinois served on the NLRS Science Team: Dennis Bowman, University of Illinois Extension; Laura Christianson, Department of Crop Sciences; Reid Christianson, Department of Crop Sciences; Jonathan Coppess, Department of Agricultural and Consumer Economics; George Czapar, Emeritus Agricultural and Biological Engineering, and Emeritus Associate Dean & Director of Extension College of Agricultural, Consumer and Environmental Sciences; Paul Davidson, Department of Agricultural and Biological Engineering; Andrew Margenot, Department of Crop Sciences; Maria Villamil, Department of Crop Sciences; and Lowell Gentry, Emeritus Department of Natural Resources and Environmental Sciences.

Photo courtesy of Holly Hudson, CMAP

AGRICULTURAL SECTOR *Key Points*

In 2021, 6% of Illinois' cropland, or 1.39 million acres, grew cover crops.
71% of cropland was managed using conservation tillage.

National Agricultural Statistics Service NLRS survey on nutrient management results:

- 76% of 2021 corn acres managed using the Maximum Return To Nitrogen, MRTN, rate.
- Corn fertilization timing: 25% of acres fall/winter, 35% fall-spring split, 40% in spring
- 85% of corn acres used nitrogen inhibitors for fall/winter-applied anhydrous ammonia, 83% for spring-applied.

Illinois Fertilizer & Chemical Association's 2018-22 4R Survey results:

- 78% of acres are soil tested at least once every four years.
- 91% applied anhydrous ammonia after recommended fall date.
- 90% used nitrogen inhibitors for fall-applied anhydrous ammonia.

50% of rivers and tributaries next to cropland had 30-foot grass buffers on both banks. An opportunity exists to expand stream buffers by 26,700 acres.

$51 million was invested for NLRS agricultural efforts in 2021-22.

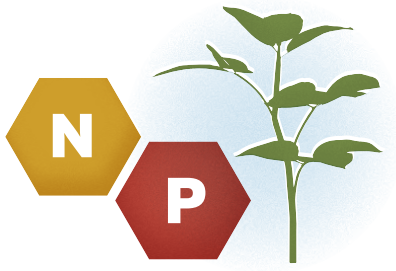
Soil and Water Conservation Districts, along with 45 state, federal, and non-governmental organization partners, reported their efforts toward nutrient loss reduction. 60+ agricultural programs target nutrient loss reduction. More than 186 staff members are dedicated to NLRS agricultural initiatives.

A record 110,660 people attended 941 agricultural events from 2021-22, with a 17% increase in events focused on cover crops.

CHAPTER 4
AGRICULTURAL SECTOR

Each of the chapters on nutrient source sectors in this report – chapters 4, 5, and 6 – has three primary parts: implementation report, current program and project updates, and future strategic actions. Chapter 4 showcases the scale at which the recommended conservation practices are implemented to reduce nutrient loads from agricultural lands. The implementation report section explores progress by tracking resources, outreach, and land and facilities measures. The program updates section highlights current agricultural programs and projects. The chapter concludes with information on how metrics are collected and future strategic actions that will support Illinois Nutrient Loss Reduction Strategy, NLRS, goals.

Chapter 4 discusses the **implementation and progress of conservation practices** to reduce nutrient loads from agricultural lands in Illinois.



Implementation Report

The progress of agricultural implementation is tracked through staff and financial resources, outreach, and land and facilities measures as outlined in Figure 4.1 and described by the full logic model framework in chapter 2. Data collected from agricultural partners about financial investments and outreach efforts inform the resource measures, which were analyzed by University of Illinois Extension staff. Outreach measures were assessed by Anna Marshall, associate professor of Sociology at University of Illinois. Information was submitted by 140 partners from all source sectors, including individual county Soil and Water Conservation Districts, and is available online in Appendix E Partner Updates. Information in the Land and Facilities section came from federal and state agencies, U of I, CropGrower LLC, and the Illinois Fertilizer & Chemical Association.

Figure 4.1. *The NLRS Logic Model. See chapter 2 for the full logic model framework.*

Resource Measures

The first step in tracking the success of the Illinois Nutrient Loss Reduction Strategy, NLRS, is to quantify the resources invested in support of the strategy. Those resources include staff members and funding that advance strategy outreach, implementation, and research. Appropriate staff and financial resources are essential to implementing the recommendations of the NLRS. The following sections summarize staff resources and funding measures that were dedicated to implementing the NLRS from 2021–22. State and federal agencies as well as non-government partner organizations submit spreadsheets detailing their contributions to these resource measures.

Staff Resources

In 2021, approximately 195 full-time equivalent staff members were engaged in Illinois NLRS outreach, implementation, or research for the agricultural sector. In 2022, the number fell slightly to 186 staff members. This includes existing agency employees and multiple organizations working in any capacity on nutrient loss reduction goals. These numbers do not include Illinois' USDA Farm Service Agency, FSA, or Natural Resources Conservation Service, NRCS, staff operations.

Estimates of staff time dedicated to implementing the strategy are not comprehensive. Many people across the state, including farmers and private contractors, implement the strategy, and tracking these efforts can be difficult. For example, there is no way to measure the efforts of private contractors who contribute a significant number of nutrient management activities. After tracking staff resources by this method for a few years, partners reassessed and noticed that more of their work is related to NLRS than previously thought. One example is the Illinois Department of Natural Resources, IDNR. Historically, only Conservation Reserve Enhancement Program staff were listed in NLRS reports. However, starting in 2020, IDNR also included staff from the Agricultural Lease program, Urban Forestry, and the Contaminant Assessment Section. This may indicate that the act of reporting efforts through the NLRS Biennial Report is leading to a greater understanding of the strategy within partner organizations.

Funding Resources

Agricultural sector partners reported $18 million of public and private funds in 2021 and $33 million of funds in 2022 put toward implementing the NLRS (Table 4.1). These funds include investments from county Soil and Water Conservation Districts, which are an integral part of nutrient loss reduction education, outreach, practice implementation, and tracking, but which may not be exclusively working on NLRS-related activities. These numbers do not include funding for USDA FSA or NRCS operations or cost-share program funds, nor do they include Nutrient Research & Education Council, NREC, funds.

It is difficult to capture all expenditures that are outside of state and federal cost-share programs. While some of this information is being tracked, the list is incomplete. As a result, figures reported in this chapter may significantly underestimate the total dollars spent in Illinois. Additionally, improvements to data collection methods in 2022 better reflected NLRS-related investments among the partners, resulting in a significant increase in funding reported in this Biennial Report.

Table 4.1. *Funding resources in the agricultural sector*

	2021	2022
Grants or Loans Received	$5,952,381	$11,150,423
Grants or Loans Given	$6,031,760	$7,551,601
Funded Programs	$6,691,548	$13,380,377
Total	**$18,675,690**	**$32,082,402**

Outreach Measures

The agricultural community in Illinois plays a crucial role in spreading the word about the NLRS and conservation practices for preventing nutrient losses. They have organized events, generated print materials and mass media content, and offered technical assistance to encourage producers to adopt new technologies and practices to reduce nutrient loss from farmland. While the COVID-19 pandemic forced the cancellation of some events, agricultural organizations remained creative in pursuing new avenues for reaching their audience through outreach and engagement activities and tools.

Outreach Activities

The Illinois agricultural community conducted extensive outreach about NLRS and conservation practices (Table 4.2). Agricultural organizations reached more than 110,000 people through 941 sponsored events in 2021 and 2022. These events addressed Illinois efforts to reduce nutrient loss or a specific conservation practice identified in the strategy and included presentations at state and county fairs, schools, Arbor Day events, and watershed planning meetings and webinars. In addition, organizations sponsored hands-on training at field days and workshops designed to show producers how to implement the practices on their own farms.

Table 4.2. *NLRS outreach events 2021–22*

Type of Outreach	Number of Events	Total Reported Attendance
Presentations	625	70,961
Field Days	186	13,548
Workshops	85	7,939
Conferences	44	18,212
Total	**940**	**110,660**

An audience of 110,000 people was the highest reported since the Illinois NLRS originated, even though there were fewer events than in previous reporting periods. Organizations have recognized the power of online presentation tools, including webinars and meetings, to reach more interested people. Partners have developed multiple online platforms to distribute information about nutrient management, cover crops, and other practices that will help Illinois meet its nutrient loss goals.

Outreach Tools

In addition to events, agricultural organizations produced a wide variety of outreach tools and publications, including fact sheets, pamphlets, and newsletters that publicize events or provide basic information about conservation practices. Partners actively used mass media by issuing press releases, providing radio spots, and even producing podcasts about the strategy.

Increasingly, organizations have turned to social media to raise awareness. Facebook is the most common social media platform used by agricultural organizations, but groups also relied on Twitter and Instagram to promote conservation.

The Illinois Farm Bureau used the Meltwater monitoring service to track media coverage of the 2021 Biennial Report and its related news release. In the month following the report's release, September 16 to October 13, the report had 37 media hits and a total reach of 145 million, which is an estimate of potential views of an article. Media outlets that covered the report included local Illinois newspapers, TV and radio stations, industry outlets, such as FarmWeek and Corn & Soybean Digest, and high-profile national outlets such as Yahoo News and Washington Examiner.

As producers across Illinois have become more familiar with the NLRS and its recommended practices,

organizations also provided more technical assistance to help producers implement those practices. Agricultural organizations offered farmers assistance in navigating the details of participating in the growing number of NLRS-related programs. They also offered more specific guidance, for example, about how to install bioreactors or how to manage cover crops. Soil and Water Conservation Districts have been particularly active in providing such assistance, including hosting sales of trees, plants, and conservation seed; sponsoring conservation practice field plots with partners; assisting producers with program participation, including the Conservation Reserve Enhancement Program and the Saving Tomorrow's Agriculture Resources program; and offering one-on-one technical assistance to farmers in their counties.

The outreach topics offered by agricultural organizations also reflect greater interest in specific practices. While the organizations continue to advance the NLRS and conservation practices in general, Table 4.3 shows that they led more events in this reporting period to promote specific practices. Programs supporting conservation practices were more heavily featured in outreach events than at any time in the past. In addition, more than half of the events addressed cover crops, reflecting a sharp increase in coverage — up from 17% of events in the last reporting period. Agricultural organizations also sponsored more events discussing edge-of-field practices, up from 13% in the last reporting period to 22% currently, and conservation tillage, up from 2% last reporting period to 25% currently.

Table 4.3. *Topics of outreach activities 2021–22**

		Number of Events	Percent of Total Events
General Topics	NLRS	157	17%
	Conservation Best Management Practices	84	9%
	Soil Health	213	23%
	Programs	228	24%
Specific BMPs	Nutrient Management	207	22%
	Cover Crops	479	51%
	Edge-of-Field	203	22%
	Tillage	232	25%

*Table reports the number of events where a topic was discussed. More than one topic may have been discussed at an event.

Land and Facilities Measures

The most direct measure of progress toward the Illinois NLRS goals is the measured river loadings of total nitrogen and total phosphorus into and out of the state. However, an additional approach is necessary to best reflect the level of effort and progress toward meeting the strategy's goals. Weather, nutrient movement dynamics, changing land uses, and other variables at the interface of land-to-water transport impact nutrient loading to rivers. Land and facilities metrics provide a measure of progress toward the NLRS water quality goals. In the agricultural sector, nutrient loss reduction measurements can be accomplished through tracking agricultural conservation practice implementation. Quantifying nitrate-nitrogen and total phosphorus loss reductions from conservation practice adoption allows Illinois to measure progress toward the water quality goals.

Partner organization outreach efforts have influenced the implementation of NLRS-recommended conservation practices. This land and facilities section provides details on the adoption of conservation practices recommended in the NLRS. It should be noted that other types of conservation practices are implemented throughout the state as well. While these practices are not currently recommended or tracked by the NLRS, they do reduce nutrient loss. As research continues, new conservation practices have been and can continue to be added for tracking and reporting. The NLRS Practice Approval Process, available at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy.html, describes the literature review, research, and evaluation process for adding new or updating existing conservation practices and conservation practice performance to the NLRS. This process serves to drive continued research into nutrient loss reduction efficiencies of conservation practices. Organizations are encouraged to submit additional conservation practices and updated practice performance through the process discussed in chapter 8.

The Illinois NLRS identified 60 agriculture-related programs, initiatives, and projects developed by agencies and non-governmental partner organizations to help producers establish practices and strategies to reduce nutrient losses. Each agency or organization submitted an update on their current programs and projects for this Biennial Report. The following list includes programs and projects from federal and state agencies that are used as metrics to track land and facilities implementation. Two non-governmental organization projects are included here because their measures improve upon existing parallel federal and state programs.

More information about monitoring, progress, scenario comparisons, and future plans are available in chapter 8.

Federal Programs and Projects

- Agriculture Conservation Easement Program
- Conservation Reserve Program
- Conservation Stewardship Program
- Environmental Quality Incentives Program
- FSA Certified Cover Crop Acres
- Mississippi River Basin Healthy Watersheds Initiative
- NASS Illinois NLRS Survey
- National Water Quality Initiative
- Regional Conservation Partnership Program

State Programs and Projects

- Building Soil Health on Agricultural Leases
- Conservation Reserve Enhancement Program
- Contaminant Assessment Section Restoration
- Fall Covers for Spring Savings
- Partners for Conservation Program
    - Conservation Capacity Building
    - Streambank Stabilization and Restoration Program
- Section 319 Nonpoint Source Program
- University of Illinois Extension Watershed Outreach Associates
- Woodchip Bioreactor Research and Demonstrations

Additional Land and Facilities Measures

- Agricultural Stream Buffers Using Satellite Imagery
- IFCA 4R Metrics Survey
- OpTIS Conservation Tillage

Governmental Land and Facilities Measures

This section provides details on the conservation practices recommended in the NLRS that were implemented with technical and financial assistance from federal and state conservation programs. Section subheadings are listed by program. Since many conservation practices are implemented without utilizing federal or state conservation programs, an NLRS survey was once again conducted by the USDA National Agricultural Statistics Service to provide a more holistic view of conservation practice adoption.

Federal Agricultural Conservation Programs

Federal cost-share programs are available through a variety of governmental agencies. These programs assist producers in adopting nutrient loss reduction practices.

USDA Farm Service Agency

Conservation Reserve Program

The Conservation Reserve Program, CRP, partners with U.S. landowners and operators to conserve and enhance the nation's natural resources. Voluntary participants receive federally funded cost-share assistance, annual rental payments, and incentives in exchange for establishing and maintaining grass-, wetland-, and tree-based practices over contracts spanning 10 to 15 years. The USDA Farm Service Agency, FSA, funds the program and administers CRP enrollment in Illinois. The USDA Natural Resources Conservation Service provides technical services with assistance from county Soil & Water Conservation Districts, SWCDs.

Since 2017, acres enrolled in CRP buffers and wetlands have remained stable, with a slight decreasing trend for buffers, and a slight increasing trend for wetlands (Figure 4.2). Each CRP conservation practice has an assigned practice code, such as CP21 which designates a filter strip. CRP buffers include acreage enrolled in filter strips (CP21), riparian buffers (CP22), farmable wetland pilot buffers (CP28), marginal pasture-land wildlife habitat buffers (CP29), habitat buffers for upland birds (CP33), and State Acres for Wildlife Enhancement, SAFE, buffers (CP38A). Wetlands include acres enrolled in shallow water areas (CP9), wetland restoration (CP23), farmable wetlands pilot wetland (CP27), marginal pasture-wetland buffers (CP30), bottomland timber establishments on wetlands (CP31), SAFE wetlands (CP38B), and farmable wetland programs and constructed wetlands (CP39).

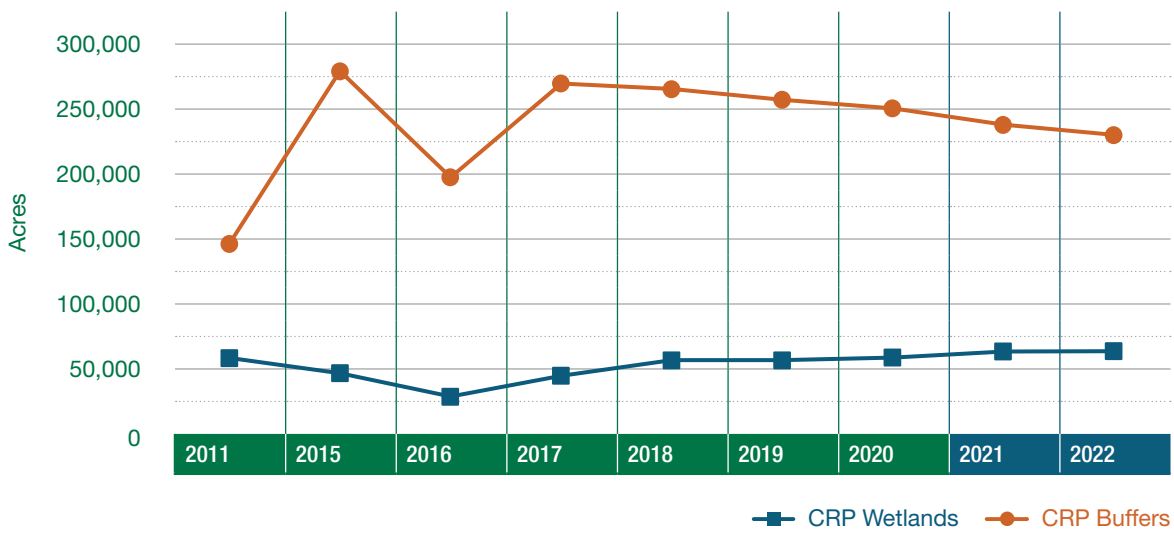


Figure 4.2. *Acres enrolled in CRP wetlands and buffers. See Appendix G for companion data.*

Producers participating in USDA programs must file an accurate and timely acreage report for all land uses and crops. In 2021 and 2022, this report included 1 million acres certified for foraging and grazing, or acres left standing. These producer acreage reports are combined with CRP-enrolled acres to result in a total acreage of perennials, energy, or pasture across Illinois. The statewide total acreage remained close to 1.5 million through 2022 (Figure 4.3). The portion enrolled in CRP perennial vegetation practices was more than half a million acres. CRP practices included: introduced grasses (CP1), permanent native grasses (CP2), permanent wildlife habitats (CP4D), grassed waterways (CP8A), vegetative cover – grass – already established (CP10), contour grass strips (CP15A), contour grass strips on terraces (CP15B), rare and declining habitats (CP25), SAFE grasses (CP38E), tree planting (CP3), hardwood tree planting (CP3A), SAFE trees (CP38C), pollinator habitats (CP42), prairie strips (CP43), and grasslands (CP87, CP87A, CP88, CP88A).

Additional information on FSA conservation practices and land measures is available online in Appendix D FSA Variables and Land Measures.

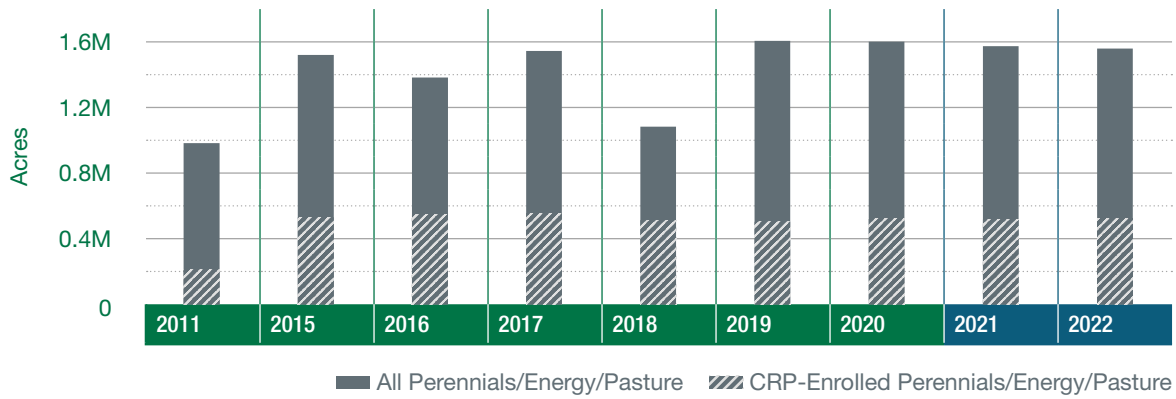


Figure 4.3. *Acres in perennials/energy/pasture. See Appendix G for companion data.*

Conservation Reserve Enhancement Program

Illinois landowners enroll frequently flooded and environmentally sensitive cropland in a federal Conservation Reserve Enhancement Program, CREP, contract with the Farm Service Agency. Following the federal program enrollment period, the Illinois Department of Natural Resources, IDNR, extends the terms of that federal contract by enrolling the land into a state-held IDNR CREP conservation easement for 15 years or in perpetuity beyond the expiration of the federal CREP contract. More information about the state IDNR CREP program is available in the State Agricultural Conservation Programs section.

FSA Certified Cover Crop Acres

Producers can simultaneously report acres in cash crops and cover crops to FSA. Some of the acres presented here were voluntarily reported and thus represent cover crops that were planted regardless of federally funded conservation programs. The total acreage also includes cover crop acres required to be reported through the USDA Risk Management Agency's, RMA, Pandemic Cover Crop Program.

SWCDs and other agricultural organizations provided outreach during the 2021 and 2022 growing seasons and reminded farmers to report their cover crop acres to FSA. Cover crop acres included all farmland planted with a certified cover crop, meaning the acres had an "intended use" of "cover only." Cover crop acres were elevated from 2019-22, perhaps for a few reasons. First, there may be a large amount of prevent plant acres in response to widespread flooding, especially in 2019. The second may be an increase in government subsidy cover crop programs offered through RMA and NRCS in 2021 and 2022 (Figure 4.4).

More information on FSA conservation practices and land measures is available in the Appendices.

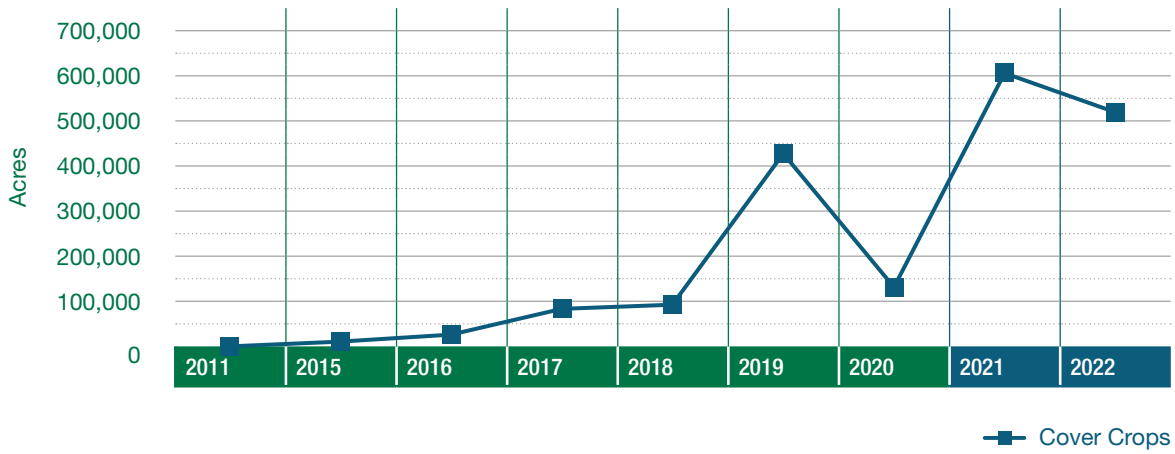


Figure 4.4. *Acres in cover crops reported by producers to FSA. See Appendix G for companion data.*

USDA Natural Resources Conservation Service

The USDA Natural Resources Conservation Service, NRCS, provides agricultural producers with one-on-one technical assistance to evaluate natural resources concerns in their farming operations and to design and implement NLRS-recommended conservation practices. Using these practices enhances agricultural operations and can lead to cleaner water and air, healthier soil, and better wildlife habitat. NRCS administers multiple programs in Illinois to address natural resource concerns such as nutrient loss and wetland restoration, including the Environmental Quality Incentives Program, EQIP, the Conservation Stewardship

Program, CSP, and the Agricultural Conservation Easement Program, which includes the Wetland Reserve Easements and Wetland Reserve Enhancement Partnership programs. In addition to general EQIP and CSP allocations received, NRCS also receives separate, additional allocations for the Mississippi River Basin Initiative, National Water Quality Initiative, and Regional Conservation Partnership Program, and several other ranking pools.

All of these voluntary conservation programs provide financial support to producers and landowners to integrate natural resources conservation into agricultural operations and other land management. Together, NRCS and producers co-invest in proven conservation practices that reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and build resilience to flooding and other natural disasters.

For detailed information on NRCS programs, see the NRCS At a Glance reports online in Appendix C and at nrcs.usda.gov/programs-initiatives.

The NLRS-recommended conservation practices promoted by NRCS are summarized in Table 4.4. Multiple practice codes are used to track for filter strips, conservation tillage, and perennial land-use changes. Unit conversions for bioreactors, saturated buffers, terraces, and water and sediment control basins, WASCOBs, are listed in Table 4.5. These conversions are used so that all NLRS metrics can be expressed as acres treated.

Photo courtesy of Jennifer Jones, Illinois Extension

Table 4.4. *NLRS conservation practice codes, names, and units are reported through the NRCS datasets*

NLRS Practice Category	Practice Base Code	Conservation Practice Name	Unit
Filter Strip	393	Filter Strip	acre
Filter Strip	391	Riparian Forest Buffer	acre
Filter Strip	390	Riparian Herbaceous Cover	acre
Nutrient Management	590	Nutrient Management	acre
Conservation Tillage	329	Residue and Tillage Management, No Till	acre
Conservation Tillage	345	Residue and Tillage Management, Reduced Till	acre
Cover Crops	340	Cover Crop	acre
Perennial	327	Conservation Cover	acre
Perennial	512	Pasture and Hay Planting	acre
Bioreactor	605	Denitrifying Bioreactor	number of
Saturated Buffer	604	Saturated Buffer	number of
Terrace	600	Terrace	feet
WASCOB	638	WASCOB	number of
Wetland	656	Constructed Wetland	number of
Wetland	658	Wetland Creation	number of

Table 4.5. *Conversion Factors for the NRCS conservation practices reported in units other than acres*

Practice Name	Unit	Illinois Conversion to Acres Treated	Conversion Notes
Denitrifying Bioreactor	number of	50	The 2014 Illinois NLRS Science Assessment referenced 50 ac, or 20ha, average treated area per bioreactor (www.sciencedirect.com/science/article/pii/S2212428413000194).
Saturated Buffer	number of	0.0384	Saturated buffer research showed the median length of saturated buffer needed to treat 1 acre of tile-drained land is 26 feet, or 1 acre/26 feet = 0.0384 ac/ft. (Janes and Isenhart 2018, and Utt et al. 2015 (https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/natural-resouces-analysis/pdfs/admc_final_report.pdf, https://acsess.onlinelibrary.wiley.com/doi/abs/10.2134/jeq2018.03.0115, https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/natural-resouces-analysis/pdfs/admc_final_report.pdf, https://acsess.onlinelibrary.wiley.com/doi/abs/10.2134/jeq2018.03.0115, and https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/natural-resouces-analysis/pdfs/admc_final_report.pdf)
Terrace	feet	0.016	The 2021 Illinois NLRS Science Team evaluation found the average terrace area treated to be 40 ac/2500 ft = 0.016 ac/ft. The 2,500 linear feet was assumed when calculating cost estimate averages using 2020 NRCS data.
WASCOB	number of	10	The 2022 Illinois NLRS Science Team evaluation found an average WASCOB treats 10 ac, or .05 ha. This average was found using NRCS data.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program, EQIP, offers financial assistance to agricultural producers who co-invest in conservation practices that address natural resource concerns and deliver environmental benefits, such as improved air and water quality, ground and surface water conservation, increased soil health and reduced soil erosion and sedimentation, new or enhanced wildlife habitat, and mitigation against drought and increasing weather volatility.

In federal Fiscal Years 2021 and 2022, NRCS obligated 869 new EQIP contracts to implement conservation practices on 68,899 acres. This represents a total financial investment of approximately $33 million.

The totals represented in Figure 4.5 include all conservation practices implemented through EQIP, not just nutrient reduction conservation practices. Since acres may be removed when contracts expire, the cumulative acres may not express practices currently implemented. Therefore, the five-year drop-off expresses acres that are currently implemented in active contracts.

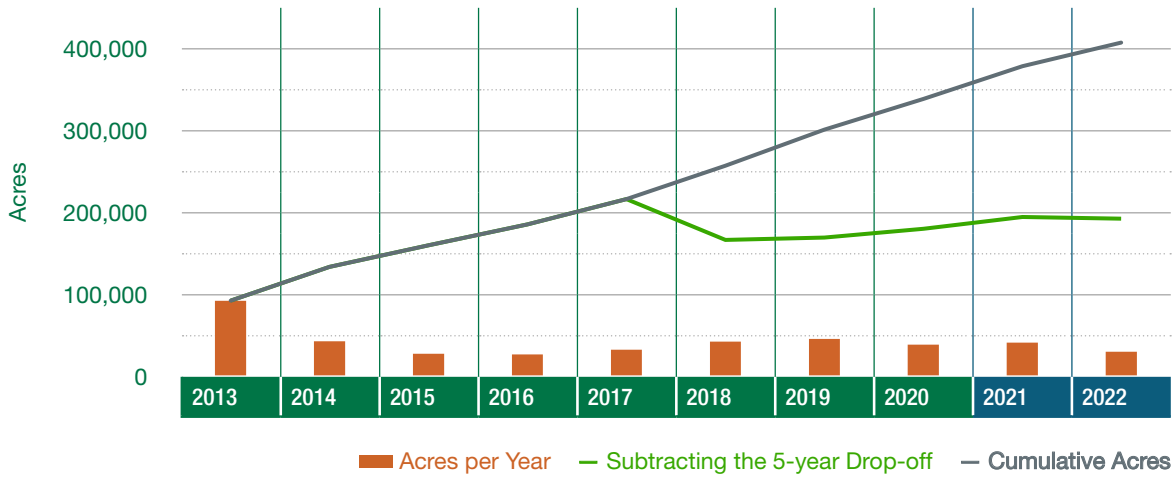


Figure 4.5. *Total acres enrolled in EQIP. See Appendix G for companion data.*

Figure 4.6 shows the number of acres and dollars spent on nutrient conservation practices implemented through EQIP. These are new implementations for 2021–22:

- ☑ Filter strips were implemented on 32 acres for approximately $12,000.
- ☑ Nutrient management plans were implemented on 17,948 acres for approximately $390,000.
- ☑ Conservation tillage practices were implemented on 19,566 acres for approximately $334,000.
- ☑ Cover Crops were implemented on 31,296 acres for approximately $1.6 million.
- ☑ Perennial practices were implemented on 1,950 acres for approximately $530,000.
- ☑ Bioreactors were implemented to treat 80 acres for approximately $33,000.
- ☑ Terraces were implemented to treat 3,421 acres for approximately $612,000. This is the first biennial period for which this practice is tracked.
- ☑ WASCOBs were implemented to treat 23,870 acres for approximately $2.7 million. This is the first biennial period for which this practice is tracked.

No wetlands and or saturated buffers were reported as implemented for 2021-22.

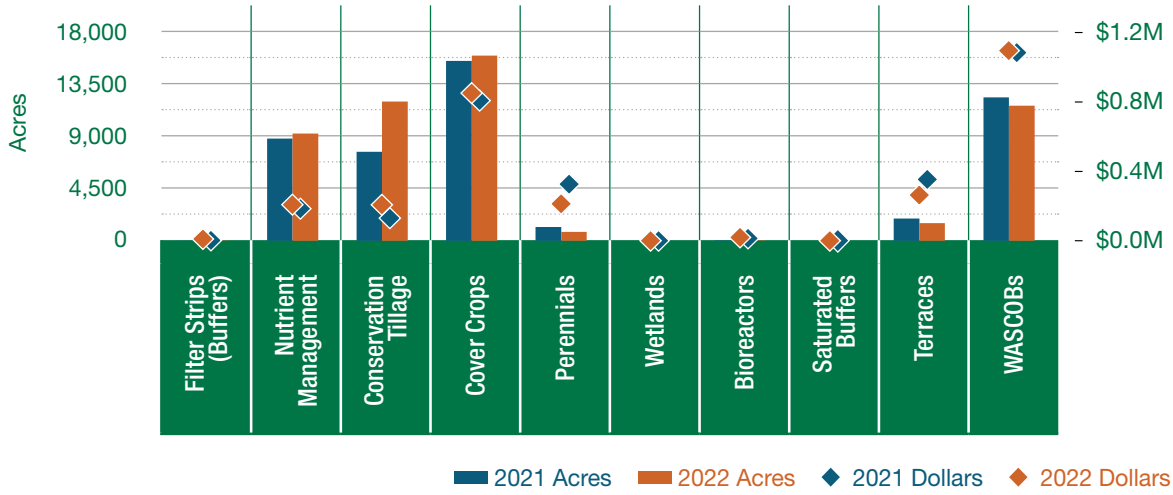


Figure 4.6. *Acres implemented and dollars spent on nutrient conservation practices through EQIP. See Appendix G for companion data.*

At the end of FY22, a backlog of 1,070 EQIP applications were waiting for funding, representing an unmet conservation need of $34,602,841 statewide. This backlog represents all conservation practices within the applications waiting for EQIP funding, not just NLRS practices.

Conservation Stewardship Program

The Conservation Stewardship Program, CSP, provides financial assistance to farmers who are maintaining and improving existing conservation systems, and adopting new, additional conservation activities. Participants earn CSP payments for conservation performance — the higher the performance, the higher the payment.

In FY21 and FY22, the Natural Resources Conservation Service, NRCS, obligated 357 new CSP contracts on 274,328 acres for a total financial investment of approximately $29 million. NRCS renewed 211 CSP contracts on 149,827 acres, investing an additional $16 million in 2021–22. Figure 4.7 shows cumulative acres implemented through CSP contracts and accounts for five-year contract expirations.

Figure 4.7 shows the number of new acres on which nutrient conservation practices were implemented through CSP, starting in 2011. These are the new CSP implementations for 2021-22:

- Filter strips were implemented on 62 acres.
- Nutrient management plans were implemented on 334,785 acres.
- Conservation tillage practices were implemented on 206,209 acres.

- Cover Crops were implemented on 185,497 acres.
- Perennial practices were implemented on 4,179 acres.
- No wetlands, bioreactors, or saturated buffers were implemented in 2021-22.

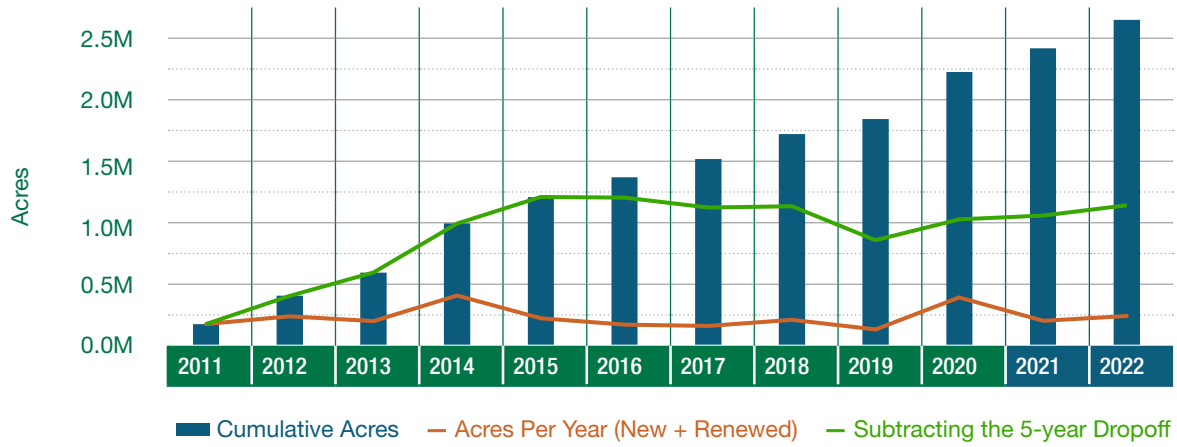


Figure 4.7. *Cumulative acres enrolled in CSP, 2011–22. See Appendix G for companion data.*

Perennial vegetation was established on 291.6 and 1,026 acres in 2019 and 2020, respectively. Figure 4.8 also provides analogous information about dollars invested for each practice under this program.

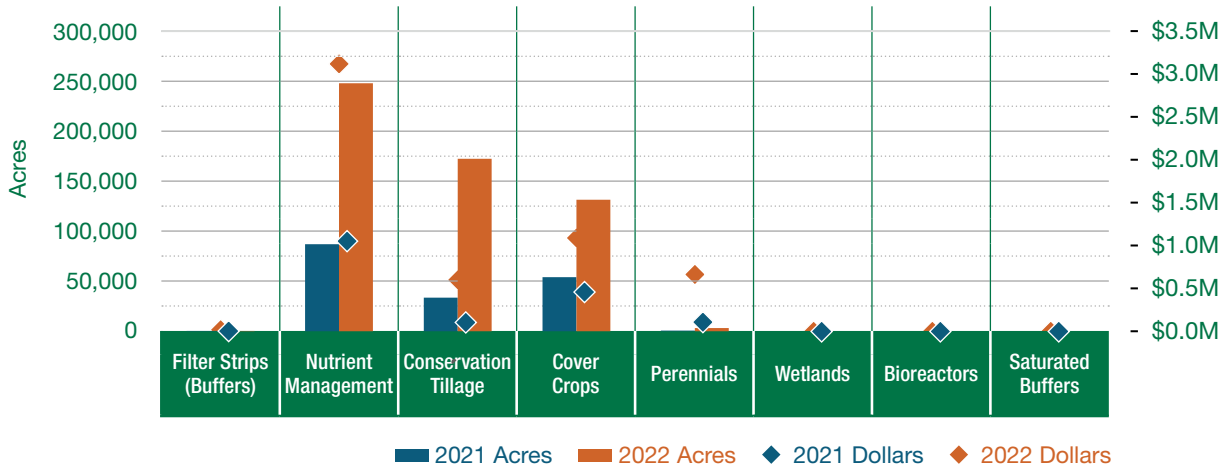


Figure 4.8. *Acres implemented and dollars spent on nutrient conservation practices through CSP. See Appendix G for companion data.*

As the end of FY22, a backlog of 370 CSP applications were waiting for funding, representing an unmet conservation need of $25,808,667 statewide. This backlog represents all conservation practices within the applications waiting for CSP funding, not just NLRS practices.

Agriculture Conservation Easement Program

The Agriculture Conservation Easement Program, ACEP, was initiated as a Farm Bill program in 2014. The program provides landowners, land trusts, and other entities with assistance to protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Prior to 2014, all NRCS wetland easements were enrolled and restored under the Wetlands Reserve Program, WRP. With the Farm Bill in 2014, WRP was repealed and replaced with the Agricultural Conservation Easement Program – Wetlands Reserve Easement, ACEP-WRE. This included priority areas under WREP, Wetlands Reserve Enhancement Program. Under ACEP-WRE and ACEP-WRE/WREP, NRCS helps to restore, protect, and enhance enrolled wetlands. These continue to be voluntary programs through which NRCS signs agreements with eligible partners to leverage resources to carry out high-priority wetland protection, restoration, and enhancement in addition to improving wildlife habitat. Unlike other conservation practices, wetlands are neither seasonal nor annual contract-based, so acres previously enrolled in this program remain on the landscape. Most easements are in perpetuity. However, some are held for 30 years if a landowner wants all the rights returned when the agreement expires.

In FY21 and FY22, NRCS funded 13 new WRE agreements with landowners to purchase easements on 1,304 acres for $7.3 million. In 2021–22, they also funded six new WREP agreements with landowners to purchase easements on 2,185 acres for $8.6 million. Figure 4.9 shows the new wetland acres enrolled in WRE and WREP contracts. WRE enrolled 850 and 454 acres in 2021 and 2022, compared to 1,403 and 1,509 acres in 2019 and 2020 respectively. WREP enrolled 1,341 and 844 acres in 2021 and 2022, compared to zero acres in 2019–20. Since 2011, nearly 15,000 total acres of wetlands have been enrolled in these programs.

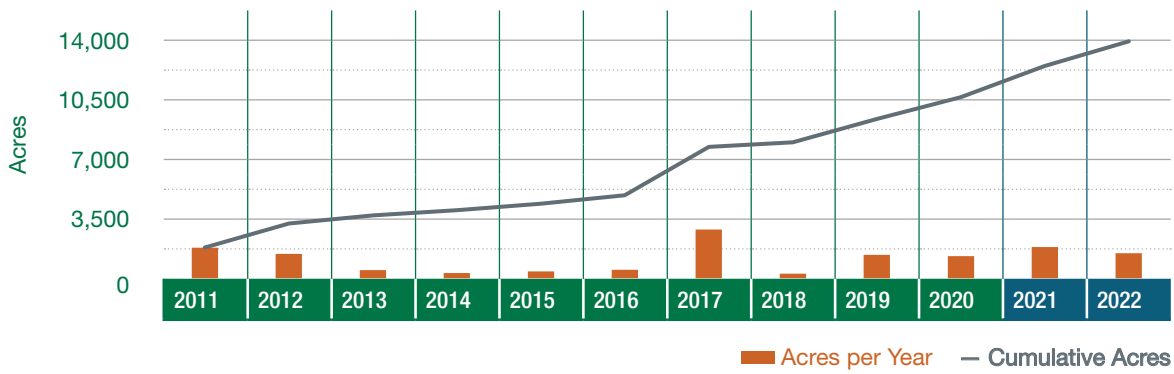


Figure 4.9. *New wetland acres enrolled in ACEP-WRE and ACEP-WRE/WREP programs. See Appendix G for companion data.*

Mississippi River Basin Healthy Watersheds Initiative

Through the Mississippi River Basin Healthy Watersheds Initiative, MRBI, (Figure 4.10), NRCS and partners work with producers and landowners to voluntarily implement conservation practices that improve water quality, restore wetlands, enhance wildlife habitat, and sustain agricultural profitability in the Mississippi River Basin.

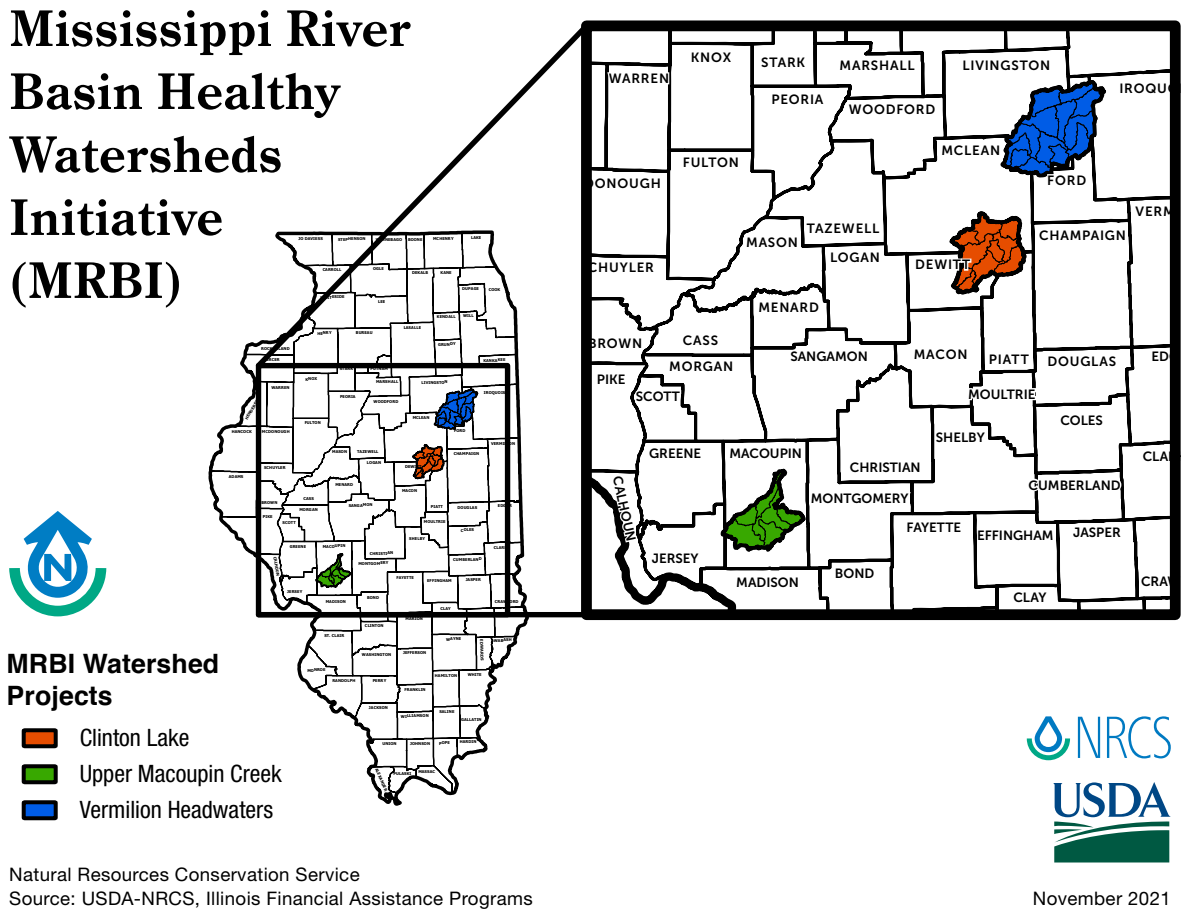


Figure 4.10. *Mississippi River Basin Healthy Watersheds Initiative participating locations*

In FY21 and FY22, NRCS obligated 26 new MRBI contracts to implement conservation practices on 4,542 acres. This represents a total financial investment of nearly $1.2 million. These two-year totals include 10 contracts obligated in the Upper Macoupin Creek watershed and 15 contracts obligated in the Vermilion Headwaters watershed. Conservation practice implementation in these watersheds is further

discussed in the NRCS Regional Conservation Partnership Program section. One contract was obligated in the Clinton Lake watershed in 2021–22. Since 2015, more than $2.3 million has been invested in the Vermilion Headwaters watershed (Table 4.6). Since 2016, more than $1 million has been invested in the Upper Macoupin Creek watershed (Table 4.7).

For more information on MRBI in Illinois, see nrcs.usda.gov/programs-initiatives/mississippi-river-basin-healthy-watersheds-initiative.

Table 4.6. *Vermilion Headwaters watershed MRBI contracts 2015–22*

MRBI	2015-18	2019	2020	2021	2022	Cumulative
Contracts	47	9	6	7	8	77
Acres	6,126	1,785	1,627	2,076	1,270	12,884
Obligation	$1,089,192	$182,376	$187,718	$521,996	$341,066	$2,322,348

Table 4.7. *Upper Macoupin Creek watershed MRBI contracts 2016–22*

MRBI	2016-18	2019	2020	2021	2022	Cumulative
Contracts	24	8	2	6	4	44
Acres	2,790	582	1,079	609	500	5,560
Obligation	$490,612	$163,270	$91,603	$175,905	$133,995	$1,055,385

National Water Quality Initiative

Through the National Water Quality Initiative, NWQI, (Figure 4.11), eligible producers implement voluntary conservation practices to contribute to cleaner water in impaired watersheds where federal investments can improve water quality. Using EQIP funds, NRCS provides financial and technical assistance to producers to implement conservation practices that promote soil health and reduce erosion and nutrient runoff while sustaining agricultural productivity.

In FY21 and FY22, NRCS obligated eight new NWQI contracts to implement conservation practices on 985 acres. This represents a total financial investment of $180,945 (Table 4.8).

For more about this initiative, see nrcs.usda.gov/programs-initiatives/national-water-quality-initiative.

Table 4.8. *NRCS National Water Quality Initiative contracts 2021–22*

	NWQI-EQIP	Lake Bloomington Watershed	Friends Creek Watershed	Money Creek Watershed	Cumulative
2021	Contracts	4			4
	Acres	689			689
	Obligation	$135,668			$135,668
2022	Contracts		2	2	4
	Acres		231	65	296
	Obligation		$32,835	$12,442	$45,277

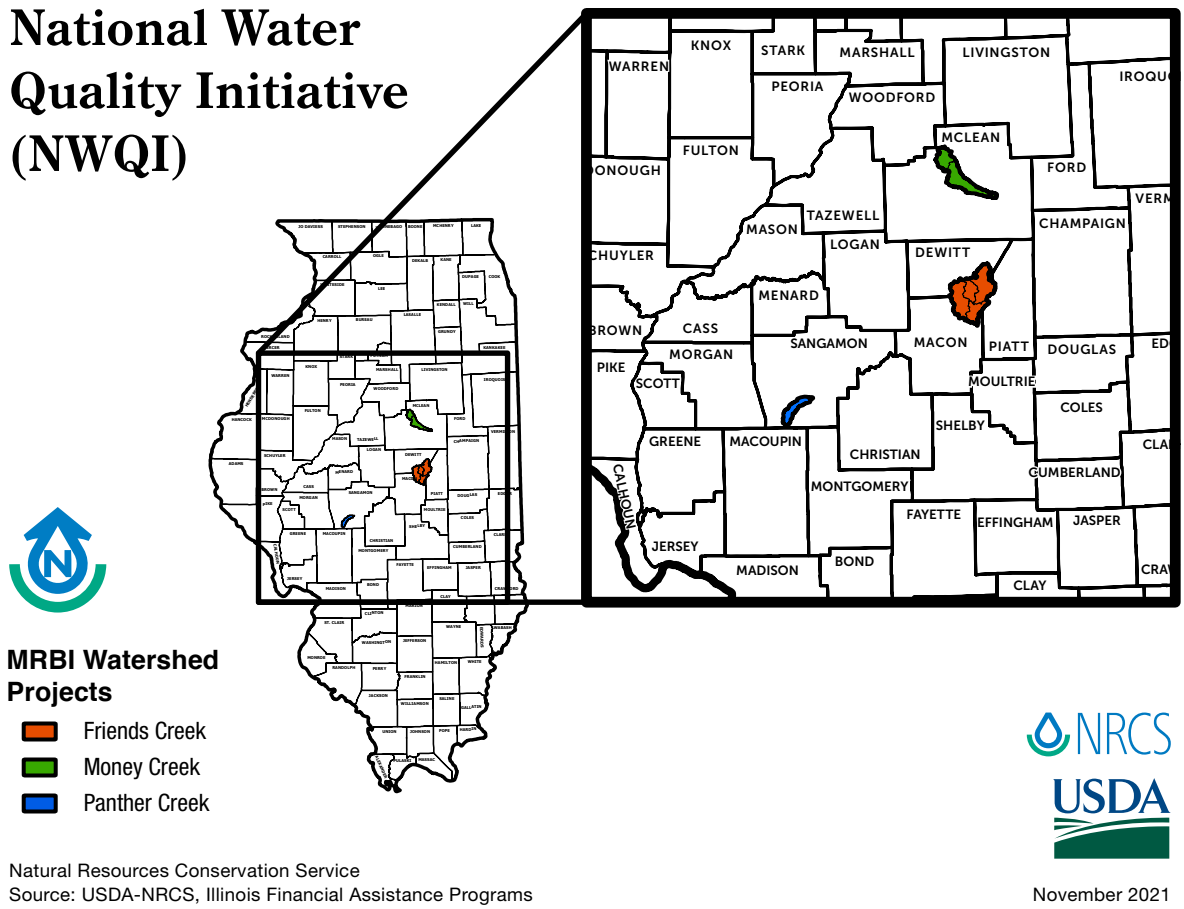


Figure 4.11. *Eligible National Water Quality Initiative watersheds in Illinois*

Regional Conservation Partnership Program

The Regional Conservation Partnership Program, RCPP, promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance through partnership agreements and RCPP conservation program contracts. For more information on RCPP projects, see nrcs.usda.gov/programs-initiatives/rcpp-regional-conservation-partnership-program.

RCPP projects in FY21–22 include:

- ☑ Upper Macoupin Creek Watershed Partnership
- ☑ Illinois Headwaters Conservation Partnership
- ☑ Otter Lake Source Water Protection
- ☑ Precision Conservation Management
- ☑ MRB-Big Bend Enhancing Water - Soil - Habitat Quality Project
- ☑ Driftless Area Habitat for the Wild and Rare Phase 2
- ☑ Illinois Working Lands, Water, and Wildlife Partnership

Lake Springfield, Lake Decatur, and Kinkaid watershed are RCPP projects funded in 2020, 2021, and 2022. Applications and funding decisions for these projects will take place in 2023 and 2024.

Figure 4.12 shows the number of acres on which nutrient conservation practices were implemented through RCPP. These were the new RCPP implementations for 2021-22:

- ☑ Filter strips were implemented on two acres.
- ☑ Nutrient management plans were implemented on 26,965 acres.
- ☑ Conservation tillage practices were implemented on 20,463 acres.
- ☑ Cover Crops were implemented on 39,588 acres.
- ☑ Perennial practices were implemented on 400 acres.
- ☑ Bioreactors were implemented to treat 40 acres in 2022 only.
- ☑ Water and sediment control basins, WASCOBs, were implemented to treat 870 acres. They were not tracked by the NLRS prior to this period.

No wetlands were implemented in 2021–22. No saturated buffers or terraces were implemented; neither were tracked by the NLRS prior to this period.

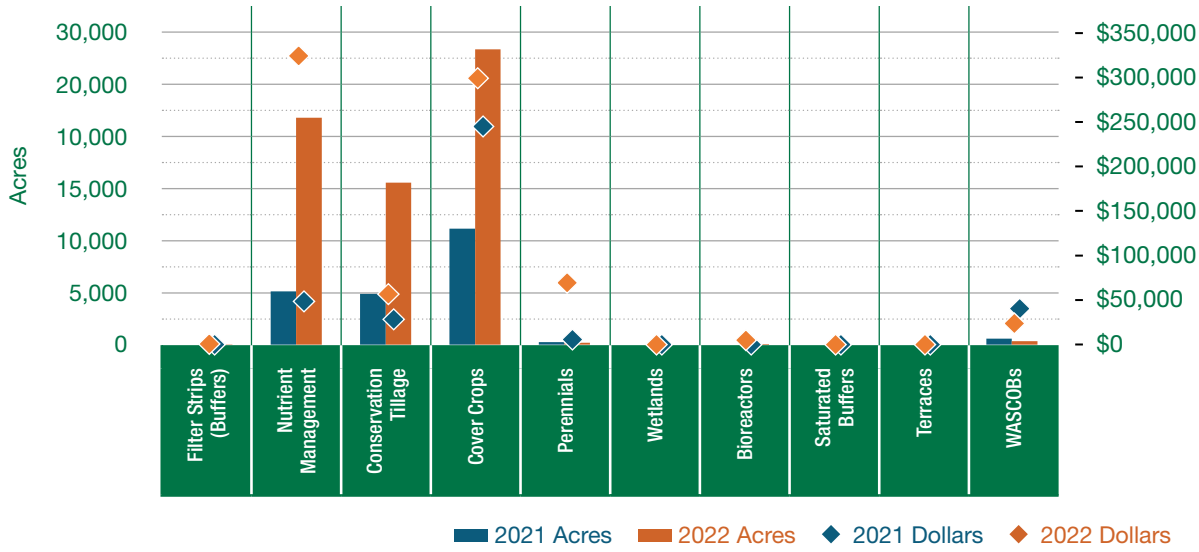


Figure 4.12. *Acres implemented and dollars spent on nutrient conservation practices through RCPP. See Appendix G for companion data.*

Upper Macoupin Creek Watershed Partnership

Through the Upper Macoupin Creek Watershed Partnership (Figure 4.13) with NRCS, the American Farmland Trust and 15 partners continue to advance the adoption of conservation practices that improve soil health, reduce nutrient loads, and provide economic benefits to local farms. The partnership has continued to invest in conservation practice implementation through RCPP and, as discussed in the previous section, the Mississippi River Basin Healthy Watershed Initiative, MRBI, funding. In 2021, $393,478 was obligated to seven contracts. In 2022, $753,346 was obligated to 13 contracts. Conservation practices — including cover crops, no-tillage, strip tillage, reduced tillage, and nutrient management — were enrolled on 13,397 acres in 2021–22. Table 4.9 provides details on NRCS investments through the RCPP funding pools from 2016–22.

Table 4.9. *Conservation practice investments in the Upper Macoupin Creek Watershed through RCPP for 2016–22*

RCPP-EQIP	2018	2019	2020	2021*	2022	Cumulative
Contracts	3	3	5	4	0	15
Acres	858	599	886	243	0	2,586
Obligation	$77,046	$77,939	$115,759	$49,508	0	$320,252

RCPP-CSP	2018	2019	2020	2021	2022	Cumulative
Contracts	11	1	6	3	13	34
Acres	6,559	1,186	11,544	3,461	9,693	32,443
Obligation	$81,326	$53,797	$487,792	$168,065	$619,351	$1,410,331

*For RCPP-EQIP, all project funds were obligated in FY21.

Since 2018, the partnership has invested more than $1.7 million in conservation practices through RCPP. From 2017 to 2021, nitrate, total phosphorus, and suspended-sediment monitoring was conducted in partnership with U.S. Geological Survey. See the Appendix E Partner Updates online for more information.

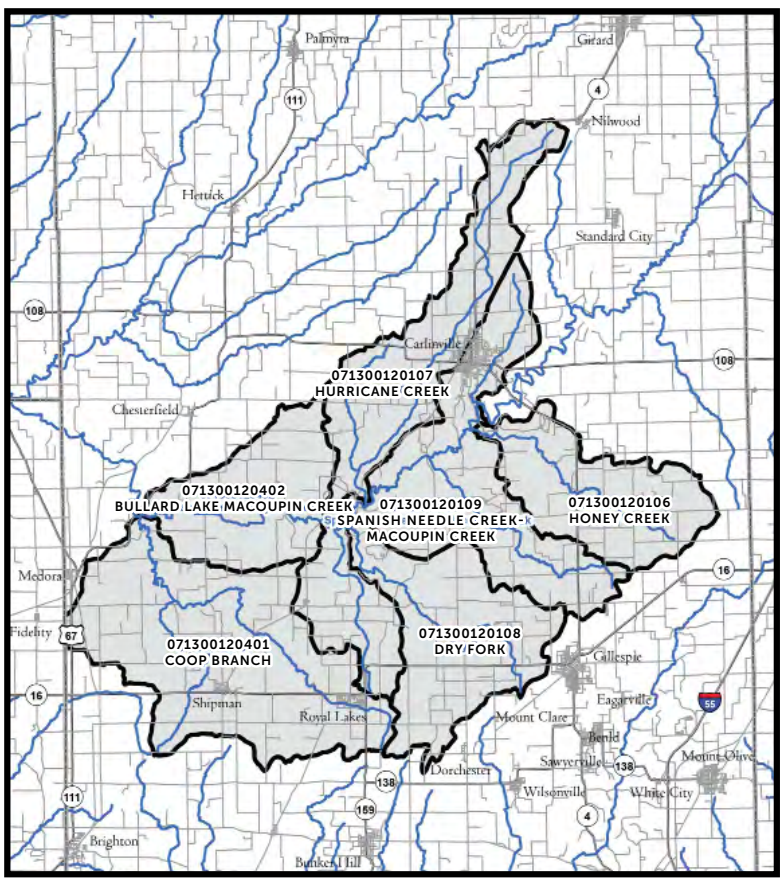


Figure 4.13. *Upper Macoupin Creek Watershed Partnership*

Illinois Headwaters Conservation Partnership

The Illinois Headwaters Invasive Plant Partnership (Figure 4.14) includes portions of the historically prairie-dominated Grand Prairie Region, as well as the South-Central Region, where forest slightly exceeded prairie acreage. While forest may not be the dominant land cover in the partnership area, it greatly contributes to the biological diversity of the region. Recreational opportunities in the forest include hunting, hiking, and camping. Healthy forests are essential for reducing soil erosion, protecting water quality, and reversing pollinator decline. Since FY20, over $387,000 has been obligated through 74 contracts to this partnership spanning nearly 3,500 acres (Table 4.10). Table 4.10 provides details on NRCS investments through the RCPP from 2020–22. The 2020 data is provided here because it was not available for the previous Biennial Report.

Table 4.10. *Conservation practice investments in the IHCP Region through RCPP in 2020–22*

RCPP-EQIP	2020	2021	2022	Cumulative
Contracts	12	35	27	74
Acres	627	1,654	1,155	3,436
Obligation	$43,620	$203,641	$140,295	$387,556

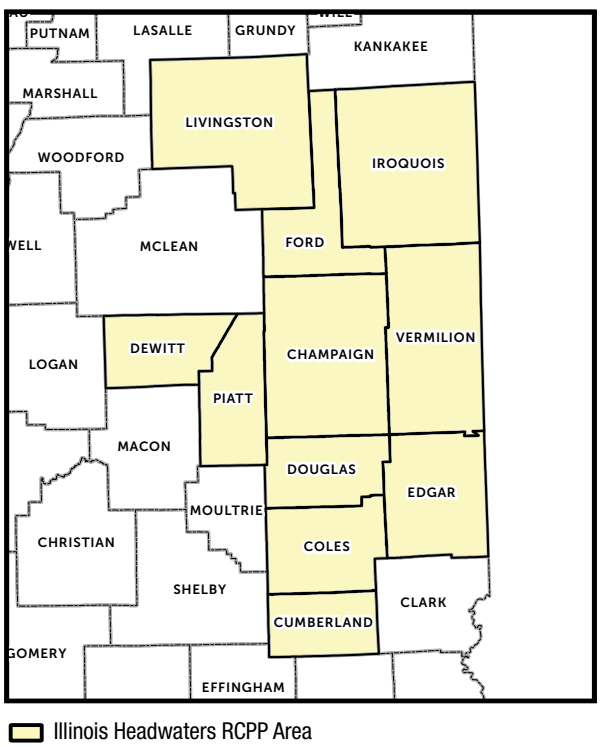


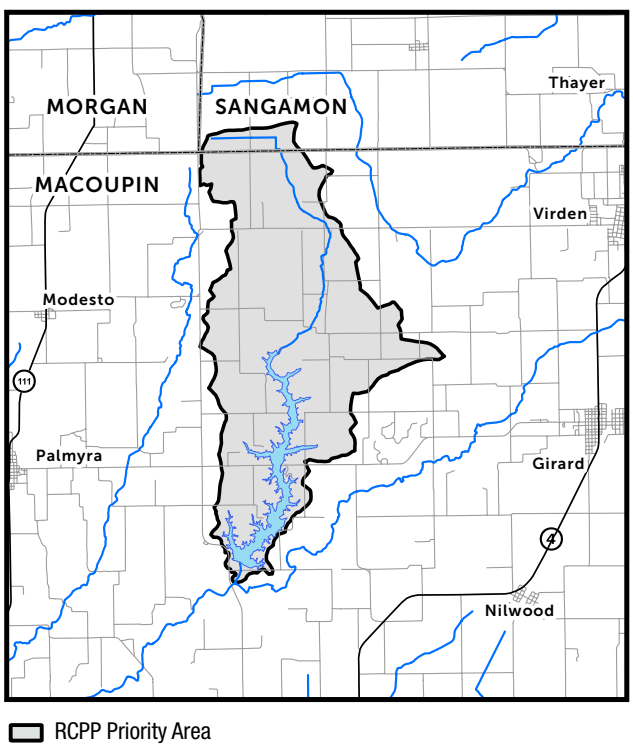
Figure 4.14. *Counties participating in the Illinois Headwaters Forest Improvement Partnership*

Otter Lake Source Water Protection

Otter Lake (Figure 4.15) is located in the heart of Illinois corn and soybean country. Its primary use is to supply drinking water to 19,000 rural residents. Every day, the lake supplies water to six towns, two villages, and two rural water districts. The Otter Lake Source Water Protection Project will protect Otter Lake by reducing excessive levels of sedimentation and nutrient loading. Since FY20, nearly $295,800 has been obligated through 12 contracts spanning 923 acres. Table 4.11 provides details on NRCS investments through the RCPP from 2020-22. The 2020 data is provided here because it was not available for the previous Biennial Report.

Table 4.11. *Conservation practice investments in the Otter Lake Source Water Project through RCPP from 2020–22*

RCPP-EQIP	2020	2021	2022	Cumulative
Contracts	7	3	2	12
Acres	411	121	391	923
Obligation	$142,783	$40,213	$112,804	$295,800



NRCS
USDA

Figure 4.15. *Otter Lake Watershed*

Precision Conservation Management

Precision Conservation Management, PCM, (Figure 4.16) is a program led jointly by Illinois Corn Growers Association and Illinois Soybean Association. PCM was launched in 2016 in response to the Illinois NLRS and has worked with 375 farmers in Illinois and about 100 farmers in Kentucky and Nebraska. The program's objective is to help farmers adopt and scale the use of conservation practices in a financially responsible way. PCM recognizes that every conservation decision is a business decision for farmers. Through collaborations with more than 30 partners and the development of a farmer-friendly data collection platform, PCM offers one-on-one technical support, confidential yearly reports of each farmer's environmental and financial strengths and weaknesses, data summaries demonstrating financial and environmental outcomes of various management systems, and opportunities to receive financial and technical assistance for adopting new conservation practices. To learn more about PCM, see the program summary and seven-year data highlights in the Current Programs and Projects section of this report, further expanded on in the online Partners Update Appendix. In Illinois, 20 counties are eligible for cover crop cost-share funding through PCM: Champaign, Christian, Clinton, DeWitt, Douglas, Edgar, Ford, Livingston, Macon, Macoupin, Madison, McLean, Monroe, Piatt, Sangamon, St. Clair, Tazewell, Vermilion, Washington, and Woodford.

Precision Conservation Management Counties

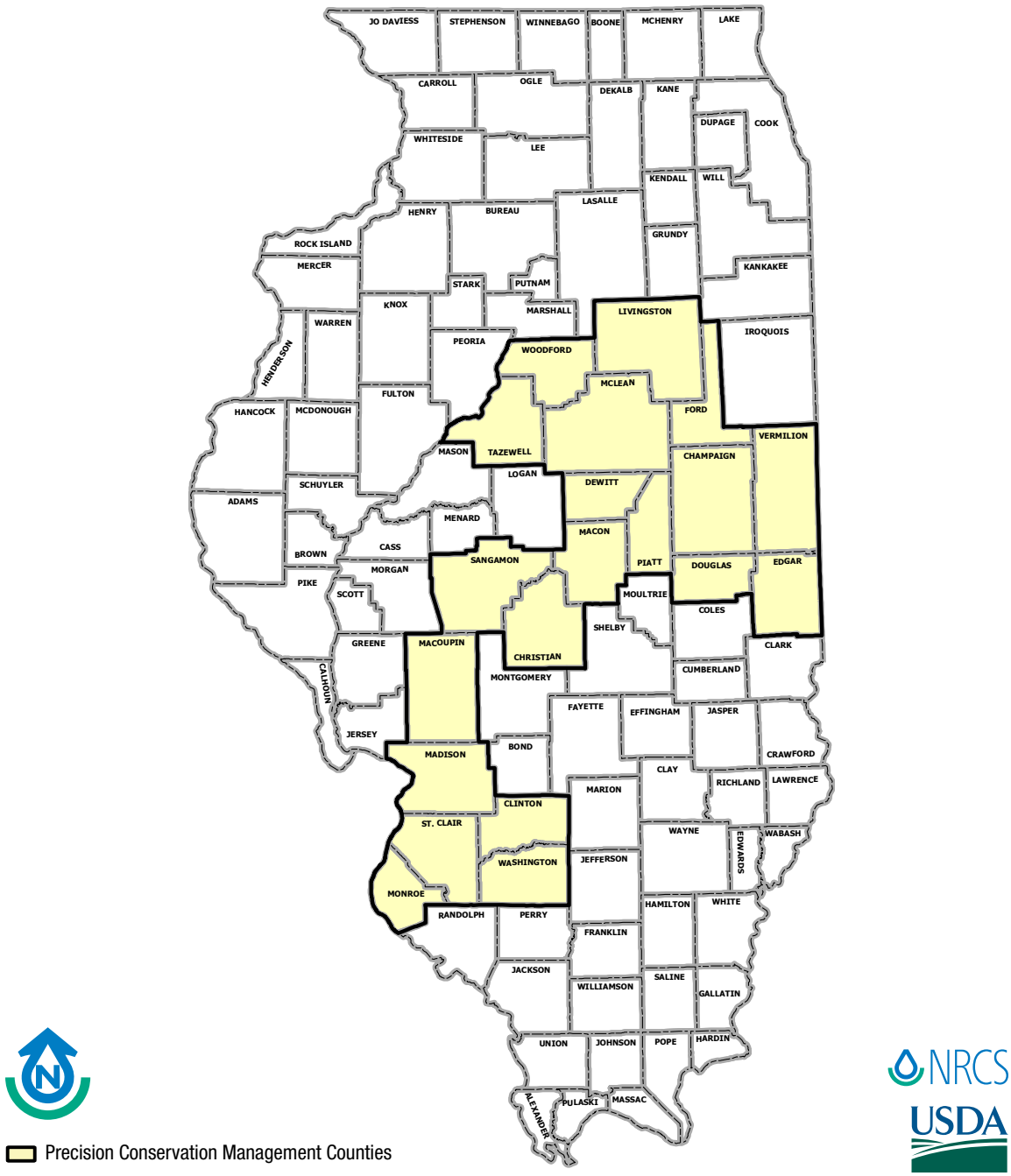


Figure 4.16. *Precision Conservation Management areas*

Mississippi River Basin – Big Bend Enhancing Water - Soil - Habitat Quality

The Mississippi River Basin – Big Bend Enhancing Water - Soil - Habitat Quality Project (Figure 4.17) is located in a critical conservation area. The project focuses on the priority/impaired Illinois River basin watershed which lies within the boundaries of Marshall and Putnam counties along the big bend of the Illinois River. The project melds the adoption of conservation practices that address soil erosion, soil health, and inadequate fish and wildlife habitat.

The last RCPP-EQIP funds for this project were obligated in 2019 and RCPP-EQIP funds are no longer available. However, RCCP-CSP has obligated nearly $1.9 million since FY2020 to 28 contracts encompassing 32,000 acres. Table 4.12 provides details on NRCS investments through the RCPP during 2020–22. The 2020 data is provided here because it was not available for the previous Biennial Report.

Table 4.12. *Conservation practice investments in the Mississippi River Basin – Big Bend Enhancing Water - Soil - Habitat Quality Project through RCPP in 2020–22*

RCPP-CSP	2020	2021	2022	Cumulative
Contracts	14	8	6	28
Acres	18,628	7,981	5,835	32,444
Obligation	$962,104	$486,017	$408,316	$1,856,437

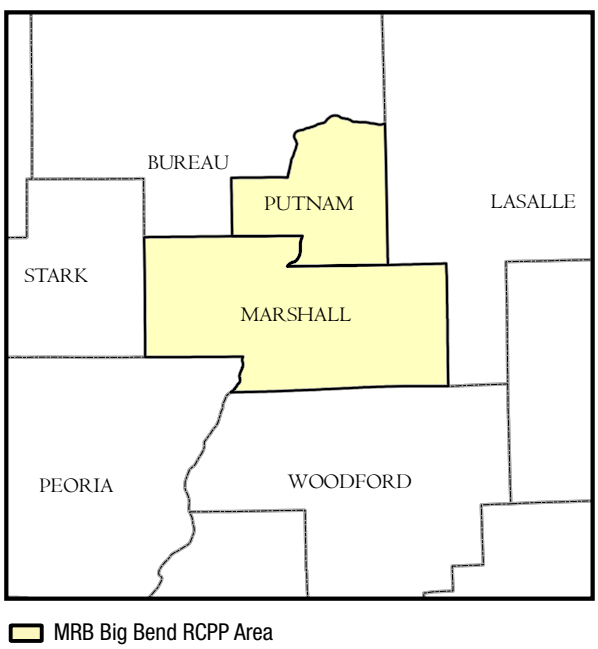


Figure 4.17. *Mississippi River Basin – Big Bend Enhancing Water - Soil - Habitat Quality Project boundaries*

Driftless Area Habitat for the Wild & Rare Phase 2

The Driftless Area in southeast Minnesota, southwest Wisconsin, northeast Iowa, and northwest Illinois was bypassed by the last continental glacier. This area features steep valleys, sandstone bluffs, and more than 600 unique spring-fed creeks and ridges once covered in prairie and scattered oak trees (Figure 4.18). This ancient landscape supports a variety of plants and animals, including dozens of uncommon species. This diversity provides critical habitat for dozens of species of concern in the State Wildlife Action Plan and has been cited as one of North America's most important resources. In FY21 and FY22, nearly $800,000 was obligated to 25 contracts spanning nearly 2,800 acres. Table 4.13 provides details on NRCS investments through the RCPP during 2021–22.

Table 4.13. *Conservation practice investments in the Driftless Area Habitat Project through RCPP in 2021–22*

RCPP-EQIP	2021	2022	Cumulative
Contracts	3	22	25
Acres	643	2,145	2,788
Obligation	$137,058	$637,163	$774,221

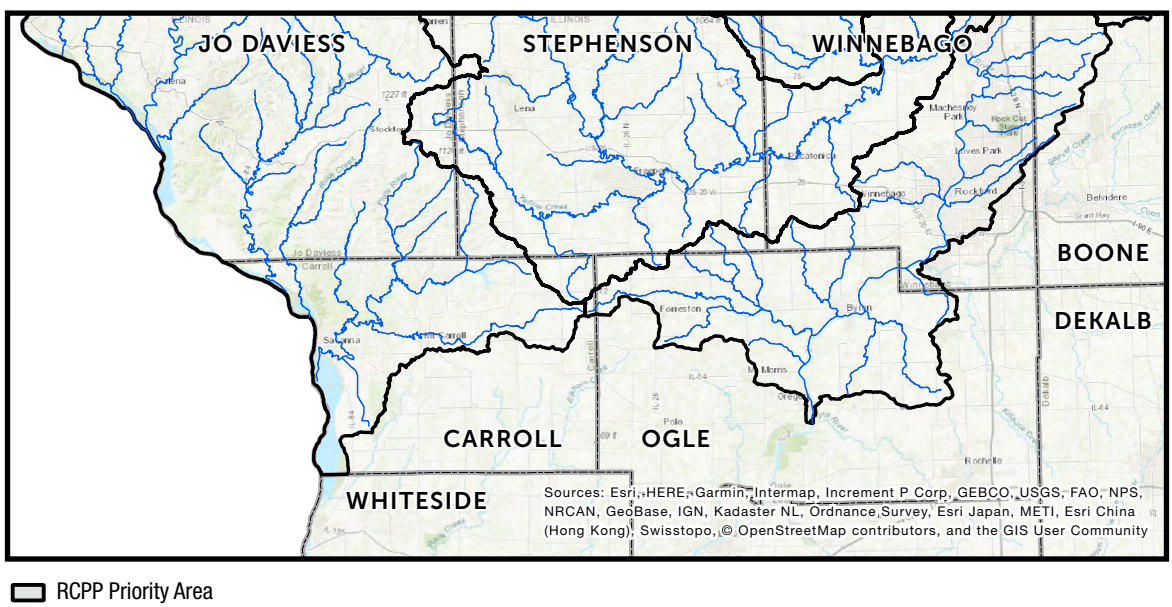


Figure 4.18. *RCPP Driftless Area Habitat for the Wild and Rare Phase 2*

Illinois Working Lands, Water, and Wildlife Partnership

Illinois' high density of productive farmland has long faced the challenges of water quality and habitat concerns as well as the threat of farmland conversion to urbanization. The Illinois Working Lands, Water, and Wildlife Partnership was a new alliance formed in FY22 to accelerate the pace of working lands conservation in Illinois. This initiative was administered through RCPP financial assistance to address inadequate terrestrial and aquatic wildlife habitat, nutrient-impaired water quality concerns, and long-term protection of natural resources throughout the state. An alliance of experts used the framework of NRCS natural resource concerns and leveraged funds to target regional and science-based planning goals of the Illinois Wildlife Action Plan and the NLRS. Figure 4.19 shows the counties that were eligible for this financial assistance in 2022. Nearly $1.4 million was allocated to 27 contracts that enrolled 3,064 acres in conservation practices.

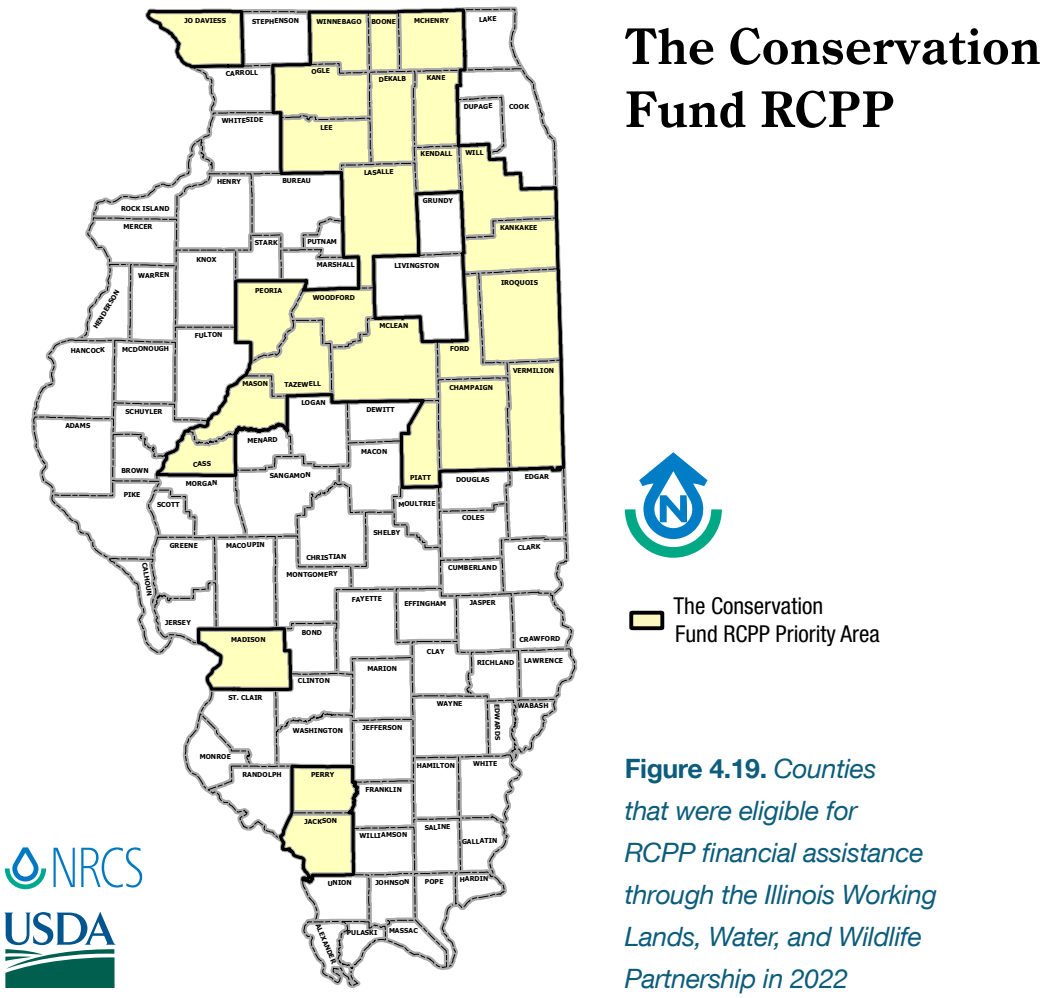
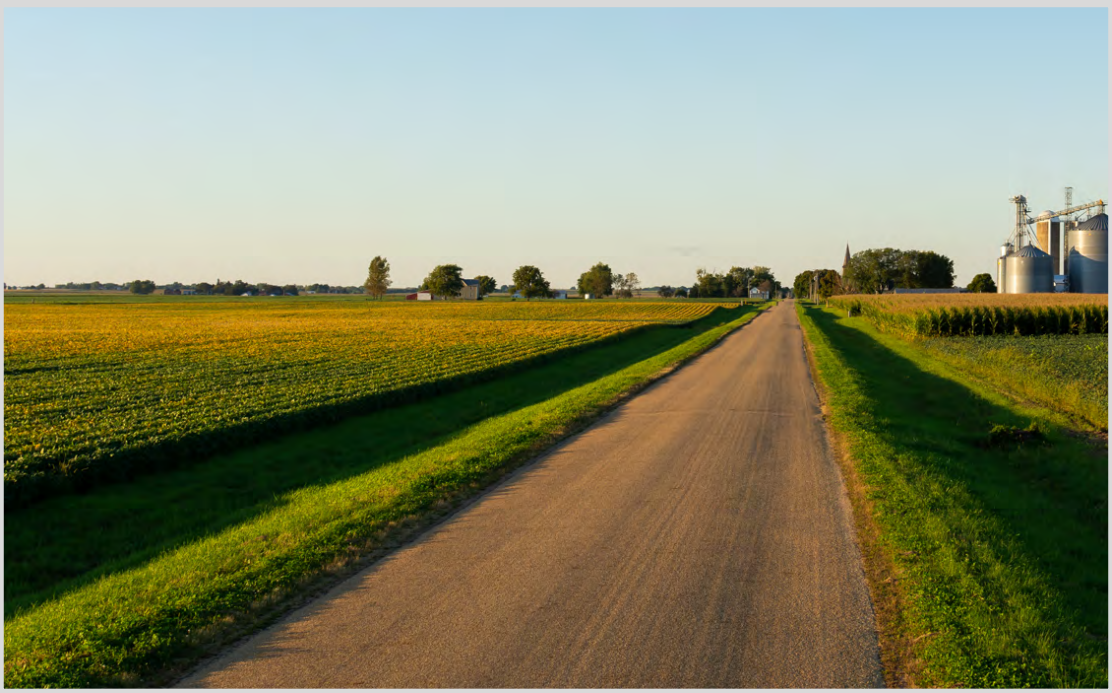


Figure 4.19. *Counties that were eligible for RCPP financial assistance through the Illinois Working Lands, Water, and Wildlife Partnership in 2022*

USDA National Agricultural Statistics Service

Illinois NLRS Survey

The USDA National Agricultural Statistics Service has been conducting a survey of Illinois farmers that is funded by the Illinois Nutrient Research & Education Council since 2016. The statistically significant survey gathers data on farmer knowledge and conservation practice adoption in support of Illinois NLRS goals and captures conservation practices implementation, regardless of a farmer's enrollment in state and federal conservation incentive programs. Previous USDA NASS NLRS Surveys have gathered information on the 2011 baseline crop year and the 2015, 2017, and 2019 crop years. This report shares the results referencing the 2021 crop year, which used a sample of 1,095 Illinois farms with 100 to 5,000 acres of cropland. The survey responses have been expanded to represent the entire state of Illinois. NASS plans to continue conducting the survey biennially as resources allow. Previous USDA NASS NLRS Surveys have gathered information on the 2011 baseline crop year and the 2015, 2017, and 2019 crop years. This report shares results using 2021 crop year data. NASS plans to continue conducting the survey biennially as resources allow.



Nitrogen Management

Many producers are using some type of professional recommendation as they decide how much nitrogen to apply on their corn acres. Table 4.14 shows the results of the NLRS Survey conducted by NASS. Data for the 2021 crop season are not directly comparable to results from previous surveys as the data collection process was changed significantly. For the 2021 survey, respondents were provided a map of Illinois with Maximum Return To Nitrogen, MRTN, expressed in pounds per acre rates for northern, central, and southern regions in Illinois. This reference also expressed MRTN rates by corn-after-corn and corn-after-soybean rotations. Producers were asked to report the number of corn acres they fertilized at or below the MRTN rate for their region of the state. The results indicate that for 76% of the 2021 corn acres, producers used the MRTN strategy to help determine the amount of nitrogen they would apply. The answer choice "other industry-recommended techniques" was not an option on this survey since respondent feedback has shown the language to be vague and open to interpretation. Previous wording of this question-and-answer choice may have allowed inclusion of acres that were in fact fertilized at MRTN rate or lower. While the previous data have shown nearly 4 million "corn acres fertilized at MRTN or lower rate," a figure that is approximately one-third of Illinois corn acres, the 2021 data indicate a large increase to 8.35 million "corn acres fertilized at MRTN or lower rate." This significant increase is almost certainly due to the changes NASS made to the survey question wording and to the use of the MRTN location and the year's corn/soy rotation reference map.

Table 4.14. *Acres with a nitrogen management strategy*

		Acres in 2015	Acres in 2017	Acres in 2019	Acres in 2021
Acres of corn planted	12,600,000	11,700,000	11,200,000	10,500,000	11,000,000
Acres where an MRTN strategy was used to determine application rates	8,820,000 or 70% of planted acres	9,430,000 or 81% of planted acres	3,730,000 or 33% of planted acres	3,700,000 or 33% of planted acres	8,360,000 or 76% of planted acres*
Acres where other industry- approved technique was used to determine application rates	Not asked	Not asked	7,750,000 or 69% of planted acres	7,390,000 or 70% of planted acres	Not Asked

*Data for the 2021 crop season are not directly comparable to results from previous surveys as the data collection process was changed significantly

Fertilizer Application Strategies

Nitrification Inhibitors

Table 4.15 summarizes fertilizer application strategies for the 2021 crop year. The survey results showed that farmers fertilized, at most, 8.58 million corn acres in fall and winter. Of the total corn acres, approximately 37% were fertilized with anhydrous ammonia, NH3, and approximately 42% were fertilized with dry blends in the fall and winter. Note that there is some overlap between NH3 and dry blend acreage estimates.

Results also showed that farmers used a nitrification inhibitor on 85% of corn acres that were fertilized with NH3 in the fall or winter. This value was similar, 83%, for spring applications.

Table 4.15. *Fertilizer application strategies for corn acres*

	2017	2019	2021
Corn acres planted	11,200,000	10,500,000	11,000,000
Corn acres fertilized in the fall and winter with dry fertilizer blends	N/A	N/A	4,560,000 or 41.5% of planted acres
Corn acres fertilized in the fall and winter with NH3	N/A	N/A	4,020,000 or 36.5% of planted acres
Corn acres fertilized in the fall and winter with nitrification inhibitors	4,590,000	2,000,000	3,410,000 or 31% of planted acres
Corn acres fertilized in the spring with any fertilizer. This includes split applications and spring only acres	N/A	N/A	8,250,000 or 75% of planted acres
Corn acres fertilized only in the spring with any fertilizer	N/A	N/A	4,440,000 or 40% of planted acres
Corn acres fertilized in the spring with nitrification inhibitors	3,810,000 or 34% of planted acres	4,290,000 or 41% of planted acres	3,690,000 or 33.5% of planted acres

Timing of Applications

Survey results show that nearly 25% of corn acres were fertilized solely in the fall or winter. Forty percent of corn acres were fertilized solely in the spring, and 35% of acres were fertilized in the fall and spring with a split-application technique (Table 4.16).

Table 4.16. *Fertilizer application timing for corn acres*

	2021
NASS Corn Planted Acres	11,000,000
Acres fertilized only in the fall	2,740,000
Acres fertilized in the spring and fall (split applications)	3,820,000
Acres fertilized only in the spring	4,440,000

Phosphorus Management

In the 2021 crop year, survey results indicated fewer acres on which phosphorus application rates were reduced compared to 2011. Survey analysts believe that the wording and position of this question, in proximity to a string of questions about corn-only acres, may have confused respondents. Respondents may not have been thinking about total cropland acres in regard to this question. In the 2019 crop year survey, the response totaled 11.2 million acres (tiled and non-tiled combined), and in 2021 crop year survey, the total was 6.2 million acres (Table 4.17). Analysts are not confident as to the number of acres receiving lower phosphorus application rates in the 2021 crop year.

Table 4.17. *Total cropland acres with reduced phosphorus application*

		Acres in 2017	Acres in 2019	Acres in 2021
Tiled Acres	Acres where phosphorus application rates were reduced since 2011	4,440,000	7,410,000	6,210,000
Non-Tiled Acres	Acres where phosphorus application rates were reduced since 2011	2,150,000	3,800,000	
Tiled Acres	Acres where placement of phosphorus applications were moved from broadcast to subsurface or banding	1,530,000	1,440,000	1,080,000
Non-Tiled Acres	Acres where placement of phosphorus applications were moved from broadcast to subsurface or banding	280,000	870,000	

In 2021, the survey continued to allow farmers to cite reasons for reducing phosphorus applications (Table 4.18). Soil test results were cited as the reason for reductions on nearly 4.6 million acres in the 2021 crop year. Changes to the Illinois Agronomy Handbook removal rates were cited as the reason for phosphorus reductions on nearly 2 million acres. Other reasons, including cost, were cited as reasons for reductions on just over 2 million acres.

Table 4.18. *Reasons cited for reducing phosphorus applications*

	Acres in 2017	Acres in 2019	Acres in 2021
The Illinois Agronomy Handbook removal rates for phosphorus were updated	2,390,000	4,460,000	1,940,000
Soil test information	4,520,000	9,470,000	4,570,000
Other reasons, including cost	2,420,000	5,030,000	2,010,000

Cover Crops

As Table 4.19 shows, the survey included questions about the seeding of cover crops in 2021. Distinction between tiled and non-tiled acres of corn and soybeans was not used in the questionnaire. Respondents were instructed not to count double-crop soybeans planted after a winter wheat cash crop. Results show that farmers planted 450,000 acres of corn after cover crops, and 890,000 acres of soybeans after cover crops in 2021. The 2021 cover crop acres decreased almost 1.4 million acres compared to the previous survey. Analysts believe this decrease may be due to weather conditions in the 2021 crop year. Note that the total acres of cover crops in the table includes 50,000 acres planted after crops other than corn and soybeans.

Photo courtesy of Jennifer Jones, Illinois Extension

Table 4.19. *Cover crop questions for corn/soybean acres*

	Acres
2021 corn acres planted after cover crops	450,000
2021 soybean acres planted after cover crops	890,000
2021 total cover crops	1,390,000
Corn / Soybean acres planted to cover crops after the 2019 crop season on tiled ground.	930,000
Corn / Soybean acres planted to cover crops after the 2019 crop season on non-tiled ground.	480,000
Corn / Soybean acres planted to cover crops after the 2017 crop season on tiled ground.	290,000
Corn / Soybean acres planted to cover crops after the 2017 crop season on non-tiled ground.	420,000
Corn / Soybean acres planted to cover crops after the 2015 crop season on tiled ground.	490,000
Corn / Soybean acres planted to cover crops after the 2015 crop season on non-tiled ground.	630,000
Corn / Soybean acres planted to cover crops after the 2011 crop season on tiled ground.	220,000
Corn / Soybean acres planted to cover crops after the 2011 crop season on non-tiled ground.	380,000

Tiled Acres

The 2021 survey included a question about tiled acres rather than separating each practice (Table 4.20) by tiled and non-tiled acres. Respondents indicated over 13.5 million cropland acres in Illinois are tiled as of 2021.

Table 4.20. *Tiled acres in 2021*

	2021
Corn	7,020,000
Soybeans	6,150,000
Other Crops	390,000
Total Cropland	13,560,000

General Questions

The NLRS Survey conducted by NASS included a series of general knowledge questions about the NLRS and conservation practices (Table 4.21). Note: While the reference year for the most recent survey was the 2021 crop season, the survey questions were posed to producers in 2022.

Survey results revealed that farmers are most knowledgeable about cover crops and using the MRTN method for determining nitrogen fertilizer rates. More than half of farmers, 55%, reported being somewhat to very knowledgeable about the NLRS in 2022. This is up from 43% in 2020. In 2022, farmers were less knowledgeable about edge-of-field practices, such as bioreactors and constructed wetlands, compared to farmers surveyed in 2020.

See Appendix F online for the USDA NASS Illinois Nutrient Loss Reduction Strategy Survey and the survey questionnaire.

Table 4.21. *General knowledge questions (percent reporting)*

		Not at All Knowledgeable	Slightly Knowledgeable	Somewhat Knowledgeable	Knowledgeable	Very Knowledgeable
2022	Nutrient Loss Reduction Strategy	20.3%	24.8%	36.7%	15.7%	2.5%
	MRTN Strategy	30.2%	29.0%	17.6%	14.7%	8.5%
	Woodchip Bioreactors	68.6%	14.7%	11.1%	4.8%	0.8%
	Constructed Wetlands	54.7%	17.2%	14.4%	11.5%	2.2%
	Cover Crop Management	42.1%	20.5%	16.5%	17.9%	3%
	Saturated Buffers	9.1%	24.7%	27.7%	26.1%	12.4%
2020	Nutrient Loss Reduction Strategy	21%	27%	38.4%	11.6%	2%
	MRTN strategy	20.3%	33.5%	25.5%	14.1%	6.6%
	Woodchip Bioreactors	53.8%	23%	15%	5.5%	2.7%
	Constructed Wetlands	19.7%	29.6%	38%	10.2%	2.5%
	Cover Crop Management	9.1%	24.7%	27.7%	26.1%	12.4%

State Agricultural Conservation Programs

Results also showed that farmers used a nitrification inhibitor on 85% of corn acres that were fertilized with NH3 in the fall or winter. This value was similar, 83%, for spring applications.

Illinois Department of Natural Resources

Conservation Reserve Enhancement Program

The Illinois Conservation Reserve Enhancement Program, CREP, provides long-term environmental benefits by allowing up to 232,000 acres of frequently flooded and environmentally sensitive cropland within the 100-year floodplains of the Illinois River and Kaskaskia River (Figure 4.20) to be restored, enhanced, and protected over periods ranging from 15 years to in perpetuity. The program's goals are to reduce sediment and nutrient runoff, improve water quality, and to create and enhance critical habitat for fish and wildlife populations on private property.

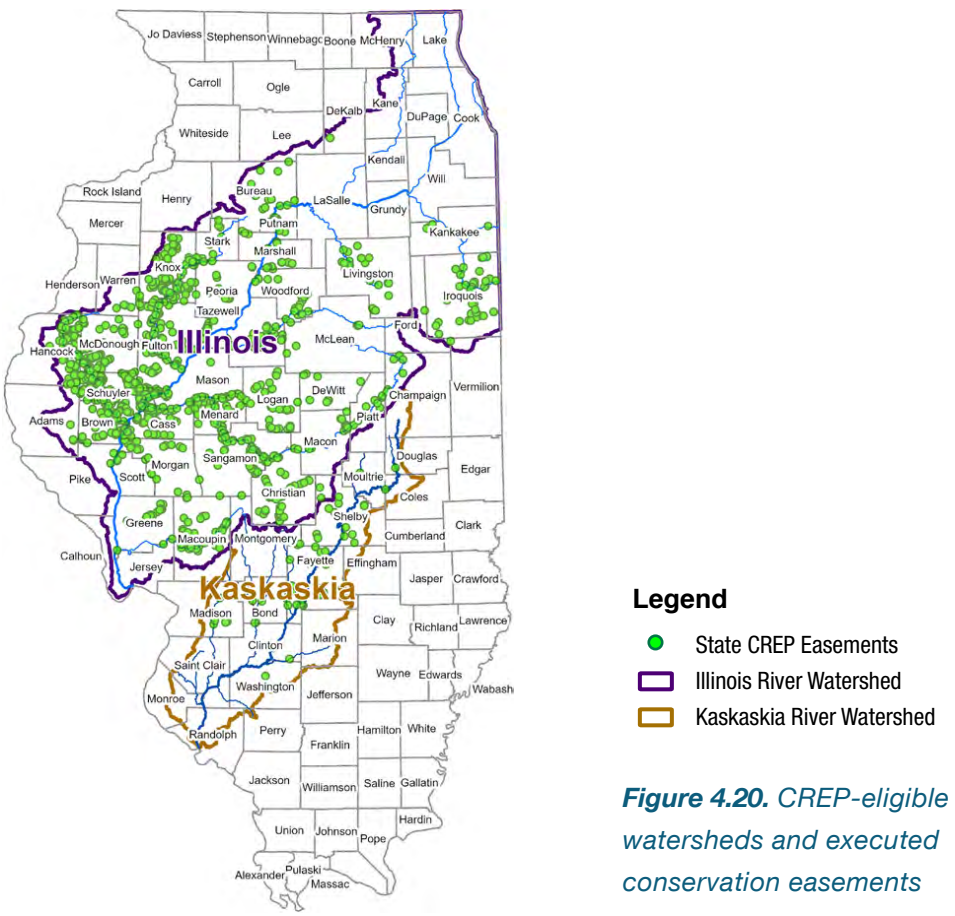


Figure 4.20. *CREP-eligible watersheds and executed conservation easements*

In Illinois CREP, landowners enroll frequently flooded and environmentally sensitive cropland in a federal CREP contract with the Farm Service Agency, FSA. The Illinois Department of Natural Resources, IDNR, extends the terms of that federal contract by enrolling the land into an Illinois CREP conservation easement for 15 years or in perpetuity beyond the expiration of the federal CREP contract. In exchange for voluntarily removing land from production, landowners received compensation to implement conservation practices. Since 1998, IDNR has enrolled 1,323 conservation easements, providing long-term protection on 90,539 acres.

On July 1, 2015, a suspension was enacted on the Illinois CREP agreement for FY16-17 due to a lack of state funding. After funding was reinstated in late 2017, IDNR and FSA began the negotiation process to amend the terms of the CREP agreement. IDNR and FSA implemented the newly amended CREP agreement on May 26, 2021, and on June 15, 2022, Illinois CREP reopened to enrollment.

The program goals were amended during the revision of the CREP agreement. The primary goals when full enrollment is reached are to:

1. decrease sediment, nitrogen, and phosphorus loading by 10% within stream reaches associated with land enrolled in CREP when compared to 1998 pre-enrollment averages;

2. increase the population of avian "Species of Greatest Conservation Need," as defined in the Illinois Wildlife Action Plan, on land enrolled in CREP by 50% when compared to similar land managed for agricultural production; and

3. increase the average number of native fish species and environmentally sensitive aquatic insects — stoneflies, caddisflies, and mayflies — by 15% within stream reaches associated with land enrolled in CREP when compared to similar streams surrounded by land managed for agricultural production.

CREP employs a variety of conservation practices, CPs, to protect and restore riparian corridors. Figure 4.21 shows CREP conservation practices that were identified by the NLRS science assessment as measures to be tracked for the NLRS reporting years. In 2022, 41,203 acres of Illinois CREP easements contributed to the NLRS. The acres listed are only for easements where the federal CREP contract has expired, and they are solely enrolled in state CREP program to avoid double reporting with the federal CREP/CRP program. While the program started in 1998, the CP acres under the federal CREP contract are not considered enrolled in the state program until the federal CREP contract expires. The graph shows a drastic increase in acreage starting in 2013 when CREP enrollments started to have their associated federal CREP contracts expire. Enrollments leveled off after 2016, as there were fewer federal CREP contracts expiring.

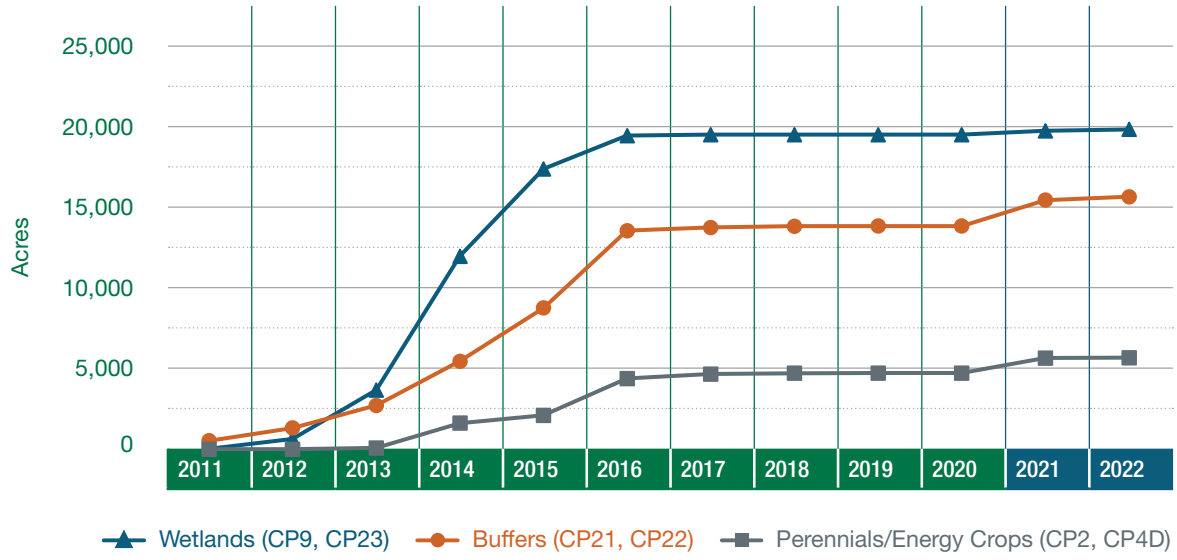


Figure 4.21. *Acres of Illinois CREP easements contributing to NLRS. See Appendix G for companion data.*

As federal CREP contracts expire over time, CREP wetland practice acres (CP9, CP23), buffer practice acres (CP21, CP22), and perennial energy practice acres (CP2, CP4D) are projected to increase as the acres convert to state CREP easements. More than 90% of federal CREP contract acres executed after the 2022 reopening are estimated to be IDNR-reportable contributions to the NLRS after September 2037.

To learn more about CREP, visit dnr.illinois.gov/conservation/crep.html.

Building Soil Health on Agricultural Leases

Building soil health on state-owned agricultural lands is a priority for IDNR, which owns 475,000 acres and manages an additional 450,000 acres on 186 sites. Within those sites, the IDNR manages 35,000 acres through agriculture. The leases developed under the Agriculture/Wildlife & Habitat Lease Management Program promote ecologically sound agricultural practices designed to improve soil health, minimize soil erosion, improve water quality, and reduce chemical impacts to benefit wildlife populations and their habitats.

IDNR Agricultural Leases have not historically allowed for the use of cover crops. However, starting in 2019, the leases have moved toward encouraging the practice. IDNR provided 50% cost-share to tenants to support cover crop implementation on 1,000 pilot acres in 2021, with an additional 1,000 acres added in 2022. IDNR received a Regional Conservation Partnership Program grant administered through the

USDA NRCS to implement cover crop/reduced tillage rotations. These practices, important in regenerative agriculture, will build soil health on 20% to 25%, or 6,500 to 9,000 acres, of the agriculture acres currently in conventional row crop production on agricultural leased lands. Tenants will receive RCPP Land Management funds or NRCS leasing agreements if they agree to implement these practices. While the RCPP matching funds were received in 2020, the cost-share from this source will begin in fall 2023 on approximately 6,000 acres. These RCPP funds combined with IDNR matching funds will cover nearly 100% of the cost for tenants to plant and terminate cover crops on selected sites throughout the state. Most of the literature on cover crops suggests that the practice takes three to five years of continuous cover cropping to reap rewards, such as reduced fertilizer and pesticide costs. After the RCPP grant is completed in 2025, agricultural leased lands will continue to be managed with cover crops in the rotation, ultimately increasing the acreage with costs offset by the reduced inputs needed to make the soil productive.

The program will allow IDNR to work in a cover crop system with minimal impact on the current tenant's operation. The cost-share element will jumpstart these efforts, planting and terminating the cover crops through RCPP until the contracts are renewed. It also allows IDNR to build soil health and invest in state-owned lands while setting up demonstration sites to showcase the program and educate producers on how to use such a rotation on their own farms. The focus will be on sites with agricultural leases and that are a priority for grassland birds as identified in the Illinois Wildlife Action Plan Farmland & Prairie Campaign.

Regenerative agriculture and the use of different cover crop species mixes not only improves soil health but creates suitable overwintering habitat for a variety of wildlife species. The primary concern is to identify when to terminate cover crops without creating an ecological sink for early nesting birds in the spring. While considerable research has evaluated the use of cover crops on soil health, additional research is required to assess the wildlife benefits of this practice. This work is part of a broader statewide partnership under the RCPP program, with 13 partners collaboratively advancing habitat and water quality goals through the Working Lands, Water, and Wildlife Partnership.

In 2021, IDNR started taking fall soil samples on IDNR lands which are in the last year of their IDNR agricultural lease contract prior to transitioning to a new contract. This sampling establishes a farm-specific benchmark of soil health to monitor a rotation's progress and success over the life of its contract. In the fall of the second lease year of the new contract, the tenant is required to perform soil testing solely at their expense. This mid- and late-contract management of soil sampling will continue to remain a component of agricultural leases moving forward to ensure soil health can continue to be tracked on these lands.

As IDNR strives to improve and maintain overall soil health on all leased properties, the plan is to expand the cover crop initiative to additional sites across the state. IDNR will continue to coordinate with University of Illinois on soil health-related research projects and on projects investigating avian use of

cover crop fields. This research has and will continue to provide benchmark and routine monitoring of lands transitioning from conventional row crop management to cover crop – row crop management systems. IDNR recognizes potential opportunities for additional institutional soil health research and avian use projects to be conducted during the RCPP funding period. Research efforts can continue to complement the IDNR Regenerative Agriculture initiative.

Contaminant Assessment Section Restoration

Federal law requires the designation of federal and state officials to act as natural resource trustees to protect public interest in natural resources and the services they provide. The IDNR and Illinois EPA have been designated as trustees by the governor and have the regulatory authority to assess damages to natural resources and to collect compensation for those injured natural resources and/or associated service losses. The Contaminant Assessment Section conducts Natural Resource Damage Assessments for IDNR, seeking compensation for the release of hazardous substances, oil, and other pollutants that harm natural resources to restore, rehabilitate, replace, or acquire equivalent resources.

Compensatory projects may be applied directly toward reducing nutrient loads in Illinois water systems and addressing the goals of the NLRS by reducing nutrients, or indirectly by restoring aquatic ecosystems. As the majority of contaminant releases affect water systems, many Contaminant Assessment Section restorations aim to improve the quality of water in Illinois.

- In Jo Daviess County, the mishandling of livestock products led to a cover crop conservation project to benefit Yellow Creek. Roughly 180 to 200 acres of the approximately 400 acres surrounding the farm and creek have been the focus of a cover crop conservation project for four years, set to conclude in 2023. A cereal rye cover crop was planted prior to soybeans and corn silage plantings. The on-farm silage storage bunker monitoring has continued to ensure no overloading occurs and that leachate is flowing through the gutter system to the waste lagoon as designed. The compliance and nitrogen fertilizer monitoring has also been routine throughout the life of this project.

- In Sangamon and Christian counties, multiple projects are being implemented to improve water quality in Sangchris Lake. Five aquatic vegetation plots were established and have since grown beyond the original planting boundaries. Progress will continue to be evaluated by monitoring the fish and aquatic life response. A shoreline stabilization planting began in 2023. The project area is approximately 26 acres, encompassing over 2,100 feet of Sangchris Lake shoreline. Non-native and invasive vegetation has been removed, and a native seed mix of prairie grasses and species important to pollinators was planted. This native plant community restoration has the potential to reduce agricultural and highway runoff entering the lake and to provide habitat to multiple species, including insect pollinators.

- Stream and wetland restoration monitoring projects continue at the Bellrose Nature Preserve in Logan County. Stream monitoring demonstrates that both instream cover and pool variability have increased post-restoration, which would indicate an increase in habitat for fish, including improved general stream conditions, such as adequate temperature and varied depths. A 2019 wetland monitoring effort indicated an increase in plant species diversity; 18 new native species were recorded compared to a 2010 monitoring effort. The 2019 effort also yielded an increase in the taxonomic richness of invertebrates compared to past years. The full reports are available at dnr.illinois.gov/programs/nrda/williamspipeline.html.

- Program planning is underway for the funds that have been secured for some watershed-scale improvement projects in impacted watersheds. Funds will assist the implementation of conservation projects designed to enhance and improve habitat conditions and overall water quality in the North Creek watershed of Knox County and in the Stony Creek and the Salt Fork of the Vermilion River watershed in east central Illinois.

More information about Illinois Natural Resource Trustee efforts can be found at dnr.illinois.gov/programs/nrda.html.

Photo courtesy of Holly Hudson, CMAP

Illinois Department of Agriculture

Partners for Conservation Program

The Illinois Department of Agriculture, in partnership with Soil and Water Conservation Districts, administers the Partners for Conservation, PFC, cost-share program. PFC encourages increased nutrient management, conservation tillage, and the implementation of cover crops into a crop management regime to slow erosion, improve soil health, enhance water infiltration, smother weeds, control pests and diseases, increase biodiversity, and sequester carbon. Several conservation practices are eligible for PFC cost-share assistance (Table 4.22). In 2021 and 2022, PFC statewide investments totaled $3.3 million and $4.25 million, respectively. Of these totals, IDOA's PFC investment covered approximately 56% of conservation adoption costs, with the balance paid by applicants or landowners.

Table 4.22. *Conservation practices eligible for PFC cost-share assistance. See Appendix G for companion data.*

Practice Code	Practice
327	Conservation Cover
329	No-till / Strip-Till
340	Cover Crops
342	Critical Area Planting
345	Mulch-Till
351	Well Decommissioning
362	Diversions
410	Grade Stabilization Structure
412	Grass Waterway
512	Pasture & Hayland Planting
554	Drainage Water Management
570	Rain Gardens
587	Structure for Water Control
590	Nutrient Management
600	Terraces
604	Saturated Buffers
605	Denitrifying Bioreactor
638	Water & Sediment Control Basin
656	Constructed Wetland

Tolerable soil loss levels were maintained or reduced on 66,303 cropland acres through these investments and activities. An estimated 27,500 tons, or 1,500 semi-trailer loads of sediment, stayed on the land and out of Illinois waterways, as reported by Revised Universal Soil Loss Equation sediment loading estimates for PFC practices during 2021 and 2022. These conservation practices not only saved the sediment from streams, rivers, and waterbodies, they also reduced soil loss in fields via detachment and movement. In 2021-22, 93,536 tons of soil were saved.

From 2021 to 2022, landowners completed 1,567 projects. The most common PFC conservation practice during this time was cover crops.

A subset of PFC-eligible practices recommended by the Illinois NLRS includes bioreactors, constructed wetlands, filter strips, conservation tillage, perennials, cover crops, nutrient management, terraces, WASCOBs, and saturated buffers (Figure 4.22). Of this subset of practices, the most common conservation practice implemented was cover crops, and the most funds were spent on WASCOBs, followed by cover crops. Two or more conservation practice types are summed to provide the totals for the tillage and perennial vegetation categories (Table 4.23).

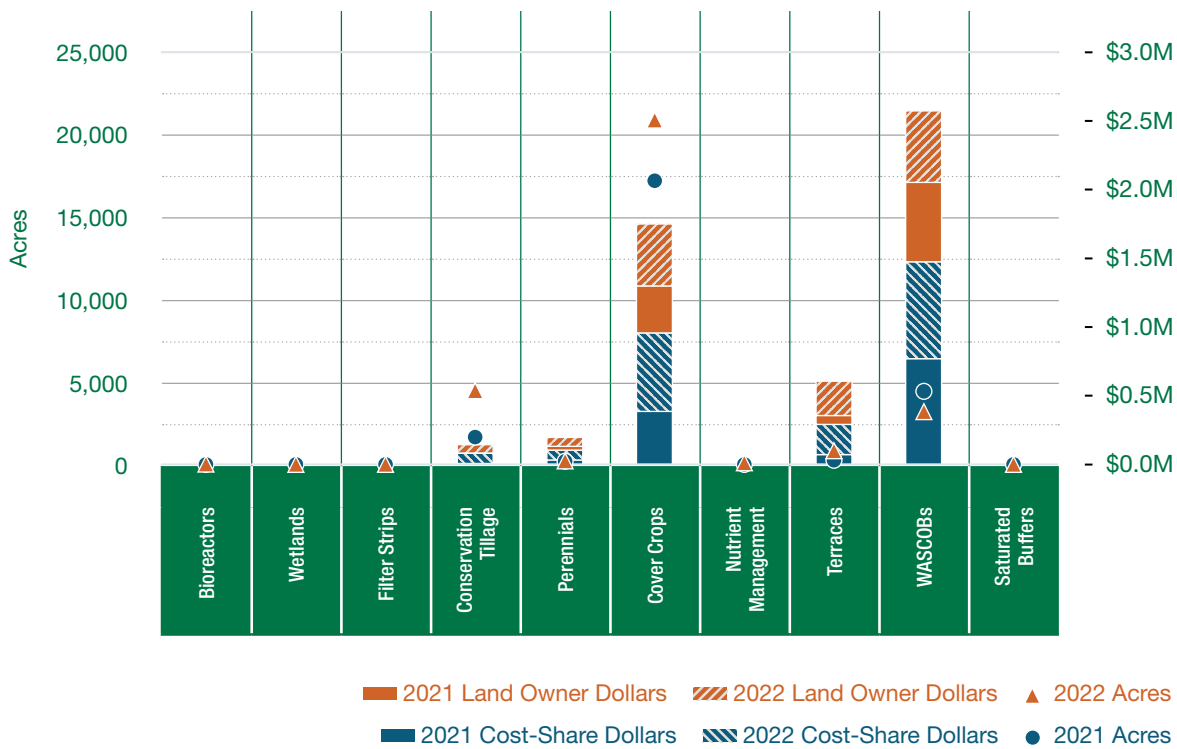


Figure 4.22. *Acres treated by and dollars spent on PFC in 2021 and 2022. See Appendix G for companion data.*

Table 4.23. *NLRS-recommended practices eligible for PFC cost-share assistance*

NLRS Practice	Conservation Practice Code
Bioreactor	605
Constructed Wetland	656
Filter Strip	393
Conservation Tillage	329 No-Till/Strip-Till 345 Mulch-Till
Perennial	327 Conservation Cover 342 Critical Area Planting 512 Pasture and Hayland Planting
Cover Crops	340
Nutrient Management	590
Terrace	600
WASCOB	638
Saturated Buffer	604

Practices installed in 2021 and 2022 reduced an estimated 60,221 pounds of total nitrogen loss and 28,790 pounds of total phosphorus loss (Figures 4.23 and 4.24).

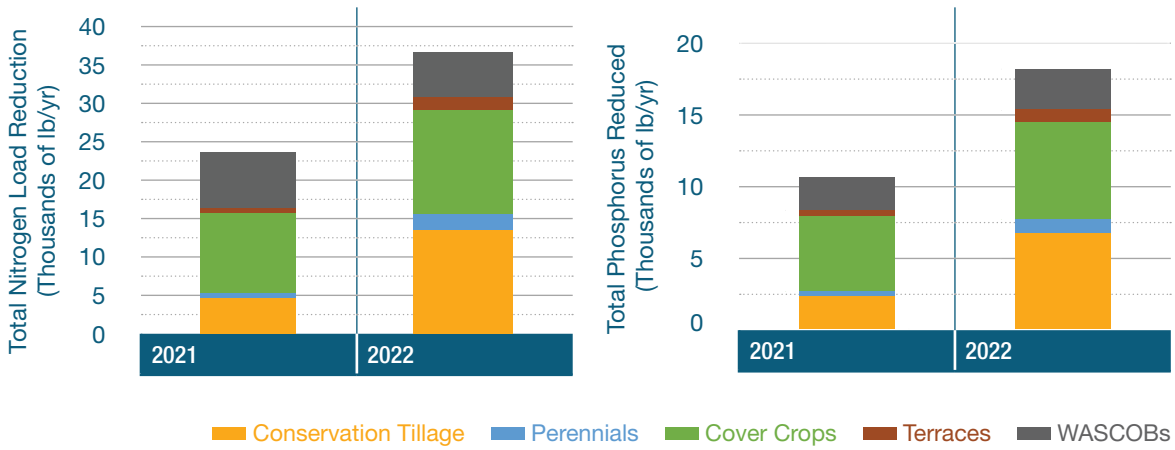


Figure 4.23. *Calculated total nitrogen load reduction (lb/yr) from PFC in 2021 and 2022. Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice. See Appendix G for companion data.*

Figure 4.24. *Calculated total phosphorus load reduction (lb/yr) from PFC in 2021 and 2022. Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of each practice. See Appendix G for companion data.*

Streambank Stabilization and Restoration Program

To stabilize and restore streambanks that would otherwise contribute sediment to the state's rivers and tributaries, IDOA, with assistance from SWCDs, administers the Streambank Stabilization and Restoration Program, SSRP. Funded through PFC, this program provides support for using low-cost techniques to stabilize eroding streambanks, including rock riffles, stone toe protection, and bendway weirs.

In 2021, SSRP allocations totaled approximately $150,000 in cost-share across 15 projects, stabilizing approximately 10,000 feet of eroding streambank and resulting in a 1,200-ton reduction in sediment loss. In 2022, SSRP allocations totaled approximately $39,000 in cost-share across five projects, stabilizing 1,130 feet of eroding streambank and resulting in a 300-ton reduction in sediment loss. The program covered approximately 60% of cost of streambank stabilization practice adoption, with the balance paid by applicants or landowners. These efforts reduced total nitrogen loading by 3,076 pounds and total phosphorus loading by 1,537 pounds.

More information about SSRP is available at www2.illinois.gov/sites/agr/ Resources/Conservation/Pages/default.aspx.

Fall Covers for Spring Savings

The highly successful Fall Covers for Spring Savings, also known as the Cover Crop Premium Discount Program, is designed to promote the planting of additional acres of cover crops that are not already covered by other state or federal incentives. This allows eligible applicants to receive a $5 per acre premium discount on the following year's crop insurance invoice for every acre of cover crop enrolled and verified in the program. Funding of the eligible acreage is on a first come, first served basis. The program has now completed its fourth year of applications. When the third year of the program opened on December 15, 2021, the allotted 100,000-acre cap was met in just 10 hours. When the program closed on January 15, 2022, an additional 32,000 acres had been requested. A total of 603 applicants applied for the program, covering 86 counties.

New in 2022-23, the program received additional state funding to expand from 50,000 to 100,000 acres. Through Gulf Hypoxia Program funding, 40,000 more acres were made available, which increased the total acreage to 140,000. These 140,000 high-demand acres were allocated during the first five hours of the program's December 15, 2022, opening. Due to the large acreage request, IDOA accessed federal funds from previous application periods and matching state funds, increasing the total available acres for the 2022–23 year to 160,000 acres. The application period for the program ended on January 15, 2023, with 828 applications requesting a record breaking 182,688 acres.

See chapter 8 for additional uses of the Gulf Hypoxia Program funds in Illinois.

Conservation Capacity Building Initiative

The Conservation Capacity Building Initiative is a collaborative effort between NRCS, IDOA, and Sangamon County SWCD to tackle conservation staffing capacity challenges in Illinois. Responding to the needs indicated by the 2021 NLRS Biennial Report, up to 40 additional conservation planners will be placed throughout the state to provide producers with technical assistance, resources, and tools to address natural resources concerns through conservation planning and through the implementation of conservation practices. This initiative represents a total financial investment of $12.9 million.

These professionals will train in conservation planning and engage in efforts to increase the pace of planning and the implementation of conservation practices, many of which have nutrient loss-reduction and greenhouse gas-reduction co-benefits. The conservation planning team created by this initiative has committed to annually enrolling or re-enrolling 640 acres in CRP plans, conducting 1,600 site visits, and developing 320 nutrient management plans.

Illinois Environmental Protection Agency

Section 319 Nonpoint Source Program

Section 319 of the Clean Water Act (33 U.S.C. 1329) provides grants supporting the implementation of conservation practices that address non-point source pollution in rural and urban areas. The Illinois EPA administers this program, which funds the establishment and management of conservation tillage, cover crops, filter strips, wetlands, and other agricultural conservation practices, specifically in watersheds with approved management plans that address reducing nutrient loading to Illinois waters (Figure 4.25). Section 319 funds are also used to support local watershed planning groups in developing watershed-based plans in Illinois. Grant proposals typically focus on local needs and concerns and local approaches to address those concerns.

The Section 319 program awards grants on a competitive basis for any type of non-point source pollution control project. For all agricultural practices implemented using 319 funds, there were 8,807 pounds of total nitrogen and 972 pounds of total phosphorus reduced in 2021, and an additional 3,685 pounds of total nitrogen and 460 pounds of total phosphorus reduced in 2022.

See the watershed based planning section in chapter 8 for more details.

Note: The Illinois EPA makes an effort to coordinate the availability of financial assistance for conservation practices with other state and federal partners within proposed project areas to reduce duplication of services and competition between programs.

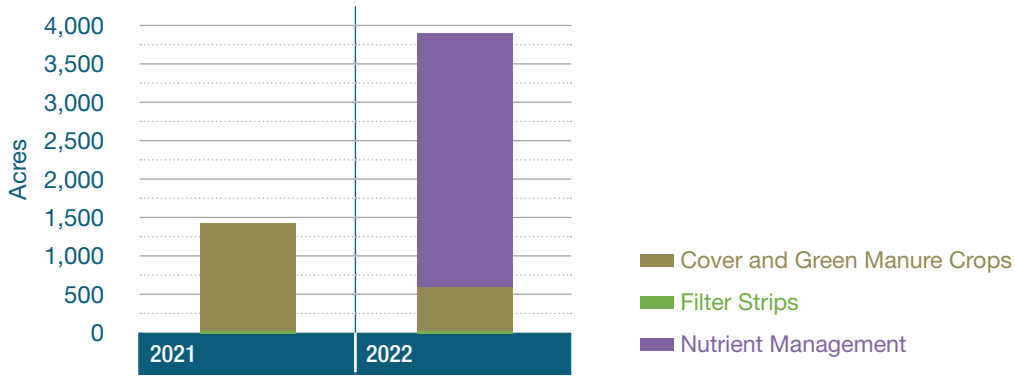


Figure 4.25. *Acres treated by agricultural practices installed under the Section 319 grant program 2021-22. See Appendix G for companion data.*

The Illinois EPA Section 319 grant program calculates load reduction estimates associated with conservation practices using U.S. EPA Region 5 Load Estimation Spreadsheets. These calculations indicate that conservation practices have significantly reduced the impact of nutrients in Illinois waters. Since 2011, Section 319 funding led to a reduction in nitrogen loads of 106,750 pounds. Years with greater nitrogen reduction correspond to years with more acres treated. During the last two years, all nitrogen reductions occurred through cover crop implementation. Section 319 grant program funds for nutrient management were limited to plan development. Nutrient load reductions were not calculated, as implementation of the plans had not yet occurred.

Since 2011, Section 319 funding also led to a reduction in phosphorus loads of slightly more than 31,000 pounds. Similar to nitrogen reductions, years with greater phosphorus reduction correspond to years with more acres treated. During the last two years, total phosphorus reductions occurred through cover crop implementation (Figure 4.26).

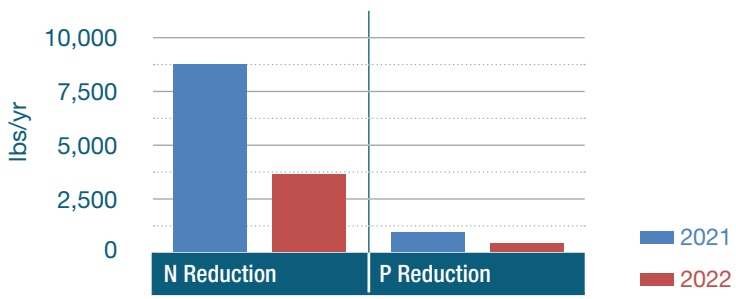


Figure 4.26. *Calculated total nitrogen and total phosphorus load reductions from Section 319 grant program agricultural practices 2021-22. Annual load reductions are based on the year the practices were implemented; reductions are achieved annually through the life of practice. See Appendix G for companion data.*

University of Illinois

Woodchip bioreactors

State and federal cost share programs, university research projects, and other voluntary sources are relied on to track the number of bioreactors and the amount of acres treated. Tracking and reporting of bioreactors in previous NLRS Biennial Reports involved adding new bioreactors to existing counts. However, the life of a bioreactor is approximately 10 years, at which point the woodchips need to be replaced. Beginning with this Biennial Report, bioreactors that are known to be more than 10 years old without being recharged with new woodchips are no longer counted.

Nine woodchip bioreactors treating approximately 382 acres were installed from 2021-22. The 2021 Biennial Report stated that by the end of 2020, there were a total of 42 known woodchip bioreactors treating approximately 1,460 acres. After subtracting bioreactors more than 10 years old, and adding the nine new bioreactors, it is estimated that there are a total of 37 functioning bioreactors currently treating 1,499 acres in Illinois. Of the 37 bioreactors counted, six were older bioreactors that had been recharged with new woodchips or carbon sources.

Photo courtesy of Janith Chandrasoma, University of Illinois

Illinois Extension Watershed Outreach Associates

Since 2018, the Illinois EPA has provided financial support to University of Illinois Extension for two watershed outreach associate positions. The work conducted under this grant supports the Illinois NLRS through the development and delivery of education, outreach, and technical assistance focused on four priority watershed basins (Figure 4.27). These watersheds were identified as priorities in the original NLRS report in 2015. The four targeted watersheds are expected to have the greatest capacity to reduce high volumes of nutrient losses on an annual basis.

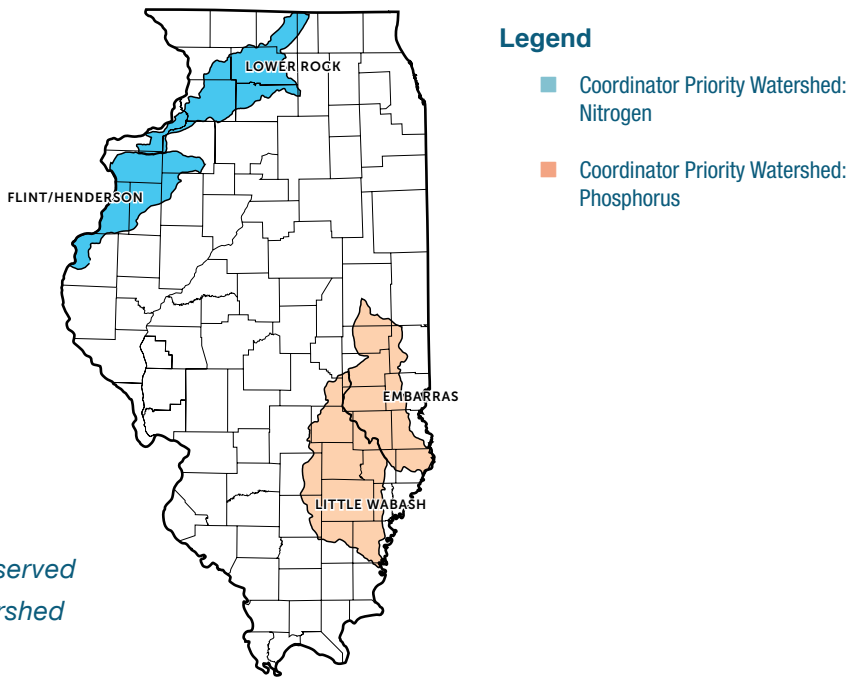


Figure 4.27. *Watersheds served by Illinois Extension watershed outreach associates*

Watershed outreach associate Rachel Curry works in the Mississippi North Central/Flint-Henderson Creek and Lower Rock River nitrogen-priority watersheds in northern Illinois. She started in November 2020 and works out of the Illinois Extension office in Galva.

Curry has continued to collaborate with the Illinois Farm Bureau and County Farm Bureaus, Northwater Consulting, Soil and Water Conservation Districts, and USDA-NRCS to create a watershed characterization, which is a water and habitat assessment, and to prioritize subwatershed planning efforts. The Mercer County SWCD submitted a Section 319 grant application to Illinois EPA in 2020 that was awarded in May 2022. To date, stakeholder input has been gathered at seven stakeholder meetings and a meeting with SWCD and NRCS employees from the counties within the watershed. Curry has also continued to

support and collaborate with the Rock Island SWCD and stakeholders within the Mill Creek watershed on a Section 604(b) grant through Illinois EPA to develop a watershed management plan. The plan has been submitted for approval and discussions about an implementation grant application are ongoing.

Watershed outreach associate Nicole Haverback focuses on the Little Wabash River and Embarras River watersheds, both phosphorus-priority watersheds in south-central Illinois. She started in July 2022 and works out of the Illinois Extension office in Effingham. Jennifer Jones previously held this position until December 2021, and the position was vacant January to June 2022.

During her time with Illinois Extension, Jones laid significant groundwork by fostering working relationships and leading watershed planning efforts with SWCDs, IFB, and other stakeholders. She co-led an ongoing collaborative effort among SWCDs, Illinois Farm Bureau, IFB, Northwater Consulting, and County Farm Bureaus to update the Embarras Watershed Management Plan. The update began in January 2021 and prioritized two HUC 12 sub-watersheds: Polecat Creek in Coles and Edgar counties; and the Slough in Crawford, Lawrence, and Richland counties. The Embarras Watershed Management Plan and the subwatershed plans were submitted to the Illinois EPA and approved in December 2022.

Starting in the spring of 2021, the watershed outreach associates continued a unique collaboration with a University of Illinois professor of urban and regional planning and an Illinois Extension community and economic development specialist. Curry worked with the professor's watershed planning class to create a watershed characterization for the Cedar Creek watershed, a subwatershed of the Flint-Henderson watershed. Over the summer, a graduate student continued to develop the characterization. That fall, Curry worked with a new class to create a watershed characterization for the Pine Creek watershed, a subwatershed of the Lower Rock River watershed. Planning efforts are ongoing in the Pine Creek watershed.

Curry has been working with Whiteside County SWCD in the Lower Rock River watershed on a cover crop program funded through grant support secured by Laura Christianson and Reid Christianson. Since its inception in 2020, the program has provided enough free seed for Whiteside County farmers to plant almost 1,900 acres into cover crops and provided an estimated nitrogen loss reduction of more than 9,600 pounds and phosphorus loss reduction of more than 500 pounds. The grant also provided funds to install a woodchip bioreactor in Rock Island County in the Lower Rock River watershed in the fall of 2021 in conjunction with the Rock Island SWCD. It is estimated that this bioreactor will reduce nitrogen loss by 240 pounds annually for the next 10 years.

The Embarras Grazing Partnership formed in 2020 by the Champaign County SWCD, The Land Connection, Illinois Extension, Terra Elossa LLC, Illinois Soybean Association, and the Pasture Project to provide education and resources to increase regenerative grazing practices in and near the Embarras River

watershed. The group has produced educational materials and shared the benefits of regenerative grazing through field days, online training sessions, and online informal discussions with grazers, farmers, landowners, educators, and stakeholders.

Watershed outreach associates also regularly create and deliver NLRS-related educational content to youth and adults, especially focusing on conservation practices farmers can adopt to reduce nutrient loss. They co-produce the Illinois Nutrient Loss Reduction Podcast which launched in 2018 in collaboration with Todd Gleason, Illinois Extension media communications specialist. Podcast episodes explore a variety of topics from conservation practices and NLRS Biennial Report updates to carbon market information and the cover crop decision tool. Guests, including researchers, Illinois Extension educators, agricultural professionals, government employees, and farmers, discuss how and why to implement conservation practices as well as associated challenges and successes. As of March 2023, the podcast series released 48 episodes with more than 10,000 downloads. The podcast is available at go.illinois.edu/NLRSPodcast along with a supplemental blog launched in December 2022, available at go.illinois.edu/NLRS_blog.

Watershed outreach associates are also engaging with the public by contributing to annual trainings, such as the Certified Livestock Manager Training. Associates provided an update on the NLRS to training participants in 2021 and 2022, and they continue to provide educational opportunities related to the NLRS for others, based on the most current information and research coming from University of Illinois and other partners around the state.

The watershed outreach associates also educate the public through virtual learning opportunities. Jones collaborated with Stacy Zuber, Illinois NRCS state soil health specialist, to create the three-part video series "Soil Health Check Up." The videos include information on at-home soil health tests that farmers, landowners, and homeowners can use to visually assess the health of their soils using household items. The videos have been viewed 2,429 times and are available on Illinois Extension's YouTube account in the Soil Health Check Up playlist at youtube.com/@UIExtension/playlists. Jones and Curry also delivered a webinar on NLRS-supported edge-of-field practices through the Illinois Extension Everyday Environment series that has 410 views and is available at youtu.be/SXLbQJWiHskz. Alongside Extension staff Eliana Brown and Layne Knoche, Curry also provided an overview of the 2021 NLRS Biennial Report, available online at youtu.be/6pKA7jxniFY.

Additional Land and Facilities Measures

Not all conservation practices recommended by the NLRS are implemented with government assistance, so some non-government organizations have worked to improve metrics of specific types of conservation practices across Illinois. Several practices are commonly implemented without government programing. This section features buffer and nutrient management metrics that are providing a more comprehensive measure than federal and state data can provide.

OpTIS Conservation Tillage

The IDOA conducted a Conservation Tillage Transect Survey from 1994-2018. In years thereafter, the surveys were suspended due to a variety of reasons, including excessive spring rain and flooding, the COVID-19 pandemic, and safety concerns. At the time of the 2018 survey, conservation tillage practices in Illinois continued to decline. For example, this dataset showed that in 2006, 51% of all soybeans were planted using no-till, as compared to 37% in 2018.

To continue tracking tillage metrics across the state, the Conservation Technology Information Center's, CTIC, Operational Tillage Information System, OpTIS 3.0, was evaluated for its potential to serve as a new data source. This new technology uses remote sensing data and automation techniques to map tillage, residue cover, winter cover crops, and soil health practices. Like the previously used Conservation Tillage Transect Survey 2006–18 data source, OpTIS data also support a distinct downward trend in use of conservation tillage practices in Illinois over the same period.

OpTIS results for Illinois are as follows and are compared in Figure 4.28:

- The total amount of no-till plantings of all crops was 34.2% and 20.5% in 2019 and in 2021, respectively.
- OpTIS' Reduced Tillage High Resolution metric refers to tillage practices leaving 30% to 50% surface residue cover at planting. This category of tillage practice implementation remained steady at 13.5% and 13.8% in 2019 and 2021, respectively.
- OpTIS' Reduced Tillage Low Resolution metric refers to tillage practices leaving 15% to 30% residue cover at planting. This category saw a 4% increase in implementation, measuring 32.7% and 36.7% in 2019 and 2021, respectively.
- Conventional tillage leaving less than 15% residue cover at planting was 12.1% and 24.1% in 2019 and 2021, respectively.

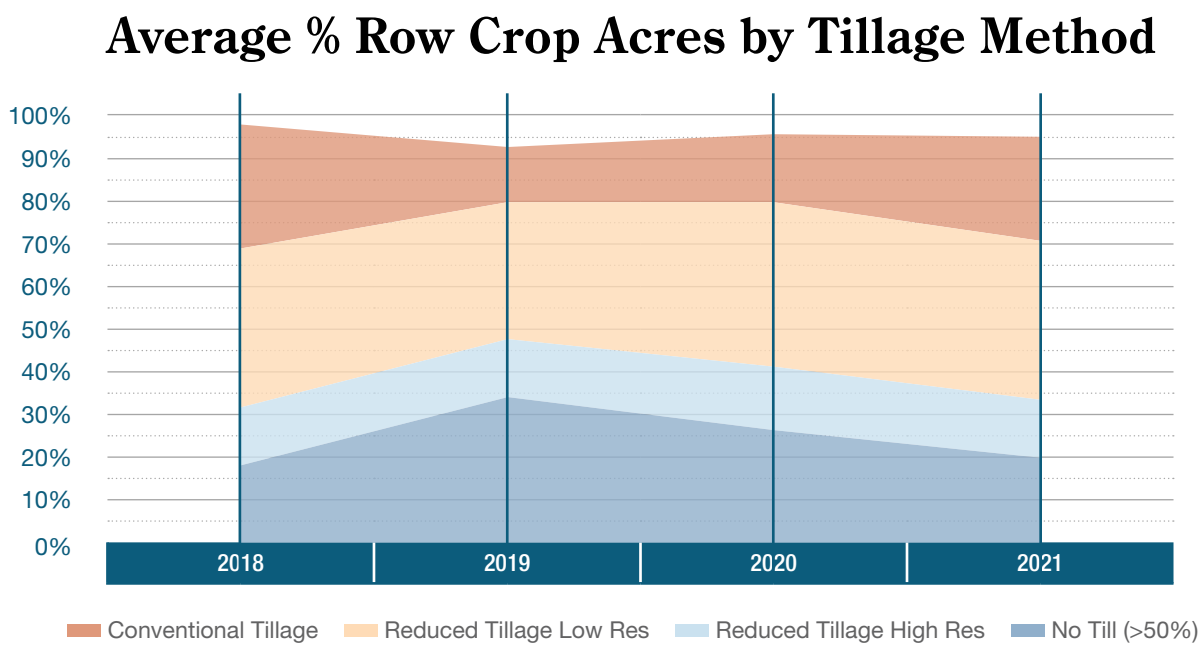


Figure 4.28. *CTIC OpTIS 3.0 tillage types in Illinois. Note, the totals do not add to 100% of the land area. The balance of the land area is comprised of fallow, perennial, or other cover.*

OpTIS technology is made available for free to the public through a partnership between the CTIC, Regrow, and The Nature Conservancy, TNC. OpTIS was developed by Regrow and its precursor companies, Applied Geosolutions and Dagan, in collaboration with the CTIC and TNC (CTIC, 2019). OpTIS is an automated system that maps tillage, residue cover, winter cover, and soil health practices in row crops using publicly available satellite data, primarily Landsat. Further details on OpTIS methodology are available on the CTIC website, www.ctic.org/OpTIS_Tillage, and in a peer-reviewed article published in the scientific literature (Hagen et al., 2020). While OpTIS calculations are performed at the farm-field scale, the privacy of individual producers is fully protected by reporting only spatially aggregated results at regional and watershed scales. OpTIS data are currently available on the CTIC website for 2005 through 2021. The most recent dataset, version 3.0, was released in January 2023 and uses updated algorithms for all 16 states in the "extended corn belt." The data are presented in the context of two-year crop rotations with options to review by the previous and following cash crop for both tillage and winter cover.

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Conservation Technology Information Center (CTIC), 2019. Mapping Conservation Practices and Outcomes in the Corn Belt - Final Report, a collaborative project between Applied Geosolutions LLC, Dagan, Inc. The Nature Conservancy, and the Conservation Technology Information Center, 10 September 2019. https://www.ctic.org/files/Final_Report_CTIC-TNC.pdf

Hagen S et al., 2020. "Mapping Conservation Management Practices and Outcomes in the Corn Belt Using the Operational Tillage Information System (OpTIS) and the Denitrification–Decomposition (DNDC) Model," Land, 9(11):408. https://doi.org/10.3390/land9110408

Conservation Technology Information Center (CTIC), 2023. Operational Tillage Information System (OpTIS 3.0). http://www.ctitc.org/OpTIS [accessed on 08-MAR-2023].

Agricultural Stream Buffers Using Satellite Imagery

This project identified grass buffer strips along streams in Illinois, using a combination of Sentinel-2 satellite imagery, the Illinois Streams GIS database, and the USDA Cropland Data Layer. The identification of buffers is important in developing a better understanding of the interaction between agricultural fields and waterways and of the potential impact of these strips on nutrient loss reduction, carbon storage, and biodiversity.

Figure 4.29. *USDA National Agriculture Imagery Program image showing grass buffer strips along a stream*

Methods

Identification of Stream Buffers in NAIP Imagery for Image Training

Stream buffer strips are natural vegetation strips, usually grassland, located along streams. These strips can be distinguished when crop is not present using imagery from the USDA National Agricultural Imagery Program, NAIP (Figure 4.29). NAIP analysis for the entire state would be too time consuming, so stream buffers were identified in 200 random locations throughout Illinois to establish index thresholds for buffer identification using 10-meters Sentinel-2 satellite imagery.

Satellite Image Analysis

Imagery from the European Space Agency Copernicus Program's Sentinel-2A and -2B satellites, which provide 12 bands of spectral information, was used for the statewide buffer analysis. Most locations worldwide are re-imaged by Sentinel-2 satellites once every five days. Still, most Illinois sites had an average of two cloud-free images per month. The entire state is not imaged on the same day, requiring multi-day composites to capture a statewide image. These methods generated two cloud-free composite images, one for fall 2021 and one for spring 2022 (Figure 4.30).

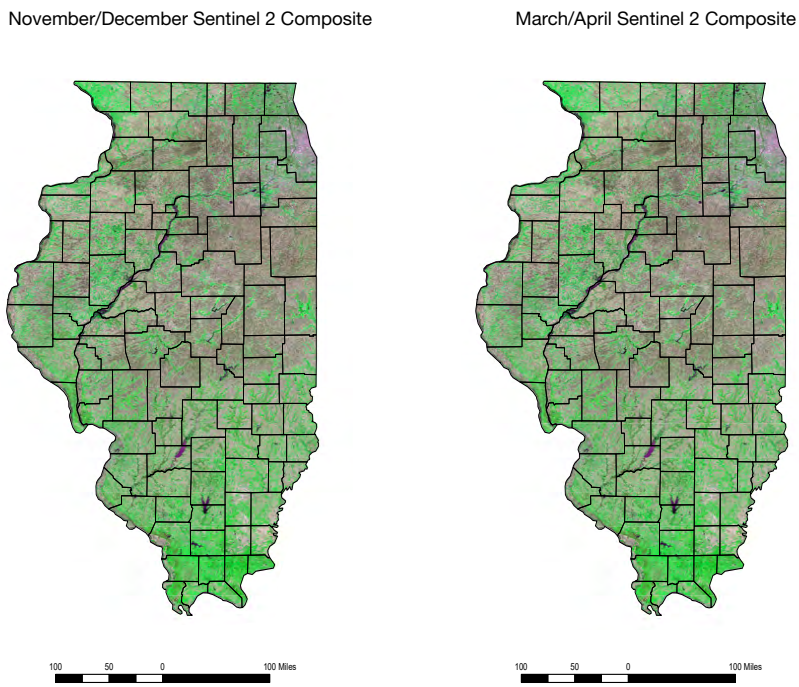


Figure 4.30. *Fall and spring Sentinel-2 composite images used to distinguish vegetation classes in Illinois*

A normalized difference vegetation index was generated for the two composite images, using the formula (NIR - red) / (NIR + red). The index contains ranges -1 to 1, with above-zero values indicating the likelihood of vegetation. Based on analysis of the buffers identified in the NAIP imagery, all values above a threshold of 0.22 were considered vegetation and assigned a value of one. All values below this threshold were considered bare soil and assigned values of zero. These values were used to create binary vegetation absent (0) or present (1) images which were combined into one map that indicates the presence/absence of vegetation in the state.

USDA Cropland Data Layer Analysis

The USDA Cropland Data Layer, CDL, is a 30-meter resolution satellite-based land cover classification developed by the USDA's National Agricultural Statistics Service to assist in crop acreage estimates and crop specific field delineation. The CDL was used to identify open water, grassland, forest, and wetlands (Figure 4.31). All other classes were recoded as zero.

Recode USDA Cropland Data Layer (CDL)

- **Only keep grassland/pasture, forest, wetland and open water classes. Turn everything else to zero. The CDL is 10 meters in resolution.**

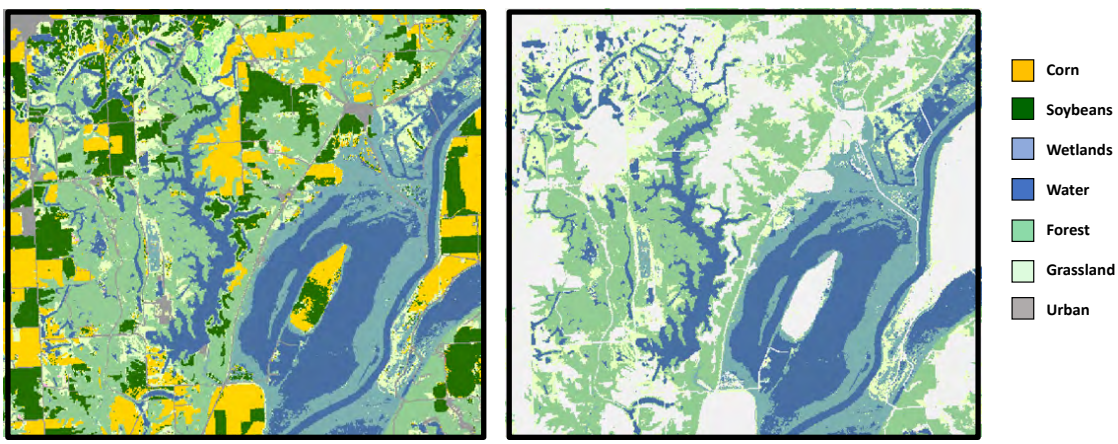


Figure 4.31. *Method for recoding the USDA Cropland Data Layer*

Combined Recoded CDL with Sentinel-2 Vegetation Map

Since many buffer strips along streams are too narrow for detection by the 30 meters offered by the CDL, the project merged the vegetation layer developed by the 10-meter Sentinel-2 imagery with the CDL's grassland, wetland, open water, and forest classes from the 2021 CDL to create a statewide vegetation map (Figure 4.32). If both datasets had positive values, then the value from the CDL was used instead of the value from the Sentinel-2 imagery. This way, the project could identify forest, since the vegetation layer does not distinguish this land cover class.

Combine Recoded CDL with Green-ness Layer

- **Green-ness layer is generated from Sentinel-2 satellite imagery (10 meters) by combining vegetation indices from fall and spring where vegetation is indicated**
- **This combined layer represents potential buffer vegetation (0=No vegetation, 1=Vegetation, 2=Water)**

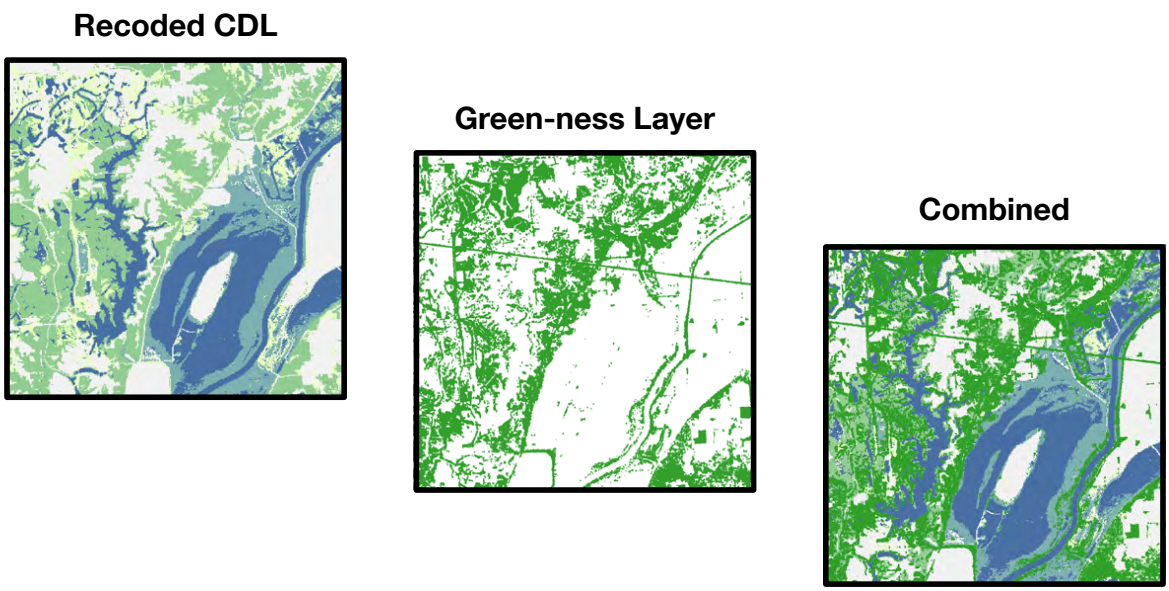


Figure 4.32. *Method of merging the CDL and Sentinel-2 vegetation map*

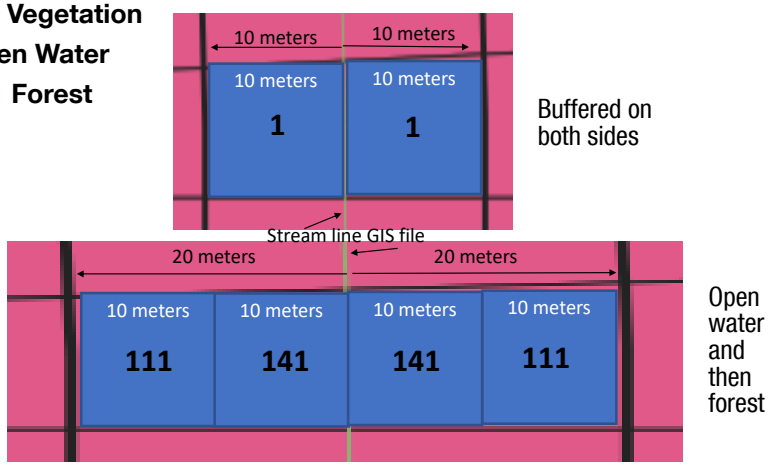
Analysis

The project used the Illinois statewide streams dataset provided by the Illinois Environmental Protection Agency for stream identification. Of the approximately 119, 000 miles of streams in Illinois, a subset of Illinois principal streams and tributaries, approximately 34,000 miles, was used for this analysis. This allowed the analysis to focus on perennial waterways and to avoid grassed waterway conservation practices in fields. Using this stream subset, a 10-meter square to each side of each stream was created in Quantum Geographic Information System, QGIS, an open-source GIS software program. Then, values from the statewide vegetation layer developed from the Sentinel-2/CDL dataset were extracted (Figure 4.33). If each square indicated no value, then the stream was considered to have no buffers. If one square indicated vegetation or grassland and the other square had no value, then the stream was considered buffered on both sides. If both sides were forested, then the stream was considered forested and not buffered.

The streams layer is a vector line file and does not identify stream width. Therefore, if one or both sides were identified as open water in the CDL, then the square was extended another 10 meters to each side until a value other than open water was obtained. This was necessary for large water bodies, such as the Illinois River, which have a stream width of several meters.

Converting Image Values to Buffer Decisions

0-No Buffers
1-Grassland and other Vegetation
111-Open Water
141-141 Forest



Left	Right	Decision
0	0	No buffers
0	1	Buffer on one side
0	111	Expand
0	141-141	Forest on one side
1	1	Buffers on both sides
1	111	Expand
1	141-141	Buffer, Forest
111	111	Expand
111	141-141	Expand
141-141	141-141	Forest

Figure 4.33. *Methods used to determine whether stream was buffered or forested. In the CDL, 111 and 141 are the class values for open water and forest.*

Results

Of the 200 buffer locations identified in the NAIP imagery, 186 were identified in the satellite imagery (93% accuracy). Half of the roughly 34,000 miles of river and principal tributaries that are next to cropland in Illinois were buffered at least 30 feet wide with grass on both banks, for a total of 62,200 acres. Another 2.7% were grass buffered on one bank, for an additional 3,300 acres. A fifth, 21.4%, were entirely unbuffered, representing an opportunity to expand stream buffers by 26,700 acres in Illinois. The remainder was a forested or forest/grass mix. See Table 4.24.

Table 4.24. *Results for statewide stream buffer analysis*

Status	Percentage	Total Miles	Total Acres
No Buffers	21.4%	7,336	26,676
Buffer on one bank	2.7%	921	3,349
Buffer on both banks	50%	17,104	62,196
Forested	20.7%	7,098	25,811
Forest/Grass Mix	5.1%	1,758	6,393
Total		**34,217**	**124,425**

Conclusion

Using the USDA CDL and a vegetation map generated from Sentinel-2 imagery, the project was able to accurately measure buffer strips along Illinois streams. Additional work could include a statewide land cover classification using the Sentinel-2 satellite imagery, which could accurately classify forest and grassland and result in an improved estimate of stream buffers.

CropGrower thanks the Illinois Corn Growers Association and The Nature Conservancy for co-funding this project.

Illinois Fertilizer & Chemical Association 4R Metrics Survey

The Illinois Fertilizer & Chemical Association concluded its 4R Metric Survey – in reference to right source, right rate, right time, and right place nutrient management practices – in the summer of 2022. A questionnaire was sent to agricultural retail members with questions regarding varying nitrogen and phosphorus agricultural practices for fall and spring. Beginning with the fall of 2018 and concluding after the spring of 2022, the survey spanned four growing seasons. Results are shown in Figures 4.34 and 4.35. This survey is comparable with the USDA National Agricultural Statistics Survey.

For the four fall seasons surveyed, 2018–21, the total acres serviced by survey respondents averaged 9,590,670 acres per season. Of the respondents that fall-applied anhydrous ammonia, either by retailer-application or by customer-application, an average of 91% of them applied ammonia after the fall application date recommended by University of Illinois. Also, an average of 90% of respondents indicated that fall-applied anhydrous ammonia included a labeled nitrification inhibitor.

For the four spring seasons surveyed, 2019–2022, the total acres serviced by survey respondents averaged 6,494,250 acres per season. Responses indicated that 78% of the acres are soil tested at least every four years. The results show an average of 78% of total nitrogen rates applied were within the recommended range according to the updated Illinois Maximum Return To Nitrogen Calculator, available at cnrc.agron.iastate.edu/nRate.aspx.

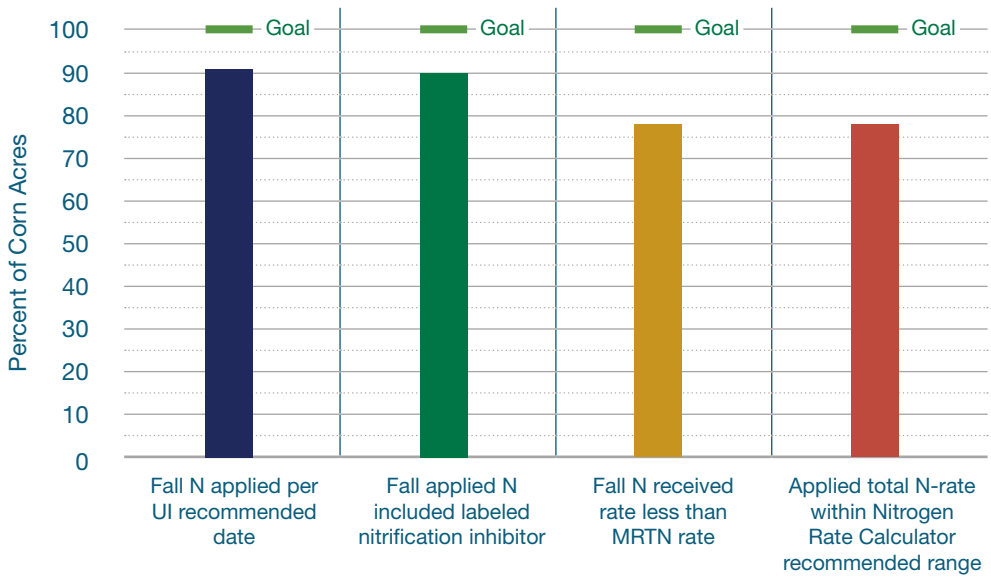


Figure 4.34. *Fall Nitrogen 4R Survey Results from Growing Season 2019-22*

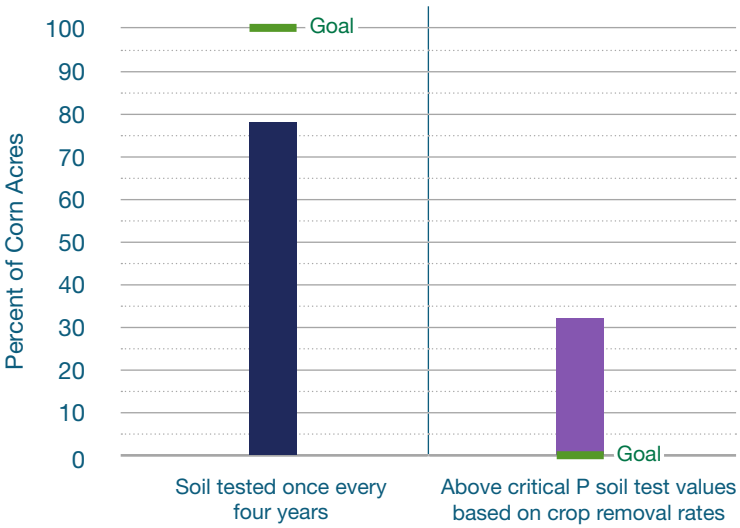


Figure 4.35. *Phosphorus 4R Survey Results from Growing Season 2019-22*

Nitrogen

- 49% of corn acres received an application of fall ammonia. Of the corn acres that received fall ammonia: 91% was applied after the U of I recommended date.
  - 90% included a labeled nitrification inhibitor.
  - 78% received a rate of applied nitrogen less than the MRTN for corn-corn or corn-soybean rotation. This is an indication of a planned split nitrogen application.

Phosphorus

- 45% of acres received variable rate phosphorus application.
- 55% of acres received fall-applied phosphorus.

Soil Testing

- 78% of acres are tested at least once every four years.
- 32% of acres are above critical phosphorus values based on crop removal rates.

IFCA has developed a new survey, "The Illinois Ag Retail Survey," to transition its efforts for obtaining information on agricultural practices. The program started at the beginning of 2023 and involves liaisons who visit agriculture retail facilities throughout the state to gather anonymous data on best management practices. This first year of the survey will focus on information from the 2022 growing season.

Current Non-Governmental Organization Programs and Projects

Many non-governmental organizations help producers establish practices and strategies to reduce nutrient losses across Illinois. The following section highlights updates provided by 39 NGOs for this NLRS Biennial Report. These are programs and projects that are new, have undergone significant changes, or have noteworthy updates.

Some programs and projects are dedicated to education, outreach, and networking and may include opportunities for free services or cost-sharing. Some are professional communities of practice, while others are dedicated to research and education. Illinois made substantial progress on these initiatives, thanks to numerous partnerships and their leveraged resources.

Non-Governmental Organization Programs and Projects

- 4R Field Day
- 4R Metrics Survey
- 5-Year Soil Health Transition
- Carbon and Ecosystem Market Resources and Programs
- Edge-of-Field Partnership for Saturated Buffers
- Edge-of-Field Partnership for Woodchip Bioreactors
- Farm Gate
- Illinois Ag Retailer Survey
- Illinois Farm Bureau NLRS Priority Watershed Work
- IFCA-supported NREC Projects
- Illinois Buffer Partnership
- Illinois Cover Crop Initiative
- Illinois Cover Crop Programs
- Illinois Grazing Lands Coalition
- Illinois Sustainable Ag Partnership
- ILSoyAdvisor
- Keep it 4R Crop
- Mackinaw River Program
- Nitrogen Rate Trials
- Nutrient Research & Education Council
- Nutrient Stewardship Grant Program
- Post Application Coverage Endorsement
- Partnerships with Drinking Water Suppliers and Wastewater Treatment Plants

- Perennial Bioenergy Crop Diversification Project
- Precision Conservation Management
- Soil and Water Outcomes Fund
- STAR Conservation Evaluation Tool
- Sustaining Our Future: A Farm Family Story
- Tree Buffer Program
- Upper Macoupin Creek Watershed Partnership
- Vermilion Headwaters Watershed Partnership
- Water Supply & Industry Partnerships
- Water Testing Initiative

Many of these programs and projects have additional information that is available to review online in Appendix E Partner Updates at go.illinois.edu/NLRS.

4R Field Day

New in 2021–22, the Illinois Fertilizer & Chemical Association partnered with the 4R Field Day Alliance, Precision Planting, producer Eric Miller, the Nutrient Research & Education Council, and University of Illinois researchers to host a public field day to highlight practices that reduce nutrient loss conservation practices and nutrient management systems.

4R Metrics Survey

The IFCA 4R Metrics Survey information is available in the Additional Land and Facilities Measures section above.

5-Year Soil Health Transition

The Illinois Corn Growers Precision Conservation Management team has been working with participating farmers in the 5-Year Soil Health Transition program to complete new enrollments and to prepare current participants for adapting to soil health management systems. Conservation specialists work with each farmer to evaluate the financial and logistical details of implementing new management practices. For more information, see Appendix E and www.precisionconservation.org

Carbon and Ecosystem Market Resources and Programs

New in 2022, the Carbon and Data Guidebook was made available at www.ilsoyadvisor.com. It provides Illinois producers with carbon and ecosystem markets and program enrollment information. The guidebook features CarbonSense information and tips for transitioning to soil health-focused management systems. For more information see www.ilsoyadvisor.com/carbon-data-guidebook.

Edge-of-Field Partnership for Saturated Buffers

The Saturated Buffer Partnership is a five-year collaboration between Illinois Farm Bureau, Illinois Land Improvement Contractors Association Inc., Southern Illinois University Carbondale, and Illinois Natural Resources Conservation Service. The purpose of this partnership is to support saturated buffer installation, water quality monitoring of the practice, and outreach events. For more information, see www.illica.net/projects or www.ilfb.org/nlrspractices.

Edge-of-Field Partnership for Woodchip Bioreactors

The Woodchip Bioreactor Partnership is a five-year collaboration between Illinois Farm Bureau, Illinois Land Improvement Contractors Association Inc., University of Illinois, and Illinois Natural Resources Conservation Service. The purpose of this partnership is to support woodchip bioreactor installation, water quality monitoring or the practice, and outreach events. For more information, see www.illica.net/projects and www.ilfb.org/nlrspractices.

Farm Gate

Illinois' livestock industry is dedicated to addressing environmental protection through regulatory programs, industry-led educational initiatives, and publicly funded programs. Illinois Farm Bureau continues to distribute resources that provide members with a first step toward understanding whether and how environmental rules and regulations impact their operations. For more information, see ilfb.org/FarmGate.

Illinois Farm Bureau NLRS Priority Watershed Work

Watershed planning efforts in Illinois EPA priority watersheds continued to be a significant area of focus for Illinois Farm Bureau and County Farm Bureaus across the state. IFB's work in this area often included providing technical, financial, and outreach support to these efforts. By working closely with CFBs and their local communities, IFB is also able to help ensure farmer and landowner feedback is brought to watershed planning initiatives.

IFCA-supported NREC Projects

New in 2021–22, the Illinois Fertilizer & Chemical Association supports research on practices listed in the Illinois NLRS at permanent sites in Douglas and Piatt counties. This work is funded by the Nutrient Research & Education Council, and IFCA staff help to manage all practices at these sites, including implementing and managing nutrient applications, crop protection applications, tillage practices, and cover crop seeding. Tile monitoring structures are used at both sites, enabling further insight into nitrogen and phosphorus losses from differing agricultural practices researched.

Illinois Ag Retailer Survey

New in 2022, an Illinois Ag Retailer Survey and data collection processes were planned to capture farm management with regards to agricultural practices recommended by the NLRS. This project is spearheaded by Illinois Fertilizer & Chemical Association, with support from many other agricultural organizations. The Illinois Ag Retailer Survey will replace the 4R Metrics Survey. The first data collection period was initiated in spring 2023.

Illinois Buffer Partnership

The Illinois Buffer Partnership promotes and provides cost-share funding to the voluntary conservation efforts of Illinois farmers and landowners with the goal of improving water, air, and soil quality. Buffer projects help to reduce erosion, sequester carbon, provide wildlife and pollinator habitat, and can also create additional income for landowners. This program is a collaborative partnership of Trees Forever, GROWMARK, state and federal government agencies, Trees Forever members, and participating landowners. For more information, see treesforever.org/illinois_buffer_partnership.

Illinois Cover Crop Initiative

The Illinois Cover Crop Initiative, ICCI, is a partnership between American Farmland Trust, the National Fish and Wildlife Foundation, Natural Resources Conservation Service, and Archer-Daniels-Midland Company, ADM. ICCI provides financial incentives to Illinois farmers planting cover crops. Additional incentives are available for ADM customers to implement no-till and/or provide data for emissions scoring. For more information, see farmland.org/icci.

Illinois Cover Crop Programs

Illinois Corn Growers Association believes in recognizing early adopters and finding ways to support growth of cover crop acres across the state. They partner with various organizations and companies to provide financial support to growers in the form of direct cost-share dollars and incentives. For more information, see ilcorn.org/covercrops.

Illinois Grazing Lands Coalition

The Illinois Grazing Lands Coalition, ILGLC, is a voluntary grazing advocacy group that works to expand regenerative grazing within Illinois. New resources acquired in 2021–22 allowed ILGLC to expand assistance to Illinois producers to implement regenerative grazing strategies and to improve management of grazing lands. Several collaborations and initiatives were planned and shared through the Roadmap for Expanding Regenerative Grazing in Illinois publication. Grazing lands are important for their perennial vegetation practices that reduce nutrient loss and land use change to perennial vegetation is one practice recommended by the NLRS. For more information, see facebook.com/ilgrazinglands.

Illinois Sustainable Ag Partnership

The Illinois Sustainable Ag Partnership is a non-profit member-based organization working collaboratively to encourage the adoption of sustainable and profitable production practices that improve soil health and restore local waters. By developing comprehensive programming, building a strong network of sustainable agriculture advocates, and sharing relevant research and resources, the partnership is committed to working together to support healthy soil, clean water, and profitable farms in Illinois. The organization invites conservation leaders to share their own conservation story by adding their pin to its new Conservation Story Map at ilsustainableag.org/conservation-story-map.

Updates on previously-reported NLRS programs and projects, such as the Advanced Conservation Drainage Training, Advanced Soil Health Training, and Soil Health and Conservation Drainage Specialist Network (Local Farmer-Led Networks), and Illinois Alphabet Soup Group, can be found at www.ilsustainableag.org.

ILSoyAdvisor

New in this Biennial Report, the ILSoyAdvisor agronomy team and website resources provide expert agronomic and management advice for Illinois soybean production. Funded by the Illinois Soybean Association checkoff program, it provides education, outreach, networking, and technical assistance on a variety of practices recommended by the NLRS. For more information, see www.ilsoyadvisor.com.

Keep it 4R Crop

The Illinois Fertilizer & Chemical Association's Keep it 4R Crop program is based on principles of 4R nutrient stewardship: use the right nutrient source, at the right rate, at the right time, and in the right place. IFCA works closely with its members, including fertilizer manufacturers, distributors, and agricultural retailers, to promote the 4Rs and uphold the IFCA 4R Code of Practice, which promotes education and adoption of specific fertilizer management practices designed to reduce nutrient losses and assure nutrient use by the crop.

Mackinaw River Program

The Nature Conservancy, TNC, in Illinois is engaged in working with partners on implementation and long-term water quality monitoring in the Mackinaw River watershed to understand how implementation of conservation practices affects water quality at multiple scales, and to gain insights related to outreach, practice delivery, and partnerships that can inform TNC and partner work on other programs and in priority watersheds. This work includes both critical edge-of-field practices – the design and efficacy of constructed wetlands to treat tile drainage water – and stacked infield and edge-of-field practices and their synergies for water quality. The TNC's research provides hard data on practice design and efficiency of these farm bill conservation practices that address nutrients in tile drainage water. Key partners for the Mackinaw River watershed project include the McLean County Soil and Water Conservation District, McLean County Natural Resources Conservation Service, University of Illinois Urbana-Champaign, and Illinois State University. TNC has ongoing projects at the Franklin Research and Demonstration Farm in Lexington, and the Paired Watershed Study in the headwaters of the Mackinaw River. TNC also has conducted/hosted trainings on edge-of-field practices and, in 2021, published a roadmap for increasing the pace and scale of edge-of-field practice adoption and implementation. For more information, see www.nature.org/en-us/get-involved/how-to-help/places-we-protect/the-mackinaw-river-watershed.

Nitrogen Rate Trials

The Nitrogen Rate Trials program is coordinated and managed by the Illinois Fertilizer & Chemical Association in partnership with University of Illinois and the Illinois Nutrient Research & Education Council. Since 2014, ongoing trials have helped to provide nitrogen recommendations through the Maximum Return To Nitrogen Calculator. An expanded partnership with Precision Conservation Management, retailers, and producers throughout Illinois will implement new trial protocols and approaches to integrating weather, soil, and yield data with hopes of improving the MRTN approach to nitrogen management. For more information, see ifca.com/4R/Trials.

Nutrient Research & Education Council

Since 2012, the Illinois Nutrient Research & Education Council has been Illinois agriculture's primary investment into nutrient research. The Council is created by state statute and works closely with a variety of stakeholders across Illinois. It supports the Illinois NLRS through targeted research requests for proposals and investments as well as education and outreach. Focus areas include: applying and understanding the 4Rs, capturing excess nutrients in the field, mitigating loss of nutrients to water supplies, and studying other nutrient management issues. For more information see www.illinoisnrec.org.

Nutrient Stewardship Grant Program

The Nutrient Stewardship Grant Program is a cornerstone of Illinois Farm Bureau's overall NLRS implementation efforts. Since 2015, more than $1 million has been committed to the program. In addition, it has provided other significant resources for county Farm Bureau and farmer member-led nutrient stewardship projects. To date, funds have been awarded to 138 projects across 74 Illinois counties. Projects have often involved a wide array of partners who provide additional expertise to individual projects. For more information, see www.ilfb.org/FieldDays.

Post Application Coverage Endorsement

IL Corn worked to help develop a new crop insurance product to cover a farmer's risk from being unable to get an in-season application of nitrogen. Post Application Coverage Endorsement, PACE, protects a farmer if a planned in-season application of nitrogen (V3-V10) cannot be made due to unfavorable conditions. For more information, see pacecropinsurance.com.

Partnerships with Drinking Water Suppliers and Wastewater Treatment Plants

The Illinois Farm Bureau has prioritized building relationships and developing cooperative efforts with drinking water suppliers and wastewater treatment plants for a number of years. In 2021 and 2022, these efforts included several examples of supporting watershed planning and implementation projects, as well as co-hosting education and outreach opportunities. For more information, see www.ilfb.org/ruralurban.

Perennial Bioenergy Crop Diversification Project

American Farmland Trust is collaborating with Argonne National Laboratory to broaden crop diversification and farm resiliency efforts in Illinois. This project will explore opportunities to support the Illinois agricultural community through the adoption and utilization of perennial bioenergy crops. These

opportunities aim to provide economic and environmental resiliency to farms while reducing nutrient loss. For more information, see farmland.org/illinois-perennial-bioenergy-crop-diversification-project.

Precision Conservation Management

The Precision Conservation Management program is an agricultural service program created to assist farmers with identifying the best management practices for their individual farming operations, conservation interests, and business goals. It is jointly managed by the Illinois Corn Growers Association and the Illinois Soybean Association. For more information, see www.precisionconservation.org.

Soil and Water Outcomes Fund

The Illinois Soybean Association, in partnership with USDA-NRCS and others, offers financial incentives to producers transitioning to conservation practices that provide positive outcomes for carbon sequestration and water quality. Program expansion in 2021–22 made incentives available to producers in 17 Illinois counties.

STAR Conservation Evaluation Tool

Saving Tomorrow's Agriculture Resources, STAR, is a free nationwide tool to assist farm operators and landowners in evaluating their nutrient and soil loss management practices on individual fields. STAR's goal is to encourage the continued adoption of conservation practices and recognize farmers for their commitment to improved water quality and soil health. For more information, see www.starfreetool.com.

Sustaining Our Future: A Farm Family Story

The Illinois Farm Bureau is committed to highlighting the work our members are doing to reach NLRS goals and to improve soil health and water quality. To showcase these voluntary efforts, IFB video and environmental teams partnered with farmers, County Farm Bureaus, researchers, and other key stakeholders on a year-long effort to create an original documentary "Sustaining Our Future: A Farm Family Story." For more information, see www.ilfb.org/documentary.

Tree Buffer Program

The Illinois Pork Producers Association offers a tree buffer cost-share program for swine producers who implement fresh landscaping on their farms. For more information see ilpork.com/farmers-care/funding-opportunities/tree-buffer-grant-program.

Upper Macoupin Creek Watershed Partnership

American Farmland Trust provided leadership for the Upper Macoupin Creek Watershed Partnership, comprised of 15 federal, state, and local government partners, agricultural trade associations, environmental groups, agricultural retailers, and a local university. The goal of the partnership is to increase the use of conservation practices that reduce soil erosion and phosphorus loss in the watershed.

Vermilion Headwaters Watershed Partnership

The Vermilion Headwaters Watershed Partnership is a group of stakeholders, including farmers, community leaders, government agencies, research institutions, and nonprofit organizations working to reduce the loss of nitrogen from farmland in the watershed. The adoption of conservation cropping systems, such as reduced tillage, cover crops, nutrient management, and tile water treatment, can help protect water quality and improve a farmer's bottom line. Key partners include American Farmland Trust, The Wetlands Initiative, NRCS – Pontiac Office, Livingston County Soil and Water Conservation District, Northwater Consulting, Precision Conservation Management, and Compeer Financial. For more information, see farmland.org/vhw.

Water Supply & Industry Partnerships

Illinois Fertilizer & Chemical Association continues to work toward nutrient loss reduction to surface water supply reservoirs across central Illinois. In 2021–22, partnerships with the Sangamon County Soil and Water Conservation District and Springfield City Water, Light, and Power continued to track metrics and provide education and outreach to stakeholders in the Lake Springfield and Lake Decatur watersheds.

Water Testing Initiative

Working to promote awareness and education of the NLRS is key to helping ensure its goals are met. Offering a water testing initiative contest to Future Farmers of America chapters across the state not only helps build overall awareness but also helps the next generation of farmers and industry professionals examine the issues facing Illinois agriculture. This program was previously offered by the Illinois Corner Growers Association as Free Confidential Water Testing Program with Illinois Future Farmers of American and County Farm Bureaus. The program shifted focus toward this educational initiative in partnership with Illinois Soybean Association.

Metric Collection

The agriculture implementation metrics discussed in this chapter are a result of dedicated partner agencies and organizations documenting and submitting their information and data. Reporting this information remains challenging, as there can be multiple organizations working on the same project, and some conservation practices are easier to track than others. Despite these challenges, tracking of several agricultural implementation metrics have improved over the last two years, including those for MRTN in-field buffers, and conservation tillage. Tracking of practices recently added to the NLRS — such as terraces, WASCOBs, saturated buffers, and bioreactors — has improved in recent years as well, but it still requires creative solutions to measure in an efficient, consistent manner statewide.

The 2022 USDA NASS NLRS Survey methods for tracking statewide use of MRTN have improved and will provide increased accuracy for this metric which is tracked in the NLRS agricultural implementation scenarios in chapter 8 of this report. Also, the NASS survey methods changed how it differentiates between tiled and non-tiled lands. As a result, NASS NLRS Survey's 2021 report sums the tile and non-tile acreages for the following practices which are used in the NLRS Scenarios: Nitrogen Management (40% in fall; 10% spring pre-plant; 50% side-dress), use of nitrogen-inhibitors, spring-only nitrogen application, soil test phosphorus, and use of cover crops on corn/soybean acres.

In the 2021 Biennial Report, no adequate statewide dataset existed to measure and report on grass buffers in Illinois beyond state and federal programming. Satellite imagery analysis methods have improved such that in-field buffers can be identified independent of partner agency program data analysis. These improved methods use satellite imagery combined with the Illinois Streams GIS database and the USDA Cropland Data Layer. This satellite imagery analysis solution has allowed for a statewide count of buffer acres that are reducing nutrient runoff in Illinois. This improved count is reflected in the NLRS Scenarios in chapter 8 that show interim and 45% reduction goals, Scenarios NP3 and NP8, respectively.

The Conservation Tillage Transect Survey has been suspended since 2018 for a variety of reasons. As an alternative, the Conservation Technology Information Center's OpTIS 3.0 imagery analysis, which has been under steady improvement since 2005, has been used as a data source for tracking conservation tillage metrics through remote sensing of seasonal residue cover. Starting with this report, the OpTIS 3.0 data for Illinois has enabled the strategy to continue tracking NLRS Scenario progress. This data source has provided an update for the reduced tillage category representing 30% or greater residue, a metric that contributes to NLRS Scenarios NP2 and NP3. OpTIS 3.0 data has also provided the conservation tillage metric that combines acres of no-till, mulch till, and reduced till shown in NLRS Scenarios NP7 and NP8.

Terraces and WASCOBs were recommended by the strategy in 2021 and 2022, respectively. The tracking

of those practices has been available through some partner program data sources, while a comprehensive statewide quantification of each practice, independent of program enrollment data, remains a challenge. As data sources improve, additional NLRS scenarios could be developed that quantify the benefits of nutrient reductions from these conservation practices as they relate to progress toward the interim and 45% goals.

Additionally, solutions are necessary to conduct efficient data collection for saturated buffers. Currently, saturated buffers can be tracked through USDA programs such as NRCS-EQIP (CP 606), FSA-CRP (CP 21S - Saturated Filter Strips and CP 22S - Saturated Riparian Buffers), IDOA-PFC (CP 606), and Illinois EPA 319 grand program (CP 606). As tracking improves, additional NLRS Scenarios could be developed to include these metrics.

Currently, denitrifying bioreactors can be tracked through USDA programs such as NRCS-EQIP (CP 605), FSA-CRP (CP 21B-Denitrifying Bioreactors on Filter Strips and CP 22B- Denitrifying Bioreactors on Riparian Buffers), IDOA-PFC (CP 605), Illinois EPA 319 grant program (CP 605), and from voluntarily reported data. Bioreactors are included in all NLRS Scenarios in chapter 8 of this report. Additional creative solutions are needed to improve tracking of this practice across Illinois.

One additional development in metrics tracking is in the conversion of all tracked units to a common unit. Due to differences in how terraces, WASCOBs, bioreactors, and saturated buffers are tracked among partner agencies, the acres treated by these practices can be either exact or estimated. Partner research on conservation practices' nutrient reduction efficiencies have been evaluated by the Illinois NLRS Science Team. This research and evaluation have improved our ability to assign nutrient reduction efficiencies and confidently assign conversion factors for practices that are tracked in units other than acres. Terraces and WASCOBs are tracked by the length of their ridges in feet, for example. Some partner programs track the exact treated acres of each terrace or WASCOB project based on the drainage areas to those practices, while other partners do not. Also, bioreactors and saturated buffers are tracked by the number of practices. Some partner programs track the exact treated acres based on the drainage area to each saturated buffer or bioreactor project, while other partners do not. As a result, quantification of the reduction benefits of terraces, WASCOBs, saturated buffers, and bioreactors are estimated for some data sources when reported in the strategy since some of the reported figures must be converted to acres treated by using an average conversion factor for each practice. This is the first Biennial Report in which these conversion factors have been necessary. Prior to this, all NLRS-recommended conservation practice metrics tracked by the strategy have been in a common unit of acres applied.

Finally, the success of traditional state and federal cost-share programs is dependent on the level of funding received and the willingness of farmers and landowners to use these programs. Many programs receive more requests than can be funded. The growth and maturation of non-governmental programs provide

additional metrics on agriculture implementation. Information can only be included in Biennial Reports if it is submitted to the Steering Committee. Any omission of programs or activities from this report is not intentional. The NLRS Steering Committee welcomes and encourages programs to report activities that lead to nutrient loss reduction in the agriculture sector.

Future Strategic Actions

Agricultural Water Quality Partnership Forum

Partnerships with farmers are crucial to the success of the Illinois NLRS objectives. The Agriculture Water Quality Partnership Forum, AWQPF, works alongside agricultural professionals to establish meaningful outreach and education programs with farmer audiences, implement science-based conservation practices, and inspire informed decisions. Members of the forum discuss ways to collaborate on agricultural initiatives, work to improve tracking conservation practice implementation, and have a technical subgroup that tracks implementation measures.

See chapter 8 for a more detailed conversation about future actions. Find more information about AWQPF and its technical subgroup's activities from 2021-22 in chapter 7 Working Group Accomplishments.

Regional Conservation Partnership Programs

The Regional Conservation Partnership Program is a USDA NRCS-sponsored program that facilitates a partner-driven approach to solving natural resources challenges on agricultural lands. It combines partner resources and local expertise with federal assistance to provide incentives for producers to implement conservation practices and systems that help to reduce nutrient losses, to sequester carbon, and to reduce greenhouse gas emissions. The Climate-Smart Partnership is on the horizon for Illinois.

Climate-Smart Partnership

The Climate-Smart Partnership encourages and incentivizes Illinois producers to voluntarily adopt biodiversity-building and regenerative farming practices, natural areas conservation, and water and energy use efficiencies improvements. Implementation of these activities will reduce the amount of sediment, nitrogen, and phosphorus loading into the Mississippi River Basin waters, limit carbon release, and expand carbon capture. The partnership aims to raise awareness of these co-benefits through outreach methods, including training opportunities that advance the awareness of the quantifiable nutrient and greenhouse gas reductions that can be realized by implementation of climate-smart agricultural practices. Education and outreach products, such as field days, webinars, and factsheets, as well as networking opportunities and conferences, will facilitate the sharing of the co-benefits of

climate-smart agriculture and will extend support to over 1,000 stakeholders over the life of the project.

This partnership is made possible by leveraging funds from several partners across Illinois, including local/state/federal agencies, the agricultural industry, agricultural associations, and not-for-profit organizations. The 2021 launch of this partnership was made possible by cash commitments from the Illinois Department of Agriculture and Illinois agricultural industry partners totaling $1 million. As of the publication of this report, program planning was underway with activities set to initiate in 2023.

Additional information about climate-smart agricultural practices can be found at www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/climate/climate-smart-mitigation-activities.

POINT SOURCE SECTOR
KEY POINTS

Phosphorus discharges decreased by 34% from baseline, surpassing the strategy's 25% interim goal set for 2025.

Point sources decreased phosphorus discharges by 6.2 million pounds in 2022, compared to the 2011 baseline measurement, largely due to improvements by National Pollutant Discharge Elimination System, NPDES, permit holders.

In 2022, **101 major municipal facilities discharged an annual average phosphorus concentration of 1 mg/L or less.** Of these facilities, 46 are meeting 0.5 mg/L or less.

Major municipal wastewater treatment facilities are making large investments to meet NPDES permit limits. In 2022, eight facilities invested $84.5 million, and in 2021, five facilities invested $107.3 million through State Revolving Funds. Others are investing without using these funds.

67 individual major municipal facilities are developing Nutrient Assessment Reduction Plans, NARPs. Another 89 facilities are developing NARPs as part of a watershed group.

The Illinois EPA issued 82 NPDES permits with total phosphorus concentration limits to facilities by the end of 2022.

210 major municipal facilities are now required to monitor for total phosphorus or total nitrogen.

More than 4,300 people attended 18 outreach events from 2021-22, including field days, presentations, workshops, and conferences.

CHAPTER 5
POINT SOURCE SECTOR

Each of the chapters on nutrient source sectors in this report — chapters 4, 5, and 6 — has three primary parts: implementation report, current program and project updates, and future strategic actions. Chapter 5 showcases the scale at which the recommended approaches are being applied to reduce nutrient loads from the point source sector.

A point source is any site of discharge into a waterway, such as a pipe. Point sources are often associated with publicly owned treatment works and industrial wastewater treatment plants. Domestic sewage and industrial wastewater require treatment to reduce the concentration of certain pollutants, such as nutrients, deposited into receiving rivers, streams, and lakes. The point source sector is implementing strategies — such as optimizing operations of existing equipment, upgrades to wastewater treatment facilities, and watershed-based approaches — to reduce these nutrient loads.

Reducing total phosphorus loads from the point source sector is especially important to the Illinois Nutrient Loss Reduction Strategy, NLRS. According to the original strategy published in 2015, nutrient loading from the point source sector represented almost half of the statewide total for phosphorus compared with just 16% for nitrate-nitrogen. The last decade has seen substantial phosphorus reduction achievements in the point source sector.

The implementation report section indicates progress toward Illinois NLRS goals by tracking point source resources, outreach, and land and facilities measures. It also includes information on metric collection. The current programs and projects section highlights updates that contribute to NLRS goals. The chapter concludes by addressing future strategic actions for the point source sector that will support NLRS goals.

This chapter covers resource tracking, metric collection, and updates toward strategy goals for the point source sector.

Illinois' largest wastewater treatment facilities contributed some of the information used in this chapter. The data is compiled by the Illinois Association of Wastewater Agencies. National Pollutant Discharge Elimination System, NPDES, permit holders are also required to submit monthly discharge data to the Illinois Environmental Protection Agency, Illinois EPA.

Implementation Report

The progress of point source sector implementation is tracked through resources, outreach, and land and facilities measures as outlined in Figure 5.1 and by the full logic model framework in chapter 2. Great improvements have been made in the point source sector, which has already surpassed its interim phosphorus load reduction goal. The strategy set a goal of a 25% reduction of phosphorus from the 2011 baseline for the point source sector by 2025. In 2022, the point source sector reduced its phosphorus discharge by 34%, or a total of 6.2 million pounds. More information about this can be found in the land and facilities section of this chapter.

Information was submitted by 140 stakeholder partners from all source sectors across the state and is available online in Appendix E Partner Updates. Some wastewater treatment agencies and watershed groups reported on their staff, financial resources, and outreach efforts through the Illinois NLRS tracking spreadsheet. At its quarterly technical meetings, the Illinois Association of Wastewater Agencies encouraged its members to complete the NLRS spreadsheet and then compiled the spreadsheets for this report. Ten entities responded in 2021 and 11 responded in 2022, including some of the largest facilities in the state, which represent most of Illinois' effluent flow. Completed spreadsheets can be found in the online Appendix A Partner Data.

University of Illinois Extension staff analyzed the submitted financial and staff information for the resource measures section. Anna Marshall, University of Illinois Urbana-Champaign associate professor of sociology, analyzed outreach measures. The Illinois EPA estimated land and facility measures data; the computation method is included in that section.

Figure 5.1. *The NLRS Logic Model. See chapter 2 for the full logic model framework.*

Resource Measures

Of the 211 major municipal facilities in Illinois, only 11 submitted resource and outreach data for this report. As a result, figures reported in this chapter significantly underestimate staff, financial, and outreach measures.

The point source sector has increased investment in operations, maintenance, and staff compared with previous years. The reported capital improvement and feasibility study investments decreased in 2021-22. However, capital improvements continue to account for most of the spending. Figure 5.2 and Table 5.1 show total investments of $137.7 million in 2021 and nearly $100 million in 2022. In 2021 and 2022 respectively, 45 and 48 full-time equivalent staff members engaged in work related to the Illinois NLRS. Table 5.1 details nutrient-related spending in the point source sector for the facilities that submitted information.

Photo courtesy of Kent Newton, Sanitary District of Decatur

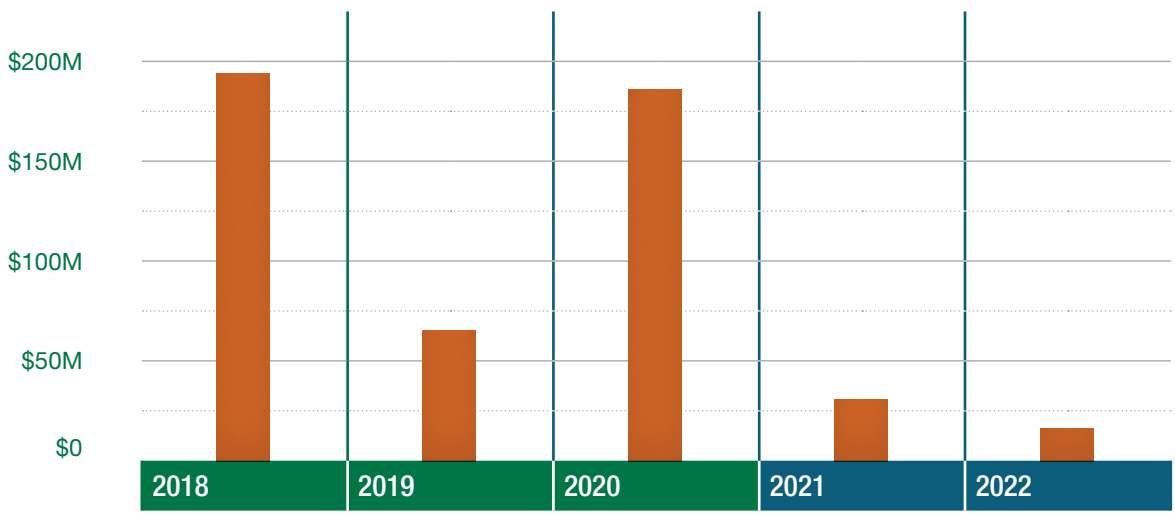


Figure 5.2. *Reported point source spending from 2018-22 submitted from facilities*

Table 5.1. *Reported expenditures supporting 2021-22 nutrient reduction activities in the point source sector for Illinois Association of Wastewater Agencies reporting agencies, watershed groups, and Illinois EPA*

Nutrient Reduction-Related Activity	2021 Totals	2022 Totals
Capital improvement	$19,970,913	$5,954,693
Operations and maintenance	$4,761,296	$4,592,671
Feasibility studies or permit-required projects	$700,830	$20,668
Staff	$4,762,150	$4,740,326
Other resources	$225,278	$169,321
Illinois EPA State Revolving Fund's Water Pollution Control Loan Program	$107,296,729	$84,520,637
Total	**$137,717,196**	**$99,998,316**

Outreach Measures

The point source sector continued its collaborations with stakeholders in both the agricultural and stormwater sectors to promote the Illinois NLRS. Table 5.2 demonstrates a range of outreach activities, including face-to-face events, virtual meetings, and webinars. While the COVID-19 pandemic hampered outreach activity in prior years, stakeholders learned that online outreach — such as the Metropolitan Water Reclamation District's, MWRD, webinars and virtual facility tours — could effectively engage broad audiences. In this reporting period, those online presentations reached thousands of people who might not have been able to visit the MWRD in person.

Table 5.2. *Point source sector activities and attendance 2021-22*

Type of Activity	Number of Events	Attendance
Field Days	2	100
Presentations	12	4,000
Workshops	2	175
Conferences	2	45
Totals	**18**	**4,320**

Many of these outreach activities focused on the efforts by point sources to control nutrient loss, including nutrient removal at wastewater facilities and biological phosphorus removal technologies. The MWRD also continued its collaboration with six different watershed planning commissions promoting nutrient management in Chicagoland area watersheds. In addition to outreach about point source activities, MWRD joined with organizations in the agricultural sector to promote research on the adoption of best management practices, including the use of cover crops, bioreactors, and edge-of-field practices. The MWRD co-sponsored field days and workshops with the Illinois Farm Bureau, Nutrient Research & Education Council, and researchers at University of Illinois Urbana-Champaign to showcase the impact of these conservation practices. Working with the Cook County Farm Bureau, the MWRD also sponsored its Annual Sustainability Summit, which featured stormwater management best practices, including green infrastructure, landscaping, and composting.

Land and Facilities Measures

This land and facilities section provides details on point source sector approaches recommended in the NLRS. Quantifying the total nitrogen and total phosphorus loss reductions as a result of implementation activities allows Illinois to measure progress. In the point source sector, nutrient loss reduction measurement can be accomplished by tracking wastewater treatment facility system upgrades that meet National Pollutant Discharge Elimination System, NPDES, permit requirements and watershed approaches.

In 2021-22, the Illinois NLRS identified 20 point source sector programs and projects reducing nutrient loss. The following are used as metrics to track land and facilities implementation.

Progress Across Illinois

The point source sector not only met its interim goal of reducing total phosphorus by 25% by 2025, it exceeded it. This is discussed in detail in the following sections of this chapter. The point source sector focuses its efforts on reducing phosphorus loads. However, reductions in nitrogen loads also resulted as part of practice implementations focused on phosphorus.

Reducing nutrient losses from the point source sector requires two key strategies: upgrading and optimizing the systems used by wastewater treatment facilities, and utilizing a watershed approach. Major municipal wastewater treatment facilities, or facilities designed to treat at least 1 million gallons per day, MGD, continue to reduce their total phosphorus loads to Illinois rivers. These reductions can be attributed to optimizations of existing operations as well as investments in new technologies.

Since February 2, 2006, and in accordance with 35 Ill. Adm. Code 304.123, all new or expanded treatment

facilities with a design average flow of at least 1 MGD must meet a monthly average total phosphorus limit of 1 milligram per liter, mg/L, upon operational attainment.

Special conditions requiring total phosphorus reductions continue to be included in NPDES permits for major municipal facilities. These conditions are based on an agreement among the Illinois Association of Wastewater Agencies, Illinois EPA, and a coalition of environmental groups. The agreement applies to NDPES permit renewals for major municipal wastewater facilities after January 25, 2018, and stipulates as such:

- If a facility had already installed chemical phosphorus removal, had a 1 mg/L total phosphorus monthly average effluent limit in its permit, the 1 mg/L shall apply and the 0.5 mg/L limit shall not be applicable.

- For facilities that choose to install chemical phosphorus removal, a 12-month rolling geometric mean phosphorus limit of 0.5 mg/L must be met by 2025.

- Facilities planning to install biological phosphorus removal must meet the 12-month rolling geometric mean limit of 0.5 mg/L by 2030.

- If a facility requires extensive modification or plans to install biological nutrient removal — both phosphorus and nitrogen — the facility must meet the 12-month rolling geometric mean phosphorus limit of 0.5 mg/L by 2035.

Permittees must notify the Illinois EPA by December 31, 2023 (or December 31, 2024, depending on the issuance date of their current NPDES permit) to identify and justify their chosen compliance date, total phosphorus limit, and timeline, all of which will be included in the permit upon its renewal.

Data show that major municipal wastewater facilities continue to reduce total phosphorus discharges. Nutrient loads are influenced by both nutrient concentrations and effluent flow, which fluctuates annually due to factors such as precipitation. These reductions are a result of facility optimization of existing equipment, installation of new equipment and operations to comply with permit limits, or both.

Total Phosphorus Load Reductions

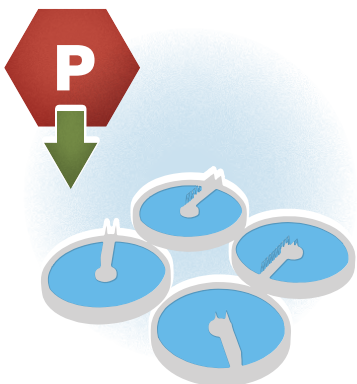
The point source sector achieved reductions beyond the interim goal of 25% total phosphorus reduction by 2025. In 2021, total phosphorus from point sources had reduced by 31% statewide from baseline measures and in 2022 loads had reduced by 34% from baseline.

34%

total phosphorus reduction from point sources. This is beyond the interim goal of 25% by 2025.

101

major municipal facilities achieved an annual average total phosphorus concentration of 1 mg/L or less, with 46 of these being 0.5 mg/L or less.



The statewide total phosphorus load from point sources already decreased by 16% or 2.9 million pounds between 2011 and 2020, according to the 2021 Biennial Report. Total phosphorus loads from point sources also decreased significantly during the 2021-22 timeframe. The 211 major municipal wastewater facilities discharge a large portion of the statewide point source load, followed by minor municipal wastewater facilities and industrial wastewater facilities.

The methods used to calculate point source nutrient loads are detailed later in this chapter. Nutrient loads for most major municipal wastewater facilities were calculated with data from monthly Discharge Monitoring Reports; however, some facilities do not have nutrient monitoring requirements in their current permit. In cases where nutrient monitoring is not required, those facilities provided nutrient data directly to the Illinois EPA.

2021 and 2022 Reductions

Reductions of 5.6 million pounds of phosphorus from the baseline were documented in 2021, and 6.2 million pounds were documented in 2022. Both years already exceeded the 2025 Goal of 25% reduction from the point source sector. In 2021 the point source sector achieved a 31% reduction and in 2022 the point source sector achieve a 34% reduction from the 2011 baseline load (Table 5.3).

In 2021, the estimated annual statewide total phosphorus load from point sources was 12.5 million pounds. Of that amount, 10.7 million pounds was attributed to the 211 major municipal wastewater facilities. Minor municipal wastewater facilities are estimated to contribute 1.3 million pounds, while industrial facilities contributed approximately 0.5 million pounds.

The 2022 estimated annual statewide total phosphorus load from point sources was 11.9 million pounds. The 211 major municipal wastewater facilities contributed 10.2 million pounds, while minor municipal facilities contributed an estimated 1.3 million pounds. Industrial facilities contributed approximately 0.4 million pounds.

Table 5.3. *Statewide total phosphorus loads from the point source sector from 2021-22*

Point Source Sector	2021 Total Phosphorus Load (million lb/yr)	2022 Total Phosphorus Load (million lb/yr)
Annual Point Source Load • 211 Major Municipals • Minor Municipals • All Industrials	12.5 10.7 1.3 0.5	11.9 10.2 1.3 0.4
Reductions from 2011 Baseline load of 18.1 million lb/yr	5.6 (31%)	6.2 (34%)

Total Phosphorus Reductions from Individual Dischargers

Reductions in total phosphorus loads from individual major municipal facilities continued through 2021-22. In 2022, 176 major municipal facilities had decreased loads, ranging from 1% to 99%, compared to the 2011 baseline loads. Some of these decreases were due to annual variations in flow and concentration, but many were the result of meeting required permit limits of 1 mg/L total phosphorus concentration or optimization of existing facility operations. Overestimation of the 2011 baseline loads for some facilities may also contribute to overall total phosphorus load reductions.

In 2021, 94 facilities had an annual average total phosphorus concentration of 1 mg/L or less, with 39 of those being 0.5 mg/L or less. In 2022, 101 facilities had an annual average total phosphorus concentration of 1 mg/L or less, with 46 of these being 0.5 mg/L or less. By comparison, in 2020, there were 90 facilities with an annual average total phosphorus concentration of 1 mg/L or less, with 31 of those being 0.5 mg/L or less.

Table 5.4 displays the 10 major municipal facilities with the highest total phosphorus loads in 2022. Estimated 2011 baseline loads and loads from 2018-22 are included for comparison. Together, these facilities comprised 62% of the statewide total phosphorus load from point sources in 2022.

Table 5.5 displays the same facilities' annual flow in million gallons per day, MGD, and total phosphorus concentration values for 2021 and 2022.

Table 5.6 displays the facilities' expected dates for compliance with a 1 mg/L total phosphorus limit. The Stickney Water Reclamation Facility permit limit went into effect in 2021. Compliance dates for Four Rivers Sanitation Authority Sewage Treatment Plant, the Thorn Creek Basin Sanitary District, and the Bloomington-Normal Water Reclamation District west-side plant are still to be determined and will be based on their chosen method for reducing nutrients.

In all tables, MWRDGC refers to the Metropolitan Water Reclamation District of Greater Chicago.

Table 5.4. *Top 10 major municipal facilities contributing total phosphorus loads in 2022*

NPDES Permit	Facility Name	Total Phosphorus Load (lb/yr)						Percent Change
		2011	2018	2019	2020	2021	2022	2011-22
IL0028061	Calumet Water Reclamation Plant (MWRDGC)	2,450,714	1,990,902	2,191,160	2,569,259	2,553,033	2,756,427	12%
IL0028321	Sanitary District of Decatur – Main Sewage Treatment Plant	1,562,750	2,022,573	2,011,785	1,897,809	1,601,329	1,745,380	12%
IL0028053	Stickney Water Reclamation Facility (MWRDGC)	2,351,312	707,230	2,164,828	2,435,218	1,277,750	995,924	-58%
IL0028088	Terrence J. O'Brien WRP (MWRDGC)	971,083	931,333	947,758	978,314	1,036,758	873,938	-10%
IL0027201	Four Rivers Sanitation Authority Sewage Treatment Plant	216,837	280,052	231,141	223,527	235,553	229,546	6%
IL0036340	John E. Egan WRP (MWRDGC)	233,759	209,074	219,942	210,437	221,709	194,107	-17%
IL0027723	Thorn Creek Basin Sanitary District Sewage Treatment Plant	104,111	130,969	99,404	96,844	123,564	176,694	70%
IL0034061	Springbrook Water Reclamation Center – Naperville	190,457	166,060	155,307	162,805	181,804	149,175	-22%
IL0027731	Bloomington-Normal Water Reclamation District west-side plant	139,207	101,236	132,693	124,924	127,637	101,959	-27%
IL0028380	Downers Grove Sanitary District Wastewater Treatment Center	91,396	85,647	103,297	110,224	113,246	86,741	-5%

Table 5.5. *Top 10 major municipal facilities' flow and total phosphorus concentrations in 2021-22*

NPDES Permit	Facility Name	2021 Average Flow (MGD)	2021 Average TP Concentration (Mg/L)	2022 Average Flow (MGD)	2022 Average TP Concentration (Mg/L)
IL0028061	Calumet Water Reclamation Plant (MWRDGC)	233	3.67	236	4.19
IL0028321	Sanitary District of Decatur – Main Sewage Treatment Plant	35	15.08	36	16.39
IL0028053	Stickney Water Reclamation Facility (MWRDGC)	604	0.72	665	0.52
IL0028088	Terrence J. O'Brien WRP (MWRDGC)	204	1.68	209	1.43
IL0027201	Four Rivers Sanitation Authority Sewage Treatment Plant	27	2.77	28	2.67
IL0036340	John E. Egan WRP (MWRDGC)	22	3.36	22	2.95
IL0027723	Thorn Creek Basin Sanitary District Sewage Treatment Plant	12	3.35	13	4.41
IL0034061	Springbrook Water Reclamation Center – Naperville	17	3.48	18	2.77
IL0027731	Bloomington-Normal Water Reclamation District west-side plant	18	2.33	16	2.23
IL0028380	Downers Grove Sanitary District Wastewater Treatment Center	10	4.01	10	3.13

Table 5.6. *Top 10 major municipal facilities' total phosphorus 1 mg/L compliance date*

NPDES ID	Facility Name	TP 1 mg/L Compliance Date
IL0028061	Calumet Water Reclamation Plant (MWRDGC)	Jan. 1, 2024
IL0028321	Sanitary District of Decatur – Main Sewage Treatment Plant	Oct. 1, 2029
IL0028053	Stickney Water Reclamation Facility (MWRDGC)	Aug. 1, 2021
IL0028088	Terrence J. O'Brien WRP (MWRDGC)	Aug. 1, 2027
IL0027201	Four Rivers Sanitation Authority Sewage Treatment Plant	TBD
IL0036340	John E. Egan WRP (MWRDGC)	Jan. 1, 2031, or Jan. 1, 2032
IL0027723	Thorn Creek Basin Sanitary District Sewage Treatment Plant	TBD
IL0034061	N Springbrook Water Reclamation Center – Naperville	Jan. 1, 2029, or Jan. 1, 2030
IL0027731	Bloomington-Normal Water Reclamation District west-side plant	TBD
IL0028380	Downers Grove Sanitary District Wastewater Treatment Center	Aug. 1, 2025, or Aug. 1, 2026

The top 10 major municipal facilities for 2022 are compared to the top facilities during the 2011 baseline year (Table 5.7). Seven facilities that were in the top 10 in 2011 remain so in 2022. Many of these facilities will remain in the top 10 simply due to the amount of treated wastewater that they discharge on an annual basis. As shown in Table 5.6, the Stickney Water Reclamation Facility is the only one in the top 10 currently required to meet total phosphorus limits and has reduced its phosphorus concentration by half. Others have continued to be discharging significant amounts of phosphorus because they have not completed construction of the equipment necessary to remove higher percentages of phosphorus than they have in the recent past. Table 5.6 indicates the timetable for when compliance with a 1.0 mg/L limit will apply and when further reductions will be anticipated.

Two Fox River Water Reclamation District facilities and the Kankakee River Metropolitan Sewage Treatment Plant have dropped out of the top 10 since 2011. The Fox Metro Water Reclamation District has reduced its phosphorus concentration from 3.05 mg/L in 2011 to 0.71 in 2022, reducing its total phosphorus load by 77%. The Fox River Water Reclamation District Albin D. Pagorski facility has reduced its total phosphorus load by 53%, while the Kankakee River Metropolitan Sewage Treatment Plant has reduced its total phosphorus load by 88%. Other facilities have experienced an increase in their 2022 load compared to their 2011 loads. Once these facilities' total phosphorus permit limits take effect, their loads will decrease as well.

Table 5.7. *2011 top 10 major municipal facilities compared to 2022 total phosphorus data*

NPDES ID	Facility Name	2011 TP Load	2022 TP Load	Difference	2011 Average MGD	2022 Average MGD	2011 Average TP mg/L	2022 Average TP mg/L
IL0028061	Calumet Water Reclamation Plant (MWRDGC)	2,407,540	2,756,427	348,887	259.7	236.3	3.10	4.19
IL0028053	Stickney Water Reclamation Facility (MWRDGC)	2,344,030	995,924	-1,348,106	715.2	665.3	1.08	0.52
IL0028321	Sanitary District of Decatur – Main Sewage Treatment Plant	1,562,750	1,745,380	182,630	35.9	35.8	14.30	15.08
IL0028088	Terrence J. O'Brien WRP (MWRDGC)	969,075	873,938	-95,137	236.3	208.6	1.35	1.43
IL0020818	Fox Metro Water Reclamation District Sewage Treatment Plant	305,870	69,173	-236,697	34.9	34.3	3.05	0.71
IL0036340	John E. Egan WRP (MWRDGC)	233,600	194,107	-39,493	26.9	22.4	2.86	2.95
IL0027201	Four Rivers Sanitation Authority Sewage Treatment Plant	204,400	229,546	25,146	31.8	22.9	2.24	2.67
IL0034061	Springbrook Water Reclamation Center – Naperville	189,526	149,175	-40,351	21.8	18.3	2.87	2.77
IL0028657	Fox River Water Reclamation District Albin D. Pagorski Water Reclamation Facility	170,747	80,888	-89,859	17.7	13.7	3.18	1.96
IL0021784	Kankakee River Metropolitan Sewage Treatment Plant	164,832	19,839	-144,993	17.7	13.8	3.06	0.47

Metropolitan Water Reclamation District of Greater Chicago

The Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, provides wastewater treatment and stormwater management services for residents and businesses in the Chicagoland area. Its service area covers 882 square miles, including the city of Chicago and 128 suburban communities in Cook County. MWRDGC serves approximately 12.72 million people each day, which includes 5.19 million residences.

MWRDGC operates seven water reclamation plants, WRPs: Stickney Water Reclamation Facility, Calumet WRP, Terrence J. O'Brien WRP, John E. Egan WRP, James C. Kirie WRP, Lemont WRP, and Hanover Park WRP. Due to the large volume of discharged water from these facilities, their nutrient contributions often comprise a large percentage of the annual statewide loads. Case in point: in 2021, the facilities collectively discharged approximately 411 billion gallons of treated water and approximately 5.2 million pounds of phosphorus; in 2022, the facilities collectively discharged approximately 435 billion gallons of treated water and approximately 4.9 million pounds of phosphorus. Together, MWRDGC facilities contributed 42% of the annual statewide total phosphorus point source loads in 2021 and 2022. Table 5.8 shows the annual total phosphorus loads from the seven MWRDGC facilities for baseline 2011 and 2018-22.

In 2020, the total phosphorus discharged from MWRDGC facilities was 6.3 million pounds. Most of the reduction since then can be attributed to nutrient removal technology operations at the Stickney facility. In 2012, the facility implemented a biological phosphorus removal system in one battery. All batteries were completed in 2014, and the system was optimized by 2018, resulting in a 95% phosphorus removal efficiency. However, issues arose with managing solids content at the WRP in January 2019. The biological phosphorus removal operation was halted and slowly restarted in 2020. In 2021, a temporary chemical phosphorus removal system was installed to ensure compliance with the permit limit of 1 mg/L that went into effect in August 2021. A permanent system is scheduled for completion by 2024.

The Calumet WRP discharged the highest statewide total phosphorus load in 2022. A phosphorus removal feasibility study was completed in 2019 and a chemical removal process is currently being constructed, though a biological removal system is still being evaluated. The Calumet facility's current National Pollutant Discharge Elimination System NPDES permit includes a schedule for achieving compliance with a total phosphorus limit of 1 mg/L by January 1, 2024.

The O'Brien WRP is MWRDGC's third-largest facility. A phosphorus removal feasibility study was completed in 2019. A pilot test using algae for nutrient removal was completed as a possible polishing process. A small-scale side-stream enhanced biological phosphorus removal, or S2EBPR, system study was initiated in 2020. Currently, Battery D is being redesigned for S2EBPR, and Battery E — a new battery with

S2EBPR — is being constructed. The facility's current NPDES permit includes a schedule for achieving compliance with a total phosphorus limit of 1 mg/L by August 1, 2027.

Significant reductions in total phosphorus loads from point sources are anticipated once all seven of these facilities, along with other large major municipal facilities throughout the state, meet a 1 mg/L and 0.5 mg/L total phosphorus concentration.

Table 5.8. *The Metropolitan Water Reclamation District of Greater Chicago facilities' annual total phosphorus loads*

NPDES	Facility Name	2011	2018	2019	2020	2021	2022
IL0028053	Stickney	2,351,312	707,230	2,164,828	2,435,218	1,277,750	995,924
IL0028061	Calumet	2,450,714	1,990,902	2,191,160	2,569,259	2,553,033	2,756,427
IL0028088	O'Brien	971,083	931,333	947,758	978,314	1,036,758	873,938
IL0047741	Kirie	141,985	40,012	52,639	51,584	58,435	31,573
IL0036340	Egan	233,759	209,074	219,942	210,437	221,709	194,107
IL0036137	Hanover Park	75,920	72,106	69,306	58,396	67,332	55,943
IL0028070	Lemont	18,469	18,797	18,537	17,940	22,730	22,213
Total Load		**6,243,242**	**3,969,454**	**5,664,170**	**6,321,148**	**5,237,748**	**4,930,125**
% of Total Point Source TP Load			**29%**	**38%**	**42%**	**42%**	**42%**

Nutrient Reduction Special Conditions

Nutrient Assessment Reduction Plans

The requirement to develop a Nutrient Assessment Reduction Plan, NARP, is being incorporated into many Illinois National Pollutant Discharge Elimination System, NPDES, permits for major municipal facilities that discharge into a receiving waterbody that is impaired by or at risk of eutrophication — an over-enrichment of nutrients — leading to a lack of dissolved oxygen. Eutrophication can cause excess algae, plant growth, and other offensive aquatic conditions.

NARPs help identify phosphorus input reductions by point source discharges, non-point source discharges, and other measures that major municipal facilities can implement alongside a watershed workgroup. This helps meet watershed-wide criteria for dissolved oxygen, offensive aquatic algae, and offensive aquatic plants.

The Illinois EPA will determine if the permittee's treatment plant discharge is located upstream of a waterbody or stream segment that has been determined to have a phosphorus-related impairment or if there is a risk of eutrophication. This determination is made upon reviewing available information concerning the characteristics of the relevant waterbody or segment and the relevant facility — e.g., quantity of discharge flow and nutrient load relative to the stream flow.

A waterbody or stream segment is at risk for eutrophication if it meets one of the following criteria:

1. Its pH exceeds 9.0, the upper limit of the water quality standard;
2. Its median sestonic *chlorophyll a* is greater than 26 mg/L; or
3. Its pH exceeds 8.35 and its dissolved oxygen is greater than 110% on the same day, for two or more days from Illinois EPA sampling.

The elements that shall be included in a NARP can be found in the online Appendix H NARP Requirements.

Currently, 67 major municipal facilities in Illinois are required to develop NARPs. Fifteen of these facilities discharge into a waterway with nutrient-related impairments, and 52 discharge into a waterway at risk for nutrient-related impairments. Fifty-eight facilities do not meet the criteria to develop a NARP, and three facilities are yet to be determined.

In addition to these facilities, 89 facilities are developing NARPs as a part of a watershed group. These watershed groups are: Fox River Study Group, DuPage River Salt Creek Workgroup, Lower Des Plaines Watershed

Group, Lower DuPage River Coalition, and North Branch Chicago River Watershed Workgroup.

The Illinois EPA developed an interactive map to display the locations of facilities for which NARP development is required, not required, to be determined, or in development as part of a watershed group. Figure 5.3 depicts a screenshot of the NARP map website, which can be found at illinois-epa.maps.arcgis.com/home/item.html?id=dd82c86b7325412f823f623b51fe6db9.

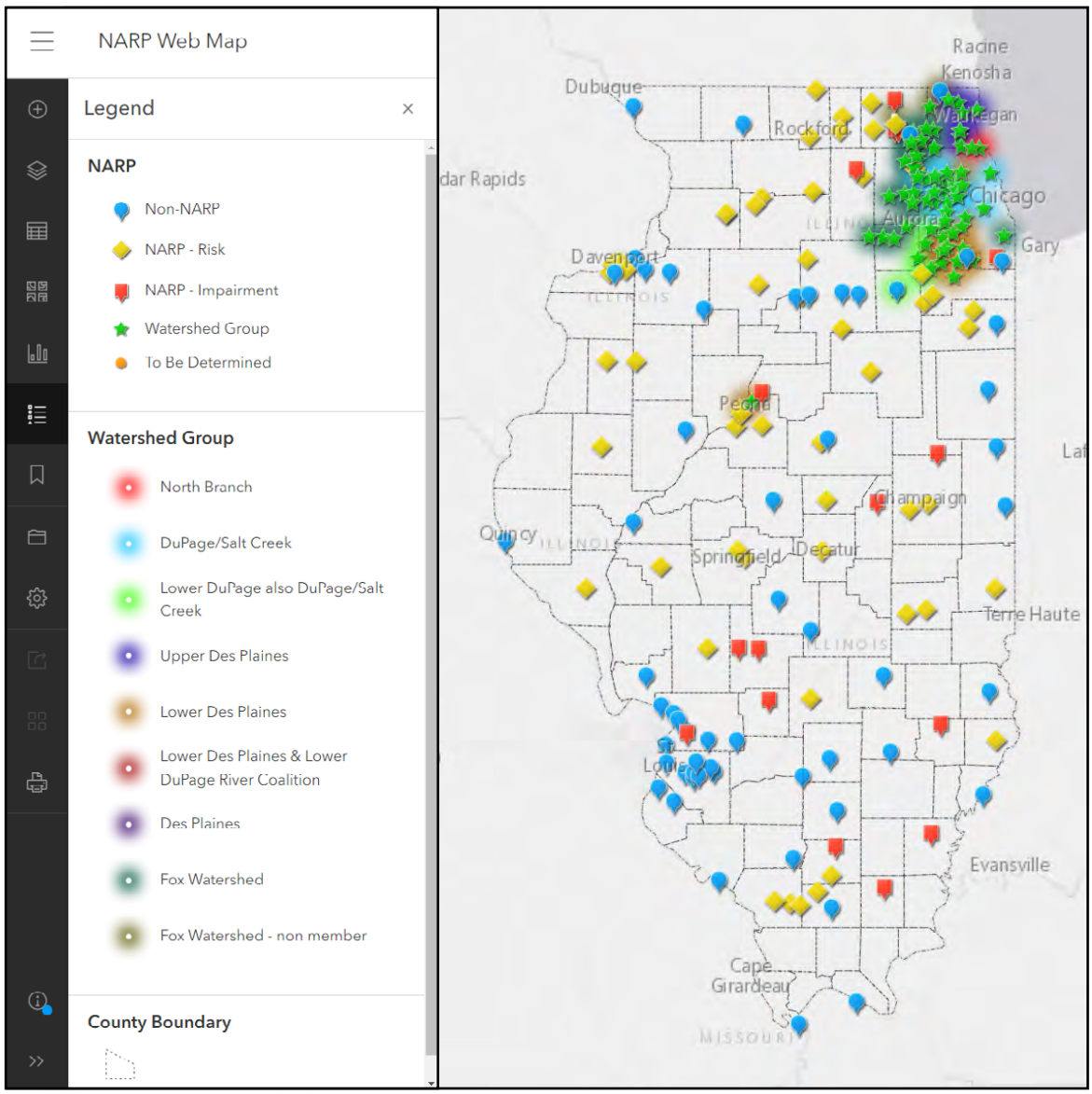


Figure 5.3. *Screenshot of the interactive NARP map*

National Pollutant Discharge Elimination System Permits Issued with Nutrient Criteria

Total phosphorus load reductions were primarily achieved through wastewater treatment facilities' installation of phosphorus removal technologies to comply with National Pollutant Discharge Elimination System, NPDES, permit limits or optimization of current operations. By the end of 2022, the Illinois EPA had issued 82 National Pollutant Discharge Elimination System permits that required each facility to meet a total phosphorus concentration limit of 1 mg/L, representing 38% of major municipal facility permits with this limit (Figure 5.4). Further, eight facilities are on a compliance schedule to meet future total phosphorus limits of 1 mg/L. Approximately 210 major municipal facilities are now required to monitor for total phosphorus and total nitrogen. Additionally, the Illinois EPA has issued 23 NPDES permits with a goal of total nitrogen removal and three NPDES permits with total nitrogen limits.

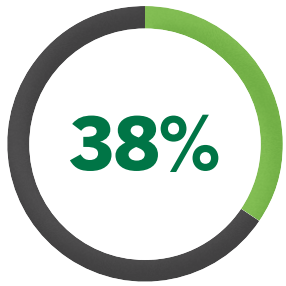


Figure 5.4.
Percentage of major municipal NPDES permits with total phosphorus limits statewide

Major municipal dischargers are required to submit and implement phosphorus discharge optimization plans for existing equipment and operations as well as develop feasibility studies to meet total phosphorus concentrations of 0.5 mg/L and 0.1 mg/L. Through the end of 2022, 210 major municipal facilities submitted optimization studies and feasibility studies.

Watershed Approach

The Illinois EPA continues to encourage and work with local watershed groups to meet the objectives outlined in the Nutrient Loss Reduction Strategy, including non-point source, stormwater, and point source nutrient loading. Where practical, the agency is using permit conditions to require nutrient reduction feasibility reports, cost-effective implementation of control technologies using existing infrastructure, and improved nutrient removal technologies. Facilities will employ improvements to meet Illinois NLRS objectives. The Illinois EPA continues to work with the Des Plaines River Watershed Workgroup, DuPage River Salt Creek Workgroup, Fox River Study Group, Lower Des Plaines Watershed Group, Lower DuPage River Watershed Coalition, North Branch Chicago River Watershed Workgroup, and the newly formed Illinois River Watershed Study Group.

Common activities from 2021-22 included continued bioassessments and water quality monitoring, dam removals, and continued work on NARPs. Detailed updates for each group can be found online in Appendix E Partner Updates.

Des Plaines River Watershed Workgroup

The Des Plaines River Watershed Workgroup is a voluntary, dues-paying organization with a mission to bring together a diverse coalition of stakeholders to improve water quality in the Des Plaines River and its tributaries in a cost-effective manner to meet Illinois EPA requirements. The workgroup conducts water quality and bioassessment monitoring and has partnered and sponsored member efforts within the watershed. The workgroup also contracted with Geosyntec Consultants to complete a Nutrient Assessment Reduction Plan. For more information, see go.illinois.edu/NLRS and drww.org.

DuPage River Salt Creek Workgroup

The DuPage River Salt Creek Workgroup formed in 2005 in response to concerns about total maximum daily loads, TMDLs, set for the east and west branches of the DuPage River and Salt Creek, located in portions of Cook, DuPage, and Will counties in northeastern Illinois. The workgroup seeks to implement targeted watershed activities that resolve priority waterway problems efficiently and cost-effectively. In 2015 and 2020, a special condition to the workgroup's National Pollutant Discharge Elimination System permits was added that substantially increased financial commitments to restoration efforts focused on improving aquatic life. The condition includes 10 stream restoration projects, two studies, and the development of a Nutrient Implementation Plan. For more information, see drscw.org.

Fox River Study Group

For 20 years, the Fox River Study Group has worked to improve the health of the Fox River for the benefit of the nearly 1 million citizens in the Fox River Valley and the over 300,000 people whose drinking water comes from the river. In 2022, the group updated its 2015 Fox River Implementation Plan and successfully advocated for a relaunch of a multi-dam removal feasibility study. To reduce algae and improve oxygen conditions in the river, the 2022 Fox River Implementation Plan recommends combining further phosphorus reductions from wastewater inputs with dam removals. For more information, see foxriverstudygroup.org.

Lower Des Plaines Watershed Group

The Lower Des Plaines Watershed Group coordinates a watershed bioassessment program to identify and address priority water quality issues in the Lower Des Plaines River and its 19 tributaries. The workgroup also provides extensive outreach materials for members and the public on issues related to water quality. For more information, see www.LDPWatersheds.org.

Lower DuPage River Watershed Coalition

The Lower DuPage River Watershed Coalition coordinates a watershed bioassessment program to identify and address priority water quality issues in the Lower DuPage River and its tributaries. The Coalition recently funded the removal of the Hammel Woods Dam in Shorewood, and planning is underway for a second instream habitat restoration project in Plainfield. The Coalition also provides extensive outreach materials for members and the public on issues related to water quality. For more information, see www.LDPWatersheds.org.

North Branch Chicago River Watershed Workgroup

The North Branch Chicago River Watershed Workgroup was formed in January 2018 to identify and assess water quality issues along the three forks of the North Branch Chicago River. The watershed includes portions of Lake and Cook counties and consists of 42 separate organizations, including 24 Municipal Separate Storm Sewer System, MS4, communities and agencies, two of which are publicly owned treatment works. Following Illinois EPA approval of its quality assurance plan and continued water quality monitoring, they developed a NARP work plan in 2021-22 and hired a consultant to help with plan implementation expected to run through 2025. For more information, see nbwwil.org.

Total Nitrogen Load Reductions

As noted in the original NLRS in 2015, nutrients from the point source sector represented only 16% of the statewide total for nitrate-nitrogen nutrient loading, but almost half, 48%, of the statewide total phosphorus. As a result, the Illinois strategy has chosen to primarily focus on reducing phosphorus from point sources. However, Illinois EPA incentivized point sources to adopt biological phosphorus removal. This is because the low dissolved-oxygen environment used with biological phosphorus removal would have the additional advantage of reducing a significant fraction of the nitrogen as well.

Annual total nitrogen loads from point sources were estimated for 2021 and 2022 and compared to the 2011 baseline load. The 2021 statewide total nitrogen load from all point sources was estimated to be 76.6 million pounds, which is a 12.2% decrease from the 2011 baseline load (Table 5.7). The 2022 total nitrogen load from all point sources was estimated to be 77.2 million pounds, which is an 11.6% decrease from the 2011 baseline load (Table 5.9).

Table 5.9. *Statewide total nitrogen loads from the point source sector from 2021-22*

Point Source Sector	2021 Total Nitrogen Load (million lb/yr)	2022 Total Nitrogen Load (million lb/yr)
Annual Total Nitrogen Load • 211 Major Municipals • Minor Municipals • Major and Minor Industrials	76.6 71.4 3.0 2.2	77.2 72.2 3.0 2.0
Reductions from 2011 Baseline of 87.3 million pounds per year	10.7 (12.2%)	10.1 (11.6%)

The 2021 Biennial Report noted a 1.7% and 4.7% decrease in total nitrogen loads from all point sources in 2019 and 2020, respectively, compared to the 2011 baseline load of 87.3 million pounds. The 2019 Biennial Report reported a 10% decrease in total nitrogen loads in 2018. Like total phosphorus, most of the total nitrogen load is discharged by the major municipal facilities, followed by minor municipal facilities, and both major and minor industrial facilities. At the end of 2022, there were 23 NPDES permits with a goal of total nitrogen removal and three NPDES permits with total nitrogen limits.

Progress Discussion

From the 2011 baseline, statewide total phosphorus loads from point sources decreased by 31% in 2021 and 34% in 2022. For comparison, this metric was measured at a 16% decrease in 2020 and a 24% decrease in 2018. The larger decrease seen in 2018 is attributed to increased phosphorus removal at the Metropolitan Water Reclamation District of Greater Chicago's, MWRDGC, Stickney Water Reclamation Facility. This was explained in greater detail in the text associated with Table 5.8.

The significant reduction in total phosphorus loads from point sources in 2021-22 compared to the baseline total phosphorus load can be attributed to three main factors:

- The MWRDGC Stickney facility's total phosphorus load decreased by 1.3 million pounds from 2011 to 2022.

- The revised minor municipal facilities' calculated estimate is 1.1 million pounds lower than the original estimate previously used.

- A significant number of the 172 major municipal facilities that have already installed enhanced phosphorus removal technologies or otherwise optimized their operations, reducing their collective phosphorus load by approximately 4 million pounds.

Table 5.10 shows statewide statistics for all 211 major municipal facilities, including the average total annual flow, total phosphorus, and total nitrogen annual average concentrations for 2019-22. The amount of wastewater discharged from each facility varies day to day and year to year, mostly driven by seasonal precipitation. The statewide total nitrogen concentration varied between 11.6 mg/l in 2019 and 13.4 mg/l in 2022. The statewide total phosphorus concentration ranged between 1.55 mg/l in 2019 and 1.78 mg/l in 2022. The total phosphorus concentration is expected to decrease over the next decade as the majority of facilities reduce the amount of phosphorus in their discharge due to more stringent permit limits.

Table 5.10. *Statewide major municipal facilities' annual average flow and nutrient concentrations*

Year	Total Million Gallons Per Year	Total Nitrogen Concentration (mg/L)	Total Phosphorus Concentration (mg/L)
2019	925,667	11.60	1.55
2020	779,145	13.07	1.72
2021	702,922	14.33	1.90
2022	731,336	13.40	1.78

Methodology for Calculating Point Source Nutrient Loads

Multiple methods were used to calculate annual statewide total phosphorus and nitrogen point source loads for 2021 and 2022. Point sources include major and minor municipal sewage treatment facilities and major and minor industrial wastewater facilities.

In 2021, there were 211 major municipal wastewater treatment facilities in Illinois, 202 of which were required to monitor for total nitrogen and 203 for total phosphorus. In 2022, there were 211 major municipal wastewater treatment facilities, 207 of which were required to monitor for total nitrogen and 208 for total phosphorus.

For major municipal facilities, Discharge Monitoring Report, DMR, data was retrieved from the Integrated Compliance Information System maintained by the U.S. EPA. Monthly DMR data was used to calculate monthly and annual nutrient loads. Monthly DMR data is entered into the electronic system, eDMR, by

each facility. Efforts were made to correct outlier values and keying errors. The accuracy of monthly DMR data depends on the facilities providing correct flow and concentration values.

Facilities that are not required to submit total nitrogen or total phosphorus DMR data were asked to voluntarily submit internal data. This method, while more laborious, allows for better quality control checks of the DMR data, ensures the correct outfalls are used, and provides greater transparency as to how loads were calculated for each facility.

The following formula was used to calculate monthly loads for the major municipal facilities:

Monthly Average Flow Value (MGD) x Monthly Average Nutrient Concentration (mg/L) x 8.34 (conversion factor) x 30.417 (average days in a month)

The U.S. EPA Water Pollutant Loading Tool was used to calculate the 2021 and 2022 annual loads for industrial facilities. This method was also used for 2017-20.

In 2021, the tool calculated total nitrogen loads for 19 major and 298 minor industrial facilities and total phosphorus loads for 12 major and 49 minor industrial facilities. In 2022, the tool calculated total nitrogen loads for 19 majors and 281 minor industrial facilities and total phosphorus loads for 14 major and 47 minor industrial facilities.

The number of facilities may fluctuate depending on permit issuances and terminations and whether or not discharges occurred. Monthly DMR data was used to check the higher-loading industrial facilities for accuracy, and drastic fluctuations between years were investigated. Continuing past practice, loads from power plants were not included, as it is difficult to differentiate between nutrients added to process wastewater and nutrients already present in the source water influent.

There are approximately 655 minor municipal facilities with individual National Pollutant Discharge Elimination System permits and 330 minor municipal facilities with general lagoon NPDES permits. Because most minor municipal wastewater facilities do not have total phosphorus monitoring requirements in their NPDES permits, total phosphorus loads from these facilities were estimated at 2.4 million pounds during the development of the Illinois Science Assessment in the original NLRS report. This figure was also used in subsequent Biennial Reports. Beginning with the 2021 point source load calculation, a new estimate was calculated using individual facility effluent flow data and a uniform concentration estimate of 4 mg/L total phosphorus. This new calculation estimates a minor municipal total phosphorus load of 1.3 million pounds. This updated estimate is used for the 2021 and 2022 minor municipal total phosphorus load.

The total nitrogen load estimate for minor municipal facilities in 2021-22 is based on data from the original NLRS Science Assessment.

Current Programs and Projects Supporting Nutrient Loss Reduction Strategy Goals

The following programs and projects support Illinois NLRS point source sector goals. Many of these programs and projects have additional information that is available to review online in Appendix E Partner Updates at go.illinois.edu/NLRS.

- Agriculture and Point Source Sector Partnership: Testing Best Management Practices
- Total Maximum Daily Loads
- Concentrated Animal Feeding Operations
- State Livestock Management Facilities Act
- State Revolving Fund
- Watershed Protection Utility
- Permit Limits and Facility Upgrades for Metropolitan Water Reclamation District of Greater Chicago, MWRDGC

Agriculture and Point Source Sector Partnership: Testing Best Management Practices

The Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, established a Nutrient Loss Reduction Research and Demonstration Project on agricultural land at its Fulton County site to foster collaboration with the agricultural sector to develop and expedite the implementation of nutrient reduction practices. The 13,500-acre property is located between the cities of Canton and Cuba, about 190 miles southwest of Chicago and 40 miles southwest of Peoria. It was originally purchased in 1970 to restore strip-mined land; approximately 4,000 acres were converted to productive farmland.

Since 2015, research and demonstration projects have been established at the site in collaboration with many partners, such as Illinois Central College; Ecosystem Exchange; Illinois Farm Bureau; Fulton County Farm Bureau; the University of Illinois Urbana-Champaign's Department of Crop Sciences and

Department of Agricultural and Biological Engineering; and the Illinois Sustainable Technology Center. Over the years, projects have included inter-seeded cover cropping, riparian grass buffers, denitrifying bioreactors, runoff irrigation, subirrigation, drainage water management, designer biochar, watershed-scale nutrient reduction demonstrations, and evaluation of struvite as a slow-release phosphorus fertilizer.

In 2021, the partners received funding through an Illinois Nutrient Research & Education Council, NREC, grant for a new multi-year study at the Fulton County site to evaluate struvite as a slow-release phosphorus fertilizer. Struvite is a product generated from the wastewater treatment process and is being evaluated in field-scale trials. MWRDGC is one such site where struvite is being recovered and reused as fertilizer.

In 2021 and 2022, field days were held at the Fulton County site in collaboration with MWRDGC, Illinois Farm Bureau, Fulton County Farm Bureau, Cook County Farm Bureau, NREC, and several University of Illinois Urbana-Champaign researchers. Participants included leaders representing the partner agencies, farmers, agriculture sector leaders, and other stakeholders. Research trials highlighted at the field days included woodchip bioreactors and designer biochar, irrigation and subirrigation, drainage water management, struvite application trials, and more. The field days drew crowds of more than 50 people in both years, bringing together diverse stakeholders to learn about on-site agriculture nutrient reduction research and ways that MWRDGC partners with IFB and other agriculture stakeholders on nutrient reduction initiatives.

In addition to field days, partners also bridged the gap between point source and non-point source stakeholders by hosting farmer tours at MWRDGC facilities. These outreach events provided invaluable opportunities for farmers to see how point source groups like MWRDGC address nutrient reduction goals. They also served as opportunities to discuss future collaborations.

All partners value the opportunities for collaboration that have stemmed from this project. The groups will once again bring farmers and the MWRDGC research team together at the Fulton County research and demonstration site in 2023 and are making plans to update their partnership publication.

For more information, visit www.ilfb.org/ruralurban.

Total Maximum Daily Loads

The Illinois EPA develops total maximum daily loads, TMDLs, for impaired watersheds that include point source waste load allocations for total phosphorus and nitrate-nitrogen when these nutrients are listed as potential causes of impairment. Waste load allocations vary, depending on the magnitude of loadings from point sources in a watershed and the degree to which the water quality standard is exceeded. Point source

reduction goals vary for TMDLs with nutrient-related point source contributions. These goals are incorporated into NPDES permits at renewal or modification stages.

In 2021-22, the U.S. EPA approved two total phosphorus TMDLs:

- Thorn Creek – Salt Trail Lake (IL_RHI)
- Lake Lou Yaeger – Lake Lou Yaeger (IL_RON)

In 2021-22, the U.S. EPA approved two nitrate-nitrogen TMDLs:

- Vermilion River (Illinois Basin) watershed – Vermilion River (IL_DS-06)
- Vermilion River (Illinois Basin) watershed – Vermilion River (IL_DS-10)

Since 2000, the U.S. EPA has approved 141 total phosphorus TMDLs and 10 nitrate-nitrogen TMDLs. The Illinois EPA is currently developing a total phosphorus TMDL for Carlyle Lake in the Middle Kaskaskia River watershed and a nitrate-nitrogen TMDL for the Mackinaw River watershed.

Concentrated Animal Feeding Operations

Concentrated Animal Feeding Operation, CAFO, is a regulatory term used by the U.S. EPA in accordance with the Clean Water Act and accompanying federal and state regulations. Livestock farms must meet certain species, size, and discharge requirements to be classified as a CAFO. Discharge from CAFOs can be a source of nutrient pollution that impairs local bodies of water.

Through internal reviews and an on-site inspection program, the Illinois EPA has identified 614 large and active CAFOs in Illinois, both permitted and unpermitted. Due to the Agency's increased efforts, the number is up from 536 CAFOs reported in the 2017 Biennial Report and 249 CAFOs reported in 2015 in the Illinois Nutrient Loss Reduction Strategy. Since July 1, 2015, Illinois EPA field staff have conducted 557 livestock facility site visits to determine compliance or assist in improving operations. Due to these inspections and previous enforcement acts, 10 facilities are currently covered under the general CAFO National Pollutant Discharge Elimination System, NPDES, permit. Previously, 14 were covered; however, four previously permitted facilities have achieved compliance with current CAFO regulations and are now designed, constructed, operated, and maintained such that the facilities no longer discharge or propose to discharge to U.S. waters. Therefore, NPDES permit coverage is unnecessary. The Illinois EPA's current

compliance monitoring strategy has set goals for on-site inspections of 36 large unpermitted CAFOs and 67 medium animal feeding operations in Fiscal Year 2023.

State Livestock Management Facilities

In addition to Illinois EPA's CAFO program, the Illinois Department of Agriculture maintains authority over livestock farms in the state. The state's Livestock Management Facilities Act [510 ILCS 77] was enacted in 1996 to "maintain an economically viable livestock industry in the state of Illinois while protecting the environment for the benefit of both the livestock producer and persons who live in the vicinity of a livestock production facility." The Act includes design and construction standards for new or modified livestock facilities, waste management planning requirements, facility operator training and testing, anaerobic lagoon financial responsibility demonstration, and facility setback requirements. It can be found on the IDOA website at www2.illinois.gov/sites/agr/Animals/LivestockManagement/Pages/default.aspx.

The IDOA receives about 100 applications every year with project proposals for the siting and construction of new or modified livestock waste handling facilities, as well as numerous facility waste management plans for review and approval. IDOA received and reviewed 47 project proposals in 2021 and 51 proposals in 2022. Approved projects are designed as zero discharge facilities; waste management plans require the agronomic use of generated manure. Livestock waste management plans are required to include appropriate manure application setbacks and other protections to ensure that nutrients in the manure remain at the application site and are appropriately used by growing crops.

State Revolving Fund

The Illinois EPA State Revolving Fund is an essential program for wastewater treatment plants that provides low-interest loans for necessary infrastructure. The Water Pollution Control Loan Program, WPCLP, includes wastewater treatment plant upgrades to improve nutrient removal, green infrastructure, urban stormwater treatment, and control of combined and sanitary sewer overflows. The WPCLP is maintained to ensure adequate resources are available to finance improvements required under NPDES permits. Table 5.11 shows that in 2021, $107,296,729 was spent on eight projects that reduced nutrient loss through treatment plant or green infrastructure improvements, while $84,520,637 million was spent on five projects in 2022. The ceiling amount reflects the entire cost of each project, while the description only details the nutrient removal component. The total funding amount through WPCLP for 2021 was $359,665,547.36 and $401,056,684 for 2022. WPCLP funding for state Fiscal Year 2023 is anticipated to total $515 million.

Table 5.11. *Nutrient removal projects financed by Illinois EPA State Revolving Funds*

Facility	Ceiling Amount	Description of Nutrient Removal Component
2021		
Berwyn	$7,212,677	This loan will fund sewer system improvements, which include approximately 6,502 feet of sewer, ranging in diameter from 6-inch to 48-inch; a new connection to the Metropolitan Water Reclamation District interceptor to increase capacity; construction of relief sewers to divert and balance system areas; and lining of existing sewer pipe. Green infrastructure, including permeable paving, silva cells, bioswales, and natural native plant landscaping, will be incorporated into the site restoration.
Collinsville	$6,898,961	The project includes the construction of a new biosolids process building and equipment; a new biosolids storage facility; new odor control system and modifications to existing processes to help with odor control; and other related appurtenances.
DuPage County	$11,530,990	This project includes rehabilitating the Nordic Park Wastewater Treatment Facility. Improvements include converting the existing aerobic basin and digester into an anaerobic/oxic biological process with a new 44-foot diameter tertiary clarifier; converting the settling tank into an aerobic digester tank; and a second anaerobic/oxic biological process.
East Peoria	$25,514,289	This loan will fund what is known as Waste Water Treatment Plant #1 Phase D Improvements. Existing equipment and tankage will be reconfigured, which will allow for the conversion to a new secondary treatment process known as biological nutrient removal. Three existing circular digester tanks will be repaired and renovated. New air diffusion and blower equipment will allow for conversion to aerobic digestion.
Freeburg	$13,000,000	The project consists of expanding the West WWTP Design Average Flow from 0.40 to 0.80 MGD and the Design Maximum Flow from 1.00 to 2.52 MGD. Construction includes an anaerobic basin, two aeration basins and aeration equipment, two final clarifiers, a single tertiary filter, and chemical phosphorus removal.
Mascoutah	$13,601,000	The project consists of the construction of a four-basin sequencing batch reactor system, chemical feed system, tertiary filtration system, biosolids pumping station, and the rehabilitation of the existing aerobic sludge digester.
Niles	$8,716,212	The loan will fund the Village of Niles' Greenwood Stormwater Basin Project. Specific activities entail the construction of a 121,968 cubic foot underground stormwater storage vault and a 1-acre open water basin; the installation of approximately 4,000 lineal feet of 36- to 54-inch diameter storm sewer main and associated manholes and other appurtenances. This project is considered "green" due to aspects such as permeable pavement and park-like green spaces.
St. Charles	$20,822,600	Existing aeration basins will be modified for a biological nutrient removal process. Chemical addition for nutrient polishing will also be incorporated. Existing aerobic digestion blowers, electrical switchgear, and mechanisms will be replaced.
Total	**$107,296,729**	

Facility	Ceiling Amount	Description of Nutrient Removal Component
2022		
Charleston	$8,383,255	The project consists of the following: A biosolid reactor, lime storage tank, and lime pump. It also includes the installation of a modified enhanced biological phosphorus removal process using existing tanks with addition of eight mixers, one 3,437 gpm RAS/WAS pump, and a 4,583 gpm recycle pump.
Crest Hill East	$5,910,700	The project consists of improvements to the city's East Water Reclamation Facility as well as new facilities for biological phosphorus removal and chemical phosphorus removal, including: a new prefabricated structure to house CPR equipment; a 5,000-gallon bulk storage tank for storing CPR chemicals; two chemical feed pump skids for forward flow and excess flow; and chemical piping for dosing CPR chemical at the final clarifier splitter structure and the excess flow splitter structure.
Crest Hill West	$49,500,000	The project entails improvements to the city's West Sewage Treatment Plant as well as the installation of new activated sludge treatment units, the construction of a new 680-foot diameter final clarifier; new disc filters; and chemical phosphorus removal facilities.
O'Fallon	$15,311,174	The project entails constructing a RAS/WAS pumping station, chemical phosphorus removal system, and tertiary filter system.
Peoria	$5,415,508	This loan will fund the first year of the Peoria Long-Term Control Plan. The proposed work includes stormwater improvements along Laveille Street, Caroline Street, Mary Street, Glendale Avenue, and Monroe Street to capture stormwater runoff, which will then reduce combined sewer overflow events. These improvements, also known as green infrastructure, consist of concrete pavers, curb and gutter, sidewalk, driveways, aggregate for infiltration trenches, and appurtenances.
Total	**$84,520,637**	

Unsewered Communities Grant Programs

Illinois EPA is aware of more than 200 Illinois communities that have inadequate or nonexistent wastewater collection and treatment facilities. Where these facilities are inadequate, they are often a patchwork of decades-old underground "wildcat" systems. When these facilities are absent, communities rely on individual septic tank systems. Both situations frequently lead to inadequate wastewater treatment, resulting in illegal and hazardous surface discharges.

For many of these communities, affordability is the biggest hurdle to implementing a solution. While their engineering and consultant costs are State Revolving Fund loan-eligible, the funds are not released until a loan is issued. Thus, communities must initially pay a consulting engineer to design a system and then seek reimbursement when the loan is issued.

To assist in providing solutions to this human health hazard and the adverse environmental impacts these situations harbor, Illinois EPA is offering $100 million in construction grants over five years for wastewater collection and/or treatment facilities through the Rebuild Illinois Capital Plan. Illinois EPA is also offering $4 million in planning grants over four years to assist small and disadvantaged communities in developing a project plan that identifies a solution to their wastewater collection and treatment needs. A well-developed project plan allows communities to apply for a construction grant or loan to implement wastewater collection and/or treatment solutions in areas where they are presently inadequate or nonexistent. At the end of 2022, funding provided for planning grants has included 55 planning projects totaling $1,515,500. Eleven of those planning grantees have moved forward with construction by applying for the construction grant, the loan program, or both. Many more are expected to move forward as the grant programs progress. For construction grants, funding has been provided for five construction projects totaling $16,879,129. Six more construction projects, four of which are from completely unsewered communities, are anticipated to receive funding totaling $21,046,025. This brings the total amount of funding provided in construction grants as of 2023 to $37,925,154. Between the two rounds of construction grants, it is estimated that over 1,700 residences that rely on private septic systems will soon be connected to public wastewater systems. Two more rounds of planning grants and three more rounds of construction grants are planned for the next three years.

Illinois EPA annually posts notices of funding opportunity, or NOFOs, for the Unsewered Communities Planning Grant Program and the Unsewered Communities Construction Grant Program and accepts proposals for projects to plan or construct wastewater collection and treatment systems in unsewered communities. Check the Illinois EPA's webpage for the latest information at epa.illinois.gov/topics/grants-loans/unsewered-communities.html.

An entity may not apply for a grant until the entity has registered and pre-qualified through the Grant Accountability and Transparency Act Grantee Portal online at grants.illinois.gov/portal. Registration and pre-qualification are required annually. Eligible applicants must be local government units as defined in 23 Ill. Adm. Code 365. The Illinois EPA will prioritize and select projects according to the ranking criteria outlined in the Unsewered Communities NOFO for each grant opportunity. Applicants may require supplemental funding in addition to the funds being offered through these grant programs. Applicants may request supplemental funding in the form of a low-interest loan through the Illinois EPA's Water Pollution Control Loan Program.

Future Strategic Actions

Most major municipal facilities required to develop a Nutrient Assessment Reduction Plan, NARP, must submit it to Illinois EPA by December 31, 2023, while the remainder are due December 31, 2024. The Illinois EPA will then review and incorporate elements of the NARP into each facility's next National Pollutant Discharge Elimination System, NPDES, permit renewal. Each NARP will be implemented through the NPDES permitting program and may include more stringent effluent limits and compliance timelines.

By the end of 2024, all major municipal facilities will have determined the type of phosphorus or nutrient removal technologies in which they plan to invest to meet a monthly geometric mean of 0.5 mg/L total phosphorus concentration in their effluent. As wastewater facilities continue to invest in nutrient removal technology, total phosphorus loads — and in some cases, total nitrogen loads — are expected to continue to decrease.

Tracking efforts for this report included submissions of resource and outreach information from 11 of 211 municipal facilities in Illinois. The NLRS team will continue to connect with facilities to encourage participation to help improve tracking of resources and outreach across the state.

URBAN STORMWATER SECTOR *Key Points*

The Illinois Groundwork website developed in 2021-22 offers green infrastructure resources for professionals and the public.

A new Green Infrastructure Inventory map displays the locations and types of nearly 2,000 stormwater best management practices in Illinois.

$4 million was funded by stormwater partners in 2021-22. The Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, invested $1.45 million in Green Infrastructure Program projects in 2021, adding over half a million gallons of retention capacity. MWRDGC committed $44.7 million for the 2021 stormwater program

More than 8,900 people participated in 121 stormwater management events in 2021-22.

In 2021-22, 14 urban stormwater best management practices, covering 174 acres, were installed through the Illinois EPA Section 319 grant.

The Illinois EPA Green Infrastructure Grant Opportunities program awarded $5 million for 11 stormwater projects in 2021. Five projects, either in progress or completed, have retained 1.2 million gallons of stormwater, reducing annual pollutants.

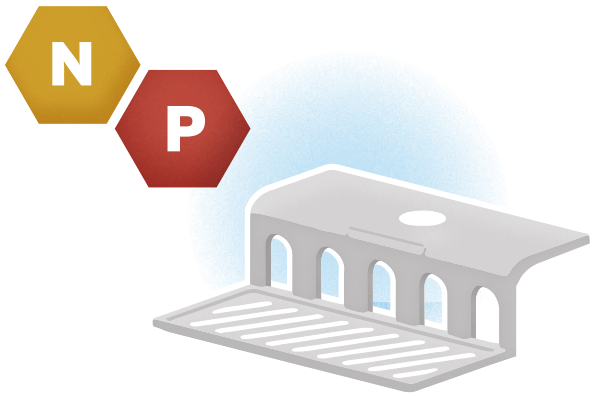
More than half of Municipal Separate Storm Sewer System, MS4, communities offered technical support for initiatives aimed at reducing nutrient loss. Of MS4 communities, 70% conduct street sweeping and leaf collection, while 28% promote rain barrel programs."

CHAPTER 6
URBAN STORMWATER SECTOR

Each of the chapters on nutrient source sectors in this report — chapters 4, 5, and 6 — has three primary parts: implementation report, current program and project updates, and future strategic actions. Chapter 6 showcases the scale at which urban stormwater management practices are being applied to reduce nutrient loads from the stormwater sector. The implementation report section explores progress by tracking resources, outreach, and land and facilities measures. The programs and projects section highlights stormwater updates that contribute to NLRS goals. The chapter concludes with future strategic actions that will support Illinois Nutrient Loss Reduction Strategy, NLRS, goals moving ahead.

Stormwater runoff is rainfall and snowmelt flowing over land or impervious surfaces, such as roads and sidewalks, that does not soak into the ground. It is a source of numerous pollutants, including phosphorus and nitrogen, that enter waterways. While the NLRS Science Assessment has determined that the stormwater sector contribution to the statewide nutrient load is small compared to the other sectors, stormwater runoff can impair water quality in Illinois' lakes and rivers and is included as part of the strategy.

Chapter 6 highlights the application of urban stormwater management practices to reduce nutrient loads, tracking progress and future actions for the stormwater sector.



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stormwater organizations provided information for this report.

Implementation Report

Progress toward Illinois Nutrient Loss Reduction, NLRS, strategy goals by the stormwater sector is tracked through resources, outreach, and land and facilities measures. This is outlined in Figure 6.1 and by the full logic model framework (Figure 2.1) in chapter 2.

Starting in 2018, stormwater partners have reported on their staff, financial resources, and outreach efforts through the Illinois NLRS tracking spreadsheet. Eleven stormwater organizations provided information for this report. Implementation information is also obtained through state program data sources. All information submitted by all source sectors across the state is available online in the Appendix E Partner Updates. Completed tracking spreadsheets can be found online in Appendix A Partner Data.

University of Illinois Extension staff analyzed the submitted financial and staff information for the resource measures section. Anna Marshall, University of Illinois Urbana-Champaign associate professor of sociology, analyzed the outreach measures.

The land and facilities measures section draws on data from the Illinois EPA Section 319 grant program; annual inspection reports from Municipal Separate Storm Sewer System, MS4, communities; the Metropolitan Water Reclamation District of Greater Chicago, MWRDGC; and the new statewide Green Infrastructure Inventory. Illinois Extension staff reviewed 643 MS4 reports covering 2021-22 to summarize community land and facility measures. Extension also used the MS4 reports as a source of resource and outreach measure information when available.

Figure 6.1. *The NLRS Logic Model. See chapter 2 for the full logic model framework.*

Resource Measures

Stormwater sector partners reported 57 and 58 staff members working on stormwater management implementation for 2021 and 2022 respectively. The Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, reported an additional 26 staff members. In 2022, Illinois Extension found there were 314 Municipal Separate Storm Sewer System, MS4, communities which may have had at least one staff member focused on stormwater management. However, 62 of these MS4s had reporting assistance from consulting firms, making an accurate staffing number indeterminate.

Reported stormwater-related funding totaled at least $4 million in 2021-22 (Table 6.1). Although more data is available for this year's report compared to previous years, these numbers still underrepresent state implementation resources in part because they primarily reflect grants and loans given or received. For example, MWRDGC's stormwater report, which includes capital and personnel, notes that they committed $44,743,377 to stormwater management implementation in 2021 alone. Capital and personnel information may be sought in the future to represent a more complete financial picture.

Some stormwater expenditures in 2021 and 2022 included:

- ☑ The Chicago Metropolitan Agency for Planning dedicated approximately $2.52 million for 2021-22 to comprehensive and subarea plans, ordinance updates, and capital improvement plans through its local technical assistance program.
- ☑ The City of Champaign awarded residents a total of $4,310 in stormwater incentives. In 2021, more than $800 of these funds were allocated to residential rain gardens. The remainder was for rain barrel purchases.
- ☑ DuPage County Stormwater Management invested more than $500,000 in grant funds in municipal stormwater projects. These included two streambank stabilization projects, creek and shoreline restorations, two detention basin retrofits, permeable paver installation, a water quality project, and native plantings.
- ☑ The Illinois EPA awarded the Greater Egypt Regional Planning and Development Commission a Water Quality Management Planning grant totaling almost $100,000 that was invested in urban stormwater management.
- ☑ Soil and Water Conservation Districts spent just under $80,000 in 2021 and $287,000 in 2022 for stormwater activities.
- ☑ The Illinois Department of Natural Resources planted 36,000 trees across 199 communities in 2022 through the Tree City USA program.

Table 6.1. *Resources reported by stormwater sector partners*

	2021	2022
Grants or Loans Received	$279,500	$655,001
Grants or Loans Given	$1,140,043	$1,467,191
Funded Programs	$641,256	$39,334
Total	$2,060,799	$2,161,526

Extension's analysis of MS4 reports noted the grants given and received, although specific grant dollars were unavailable. For 2021–22, 30 of the reporting MS4 communities received grants or loans, and 124 reported giving grants or loans.

This review also sought information about which MS4 communities have established stormwater utility fees, which can serve as a funding mechanism for NLRS implementation. The review, along with information from a 2022 Western Kentucky University Stormwater Utility Survey, found 31 facilities in Illinois issuing stormwater utility fees.

Outreach Measures

The stormwater sector shared information and best practices related to the Illinois Nutrient Loss Reduction Strategy, NLRS, during the 2021-22 reporting period. Table 6.2 reports on the activities of stormwater sector partners promoting these best practices. As the COVID-19 pandemic restrictions receded, these activities increasingly transitioned to an in-person format, offering professionals and members of the public hands-on instruction in managing nutrient loss. This sector also valued virtual communication. A host of new online resources have become available to support stormwater best practice implementation.

Table 6.2. *Types of outreach activities by the stormwater sector as reported by NLRS partners*

Type of Activity	Number of Events	Attendance
Field Days	18	2,830
Presentations	57	1,231
Conferences	10	1,800
Education and Training Workshops	36	3,106
Totals	121	8,967

Led by the Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, DuPage County, and University of Illinois Extension, the stormwater sector collaborated with public officials and stormwater management professionals to advance the Illinois NLRS. For example, giving presentations to watershed planning organizations and at professional conferences increased awareness of the need for stormwater best management practices, BMPs. These entities also sponsored workshops that provided information about compliance with the Municipal Separate Storm Sewer System permitting process and worked with public officials to find support for green infrastructure initiatives.

The stormwater sector also worked closely with University of Illinois Extension and Illinois-Indiana Sea Grant to create professional tools that support green infrastructure development. These organizations developed the Illinois Groundwork website, available at IllinoisGroundwork.org, to provide green infrastructure research results, tools, and resources to stormwater professionals, local leaders, and community members. Based on a multidisciplinary pilot project that started with two Chicago suburbs, Calumet City and Midlothian, Illinois Groundwork is now available to communities across Illinois.

During 2021-22, the stormwater sector also engaged with the public to raise the profile of stormwater conservation practices. They arranged tours of flood control facilities, rain gardens, and other examples of green infrastructure, and sponsored clean-up days for local waterways. They offered workshops on conservation practices at home, providing information about natural lawn care, native plants, and installing rain gardens. Focusing on the next generation, they expanded their educational programming, sponsoring tours and presentations for schools and students in grades K-12.

Community outreach is one of the requirements of MS4 permits, the scope of which is reflected in Table 6.3. Extension's analysis of MS4 permit reporting shows the vast majority of MS4 communities reporting educational and training workshops or presentations. Additionally, many communities offered technical assistance to those implementing practices.

Table 6.3. *Scope of stormwater sector outreach based on MS4 community reports from 2022*

Type of Activity	Number of MS4 reports	Percent of total MS4 reports
Education and Training Workshops	297	95%
Presentations	278	89%
Conferences	86	27%
Field Days	38	12%
Technical Assistance	159	51%

Land and Facilities Measures

Illinois Environmental Protection Agency Section 319 Grant Program

Section 319 is a grant program under the Clean Water Act (33 U.S.C. 1329) that provides funding for states with approved non-point source management plans. These states award sub-grants for both rural and urban sectors to support non-point source pollution control projects that have been identified in an Illinois EPA-approved watershed-based plan. Watershed-based planning is discussed more in chapter 8.

During 2021–22, 14 urban practices totaling 174 acres were installed through the Section 319 grant program (Figures 6.2 and 6.3). This included one woodland management practice that totaled 165 acres. As of 2022, the cumulative total of urban practices installed through the program since 2011 was 117. Cumulatively, urban practices total 213 acres.

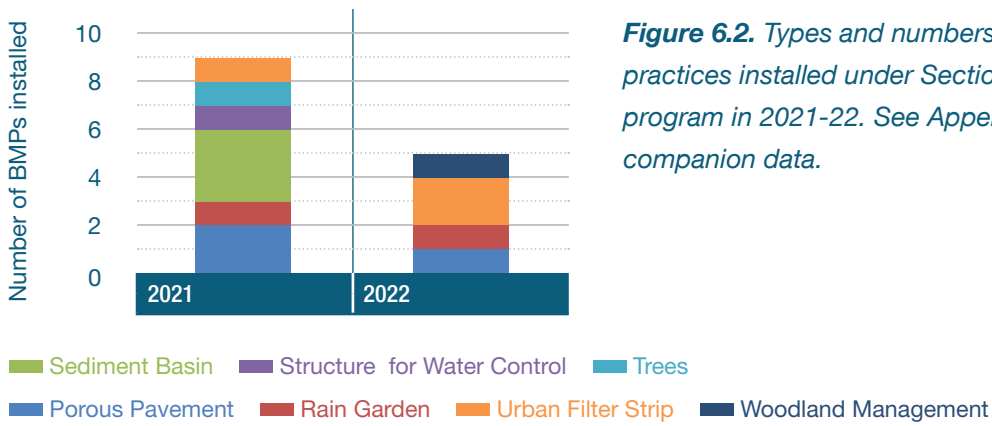


Figure 6.2. *Types and numbers of urban practices installed under Section 319 grant program in 2021-22. See Appendix G for companion data.*

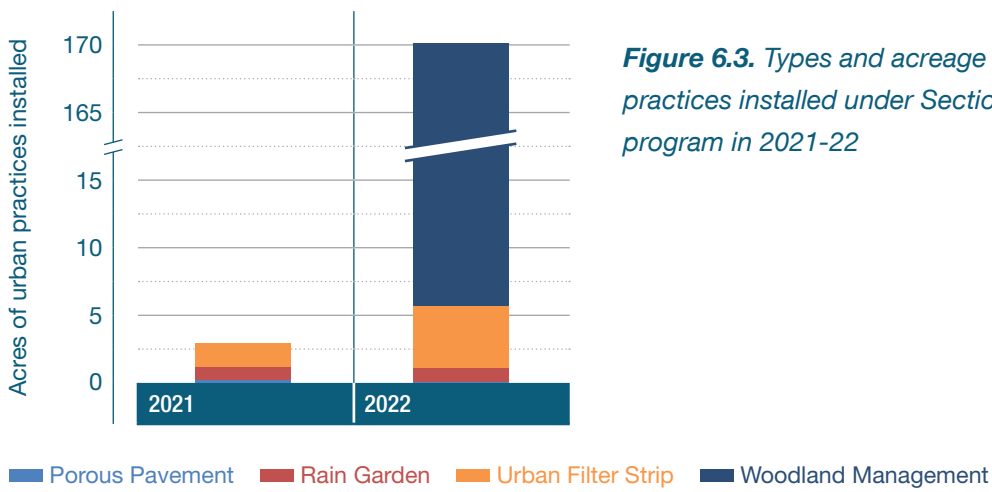


Figure 6.3. *Types and acreage of urban practices installed under Section 319 grant program in 2021-22*

As stipulated by the Section 319 grant program, on-the-ground practices are converted into pounds of nutrients removed per year using the U.S. EPA Region 5 Model for Estimating Pollutant Load Reductions. The model estimates long-term annual reductions in sediment-bound nutrients. Figure 6.4 shows calculated nutrient loads removed in pounds per year for 2021–22. The estimated annual load reductions are represented by each practice for the year that practice was implemented. Many of these structural practices have a life span of 10–20 years, and load reductions are realized annually over the course of that time period.

In 2021, urban practices implemented using Section 319 funds reduced total nitrogen by 540 pounds and total phosphorus by 269 pounds. In 2022, 3,652 pounds of total nitrogen and 764 pounds of total phosphorus were reduced.

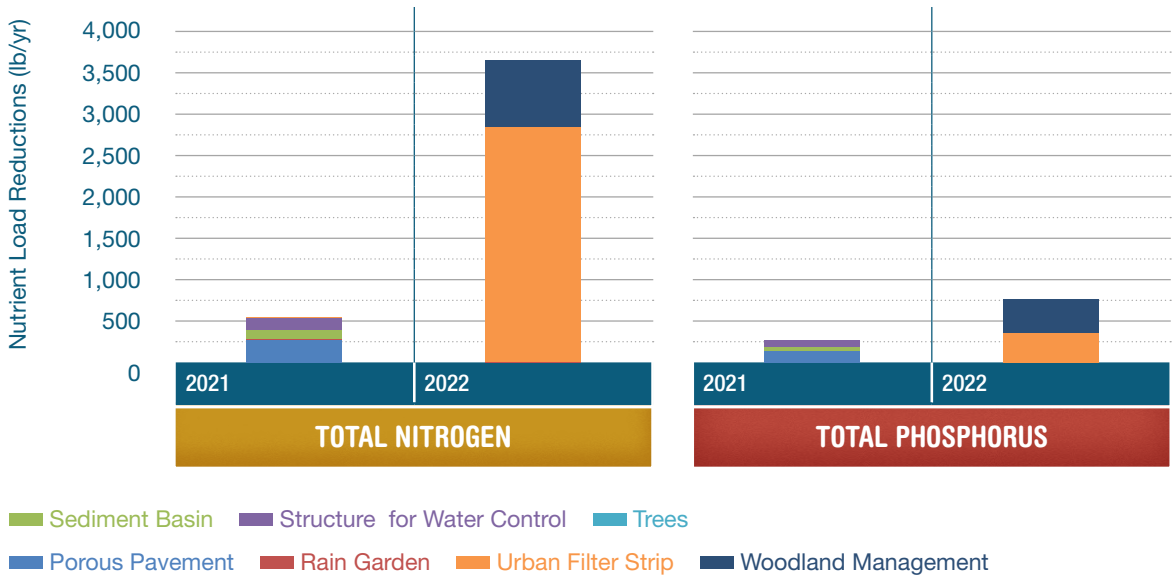


Figure 6.4. *Calculated total nitrogen and total phosphorus load reduction (lb/yr) from Section 319 grant program by urban practice type in 2021–22. See Appendix G for companion data.*

Weather and program enrollment can play a significant role in the timing of the implementation of best management practices. Section 319 grantees might secure all their best management practices, BMPs, acreage in the first year of a two-year project and, therefore, have a 'zero' for the second year. In addition, BMP units are documented upon invoicing after completion, so practices installed in late fall may not be recorded until mid-spring of the following year.

The Illinois EPA makes an effort to coordinate availability of financial assistance for BMPs with other state and federal partners within proposed project areas to reduce duplication of services and competition between programs.

Green Infrastructure Grant Opportunities Program

The Illinois EPA administers the $25 million Green Infrastructure Grant Opportunities, GIGO, program to support green infrastructure best management practices to reduce localized or riverine flooding. The GIGO program defines green infrastructure as any stormwater management technique or practice employed with the primary goal to preserve, restore, mimic, or enhance natural hydrology. Green infrastructure includes, but is not limited to, methods of using soil and vegetation to promote soil percolation, evapotranspiration, and filtering, or the harvesting and reuse of precipitation. Such practices prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois rivers, streams, and lakes.

GIGO program funds are available to local watershed groups, land conservancies or trusts, public and private profit and nonprofit organizations and institutions, units of government, universities and colleges, park districts and other local land managing agencies, Soil and Water Conservation Districts, and conservation organizations.

Localized and riverine flooding will likely become more frequent in the coming years according to the U.S. EPA. By decreasing stormwater runoff, diverting water away from impacted areas, and reconnecting streams to their floodplains, GIGO can improve water quality by reducing the amount and duration of localized and riverine flooding.

Eligible GIGO projects include:

1. Reconnecting a stream with its floodplain, for example with a two-stage ditch or daylighting;
2. Treatment and flow control of stormwater runoff at sites directly upstream or downstream of an impervious area that impacts river, stream, or lake water quality;
3. Treatment and flow control of water generated from impervious surfaces associated with urban development, such as roads and buildings.

GIGO uses funds distributed by the state of Illinois generated under the Build Illinois Bond Fund. From 2021-25, the Illinois EPA expects to distribute a total of $5 million in awards a year. Two to 10 projects annually will receive funding, with individual awards ranging from $75,000 to $2.5 million.

The Illinois EPA awarded 11 GIGO grants, totaling $5 million, in 2021. Local match is expected to be almost $4 million for an estimated total project implementation cost of $9 million. Project applicants submitted the following annual pollutant load reduction estimates:

- 4,973 pounds of nitrogen reduced
- 1,423 pounds of phosphorus reduced
- 1,063 tons of sediment reduced
- 31,414,497 gallons of stormwater retained.

Five of the 11 grant recipients have partially or fully implemented their GIGO projects. Collectively, these projects have reduced the annual pollutant load by the following amounts:

- 1,005 pounds of nitrogen reduced
- 318 pounds of phosphorus reduced
- 340 tons of sediment reduced
- 1,280,371 gallons of stormwater retained.

Green Infrastructure Inventory

Stormwater management implementation tracking moves Illinois toward a better understanding of the benefits of green infrastructure on local levels as well as progress toward statewide NLRS nutrient reduction goals. Illinois has an emerging inventory of the state's green infrastructure best management practices, a project for which the Urban Stormwater Working Group began discussions five years ago. Illinois Extension, in collaboration with the National Center for Supercomputing Applications and the National Great Rivers Research and Education Center, created the Green Infrastructure Inventory. This project included data sharing efforts by Calumet Stormwater Collaborative, University of Illinois staff, Illinois EPA, MWRDGC, DuPage County, University of Illinois Extension, and other Urban Stormwater Working Group member organizations. This effort may also provide communities with examples of best management practices around the state, costs, funding mechanisms, and water quality and quantity benefits.

The Green Infrastructure Inventory is an Esri GIS layer featuring nearly 2,000 urban stormwater practice installations in Illinois that have been added to the existing Great Lakes to the Gulf Virtual Observatory. This map shows the location and type of practice and may be viewed at greatlakestogulf.org/explore/all#/explore/all.

Municipal Separate Storm Sewer System Report Analysis

The National Pollutant Discharge Elimination System, NPDES, stormwater program began in 1990 and was expanded in 2003 to include Municipal Separate Storm Sewer Systems, or MS4s, in U.S. Census Bureau-defined urbanized areas and non-traditional MS4s, such as public universities. Illinois EPA manages MS4 permits for communities around the state.

As part of the NPDES stormwater program, MS4 communities are required to follow six minimum control measures:

1. Public education and outreach on stormwater impacts
2. Public involvement and participation
3. Illicit discharge detection and elimination
4. Construction site stormwater runoff control
5. Post-construction stormwater management in new developments and redevelopments
6. Pollution prevention/good housekeeping for municipal operations

University of Illinois Extension performed a comprehensive review of the Annual Facilities Inspection Reports from communities with MS4 permits (Figure 6.5) to better understand statewide NLRS-related practice implementation. For 2021 and 2022, 320 and 314 respective reports were analyzed.

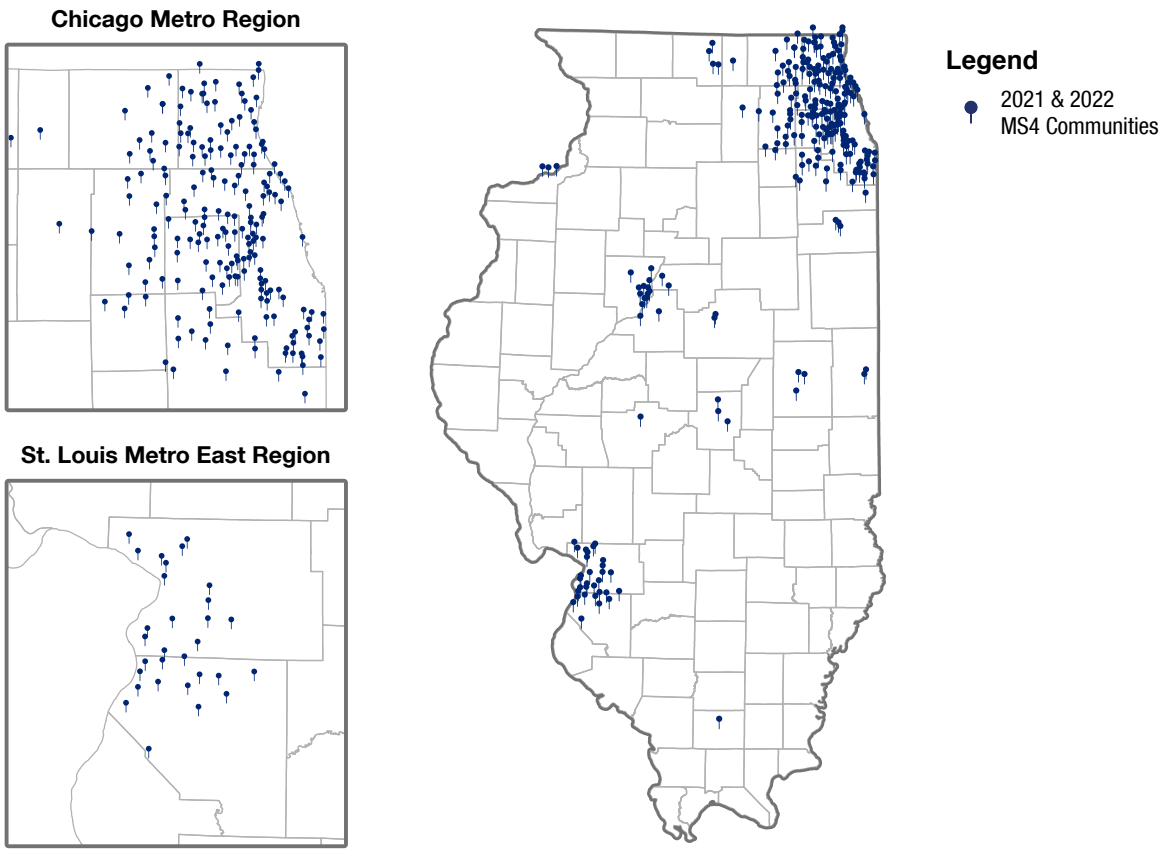


Figure 6.5. *Illinois MS4 communities evaluated in 2021 and 2022*

70%

of communities with Municipal Separate Storm Sewer Systems sweep streets and collect leaves annually

59%

of communities reported local ordinance requirements for volume control and water quality improvements for new development and redevelopment

Findings

As in past years, some practices, such as community outreach, are almost universally done because they are required as a condition of the permit. However, approximately 70% of communities have also implemented street sweeping and leaf collection. Approximately 30% of MS4 communities do street sweeping and leaf collection more than once a year. Street sweeping and leaf collection have been shown to reduce phosphorus loads through storm sewer discharge.

The analyses also sought information about green infrastructure. In 2022, 59% of communities reported local ordinance requirements for volume control and water quality improvements for new development and redevelopment. In past reports, analysts only looked at green infrastructure requirements. For this year, the analysis was expanded to include volume control and water quality improvement since follow up with MS4s indicated that this requirement can be met by green infrastructure. Some Illinois counties, such as DuPage, Cook, and Lake, have ordinances that are followed by the MS4 communities within them. Of reporting MS4 communities, 17% have some form of inventory to monitor the location and efficacy of green infrastructure installations. The analysis reported a steady increase, 28%, in MS4 communities with rain barrel incentive programs.

During 2021, COVID-19 restrictions decreased the number of community events, including litter cleanups, waste collections, and stormwater-related conferences from previous years. There was also a drop in grants made available to or from communities for green infrastructure projects. However, there was an increase in stormwater-related outreach programs such as podcasts and e-newsletters during this timeframe, a trend that continued into 2022. A few of the negatively impacted categories saw slight rebounds in 2022.

Table 6.4 displays the number of reporting MS4 communities using practices in 2021-22.

Table 6.4. *The number of MS4 communities reporting practices in 2021-22*

Number of Communities Reporting	2021		2022	
	320		314	
Urban Practice Type	**Number of Communities**	**%**	**Number of Communities**	**%**
Community outreach	301	94%	295	94%
Erosion control programs	300	94%	292	93%
Electronics recycling programs	203	63%	211	67%
Street sweeping programs	223	70%	222	71%
Hazardous household waste collections	183	57%	179	57%
Litter cleanup events	175	55%	202	64%
De-icer management programs	217	68%	227	72%
Leaf collection programs	215	67%	240	76%
Detention basin management/inspection programs	164	51%	162	52%
Green infrastructure grants	82	26%	96	31%
Detention pond inventories	124	39%	119	38%
Green infrastructure requirements in new development and redevelopment	189	59%	185	59%
Stormwater master plans	75	23%	76	24%
Green infrastructure inventories	53	17%	52	17%
Rain barrel programs	59	18%	89	28%
Homeowner rain garden incentives	10	3%	8	3%
Stormwater utility fees	27	8%	27	9%
Community rain gardens	20	6%	27	9%

Data Collection Challenges

Comparing rates of practice implementation has value, but it is difficult, given the nature of MS4 reporting to Illinois EPA. Reports are narratives, and some provide easily accessible information about practice implementation, while others are less complete and may not fully reflect the activities utilized. Other comparison challenges include variations in report terminology and formats that make information more difficult to locate. Many reports are in a scanned PDF format that is not searchable, which requires additional review time and creates possibility for error. Many communities have incomplete reporting. They have programs that are listed on their websites but not in their reports, requiring further research to gather accurate data.

Metropolitan Water Reclamation District of Greater Chicago Green Infrastructure Program

Established in 2014, the Green Infrastructure Program, led by the Metropolitan Water Reclamation District of Greater Chicago, MWRDGC, seeks to increase the acceptance and investment of green infrastructure throughout Cook County through numerous partnerships. The program calls for green infrastructure projects and seeks to partner with local communities and public agencies throughout Cook County to fund and build a variety of green infrastructure projects, including roadside bioswales and rain gardens, green roofs, permeable pavement alleys and parking lots, green streetscapes, and eco-orchards. The program is available to government organizations within MWRDGC's corporate boundaries. Projects are prioritized on their ability to capture and store water, which is measured as design retention capacity, flood risk, structures that benefit from green infrastructure, and other criteria. MWRDGC and a partnering agency execute an intergovernmental agreement to facilitate the project, with long-term maintenance responsibilities assigned to the partnering agency. The design and construction of each installation are monitored to optimize benefits. After completion, staff inspect the installation, ensuring maintenance is in line with the project's operation and maintenance plan.

Since 2017, this program has selected 93 projects that will provide a total design retention capacity of approximately 7.9 million gallons.

- The Arlington Heights, River Forest, Skokie, and Wheeling Park District projects were completed in 2018, providing 205,453 gallons of design retention capacity for an investment of $689,000. In 2019, the MWRDGC worked with the City of Des Plaines; the Forest Preserve District of Cook County; and the villages of Forest Park, Harwood Heights, La Grange, Maywood, Riverside, Tinley Park, Broadview, and River Grove to develop green infrastructure projects. including permeable pavement parking, green alleys, and bio-retention facilities. MWRDGC contributed approximately $3.9 million to these projects, which provided a combined design retention capacity of 1.3 million gallons.

- In 2020, the MWRDGC partnered with the cities of Chicago and Northlake; the villages of Summit, Broadview, Maywood, and River Grove; two Cook County school districts; the Chicago Park District; and University of Illinois at Chicago to develop green infrastructure projects. MWRDGC contributed nearly $3.2 million to these projects, which provided a combined design retention capacity of approximately 1.5 million gallons.

- The Harwood Heights, Lyons, Oak Park Rain Garden, Bartlett, and Westchester projects were completed in 2021, providing 552,358 gallons of design retention capacity for an investment of $1.45 million.

MWRDGC also supports 34 additional projects that are collaborations including Space to Grow, an innovative public-private partnership with a mission of transforming Chicago schoolyards into vibrant green spaces for physical activity, outdoor learning, and play. The completed projects provided 6.54 million gallons of design retention capacity for an investment of $16 million. These schoolyards incorporate permeable play surfaces, native plantings, rain gardens, and other green infrastructure design elements to reduce pollution and neighborhood flooding. The program is co-managed by the Healthy Schools Campaign and Openlands, with capital funding, leadership, and expertise from MWRDGC, Chicago Public Schools, and the City of Chicago Department of Water Management. MWRDGC also provides technical support for green infrastructure elements to ensure that the new schoolyards provide optimal stormwater capture benefits.

Space to Grow schools are prioritized based on flood risk, site suitability, and socioeconomic factors. Numerous community meetings were held to describe project details and benefits. MWRDGC and Chicago Public Schools executed an intergovernmental agreement to facilitate the projects whereby long-term maintenance responsibilities are assigned to Chicago Public Schools.

A new intergovernmental agreement is being negotiated to continue the program past 2022.

See mwrd.org/sites/default/files/documents/2021%20Stormwater%20Report_220621.pdf and mwrd.org/services/green-infrastructure for more information.

Current Programs and Projects Supporting Nutrient Loss Reduction Goals

The following programs and projects support Illinois Nutrient Loss Reduction Strategy's goals for the stormwater sector. This section highlights updates from nine partners and includes programs and projects that are new, have undergone significant changes, or have noteworthy updates. Several of these programs and projects have additional information that is available to review online in Appendix E Partner Updates at go.illinois.edu/NLRS.

- Calumet Stormwater Collaborative
- Chicago Metropolitan Agency for Planning Local Technical Assistance Program
- Conservation@Home
- DuPage County Water Quality Improvement Program
- Illinois Department of Transportation Stormwater Programs
- Illinois Groundwork
- Lawn to Lake Midwest
- National Green Infrastructure Certification Program
- Rainscaping Education Program
- Red Oak Rain Garden
- Watershed-Based Planning
    - Chicago Metropolitan Agency for Planning
    - DuPage County Stormwater Management
    - Greater Egypt Regional Planning and Development Commission

Calumet Stormwater Collaborative

Since 2014, the Calumet Stormwater Collaborative has convened stakeholders to solve flooding and water quality problems in the Little Calumet River and Cal-Sag Channel watersheds. Representatives from more than 40 organizations participate in the collaborative. During monthly meetings, group members exchange information on water quality and flooding needs as well as worthwhile projects and initiatives. The collaborative has developed free, online green infrastructure design templates for communities, a new data-mapping tool for the region, a repository of stormwater management resources, and a logic model for green infrastructure training and maintenance. It developed four watershed plans: the Little Calumet River,

Cal-Sag Channel, Des Plaines River in Cook County, and Poplar Creek. These plans were approved by Illinois EPA and recommend best management practices, such as green infrastructure, to reduce nutrient pollution from stormwater.

As of 2023, the Calument Stormwater Collaborative has completed the first iteration of the green infrastructure baseline inventory, led by the Metropolitan Planning Council, and the urban flooding baseline, led by the Center for Neighborhood Technology.

More information on the green infrastructure baseline can be found at www.metroplanning.org/work/project/23/subpage/7. The urban flooding baseline tool can be found at ufb.cnt.org.

Chicago Metropolitan Agency for Planning Local Technical Assistance

The Chicago Metropolitan Agency for Planning's Local Technical Assistance Program supports communities in northeastern Illinois and aligns with the region's current long-range plan — ON TO 2050 — and its principles of regional resilience, inclusive growth, and prioritized investment. Since 2012, the program has assisted communities in developing more than 200 projects with local governments, nonprofits, and intergovernmental organizations to address local issues at the intersection of transportation, land use, and housing, including the natural environment, economic growth, and community development. The program helps communities plan projects that build local capacity, engage marginalized groups, and connect local partners with implementing agencies and capital funding for infrastructure investments, including stormwater management.

For more information, see www.cmap.illinois.gov/programs/lta.

Conservation@Home

Developed by The Conservation Foundation, Conservation@Home is an educational program that recognizes and certifies properties that demonstrate environmentally sound landscape practices. Through the Conservation@Home certification program's guidance and education, residents can shape their private and community landscapes in an environmentally-minded way. Conservation@Home is a northeastern Illinois regional program. A map of participants is available at tcfwatersheds.maps.arcgis.com/apps/webappviewer/index.html?id=cfeedc632f454f20b8d384edbc527114. In Cook County, this program is a partnership between University of Illinois Extension and The Forest Preserves of Cook County. For more information, see extension.illinois.edu/cook/ConservationHome and theconservationfoundation.org/conservation-home.

DuPage County Water Quality Improvement Program

DuPage County Stormwater Management recognizes the financial burden a property owner may face when undertaking a project that improves regional water quality. The county's Water Quality Improvement Program, WQIP, offers financial assistance to projects providing a regional water quality benefit to local waterways. The grant funds up to 25% of eligible construction costs for water quality improvement projects. DuPage County initiated the grant program in 2000 and has awarded nearly $6.3 million across 108 projects. DuPage County government agencies, organizations, and individuals are eligible to receive funds under the WQIP. The WQIP story map provides information on the grant and application process and gives examples of eligible projects, such as rain gardens, green roofs, permeable pavers, and streambank stabilization. The story map also includes animated infographics, photos, project descriptions, and an interactive map of previously awarded projects.

For more information, see dupagecounty.gov/government/departments/stormwater_management/grants/water_quality_improvement_program.php.

Illinois Department of Transportation Stormwater Programs

The Illinois Department of Transportation, IDOT, maintains a chartered Stormwater Committee composed of members from a variety of backgrounds and agencies to inform and guide policy creation, advise IDOT staff on relevant stormwater issues, and oversee erosion control training for staff and consultants. The committee also coordinates with other stormwater groups and initiates research through the Illinois Center for Transportation to study aspects of the stormwater management program and determine whether improvements can be made to best management practices.

IDOT continues to research alternatives to erosion control blankets that use plastic mesh, which is known to entangle wildlife and contribute to microplastics in waterways. The literature review is completed, and field trials are planned, with a report expected at the end of 2023. When applicable, IDOT will utilize research and practices generated through other state departments of transportation, the National Cooperative Highway Research Program, and the Illinois Urban Manual. IDOT also continues to revise Specifications and Standards based on implementable research or when otherwise warranted.

For more information, see idot.illinois.gov/transportation-system/transportation-management/planning/other-plans/storm-water-management-plan.html.

Illinois Groundwork

From 2021-23, University of Illinois Extension and Illinois-Indiana Sea Grant developed a website, Illinois Groundwork, based on multidisciplinary green infrastructure research and an extension process piloted in the Chicago Calumet region. By improving access to data, research, and other resources, Illinois Groundwork increases the effective use of green infrastructure to address stormwater management challenges. For more information, see IllinoisGroundwork.org.

Lawn to Lake Midwest

In 2021–22, the Lawn to Lake Midwest Program used insights from the 2019 Lawn Caretaker Survey to develop five outreach tools, distribute 50,000 copies of each across the state, and create a comprehensive website to showcase them. A social media campaign raised awareness of the new resources by generating 85,000 impressions, or views, and driving 10,000 users to the new website. For more information, see LawntoLakeMidwest.org.

National Green Infrastructure Certification Program

The National Green Infrastructure Certification Program Training Center is located at Parkland College in Champaign. Due to the COVID-19 pandemic and the ownership transition of the certification program, the center did not hold any trainings in 2021. The center successfully held its first virtual training in spring 2022 and plans to hold two to three trainings annually. Faculty in the center are also involved in the Curriculum Committee to update the program curriculum. For more information, see www.ngicp.org.

Rainscaping Education Program

The Rainscaping Education Program is a collaboration between University of Illinois Extension, Purdue University Extension, and community partners to provide training to communities interested in building rain gardens. From 2021-22, Illinois Extension offered seven events with 98 participants. As part of the curriculum, four demonstration rain gardens were built or renovated, one program taught hands-on maintenance, and 11 homeowners qualified for stipends to build residential rain gardens. Illinois Extension and Purdue Extension also taught 10 additional Illinois staff members how to host and teach the Rainscaping sessions. For more information, see iiseagrant.org/work/sustainable-community-planning/programs-initiatives/purdue-rainscaping-education.

Red Oak Rain Garden

The Red Oak Rain Garden is a demonstration landscape on the University of Illinois Urbana-Champaign campus, managed by Illinois Extension and Illinois-Indiana Sea Grant. The garden reduces flooding, improves water quality, increases green infrastructure literacy, and models best practices for rain garden design, construction, and care. In 2021, the plant and species numbers were expanded to 13,000 individual plants and 59 species. In 2022, Extension hosted a public engagement event at the rain garden, expanded options for volunteer stewardship, and established a campaign for a maintenance endowment. Throughout 2021-22, Extension provided green infrastructure education via several virtual presentations. For more information, see go.illinois.edu/RORG.

Watershed-Based Planning

Watershed-based plans outline current conditions, identify control practices, and provide an integrated, holistic framework to protect and improve water quality in a geographic region. Plans address practices in all three Nutrient Loss Reduction Strategy sectors: agriculture, point sources, and stormwater. Plans are typically developed in partnership with local government agencies, businesses, nonprofits, and residents. Plans are tracked in the Resource Management Mapping Service available at www.rmms.illinois.edu.

The following three sections are examples of plans developed or being developed by NLRS partners that feature best management practices for stormwater management. These plans strive to identify the causes and sources of impairment and propose solutions, such as streambank stabilization, green infrastructure, and educational programs to reduce nutrient and other pollutant loading.

Chicago Metropolitan Agency for Planning

The Chicago Metropolitan Agency for Planning is developing a watershed-based plan for a 16-square-mile area in northeastern Illinois that drains to Indian Creek and the adjoining Fox River. The planning area spans eastern Kane and western DuPage counties and involves numerous planning partners, including the cities of Aurora and Batavia, counties of Kane and DuPage, the Fox River Study Group, the Fox River Ecosystem Partnership, Fermilab, and the Fox Metro Water Reclamation District. The plan will be completed in early 2023. For more information, see engage.cmap.illinois.gov/indian-creek-watershed-based-plan.

DuPage County Stormwater Management

Using funds awarded through the Illinois EPA's Section 604(b) Water Quality Management Planning Grant program, DuPage County Stormwater Management completed a watershed-based plan for the East Branch

DuPage River watershed. The East Branch DuPage River watershed spans more than 52,000 acres and is located in central DuPage County, with a small portion extending south into Will County. It has been classified as an impaired waterway by the Illinois EPA due to several pollutants, including total phosphorus, sediment/siltation, dissolved oxygen, and aquatic algae. The Illinois EPA is reviewing the plan.

Greater Egypt Regional Planning and Development Commission

The Greater Egypt Regional Planning and Development Commission has an active role in the development of watershed-based plans in southern Illinois. Two watershed-based plans were completed during the reporting period: Western Crab Orchard Creek watershed, a collection of three HUC 12 watersheds encompassing Carbondale and Makanda; and Kinkaid Creek watershed, a HUC 10 watershed containing Kinkaid Lake. For more information, see GreaterEgypt.org/watershed-based-planning.

- The Kinkaid Creek Watershed-based Plan was approved in 2022. Partners include US Forest Service Shawnee National Forest, Jackson County Emergency Management Agency, Kinkaid-Reed's Creek Conservancy District, Jackson County IL League of Women Voters, Sierra Club Shawnee Chapter, and citizens of the Kinkaid Creek Watershed. Entities will use the plan to apply for funding for various water quality management grants.

- The Western Crab Orchard Creek Watershed-based Plan was approved in 2021. Partners include Green Earth, Inc. Carbondale, Carbondale NAACP, City of Carbondale, Sierra Club Shawnee Chapter, Village of Makanda, Jackson County Emergency Management Agency, Southern Illinois University-Carbondale, Jackson County IL League of Women Voters, and citizens of the watershed. Entities will use the plan to apply for funding for various water quality management grants.

Future Strategic Actions

Urban Stormwater Working Group

The Urban Stormwater Working Group was created to explore funding, identify legislative initiatives, and develop plans related to stormwater. The group coordinates outreach and orchestrates statewide efforts to expand and retrofit green infrastructure, provide training for the MS4 program, and monitor urban streams, lakes, and stormwater.

Based on a previous recommendation from the working group, University of Illinois Extension led an inventory tracking project to help measure the implementation of stormwater land and facilities practices. The Green Infrastructure Inventory documents projects across the state and will be a valuable tracking and planning resource. The group is working on a strategy to unify tracking methods. Looking ahead, it would be valuable to continue development of the Green Infrastructure Inventory. See the Green Infrastructure Inventory section of this chapter for more information.

The group and its subgroups — education and tracking — continue to meet. See chapter 7 for more information about activities in 2021 and 2022.

WORKING GROUP ACCOMPLISHMENTS
Key Points

Across 17 sessions and two annual conferences, stakeholders met to review progress toward the strategy's objectives, review ongoing and planned initiatives, celebrate successes, address challenges, and facilitate open discussion.

Partner feedback was continuously welcomed and consistently provided.

In response to the COVID-19 pandemic, all meetings were held remotely or in a hybrid format.

A working group member list, agendas, presentations, and meeting minutes are available on each of the working group's pages at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy.html.

CHAPTER 7
WORKING GROUP ACCOMPLISHMENTS

Nutrient pollution has neither a single source nor a single solution. This makes versatility, fluidity, and collaboration crucial tenets of the Illinois Nutrient Loss Reduction Strategy, NLRS. In the last two years, stakeholders with diverse experience and expertise — policymakers, industry partners, communicators, researchers, agricultural professionals, data analysts — participated in seven working groups and subgroups. Chapter 7 summarizes the progress and accomplishments of these groups in 2021 and 2022:

- **Policy Working Group**
- **Communication Subgroup**
- **Agriculture Water Quality Partnership Forum**
  - Agriculture Water Quality Partnership Forum *Technical Subgroup*
- **Urban Stormwater Working Group**
  - Urban Stormwater Working Group *Education Subgroup*
  - Urban Stormwater Working Group *Tracking Subgroup*
- **Nutrient Monitoring Council**
- **Performance Benchmark Committee**

Chapter 7 discusses **collaboration among diverse stakeholders** in addressing nutrient pollution in Illinois and highlights progress in 2021 and 2022 by **working groups**.

Policy Working Group

Group Objectives

- ☑ Explore funding opportunities.
- ☑ Identify needed legislative initiatives.
- ☑ Network with the appropriate people and groups.
- ☑ Identify adaptive management adjustments and update the strategy.

While anchored by its key objectives, the Illinois NLRS also remains a living document. Faced with evolving legislation, dynamic partnerships, and fluid funding opportunities, the strategy itself can evolve. After a decade of stewardship, members of the Policy Working Group continue to guide the strategy's implementation with creativity and care.

The working group met five times: March 29, 2021; November 10, 2021; February 9, 2022; September 1, 2022; and November 1, 2022.

The meeting on March 29, 2021, addressed topics including the Science Team's decision to support saturated buffers and terraces; the digital Land to Water: Nutrient Explorer tool; profitable nutrient loss reduction practices, particularly the "right rate" aspect of the 4Rs of nutrient stewardship (i.e., right rate, right source, right time, and right place); and the Fall Covers for Spring Savings program, which fielded 768 applicants in less than 12 hours.

The meeting on November 10, 2021, occurred during the 2021 NLRS Partnership Conference. University of Illinois Extension Director Shelly Nickols-Richardson provided the opening remarks. Sessions addressed the Illinois River Phosphorus study and the Rock River nitrate study; the U.S. Geological Survey super gage network; and progress made by Illinois Extension watershed associates in 2019 and 2020. Additionally, the Illinois Farm Bureau provided an organizational update; University of Illinois Urbana-Champaign proposed a statewide inventory of green infrastructure to enhance stormwater monitoring; and the Urbana & Champaign Sanitary District contrasted the benefits and challenges of implementing Nutrient Assessment Reduction Plans across various geographical regions in Illinois. Finally, the Illinois Nutrient Research & Education Council gave an overview of its 2021–22 research ventures and indicated a preference for innovative projects.

The meeting on February 9, 2022, prioritized two topics: total phosphorus loads and the impact of livestock on nutrient loads. Both conversations generated positive feedback from members. Further topics of discussion included the Iowa Nutrient Reduction Strategy's interactive data dashboards; the Partners for Nutrient Loss Reduction Act, or Senate Bill 3471; the Illinois Climate-Smart Agricultural Partnership initiative of the Illinois Department of Agriculture; and the Bipartisan Infrastructure Law signed by President Joe Biden on November 15, 2021. An open discussion addressed strategies for streamlining the production of the 2023 Biennial Report, considering staff bandwidth, budgetary constraints, and an increasing volume of content.

During the meeting on September 1, 2022, the Sierra Club shared strategies for public outreach on topics related to nutrient management. Members reviewed results from a survey about the 2023 Biennial Report, which polled partners on the report's use, content, style, structure, and timeline. Responses mentioned the report's positive impact on funding, outreach, and stakeholder partnerships, and indicated a preference for graphics and analyses over raw data.

The meeting on November 1, 2022, occurred during the 2022 NLRS Partnership Workshop. Nickols-Richardson provided the opening remarks. The U.S. Geological Survey reviewed nutrient load and stream-flow metrics, reporting that nitrate-nitrogen loads increased by 8%, and total phosphorus loads increased by approximately 40% between the 1980–96 and 2017–21 reporting periods. The Illinois Environmental Protection Agency, Illinois EPA, then elaborated on changes to point source nutrient loads from 2011–21, reporting a 30.6% reduction in total phosphorus loads from point sources and a 12.2% reduction in total nitrate-nitrogen loads from point sources. Illinois Extension reviewed its initiatives in priority watersheds and highlighted the Illinois Nutrient Loss Reduction Podcast as a successful outreach endeavor. The U.S. Department of Agriculture reviewed results from the 2021 NRLS Survey conducted by the USDA National Agricultural Statistics Service, NASS, and several working groups provided progress reports. The NLRS Science Team reviewed three projects proposed for the NLRS-recommended best management practices list and endorsed one project focused on water and sediment control basins for inclusion. Finally, Illinois Extension presented the Steering Committee's conclusions for streamlining the 2023 Biennial Report, including relocating raw data to appendices, using fewer photos, and releasing the report in December 2023.

The Policy Working Group webpage is available at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/policy-working-group.html.

Communication Subgroup

The Illinois NLRS impacts a wide group of stakeholders across the state and beyond. From students exploring environmental advocacy to elected officials learning the nuances of nutrient loss in their jurisdictions, engaging programs and clear communications can catalyze positive change. The Communication Subgroup educates policymakers, industry professionals, contractors, and learners of all ages about hypoxia in the Gulf of Mexico, exploring why it matters, what is at stake, and how to help.

The subgroup met on October 13, 2021, to discuss outreach for the 2021 Biennial Report. Members supported drafting a cover letter for dissemination to state legislators as well as a slide presentation to communicate the strategy with a unified voice. Media coverage and youth outreach were identified as a requisite to the report's success — particularly considering results from the 2021 NRLS Survey conducted by the USDA NASS. The new Land to Water: Nutrient Explorer tool emerged as integral to these efforts.

The Communication Subgroup webpage is available at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/communication-subgroup.html.

Agriculture Water Quality Partnership Forum

A large majority of Illinois is made up of farmland. This makes partnerships with farmers crucial to the success of the Illinois NLRS. The Agriculture Water Quality Partnership Forum, AWQPF, works alongside agricultural professionals to establish meaningful educational programs, implement science-based conservation practices, and inspire informed decisions.

The forum met three times: March 1, 2021; March 16, 2022; and June 15, 2022.

The meeting on March 1, 2021, addressed two prongs of conservation practice implementation: monitoring and funding. UIUC researcher Kaiyu Guan presented his approach to remote sensing: a secure, satellite-based method for monitoring conservation practices on farmlands over extended periods of time. Such data could improve the tracking of grassed waterways, stream buffers, and other conservation buffers. Members discussed the technology's current and potential capacities and considered annual costs, and Guan reiterated his interest in leveraging research to meet stakeholder needs. The American Farmland Trust, AFT, discussed ecosystem services markets, through which companies and communities can compensate landowners to protect and restore their ecosystems. AFT outlined various opportunities available to Illinois farms and advocated for investing in the state's soil health while simultaneously strengthening climate resilience.

The meeting on March 16, 2022, included a discussion about streamlining the 2023 Biennial Report. CropGrower LLC presented its satellite-based method for identifying in-field buffers, stream buffers, and cover crops, generating data that could augment the strategy's existing conservation practice metrics. The Illinois EPA reviewed the data sources used to calculate progress toward the strategy's overall reduction goals, and stakeholders recommended additional sources to fill in data gaps. The topic turned to climate-smart agriculture, a concept coined by the United Nations Food and Agriculture Organization for local efforts that stimulate productivity, reduce greenhouse gas emissions, and strengthen climate resilience. Initiatives in Illinois included the Illinois Climate-Smart Agriculture Working Group; a U.S. Climate Alliance technical assistance grant; and the Partnerships for Climate-Smart Commodities program. The session concluded with an overview of partner initiatives and calls for feedback.

During the June 15, 2022, meeting, members discussed strategies for encouraging farmers, landowners, and land managers to voluntarily adopt conservation practices that support the strategy's goals. Representatives from 10 partner organizations provided statements addressing technical and cost-share assistance, planned programs and partnerships, insights for affecting small-scale change, and ideas for engaging middle and late strategy adopters.

The following partners provided updates:

- The American Farmland Trust
- The Illinois Corn Growers Association
- The Illinois Farm Bureau
- The Illinois Fertilizer & Chemical Association
- The Illinois Sustainable Ag Partnership
- The Nutrient Research & Education Council
- The Prairie Rivers Network
- The Nature Conservancy
- The Illinois Soybean Association
- The Metropolitan Water Reclamation District of Greater Chicago

General comments indicated an interest in expanded partnerships with community colleges and traditional academic institutions to galvanize the next generation of agricultural professionals. Subsequent presentations included an update on potential data sources to be used in the 2023 Biennial Report as well as an overview of climate change in Illinois. This latter discussion underscored the importance of climate-smart agricultural practices in enhancing farm resilience to climate change, reducing greenhouse gas emissions, and maintaining food production yields.

Agriculture Water Quality Partnership Forum objectives

- ☑ Steer and coordinate outreach and educational efforts to help farmers address nutrient loss and select the most appropriate agricultural conservation practices.
- ☑ Identify needed educational initiatives or training requirements for farmers and technical advisers.
- ☑ Strengthen connections between industry initiatives, certified crop adviser continuing education requirements, state initiatives, and other technical services.
- ☑ Track conservation practices.
- ☑ Coordinate cost-share and targeting.
- ☑ Develop other tools, as needed.

The Agriculture Water Quality Partnership Forum webpage is available at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/agriculture-water-quality-partnership-forum.html.

Agriculture Water Quality Partnership Forum Technical Subgroup

Technical Subgroup objectives

- ☑ Determine the best way to share and aggregate agricultural conservation practice implementation data across agencies (to track progress in accomplishing strategy goals).

- ☑ Determine agricultural conservation practice implementation parameters to be tracked (e.g., cover crops, wetlands, buffer strips, etc.) and how data will be aggregated (e.g., per watershed; statewide; practices lumped into categories such as edge-of-field, etc.). This includes identifying future data parameters required from producer surveys or transect surveys to track progress in accomplishing Illinois NLRS goals.

Transparency leads to equity and equity to progress. The Agriculture Water Quality Partnership Forum, AWQPF, Technical Subgroup maintains the transparency and equity of data collection among stakeholders, including determining which conservation practices to monitor, standardizing procedures for data gathering, and accurately reporting metrics for the benefit of all partners. Drawing from the collective well of partner successes, challenges, and observations will enable the strategy to make intentional and data-driven advancements.

The subgroup met on December 1, 2022, and reviewed chapter 4 of the 2021 Biennial Report. Illinois Extension reviewed each partner's anticipated contributions to the 2023 report, and partners advised on the topics, data sources, data visualizations, and narrative content of their respective sections.

A member list is available online at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/agriculture-water-quality-partnership-forum-technical-subgroup.html.

Urban Stormwater Working Group

Urban Stormwater Working Group objectives

- ☑ Explore funding.

- ☑ Identify legislative initiatives and develop plans.

- ☑ Coordinate outreach and orchestrate statewide efforts related to green infrastructure expansion and retrofitting; Municipal Separate Storm Sewer System program training; and urban stream, lake, and stormwater monitoring.

Urban runoff occurs when constructed surfaces, such as sidewalks and parking lots, prevent rainwater from soaking into the soil and can negatively affect local water quality. The Urban Stormwater Working Group explores funding opportunities, legislative initiatives, and strategies for monitoring urban stormwater. Group members coordinate outreach and education efforts, orchestrate statewide green infrastructure and retrofitting projects, and oversee Municipal Separate Storm Sewer System, MS4, program training.

The working group met on January 12, 2021; March 9, 2021; May 11, 2021; and April 19, 2022.

The meeting on January 12, 2021, included an executive summary and review of the 2021 Biennial Report and highlighted expectations for the 2023 report.

During the meeting on March 9, 2021, The Conservation Foundation and DuPage River Salt Creek Workgroup led a discussion of their Nutrient Assessment and Reduction Plan.

During the meeting on May 11, 2021, Illinois Extension reviewed Chapter 6 of the 2021 Biennial Report. An open discussion highlighted the unanticipated silver lining of using virtual communication strategies like Zoom calls to engage stakeholders across the state.

The meeting on April 19, 2022, focused on cultivating a unified approach to tracking green infrastructure best management practices across the state. Proposed strategies included converting to a common unit of measurement (i.e., watershed acres treated), organizing best management practices into discrete categories (e.g., filtration, green roof, permeable pavement, etc.), and distinguishing retrofitting projects from new construction.

The Urban Stormwater subgroups did not meet during the report time period.

The Urban Stormwater Working Group webpage is available at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/urban-stormwater-working-group.html.

Nutrient Monitoring Council

The Illinois NLRS progress toward long-term goals is measured incrementally. The baseline data lends context to current observations, which in turn helps calibrate the strategy toward its targets. The Nutrient Monitoring Council coordinates the development and implementation of statewide nutrient monitoring, ensuring that stakeholders receive the information needed to calculate annual nutrient loss metrics, compare five-year running average loads of nitrate-nitrogen and total phosphorus to the 1980–96 and 1997–2011 baselines, and detect water quality trends.

The Council met on June 10, 2021 and August 2, 2022.

During the meeting on June 10, 2021, the U.S. Geological Survey, USGS, reviewed the Next Generation Water Observing System in the Illinois River Basin as well as its successful effort from 2016–20 to better equip eight Illinois rivers for nutrient and sediment monitoring. The Illinois Corn Growers Association summarized its investigation into increased streamflow in the Rock River watershed, and University of Illinois Urbana-Champaign, UIUC, reviewed its collaboration with Illinois Nutrient Research & Education Council and the USGS to investigate increased phosphorus loads in the Illinois River Basin. The Illinois EPA summarized the activities of the Hypoxia Task Force Water Quality Monitoring Workgroup between March 2020 and April 2021, and council members reviewed the Land to Water: Nutrient Explorer tool.

During the meeting on August 2, 2022, the USGS reported statewide nutrient load estimates generated by its super gage network. Between the periods of 1980-96 and 2017-21, nitrate-nitrogen loads increased by an estimated 10%, and total phosphorus loads increased by an estimated 30%. Statewide total phosphorus loads were largely attributed to activities in the Illinois River Basin. A UIUC study published in the *Journal of the American Water Resources Association* demonstrated that total phosphorus loads at the Valley City gaging station increased from 1989–96 to 2015–19, with 78% of this increase attributed to the lower mainstem subwatershed of the Illinois River. A review of nitrate-nitrogen loads in the Rock River Basin reported an average of 21.5 pounds of nitrate-nitrogen per acre per year from 2015-19, compared to an average of 4.2 pounds of nitrate-nitrogen per acre per year from 1980–96. Illinois State Water Survey reviewed preliminary results for groundwater nitrate-nitrogen modeling. Council members received an overview of the Next Generation Water Observing System in the Illinois River Basin from USGS.

Nutrient Monitoring Council objectives

The Nutrient Monitoring Council's overall goal is to coordinate the development and implementation of monitoring activities that provide the information necessary to:

- ☑ Generate estimates of five-year running average loads of nitrate-nitrogen and total phosphorus leaving Illinois, compared to 1980-96 baseline conditions;
- ☑ Generate estimates of nitrate-nitrogen and total phosphorus loads leaving selected Illinois NLRS-identified priority watersheds, compared to 1997-2011 baseline conditions;
- ☑ Identify nutrient load trends, both statewide and in Illinois NLRS priority watersheds over time.

A member list is available online at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-monitoring-council.html.

Performance Benchmark Committee

The Performance Benchmark Committee addresses on-the-ground implementation needs for the strategy's goals. Collaborating with other working groups, the committee advises on adaptive management strategies and sector reporting metrics. The committee met on September 28, 2022, to review Chapter 8 in the 2021 Biennial Report. Looking ahead to the 2023 report, members deliberated over the best method of including big-picture analyses and conclusions (e.g., responsibility, funding, and timing) as recommended by the Policy Working Group.

The Performance Benchmark Committee webpage is available online at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/performance-benchmark-committee.html.

NLRS Partnership Conferences and Workshops

Illinois NLRS partners meet annually to reflect on the previous year and plan for the future. A conference takes place during odd-numbered years to coincide with the release of the biennial report, and a one-day workshop happens during even-numbered years.

The 2021 Illinois NLRS Partnership Conference was online on November 10, with 123 attendees. Todd Gleason, University of Illinois Extension media and communications specialist, hosted the event, and Jerry Costello, director of the Illinois Department of Agriculture, IDOA, provided the welcome. Robert Bonnie, deputy chief of staff at IDOA, presented the keynote. In the morning session, attendees reviewed and discussed key takeaways from the from the source sectors in 2019 and 2020 as indicated in the 2021 Biennial Report. The Policy Working Group held meetings during the afternoon session. Lisa Merrifield, a sustainable communities specialist at Illinois Extension, provided closing remarks.

The 2022 Illinois NLRS Partnership Workshop was held in a hybrid format on November 1, with 121 attendees: 46 in person and 75 virtual. Todd Gleason hosted the event, and John J. Kim, director of the Illinois EPA, provided opening remarks. Topics covered during the morning session included the Bipartisan Infrastructure Law (P.L. 117-58) and its impact on the Mississippi River/Gulf of Mexico Hypoxia Task Force; the Illinois River Watershed Study Group; a review of NARPs, including current Illinois regulations and examples of successful plans; the USGS selection of the Illinois River Basin for its 10-year Integrated Water Science Basins study; an overview of Illinois Nutrient & Education Council's history, structure, and key working areas; and the Phosphorus Assessment & Reduction Plan underway in the Chicago Area Waterway System. The Policy Working Group met in the afternoon. Jerry Costello provided closing remarks.

Information about NLRS workshops and conferences is available online at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nlrs-workshops-conferences.html.

ADAPTIVE MANAGEMENT AND MEASURING PROGRESS
Key Points

Statewide nutrient loads in Illinois rivers, especially phosphorus, exceed interim targets.

While nutrient loads increased from the baseline, five-year averages showed a decline from 2016-20 to 2017-21.

Subwatershed nutrient loads vary across Illinois, with multiple factors influencing these differences. More research is needed to understand the roles of streamflow, nutrient management, changes in population, hydrology, and legacy nutrients.

143 watershed-based plans were developed since 2011 with Illinois EPA cost-share funding.

Since 2015, adoption of practices known to reduce nitrogen and phosphorus loads has grown across all sectors, with enhanced tracking.

- Point sources surpassed the interim goal of 25% total phosphorus reduction by 2025, achieving a 34% decrease from baseline, largely due to compliance with Illinois EPA's National Pollutant Discharge Elimination System permits.
- In agriculture, while nutrient management practices and conservation tillage implementation have progressed, other practices lag behind in meeting interim reduction goals.
- A new Green Infrastructure Inventory tool has been introduced for mapping stormwater management practices.

Continued support is crucial for research, conservation practices, and education. Incorporating climate impact research into nutrient loss plans is vital.

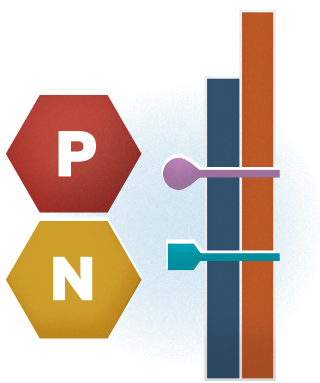
CHAPTER 8
ADAPTIVE MANAGEMENT AND MEASURING PROGRESS

This chapter summarizes the current state of water quality in Illinois and outlines recommendations for strategy adjustments to new technologies and practices based on current data as well as emerging research and policies to achieve Nutrient Loss Reduction Strategy, NLRS, goals. The NLRS first outlined the use of adaptive management in the 2019 Biennial Report to be in alignment with the 2008 Gulf Hypoxia Action Plan. The NLRS Performance Benchmark Committee helps inform adaptive management goals and has developed interim milestones and ultimate objectives. As new research emerges and new practices and technologies develop, the most effective approaches for reaching these goals may also change. Adjustments to the strategy, such as those outlined in this chapter, will help NLRS stakeholders increase the adoption of practices that help reach Illinois water quality goals.

Practices known to reduce nitrogen and phosphorus loads have continued to be adopted in both the agricultural and point source sectors. However, reaching the NLRS water quality goals for Illinois will require greatly scaled-up implementation of nutrient loss reduction practices, especially from the non-point sectors.

Chapter 8 outlines recommendations for adjusting the Nutrient Loss Reduction Strategy based on emerging research and policies to improve Illinois water quality.

Practices known to reduce nitrogen and phosphorus loads have continued to be adopted in both the agricultural and point source sectors.



Water Quality Goals

The NLRS was established to improve water quality in Illinois waterbodies and the Gulf of Mexico, per U.S. Environmental Protection Agency guidelines. To achieve nutrient load reductions, Illinois has set long-term goals to reduce both nitrate-nitrogen and total phosphorus by 45%, with interim reduction goals of 15% and 25%, respectively, by 2025. Figures 8.1 and 8.2 illustrate the state's five-year average load estimates as compared to the baseline years 1980–96 and the NLRS goals. Annual precipitation and other environmental conditions can greatly impact nutrient loads, so they are averaged over a multi-year range. A rolling average is a more reliable measure than individual years.

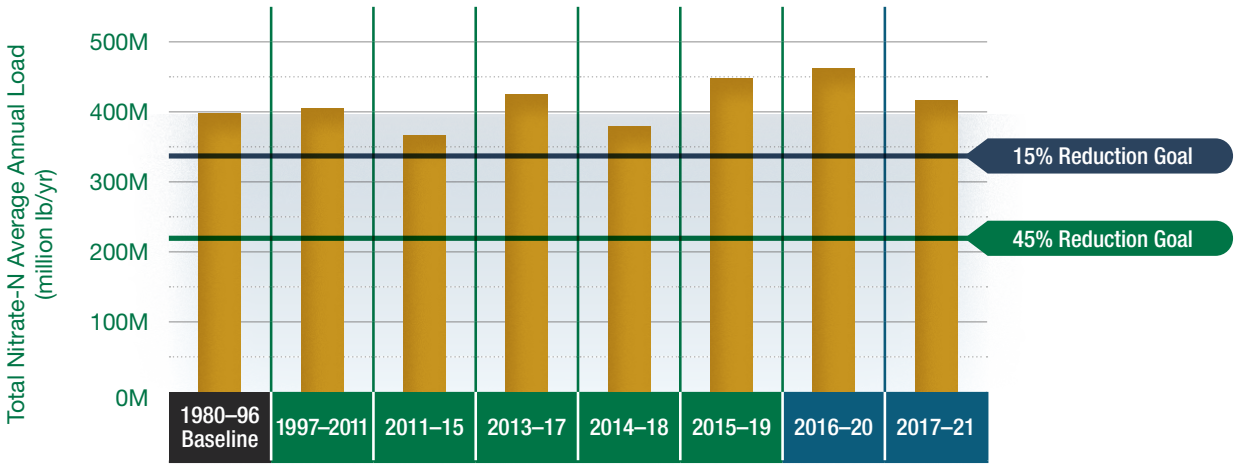


Figure 8.1. *Illinois nitrate-nitrogen loads relative to the 2025 interim and long-term reduction goals*

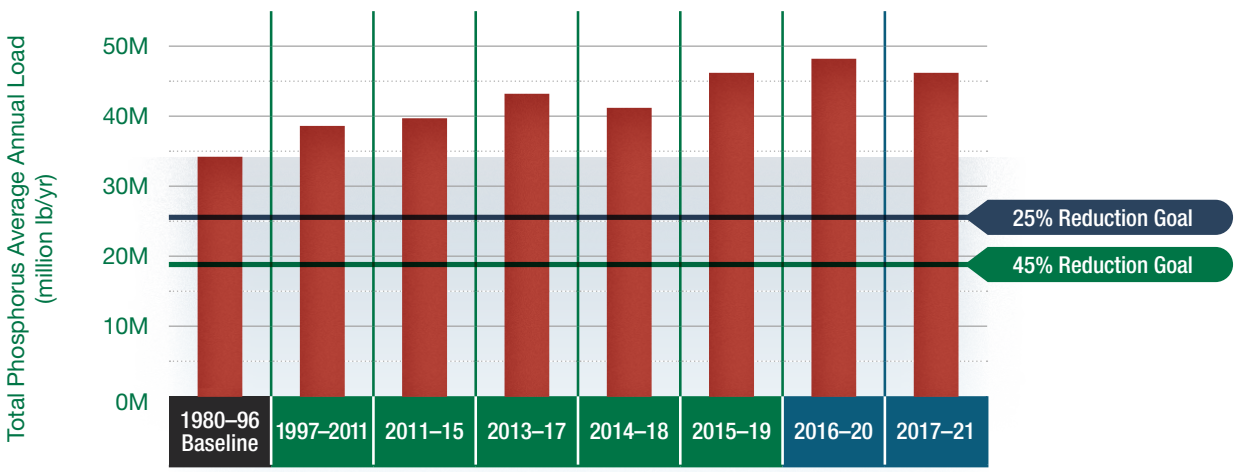


Figure 8.2. *Illinois total phosphorus loads relative to the 2025 interim and long-term reduction goals*

Statewide Nutrient Loads

Nutrient loads remain high, particularly for phosphorus. A large fraction of the phosphorus load previously came from the point source sector before it made substantial reductions in recent years. Phosphorus load reductions from the point source sector are expected to continue as more large dischargers implement nutrient removal systems to meet new regulatory requirements.

Nutrient levels remain high, but point sources are making substantial reductions.

Further determination of nutrient reductions attributed to agriculture, stormwater, or other non-point sources, such as legacy nutrients, remains to be quantified through research and improved tracking. Since a substantial amount of nutrients may be coming from legacy sources, quantifying legacy contributions will allow for a more accurate estimate of the impact of the NLRS and of other management and conservation efforts on nutrient loads.

Crucial research is needed to gauge non-point source effects, especially from legacy nutrients.

Increased streamflow is likely a major factor contributing to increased nutrient loads compared to baseline. Streamflow from the most recent five-year period, 2017–2021, increased by an average of 30% compared to baseline. In general, annual river flows are highly correlated with annual precipitation, so the increase in river flows is very likely a result of increased precipitation across the state.

Increased streamflow, likely due to higher precipitation, significantly contributes to elevated nutrient loads compared to the baseline.

Major Subwatersheds Overview

Subwatershed rolling averages over the last decade show nutrient loads vary across locations and time periods. Compared to their baselines, subwatershed loads of nitrate-nitrogen in 2016-20 ranged from -14% to 157%. In 2017-21 loads ranged from -19% to 117%. Compared to their baselines, subwatershed loads of total phosphorus ranged from 1% to 101% in 2016-20, and from -8 to 102% in 2017-21. There is a need for research into factors other than streamflow that may be influencing subwatershed loads. Table 8.1 illustrates the subwatershed nutrients yields relative to their baselines. Subwatershed yields in pounds per acre per year are presented in chapter 3, Tables 3.4 and 3.5.

Subwatershed nutrient loads vary significantly over time and location, with the need for research into non-streamflow factors influencing these variations.

Table 8.1. *Percent change of nitrate-nitrogen and total phosphorus yields relative to baseline for eight major rivers*

	NITRATE-NITROGEN		TOTAL PHOSPHORUS	
	2016-20	2017-21	2016-20	2017-21
Big Muddy	20%	33%	54%	45%
Embarras	22%	8%	29%	27%
Green	40%	25%	1%	-8%
Illinois	4%	-5%	32%	23%
Kaskaskia	3%	-6%	101%	102%
Little Wabash	16%	19%	88%	86%
Rock (Illinois portion)	157%	117%	44%	28%
Vermilion (Wabash)	-14%	-19%	9%	-3%

Generally, nutrient loads are highly correlated with water yield, and years with more precipitation and streamflow are highly correlated with years of higher nutrient loads. Investigations into higher nutrient loads in the Rock and Illinois river subwatersheds reveal that not all the load variability can be explained by streamflow and may be due to a variety of factors.

Recent Rock River Basin studies suggest that aquifer lag time may explain why the nitrate-nitrogen yield was unusually low during the baseline period but is now similar to other watersheds in the region. In other words, a load increase that followed the increased use of nitrogen fertilizer appears to have occurred later in this river than in other rivers in the state. Other factors, such as precipitation and streamflow, expansion of irrigation, and increased corn-soybean acres can partly account for increases in riverine nitrate loads. In this watershed, the influence of legacy nitrate loading from groundwater requires further investigation.

Conservation practices that reduce nitrate leaching from cropland in this region may take more time to contribute to reduction in riverine nitrate loads than in other regions of the state. Opportunities to expand conservation practices include research and implementation on improvements to irrigation efficiency; cover crop establishment using irrigation; nutrient management that credits nitrate in irrigation water; nutrient loss reduction practices targeted to seed corn acres, since this crop has lower nitrogen removal efficiencies at harvest; and riparian wetland implementation.

Recent research into the Illinois River Basin indicates 78% of the increase in total phosphorus load at Valley City could be attributed to the lower mainstem subwatershed of the Illinois River, not from its

tributaries. In the past, the Illinois River lower mainstem has acted as a phosphorus sink, but recently that dynamic has changed. The causes of this shift are unclear, and more research is needed to identify causal mechanisms and their relative influences on total phosphorus river loads. The remaining 22% of the load increase could be explained by increased loads from the Sangamon River, especially between Monticello and Riverton. In the Kaskaskia, Little Wabash, and Big Muddy rivers, phosphorus loads might be increasing because of sediment containing legacy phosphorus. As discussed in chapter 3, statewide research on legacy phosphorus loads from streambank erosion is underway and can be expected to provide additional information in coming years about the magnitude and timescale of the sources of total phosphorus loss specific to Illinois landscapes, streams, and rivers. Such information could impact phosphorus reduction strategies.

Agricultural Implementation Progress

The Illinois NLRS includes agricultural conservation practice implementation scenarios that detail combinations of conservation practices, scales of implementation, and the associated nutrient load reductions that could be realized when fully implemented. Scenarios NP2 and NP3, Tables 8.2 and 8.3, were outlined in the initial 2015 Strategy as two possible implementation scenarios that represent the level of practice adoption needed to meet the 45% reduction goals for nitrogen and phosphorus.

Scenarios NP7, Table 8.4, the interim reduction goal, and NP8, Table 8.5, a 45% reduction goal, were added to better reflect available data. Details of each are discussed in the 2021 Biennial Report. NP7 provides a scenario that represents the level of practice adoption needed to meet 15% nitrate-nitrogen and 25% total phosphorus interim reduction goals starting at benchmark levels in 2011. NP8 provides a scenario that represents the level of adoption needed to meet the 45% reduction goals. Both NP7 and NP8 were intended to be combinations of practices that better align with the data available for tracking implementation across the state. However, changes to the USDA's National Agricultural Statistics Service NLRS survey in 2021 eliminated some of these data sources for NP7 and NP8, as discussed below. The agricultural implementation scenarios are meant to provide scope and scale and to guide the agricultural sector's implementation strategy.

Tables 8.2-8.5 highlight the different quantities of practice implementation that comprise scenarios NP2, NP3, NP7, and NP8. For example, NP2 may only require 3.7 million acres under Maximum Return To Nitrogen, MRTN, management, while NP8 requires 11.2 million acres under MRTN management. The tables also display summaries and data sources for each scenario. Starting in 2021 the U.S. Department of Agriculture National Agricultural Statistics Service NLRS survey no longer distinguished between tiled and non-tiled acres. Therefore, cover crops, nitrogen management, and nitrogen inhibitor practices were combined in the scenarios. Also, the survey no longer included nitrogen management 40% fall, 10% pre-plant, and 50% sidedress. This metric has shifted to fall-spring split nitrogen management to match collected data.

The full 2020 Scenario Development Spreadsheet is available online at epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nlrs-scenario-development.html.

Table 8.2. *Scenario NP2 practices, features, and data sources*

Scenario NP2 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
Reducing N rate from background to MRTN	Applies to all corn acres, but reductions only realized on 10%	11.2	3.7	N	USDA NASS
Spring-only N application	On 50% of corn acres	5.7	1.9	N	NASS
Bioreactors (acres treated)	50% of tile-drained crop acres	4.45	1.48	N	NRCS, IDOA, Illinois EPA, University of Illinois, partner data
Wetlands (acres treated)	10% of tile-drained crop acres	0.89	0.30	N	Federal and state cost-share, USDA NRCS RCA data viewer, Illinois EPA
No P fertilizer above STP maintenance	Assumes 12.5 million acres are above maintenance	12.5	6.94	P	IDOA, other. Assumes that 12.5 million acres are above maintenance
Reduced till of conventional eroding>T	Defined as leaving 30% or greater crop residue cover	1.8	1.0	P	Soil Transect Survey
Cover crops on all corn/soybeans	Fall planted	21	7.1 (N) 11.8 (P)	N & P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Point Sources (Majors only)	1 mg/L TP permit limit	N/A	N/A	P	Illinois EPA
Point Sources (Majors only)	10 mg/L nitrate permit limit	N/A	N/A	N	Illinois EPA

Table 8.3. *Scenario NP3 practices, features, and data sources*

Scenario NP3 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
Reducing N rate from background to MRTN	Applies to all corn acres, but reductions only realized on 10%	11.2	3.7	N	NASS
Spring-only N application	Tile-drained corn acres	5.7	1.9	N	NASS
Bioreactors (acres treated)	30% of crop acres	2.7	0.89	N	NRCS, IDOA, Illinois EPA, University of Illinois, partner data
No P fertilizer above STP maintenance	Assumes 12.5 million acres are above maintenance	12.5	6.94	P	IDOA tonnage report, other
Reduced till of conventional eroding>T	Defined as leaving 30% or greater crop residue cover	1.8	1.0	P	Soil Transect Survey
Cover crops on all corn/soybeans	87.5% of acres	18.6	2.8 (N) 10.3 (P)	N&P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Stream buffers on all applicable lands	Estimated 100 feet from stream	0.20	0.07	P	Illinois EPA, FSA, NRCS, satellite imagery
Perennial crops on land eroding>T add perennials	Biofuels, hay, or CRP	2.5	0.83 (N) 1.39 (P)	N&P	FSA (CRP), IDNR (CREP), other

Table 8.4. *Scenario NP7 practices, features, and data sources*

Scenario NP7 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
MRTN	Applies to all corn acres	N/A	3.7	N	NASS
Soil Test Phosphorus	100% of total acres	N/A	22	P	NASS
Conservation Tillage*	94% of total acres	N/A	20.7	P	Soil Transect Survey, CTIC OpTIS 3.0
Bioreactors (acres treated)	100% of maximum implementation of tile-drained acres	N/A	4.7	N	NRCS, IDOA, Illinois EPA, University of Illinois, partner data
Cover Crops (Grass Based)	31% of maximum implementation	N/A	6.9	N	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Nitrification Inhibitor	47% maximum implementation on all corn acres	N/A	3.1	N	NASS

*Conservation Tillage is calculated from "NoTill", "RedTillLowRC" and RedTillHighRC" acreages available in Conservation Technology Information Center (CTIC), 2023. Operational Tillage Information System (OpTIS 3.0). http://www.ctitc.org/OpTIS [accessed on 08-MAR-2023].

Table 8.5. *Scenario NP8 practices, features, and data sources*

Scenario NP8 Practice	Summary	Est. Million Acres Needed for 45% Reduction Goal	Est. Million Acres Needed for Interim Goal	Nutrient Reduced	Potential Data Sources for Tracking Metric
MRTN	Applies to all corn acres	11.2	3.7	N	NASS
Soil Test Phosphorus	Applies to all acres	22.1	12.3	P	NASS
Conservation Tillage*	Applies to all acres	22.1	12.3	P	Soil Transect Survey, CTIC OpTIS 3.0
Bioreactors (acres treated)	100% of maximum implementation of tile-drained acres	4.7	1.6	N	NRCS, IDOA, Illinois EPA, University of Illinois, partner data
Wetlands	100% of maximum implementation of tile-drained acres	2.4	0.8	N	Wetlands Reserve Easement Program, NRCS EQIP, DNR CREP Easements
Cover Crops (Grass Based)	100% of maximum implementation	22.1	7.3 (N) 12.3 (P)	N, P	NASS, FSA, Illinois EPA, NRCS, satellite imagery
Nitrogen Management (Fall-Spring split)	100% of maximum implementation	6.4	0.9	N	NASS
Nitrification Inhibitor	21% maximum implementation on all corn acres	1.4	0.5	N	NASS
Stream Buffers	36% of maximum implementation of non-tiled acres	4.4	1.5 (N) 2.5 (P)	N, P	Satellite imagery

Figures 8.3-8.6 compare recommended conservation practice adoption levels necessary to meet the interim and 45% reduction goals. The following practices reported progress since 2019:

- **MRTN nitrogen** management was reported as 8.36 million acres in 2021. In addition to increased practice implementation, this may be due to improved measurement accuracy because of improved data collection methods.
- **Fall-Spring split nitrogen management** was reported as 4.44 million acres in 2021.
- **Bioreactors** were reported to treat 1,449 acres in 2022.
- **Conservation tillage** practices were reported at 15.2 million acres.
- **Nitrogen inhibitor use** was reported on 2.6 million acres.
- **Soil Test Phosphorus** was reported as 11.2 million acres.
- **Wetlands** were reported as 421 acres. This metric was modified to include only constructed wetland practice CP 656 from all USDA programs. Previous years used 160,000 acres which had been reported by the 2015 USDA NASS NLRS Survey.
- **Cover crops** were reported on 1.39 million acres.

Stream buffers were reported for the first time using 2021-22 satellite imagery analysis methods discussed in chapter 4.

NP2, NP3, NP7, and NP8 scenarios notes:

- **MRTN** for the 2021 crop season are not directly comparable to results from previous surveys as the data collection process was changed significantly.
- **No P fertilizer above Soil Test Phosphorus** has not been updated since 2019. Data collection methods are under development. See chapter 4 NASS.
- **Conservation Tillage** is a sum of "NoTill", "RedTillLowRC" and RedTillHighRC" acreages available in Conservation Technology Information Center (CTIC), 2023. Operational Tillage Information System (OpTIS 3.0). http://www.ctitc.org/OpTIS [accessed on 08-MAR-2023].
- **Bioreactor** data is from 2022.
- **Wetlands** only include Resource Conservation Act Data Viewer query for all CP 656 constructed wetland practice "counts" Fiscal Years 2005-22 enrolled in any USDA program, including Conservation Stewardship Program, CSP, for any land use type in Illinois. The count was then multiplied by the USDA conversion factor for CP 656, 16.8598.
- Scenario NP7 graph contains 2019-20 and current implementation data to show near-term progress toward the 2025 interim goal.
- For all scenarios, some practices contribute to nitrogen or phosphorus reductions, while others contribute to reductions of both nutrients.

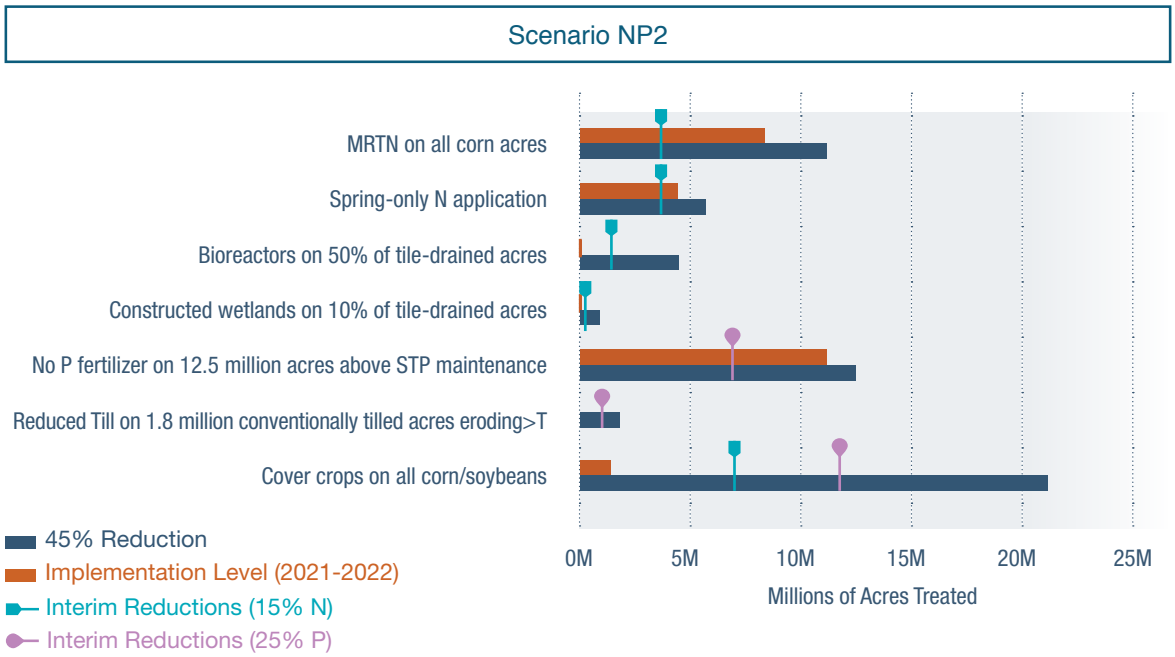


Figure 8.3. *Agricultural implementation as compared with scenario NP2*

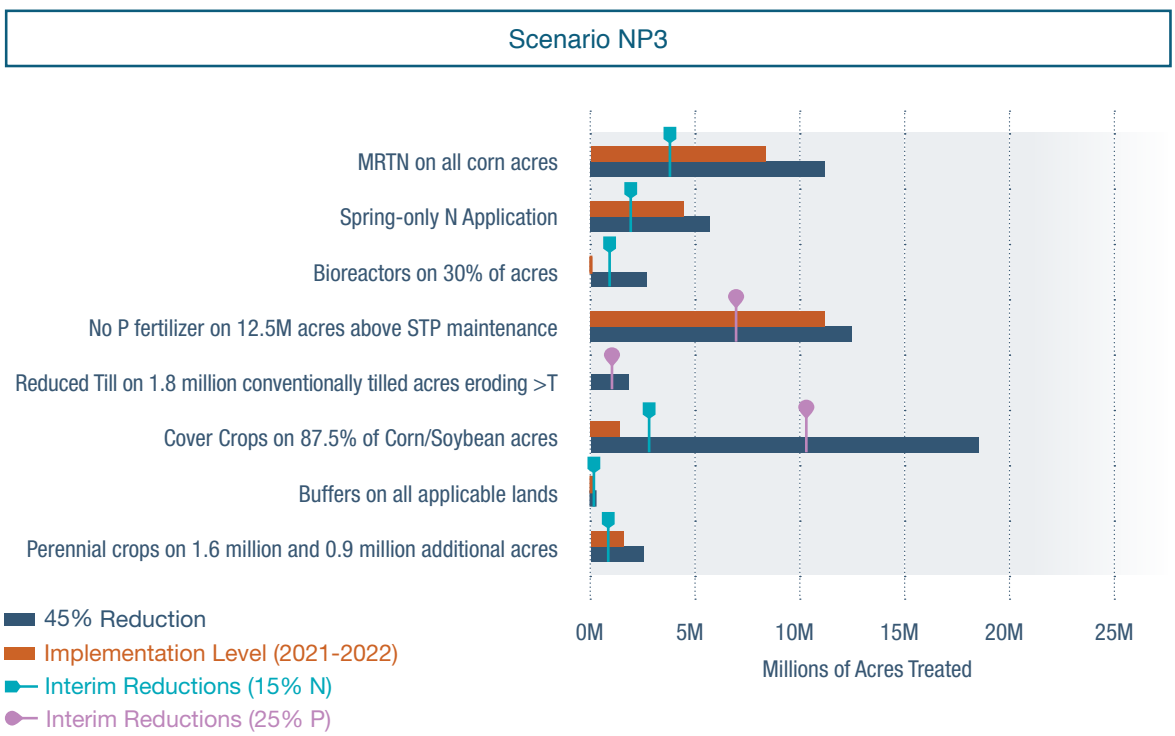


Figure 8.4. *Agricultural implementation as compared with scenario NP3*

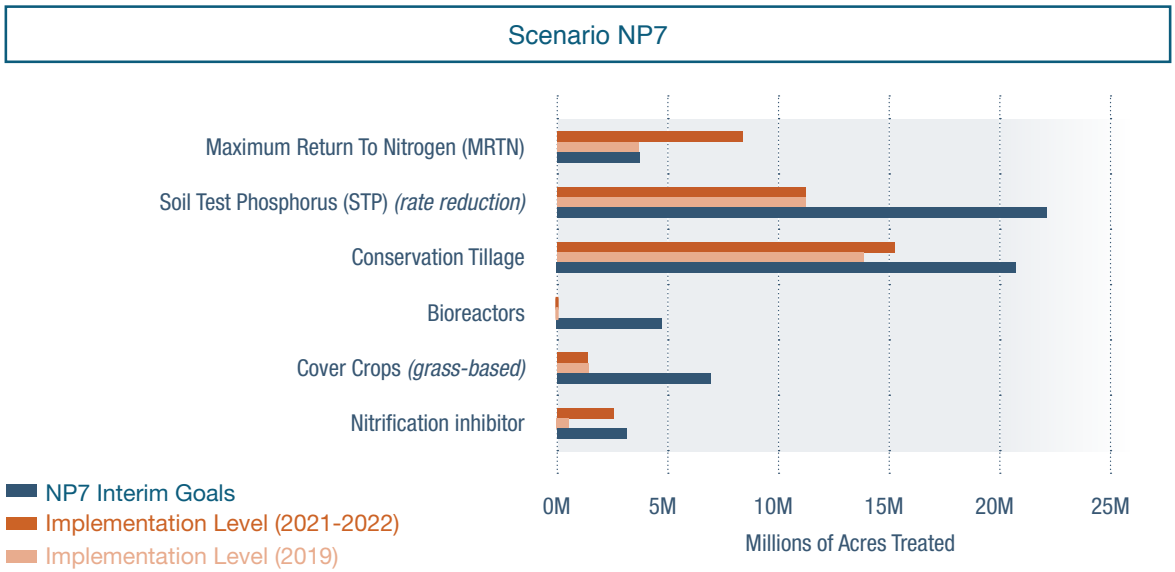


Figure 8.5. *Agricultural implementation as compared with scenario NP7. Scenario NP7 represents the level of practice adoption needed to meet 2025 interim reduction goals.*

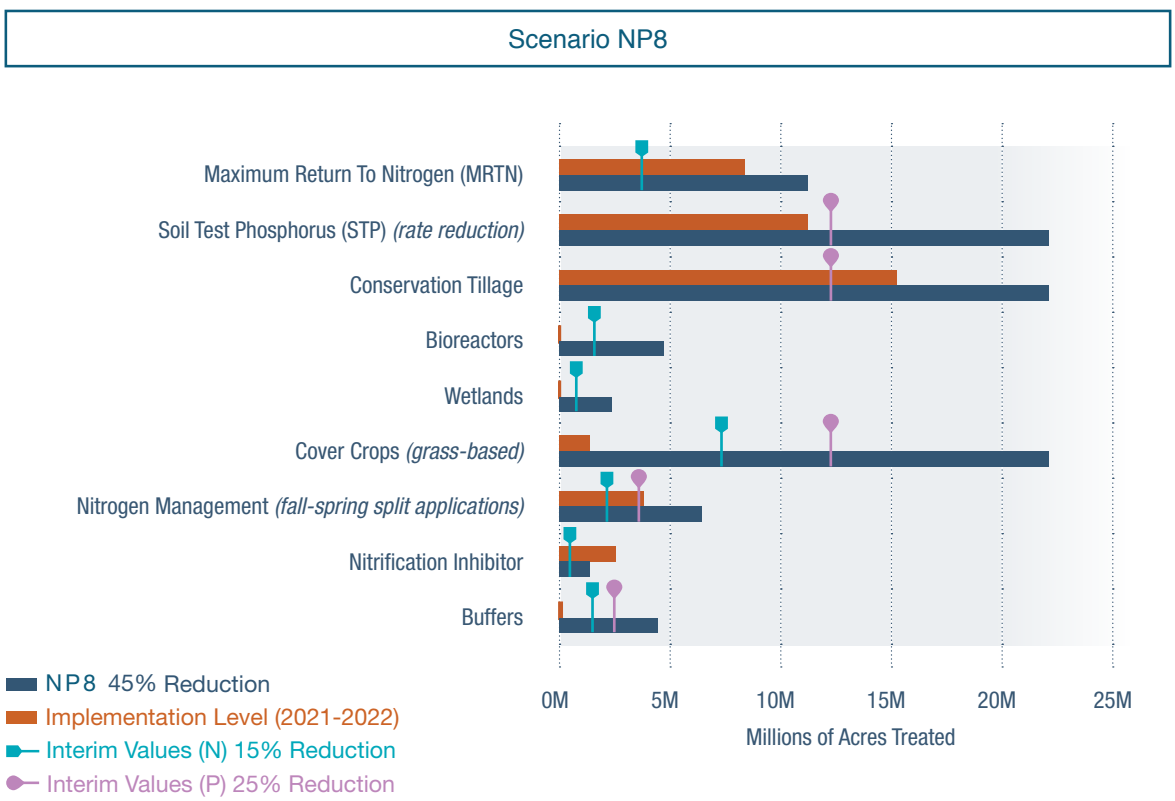


Figure 8.6. *Agricultural implementation as compared with scenario NP8*

Point Source Implementation Progress

The state's strategy to reduce total phosphorus discharges from point sources was initiated through an agreement with the Illinois EPA, the Illinois Association of Wastewater Agencies, and a coalition of environmental groups. The intent of the agreement is to improve and protect water quality in local, in-state streams and rivers downstream of point source discharges. The terms of the agreement are currently being implemented through the National Pollutant Discharge Elimination System, NPDES, permit program. Meeting NLRS goals to reduce Illinois' nutrient loads to the Gulf of Mexico is a mutual, secondary benefit of the agreement. The 34% reduction of total phosphorus loads from point sources discussed in chapter 5 is primarily due to previous NPDES permit conditions affecting new or expanded major municipal treatment facilities, facility optimization, and facilities' adoption of new technologies Likewise, point source facilities required to develop a Nutrient Assessment Reduction Plan will result in even further total phosphorus load reductions from the point source sector.

Figure 8.7 displays annual total phosphorus loads for 2018-22 from the point source sector compared to the 2011 baseline loads. An interim goal of the NLRS is for each sector to reduce its total phosphorus load by 25% by 2025. The point source sector achieved this goal in 2021 with a 31% reduction and in 2022 with a 34% reduction.

The bars on the far right of Figure 8.7 are estimates of future point source loads if all major municipal facilities were meeting 1 mg/L and 0.5 mg/l total phosphorus concentrations in their discharge. These estimated loads are based on each facility's 2022 discharge flow data calculated using total phosphorus concentrations of 1.0 mg/L and 0.5 mg/L. As noted in chapter 5, 46 facilities had total phosphorus annual average concentration at or below 0.5 mg/L in 2022.

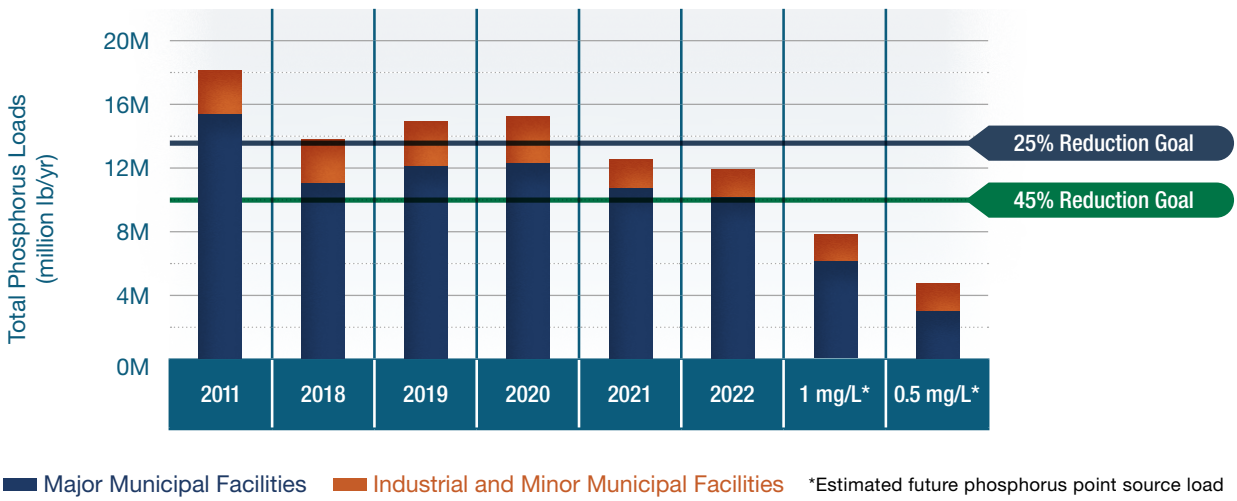


Figure 8.7. *Total phosphorus point source load relative to the 2025 interim and long-term reduction goals*

NLRS Conservation Practice Evaluation Process Update

As discussed in chapter 3, the Illinois NLRS Science Team evaluates proposals to adopt new conservation practices and update practice performance efficiencies. Historically, proposal evaluations occurred biennially, which limited the speed at which new practices could be added to the NLRS. In 2019 and 2021, proposal evaluations resulted in requests for revisions and resubmissions, which are requested when an initial proposal has insufficient evidence or when ongoing research has yet to be incorporated. Cooperation between partner applicants and the Science Team will continue to anchor the NLRS practice adoption process. Beginning in 2022, the NLRS conservation practice proposal submission and evaluation cycle shifted to an annual timeline to expedite NLRS practice adoption.

Watershed-Based Planning

Through technical and financial assistance, Illinois EPA encourages the development of watershed-based plans, WBPs, and the subsequent implementation of plan recommendations to protect and improve water quality. The U.S. EPA defines a WBP as a strategy that provides assessment and management information for a geographically defined watershed, including the analyses, actions, participants, and resources related to developing and implementing the plan. In addition to summarizing the overall condition of a watershed, a WBP provides an integrated, holistic framework to restore water quality effectively and efficiently in impaired waters and to protect water quality in other waters adversely affected or threatened by point source and non-point source pollution. While WBPs may address a variety of water quality concerns and have different water quality goals, their implementation will help Illinois meet its statewide nutrient loss reduction goals.

Illinois EPA's Section 319 and Section 604 grant funds have been used since the mid-1990s to support local watershed planning groups in developing WBPs in Illinois. WBP development and implementation in Illinois is voluntary. It is imperative that local stakeholders are involved in the plan's development so that they will implement the local recommendations as soon as the WBP is complete. Most WBPs in Illinois have a 20-year implementation schedule and have identified a vast number of resources required for success.

Since 2004, 143 WBPs have been developed. The Illinois EPA considers WBPs more than 10 years old to be a low priority for implementation, as they are less current than newer WBPs.

WBPs must be updated to remain eligible for Section 319 grant funds; however, the information regarding pollutant load reduction targets is still appropriate to support the NLRS.

Table 8.6 shows the pollutant load reduction amounts that could be realized as estimated in the WBPs. These estimates reflect reductions that could be achieved if all components of the WBPs are implemented.

Table 8.6. *Pollutant load reduction if all components of the watershed-based plans, WBPs, were implemented*

	WBPs Since 2004	WBPs Under Development	WBPs (Outside Source) Under Illinois EPA Review
Number of Plans	138	6	4
Nitrogen (lb/yr)	20,002,652	TBD	TBD
Phosphorus (lb/yr)	3,563,058	TBD	TBD
Sediment (tons/yr)	1,668,817	TBD	TBD
TSS (lb/yr)	28,635,716	TBD	TBD

There are six additional WBPs currently under development using funds from the Section 319 and Section 604 grant programs. An additional four planning documents, created without Illinois EPA financial assistance, are currently under review by Illinois EPA to determine whether they qualify as approved WBPs. Watershed-based planning is strongly encouraged and is most successful when conducted as a grassroots effort led by local stakeholders addressing local water quality concerns. A WBP not only improves local water quality, but contributes to downstream improvements as well. Whether complete or in development, these WBPs are tracked through the Resource Management Mapping Service, available at www.rmms.illinois.edu. For more information about WBPs, go to epa.illinois.gov/topics/water-quality/watershed-management/watershed-based-planning.html.

Watershed-based planning is strongly encouraged and is most successful when conducted as a grassroots effort led by local stakeholders addressing local water quality concerns.

See Appendix B for a list of WBPs submitted to Illinois EPA since 2004. Figure 8.8 shows the location of most of the watershed planning efforts that have been reported to Illinois EPA.

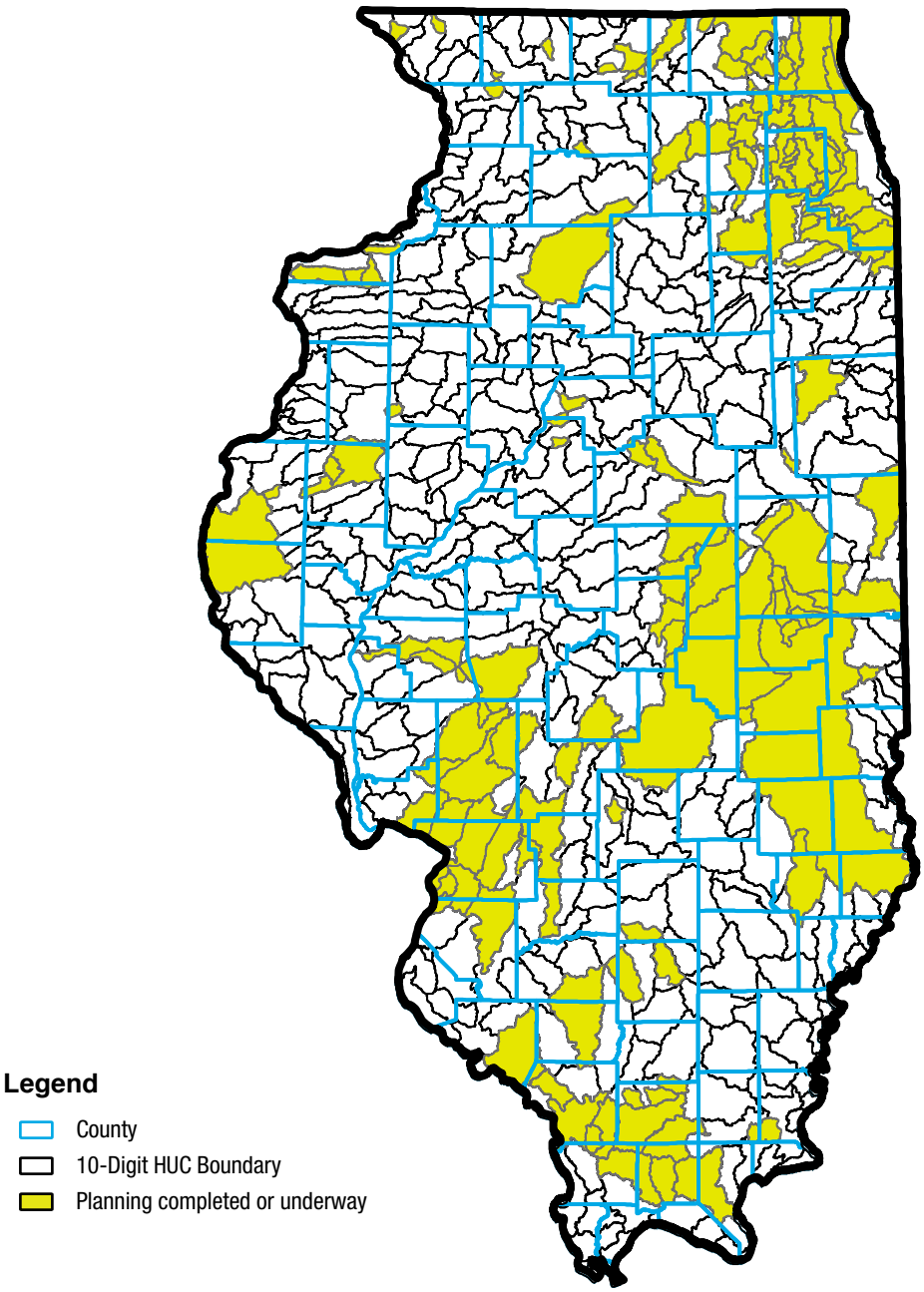


Figure 8.8. *Watershed planning efforts reported to Illinois EPA*

Looking Ahead
Future Strategy Considerations

The previous chapters in this biennial report demonstrate the continued implementation of the Illinois NLRS across the agriculture, point source, and urban stormwater sectors. The water quality analysis provided in chapter 3 confirms that nutrient loads, particularly total phosphorus, continue to increase. To meet water quality goals, there is an urgent need to continue supporting work in nutrient loss research, education, outreach and technical assistance capacity, implementation, tracking methods and metrics.

Nutrient Loss Research

Streambank Contributions to Phosphorus Loss

Efforts are underway to improve methodology and measurement of streambank erosion contributions to non-point phosphorus losses in Illinois. Preliminary studies led by University of Illinois researcher Andrew Margenot indicated that minor streambank and streambed erosion can contribute significant loads to waterways. Locating and quantifying streambank sources of phosphorus losses throughout the state will help account for non-point phosphorus sources not directly due to urban or agricultural soil erosion or fertilizer loss. The original NLRS simplified phosphorus sources into agriculture and urban stormwater as non-point source contributors. Studies funded by the Nutrient Research & Education Council, NREC, and Illinois EPA are underway to measure statewide streambank erosion contributions to phosphorus losses in Illinois. Illinois-specific research on legacy phosphorus contributions from streambanks may reshape expectations about the magnitude and timescale of non-point phosphorus loss reduction in Illinois.

Watershed-Specific Research

The importance of watershed-specific research cannot be overstated. Research on watershed-level nutrient loads paves the way for local strategy and stakeholder coordination. Watershed-led networks are needed to expand awareness of watershed issues, maintain trust, expand outreach, and enhance implementation capacities. Recent research in the Rock River and Illinois River should continue to relate controllable and uncontrollable variables to water quality measurements. This information can shape local strategy in these watersheds.

Nutrient Research & Education Council Efforts

NREC investments in research related to 4R Strategy, cover crops, edge-of-field practices and phosphorus will continue to be an important interface among producers, industry, and academia to ensure the discovery and adoption of practices that address environmental concerns, optimize nutrient use efficiency in agricultural production, and sustain soil fertility.

Non-Government Organization Research

Several non-government organizations, NGOs, conduct research on nutrient loss reduction in the agricultural sector. Statewide in 2021-22, NGOs reported investments of $6.8 million in nutrient loss-related research. Furthermore, the NLRS working groups and biennial reporting efforts assist in guiding NGO research-related partnerships and investments.

Human and Financial Resources for Implementation

The implementation of practices that reduce nutrient loss across all sectors is paramount to Illinois' strategy to meet water quality goals. The scale and pace of adoption of recommended conservation practices must improve. The benefits of nutrient reducing conservation practices — along with other co-benefits — could be further integrated into formal and non-formal education and professional training workshops. Many forms of education and outreach can translate to enhanced and sustained technical assistance capacity in Illinois. Training technical assistance providers takes many years. There is currently a statewide shortage of trained staff across agencies, which is a challenge to meeting the demand for practice implementation. At the writing of this report, an Illinois Department of Agriculture, IDOA, and Natural Resources Conservation Service, NRCS, partnership was initiating a three-year, statewide, capacity-building initiative to train and integrate 40 new conservation planners to provide technical assistance for agricultural practice implementation efforts. Furthermore, Illinois NRCS was advertising 40 additional NRCS Soil Conservationist positions statewide at the writing of this report. These hiring and training initiatives will boost knowledge sharing and networking, partnerships, and implementation of nutrient reduction practices that can be carried on to future generations of stakeholders.

Conservation funding levels have been unable to keep up with the demand for conservation practice implementation, as noted by U.S. Department of Agriculture Environmental Quality Incentives Program, EQIP, and Conservation Stewardship Program, CSP, backlogs totaling over $60 million estimated from 1,440 unfunded applications statewide. In 2022, the federal Inflation Reduction Act authorized more than $19 billion of funding for EQIP, CSP, and Regional Conservation Partnership Program conservation programs through 2031. This is an unprecedented flow of funding to conservation. These resources will help address Illinois' existing backlogs of needs for conservation technical assistance, financial assistance, and implementation.

In addition to continued capacity needs, partners have identified a need to coordinate messaging about the multiple technical and financial assistance opportunities from various state, federal, and non-government sources and about cost-share, pricing, and profits that can be realized through conservation implementation.

Adopting new conservation practices can come with substantial costs. For successful implementation of these practices across Illinois agriculture, the process needs to be approachable and make financial sense.

Conservation planning technical assistance providers emphasize that awareness of barriers and coordinated messaging is key to assisting producers. Many producers seek information on how to integrate conservation practices into their agricultural operations, with a particular interest in cover crops, tillage, and nutrient management. Those that focus on maximizing net farm income over maximum yield are more likely to try conservation practices with limited or no cost-share. Other producers are more apprehensive about trying practices where they do not see a direct financial return, such as with edge-of-field practices or cover crops, and may need an additional financial incentive. These middle-late and late adopters can be discouraged by the yield drag experienced from cover crop adoption and do not use them long enough to see soil health benefits since it may take several years to notice these benefits. Rising input prices also may impact farmers' ability or willingness to implement conservation practices. The turbulent farm economy and the current tight margins make it hard for producers to take on the additional risk and cost of conservation practices. Additional focus on research that links conservation implementation to economic and yield benefits could help increase practice adoption. Coordinating messaging about the multiple technical and financial assistance opportunities and about cost-share, pricing, and potential profits will be important to important to impacting farmer adoption of conservation practices and management methods.

The point source sector continues to need additional resources to implement nutrient controls that will reduce total phosphorus. As reported in chapter 5, substantial drops in major municipal phosphorus discharges are expected by 2030. Also, as Nutrient Assessment Reduction Plan, NARP, plan components are implemented, progress will continue over several years. As target reductions for total phosphorus are achieved by major municipal wastewater treatment facilities, strategy for maintenance will become more important. Point source facilities can experience difficulties even after new nutrient removal technologies have been installed. It is important to note that nitrogen reductions are also being achieved through some types of targeted phosphorus reduction strategies.

Urban stormwater technical assistance capacity and implementation requires professional training focused on green infrastructure design, installation, maintenance, and tracking to optimize projects and enhance long term success of projects and of nutrient loss benefits. Also, with enhanced human and financial capacity, green infrastructure systems, rather than isolated projects, could be better coordinated within communities.

Tracking Methods and Data Sources

Methods for improving and refining the tracking of agricultural conservation practice implementation and the benefits from nutrient reduction should continue. As summarized in chapter 4, nutrient management data collection is improving through the USDA National Agricultural Statistics Service and Illinois' first Illinois Ag Retailer Survey. This survey aims to track nutrient management at 150 locations throughout Illinois with 10 questions per location, resulting in 1,500 data points. Results will be available later in 2023. Also, statewide aggregated metrics of grass buffer and tillage practices are improving as satellite imagery

analyses methods are developed. Future areas of metrics collection improvement may involve statewide aggregates of structural practices, such as water and sediment control basins and terraces using satellite imagery. Metric collection on Hydrological Unit Code 8, HUC 8, HUC 12 or other subwatershed scales could also improve strategy planning in subwatersheds.

Expanding the tracking of nutrient load reductions from conservation practices will be an ongoing need. State data sources such as the Illinois EPA 319 grant program, along with IDOA's Partners for Conservation, PFC, programs, track estimated nutrient load reductions associated with each implemented practice. Other state, federal, and NGO data sources used for tracking could potentially adopt methods to estimate nutrient load reductions, measured by pounds of nutrients reduced per acre, for each practice implemented. While the ultimate objective is the achievement of water quality goals, there is also value in documenting nutrient reduction estimates that are associated with implemented agricultural conservation practices. This data would provide a more complete picture of the water quality benefits provided by these practices.

Urban stormwater managers continue to improve the tracking methodologies for green infrastructure practices statewide. Successful inventory methodologies and sustained tracking efforts can improve. This could result in better information to use when managing local water quality and enhance awareness and behaviors related to environmental stewardship in populated areas. Tracking metrics can translate to enhanced support for urban sector practice implementation staffing, tools, and resources.

Continued research and development, education and outreach, implementation capacity, technical and financial capacities, and tracking capabilities remain important components of all sectors as we consider future strategies. As already demonstrated since the strategy's launch in 2015, an improved understanding of the variables affecting nutrient loss in our waterways leads to the knowledge, tools, and skills exchange necessary to implement practices that lead to improved water quality.

Climate Change and Its Impact on Nutrient Management and Practices

The last few years have thrown agricultural producers and landowners across Illinois a curveball in terms of weather patterns. From drought in 2012 across much of the Corn Belt to excessive moisture affecting spring planting and fall harvest over the past several years in many regions, the only constant in the weather is that it is going to change and have a direct impact on land management practices.

Historical trends and model projections for this century indicate significant increases in precipitation and rainfall intensity across Illinois, portending an increased potential for soil erosion and nutrient runoff. As climate change accelerates its direct impact on nutrient loss, ambitious and effective action, now more than

ever, is critical and urgently needed to address the impacts and future risks of climate change. Recent momentum behind state and federal government climate commitments is encouraging. However, translating the recent political momentum toward climate policy and resources to adapt to climate change into implemented practices is a long-term challenge.

The scope of NLRS under climate change is vast and encompasses a wide range of practices and strategies aimed at maintaining soil health, conserving water, and reducing nutrient losses. Key areas of sustainable nutrient management that can have a significant impact include crop productivity, reducing production costs, and minimizing the environmental impacts of agriculture, such as greenhouse gas emissions and water pollution. Producers and landowners can improve soil health, conserve water, and reduce nutrient losses by adopting practices such as crop rotation, cover cropping, conservation tillage or no-till, and precision nutrient management.

As such, understanding the mechanisms by which crops, producers, and landowners respond and adapt to these new environmental challenges is crucial to developing adaptive strategies for maintaining agricultural productivity and ecosystem services. To raise awareness and stimulate research interest, an interdisciplinary effort is needed to focus on how nutrient loss reduction strategies interact with climate change. This understanding will help us achieve NLRS goals, increase producer productivity, and sustain the state's most valuable natural resources of land and water.

Efforts should be forward-focused on conservation climate-related practices that will directly translate to on-the-ground biodiversity conservation efforts that:

1. Minimize current and future climate change impacts through reductions in greenhouse gas emissions, and;

2. Mitigate climate change impacts by increasing carbon sequestration in the soil and water retention capacity.

Specific efforts should be aimed at comprehensive approaches that consider climate change, conservation, and the health of agroecosystems.

Integration of research impacts of climate change into nutrient loss planning will be increasingly important. Currently, climate discussions, information exchange, and planning mainly focus on carbon sequestration and emissions. However, soil health and nutrient loss reduction could become a larger part of the climate focus. Partnerships in Illinois have initiated several programs and tools to bring climate change awareness and practice implementation incentives to the agricultural sector. These include climate-smart initiatives and commodities programming for cover crop adoption and carbon markets. The Illinois Climate Assessment is also now

available. Looking ahead, Illinois partners have begun discussions around climate planning for natural working lands. Such a plan would integrate nutrient management, soil health, carbon sequestration and greenhouse gas emissions to make all of these components significant in climate messaging.

The Climate-Smart Partnership, launched in 2021, will encourage and incentivize Illinois producers to voluntarily adopt biodiversity-building and regenerative farming practices, natural areas conservation, and water and energy use efficiencies improvements. Implementation of these activities will reduce the amount of sediment, nitrogen, and phosphorus loading into the Mississippi River Basin waters, limit carbon release, and expand carbon capture. The partnership aims to raise awareness of these co-benefits through outreach methods, including training opportunities that advance the awareness of the quantifiable nutrient and greenhouse gas reductions that can be realized by implementation of climate-smart agricultural practices.

Disadvantaged Communities

Over the past several years, the U.S. EPA and Illinois EPA have emphasized the importance of prioritizing investments in disadvantaged communities. On January 27, 2021, President Biden issued Executive Order 14008 - Tackling the Climate Crisis at Home and Abroad, and announced Justice40, which mandates that at least 40% of the benefits of certain federal programs must be invested in disadvantaged communities. In July 2021, the U.S. EPA received interim guidance to support implementation of the Justice40 pilot for six programs. Since then, the U.S. EPA has expanded the number of applicable programs beyond these initial six, including programs funded by the Bipartisan Infrastructure Law, BIL, that match the criteria for Justice40. The U.S. EPA is focusing on these pilot and BIL-funded programs as the first phase of full Justice40 implementation at U.S. EPA. The U.S. EPA is also in the process of developing benefit methodologies to track and report the benefits going toward disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This information was provided by the Justice40 program website at www.epa.gov/environmentaljustice/justice40-epa.

As discussed earlier in this report, Illinois EPA will use funding from the Gulf Hypoxia Program to develop a new cost-share program that will invest in non-point source practices that reduce nutrient loss as recommended in the NLRS. The program will prioritize source water protection areas within watersheds that have an approved watershed-based plan or approved total maximum daily load for nutrients, within areas that will benefit disadvantaged communities. Illinois intends to use the U.S. EPA Justice40 Interim Disadvantaged Communities Indices developed utilizing the EJScreen methodology, using the 80th percentile coverage for the purpose of defining disadvantaged communities in Illinois. The U.S. EPA has provided Illinois EPA with data detailing the disadvantaged community geographic area and associated populations both statewide and on a HUC-12 watershed basis within existing NLRS priority watersheds.

Cross Sector Partnerships and Goals Alignment

To address the resource needs of the NLRS, cross-sector partnerships can bring together companies, government, the finance sector, and the public to leverage shared resources, networks, expertise, technology, and human capital to solve today's biggest nutrient loss, conservation, and climate change challenges. While the agricultural sector has reported modest increases in conservation activities in the NLRS biennial reports since 2015, Illinois needs elevated partnerships to secure sustainable and extended funding to get enough conservation farming practices on the ground to stem the flow of nutrients from the land. Particularly, Illinois needs a long-term strategy that guides tactics moving forward and aims to advance the landscape changes and farming practices needed on the ground, not just an overview of the number of acres of each practice needed.

These kinds of highlighted data points make it clear that addressing the scope of the challenges facing conservation efforts across the state will require concerted action on a much larger scale than has happened to date. However, concerns over climate change, soil health, and limited or reduced conservation staffing capacity have historically received limited attention in favor of short-term growth over longer-term resilience. Conservation challenges are increasingly complex and comprised of multi-faceted social, institutional, and ecological factors at a local to global scale.

Conservation efforts in Illinois are challenging due to insufficient funding, and because much of the funding that is available is unstable over time. It's not just a matter of more money; conservation funding needs to take more of a collective action approach that pools funding from multiple sources, helps direct it toward the best models based on results and impact, and provides a more compelling case for both private and public investment. Successful conservation efforts require that Illinois scale up the best local models, build stronger statewide movements that can promote learning and influence policy, and catalyze greater and more effective funding. Yet, doing these things requires that we invest in strong and diverse collaborations that link state and national networks and resources to innovative and locally rooted conservation groups.

Two such approaches are the U.S. EPA's 2022 memorandum, Accelerating Nutrient Reductions in the Nation's Waters, and the United Nation's Sustainable Development Goals.

- In the 2022 memo, the U.S. EPA laid out strategies to drive continued reductions in nutrient pollution by deepening the Office of Water's collaborative partnerships with agriculture, redoubling efforts to support states to achieve nutrient reduction goals, and utilizing the EPA Clean Water Act authorities to drive progress, innovation, and collaboration. They also state governing principles, many of which already align with our strategy. These include equity and environmental justice,

building and fostering partnerships, following the science and investing in data-driven solutions, supporting innovation, and scaling up successful initiatives. Keeping this in mind as we move forward may help secure funding and create win-win situations throughout local, state, and federal government agencies.

- Also, in response to the increasing urgency of ecological risks, governments and major companies are proposing bold rules and policy establishment making aggressive sustainability, climate, and biodiversity conservation commitments that align with the United Nation's Sustainable Development Goals and global priorities. Such commitments from the public and private sectors, if realized, have the potential to change the Illinois NLRS trajectory.

To reduce nutrient loss, build resilient soils, and adapt to climate change, conservationists within the Illinois agriculture industry could usher in a new era of collaboration that stabilizes and leverages fiscal resources, best practices, and most of all, conservation staffing capacity.

Future Needs and Resources to Achieve Nutrient Goals

Achieving nutrient loss reduction goals requires significant capital, personnel, and technological investment from all sectors. The Policy Working Group has identified areas for future investment to continue progress toward the 2025 milestones and the long-term 45% reduction goals. The Performance Benchmark Committee members have identified the following sectors and partnerships as those that will advance Illinois' progress.

The following list of resources have been secured. Some are subject to annual appropriations.

Agricultural Resources

Federal Financial Assistance Programs

Gulf Hypoxia Program Funding

The federal Bipartisan Infrastructure Law, passed in November 2022, provides $60 million, distributed as $12 million per year for five years, for actions that support the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force's Gulf Hypoxia Action Plan. Through the Gulf Hypoxia Program, Task Force member states, Tribes, sub-basin committees, and Land Grant University stakeholders will have the resources to make significant progress toward reducing nutrient loads. Table 8.7 displays the annual funding levels for Gulf Hypoxia Program recipients.

Table 8.7. *Gulf Hypoxia Program recipients and annual funding levels*

	FY22 $	FY23 $	FY24 $	FY25 $	FY26 $
State Annual Total	11,580,000	8,980,000	8,980,000	8,980,000	11,580,000
Each State (Total/12)	**965,000**	**748,333**	**748,333**	**748,333**	**965,000**
Eligible Tribes	–	2,000,000	2,000,000	2,000,000	–
Sub-Basin Committees	–	400,000	400,000	400,000	–
Land Grant University Consortium	–	200,000	200,000	200,000	–
EPA 3% Set Aside	360,000	360,000	360,000	360,000	360,000
EPA 0.5% Inspector General Set Aside	60,000	60,000	60,000	60,000	60,000

Source: www.epa.gov/ms-htf/gulf-hypoxia-program

The U.S. EPA released guidance on applying for GHP funding to Task Force states on June 9, 2022. States were required to submit workplans to U.S. EPA by July 26, 2022. The guidance included five strategic outcomes that must be included in each state workplan:

1. Support staff to implement the work plan
2. Reduce non-point source nutrient pollution as articulated in state strategies
3. Prioritize and target watersheds with the greatest opportunities for nutrient reductions
4. Collaborate across state boundaries with Hypoxia Task Force partners
5. Use state-level water quality programs and actions to better support nutrient reductions.

Priorities of the guidance also emphasized that benefits are realized by disadvantaged communities.

The Illinois EPA submitted a workplan for the first two years of funding. Table 8.8 details the workplan's seven projects to advance the implementation of the Illinois NLRS by creating new initiatives and scaling up existing programs. Projects include water quality monitoring in surface and groundwater, agriculture conservation practice implementation, watershed education and outreach, data metrics collection, and nutrient strategy update and reporting, with an emphasis on benefiting disadvantaged communities.

Table 8.8. *The Illinois EPA Gulf Hypoxia Program Workplan summary*

FY22 Funding	
Projects	Project Description
Priority Watershed outreach and watershed planning	Watershed outreach associates provide technical assistance and information regarding the implementation of agriculture conservation practices and urban stormwater best management practices to local organizations and stakeholders. This includes assisting local soil and water conservation districts, civic organizations, watershed groups, and individual landowners. Educational programming includes presentations at field days, trainings, workshops, and watershed meetings. Podcasts will be developed, focusing on agriculture and urban stormwater conservation practices recommended in the NLRS.
Continuous Nutrient Monitoring Network	Operation and maintenance of nutrient data collection at eight U.S. Geological Survey continuous monitoring stations in Illinois collect data that will be used to characterize nutrient concentrations and compute constituent loadings exported from annual data summaries that will be provided in a formal, citable report written in the final year of the project. In addition to the load computation using the surrogates, USGS will complete Weighted Regression on Time Discharge and Season modeling for total phosphorus loads and linear interpolation for nitrate loads at the eight sites.
Fall Covers for Spring Savings Program	IDOA's Cover Crop Premium Discount Program is offered for acres of cover crops installed outside of state and federal program incentives. Eligible applicants will receive a $5/acre insurance premium discount on the following year's crop insurance invoice for every acre of cover crop enrolled and verified in the program. GHP funds will provide 40,000 acres in addition to the 100,000 acres allocated by IDOA.
Groundwater nitrate monitoring	IDOA administers the state's Groundwater Monitoring Well Network to monitor pesticide levels in shallow groundwater. The monitoring network currently consists of 133 shallow groundwater monitoring wells located throughout the state. All wells are in public rights-of-way adjacent to row-crop fields and are installed in areas where aquifer materials occur within 50 feet of land surface. Each well is sampled once during a two-year period. In 2000, the IDOA expanded the monitoring program to include testing for nitrate concentrations. However, due to state funding cuts, the nitrate analysis was terminated in 2014. Funding from GHP will be used to purchase nitrate analysis equipment to resume collecting data for nitrate concentration in groundwater.
2023 Biennial Report development	The NLRS 2023 Biennial Report is developed to inform the public on the state of Illinois' progress toward implementing the NLRS. The report serves a dual purpose to detail implementation activities and to update the NLRS so that it functions as a living document.

FY 2023 Funding	
Projects	Project Description
Continuous Nutrient Monitoring Network	*See Continuous Nutrient Monitoring Network description*
Fall Covers for Spring Savings Program	*See Fall Covers for Spring Savings Program description*
Illinois Ag Retailer Survey	A survey will be conducted at agricultural retail facilities to collect data on the implementation of nutrient management practices in Illinois following the 4Rs of nutrient management: right rate, right time, right place, and right source. The methodology will be based on the survey used by the Iowa Nutrient Research and Education Council to support Iowa's nutrient reduction strategy.
NLRS Implementation in Priority Watersheds	A new funding program will be established to implement non-point source best management practices that address nutrient loss. Eligible practices will include those recommended in the NLRS, such as in-field and edge-of-field agriculture conservation practices and urban stormwater green infrastructure practices. Funding will be focused on priority watersheds listed in the NLRS, with an emphasis on source water protection areas (public water supplies) serving disadvantaged communities. There is potential for subawards to Soil and Water Conservation Districts to help private landowners implement recommended conservation practices through a competitive application process.

The Illinois EPA intends to submit a second work plan to the U.S. EPA in 2024 to support projects that will use FY 2024-26 GHP funds.

Inflation Reduction Act

In addition to EPA's Bipartisan Infrastructure Law, BIL, Gulf Hypoxia Program funding, the Inflation Reduction Act, IRA, provides nearly $20 billion dollars nationwide over the next 5 years for greenhouse gas mitigation and carbon sequestration through EQIP, CSP, RCPP, and Agricultural Conservation Easement Program, ACEP. It also reauthorizes CRP and provides $1 billion for Conservation Technical Assistance. Future strategic actions must factor in the uncertainties of 2023 Farm Bill reauthorization as well as the potential opportunities provided by IRA. This historic funding is expected for FY23-26.While it is climate mitigation focused, there is strong overlap between some NLRS practices and EQIP-IRA, CSP-IRA etc. eligible practices.

State Financial Assistance Programs

Partners for Planning and Conservation Funding

Partners for Planning and Conservation Funds are used to establish comprehensive programs to protect Illinois' natural resources through cooperative partnerships between state governments and public and private landowners. Illinois legislation to support the program was signed into law in 1999 as the Partners for Planning and Conservation 2000 Fund and extended from 2008-21 under the Partners for Conservation, PFC, label. In early 2022, the Partners for Nutrient Loss Reduction Act proposed as SB 3471, sought to provide sustained funding for Soil and Water Conservation Districts, SWCDs, and to coordinate public and private entities around the NLRS, but it did not pass. In late 2022, the Partners for Conservation Reauthorization Act, SB 1701, was passed and will extend to 2033. The Act included:

- Environmental protections related to conservation and water quality;
- Soil and water conservation programs returned to near-level funding after threats of a 50% cut earlier in the 2022 Governor's proposed budget;
- Authorization of allocations to the Partners for Conservation Fund. Allocation sizes will continue to require annual conversations and negotiations within the state legislature;
- The Healthy Soils Initiative supporting sustainable agriculture. At the writing of this report, it was not clear whether the Healthy Soils Initiative would be funded through PFC allocations;
- Sustained levels of funding for open space conservation and acquisition.

It is important to note that while the 2023 Partners for Conservation Reauthorization Act, SB 1701, allocated $18 million to the PFC Fund, it is unknown whether this allocation is specifically related to supporting new initiatives as outlined in the Act. Also, while the amount reflects an increase in funding sourced from the General Revenue Fund, up from $14.4 million, it is similar to the amounts that have funded SWCDs in the past two fiscal years. During the past two years, the State of Illinois transferred Budget Implementation Bill funds added $4.1 million in Fiscal Year 2022 and $5.9 million in FY23 to the $14.4 million from the General Revenue Fund.

The levels of state funding for conservation through the PFC program since the 2011 baseline are provided in Figure 8.9.

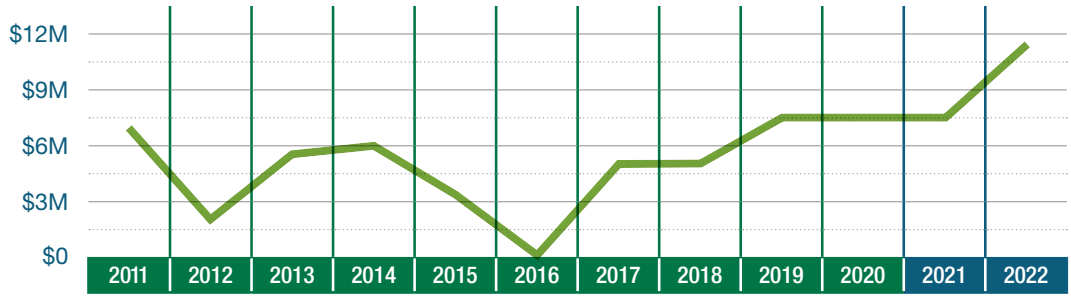


Figure 8.9 *Partners for Conservation cost-share funding since 2011 baseline. See Appendix G for companion data.*

Fall Covers / Spring Savings Program

Cover crop implementation has been steadily growing. Yet, implementation is at about 6% of that needed to meet the 45% nutrient reduction goal outlined in ag implementation scenario NP8. One program that has been very successful in moving cover crop implementation forward is the Fall Cover for Spring Savings program, which is funded through General Revenue Fund, separate from the PFC funding. In FY23, the appropriation was $660,000. In addition, the Gulf Hypoxia Program funds have provided a supplement to this program. However, demand continues to outpace the supply of funding. There is a backlog of over-prescribed acres, or acres in unfunded applications, for this program as of FY22. Partners should continue advocating for increased funding for this program and its expansion since this program has been a key tool for implementation of cover crops and for meeting strategy goals. Figure 8.10 shows both the growth of funded acres in this program since 2019 and that the acres submitted in applications far outpace the funding available each year. Table 8.9 shows the totals of over-prescribed acres since 2019. During 2021-22 significant headway was achieved by investments from the Gulf Hypoxia Program and unused federal funds from previous application periods.

Table 8.9 *Over-prescribed acres in the Fall Covers for Spring Savings program since 2019*

Year	Over-prescribed acres
2019-20	83,383
2020-21	81,383
2021-22	72,652
2022-23	22,688

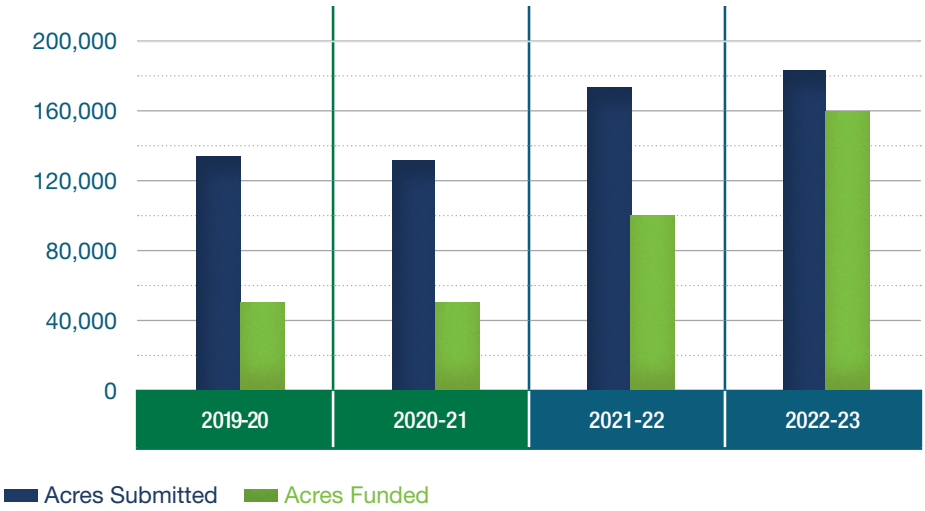


Figure 8.10 *Acres submitted to and funded by the Fall Covers for Spring Savings program since 2019*

Soil and Water Conservation Districts

A network of 97 Soil and Water Conservation Districts serve Illinois' 102 counties, providing a planning and distribution mechanism for IDOA's PFC program and Streambank Stabilization and Restoration Program, SSRP, which are state cost-share funds with which to implement agricultural conservation practices and urban stormwater practices. SWCDs also provide ongoing technical and administrative assistance to the U.S. Department of Agriculture to implement federal Farm Bill conservation programs through partnering with NRCS to help administer the EQIP, CSP, and Wetland Reserves Enhancement Program. They partner with Farm Service Agency to help administer the CRP, Conservation Reserve Enhancement Program, CREP, and State Acres for Wildlife Enhancement. They also partner with the Illinois Department of Natural Resources, IDNR, to administer and monitor the long-term IDNR CREP easements. SWCDs work with U.S. Fish and Wildlife Services to provide the Landowner Incentive Program and Habitat and Forestry Management Program. SWCDs also partner with the U.S. Army Corps of Engineers, U.S. EPA, and numerous grant and landowner payment programs administered by not-for-profit organizations.

A Conservation Capacity Building Initiative, administered by IDOA in partnership with Illinois NRCS, is underway to enhance capacity of SWCD and NRCS services statewide. This initiative, representing a total financial investment of $12.9 million, is training and employing 40 additional staff dedicated to agricultural conservation planning efforts across Illinois. With hiring started in 2022, the training and practice implementation goals of this three-year, capacity-building project are set to impact the pace of NLRS practice implementation in Illinois.

In 2022, the state of Illinois invested $11.5 million in SWCDs. Increased funding for SWCD operations will allow SWCDs to fulfill their critical role of assisting landowners in adopting agricultural and urban conservation practices.

Wastewater Treatment Facility Upgrades

Major municipal wastewater treatment plants continue to spend billions of dollars as they strive to reduce total phosphorus loads while also meeting other National Pollutant Discharge Elimination System permit limits. As reported in chapter 5, 81 major municipal wastewater treatment plants now have permit limits of 1 mg/L total phosphorus. This represents four additional facilities with total phosphorus permit limits compared to the 2021 Biennial Report.

As more treatment plants initiate extensive construction projects every year, the need for continued funding is expected to remain high for the foreseeable future. Local governments require loans or cost-share grants to finance and construct nutrient-capture infrastructure at municipal wastewater facilities to reduce nutrient loads from point sources expediently. Additional costs will be incurred as facilities develop and implement NARPs. Facilities that are required to comply with limits beyond 0.5 mg/L will incur substantially greater costs per pound of phosphorus reduction, as the costs increase exponentially to remove the final pounds of any pollutant.

Stormwater Best Management Practice Adoption

Background

Increasingly, Illinois communities are turning to stormwater best management practices known as green infrastructure. Practices such as rain gardens and permeable pavement address flooding and water quality while helping to achieve compliance with Illinois EPA permits. Investment in green infrastructure can have significant benefits to local water quality. Events, websites, fact sheets, and other outreach resources help communities become aware of these practices and how to use them effectively. It is important to identify and catalog green infrastructure practices to have a full picture of implementation progress, which can inform the need for additional projects.

Progress

From 2021-22, Illinois made strides in advancing green infrastructure, including investment, education, and cataloging projects. Many green infrastructure installations would not be possible without funding initiatives such as the Illinois EPA's Green Infrastructure Grant Opportunity program. To help break down barriers to implementation, newly developed websites such as Illinois Groundwork, illinoisgroundwork.org, have reached audiences across Illinois with information that promotes and improves green infrastructure success.

Identifying and locating existing green infrastructure practices provides a better picture of implementation progress. University of Illinois Extension led an inventory tracking project that documented green infrastructure projects throughout the state. The information from the Green Infrastructure Inventory was added as a new stormwater layer to the existing Great Lakes to the Gulf Virtual Observatory map, available at GreatLakestoGulf.org/#/explore/all.

See chapter 6 for more information about the stormwater sector's progress.

Future Needs

The stormwater sector needs ongoing support in several areas. Support includes ways to expand capital funding grants to include maintenance, to encourage green infrastructure and set projects up for success, and to continue the statewide inventory.

While existing investment programs help to support the establishment of green infrastructure projects, much of the funding cannot be used for ongoing maintenance, which is oftentimes an overlooked need. Maintenance can be a challenge for many communities. Successful, well-maintained green infrastructure is both functional and beautiful, enhancing public spaces. Green infrastructure that is not maintained can fail, causing communities to avoid additional projects. Expanding funding programs to include maintenance, including training for staff, can help ensure that green infrastructure investment has long-term success.

Staff training about green infrastructure is a priority. While awareness remains an ongoing outreach need, going further to create, curate, provide and hone information about site design, installation, and maintenance to professionals can optimize projects. There is a need for outreach that expands approaches toward well-planned, coordinated green infrastructure systems within communities rather than isolated projects.

The Green Infrastructure Inventory requires funds for fees to house the data on the National Center for Supercomputing Applications' servers, to maintain and expand the data, and to develop a communications plan that encourages communities to participate. Maintenance costs are expected to be minimal. As partners in this sector participate in tracking of their organizations' stormwater practices, the inventory will be valuable as a regional tracking and planning resource.

Water Quality Monitoring

U.S. Geological Survey Continuous Nutrient Loading Network

Since 2015, the Illinois EPA has contracted with the U.S. Geological Survey to provide cost-share funding for operation and maintenance of the eight super gages. Each super gage continuously measures streamflow and nutrient data. Summary bulletins regarding network operation, including annual loading estimates, are developed after each full year of data collection. These super gages also provide direct monitoring and evaluation support for generating estimates of five-year running average loads of nitrate-nitrogen and total phosphorus leaving Illinois. As previously discussed in this report, the Illinois EPA will support this monitoring with Gulf Hypoxia Program funds starting in 2023 through 2026.

U.S. Geological Survey Illinois River Basin Next Generation Water Observing Systems

The U.S. Geological Survey selected the Illinois River Basin as an Integrated Water Science basin in fall of 2020, initiating a 10-year period of intensive study of the watershed and underlying aquifers through high-density monitoring and modeling of water quantity, quality, and use. It is anticipated that this research will provide insight into changes in nutrient loads, the sources of those loads, and how nutrient sources in combination with climate and land-use changes, may limit water availability. It could help clarify factors contributing to increased nutrient loading in the Illinois River Basin, the role of legacy nutrients, and the role of increased precipitation and runoff in nutrient loading. This information could impact future strategies for reducing nutrient loss.

Studies and efforts in 2021-22 have focused on stakeholder engagement, deploying monitoring equipment and super gages, discrete sampling of low-order streams and ditches, and remote sensing using satellite imagery. Monitoring will continue, and new data will be compiled on streamflow, evapotranspiration, snowpack, soil moisture, water quality, groundwater-surface water connections, stream velocity distribution, sediment transport, and water use. Modeling efforts will also continue to improve with data compilation as more data gaps are understood and filled.

Allocating resources to continue this program is recommended.

Illinois Environmental Protection Agency Monitoring Programs

The Illinois EPA continues to operate an Ambient Water Quality Monitoring Network, consisting of 147 fixed stations, to support surface water chemistry data needs. Integrated water column samples are collected and analyzed for a minimum of 55 universal parameters, including nutrients. Data from this network

continue to be used to calculate statewide nutrient loads. This monitoring program is crucial, not only to track nutrient load trends over time, but as the foundation for assessing individual waterbodies for the Illinois EPA Integrated Report and 303(d) List.

The Harmful Algal Bloom Program has two parts: Routine Monitoring and Event Response. Routine Monitoring is conducted at public-water-supply intakes, lake beaches, and Lake Michigan nearshore areas. Event Response investigates potential cyanobacteria blooms in lakes or streams where blooms may threaten public health. Toxin samples are sent to the Illinois EPA Division of Laboratories for analysis.

From January 1, 2021, to December 31, 2022, 1,496 routine cyanotoxin samples were collected from 73 waterbodies, and 413 Event Response samples were collected from 63 waterbodies. Additionally, samples were collected at 34 water treatment facilities including 413 raw tap and 429 finished tap samples. Toxins analyzed included microcystin, cylindrospermopsin, anatoxin-a, and saxitoxin.

Allocating resources to continue this program is recommended.

Illinois Department of Agriculture Nitrate Analyzer and Testing

In 1995, the Illinois Department of Agriculture contracted the Illinois State Geological Survey and the Illinois State Water Survey to construct a statewide dedicated groundwater monitoring well network. The monitoring well network, with 130 wells across the state, was designed to determine the regional impacts of agroecosystem non-point sources, rather than the impacts of site-specific point sources. This network provides statistically reliable estimates on the occurrence of selected pesticides and nutrients in groundwater within shallow aquifers in areas of corn and soybean production. Shallow aquifers are areas where the depth to the top of aquifer material is less than 50 feet below land surface. Well depths vary from 10 feet to 81.5 feet. Each well in the network is sampled once during a two-year period. The Illinois State Geological Survey and Illinois State Water Survey conducted a one-time sampling of the network beginning in the fall of 1998 and sampled the network from September 2000 through June 2001. The IDOA assumed responsibility for all sampling in July 2001 and continues the network sampling to date.

In 2014, the IDOA nitrate analyzer was decommissioned, and due to the state budget impasse, funding was not available to secure a new nitrate analyzer. In 2022, with funding from the U.S. EPA Gulf Hypoxia Program, the IDOA purchased a new nitrate analyzer to reestablish the monitoring of nitrates in groundwater as a critical element in effectively managing groundwater quality. Continuous monitoring of the nitrate concentration allows for the collection of a larger dataset in comparison to periodic or event-based sampling.

Monitoring efforts raise awareness that our groundwater resources may be impacted by nitrates due to factors such as proximity of nitrate sources, depth to groundwater surface, soil type, and well construction type. Monitoring and communication of monitoring efforts contribute to drinking water stewardship education and planning in watersheds. In this way, the public is enlisted as a partner in local, regional, and national water resources conservation issues.

Illinois NLRS Meetings and Reporting

The Illinois EPA continues to provide financial support to University of Illinois Extension to facilitate Policy Working Group and subgroup meetings as well as the development of the biennial reports. The structure of the policy working group, its subgroups, and committees provide a collaborative foundation for implementation of the Illinois NLRS. This work relies on ongoing investment in these activities. Likewise, the development of the biennial report is an important process for recognizing successes, providing updates, and noting new challenges and opportunities. Long-term resources supporting these activities ensure continued implementation of the strategy and water quality improvement in Illinois and beyond.

ILLINOIS
NUTRIENT LOSS
REDUCTION STRATEGY

Biennial Report
2023