



Illinois Nutrient Loss Reduction Strategy

2023 Biennial Report

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.

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 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.

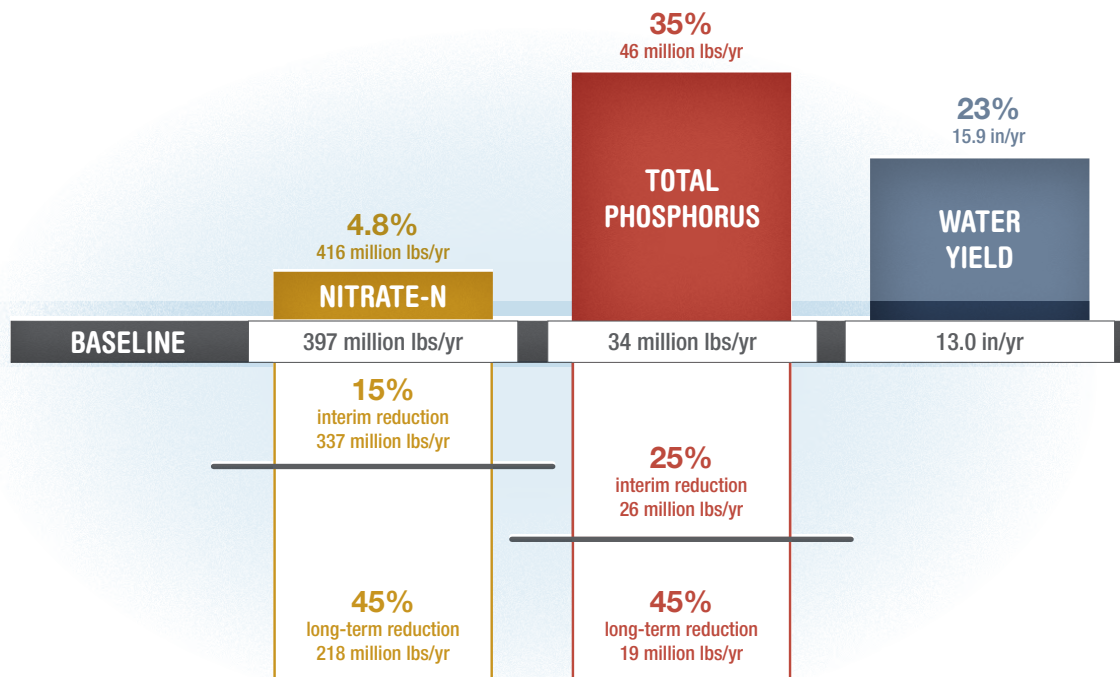


Figure 1.1 Quantities and percent increases of recent five-year averages (2017–21) of nitrate-nitrogen, total phosphorus, and water yield relative to baseline and to interim and long-term NLRS goals in Illinois.

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.

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.



“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.”

Agricultural Outreach:

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

10,000+
total downloads of the
Nutrient Loss Reduction
Podcast’s 48 episodes.



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 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.

55%

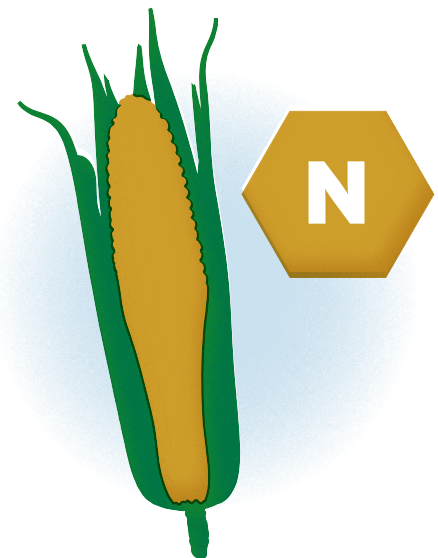
of farmers, a 28% increase from 2020, are somewhat to very knowledgeable about the NLRS.

– 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



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.

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

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

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.

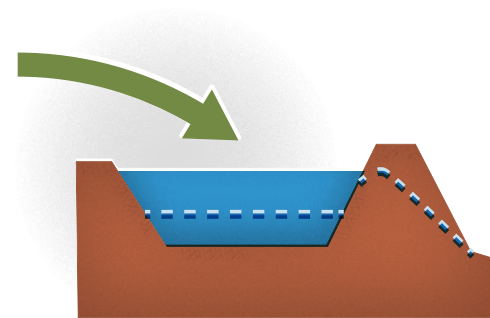
Point Source Sector

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.

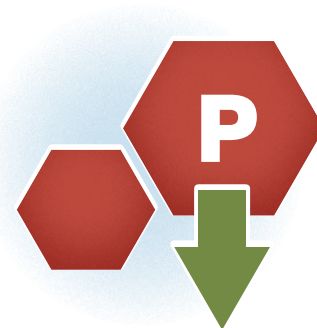
In 2021–22, the point source sector documented investments of over \$237.7 million to further reduce total phosphorus loads. This included \$191.8 million allocated to 13 projects funded by the Water Pollution Control Loan program. This low-interest loan program is offered by Illinois EPA through the 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.

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.



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.

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

101

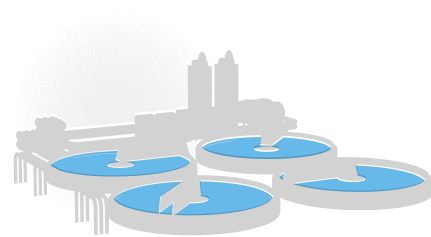
major municipal facilities discharged an annual average phosphorus concentration of 1 mg/L or less in 2022. Of these facilities, 46 are meeting 0.5 mg/L or less.

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.



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.

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.

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.

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.

IllinoisGroundwork.org offers green infrastructure resources.

Over 8,900

participants attended 121 stormwater outreach events in 2021–22.



143

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





Photo courtesy of Layne Knoche, University of Illinois Extension

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.

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 Left: Eureka Lake. By Amanda Christenson, University of Illinois Extension