Indiana's State Nutrient Reduction Strategy

A framework to reduce nutrients entering Indiana's waters

Version 7 – March 2026

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With contributions from the Indiana Conservation Partnership:
Indiana State Soil Conservation Board (SSCB)
USDA Natural Resources Conservation Service (NRCS)
USDA Farm Service Agency (FSA)
Indiana Association of Soil and Water Conservation Districts (IASWCD)
Indiana Department of Natural Resources (IDNR)
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And also by members of the:
Indiana State Nutrient Reduction Strategy Workgroup
Indiana Agriculture Nutrient Alliance

This state nutrient reduction strategy is a dynamic document created as a key step toward improving Indiana's water quality. It will be reflected upon/reviewed as necessary.
An update of this document will be provided every five years.
To provide comments and feedback of this strategy document, please use ISDANutrientReduction@isda.in.gov.

Executive Summary

Eutrophication, or nutrient enrichment of waters, is a concern in many areas of the United States as well as around the world. Nutrients are an essential part of the water system for plant and animal life, however when there is an excess of nutrients, it can cause water quality impairments such as hazardous algal blooms and oxygen depleted water. Excess nutrients such as nitrogen and phosphorus come from many sources including waste water treatment plants (WWTPs), failed septic systems, land-disturbing activities, and stormwater runoff from developed areas and agricultural lands. When these excess nutrients enter our waterbodies, they stimulate excessive plant growth or algal blooms. When the plants and algae die, sink, and decompose, oxygen levels are depleted in the water, which is a condition referred to as hypoxia. These hypoxic areas cannot support aquatic life and are often called "dead zones."

The Gulf of America has been for many years experiencing a large hypoxia zone, so the Mississippi River/Gulf of America Hypoxia Task Force (HTF) in 2008 created a priority action plan that calls for each of the major states that drain to the Mississippi River basin to develop a state nutrient reduction strategy to address the issue of excess nitrogen and phosphorus entering their rivers, lakes, streams, aquifers, wetlands, and drinking water supplies. In 2011, the U.S. Environmental Protection Agency (U.S. EPA) released a memo outlining eight (8) *Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution*, which gave guidance to the 12 states that are a part of the Gulf of Mexico HTF. Indiana is one of those 12 states.

The HTF goal is to reduce the areal extent of the Gulf of America hypoxic zone to less than 5,000 square kilometers (1,900 square miles) by the year 2035, with an agreed upon interim target of a 20% nitrogen and phosphorus load reduction by the year 2025 as a milestone toward reducing the hypoxic zone size goal by the year 2035.

The Great Lakes are also experiencing water quality issues due to excessive amounts of nutrients. The 2012 Great Lakes Water Quality Agreement (GLWQA) amendment established the Nutrients Annex 4 Binational Subcommittee, which is charged with coordinating actions in the United States and Canada, to manage phosphorous loadings and concentrations in the Great Lakes and to commence its work with Lake Erie, which is experiencing excessive phosphorus loading that threatens water quality and ecosystem health by contributing to harmful and nuisance algal blooms. Approximately 3.5% of Indiana drains into Lake Erie and Indiana has been an active member of this subcommittee since its establishment in 2013. A portion of Indiana also drains into Lake Michigan for which a plan will be developed in accordance with the GLWQA in the coming years.

The development of Indiana's State Nutrient Reduction Strategy is benefitting our state's local waters resources, which in turn will benefit the Gulf of America and the Great Lakes into which Indiana's waterways drain. *The Indiana State Nutrient Reduction Strategy* represents the state's commitment to reduce nutrient runoff into Indiana's waters from point sources and nonpoint sources alike. The overall guiding principles noted below are the foundation of Indiana's strategy:

- **Encourage voluntary, incentive-based, practical, and cost-effective actions**
- **Use and strengthen existing regulatory and non-regulatory programs**
- **Identify existing and additional funds needed and funding sources**
- **Identify research needs**
- **Identify opportunities for innovative, market-based solutions**
- **Follow adaptive management**

More specifically, the main objectives of this strategy include:

- Acknowledgment of the challenges facing the improvement of Indiana's impaired waters;
- Involvement and engaging of stakeholders and partners in the state's efforts to reduce nutrient loads;
- Prioritization of HUC 8 watersheds within Indiana;
- Discussion of the importance of water quality monitoring and regulatory control of point sources;
- The inventory and utilization of resources and practices to achieve their highest impact on nutrient reduction;
- Encouragement of voluntary incentive-based conservation through the many local, state and federal water quality related programs;
- Measuring the impacts of urban and rural conservation practices and tracking sediment and nutrient load reductions; and
- Serving as a strategic document for addressing milestones and action items, and seeking continued funding sources for current and future efforts concerning water quality in Indiana.

The Indiana State Nutrient Reduction Strategy underscores the importance of continual outreach and education to conservation partnerships and the public regarding stewardship of Indiana's waters. This strategy acknowledges that the great potential to reduce nitrogen and phosphorus entering our waters depends on the cooperation of state, federal and local organizations', agricultural and urban programs and initiatives, as well as private sector and citizen endeavors. This strategy identifies measures such as the proper types of conservation practices on productive agricultural ground and at the edge-of-field, efficient nutrient management, managed drainage, septic system maintenance, appropriate residential fertilizer applications, erosion control at construction sites, and urban best management practices (BMPs) such as green infrastructure as being keys to controlling nutrient runoff. It recognizes a continued need for conservation efforts, education, outreach and research in order to see progress.

The State of Indiana recognizes the importance of early involvement of stakeholders and partners in the planning and development of the State Nutrient Reduction Strategy. It provides transparency of the process, allows time for trust to develop, permits incorporating local knowledge, and makes it possible to effectively address misperceptions and manage expectations. All of this helps gain buy-in and cooperation from stakeholders and partners and increases the likelihood of moving toward effective and sustainable solutions together. Many agencies and stakeholders were consulted in the planning and development of the Indiana State Nutrient Reduction Strategy.

Although the Indiana strategy was originally developed as a result of the HTF 2008 Action Plan for the Gulf of America, this strategy encompasses all waters of the state of Indiana that drain to the Mississippi River and the Gulf of America as well as to Lake Michigan and Lake Erie.

Indiana will continue to evaluate the efficacy of the nutrient reduction policies, programs, and practices outlined in this Strategy. Based on that evaluation and new information/data arising from research and monitoring data, Indiana will modify this Strategy as necessary.

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Foreword

The Indiana State Nutrient Reduction Strategy (SNRS) is the product of an inclusive effort of the Indiana Conservation Partnership (ICP) and the SNRS Workgroup[1] under the leadership of the Indiana State Department of Agriculture (ISDA) and the Indiana Department of Environmental Management (IDEM) to capture statewide, present and future endeavors in Indiana which positively impact the State's waters, as well as document the progress of conservation, water quality improvements, and the adoption of soil health and edge-of-field practices in Indiana. Using the principle of adaptive management, this State Nutrient Reduction Strategy is a dynamic document acknowledging that nitrogen and phosphorus in particular, and nutrient pollution in general, is a very complex problem caused by point and nonpoint sources across many sectors, which requires a multi-dimensional solution.

Since the release of the 2021 Version 6 of Indiana's State Nutrient Reduction Strategy, the following changes and key refinements have been made.

1) Each Section in the Table of Contents was updated to add reference numbers for each sub-section.
2) The Index of Tables and Index of Figures were updated to reflect changes throughout the document.
3) Images, pictures, figures, graphs, and website links throughout the document were updated as necessary.
4) Section 1 – Introduction
    a. Updated the figures showing the size of the Hypoxia zone from the 2025 NOAA cruise.
    b. Added reference to the Gulf Hypoxia Program (GHP).
    c. Updated the graphs of the Mississippi River Basin WRTDS results for the Gulf of America.
    d. Moved part of *The Great Lakes* section to be under the *National Nutrient Load Concerns* and then continued the discussion of the Indiana Domestic Action Plan (DAP) for the Western Lake Erie Basin under the *Nutrient Load Concerns on Indiana's Waters* section.
    e. The section 1.2.1 was previously titled *Indiana Drainage Overview* and was changed to *Indiana Drainage Basins.*
    f. The section discussing the progress being made in Indiana was previously under the *National Nutrient Load Concerns* section in order to relate it to the progress made within the MRB, but this was moved under *Nutrient Load Concerns on Indiana's Waters* and was renamed to *Is Progress Being Made in Indiana's*

[1] Members of SNRS Workgroup include the Indiana State Department of Agriculture-Division of Soil Conservation, Indiana Department of Environmental Management-Watershed Assessment and Planning Branch, Indiana Department of Environmental Management-Drinking Water Branch, USDA-Natural Resources Conservation Service, the US Geological Survey, Indiana Association of Soil and Water Conservation Districts, Purdue University, The Nature Conservancy, Indiana Farm Bureau, Indiana Agriculture Nutrient Alliance, Indiana Soybean Alliance, Indiana Corn Marketing Council, Indiana Pork Producers Association, the Agribusiness Council of Indiana, Beck's Hybrids, and the St. Joseph River Basin Commission.

Portion of the Mississippi River Basin?. Updates were made to the graphs for the water quality trends at New Harmony, IN.

   g. Information about legacy phosphorus and its contribution to nutrient loading was added in addition to information related to the effects of streambank erosion on legacy phosphorus.

5) Section 2 – Engage Stakeholders and Partners
   a. A mention of the importance of the SNRS Workgroup was included and how they are engaged with efforts of this strategy.
   b. The section on the Indiana Chapter of The Nature Conservancy was updated.
6) Section 3 – Watershed Prioritization and Characterization
   a. The HUC8 priority watersheds were re-examined for the state of Indiana by a subcommittee of the SNRS Workgroup. This section includes information and results of a reassessment that was done for priority watersheds at the HUC8 level. The methodology document for this process is included in Appendix B.
   b. The discussion of prioritization in HUC12 watersheds was updated, and the examples of projects were removed. The map of the major river and lake basins was moved from this section to Section 4 under the *Surface Water Monitoring Programs* because of the Probabilistic Monitoring program.
7) Section 4 – Water Quality Monitoring in Indiana's Waters
   a. Mention of the HUC12 Prioritization process done in the WLEB was removed.
   b. Map of the major river and lake basins was moved to section 4.2.1 *Surface Water Monitoring Programs*.
   c. Section 4.2.2 on *Groundwater Monitoring Programs* was expanded with further explanation of this program.
   d. Under section 4.2.3 *Data Sharing and Inventory*:
      i. Removed reference to the InWMC whitepaper *An Assessment for Optimization of Water Quality Monitoring in Indiana, 2017*.
      ii. Added information about the new technology, a Gybe Sensor, that was added to collocate with the USGS supergage on the Wabash River at New Harmony, IN.
      iii. Information about IDEM's External Data Framework was expanded and explained further than in the last report.
   e. Under section 4.4 *Harmful Algal Bloom (HAB) Monitoring Data*, the exposure thresholds for human and dog recreation have been updated. Tables showing results of water quality sampling in some State Recreation Areas and State Parks have been updated.
8) Section 5 – Nutrient Criteria
   a. The section 5.2 on *Numeric Criteria* was updated to reflect changes.
9) Section 6 – Practices to Reduce Point Source (PS) and Nonpoint Source (NPS) Pollution
   a. The section 6.2.1 on *Nonpoint Source Strategy Objectives* was updated with some additional language on Indiana's nonpoint source approach and updated with some additional strategies for improvement.
   b. The section 6.2.2 on *Practices to Reduce Nonpoint Source Pollution* was changed by combining the two lists of practices into one list and expanding the language on some of the practices.

c. A new section 6.2.3 on *Septic System Maintenance for Nutrient Reduction* was added.
d. A short section 6.2.4 on *Key Takeaways* was added.

10) Section 7 – The Indiana Science Assessment
   a. Removed reference to "Nutrient Reduction Estimation Framework" workshop.
   b. Removed the Indiana Science Assessment Strategy document in the Appendices.
   c. Updated each Component of the Science Assessment to explain the progress that has been made. Included the Individual Site-Specific Trend Results under Component 1 in a new Appendix C.
   d. Added section 7.1.3 to explain the *Indiana Nutrient Research and Education Program (INREP)*.

11) Section 8 – Programs, Projects, and Initiatives Supporting Nutrient Reduction
   a. Under the *Point Source/Regulatory Programs, National Pollutant Discharge Elimination Systems (NPDES)* section 8.1.1, the previous Appendix B was removed, which referenced facilities with water quality monitoring for ammonia and phosphorus including facilities with permit limit notations.
   b. State and federal programs were updated to reflect program changes.
      i. The *INfield Advantage* program was removed since this program is no longer available.
      ii. The *Classified Forest and Wildlands Program* was added under the state program section 8.3.2.
      iii. The Special Projects/Initiatives map under the USDA section 8.3.4 was outdated and removed.
   c. Agricultural Initiatives
      i. The *Conservation Cropping Systems Initiative (CCSI)*, *IANA*, and the *4R Nutrient Stewardship Program in Indiana* were updated to reflect changes.
      ii. The *Indiana Small Farms Conservation* program was added under this section.
      iii. The *Ohio River Basin Water Quality Trading Project* section was deleted since this program is no longer available and active.
      iv. The links and information under section 8.4.7 *Agricultural Landowner Educational Resources Available Online* were been updated.

12) Section 9 – Measuring Impacts
   a. Made updates to section 9.1 on *Indiana's Conservation and Cover Crop Transect*.
      i. Removed the national Census map from 2017 showing U.S. Cover Crop Acreage.
   b. Made updates to section 9.2 on *U.S. EPA Region 5 Nutrient Load Reduction Modeling and Mapping*.
      i. The Methodology Chart was removed but reference to the methodology report remains.
      ii. The figures showing the 2019 sediment, nitrogen and phosphorus load reductions statewide by watershed have been removed and reference to where these maps can be found is included.
   c. Figure 28 in section 9.3 on *Significant Waterbodies* was updated.

   d. The section previously titled “GIS Story Maps for Indiana’s Ten Major River and Lake Basins” was changed to “Expanding Access Through Interactive Watershed Tools”, and this section was updated.
   e. Section 9.5 *Performance Measures Monitoring* section was updated to reflect changes.
   f. The section on *Adaptive Management* was moved to Section 10.

13) Section 10 – Milestones and Actions Items Table
   a. *Adaptive Management* was moved to this section because goals and action items may change over the next 5 years based on new research data, partner feedback and funding availability, and learning to adapt to this is vital.
   b. The Milestones and Action Items Table was updated to show only Goals & Action Items to simplify its use and to show more overarching goals to guide efforts over 5 years. Goals are listed out in five different categories.

14) Section 11 – “What You Can Do to Protect Water Quality in Indiana”
   a. *You, Me, and Water Quality* was removed as this resource no longer exists online.
   b. The section previously titled “Interactive Online Resources” was removed, however, the Clear Choices Clear Water program was not removed.

15) Appendix A – Acronyms has been updated as necessary.
16) A new Appendix B was added to share the methodology document and results of the re-assessment of the priority watersheds from Section 3.
17) A new Appendix C was added to show the Individual Site-Specific Trend results under Component 1 of the Indiana Science Assessment and referenced in Section 7.

Section 1 – Introduction

1.1 National Nutrient Load Concerns and Priorities

1.1.1 Gulf of America

Eutrophication, or nutrient enrichment of waters, is a concern in many areas of the United States as well as around the world. Nutrients are an essential part of the water system for plant and animal life, however when there is an excess of nutrients, it can cause water quality impairments such as hazardous algal blooms and oxygen depleted water. Excess nutrients such as nitrogen and phosphorus come from many sources including waste water treatment plants (WWTPs), failed septic systems, land-disturbing activities, and stormwater runoff from developed areas and agricultural lands. When these excess nutrients enter our waterbodies, they stimulate excessive plant growth or algal blooms. When the plants and algae die, sink, and decompose, oxygen levels are depleted in the water, which is a condition referred to as hypoxia. These hypoxic areas cannot support aquatic life and are often called “dead zones”.

The dead zone or Hypoxia Zone in the Gulf of America is among the most pressing, where nutrient loads from the Mississippi/Atchafalaya River Basin (MARB) (Figure 1) are contributing to eutrophication and harmful algal blooms. Since 1985, the National Oceanic and Atmospheric Administration (NOAA) and the Louisiana Universities Marine Consortium (LUMCON) have conducted an annual research cruise to measure the area of hypoxia in the Gulf of America. In 2025, the dead zone covered an area approximately 4,402 square miles (11,400 square kilometers), and was the 15th smallest measured since dead zone mapping began (Figure 2). This equates to roughly 2.8 million acres of habitat potentially unavailable to fish and bottom-dwelling species, a reduction of 30% from the previous year.[2] To see information on current and past cruises visit https://www.epa.gov/ms-htf/northern-gulf-america-hypoxic-zone.

Figure 1 – Mississippi/Atchafalaya River Basin
Image source: https://www.epa.gov/ms-htf/mississippiatchafalaya-river-basin-marb

[2] https://www.noaa.gov/news-release/gulf-of-america-dead-zone-below-average-scientists-find

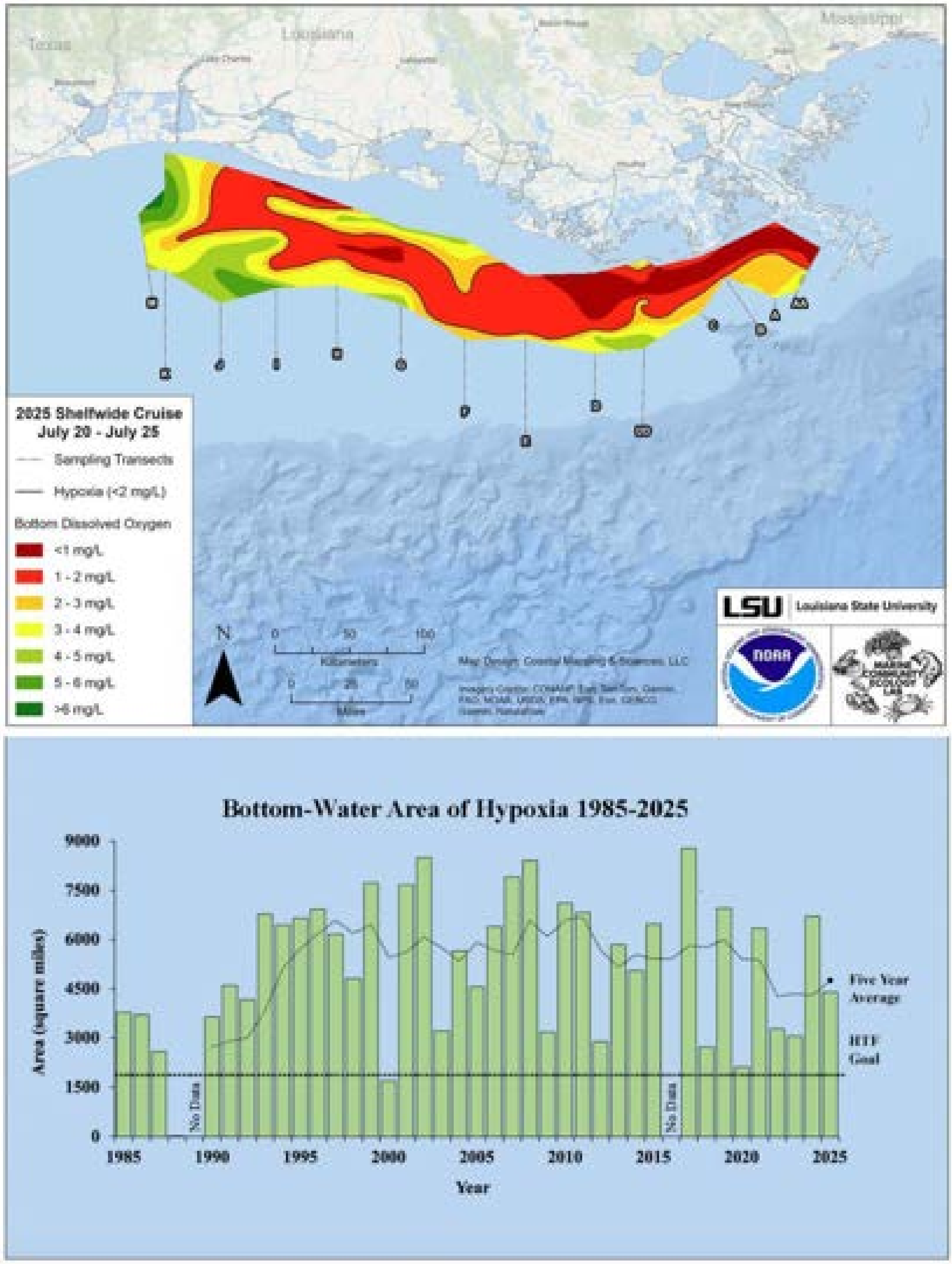

Figure 2 – Image showing (Top) Map of measured Gulf hypoxia zone, July 20-25, 2025. Red area denotes 2 mg/L of oxygen or lower, the level which is considered hypoxic, at the bottom of the seafloor. (Bottom) Long-term measured size of the hypoxic zone (green bars) measured during the ship surveys since 1985, including the target goal established by the Mississippi River/Gulf of America Hypoxia Task Force and the 5-year average measured size (black dashed lines).
(Image credit: NOAA/LUMCON/LSU)

As a result of this issue in the Gulf of America, the Mississippi River/Gulf of America Hypoxia Task Force[3] (HTF) in 2008 created a priority action plan that calls for each of the major states that drain in the basin to develop a state nutrient reduction strategy to address the issue of excess nitrogen and phosphorus entering their rivers, lakes, streams, aquifers, wetlands, and drinking water supplies. In 2011, the U.S. Environmental Protection Agency (U.S. EPA) released a memo outlining eight (8) *Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution*, which gave guidance to the 12 states[4] that are a part of the Gulf of America HTF. Indiana is one of those 12 states.

The HTF goal is to reduce the areal extent of the Gulf of America hypoxic zone to less than 5,000 square kilometers (1,900 square miles) by the year 2035, with an agreed upon interim target of a 20% nitrogen and phosphorus load reduction by the year 2025 as a milestone toward reducing the hypoxic zone size goal by the year 2035.

Reaching this goal requires a significant commitment of resources to greatly accelerate implementation of actions to reduce nutrient loading from all major sources of nitrogen and phosphorus in the MARB. While the U.S. EPA has long supported the HTF states with general support for their water quality programs and through small, intermittent grants as they developed and implemented their state nutrient reduction strategies, the Gulf Hypoxia Program[5] (GHP) provides for the first time a dedicated, sustained funding source for implementing the Action Plan and strengthening states' nutrient reduction strategies. (*HTF 2025 Report to Congress*[6]) The GHP was created in 2022 through the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (BIL), and supports the work of the HTF states as they update and strengthen their reduction strategies, as well as support for tribes and regional basin subcommittees.

1.1.2 Is Progress Being Made in the Mississippi River Basin?

There are two metrics that the HTF uses to track and report progress being made toward the HTF goal. One metric is the 5-year moving average size of the Gulf hypoxic zone (Figure 2), which is measured through the annual research cruise and which is influenced by many factors including precipitation across the MARB, associated stream flow, and summer hurricanes and can cause variability in the overall results because of low flow and high flow years. A second metric, agreed upon by the HTF in January of 2018 to be used as an additional reporting metric to assess progress in the Mississippi River Basin, is to measure the water quality trends of total nitrogen (TN) and total phosphorus (TP) using the United States Geological Survey's (USGS) Weighted

[3] The Mississippi River/Gulf of America Hypoxia Task Force is made up of 5 federal agencies, 12 states bordering the Mississippi and Ohio Rivers, and the National Tribal Water Council. Federal agencies include U.S. Environmental Protection Agency (U.S. EPA); U.S. Department of Agriculture (USDA); U.S. Geological Survey (USGS); National Oceanic and Atmospheric Administration (NOAA); and the U.S. Army Corps of Engineers.
[4] Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Minnesota, Mississippi, Missouri, Ohio, Tennessee, Wisconsin
[5] https://www.epa.gov/ms-htf/gulf-hypoxia-program
[6] https://www.epa.gov/ms-htf/hypoxia-task-force-reports-congress

[Regressions on Time, Discharge, and Season (WRTDS) Model](). The WRTDS model and method “normalizes” loads to average flow conditions, providing a trend analysis of flow-normalized loads and concentrations. It more clearly evaluates changes in nutrient load that are caused by factors other than changes in streamflow, such as land-use, management changes, and hydromodification. The WRTDS method is used to analyze water quality data from USGS water quality sampling stations and US Army Corp of Engineers streamflow gages in the lower Mississippi River watershed to assess a trend for the basin. As reported by USGS, Figure 3 shows the total nitrogen loading to the Gulf of America using the WRTDS model from 1980 through 2024, and Figure 4 shows the total phosphorus loading to the Gulf.[7]
Tracking changes in nutrient loads is complex due to many different factors, therefore it is important that more than one method be used to track progress, especially when looking at such a large watershed as the Mississippi River Basin.

As shown on the TN graph below, the Hypoxia Task Force accomplished the 2025 interim goal for total nitrogen, which is the 20% reduction target. There are many factors that contribute to this decrease, and there is still more work to do. The graph for total phosphorus shows that TP is increasing; there is much that goes into understanding the science as to why, and there are many factors that contribute to the phosphorus increase as well. The 2023 and 2025 HTF Report to Congress[8] explains and discusses many of the factors that contribute to the differences in the nitrogen decrease versus the phosphorus increase.

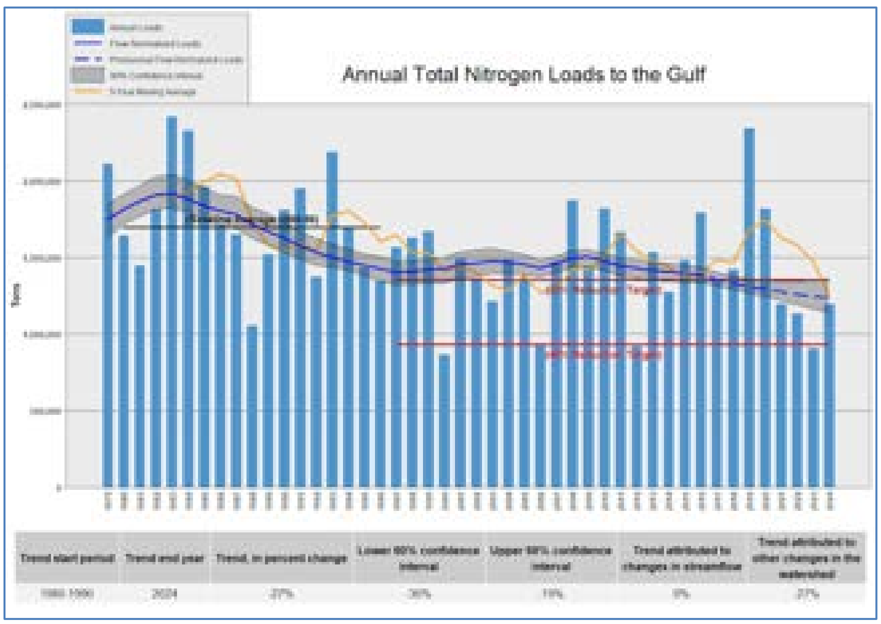

Figure 3 – Annual Total Nitrogen Loads to the Gulf of America from 1980-2024 showing two metrics to assess progress adopted by HTF. https://nrtwq.usgs.gov/nwqn/#/GULF

[7] https://nrtwq.usgs.gov/mississippi_loads/#/GULF
[8] https://www.epa.gov/ms-htf/hypoxia-task-force-reports-congress

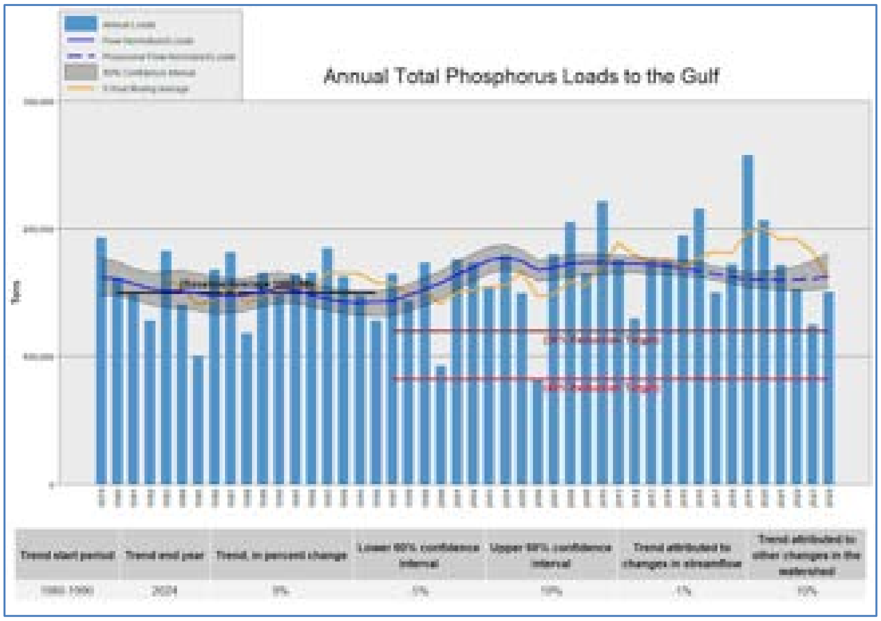

Figure 4 – Annual Total Phosphorus Loads to the Gulf of America from 1980-2024 showing two metrics to assess progress adopted by the HTF. https://nrtwq.usgs.gov/nwqn/#/GULF

1.1.3 The Great Lakes

The Great Lakes are also experiencing water quality issues due to excessive amounts of nutrients. The 2012 Great Lakes Water Quality Agreement (GLWQA) amendment established the Nutrients Annex 4 Binational Subcommittee, which is charged with coordinating actions in the United States and Canada, to manage phosphorous loadings and concentrations in the Great Lakes and to commence its work with Lake Erie, which is experiencing excessive phosphorus loading that threatens water quality and ecosystem health by contributing to harmful and nuisance algal blooms. Approximately 3.5% of Indiana drains into Lake Erie and Indiana has been an active member of this subcommittee since its establishment in 2013.

In accordance with the Annex 4 GLWQA Lake Ecosystem Objective to “maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health,” Indiana’s GLWQA Domestic Action Plan (DAP) to reduce phosphorous to the Western Lake Erie Basin (WLEB) was released February 28, 2018, and updated thereafter in December of 2023. Reaching the goals under the GLWQA and the DAP are also challenging and also require a significant commitment of resources to greatly accelerate implementation of actions to reduce nutrient loading from all major sources of nitrogen and phosphorus in the the Great Lakes. For more information about Indiana’s DAP for the WLEB, refer to the Great Lakes section below under the “Nutrient Load Concerns on Indiana’s Waters”.

A portion of Indiana also drains into Lake Michigan for which a plan will be developed in accordance with the GLWQA in the coming years.

1.2 Nutrient Load Concerns on Indiana's Waters

Indiana's surface and groundwaters are adversely affected by excessive nutrient loads from point sources and nonpoint sources to our rivers, streams, lakes and aquifers. This is evident in increasing occurrences of cyanobacteria (also known as blue-green algae) blooms in Hoosier lakes and reservoirs, which can result in the release of toxins. This is having a negative economic impact by increasing the cost of treating public water supplies as well as reducing the recreational use of lakes for swimming. A number of Indiana's drinking water facilities that use surface water find it necessary to add activated carbon to control taste and odor compounds attributed to algal blooms. Several public water systems apply herbicides to their source waters as a means to control algal blooms. The Indiana Department of Natural Resources (DNR) issues recreational alerts due to high cyanobacteria cell counts for public beaches at state parks and state recreation areas weekly during the DNR swimming beach season which runs from Memorial Day through Labor Day. These recreational alerts are issued when the cyanobacteria count exceeds 100,000 cells/mL.

In addition, nitrate is one of the most common groundwater contaminants found in the State. It represents a threat to drinking water primarily because excess levels can cause methemoglobinemia, or "blue baby" syndrome. Although nitrate levels that affect infants do not pose a direct threat to older children and adults, they do indicate a need for nutrient control.

We must address the health of our water resources in a comprehensive way. Recognizing that what we do on the landscape with urban, rural and agricultural activities and drainage is reflected in our waterways. While regulatory approaches to controlling point sources of nutrients are in place, they remain under continued assessment and improvement, including refining expectations and operations in wastewater treatment facilities and other municipal systems, such as storm water management and the use of green infrastructure for water infiltration and uptake by plants and trees.

There remains a strong preference for promoting non-regulatory, voluntary approaches for nonpoint sources such as increased technical and financial assistance for coordinated, effective conservation on agricultural and urban lands. This includes managing agricultural lands to reduce nutrient loads lost to runoff, optimizing nutrient inputs through enhanced management of the timing, rate, form and placement of fertilizers for crop production, managing soil health and water-holding capacity through a system of practices including no-till, never-till, conservation tillage, nutrient management, and cover crops as well as utilizing edge-of-field and riparian filters, and other conservation practices along waterways in both urban and rural areas.

1.2.1 Indiana Drainage Basins

The State of Indiana has a surface area of approximately 36,532 square miles. There are about 63,000 miles of rivers, streams, ditches and drainage ways in Indiana.

Indiana is made up of three major drainage basins known as 4-digit HUC[9] watersheds (Figure 5). The blue shaded area on the map shows that the majority of the state drains to the Mississippi River Basin, either to Illinois through the Kankakee River System, into the Ohio River along the southern border of Indiana, or through the Wabash River System.

The main rivers that drain Indiana in the Mississippi River Basin are the Wabash River, the Tippecanoe River, the White River, the Kankakee River, the Whitewater, and several smaller tributaries that drain to the Ohio River. This system drains approximately 90% of Indiana's 92 counties and consists of primarily agricultural land with many small towns and some cities located along the rivers.

Figure 5 – Indiana's major drainage basins

The green and yellow shaded areas in Northeast and Northwest Indiana are within the Great Lakes basin, and drain to Lake Erie and Lake Michigan, respectively.

The green shaded area in northeast Indiana is known as the Western Lake Erie Basin (WLEB) and covers all or part of 6 counties, covering approximately 812,500 acres. The main rivers that drain the WLEB area are the St. Joseph River, the St. Marys River, and the Upper Maumee River. The St. Joseph River and the St. Marys River come together in Fort Wayne, IN to form the Maumee River that drains to and through Ohio and eventually empties into the western basin of Lake Erie at Toledo, Ohio.

The yellow shaded area along the northern border drains to Lake Michigan and covers all or part of 10 Indiana counties, encompassing approximately 1,416,113 acres. The northwest portion is drained through the Grand Calumet and Little Calumet Rivers, Trail Creek, and Salt Creek and is made up of mostly urban areas. The northeast portion drains to Lake Michigan through the St. Joseph River System (different than the St. Joseph River in the WLEB area), the Elkhart River, the Little Elkhart River, Pigeon River and Pigeon Creek. It consists of primarily agricultural land with small towns and cities located in the watershed.

[9] Hydrologic unit codes (HUC) are a way of identifying all of the drainage basins in the United States in a nested arrangement from largest (Regions) to smallest (Cataloging Units). The term watershed is often used in place of drainage basin. The smaller the HUC number, the larger the drainage area. For example a HUC8 watershed is larger than a HUC12.

1.2.2 Is Progress Being Made in Indiana's Portion of the Mississippi River Basin?

Using the same method of "normalizing" loads, WRTDS can provide a trend analysis of flow-normalized loads and concentrations in Indiana. Water quality data from the USGS water quality sampling station on the Wabash River at New Harmony, IN (Figure 6) was analyzed to assess a trend for Indiana and whether progress is being made in Indiana. The New Harmony USGS location on the Wabash River is the last station on the Wabash River before it flows into the Ohio River, collecting data from the Wabash River watershed as well as the White River Watershed. Figure 7 on the next page shows the total nitrogen loading (TN) to the Wabash River from 1997-2025 using the WRTDS model, and Figure 8 shows the total phosphorus (TP) loading in the Wabash River from 1998-2025.

Figure 6 – Location of the USGS Water Quality Sampling Station on the Wabash River at New Harmony, IN is shown by the red dot on the map. Station is number 03378500. (map credit to ISDA)

This analysis was done as a part of the Indiana Science Assessment, which is explained in Section 7. Through Component 1 of the IN Science Assessment, water quality monitoring data from USGS and IDEM was analyzed at several pour points[10] on the state borders and within the major drainage basins in Indiana, allowing us to see what the water quality trends are both within the state and leaving the state. To see the map of sites analyzed and the results of the trend analysis done through the Science Assessment, refer to Section 7. In addition, this analysis of WQ data at the pour points and within the major drainage basins is one of the tools that assisted with the re-prioritization of the HUC8 priority watersheds as explained in Section 3.

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[10] Definition of pour point: The outlet, or pour point, is the point on the surface at which water flows out of an area. It is the lowest point along the boundary of a watershed.

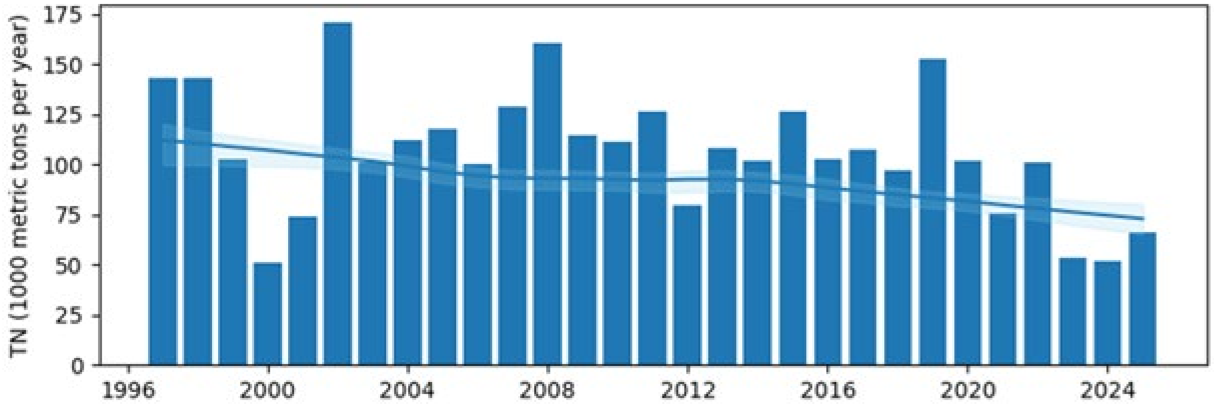

Figure 7 – Annual Total Nitrogen Loads at the New Harmony, IN USGS Station from 1997-2025.

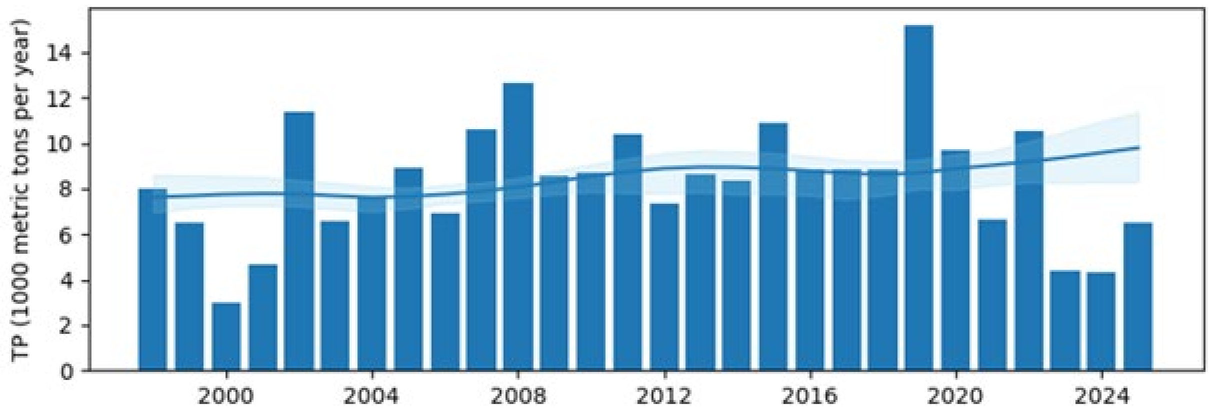

Figure 8 – Annual Total Phosphorus Loads at the New Harmony, IN USGS Station from 1998-2025.

According to the graphs for the New Harmony site, the trend for TN is decreasing, but the trend for TP is not. All of the sites in the state analyzed through the trend analysis show variations in whether they remain static or are decreasing or increasing for both TN and TP. It is important to understand that there is a delay or time-lag, which can be decades, between installation or adoption of conservation practices and positive, statistically significant changes in water quality.[11] According to Meals and Dressing, 2008, land treatment-water quality monitoring projects – even those designed to be "long-term" – may not show definitive results if the lag time exceeds the monitoring period. This is especially true over a large watershed area. Reductions in pollutant loads to streams, rivers and lakes may be seen sooner on a smaller watershed scale, and through agricultural edge-of-field practices and at point source outfalls.
Also, according to Van Meter and Basu, 2017, "Despite the widespread implementation of conservation measures, nitrogen concentrations in rivers and streams are often remaining steady or continuing to increase. Although many attribute this lack of response to stores of legacy nitrogen in soil and groundwater, it remains unclear how much nitrogen is being stored beneath

[11] Donald W. Meals and Steven A. Dressing. 2008. Lag time in water quality response to land treatment. Tech Notes 4, September 2008. Developed for U.S. Environmental Protection Agency by Tetra Tech, Inc., Fairfax, VA, 16 p. Available online at https://www.epa.gov/sites/production/files/2016-05/documents/tech_notes_4_dec2013_lag.pdf

the surface."[12] VanMeter's and Basu's research shows that nitrogen dynamics in the Mississippi River Basin are dominated by legacy nitrogen in the soil, which can result in the time-lag of the effects of conservation practices, that even if agricultural N use became 100% efficient, it would take decades to meet target N loads. Their results also suggest that both long-term commitment and large-scale changes in agricultural management practices are necessary to decrease Mississippi N loads to meet current goals for reducing the size of the Gulf hypoxic zone.[13] Their research notes that nitrogen can be in the system for over 80 years.

Phosphorus losses, including legacy phosphorus is a major and complex challenge for nutrient management. Research done by Dr.Tanja Williamson et al., 2025, in the Western Lake Erie Basin shows that streambank erosion can be a significant source of legacy phosphorus in agricultural watersheds.[14] Radionuclide fingerprinting was used to determine if streambed sediment was new (from current erosion) or old (accumulated over time). According to Williamson et al., "Data indicate that in-stream accumulation of streambed sediment, even in small watersheds, has the potential to affect downstream sediment and phosphorus loads in the Maumee River on a management timescale, delaying successful reductions to Lake Erie." This research suggests that in order to effectively manage phosphorus loads, nutrient reduction strategies should address phosphorus contributions from streambank erosion rather than assuming all nonpoint source phosphorus comes from agricultural field topsoil. Additionally, edge-of-field and drainage practices can play a major role in controlling the rapid movement of water through agricultural tile systems that when combined with stormwater from developed landscapes can overwhelm streams and compromise their banks as noted above. Legacy phosphorus in streambanks, especially from relocated streams and excavated ditches, can have long-lasting impacts as streambanks can continue to release phosphorus into a waterbody for years, or decades, even if phosphorus from agricultural fields are reduced. Solely focusing on infield management practices will not produce immediate water quality improvements at the watershed scale.

1.2.3 The Great Lakes

As mentioned above under the National Nutrient Load Concerns, in accordance with the Annex 4 GLWQA Lake Ecosystem Objective to "maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health," [Indiana's GLWQA Domestic Action Plan (DAP)] to reduce phosphorous to the Western Lake Erie Basin (WLEB) was released February 28, 2018, and updated thereafter in December

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[12] "Two centuries of nitrogen dynamics: Legacy sources and sinks in the Mississippi and Susquehanna River Basins", K. J. Van Meter, N. B. Basu, P. Van Cappellen. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GB005498

[13] http://science.sciencemag.org/content/early/2018/03/21/science.aar4462

[14] "Source and longevity of streambed sediment and phosphorus retention in a lake-plain tributary of the Maumee River", Tanja N.Williamson, Faith Fitzpatrick, Diana L.Karwan, Rebecca Kreiling, James D. Blount, and Dayle Jordan Hoefling. 2025. https://pubs.usgs.gov/publication/70268494

of 2023. To achieve the above-referenced Lake Ecosystem Objective, a 40 percent reduction in spring-time total phosphorus and soluble reactive phosphorus is needed for the Maumee River. This translates to a flow-weighted meanc oncentration of 0.23 mg/L total phosphorus and 0.05 mg/L soluble reactive phosphorus respectively. Progress toward these target values is being measured on the Maumee River at Antwerp, Ohio, which is 7.6 river miles downstream of the Indiana border and best represents Indiana's phosphorus loading.

The Indiana WLEB DAP is the product of a dedicated Advisory Committee comprised of representatives from different stakeholder sectors and led by the Indiana Department of Environmental Management (IDEM). The Indiana DAP is informed by the intensive planning, research, and steadfast work that is underway in the WLEB by individuals, non-governmental organizations, universities, professional associations, for-profit industries, and governmental entities at the town/municipal, county, state, and federal levels. It is in keeping with the principles and approaches within the Indiana State Nutrient Reduction Strategy. It emphasizes using existing programs and optimizing partnerships, affecting the most change with the least cost, prioritizing resources to areas with the most phosphorus export and/or reduction potential, seeking to engage citizens who are not participating in conservation efforts, and employing adaptive management.

1.3 Guiding Principles

The development of Indiana's State Nutrient Reduction Strategy is benefitting our state's local waters resources, which in turn will benefit the Gulf of America and the Great Lakes into which Indiana's waterways drain. This strategy represents the state's commitment to reduce nutrient runoff into Indiana's waters from point sources and nonpoint sources alike.
The six guiding principles noted below are the foundation of Indiana's Strategy:

- **Encourage voluntary, incentive-based, practical, and cost-effective actions**
- **Use and strengthen existing regulatory and non-regulatory programs**
- **Identify existing and additional funds needed and funding sources**
- **Identify research needs**
- **Identify opportunities for innovative, market-based solutions**
- **Follow adaptive management**

Specific goals and actions tied to these principles are enumerated in Section 10, the Milestones and Action Table. As practices, technologies, management systems etc. evolve, and new data and information show that changes are required, adaptations will be made.

Section 2 – Engage Stakeholders and Partners

The State of Indiana recognizes that early involvement of stakeholders and partners provides transparency of the process, allows time for trust to develop, permits incorporating local knowledge, and makes it possible to effectively address misperceptions and manage expectations. All of this helps gain buy-in and cooperation from stakeholders and partners and increases the likelihood of moving forward, together, with effective and sustainable solutions. Many agencies and stakeholders were consulted in the planning and development of the Indiana State Nutrient Reduction Strategy. There is a SNRS Workgroup that is made up of many of the partner agencies and organizations detailed below. Members of the SNRS Workgroup meet together periodically to discuss needed updates to the SNRS, and to work on the many different efforts of the SNRS. In addition, they review the draft update of the strategy to provide edits and comments. Their knowledge and expertise have contributed to successful collaboration and implementation of efforts under this state nutrient reduction strategy.

Indiana Conservation Partnership (ICP) – One of the most important tasks in this effort is that of engaging and utilizing the Indiana Conservation Partnership. As both a leadership body and as stakeholders in Indiana's water quality, the ICP actively works to address environmental issues across Indiana at local, state and federal levels. Indiana is a national leader in fostering cooperative, progressive and productive state-wide partnerships and has served as a model for other states. The ICP embodies that reputation. http://icp.iaswcd.org/

The ICP is comprised of eight entities, including the:

- State Soil Conservation Board (SSCB)
- USDA Farm Service Agency (FSA)
- USDA Natural Resources Conservation Service (NRCS)
- Indiana Association of Soil and Water Conservation Districts (IASWCD)
- Indiana State Department of Agriculture's Division of Soil Conservation (ISDA-DSC)
- Indiana Department of Natural Resources (IDNR)
- Indiana Department of Environmental Management (IDEM)
- Purdue Cooperative Extension Service (CES)

The mission of the ICP is to provide technical, financial and educational assistance needed to implement economically and environmentally compatible land and water stewardship decisions, practices and technologies. The ICP provides a roadmap for addressing Indiana's conservation issues and functions collectively to touch many other organizations and individuals.

State Soil Conservation Board (SSCB) – The Indiana State Soil Conservation Board is another key group of stakeholders in Indiana's water quality and is a member of the ICP. The SSCB appoints Supervisors as recommended by County Soil and Water Conservation Districts (SWCDs) and sets policy governing programs of the ISDA Division of Soil Conservation (DSC) and the activities of SWCDs. Through ISDA and the policies set by the SSCB, this board serves SWCDs by providing state appropriated funding for SWCD operations, providing technical assistance through ISDA DSC employees, and builds district capacity by facilitating information exchange between the SWCDs through SWCD Annual Conference, publications, workshops, and the efforts of the DSC Resource Specialists.

The SSCB also serves as a body for advice and consultation for ISDA and the SWCDs, as well as assists in securing federal and state agency help for district programs. Lastly, the board administers Clean Water Indiana, a water quality-related erosion and sediment reduction program.

There are geographical areas within all watersheds of Indiana that have critical natural resource concerns related to soil and water conservation. The SSCB works with the ISDA-DSC, SWCDs and all partners to address these concerns and support federal initiatives. In a strategic effort to address the top resource concerns identified by the ICP, the SSCB developed goals and strategies within its business plan. These goals and strategies are consistent with the Board's general authority and duties outlined in the District Law as well as its specific authority to provide direction to the ISDA-Division of Soil Conservation on the administration of the Clean Water Indiana (CWI) Program. Several of these goals are outlined in the list of action items under Section 10. https://www.in.gov/isda/boards/state-soil-conservation-board/

Soil and Water Conservation Districts (SWCDs) – Indiana's 92 County Soil and Water Conservation Districts are the grassroots partners in Indiana's effort to improve its waters. Districts not only bring a local environmental perspective to land users and economic developers, but act as local hubs for any and all citizens whom they serve to find information regarding conservation issues and programs available to them. SWCDs most often share residence with local FSA and NRCS offices as well as DSC employees, or are located in close proximity. This not only allows for cooperation and shared resources, but ensures that farmers, landowners and developers can access conservation programs and technical support at local, state and federal levels when they respond to outreach from SWCDs or they themselves reach out to any of these partners.

Partners of the Indiana Conservation Partnership and the State Soil Conservation Board all work closely with SWCDs to ensure that information, technical assistance, funding and programs are made available to landowners and the public in Indiana's 92 counties.
https://www.in.gov/isda/divisions/soil-conservation/soil-and-water-conservation-districts/

Agricultural Commodity Groups and Organizations – Indiana Corn, Soybean, Pork, Beef, Dairy and Poultry commodity groups, as well as the Indiana Farm Bureau (INFB), the Agribusiness Council of Indiana (ACI), and Purdue University Extension are actively engaged in identifying and approaching the challenges of nutrient loading and soil health, subsequently improving water quality. These groups with the addition of members from the ICP and The Nature Conservancy, worked to develop what was referred to as the nutrient management and soil health strategy, which complemented this strategy and was used as an agricultural industry implementation plan. As a result of this effort, the Indiana Agriculture Nutrient Alliance (IANA) was created in 2018 to further coordinate the efforts of the ag community beyond federal and state cost-share programs.

In an agricultural state rich with steward-farmers, this partnership is invaluable in addressing water quality and soil health related issues. The Indiana Agriculture Nutrient Alliance will be discussed in more detail later in this strategy as an agricultural initiative under section 8.

Municipalities – Primarily those with municipal separate storm sewer systems (MS4s), major wastewater treatment plants (WWTP) (greater than 1 million gallons design flow per day MGD), and those with combined sewer overflow systems (CSOs) are actively engaged in implementing their Storm Water Quality Management Plans (SWQMPs), National Pollutant Discharge Elimination System (NPDES) permits, and Long Term Control Plans (LTCPs) respectively to reduce nutrients and other pollutants to Indiana's waterways.

The Indiana Chapter of The Nature Conservancy (TNC) – Focused on conserving the lands and waters on which all life depends, the Indiana Chapter of The Nature Conservancy is a key partner to champion, develop, implement, and support conservation projects across the state that improve water quality. TNC has adopted the water quality goals established by the Gulf of America Hypoxia Task Force and the GLWQA to improve the Gulf of America and the Great Lakes. Applying these goals to Indiana's waters, TNC actively works with members of the ICP, commodity organizations, academia, utilities, foundations, and the private sector to protect and improve the state's iconic freshwater resources, like the Wabash River. TNC is actively engaged with Indiana's SNRS to collaboratively support the necessary monitoring and conservation practice evaluation components of the Indiana Science Assessment that quantifies Indiana's nutrient contributions downstream and evaluates the efficiencies of conservation practices on reducing nitrogen and phosphorus loads to Indiana waters, ultimately working toward establishing the scale of conservation practice adoption needed to achieve goals.

TNC, an active member of IANA, supports the broad adoption of soil health practices, 4R nutrient management, and edge of field practices across 50% of row crop acres. TNC has restored over 150,000 acres of floodplains in the Wabash River watershed since the 1980s and has a goal to protect another 15,000 acres by 2030 via ISDA's Conservation Reserve Enhancement Program and the NRCS Wetland Reserve Program. TNC supports the persistence of practices, systems level change, science to highlight opportunities, and monitoring to demonstrate success. https://www.nature.org/indiana

The United States Geological Survey (USGS) – The USGS is another key stakeholder and partner in improving Indiana's water quality by providing streamflow and discharge data and water quality monitoring data throughout key areas of the state. This data and the USGS's cooperation and involvement in many projects and studies is vital to knowing the state of our waters and where more work is needed to improve the water quality.

Section 3 – Watershed Prioritization and Characterization

3.1 Prioritize 8-digit Hydrologic Unit Code (HUC) Watersheds

Prioritizing watersheds is an important step in the development of a nutrient reduction strategy in order to optimize limited resources in achieving the greatest impact toward sediment and nutrient load reductions.
In 2011 ISDA and IDEM determined, along with assistance and feedback from the ICP, specific watersheds where it was believed that most of the nutrients were coming from, which was determined by using a number of different resources. It was agreed on by ISDA, IDEM and members of the ICP that prioritization would begin at the 8-digit HUC level with subsequent prioritization at the 12-digit implementation scale.

The resources used to assist in determining the priority HUC8 watersheds at that time included the USGS 2002 Spatially Referenced Regressions on Watershed Attributes (SPARROW) model (http://water.usgs.gov/nawqa/sparrow/), which is a modeling tool for the regional interpretation of water-quality monitoring data and is used to approximate nutrient loads from major watersheds. Other resources used in the prioritizing of the HUC8 watersheds included data analyzed by NRCS to prioritize watersheds for the Mississippi River Basin Initiative (MRBI), IDEM's 303d listings, IDEM 319 approved Watershed Management Plans (WMPs), IDNR Lake and River Enhancement Watershed (LARE) Diagnostic studies, the Conservation Reserve Enhancement Program (CREP) watersheds, and a newly developed (at that time) geospatial tool known as the State Resource Assessment (SRA).

The previous eight HUC8 watersheds were within the Wabash River System, situated along the Wabash and White Rivers, and the Maumee River watershed in northeast Indiana. (Figure 9) These watersheds were the:

- Upper Wabash
- Middle Wabash-Deer
- Middle Wabash-Little Vermillion
- Middle Wabash-Busseron
- Lower Wabash
- Upper White
- Lower White
- Maumee

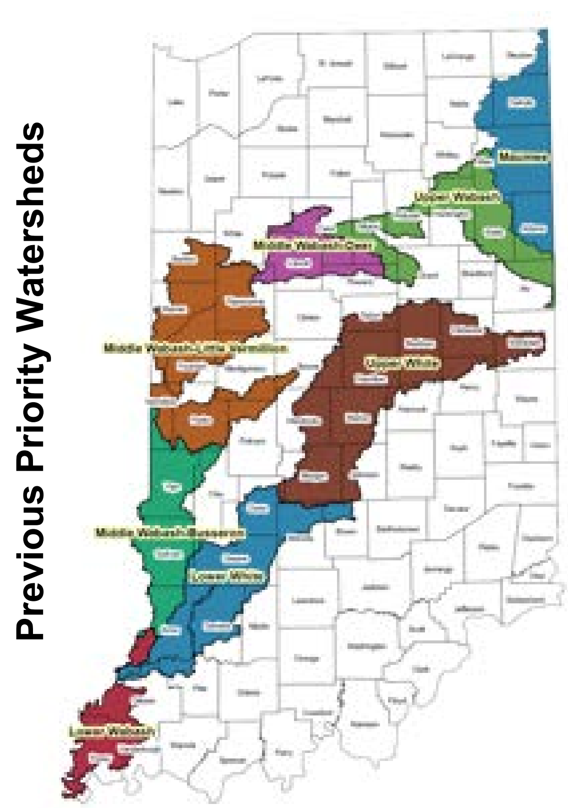


Figure 9 – Indiana's previous priority HUC8 watersheds

3.2 New HUC8 Priority Watersheds

Since it has been over a decade since the HUC8 priority watersheds were chosen, the SNRS Workgroup decided to re-examine the watersheds in the state to re-prioritize them. A Prioritization subcommittee of the SNRS Workgroup was formed and this committee developed a standardized, data-driven process to prioritize all the HUC8 watersheds in the state according to a tiered system. The purpose of this process is to direct resources toward the watersheds where reductions in nitrogen, phosphorus, and sediment loads will have the greatest impact and benefit for water quality. The subcommittee developed a six-factor, multi-category evaluation framework to score and rank all Indiana HUC8 watersheds. Each factor reflects a unique aspect of watershed condition or risk related to nutrient pollution.

3.2.1 Factors Used in Prioritization

Each HUC8 watershed was scored using these six factors, scoring from 1-5, with 1 being low priority and 5 being the highest priority.

1) **Source Water Protection watersheds** – presence/number of drinking water intakes or reservoirs indicating susceptibility of surface-water sources to contamination.
2) **Water Quality Monitoring Data/Trend results from the WRTDS analysis in Component 1 of the Science Assessement** – nitrogen and phosphorus load estimates (lbs/acre/year) from IDEM and USGS data (2015-2020).
3) **Impairments/Impaired Streams** – percent of streams miles assessed for aquatic life that are impaired for nutrients.
4) **Loading Data from SPARROW Model** – nitrogen and phosphorus yield from USGS SPARROW model (kg/km^2/year)
5) **Conservation Practice Implementation Data** – estimated sediment saved per agricultural acre based on the Region 5 model (lower values indicate fewer practices and lower reduction and therefore higher priority).
6) **Ground Water Vulnerability** – aquifer sensitivity rankings (1-5) based on Indiana Geological Survey datasets.

3.2.2 Categorization of Factors

Each of the six factors were assigned to one of three categories used for the final prioritization:

1) **Water Resource Protection** – These are factors that identify watersheds that have water resources, surface water and groundwater, that are valuable, and/or suspectable due to high levels of nutrients.
    a. Source Water Protection watersheds
    b. Ground Water Vulnerability
2) **Water Quality** – These factors identify the current state of water quality within HUC8 watersheds, focused on water quality as it relates to nutrients. Water quality metrics were also analyzed separately for **nitrogen-specific** and **phosphorus-specific** prioritization.
    a. Impaired Streams
    b. Water Quality Data results from WRTDS
    c. Loading Data from SPARROW

3) **<u>Indiana Conservation Partnership (ICP) Conservation Adoption</u>** – This factor was chosen to identify the amount of conservation practice adoption within the HUC8 watersheds based on sediment saved and its effect on water quality.
    a. Conservation Practice Implementation Data

3.2.3 Data Preparation and Scoring

To ensure comparability across different data sources and units, each factor and category was scored and values were standardized following a specific process. This process is described and recorded in the Methodology document in Appendix B. Supporting data and maps for each factor can be found in that document, and is also available on the Indiana State Nutrient Reduction Strategy website at https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/.

Each watershed was assigned one of four tiers based on how many of the three categories ranked as "high priority".

- Tier 1: High in all three categories
- Tier 2: High in two categories
- Tier 3: High in one category
- Tier 4: High in zero categories

3.2.4 Results

Maps were created to show the results of this prioritizationprocess. The map on the following page (Figure 10) shows the overall results of the watershed prioritization ranking when taking all factors and categories into consideration. Maps were also created to show the watershed prioritization based on nitrogen loads and on phosphorus loads. These nutrient-based maps do not differ much from the overall results in Figure 10, and can be found in Appendix B.

Tier 1 watersheds are the highest priority watersheds and Tier 4 are the lowest priority watersheds.

Tier 1 Watersheds	Tier 2 Watersheds	Tier 3 Watersheds	Tier 4 Watersheds
Middle Wabash-Deer	Little Calumet-Galien	St. Joseph (Michigan)	Maumee
	St. Marys	St. Joseph (Ohio)	Middle Ohio-Laughery
	Upper Great Miami	Auglaize	Upper Eel
	Lower Great Miami	Whitewater	Middle Wabash-Busseron
	Upper Wabash	Middle Wabash-Little Vermillion	Lower Wabash
	Salamonie	Lower White	Lower Eel
	Mississinewa	Driftwood	Flatrock-Haw
	Tippecanoe	Lower East Fork White	Upper East Fork White
	Wildcat	Patoka	Muscatatuck
	Vermillion	Highland-Pigeon	Silver-Little Kentucky
	Sugar	Iroquois	Blue-Sinking
	Upper White		Lower Ohio-Little Pigeon
	Kankakee		
	Chicago		

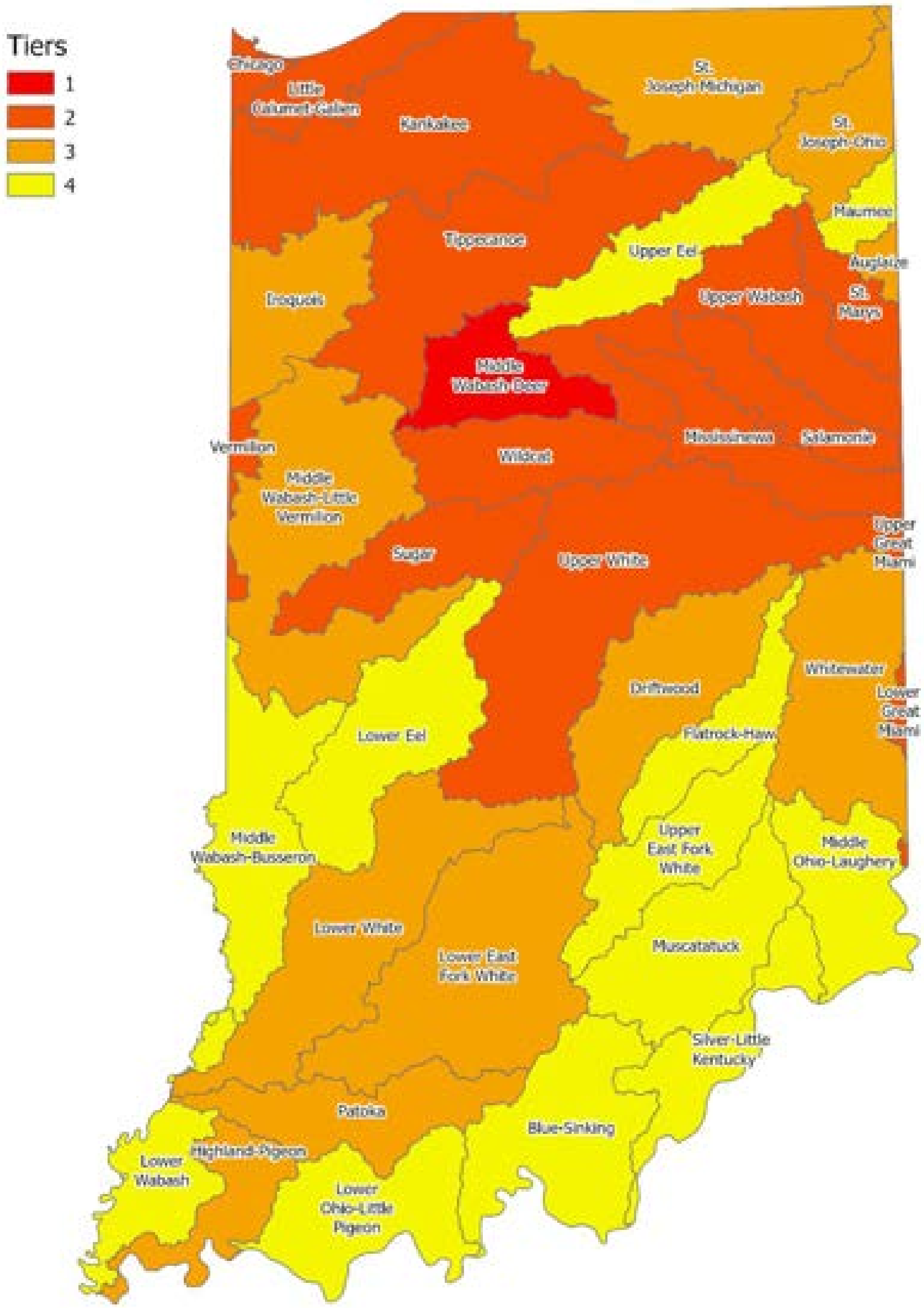


Figure 10 – Watershed Prioritization Tiers – Watershed Priorities

3.3 Further Prioritization

Prioritizing at the 12-digit HUC watershed scale is important because ambient water quality changes can occur more quickly at a smaller watershed scale in response to targeted land-based BMPs and reductions in point source discharges. There are several smaller watershed projects that Indiana partners have worked on together to gather significant amounts of water quality data that helps to measure changes over time. One example is the Eagle Creek watershed, which is a reservoir west of the City of Indianapolis, and a second is a long-term trend site for the USGS National Water Quality Assessment Program on Sugar Creek at New Palestine in south-central Indiana. Additionally, the Eagle Creek watershed has had multiple studies, specifically the School Branch watershed nested inside the Eagle Creek watershed, that has an ongoing Edge-of-Field study with a collaboration of many federal, state, and local partners. Information that is gathered from these smaller watershed scale projects can provide valuable water quality data and research data that can be used by watershed groups and organizations and for the Indiana Science Assessment.

Section 4 – Water Quality Monitoring in Indiana’s Waters

The primary goal of the Federal Clean Water Act (CWA) is to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” Most of the provisions of the CWA are implemented at the state level in Indiana through various CWA programs at IDEM in the Office of Water Quality (OWQ). Over the last few years, IDEM has sought to recognize the nexus between the CWA and the Safe Drinking Water Act in achieving water quality goals; thus, the *Indiana Water Quality Monitoring Strategy 2022-2026* includes the various surface water monitoring programs as well as the groundwater monitoring network. Surface water and groundwater interactions, including the effects of land use on quantity and quality, are being analyzed to assist with OWQ program decisions and are a factor in prioritizing watersheds for nutrient load reductions. School Branch, the National Water Quality Monitoring project mentioned in Section 3, is an example of coupling at differing scales, surface water and groundwater monitoring efforts to characterize a watershed and the effects of different land uses on water quality.

4.1 Water Quality Standards

Water Quality Standards (WQS) are the foundation of the water quality based control programs mandated by the Clean Water Act. A standard can consist of either numeric or narrative criteria for a specific physical or chemical parameter and is used as the regulatory target for permitting, compliance, enforcement, and monitoring and assessing the quality of the state's waters. When assessments identify a waterbody as not meeting adopted water quality standards, the assessment may lead to a determination of impairment, initiating further action such as a Total Maximum Daily Load (TMDL) or other regulatory procedure aimed at addressing the impairment.

Water quality standards consist of:

- Designated Uses: identification of how people, aquatic communities and wildlife use our waters (e.g. public water supply, propagation of aquatic life, recreation).
- Water Quality Criteria: numeric or narrative in form and protect the designated uses. Numeric criteria are allowable concentrations of specific pollutants in a water body while narrative criteria are statements of unacceptable conditions in and on the water.
- Antidegradation Policies: protection of existing uses and extra protection for high-quality or unique waters.

4.2 IDEM Water Monitoring Programs

4.2.1 Surface Water Monitoring Programs

IDEM’s surface water monitoring programs are implemented in the Watershed Assessment and Planning Branch and are guided by the *Indiana Water Quality Monitoring Strategy 2022-2026*, which can be found at https://www.in.gov/idem/cleanwater/surface-water-monitoring/indiana-surface-water-quality-monitoring-strategy/. IDEM collects surface water quality, bacteriological, biological, and habitat data for the following purposes:

- To fulfill requirements of the CWA §305(b), §303(d) and §314 to assess all waters of the state to determine if they are meeting their designated uses and to identify those waters that are not;
- To support OWQ programs including water quality (WQ) standards development, National Pollutant Discharge Elimination System (NPDES) permitting, and compliance;
- To support public health advisories and address emerging water quality issues;
- To support watershed planning and restoration activities;
- To determine WQ trends and evaluate performance of programs; and
- To engage and support a volunteer citizen scientist monitoring network across the state.

The following monitoring programs are employed to achieve the above objectives:

- Probabilistic monitoring in one basin/year on a 9-year rotating basin cycle (Figure 11);
- Fixed Station monitoring at 165 sites per month across the state;
- Fish Tissue contaminant monitoring on a 5-year rotating basin cycle;
- Targeted monitoring (watershed characterization) for Total Maximum Daily Load (TMDL) reassessments and document development, watershed baseline planning, and performance measures to determine if best management practices implemented in accordance with an approved 9-Element Watershed Management Plan have improved water quality. (To read about restoration success stories, please go to: https://www.in.gov/idem/nps/what-is-nonpoint-source-pollution/make-a-real-difference/);
- Cyanobacteria monitoring of 21 swimming beaches at 18 IDNR owned or managed sites and one IDNR dog park lake;
- Reference site monitoring to calibrate Indiana's biological indices
- Special studies such as thermal verification studies, Area of Concern monitoring, etc.; and
- Hoosier Riverwatch Program. http://www.in.gov/idem/riverwatch/index.htm

To see the Monitoring Matrix showing the current list of IDEM surface water monitoring projects, visit https://www.in.gov/idem/riverwatch/.

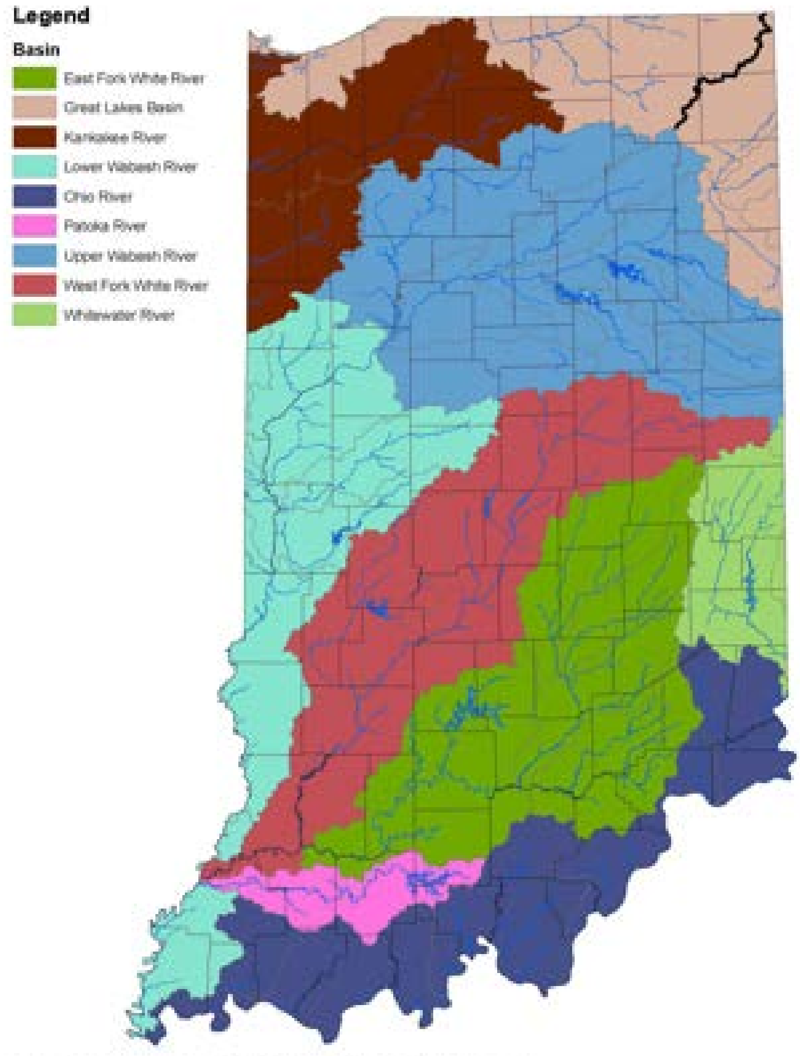


Figure 11 – Nine Major River and Lake Basins in Indiana
The major drainage basins are monitored probabilistically and assessed statistically by IDEM on a nine-year rotating basin schedule to determine if waters are meeting their designated uses and/or water quality standards.

4.2.2 Groundwater Monitoring Programs

In 2008, the Indiana Department of Environmental Management (IDEM) Groundwater Section[15] began collecting untreated water samples from groundwater wells statewide as part of a Groundwater Monitoring Network (GWMN)[16]. An estimated 30% of Hoosiers utilize a private residential well as their primary drinking water source. These wells are not regulated by the Safe Drinking Water Act[17], and residents may be unknowingly exposed to unsafe levels of

[15] https://www.in.gov/idem/cleanwater/information-about/groundwater-monitoring-and-source-water-protection/
[16] https://www.in.gov/idem/cleanwater/information-about/groundwater-monitoring-and-source-water-protection/statewide-groundwater-monitoring-network/
[17] https://www.epa.gov/dwreginfo/drinking-water-regulations

contamination. This was the impetus for starting the GWMN in Indiana. With the GWMN, IDEM seeks to:

1. Collect groundwater samples from public water supply (PWS) wells and private residential wells within distinct hydrogeologic areas of the state with the overall goal to determine the quality of groundwater in the state's aquifers,
2. Identify and expand sampling in areas with notable groundwater contamination, and
3. Practice continual improvement adjusting the GWMN as necessary to best fit resources (monetary/field support) and data gap needs.

The GWMN has grown each year with groundwater samples being collected from over 240 public water supply wells and approximately 1400 private residential wells. To date, nearly 4000 groundwater samples have been collected from the network over multiple rounds of sampling. Samples are analyzed for approximately 200 parameters which include nitrate-nitrite, pesticides, and pesticide degradants at each groundwater well sampled. For the statewide sampling, approximately 28% of groundwater samples contained detectable levels of nitrate-nitrites, but less than 2% of the samples contained nitrate-nitrite above the maximum contaminant level (MCL), with the highest observed concentration at 22 mg/L. Samples collected from hydrogeologic settings with a "high" or "very high" aquifer sensitivity (based on recharge models) showed the highest percentages of nitrate-nitrite contamination above the MCL.

In 2020 and 2021, approximately 360 of the previously sampled residential wells were resampled to collect updated data on groundwater chemistry. For this sampling, ammonia was added to the analyte list to better understand nitrogen loading and the nitrogen cycle in Indiana aquifers. Nearly 60% of these samples contained detectable levels of free ammonia at concentrations as high as 7.3 mg/L. Only approximately 7% of the samples contained both nitrate-nitrite and free ammonia, indicating that incomplete nitrogen cycling is occurring in these areas. Additional investigation and analysis is needed to fully understand the processes controlling nitrogen cycling in Indiana groundwater.

Since 2023, the focus of the Groundwater Monitoring Network has been on local-scale studies of geological and geochemical factors controlling arsenic contamination. Nitrogen (nitrate and ammonia) analysis is included in these studies, along with other geochemical parameters that may influence the nitrogen cycling, such as organic carbon (both total and dissolved) and humic and fulvic acid (UVA 254). These studies will allow better understanding of geochemical processes occuring within Indiana aquifers.

Once statistically-established ambient groundwater conditions have been established for Indiana, comparisons between groundwater and surface water data may be made and hypotheses concerning groundwater/surface water interactions can be formulated and tested.

On the next page (Figure 12) is the map depicting nitrate-nitrite results from the water samples collected. The GWMN website also has maps and information for other parameters that are analyzed.

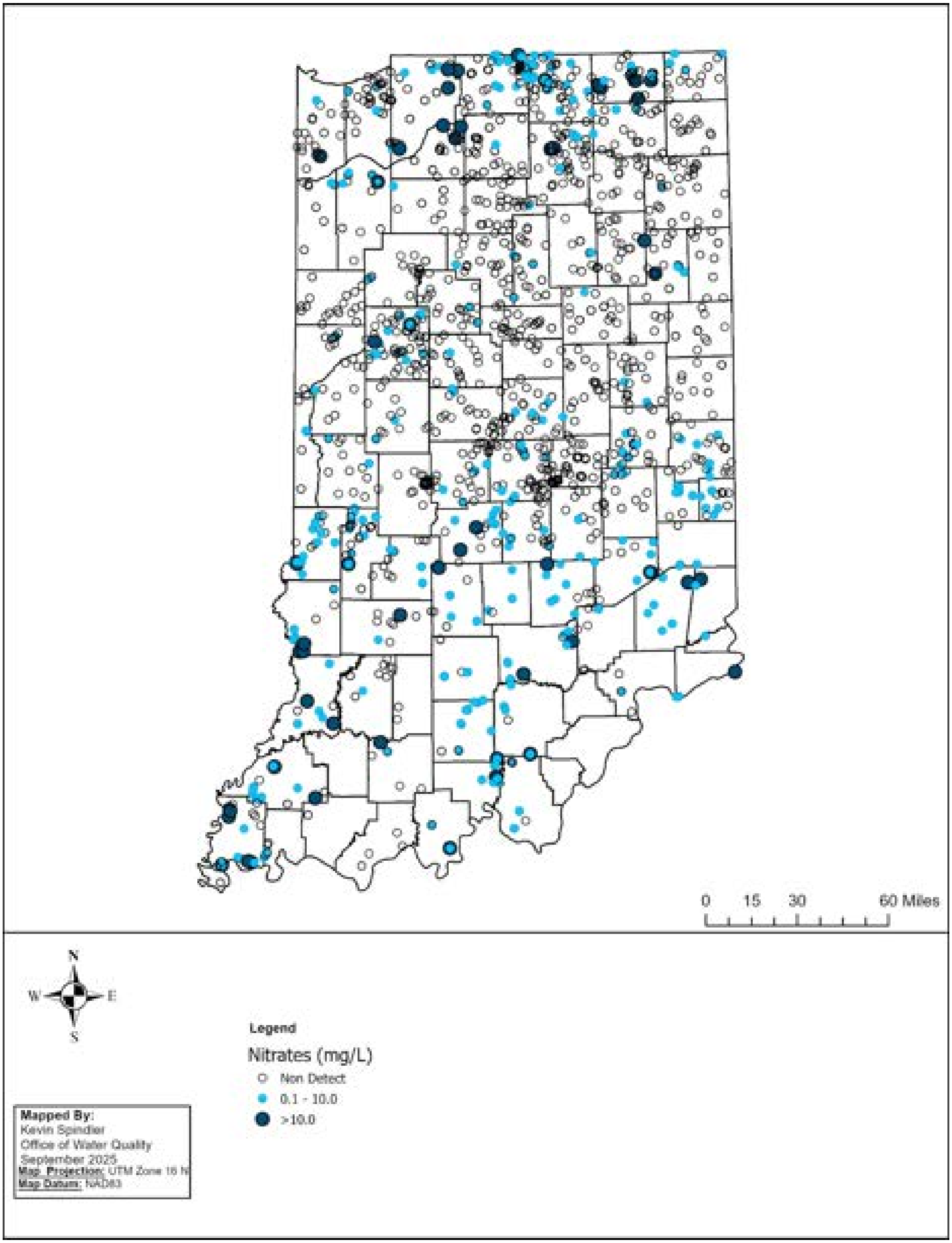


Figure 12 – Nitrogen, Nitrate-Nitrite Concentrations (mg/L) analyzed from wells

4.2.3 Data Sharing and Inventory

There is a wealth of monitoring data available in Indiana from the US Geological Survey (USGS), IDEM, other governmental entities, universities, and non-governmental organizations such as watershed groups, environmental consultants, and conservation organizations. The Indiana Water Monitoring Council (InWMC) was formed to "Maximize resources through improved communication, coordination, data sharing, and collaboration." IN 2026, this Council has joined forces with the Indiana Water Resources Association (IWRA), and will become the Water Monitoring committee under the IWRA. Specifically, the InWMC:

1) provides a forum for communication among groups that are monitoring water resources,
2) promotes sharing of monitoring information including data, and effective procedures and protocols for sample collection, and
3) facilitates the development of collaborative monitoring strategies.

The USGS, IDEM, ISDA, and TNC are working together to provide funding and resources to maintain the supergage on the Wabash River in New Harmony, IN to continue to capture the nutrient loads in the Wabash River. This site is an important site for the work under the Indiana Science Assessment for determining the trend of nitrogen and phosphorus loading to the Wabash River and ultimately the Gulf of America. In addition to the funding and support to maintain this USGS supergage, in 2024 USGS, TNC and ISDA worked with a company known as Gybe[18] to install, at the New Harmony site, a Gybe Sensor that measures satellite-based water quality information. The technology measures biological (such as chlorophyll), physical (such as turbidity), and chemical (such as nitrates and phosphates) parameters. It can give a complete view with detail across the entire waterbody, rather than information at limited grab sample or sonde locations. Over time, using the data gathered from the USGS supergage and the data gathered from the Gybe Sensor, the data can be compared to check the performance and accuracy of the Sensor.

Additionally, IDEM's External Data Framework (EDF)[19] provides a systematic, transparent, and voluntary means for external organizations to share their water quality data for consideration and possible use in various Office of Water Quality (OWQ) programs. IDEM OWQ recognizes that many universities, municipalities, watershed groups and grassroots organizations throughout the state participate in water monitoring activities at various scales. There are also regulated facilities that conduct monitoring above and beyond what their permits require. The EDF provides a pathway for greater collaboration between IDEM OWQ and the many individuals and organizations conducting water quality monitoring to help meet the shared goal of improving and protecting Indiana's water resources.

The premise of the EDF is that all data are potentially useful. The EDF is based on a graded approach that allows for varying levels of data quality depending on the intended use(s) of the data and available resources. Generally, the greater the stakes associated with a potential use, the more scientifically rigorous the supporting data needs to be. For the purposes of the EDF, scientific rigor means that the data collection followed documented field, laboratory, and data handling procedures and includes sufficient quality control to ensure the quality of the resulting

[18] https://www.gybe.eco/
[19] https://www.in.gov/idem/cleanwater/resources/external-data-framework/

data set is commensurate with its intended use. Using a graded approach to data quality allows OWQ to accept all readily existing data from external organizations and creates greater opportunity for collaboration.

4.3 IDEM Lake Monitoring Data

The Indiana Clean Lakes Program was created in 1989 as a program within the Indiana Department of Environmental Management's (IDEM) Office of Water Management. The program is administered through a grant to Indiana University's O'Neill School of Public and Environmental Affairs (SPEA) in Bloomington. The Indiana Clean Lakes Program is a comprehensive, statewide public lake management program founded on three overall objectives:

1. Lake Water Quality Assessment
    - Lake water quality assessments are conducted annually on 70-80 publicly accessible lakes randomly distributed throughout the state of Indiana.
    - These data are used to update the lake classification system and management plan as well as to update Sections 305(b) and 303(d) listing of impaired waterbodies to the U.S. EPA.

2. Citizen Science – Volunteer Lake Monitoring
    - The Volunteer Lake Monitoring expands upon the water quality assessments of the statewide program by training volunteer citizen scientists to collect data on the lake where they live or most frequently recreate.
    - Data from citizen scientists allow the Indiana Clean Lakes Program to track more long term trends in specific lakes than would be cost effective for the statewide monitoring program.
    - The program has multiple levels of monitoring available depending on the needs of the lake community and the volunteer's time commitment.

3. Outreach and Education
    - Publish monthly web engagements to social media or website.
    - Sponsor and present at the annual Indiana Lakes Management Society conference.
    - Trainings and workshops: Lake Science 101, Aquatic Macrophyte ID and Mapping, Aquatic Invasive Species Monitoring, etc.
    - Lake Association programs and assistance: technical assistance on their lake and data interpretation, develop programs and workshops for the specific needs of these groups, etc.

4.4 Harmful Algal Bloom (HAB) Monitoring Data

IDEM's blue-green algae (cyanobacteria) monitoring program samples twenty-one swimming beaches at eighteen IDNR owned or managed sites and one dog park lake. Those samples are analyzed for the type and quantity of blue-green algae present and for the following toxins which may be produced by certain types of blue-green algae: microcystin, cylindrospermopsin (only done if species that produce it are present), anatoxin-a, and saxitoxin.

For protection of human health from exposure to the algae and any of the toxins, cyanobacteria will be compared to the World Health Organization (WHO) and U.S. EPA guidelines. Recreational advisory signs are posted when the cyanobacteria cell counts are at or above 100,000 cells/ml. IDNR's advisory states, *"Swimming and boating permitted. Avoid contact with algae. Don't drink the water. Shower with warm soapy water after swimming. Do not use lake water for cooking or bathing. Do not allow pets to swim in or drink water where algae are present."*

For cyanotoxin exposure for dogs, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment has developed action levels for microcystin, anatoxin-a and cylindrospermopsin. The Oregon Health Authority Public Health Division has set an action level for saxitoxin. A warning to dog owners using the Fort Harrison State Park Dog Park lake will occur whenever any cyanotoxins are detected, and the lake will be closed to dogs if levels in the table below are met.

EXPOSURE THRESHOLDS

Exposure Reference Values ppb (µg/l)	Microcystin	Cylindrospermopsin	Anatoxin a	Saxitioxin
Human Recreation Advisory	8.0	6.0	8.0	0.8
Dog Recreation Advisory	0.4	0.5	-	-
Dog Recreation Prohibited	0.8	1.0	0.4	0.05

Table 1 – Exposure thresholds for human and dog recreation.

Exact cell counts and toxin levels can be found in the Test Results section of the web site at https://www.in.gov/idem/algae/test-results/. Swimming areas will stay on the Advisory alert level until the cell counts fall below 100,000.

The Blue-Green Algae home page is found at: http://www.in.gov/idem/algae/.

Cell Count Summary

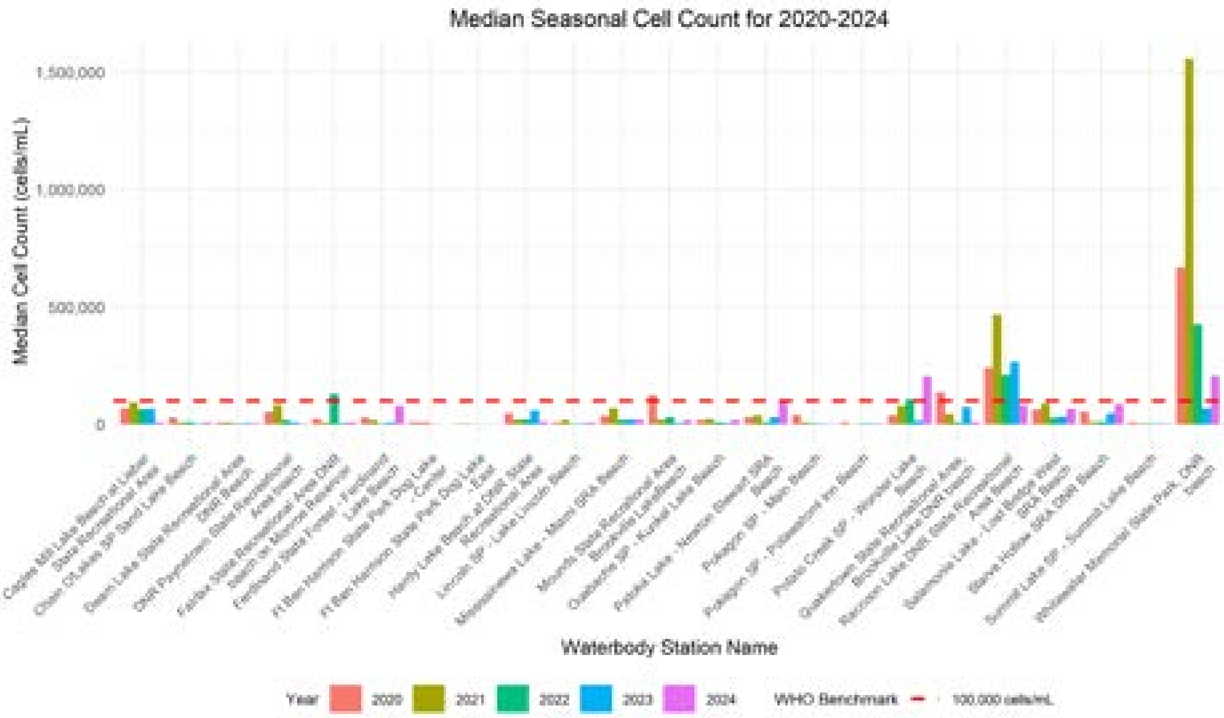


Figure 13 – Median Seasonal Cell Count for 2020-2024 in sampled State Recreation Areas (SRAs) and State Parks.

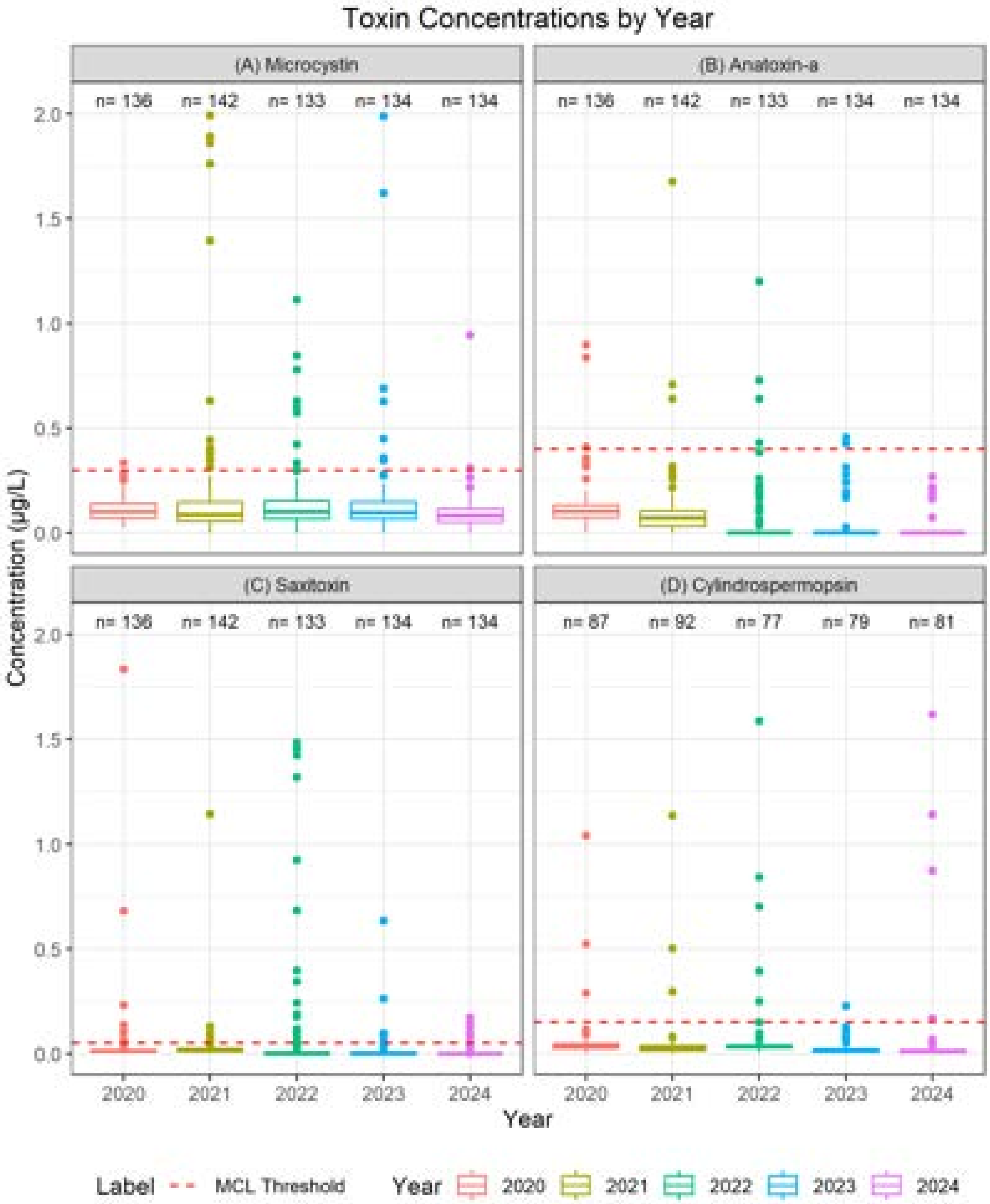


Figure 14 – Annual Cyanotoxin concentrations for 2020-2024 in sampled State Recreation Areas (SRAs) and State Parks.

4.5 CWA 305(b) Water Quality Assessments

CWA 305(b) requires states to assess water quality conditions of all waters of the state. IDEM conducts two types of CWA 305(b) assessments. Comprehensive basin assessments are based on statistical analyses of data collected by IDEM's Probabilistic Monitoring program and reflect overall water quality conditions throughout a given basin. Waterbody-specific assessments are based on data collected by both the Probabilistic and Targeted Monitoring programs and are representative of conditions in a given waterbody. Both assessment types are based on Indiana's water quality standards (WQS), which provide narrative and numeric water quality criteria that Indiana waters must meet to ensure they support their designated uses – the activities that we as a society want those waters to support and the benefits that we want them to provide (e.g. public water supply, propagation of aquatic life, recreation). Indiana's WQS may be found online at: https://www.in.gov/idem/cleanwater/resources/water-quality-standards/

To make waterbody-specific 305(b) assessments, IDEM follows the processes outlined in its *Consolidated Assessment and Listing Methodology* (CALM), which describes the designated uses IDEM assesses, types and amount of data needed to make each type of assessment, and the water quality criteria used to make them. The CALM also explains IDEM's Consolidated Listing Process, which places all Indiana waters into one or more of five categories depending on what is known about their water quality and the extent to which they are meeting their designated uses. IDEM's most recent CALM is available online at https://www.in.gov/idem/nps/watershed-assessment/water-quality-assessments-and-reporting/idems-consolidated-assessment-and-listing-methodology-calm/

U.S. EPA has issued drinking water health advisory values for cylindrospermopsin and microcystin-LR which allow IDEM to use these cyanobacterial toxins as water quality indicators for determining support of the public water supply designated use.

Public Water Supply Use Support – All Waters		
Chemical Toxicants	Minimum of three measurements collected within the same year at least one month apart	Most recent five consecutive years
Cyanobacterial Toxins	Minimum of one measurement Or One consumption and use notification issued by a water treatment facility based on cyanobacterial toxin concentrations in treated drinking water	Most recent five consecutive years
Conventional Inorganics	Minimum of three measurements collected within the same year at least one month apart	Most recent five consecutive years
Bacteria	All Level 1 and/or Level 2 assessments performed in accordance with the Revised Total Coliform Rule (RTCR)	Most recent five consecutive years

Table 2 – Public Water Supply Use Support – All Waters

Indiana is committed to prioritizing drinking water sources and reducing nutrients to them.

4.6 The 303(d) List of Impaired Waters

CWA Section 303(d) requires states to develop a list of impairments identified through IDEM's 305(b) assessments for which a Total Maximum Daily Load (TMDL) must be developed. IDEM develops the 303(d) List of Impaired Waters as part of its Consolidated List and publishes both in the biennial Indiana Integrated Water Monitoring and Assessment Report. IDEM's most recent (2024) Integrated Report can be found online at: https://www.in.gov/idem/nps/watershed-assessment/water-quality-assessments-and-reporting/integrated-water-monitoring-and-assessment-report/

The Consolidated List includes assessment information for all waters of the state while the 303(d) list is a subset of just those waters that are known to be impaired.

IDEM relies primarily on data collected by the Watershed Assessment and Planning Branch monitoring programs for its CWA 305(b) assessments, which are how most impairments are identified. However, IDEM also solicits additional data and information from external parties to develop its list, including state and federal agencies, colleges and universities and local organizations, such as county health departments, cities and towns, and watershed management groups, to develop its 303(d) list.

IDEM publishes the draft 303(d) list and the CALM every two years for a 45-day public comment period in order to lend transparency to its assessment and listing processes and to give the public an opportunity to provide input regarding these processes and any additional information that might be useful for developing the 303(d) list. U.S. EPA also provides comments during this time. After the public comment period ends, IDEM reviews all comments received, makes any necessary revisions, and works with U.S. EPA to get formal approval of the 303(d) list.

4.7 Total Maximum Daily Loads (TMDLs)

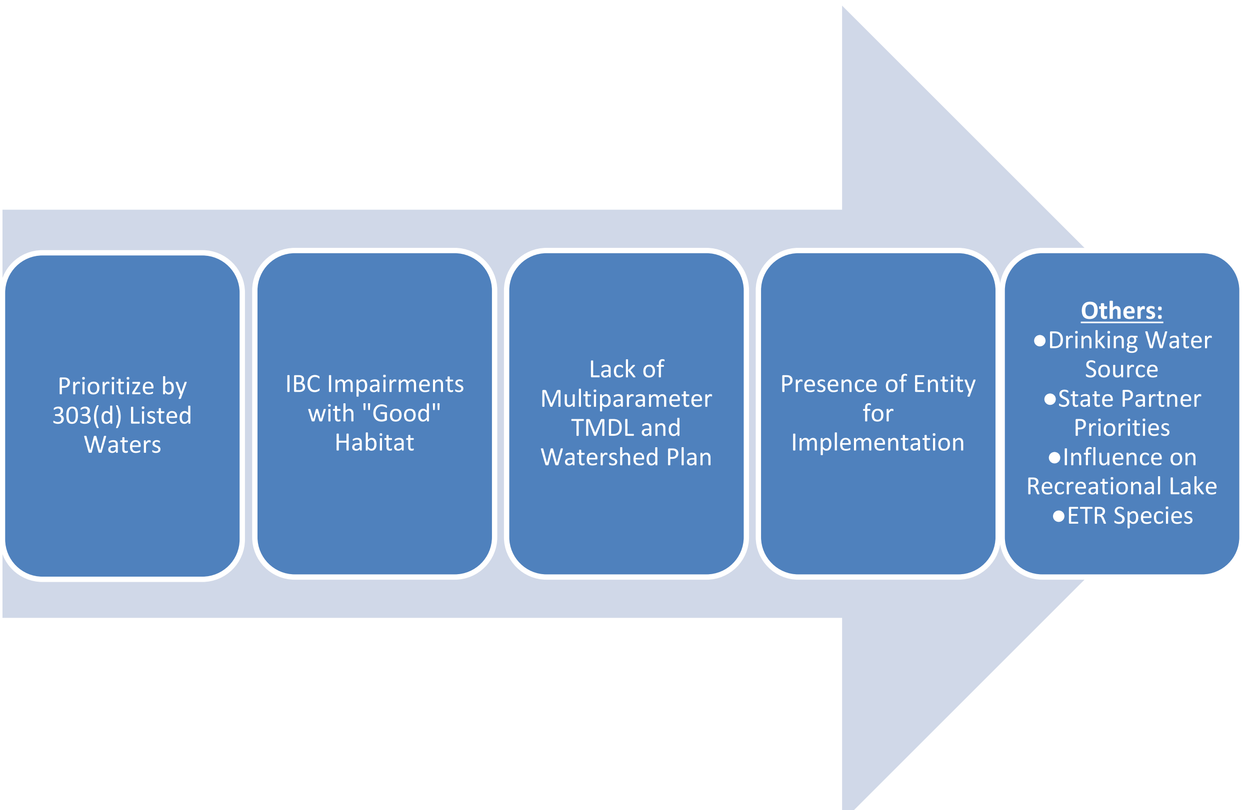
CWA Section 303(d) requires states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting their WQS and have been placed on the state's 303(d) list for one or more impairments. A TMDL is a report that identifies the maximum amount of pollutant that a waterbody can receive and still meet water quality standards, and allocates that amount among the sources of the pollutant in the watershed. The TMDL also provides information that can be used to guide restoration activities in the watershed aimed at mitigating the impairment(s) identified and restoring water quality.

The completion of a TMDL report is just the first step in remedying an impairment. Once a TMDL report is completed, IDEM works with local watershed groups wherever possible to implement the recommendations in the TMDL document, which are intended to help restore the waterbody to the point at which it meets water quality standards. More information on the TMDL program, including completed TMDL reports and those still in progress may be found online at: https://www.in.gov/idem/nps/resources/total-maximum-daily-load-reports/.

IDEM's TMDL Program Priority Framework[20], which U.S. EPA approved in 2016, and then most recently updated in 2025, identifies a prioritization process that addresses nutrient pollution by focusing on impaired biotic communities where the habitat is good. TMDLs will be developed for streams and rivers with impaired biotic communities and *E. Coli* impairments caused by one or more of the following conditions:

- Dissolved oxygen
- Algae
- Total Suspended Solids
- Phosphorus

The following graphic illustrates the secondary filters or considerations for prioritizing TMDLs:



[20] https://www.in.gov/idem/nps/watershed-assessment/total-maximum-daily-loads/

Section 5 – Nutrient Criteria

The quantitative measure of the state's progress in nutrient reduction will be addressed in sections to follow.

5.1 Narrative Limits

The state of Indiana currently has narrative limits found at 327 IAC 2-1-6 regarding minimal criteria for water quality. https://iar.iga.in.gov/code/2026/327/2#327-2-1-6. Those state:

"All surface waters at all times and at all places, including waters within the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges that do any of the following:

(A) Will settle to form putrescent or otherwise objectionable deposits.
(B) Are in amounts sufficient to be unsightly or deleterious.
(C) Produce:
(i) color;
(ii) visible oil sheen;
(iii) odor; or
(iv) other conditions;
in such degree as to create a nuisance.
(D) Are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to:
(i) create a nuisance;
(ii) be unsightly; or
(iii) otherwise impair the designated uses

5.2 Numeric Criteria

The development of numeric nutrient criteria for Indiana waters continues to present difficult and complex challenges. Indiana's recent collaboration with U.S. EPA through the Nutrient Scientific Technical Exchange Partnership Support (N-STEPS) program provided valuable insight into the relationship between nutrient levels and biological responses in Indiana's rivers and streams. The study found that diatom indices had the strongest relationship with nutrient levels, while macroinvertebrate indices showed moderate relationships and fish indices showed little to no correlation. Because IDEM already collects diatom data through its Probabilistic and Reference Site monitoring programs, the Diatom IBI may offer a practical tool to supplement nutrient or biological condition assessments.

The N-STEPS study also found significantly lower nitrate (measured as nitrate + nitrite) concentrations at sites with modeled reference conditions – based on StreamCat variables that reflect minimal human disturbance – compared to the measured nitrate levels at bioattaining and designated Reference Sites. This suggests that Indiana's current expectations for nutrient and biological conditions (*i.e.*, reference conditions) may be based on systems with elevated nitrate levels. This finding helps explain unexpected results that showed a weak positive relationship between nitrate levels and biological indices. In practice, measurements of total Kjeldahl nitrogen (TKN) showed a better predictive relationship to biological indices than nitrate.

Other nutrient-related indicators, such as dissolved reactive phosphorus (DRP) and benthic algal biomass, were also evaluated but presented significant challenges. DRP is highly variable and difficult to measure accurately in flowing systems, while periphyton biomass is influenced by many factors other than nutrients, making them poor predictors of biological response. IDEM is in the early stages of reviewing the findings of the N-STEPS study and will engage internal stakeholders to evaluate next steps. These results highlight both the complexity of nutrient assessment and Indiana's willingness to partner with U.S. EPA to explore science-based solutions for effective nutrient management strategies.

Currently, Indiana uses the following nutrient benchmarks for rivers and streams, which are monitored by the IDEM and are considered alongside the state's narrative limits in nutrient TMDLs:

Total Phosphorus	Not to exceed 0.3 mg/L
Nitrate+Nitrite	Not to exceed 10 mg/L (current Drinking Water standard)
Dissolved Oxygen	Not to be below 4.0 mg/L or consistently in the range of 4.0 to 5.0 mg/L and/or not to exceed 120% saturation
pH Values	Not to be above 9.0 or consistently close to the standard (8.7 or above)
Algae Growth	Should not be "excessive" based on field observations by trained staff

In most cases, two or more of these conditions must be met on the same date in order to classify a waterbody as impaired. This methodology assumes a minimum of three sampling events.

U.S. EPA published its 2021 Nationally Recommended Ambient Water Quality Criteria to Address Nutrient Pollution in Lakes and Reservoirs as well as the Technical Support Document for the 2021 nutrient lake criteria. The models can be used to derive Indiana-specific chlorophyll-a, TN and/or TP values that will protect a specific designated use (aquatic life, recreation, drinking water). U.S. EPA developed, as part of a pilot project for the 2021 NRWQC, an Indiana-specific chlorophyll a-microcystin model for the recreation designated use at certain lakes and reservoirs. IDEM found that the model did show a strong and promising relationship, but the model was based on a small dataset. Additional paired chlorophyll-a and microcystin data is needed to further evaluate the model. IDEM is evaluating whether additional lake data from the Corps of Engineers may be used to derive a nutrient model and resulting criteria for a sub-set of Indiana lakes, such as our reservoirs, to protect the recreation and/or drinking water designated use. IDEM will also evaluate the feasibility of implementing other models that may be more appropriate for protecting designated uses at other lakes and reservoirs, and whether additional data collection is needed to verify and implement the selected models.

Section 6 – Practices to Reduce Point Source and Nonpoint Source Pollution

6.1 Point Source Pollution

Point Source (PS) pollution is defined as water pollution that comes from a single, discrete place, typically a pipe. The Clean Water Act specifically defines a "point source" as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture."[21]

It is important to remember that not all pipes create point source pollution. Federal and state laws exist that require permits and place limits on many different types of businesses, cities, and industry that may discharge water containing pollutants to a pipe that, in turn, may flow to a river, stream or lake. These limits are set at levels protective of both aquatic life and recreational use in the waters which receive the discharge. The National Pollution Discharge Elimination System (NPDES) program will be discussed further in the next section on programs.

6.1.1 Point Source (Regulated) Strategy Objectives

Urban/Suburban and Rural

- Wastewater Treatment Plants (WWTPs) and Publicly Owned Treatment Works (POTWs) will seek to employ optimization techniques by analyzing their current operation and maintenance processes to seek better nutrient removal.
- Combined Sewer Overflow (CSO) communities will implement their long term control plans (LTCPs) and associated schedules and track progress. Nutrient load reductions will be quantified via modeling and, where possible, by ambient water quality monitoring as projects and practices are implemented.
- Stormwater management:
  - Municipal Separate Storm Sewer System (MS4)[22] communities will implement their stormwater quality management plans (SWQMPs) and track progress.
  - Construction site sediment runoff controls will be implemented according to the Notice of Intent (NOI) and living stabilization covers will be used that minimize nutrient inputs.
  - Industrial site runoff controls will be implemented according to the Notice of Intent (NOI).

[21] https://www.epa.gov/cwa-404/clean-water-act-section-502-general-definitions

[22] Municipal Separate Storm Sewer Systems (MS4s) are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels and conduits. It does not include combined sewer overflows and publicly owned treatment works. https://www.in.gov/idem/stormwater/municipal-separate-storm-sewer-systems-ms4/

- Local health departments and communities will continue to identify failing residential septic systems and seek to put infrastructure in place to replace them or connect them to WWTPs.

6.2 Nonpoint Source Pollution

Nonpoint Source (NPS) pollution means that the source of pollution cannot be traced back to a single point or location, and its source is usually unidentifiable. It can come from oil, pet waste, pesticide, herbicide, fertilizer, road salt, bacteria, sediment, and any other contaminant that ends up on the ground naturally or from human activity. Rainwater and snowmelt pick up these contaminants as it washes over yards, sidewalks, driveways, parking lots, and fields and deposits them into Indiana's lakes and streams as nonpoint source pollution. Common sources of nonpoint source pollution in Indiana include:[23]

- Animal production operations and feedlots;
- Agricultural activities;
- Stream bank and shoreline erosion;
- Timber harvesting;
- Land disturbance;
- Urban, suburban, and rural residential runoff;
- On-site sewage diposal units;
- Solid waste disposal landfills;
- Transportation-related facilities;
- Coal mining;
- Oil and gas production;
- Non-energy mineral extraction; and
- Atmospheric deposition

6.2.1 Nonpoint Source Strategy Objectives

The overall goals are to enhance nutrient management, promote soil health practices, and restore more natural hydrology and ecological functions by promoting drainage water management, floodplain restoration, and wetland restorations (rather than moving water off the landscape quickly) and emphasizing the importance of allowing water to infiltrate where it falls.

Hydromodification is the alteration of the natural flow of water through a landscape that reduces precipitation infiltration and changes drainage patterns causing rainfall to discharge into streams more quickly with higher energy. Large flow events occur more frequently and local drought and flood cycles may be exacerbated. The U.S. EPA indicates that hydromodification is one of the leading sources of water quality degradation in our nation's waters.[24]

[23] https://www.in.gov/idem/nps/what-is-nonpoint-source-pollution/
[24] National Management Measures to Control Nonpoint Source Pollution from Hydromodification, EPA 841-B-07-002, July 2007.

The U.S. EPA indicates that hydromodification is one of the leading sources of water quality degradation in our nation's waters.

Examples of hydromodification include channelization and dredging; streambank denuding; removal of riparian corridors, wetlands and floodplains; stream relocation; dams; streambank and shoreline hardscapes; subsurface drainage (agricultural and residential); and conversion of open landscape to roads, buildings, parking lots, and other impervious surfaces. These changes to flow result in higher sedimentation and nutrient loading to our waterways as well as higher water temperatures, lower dissolved oxygen, degradation of aquatic habitat structure and declines in biological communities.

Indiana's nonpoint source approach is built around watershed-based plans that pool local, state, and federal resources to deliver coordinated practices where each best management practice (BMP) reinforces the next. By targeting high-priority HUC12 subwatersheds, those small, interconnected drainage units where nutrient exports are highest, state and local partners can concentrate outreach, technical assistance, and funding in places where the combined impacts are greatest. For example, a farmer tests their soil and applies fertilizer at the right rate and timing to match crop needs. After harvest, they seed cover crops to hold soil in place and scavenge leftover nutrients through winter. A grass filter strip along the field edge then traps any sediment or residual nutrients before water flows into the stream. That system ensures precise nutrient uptake at planting, locks up leftover nutrients, and filters out sediment and phosphorus in the grass strip, each practice forming its own barrier to keep nutrients from leaving the field.

To assemble these systems of BMPs, Indiana must consider every available funding source. At the federal level, the Natural Resouces Conservation Service (NRCS) programs like Environmental Quality Incentive Program (EQIP), Conservation Stewardship Program (CSP), the Regional Conservation Partnership Program (RCPP) and the Mississippi River Basin Intiative (MRBI) deliver cost-share and agronomic expertise for in-field practices. State programs such Clean Water Indiana grants, layer additional incentives for edge-of-field treatments, riparian buffers and soil health improvements. Local Soil and Water Conservation Districts (SWCDs) and watershed groups add small grants, outreach events and on-farm demonstrations, reducing adoption barriers and promoting local successes. Wherever possible, nutrient trading markets and fee-for-service models complement grants, offering flexible, market-based pathways for municipalities, industries and farmers to invest in watershed health.

A comprehensive monitoring framework that combines water-quality sampling, practice assessments, and load-reduction modeling informs adaptive management. Effective nutrient reduction efforts require clear, consistent, and adaptive communication across agencies, landowners, and partners. Use of dashboards, GIS maps, and collaborative planning tools foster transparency, build trust, and ensure that all partners are strategically aligned. Communication strategies should go beyond data-sharing by incorporating stakeholder-specific messaging and visuals that turn complex science into clear, actionable guidance.

Strategies/Opportunities for improvement include but are not limited to the following approaches:

Urban/Suburban landscapes: create a green infrastructure (GI) paradigm by seeking incentives and opportunities for it.[25]

- Support practices that promote infiltration, bio-retention, and more natural water release.
- Seek the installation of larger, regional or multipurpose GI practices that are often more cost-effective.
- Ensure that the maintenance of GI practices is included in cost estimates and budgets.
- Provide technical and financial support to install rain gardens, green roofs, rain barrels, and porous pavement in industrial, commercial and residential settings.

Rural landscapes:

- Repair and restore streambank stabilization.
- Restore stream sinuosity and riparian buffers.
- Restore and reconnect riparian wetlands and floodplains.
- Employ practices from the *Indiana Drainage Handbook* for the maintenance of legal drains such as retaining native vegetation on one streambank while staging maintenance equipment on the side with easier drain access.
- Install 2-stage ditches where feasible on both regulated and non-regulated drains.
- Install drainage water management BMPs and saturated buffers on working lands.
- Restore natural wetland areas with hydric soils.

Agricultural landscapes:

- Repair and restore streambank stabilization.
- Ensure compliance with the Confined Feeding Operation (CFO) and Fertilizer Certification rules via routine inspections.
- Timely investigate reports of nutrient mismanagement or runoff from regulated farms and spills from unregulated farms.
- Promote manure storage, treatment, and nutrient recovery systems (e.g., lagoons, composting) to prevent over-application of livestock waste.
- Repair broken sub-surface drainage tile that create blow-holes that allow surface water to enter sub-surface drainage systems. Consider adding blind inlets in place of tile risers.
- **Adopt nutrient management planning**:
    - Optimize inputs and uptake by crops through employing nutrient efficiency practices of the "4 Rs" specific to the field and cropping system to meet crop needs while minimizing losses; applying the right nutrient source at the right rate at the right time in the right place.
        - Examples of some nutrient efficiency practices includes:
            - No fall application of nitrogen is recommended, but if fall application is done, it should not be in any form of nitrate and after soil temperatures are below 50°.

[25] U.S. EPA's website for Green Infrastructure is a great resource for design and implementation measures as well as funding sources, and Indiana's manual entitled the *Planning and Specification Guide for Effective Erosion and Sediment Control and Post-Construction Water Quality* shows pollutant removal expectations for the various BMPs.

    - Type of nitrogen and placement – do when it can be most efficient for the crop, for the environment, and for economics.
    - Split applications of nitrogen can reduce input costs and prevent over-application of nutrients.
    - Apply sulfur to make nitrogen and phosphorus more available to plants (sulfur increases/improves nitrogen and phosphorus efficiency).
    - Use nitrogen stabilizers in the soil to extend the availability of nitrogen in the root zone during critical growth stages. It keeps N in the form (NH_4) that is available to the plant instead of the form (NO_3) that is lost through leaching into groundwater or denitrification into the atmosphere.
  - Increase outreach on manure management to livestock farms.
  - Increase outreach to and adoption by farmers of performing regular soil sampling to determine nutrient management needs on ag land.
- **Emphasize soil health**: Healthy soil with a higher organic matter content reduces erosion, requires less nutrient inputs, ameliorates the effects of flood and drought, and reduces nutrient and sediment loading to streams and rivers. The four key principles to increasing organic matter and building healthy soils are:
  - Minimize disturbance through no till or conservation tillage practices.
  - Maximize soil cover.
  - Keep living roots growing as long as possible.
  - Grow a variety of plants.
- Implement a system of conservation practices to get the most bang for the buck. A system of conservation practices is important and is what is needed. Each conservation practice treats nutrients differently, so a system or combination of practices treats nutrient runoff more effectively.

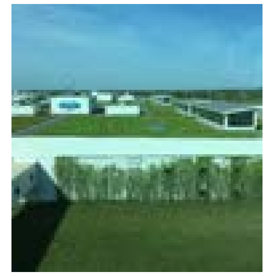
> *A system of conservation practices is important and is what is needed. Each practice treats nutrients differently, so a system or combination of practices treats nutrient runoff more effectively.*

6.2.2 Practices to Reduce Nonpoint Source Pollution

Urban/Suburban practices: below are some examples and recommendations of BMPs that can be used to slow, infiltrate, and treat runoff in urban and suburban landscapes to address nonpoint source pollution.

- Curb Cuts: curb cuts are spaces cut into parking lot curbs to allow storm water to flow onto a pervious surface. In areas with large parking lots, curb cuts are a good option for reducing storm water runoff, and can be especially valuable if combined with the parking islands that contain a rain garden.

- Swale: a swale is very similar to a rain garden. Both are depressions where storm water is allowed to infiltrate deep into the ground. Swales are usually larger and longer that rain gardens, and are able to treat greater amounts of storm water.



- Green Roof: green roofs are where plants and small shrubs are planted on top of buildings. Green roofs lower the temperature of a building, filter pollution and reduce the amount of runoff from rain. They can also reduce the heat island effect in cities.
- Pervious pavement: porous pavement refers to any surfacing material that allows storm water to move through it rather than run off so it can infiltrate into the ground.
- Rain Barrel: a rain barrel is a large 40-60 gallon container that collects rainwater from a roof. The barrel is placed at the base of a downspout which directs the water into the barrel during rain and a hose attached to the bottom of the barrel can be used to water lawns and gardens.

- Rain Garden: a rain garden is a planted depression that collects rainwater runoff from impervious urban areas, such as roofs, driveways, walkways and compacted lawn areas, and allow the water to absorb into the ground. This reduces rain runoff by diverting rainfall away from storm drains.

Agricultural practices: below are some examples and recommendations of BMPs that can be used on rural and agricultural lands to address nonpoint source pollution.

An important factor to consider on agricultural lands is sub-surface drainage. The use of sub-surface drainage tile on agricultural lands is important for high production of agricultural crops, however sub-surface drainage is associated with an increase in nitrate loads to streams and rivers that drain to the Gulf of America and the Great Lakes, where it contributes to the low oxygen hypoxic zone. One way to reduce nitrate loads would be to reduce the amount of drained land, but this is unlikely due to the important role of drainage in Midwestern agriculture. Instead focus should be on ways that cropping systems and drainage systems can be managed to reduce nitrate loads, while maintaining high agricultural productivity. [26]

One way to reduce nitrate loads would be to reduce the amount of drained land, but this is unlikely due to the important role of drainage in Midwestern agriculture. Instead focus should be on ways that cropping systems and drainage systems can be managed to reduce nitrate loads, while maintaining high agricultural productivity.

[26] "Ten Ways to Reduce Nitrogen Loads from Drained Cropland in the Midwest", L.E. Christianson, J. Frankenberger, C. Hay, M.J. Helmers, and G. Sands, 2016. Pub. C1400, University of Illinois Extension.

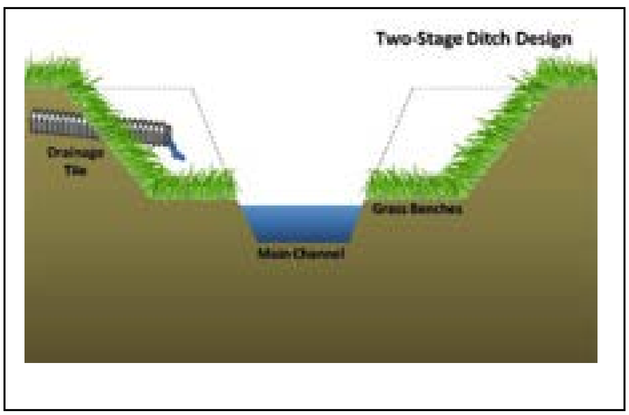
The following practices are BMPs that can be used in managing nitrate loads thus improving water quality from agricultural-drained cropland, and can be used to reduce phosphorus loads from agricultural lands and help keep soil in place to prevent erosion.

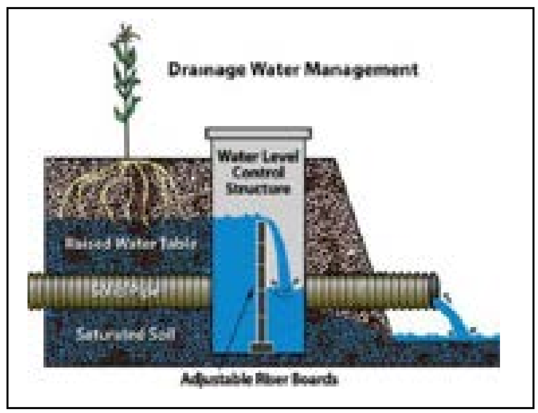
- **Conservation Tillage Practices** – No-till, strip-till, ridge till and mulch till are practices that leave crop residues on the soil surface to reduce soil erosion by water, and can increase organic matter content of the soil allowing for many benefits including increased infiltration.
- **Cover Crops** – Cover crops can reduce soil disturbance and hold the soil in place to prevent erosion and the transport of particulate phosphorus attached to sediment. Also, because cover crops increase infiltration of water, this could reduce surface water runoff with dissolved phosphorus. Cover crops also maintain living roots year-round; winter cover crops capture residual nitrogen and build soil organic matter. A winter cover crop, such as cereal rye, that are planted in the fall and cover the soil during the winter reduce nitrate losses by taking up water and nitrate from the soil after the main crop is harvested, and cover crops that overwinter can also take up nitrate before the main crop starts growing in the spring.
- **Soil Testing** – Conducting a soil test provides an opportunity to check the nutrient levels in the soil, thereby allowing accurate nutrient recommendations and management to be made for the field.

- **Improved nutrient management** – Applying nitrogen at the rate needed by the crop and in spring or summer as close as possible to the time it is needed can reduce nitrate loads in subsurface drainage water. Using the right sources of fertilizers and manures at the right rate at the right time and in the right place allows for good management of nutrients and can improve the efficiency of the plants that are using the nutrients, thus decreasing the amount that is transported off the field.
- **Livestock Exclusion & Heavy Use Area Protections** – Install exclusion fencing to keep livestock out of streams and sensitive riparian zones, reducing direct nutrient inputs and bank erosion. Construct Heavy Use Area Protection (HUAP) and off-stream watering facilities to stabilize high-traffic zones, minimize sediment runoff, and improve animal health. These practices work together to protect water quality while supporting sustainable grazing systems.
- **Perennials in the cropping system** – Perennials are plants that can grow for two or more years without re-planting, such as hayland. By increasing perennials in the cropping system, they reduce nitrate loads by extending the season during which water and nitrates are removed from the soil, and are the least “leaky” cropping system. Long-term perennial planted crops also help keep soil in place to reduce erosion and allow for infiltration of water to reduce runoff.
- **Controlled Drainage (Drainage Water Management)** – Drainage water can be managed through the use of adjustable water control structures placed in the drainage system that allow the outlet level (or water depth) to be adjusted. Water can be held in

the field reducing the overall amount of drainage water and nitrogen that moves downstream.

- **Reduced Drainage Intensity** – Installing drainage pipes either with wider spacing or closer to the soil surface can reduce the total water drained, and thus, result in less nitrate transported from the field.
- **Drainage Water Recycling** – Capturing and storing drainage water in a pond or reservoir and then returning it to the soil through irrigation can reduce or even potentially eliminate nitrate loss by reducing the water that leaves the site.
- **Bioreactors** – Bioreactors are trenches filled with woodchips through which drainage water is routed, allowing water to be treated by enhancing the natural, biological process of denitrification.[27]
- **Two-Stage Ditches** – This practice consists of a small main channel that accommodates low flow conditions and a second low, grassed floodplain that accommodates high flows within the ditch. This creates a zone of plants and soil that absorbs part of the nitrate load through plant uptake and denitrification, and can also reduce flow, as well as decrease costs of ditch maintenance.
- **Saturated Buffers** – This is an edge-of-field practice that allows drainage water to be distributed through a riparian buffer via a shallow perforated drain pipe that extends laterally along the buffer. As the drainage water seeps through the buffer soil, denitrification is increased and the roots take up the drainage water and nitrate.





- **Constructed Wetlands/Wetland Restorations** – Wetlands reduce flooding and can improve water quality. Wetlands remove nitrate through denitrification, plant uptake, and reduction in flow due to seepage and evaporation. Constructed wetlands can be built to treat tile-drain effluent and overland flow.
- **Conservation Buffers** – Strips of land planted with trees and/or grasses help control pollutants by slowing water runoff, preventing erosion, trapping sediment, fertilizers and pesticides before they reach surface waters, and enhancing infiltration within the buffer area. Buffers can include riparian areas, grass filter strips.

[27] Denitrification is defined as the part of the nitrogen cycle where nitrate is converted to a gaseous form of nitrogen, typically either dinitrogen gas or nitrous oxide. The soil microbes responsible for this process require a carbon source and anaerobic (low oxygen) conditions in addition to a supply of nitrate.

- **Grassed Waterways** – A grassed waterway is a natural or constructed channel that is shaped or graded and planted with suitable vegetation for the stable conveyance of runoff from a field or diversion without causing erosion in the channel and flowing to a stable outlet. The vegetation in the waterway slows the water as it flows through the waterway and may uptake nutrients before reaching nearby surface waters.
- **Grade Stabilization Structures** – these are practices that hold soil in place to prevent excessive erosion in high flow areas.
- **Blind Inlets** – using blind inlets in place of tile risers in the field can filter excess water and P loss to tile drains.
- **Bottomland Timber Establishment** – Planting trees in the floodplain can help keep soil in place and control erosion. It can restore or enhance the natural and beneficial functions of wetlands, and can enhance wildlife habitat.

6.2.3 Septic System Management for Nutrient Reduction

Septic and failing onsite wastewater systems represent a significant nonpoint source of nitrogen and phosphorus across Indiana's urban and rural communities. To date, data on the location, condition, and failure rates of septic systems have been fragmented, limiting our ability to target efforts where they will drive the greatest water-quality improvements. A new, CWA-funded Indiana Septic Inventory and Spatial Methodology Study will help fill this gap by surveying every county health department, updating counts of known, unknown, and failing septic systems, and piloting a GIS-driven inventory in selected counties. These spatial inventories will support watershed-scale prioritization, enabling IDEM and local partners to implement voluntary repair and replacement incentives exactly where nutrient loads from malfunctioning systems are highest.

Financial barriers often keep homeowners from repairing or replacing failing systems, so the Lake Monroe Water Fund has launched an innovative funding model to expand access to grants, low-interest loans, and public–private partnerships for septic maintenance, system upgrades, and sewer hookups. By educating bank officers, contractors, and local health departments on nonpoint-source financing, developing technical-assistance tools, and publishing an online directory of funding resources, the project directly supports the strategy's call for market-based incentives that turn environmental stewardship into an economically accessible option for homeowners of all income levels.

Complementing these on-the-ground efforts, the Indiana Septic Systems Resource Toolkit consolidates best practices, regulatory guidance, and funding links into a single, publicly accessible platform. Crafted to meet NOAA and U.S. EPA nonpoint-source management measures, the toolkit empowers property owners and local officials with the technical knowledge and outreach materials needed to sustain healthy onsite systems over the long term. This centralized resource advances the strategy's education and stakeholder-engagement objectives, ensuring that every homeowner understands both the environmental concerns and the financial options for septic upkeep. https://sites.google.com/view/indianasepticsystems/home

Since 2004, Indiana's Clean Water State Revolving Fund (CWSRF) program has invested over $426 million in nonpoint-source related loans to remove or replace more than 23,120 failing septic systems. From small rural districts to municipal hookups, these projects demonstrate the impact of sustained financial commitment, directly reducing nutrient inputs to Indiana's lakes and rivers while complementing local momentum for larger watershed restoration efforts.

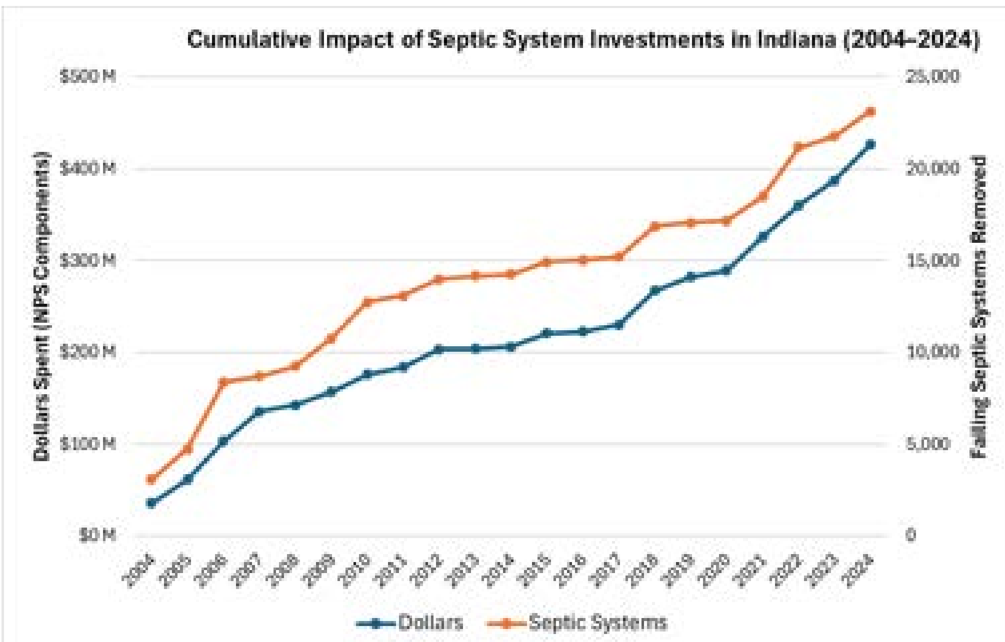


Figure 15 – Cumulative impacts of failing septic system removals through the Clean Water State Revolving Fund program from 2004-2024.

6.2.4 Key Takeaways

No single practice can solve nutrient loading on its own. Impactful load reductions are obtained when in-field controls, edge-of-field treatments and landscape-scale buffers operate as a system with each practice building on each other. A systems thinking, along with watershed-scale prioritization, increases overall return on investment and greater watershed level resiliency. Leveraging every funding source lowers economic hurdles and accelerates adoption.

Ongoing monitoring and modeling support real-time adjustments to practice mixes, incentive structures, and funding priorities. For detailed specifications, funding tiers, and implementation timelines, see the Indiana Nonpoint Source Program Management Plan.

Section 7 – The Indiana Science Assessment

Estimating nutrient reduction from individual conservation practices is critical for tracking water quality improvement but is very scientifically challenging. Indiana has made substantial progress in tracking sediment and nutrient load reductions statewide. Starting in 2013, the U.S. EPA Region 5 Sediment and Nutrient Load Reduction Model was adopted by the ICP to model the conservation practices that are implemented through assistance of all the ICP partnership staff.
The current method that Indiana uses to capture sediment and nutrient load reductions from the conservation practices applied is explained further in Section 9 – "Measuring Impacts". While this method has worked for Indiana, it has some limitations and it would benefit from using the most recent research and by including more parameters such as dissolved nutrients and practices such as nutrient management. The ICP is working to strengthen the current method in order to capture more accurate reductions and to better assess the progress being made on improving water quality.

In 2018, it was agreed upon by conservation agency staff and partners, including researchers from universities, that Indiana needed a science assessment to determine a load reduction method based on observed reductions in Indiana and similar regions in the Midwest. Additional goals to achieve would be determining the current or baseline load which can be used to set goals and provide an additional method for assessing progress, provide agreed-upon reduction estimates that could be used beyond the state's Nutrient Reduction Strategy, provide a foundation for speaking with one voice about conservation priorities, and determining the efficiency of various conservation practices on the reduction of nitrogen and phosphorus loads to improve water quality.

Tracking nutrient loading in Indiana's waterways is important for highlighting the accomplishments of all conservation practice implementation efforts around the state. Monitoring efforts statewide have been increasing in recent years as well, yet gaps in the data remain, making it challenging to tie modeled data to observed effects downstream. Without an Indiana focused science assessment, national models sometimes based on extrapolation are used, which may not highlight progress made in Indiana. A science assessment can provide a systematic, inclusive, widely accepted assessment of Indiana's nutrient loads during the baseline period and in future years.

A Core Team of partners from the Indiana State Department of Agriculture (ISDA), Indiana Department of Environmental Management (IDEM), the Indiana Natural Resources Conservation Service (NRCS), the Indiana Chapter of The Nature Conservancy (TNC), the Indiana Agriculture Nutrient Alliance (IANA), and the Purdue University College of Agriculture developed an overall strategy to guide the Science Assessment, which was finalized in September of 2019 and can be found on the Indiana Science Assessment website here, https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/indiana-science-assessment/.

7.1 Components of the Indiana Science Assessment

The Science Assessment consists of two critical needs to move the State Nutrient Reduction Strategy forward.

7.1.1 Component 1 – Water Quality Trends in Indiana's Waters

Component 1 is to determine historic and ongoing nutrient loads leaving the state, and also by watershed basins in the State Nutrient Reduction Strategy.

Three water quality constituents were chosen to meet the objectives outlined by Component 1: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). Water quality monitoring data at key locations around the state were identified, analyzed and used to determine the trend of nutrient loads leaving the state at the pour points on the state borders, and at pour points within the major river basins in the state. Water quality monitoring data included in the trend analysis is from USGS's streamflow and discharge data and IDEM's Fixed Station water quality and nutrient concentration data.

Data was evaluated using the USGS WRTDS model to determine trends in nitrogen, phosphorus, and sediment loads and concentrations. The WRTDS model and method "normalizes" loads to average flow conditions, providing a trend analysis of flow-normalized loads and concentrations[28]. It more clearly evaluates changes in nutrient loads and concentrations that are caused by factors other than changes in streamflow, such as land-use, management changes, and hydromodification. The time period of data used in this trend analysis is based on the best data that we have available at this time. Originally, the desire was to mirror the baseline period of the Gulf of America HTF, which is 1980-1996, however this is not possible due to the timeframe of the available data for Indiana.

Analyzing water quality monitoring information to determine loading and trends within each of the basins in the state will help show the current state of Indiana's water quality and will further help in prioritizing watersheds for more targeted conservation efforts in the future.

Project Objectives

1. Better understand long term trends of water quality related to nutrients entering and exiting the state.
2. Better understand trends of water quality related to nutrients within the state.
3. Document the data compilation, processing, and statistical methods used for the project.
4. Document the statewide and basin site-specific trend results.

[28] Load is the amount (mass) of a pollutant that is discharged into a water body during a period of time (i.e. tons of sediment per year). Concentration is the mass of a pollutant in a defined volume of water (for example, milligrams of phosphorus per liter, or PPM). The flow-normalized is calculated by dividing the total load over the estimation time period by the total streamflow.

Site Selection

Site selection was based on the goals of this project, within the constraints of approximately collocated IDEM fixed station locations and USGS streamflow gages. To be considered approximately collocated, a fixed station site and a streamflow gage are required to have within 10% drainage area ratios, and discharge data was adjusted by the drainage area ratio. Key locations were chosen within the state's basins, as well as those sites leaving the state and entering the state.

Key site locations were selected as close to the downstream export of each major basin to capture the major exports from each basin. Sites were also selected to capture the exports from basins interior to the state. There are nine site locations or pour points near or at the state border that act as **exports (Ex)**. There are three site locations or pour points that are entering the state of Indiana and are located along the northeast border of Indiana and are referred to as **imports (Im)**. There are eight site locations within the state's major river basins that are referred to as **interior (In)** sites. Refer to Table 3 for the list of sites used in the analysis, and Figure 16 showing the location of sites and their corresponding watersheds.

Table 3: List of sites used in trends analysis

Map ID	USGS Site Name	Sub-Watershed	Type
Mississippi River Basin			
Ex1	Wabash River at New Harmony, IN	Wabash River	Export
Ex2	Kankakee River at Shelby, IN	Kankakee River	Export
Ex3	Whitewater River at Brookville, IN	Whitewater River	Export
Ex4	Iroquois River near Iroquois, IL	Kankakee River	Export
Ex5	Blue River near White Cloud, IN	Ohio River	Export
Im1	Wabash River at Linn Grove, IN	Wabash River	Import
Im2	Mississinewa River near Ridgeville, IN	Wabash River	Import
In1	Wabash River at Riverton, IN	Middle and Lower Wabash	Interior
In2	Wabash River at Lafayette, IN	Upper Wabash	Interior
In3	Wildcat Creek near Lafayette, IN	Middle Wabash	Interior
In4	White River at Petersburg, IN	White River	Interior
In5	East Fork White River at Shoals, IN	East Fork White River	Interior
In6	White River at Newberry, IN	West Fork White River	Interior
In7	Patoka River at Winslow, IN	Patoka River	Interior
Lake Michigan Basin			
Ex6	St. Joseph River at Niles, MI	Lake Michigan	Export
Ex7	Burns Ditch at Portage, IN	Lake Michigan	Export
Ex8	Trail Creek at Michigan City, IN	Lake Michigan	Export
Western Lake Erie Basin			
Ex9	Maumee River at New Haven, IN *(used with SR101 in IN near IN/OH State Line)*	Maumee River	Export
Im3	St Joseph River near Newville IN	St. Joseph River	Import
In8	Maumee River at New Haven, IN	Maumee River	Interior

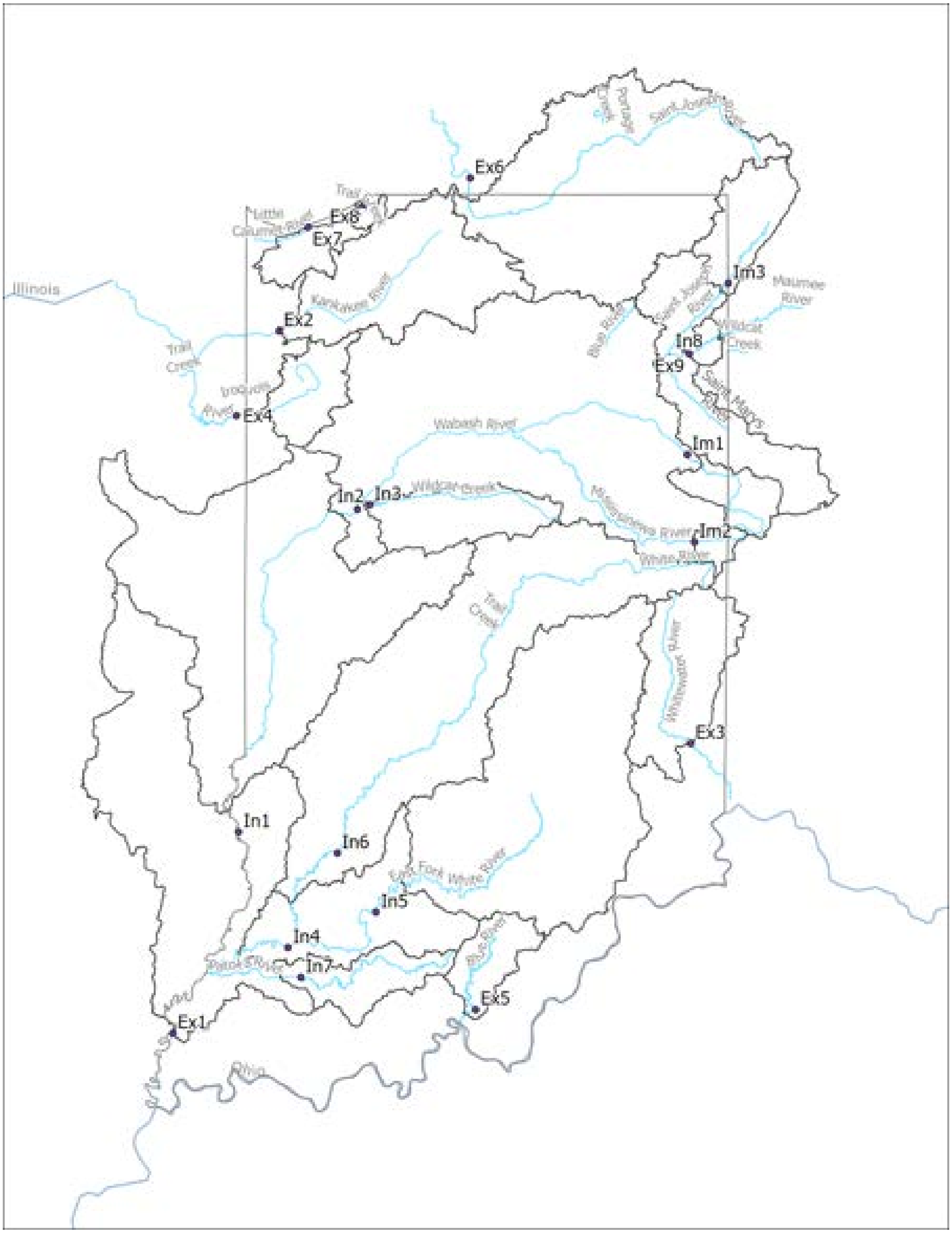


Figure 16 – USGS streamflow gages and associated watershed areas for all sites.
The figure shows the site location for the USGS gages for each sampling site, and the associated drainage area for each watershed.

Trend Results

The results of all of the analyses, as well as an explanation and method of how the analysis was completed, can be found in the report *Trends of Sediment and Nutrient Loads in Indiana Watersheds*, which can be found on the Indiana Science Assessment website[29]. Flow normalized loads (referred to as fluxes in WRTDS) and concentrations for each constituent were calculated annually by the WRTDS model for each site. In the report, all of the export sites that were identified for each major basin were summed to provide the total load for each corresponding basin for each constituent. The largest period of overlapping data was used for all sites. Individual sites generally have longer trends, and the basin trends are the summation of the individual annual loads from the longer site trends. Figures 17-19 on the next three pages show the trends for TN, TP, and TSS for the statewide export sites for the Mississippi River Basin, the Lake Michigan Basin, and the Western Lake Erie Basin.

The trends report also includes flow normalized loads and concentrations for each constituent calculated annually by WRTDS for each individual site that was selected for analysis. The trends report includes data through 2020, however using new data in recent years, each site has been re-calculated to add additional data through 2023. To see these results for each individual site, refer to Appendix C. More information can also be found in the Trends Report. In addition, as more years of data are collected, future updates of the trends for these sites will be made available on the Indiana Science Assessment webpage on ISDA website.

[29] https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/indiana-science-assessment/

All Sites that Export from Indiana to the Mississippi River Basin

The largest period of overlapping data was used for the 5 export sites in the Mississippi River Basin, which was from 2000-2019, to show the flow normalized load/flux trend.

The 5 sites are:

1) Ex1 - the Wabash River at New Harmony, IN,
2) Ex2 - the Kankakee River at Shelby, IN,
3) Ex3 - the Whitewater River at Brookville, IN,
4) Ex4 - the Iroquois River near Iroquois, IL, and
5) Ex5 - the Blue River near White Cloud, IN.

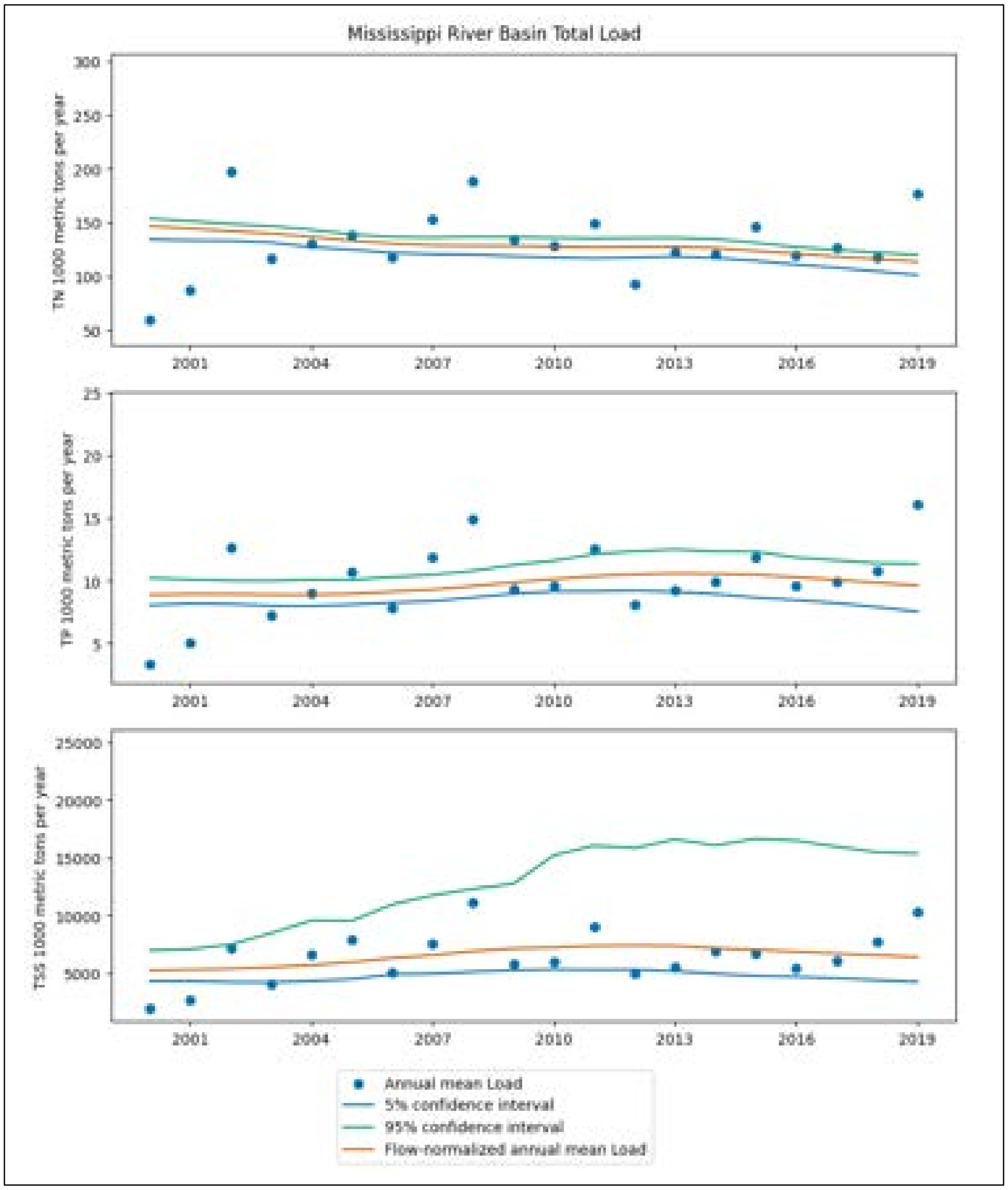


Figure 17 shows the trend in flow normalized load combined for the 5 Mississippi River Basin export sites.

All Sites that Export from Indiana to Lake Michigan

The largest period of overlapping data was used for the 2 export sites in the Lake Michigan Basin, which was from 1994-2018, to show the flow normalized load/flux trend. The 2 sites are: 1) Ex6 - the St. Joseph River at Niles, MI and 2) Ex7 - Burns Ditch at Portage, IN. The Trail Creek site at Michigan City was not used because it had a gap in coverage of discharge data from the mid-1990s to the mid-2000s, and therefore it was not included in the Lake Michigan Basin trend.

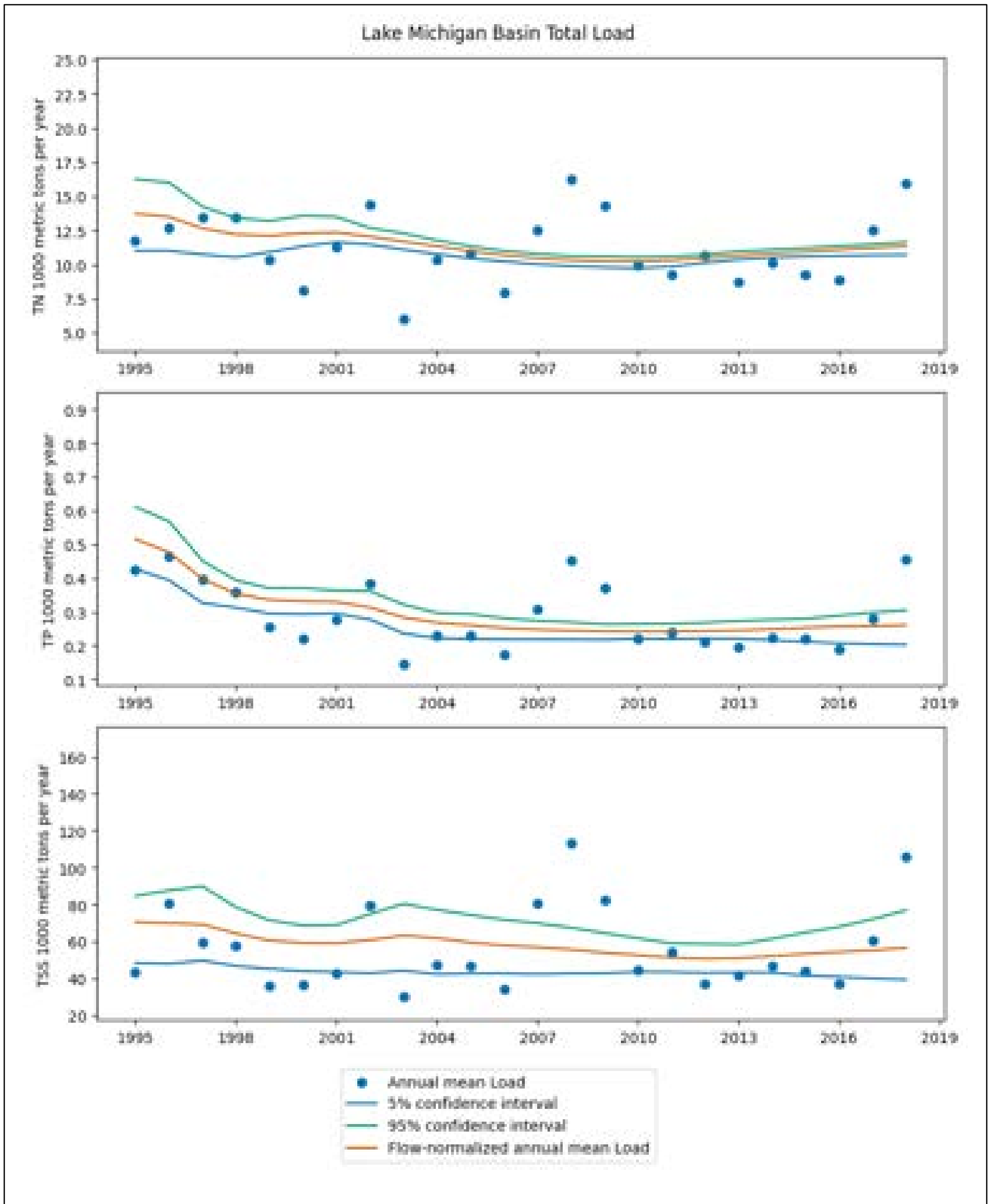


Figure 18 shows the trend in flow normalized load combined for the 2 Lake Michigan Basin export sites.

<u>All Sites that Export from Indiana to the Western Lake Erie Basin</u>

There is only one export site in the Western Lake Erie Basin, and the period of data for this export site was from 1967-2020. However, the graphs below showing the flow normalized load/flux trend show results of the data from 1980-2020 so that a more recent trend is shown, and because WRTDS variability in early data did not produce reliable results. The IDEM site is on the Maumee River at SR 101 in Indiana near the IN/OH state line (Ex9), and the USGS site used is located on the Maumee River in New Haven, IN.

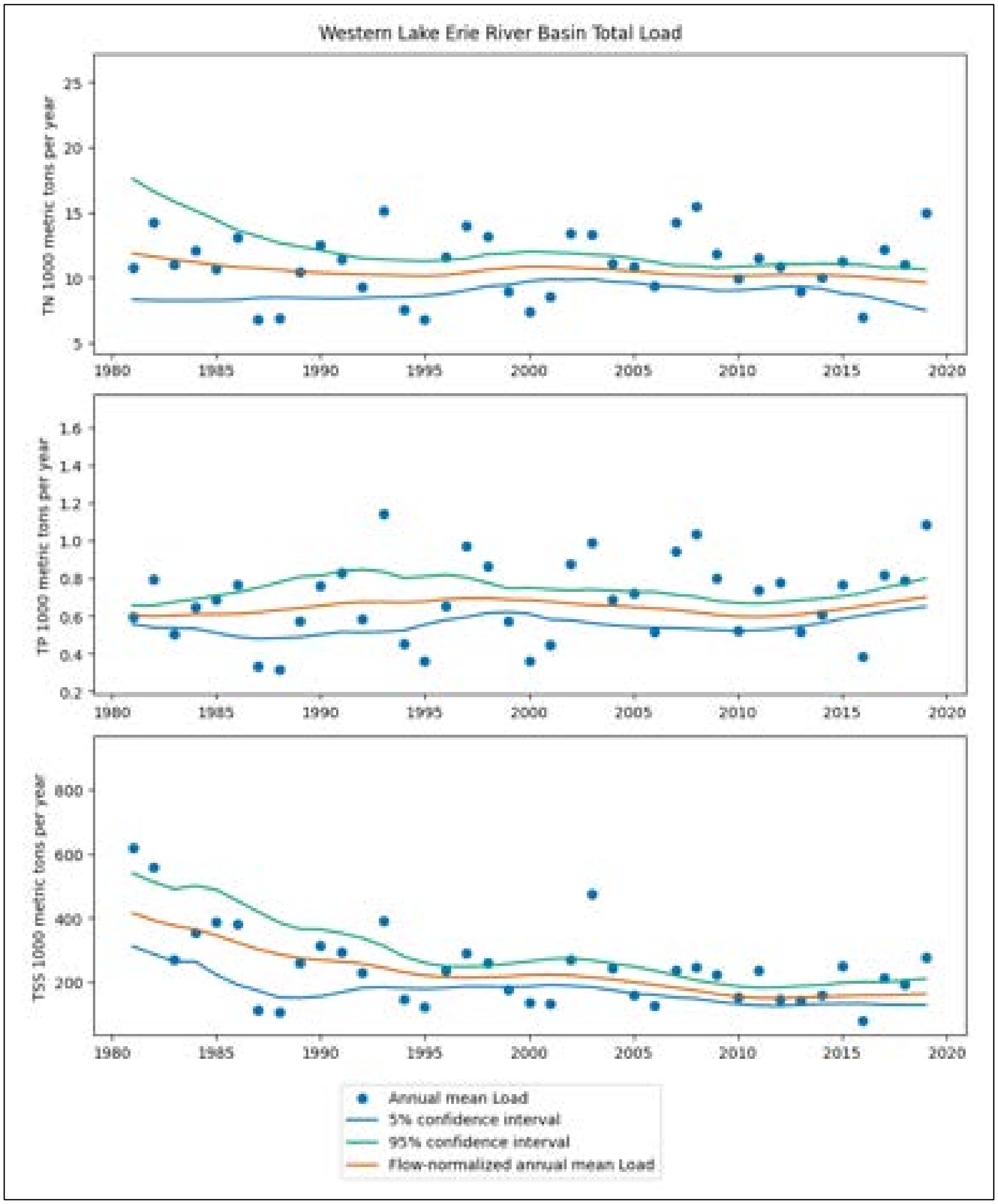


Figure 19 shows the trend in flow normalized load for the Western Lake Erie Basin export site.

7.1.2 Component 2 – Conservation Practices Efficiences

Component 2 is to improve method to quantify nutrient reductions from conservation practices, including dissolved nutrients, and determine efficiency of practices in reducing loads.

Monitoring conducted around the Midwest and in Indiana provides new understanding of the effectiveness of in-field and edge-of-field conservation practices in reducing nitrogen and phosphorus loads from agricultural fields. This research is being compiled, reviewed and analyzed with a goal to improve the current method that Indiana uses to calculate reductions in sediment and nutrient loads from the implementation of conservation practices. A team of experts, working through the Purdue University College of Agriculture, is analyzing research studies and data to determine the effectiveness of certain conservation practices on reducing the nitrogen and phosphorus loads, and using this to identify or develop a standardized tool for calculating nutrient load reductions from conservation practices. Drawing from available science that can apply to Indiana cropland, this will allow for more consistent communication of the value of practices to those involved in implementation, as well as uncover knowledge gaps that need to be addressed with future research.

The Core Team, with members from conservation organizations and agencies mentioned under the intro to this section, provides overall guidance to this component. The assessment is also guided and advised by a Science Committee comprised of scientists and experts from throughout Indiana, which provides scientific input and evaluation of the process. The members are established researchers from five academic institutions in Indiana and two federal science agencies (USDA-ARS and USGS) who conduct research related to nutrients and water quality in Indiana. To see the list of Science Committee members, refer to the Science Assessment website.

Practices being studied in the Indiana Science Assessment include soil health practices, nutrient management practices, In-field and Edge-of-Field practices, practices that manage water and drainage, and practices that change the cropping system. The practices include:

1. No-Till
2. Reduced Tillage
3. Cover Crops
4. Nitrogen Rate
5. Phosphorus Rate (based on soil test P)
6. Nitrogen Timing
7. Subsurface P application
8. Drainage Water Management
9. Filter Strips/Riparian Buffers
10. Grassed Waterways
11. Blind Inlets
12. Two-stage ditches
13. River-floodplain restoration and reconnection
14. Constructed or restored wetlands
15. Bioreactors
16. Water and Sediment Control Basins (WaSCOBs)
17. Nitrification inhibitor
18. Gypsum
19. Saturated Buffers
20. Phosphorus Removal Structures
21. Adding Small Grain into rotation
22. Adding hay into rotation
23. Harvested/grazed perennials
24. Non-harvested perennials
25. Reduced drainage intensity

This list of practices were chosen and agreed on based on one or more of the following:

- This practice is promoted by agencies in Indiana,
- There is potential for widespread use of the practice in Indiana,
- Sufficient data exists in the literature to assess the practice effectiveness, and
- Indiana scientists have expertise and willingness to assess the practice.

The goal of this assessment is to address the effects of conservation practices on nitrogen loss, phosphorus loss, and sediment loss; and to show reductions in both surface runoff and tile drainage (where applicable). Also, for applicable practices, the reductions will be expressed in two ways; by 1) percent reduction, and 2) pounds per acre (lbs/acre).

Surface Runoff

Tile drainage
(where applicable)

For each practice, definitions and criteria have been developed to provide a collective list and consistent definitions of conservation practices. The definitions provide a broad overview of the practice and a basis for the definition used in this project. The criteria for inclusion into the Science Assessment provides a basis for deciding which research studies to include in the systematic review. A public version of the definitions document can be found on the Science Assessment website.

Communicating results is important for ensuring support for the Science Assessment results and providing transparency about the process of development. Results of the Assessment will be shared through:

1) Document of practice definitions (as mentioned above);
2) A tool that will calculate practice effectiveness for new practices implemented in the state and improve the current method to calculate and track nutrient reduction;
3) A table that will report effectiveness of each practice;
4) Development of Practice Fact Sheets to show results of analysis; and
5) A website to make information about the Science Assessment easily accessible to conservation partners and the public.

A strategy was developed for connecting practices from the science assessment to the practices assisted by NRCS and other ICP agencies. These relationships will allow us to apply calculated effects to practices that are installed throughout Indiana.

Fact sheets showing results of the analyses of practice effectiveness have been and are being developed for each practice that is completed and approved by the Science Committee, which will be shared with practitioners, landowners, and others. These fact sheets are being designed in two formats, one with more detail about the data and analysis designed for agencies and scientists, and one will be an outreach piece more like an infograph for farmers and other consumers of the information. Once completed, these fact sheets will be made available online.

The Indiana Science Assessment has made substantial progress since the work began in 2019. In order to build upon the progress, funds provided by U.S. EPA through the Gulf Hypoxia Program were designated to create the Indiana Nutrient Research and Education Program (INREP). The funds are allowing INREP to provide the scientific foundation for documenting nutrient reductions from conservation practice implementation, prioritizing those that are most effective, and which are critical components of this nutrient reduction strategy.

7.1.3 Indiana Nutrient Research and Education Program (INREP)

The Indiana Nutrient Research and Education Program (INREP) was created to continue and expand upon the work of Component 2 of the Indiana Science Assessment. It will continue to develop and deliver knowledge that optimizes the management of conservation practices and nutrients across the Indiana landscape. Based at Purdue University, it is pursuing science-based approaches by assessing the performance of current and emerging conservation and nutrient management practices, building on consensus-based recommendations and analyses, and informing nutrient reduction strategies. It continues to include scientists, researchers, experts and partners from across Indiana.

Goals are to:

1. Sustain and strengthen the network of scientists and agencies collaborating to provide the scientific foundation for the Indiana SNRS and related conservation and education efforts.
2. Lead a continual process of refining and improving the Science Assessment.
3. Increase the availability of data from Indiana research on nutrient loss reduction.
4. Synthesize and deliver the knowledge to conservation partners and the agricultural community.

To meet these goals, the **Midwest Nutrient Reduction Group** was created, which is a group of researchers and agency staff in other states in the Midwest who are conducting similar science assessment processes as Indiana (Minnesota, Iowa, Illinois, and Wisconsin). Consultation with other scientists and experts is also taking place, such as with experts on the method for evaluating wetland performance and helping ensure that the method being developed is based on appropriate data and consistent with wetland science, and with experts on bioreactors and saturated buffers. This collaboration is increasing the information and practice data available to the states, as well as helping with strategy development for the most difficult practices.

Furthermore, to increase the availability of data from Indiana research on nutrient loss reduction, a grant program was created through INREP to gather research data on nutrient reduction practices related to conservation practices and nutrient reduction. This includes funding new research projects as well as adding or enhancing a monitoring component to existing research projects.

The list of practices and their associated load reductions and percent efficiencies will be reviewed periodically as new research is conducted and more is known about the effectiveness of these practices, thereby improving the accuracy of the Science Assessment. To read more about the Indiana Science Assessment and INREP, visit the Indiana Science Assessment website here: https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/indiana-science-assessment/.

7.2 Benefits of the Indiana Science Assessment

The Science Assessment will lead to:

- Improved documentation showcasing statewide progress towards nutrient reduction goals
- Prioritization of the most effective conservation practices based on Indiana conditions, to improve program implementation
- More accurate assessment of Indiana's contributions to downstream water quality issues
- Alignment of communication by researchers, agencies, and others throughout Indiana about conservation practices effectiveness
- Enhanced transparency and accuracy for Indiana's water quality improvement quantifications
- A bolstered set of reportable goal-tracking parameters that includes dissolved nutrients
- A scientifically sound understanding of the nature of nutrient loading in Indiana waterways
- Determining the scale of conservation needed by running a series of scenarios based on economic feasibility and on load reductions needed to reach a certain reduction goal.

The Indiana Science Assessment is demonstrating that a system of conservation practices is what is most effective for achieving nutrient load reductions for both nitrogen and phosphorus. In addition, if we know which practices are the most effective, and know which watersheds have the highest sediment and nutrient load trends based on the work of Component 1, then we can better target where more conservation work is needed and with the right combination of practices.

Section 8 – Programs, Projects, and Initiatives Supporting Nutrient Reduction

Opportunities exist to reduce nutrient inputs from both urban and rural landscapes, including both point and nonpoint sources. Emphasis is on using existing regulatory and non-regulatory programs, and implementing voluntary BMPs.

8.1 Point Source/Regulatory Programs

8.1.1 National Pollutant Discharge Elimination Systems (NPDES)

NPDES permit requirements ensure that, at a minimum, any new or existing point source must comply with technology-based treatment requirements that are contained in 327 IAC 5-5-2. According to 327 IAC 5-2-2, "Any discharge of pollutants into waters of the State as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to discharge." This is the most basic principal of the NPDES permit program.

To reduce significantly the discharge of nutrients to surface waters of the state and to protect downstream water uses, IDEM set a practical state treatment standard of 1.0 mg/L of total phosphorus (TP) for sanitary wastewater dischargers with design flows of 1 million gallons/day (MGD) or greater. This policy became effective January 1, 2015. Today, virtually all major sanitary discharges have an effective 1 mg/L TP limit, which is estimated to have reduced TP loads from major sanitary dischargers by nearly 45-50% over prior levels.

Additionally, IDEM will implement TMDL load reductions as written and approved for total phosphorous upon the renewal of any affected permit, and IDEM will continue to implement phosphorus removal as required by 327 IAC 5-10-2. IDEM's position is that applying the state treatment standard of 1 mg/L total phosphorus to this limiting nutrient sufficiently addresses potential water quality impacts from point sources to fresh water systems; thus, there is no need to interpret Indiana's narrative criteria into water quality-based effluent limits at this time.

The State of Indiana has now fully implemented a statewide monitoring requirement for total nitrogen in NPDES permits for major sanitary dischargers. To implement the process of total nitrogen data collection, IDEM required all major sanitary dischargers with average design flow ratings of 1.0 MGD or greater to begin monitoring and reporting for total nitrogen as a requirement of their NPDES permit renewal. This effort started with permittees required to submit NPDES renewal applications or applications for modification of an effective NPDES permit after January 1, 2019. IDEM is requiring that total nitrogen be monitored and reported to IDEM on a monthly basis, both as monthly average of concentration (mg/L) and monthly average mass discharged (lbs./day).

The data collected will be used to garner a better understanding of nitrogen loadings in Indiana waters and aid the State of Indiana with future updates of the State of Indiana's nutrient reduction efforts.

8.2 Nonpoint Source/Regulated Programs

8.2.1 IDEM Wellhead Protection Program

IDEM's Wellhead Protection Program, is an essential educational awareness program focusing on source water protection and promoting the resource value of groundwater. Community Water Systems (CWS), which utilize groundwater as their source of drinking water, are responsible for planning for the prevention of groundwater to become contaminated through the implementation of their Wellhead Protection Plan. CWS planning activities include educating the public on pollution prevention, identifying potential sources of contamination within their Wellhead Protection Area, and promoting the value of the groundwater resources. As mentioned earlier, IDEM developed the Groundwater Monitoring Network (GWMN) to gather groundwater quality information across Indiana to be able to establish a baseline of groundwater quality within Indiana's aquifers. Together, Indiana's Wellhead Protection Program and the GWMN are essential steps in Indiana's protection, characterization and improvements of groundwater quality. https://www.in.gov/idem/cleanwater/information-about/groundwater-monitoring-and-source-water-protection/wellhead-protection-program/

8.2.2 Confined Feeding Operations (CFOs)

All regulated animal feeding operations in Indiana are considered Confined Feeding Operations (CFO). To be regulated under the Confined Feeding Control Law in Indiana, you must meet the following size of any one livestock group listed below, and confine those animals for more than 45 days:

- 300 or more cattle
- 600 or more swine or sheep
- 30,000 or more poultry (chicken, turkey or ducks)
- 500 horses

8.2.3 Concentrated Animal Feeding Operations (CAFOs)

The Concentrated Animal Feeding Operation (CAFO) designation is strictly a size designation in Indiana. Farms of this size are permitted under the CFO rule, but have added requirements under Indiana regulations. A CFO that meets the size classification as a CAFO is a farm that meets or exceeds an animal threshold number in the U.S. Environmental Protection Agency's definition of a large CAFO, which is:

- 700 mature dairy cows
- 1,000 veal calves
- 1,000 cattle other than mature dairy cows
- 2,500 swine above 55 pounds
- 10,000 swine less than 55 pounds
- 500 horses
- 10,000 sheep or lambs
- 55,000 turkeys
- 30,000 laying hens or broilers with a liquid manure handling system
- 125,000 broilers with a solid manure handling system
- 82,000 laying hens with a solid manure handling system
- 30,000 ducks with a solid manure handling system
- 5,000 ducks with a liquid manure handling system

IDEM's Role

Anyone who plans to operate or start construction or expand a farm that meets the requirements of Indiana's Confined Feeding Control Law (Indiana Code 13-18-10) must submit an application and receive an approval from IDEM prior to beginning construction or expansion of an operation. No one may operate or start construction or expansion of a CFO without IDEM's prior approval. The laws and rules[30] that govern IDEM's Confined Feeding Operation Program are found in 327 Indiana Administrative Code (IAC) 19 (CFO Rule) and 327 IAC 15-16 (NPDES CAFO Rule). IDEM's permitting, compliance, and enforcement sections implement the rules and the requirements of the rules:

> **Permitting**
> The CFO Permits staff reviews applications for CFO permit approvals. IDEM permit managers, engineers and geologists review designs and drawings and conduct inspections prior and during construction of new buildings and manure storage structures. The CFO permit manager is a good point of contact for any question regarding a new permit or modification, renewal, or construction for an existing permit.
>
> **Compliance**
> The CFO Compliance staff conducts routine and complaint-based inspections to assure compliance with operational requirements in the rules. New farms may receive an initial compliance assistance visit and will be inspected at least once in their first year of operation.
>
> **Enforcement**
> The Enforcement Section staff follows up with an enforcement action when a CFO has a serious or unresolved violation.

The CFO rule requires that CFO operations apply manure to their fields on the basis of the nitrogen needs for the crop to be grown or the soil's phosphorus content. Previously, manure was applied to fields based only on nitrogen needs for the coming crop. Fields with soil test phosphorus levels of 0 to 50 parts per million (ppm) may use nitrogen based manure application levels. Current regulations require that manure application on soils with soil test phosphorus levels greater than 50 ppm and not to exceed 200 ppm be based on the phosphorus content of the manure, soil, and on the crop to be grown on the field. If soil test phosphorus levels are greater than 200 ppm, manure from a CFO may not be applied to that land. That means that farmers will need to monitor soil phosphorus concentrations and work to begin the gradual process of reducing the phosphorus content of their fields. Additionally, there are rules specific to CFO operators regarding winter manure application and soil phosphorus. Under these regulations, manure application on frozen or snow-covered ground is prohibited with exceptions for emergency situations. Operators can apply for special permits that allow for winter application if a farm was previously permitted with less than 120 days of manure storage. CAFO sized operations are prohibited from spreading manure on frozen or snow-covered ground unless they get an Individual NPDES permit under 327 IAC15-16. https://www.in.gov/idem/cfo/

[30] https://www.in.gov/idem/cfo/laws-and-rules/

8.2.4 Fertilizer and Detergent Regulations

Thirty-five years ago, Indiana became the first state in the nation to protect its lakes and waterways by prohibiting the use of laundry detergents containing phosphorous under IC 13-18-9 and, in 2012, the state legislature extended the phosphorus ban to detergents used in residential automatic dishwashers. On July 28, 2010, the Indiana rule, *Certification for Distributors and Users of Fertilizer Materials,* 355 IAC 7-1.1, went into effect. The date for full compliance with the requirements of this rule was January 1, 2012. The purpose of this rule is to ensure that fertilizer users are competent to apply and handle these materials safely and effectively and in a manner that minimizes negative impacts on water quality and the environment.

8.2.5 Storm Water Runoff Programs

- Municipal Separate Storm Sewer Systems (MS4s)
  MS4s are required to develop Storm Water Quality Management Plans (SWQMPs) to address local resource concerns as part of their general permit requirements. As part of their Public Education component, MS4s have taken an active role to educate the general public and commercial industry on the use of fertilizer, including the use of phosphorous free options. In addition to these education efforts, MS4s are required to address the generation of pollutants, including nutrient management for those facilities that they own and/or operate. As the Storm Water Program re-evaluates future requirements, this topic will continue to be assessed and where appropriate and applicable, provisions and requirements will become part of program administration.

- Construction Site Run-off
  There are no specific regulatory requirements in the Construction Stormwater General Permit (CSGP) regarding the application of nutrients on active construction sites during the stabilization of the site. However, the technical standards and specifications in the *Indiana Storm Water Quality Manual* encourages utilization of soil tests and lower application rates for fertilizer. Additionally, the premise of the CSGP is to reduce sediment discharges, which in turn reduce the discharge of nutrients (phosphorous).
  https://www.in.gov/idem/stormwater/resources/indiana-storm-water-quality-manual/

- Industrial Site Run-off
  Due to the diversity and uniqueness of industrial facilities, it is problematic to develop a "one size fits all" approach. Therefore, IDEM deals with such facilities on a case-by-case basis. Issues that are considered in such an approach include, but are not limited to, concentration and loading of the discharge, the applicable aspects (flow, impairments, downstream uses, etc.) of the receiving stream, and the facilities' treatment capabilities.

8.3 Nonpoint Source/Non-Regulated (Voluntary) Programs

Indiana has an infrastructure in place that serves to educate conservation partners and the public. This infrastructure, which exists in the form of state and federal entities, is the most important tool we have in our "toolbox". By organizing educational and outreach events, helping to leverage state and federal funds, offering technical assistance and expertise, and providing cost-share programs to those wishing to put conservation practices on the ground, state and federal employees are directly promoting grass roots solutions to environmental issues by empowering agri-business, educational institutions, farmers, landowners, watershed groups and other environmental organizations to be a part of the solution. While the majority of these programs and initiatives directly improve water quality by reducing sediment and/or nutrient loss or runoff, many others have similar benefits through wildlife habitat improvement and soil health improvements.

The State departments of the ISDA, IDNR and IDEM are all invested in the continued growth and promotion of grants and programs that improve the state's water quality. Such efforts include the Conservation Reserve Enhancement Program (CREP), Indiana's own Clean Water Indiana (CWI) funds, the Cover Crop Premium Discount Program (CCPDP), the Mississippi River Basin Soil Sampling Program, the Lake and River Enhancement Program (LARE), and the Healthy Rivers Initiative (HRI). Other programs, practices and grants include those funded by the CWA Sections 106, 319(h) and 205(j) monies awarded to the IDEM by the U.S. Environmental Protection Agency (EPA).
Federal Farm bill programs are also available through the USDA NRCS and the FSA which offer cost-share of best management practices that reduce runoff, increase nutrient uptake and improve the health of our soils.
These and other grant-funded or cost-share programs are described on the following pages.

8.3.1 Indiana State Department of Agriculture (ISDA)

Conservation Reserve Enhancement Program (CREP) –
The Conservation Reserve Enhancement Program (CREP) is a voluntary federal and state natural resource conservation program that aims to improve water quality and address wildlife issues by reducing erosion, sedimentation and nutrients, and enhancing wildlife habitats. This program is designed to help alleviate some of the concerns of high nonpoint source sediment, nutrient, pesticide, and herbicide losses from agricultural lands by restoring grass and riparian buffers and wetlands to improve water quality, as well as to protect land from frequent flooding and excessive erosion by planting hardwood trees in floodplain areas along rivers and streams. CREP continues to address a major milestone of the ISDA and the USDA Farm Service Agency (FSA), showcasing Indiana's progressive and meaningful implementation of conservation practices to protect Indiana's soil, water and related natural resources, and to help alleviate hypoxia in the Gulf of America.

CREP in Indiana was first announced in 2005 across three HUC8 watersheds in the state. The program expanded in 2010 to include eleven HUC8 watersheds in Indiana, covering a total of 65 Indiana counties. In October of 2024, the program was expanded further and is now available statewide in every county and watershed in the state. (Figure 20) The goal of the program is to enroll 100,000 acres and to protect a minimum of 4,000 linear miles of waterbodies in the state.

As of December 2025, over 22,972 acres of buffers, wetlands and trees have been implemented in floodplains and along bodies of water protecting to date approximately 900 linear miles of water ways. The ISDA, and its partners have invested over $12.4 million in state funds to implement these conservation practices, and for every state dollar that is invested, $4-$13 federal dollars are matched through the Conservation Reserve Program (CRP) incentives available through the FSA.

The State Soil Conservation Board supports the CREP by appropriating Clean Water Indiana dollars each year to pay the state practice incentive payments to participating landowners. Other partners supporting CREP include The Nature Conservancy (TNC), and the Indiana Wildlife Federation and the American Electric Power Company.

Information about the Conservation Reserve Enhancement Program can be found here:
https://www.in.gov/isda/divisions/soil-conservation/conservation-reserve-enhancement-program/

Through CREP, program participants receive financial incentives from the ISDA and the FSA to voluntarily enroll in the program and implement conservation practices on environmentally sensitive land. Eligible practices include:

- Permanent Native Grasses
- Hardwood Tree Planting
- Wildlife Habitat
- Riparian Forest Buffers
- Grassed Filter Strips
- Bottomland Timber Establishment
- Wetland Restoration
- Shallow Water Areas for Wildlife

Figure 20 – Indiana CREP Watersheds

Clean Water Indiana (CWI) - The Clean Water Indiana (CWI) Program was established to provide financial assistance to landowners and conservation groups. The financial assistance supports the implementation of conservation practices that reduce nonpoint sources of water pollution through education, technical assistance, training, and cost sharing programs. The program is responsible for providing local matching funds as well as competitive grants for sediment and nutrient reduction projects through Indiana's SWCDs. CWI also contributes critical state matching funds for Indiana's CREP. Furthermore, the (CWI) Program has supported non-SWCD led grants such as the Conservation Cropping Systems Initiative (CCSI) which focuses on a management systems approach to crop production that results in improved soil and water quality as well as profitability on Indiana cropland.

In 1999, the Clean Water Indiana Program was created by a unanimous vote of the Indiana General Assembly by amending the Indiana District Law to add this program authority (IAC-14-32-8). The purpose of the CWI Program is to provide assistance to help protect and enhance Indiana's streams, rivers and lakes by reducing the amount of polluted storm water runoff from urban and rural areas entering surface and groundwater. The CWI program did not receive funding to carry out the program until 2001. The CWI is supported by a portion of the Indiana Cigarette Tax Revenue on a biannual basis.

The ISDA-Division of Soil Conservation administers the CWI dollars appropriated by Indiana legislators under the direction of the SSCB. For the competitive grants, the soil and water conservation districts are required to submit a CWI Project(s) proposal for approval by the SSCB on an annual basis with the intention for the grant money to be used within two years from approval. Each SWCD has an assigned District Support Specialist through ISDA to provide support in developing CWI projects, as well as to aid in district capacity building, including grant writing assistance, developing business plans, and sharing marketing opportunities.

Since the start of the program funding in 2001, millions of CWI dollars have been utilized by the SWCDs to implement local projects, also resulting in thousands of dollars of cash and in-kind support. The districts use the grant money in three areas: Cost Share, Professional Assistance, and Adult Education. Examples of past projects include using the funds for:

1) cost-share/incentives for applying conservation practices, such as cover crops;
2) purchase of equipment for the purpose of renting it to land users for applying conservation practices, such as warm season grasses;
3) contracting for technical assistance to survey, design, and oversee construction of engineered conservation practices, such as grassed waterways and grade stabilization structures; and
4) nonpoint source pollution prevention related information materials, planning assistance and projects.

Information on past and current CWI projects can be found on the ISDA website at https://www.in.gov/isda/divisions/soil-conservation/clean-water-indiana/. Successful projects such as those listed on the website, and the continued support of current and local CWI projects mean that the goals and objectives of the SSCB Business Plan are being addressed and accomplished.

Cover Crop Premium Discount Program (CCPDP) – The Cover Crop Premium Discount Program is a partnership between ISDA, The Nature Conservancy and the USDA Risk Management Agency. The goal of the program is to expand cover crop use among farmers in the state to expand awareness and the adoption of cover crops as a tool to improve farm resiliency. The focus is to target first-time cover crop users, but others are eligible as well, and only fields not enrolled in another cost-share program are eligible. Eligible growers can receive a $5.00/acre premium discount on the following year's crop insurance invoice for verified acres. The program has experienced high interest and achieved great success and is planned to continue to be offered to landowners as long as funding is available. Some of the funding used to support this program financially comes from the Gulf Hypoxia Program. To see more details about the program and what counties the program is available in each year, visit the CCPDP page on the ISDA website here, https://www.in.gov/isda/divisions/soil-conservation/cover-crop-premium-discount-program/

Mississippi River Basin Soil Sampling Program - In September 2023, the ISDA-Division of Soil Conservation launched a new soil sampling program focused on increasing the knowledge and use of soil testing as a nutrient management practice to improve nutrient use efficiency while also reducing the risk of ecological impacts to local and downstream waterways. ISDA promotes the importance of nutrient management and the principle of the 4R Nutrient Stewardship framework. The program focuses on soil sampling because it is a key component, and first step of developing a plan for nutrient management. If used effectively, soil sampling provides an assessment of the soil's fertility which can be used for making fertilizer application recommendations, assessing available nutrients over time, increase farmer profitability, and enhance environment protection by reducing the risk of nutrient loss.

The program is supported financially by the Gulf Hypoxia Program and provides free or reduced cost of soil testing to farmers in Indiana watersheds that drain to the Mississippi River, and include row crop, pasture, hay and speciality crop production systems. Program enrollment occurs during the spring and fall seasons each year, and funding for the program currently goes through 2030. Information on the program can be found here, https://www.in.gov/isda/divisions/soil-conservation/indiana-soil-sampling-program/.

8.3.2 Indiana Department of Natural Resources (IDNR)

Lake and River Enhancement (LARE) Grant - https://www.in.gov/dnr/fish-and-wildlife/wildlife-resources/lake-and-river-enhancement/. The Lake and River Enhancement program is part of the Aquatic Habitat Unit of the Fisheries Section in the Division of Fish and Wildlife, Indiana Department of Natural Resources (IDNR). The LARE program goals include operating a scientifically-effective program in a cost-efficient manner to protect and enhance aquatic habitat for fish and wildlife, and to insure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. This is accomplished through grant projects that reduce nonpoint sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality standards.
LARE grants are prioritized towards activities involving publicly accessible lakes and rivers, and involve organizations having the resources and ability to properly administer the funds. This includes non-profit organizations such as formally established lake associations, and governmental entities including cities, counties, conservancy districts, soil and water conservation districts, as well as other local units of government.

Approved grant funding may be used for one or more of the following purposes:

1. Investigations to determine what problems are affecting a lake/lakes or a stream segment.
2. Evaluation of identified problems and effective action recommendations to resolve those problems.
3. Cost-sharing with land users in a watershed above/upstream from a project lake or stream for installation or application of sediment and nutrient reducing practices on their land.
4. Matching federal funds for qualifying projects.
5. Feasibility studies to define appropriate lake and stream remediation measures.
6. Engineering designs and construction of remedial measures.
7. Water quality monitoring of public lakes.
8. Management of invasive aquatic vegetation
9. Sediment removal from qualifying lakes.
10. Logjam removal from qualifying rivers.

Participation in the program requires the submittal of an application form for each program element. There are five different kinds of LARE grants awarded annually by the Director of IDNR:

Biological and Engineering Project Grants
These "traditional" LARE grants, awarded since 1989, are available on a competitive basis for several actions that can address the ecology and management of lakes and rivers and their watersheds. Depending on the needs of the waterbody, funds can be granted for:

1) Lake or River Watershed Diagnostic Study,
2) Engineering feasibility study of proposed measures,
3) Design and/or construction projects for specific sediment or nutrient control measures,
4) Bioengineering for bank stability, and
5) Biomonitoring.

Watershed Land Treatment Project Grants
Grants are awarded to Soil and Water Conservation Districts (SWCD's) who work with local landowners to install or adopt various conservation measures directly on the land in targeted watersheds. Technical assistance in the design and installation is provided by personnel of NRCS, ISDA and the SWCD's.

Sediment Removal Plan Development or Sediment Removal Grants
Grant funds may be used to contract for the production of a sediment removal plan or, if such a plan has already been prepared, for funds to be used for a sediment removal project. A sediment removal plan is a prerequisite to acquiring grant funds for actual sediment removal projects.

Exotic Plant or Animal Control Grants
Grant funds may be used for the development of aquatic vegetation management plans or, if such a plan has already been prepared, for actual control of invasive vegetation in lakes or rivers. An aquatic vegetation management plan is a prerequisite to acquisition of grant funds for actual vegetation control. Efforts are limited to management and control of invasive vegetation, not native plants that are considered a nuisance.

Logjam Removal Grants
Grant funds may be used to remove logjams from qualifying rivers.

Information on past and current LARE projects can be found on the IDNR website at https://www.in.gov/dnr/fish-and-wildlife/wildlife-resources/lake-and-river-enhancement/lare-project-applications-and-funding-approvals. The funds used to pay costs incurred by the IDNR in implementing the LARE projects is paid by Indiana boat owners in their annual registration. The state of Indiana will continue to push for continued funding appropriated to the LARE Program by the State Legislature so that the program grants can be used to target nutrient reduction efforts and to meet IDEM's water quality targets in watersheds throughout Indiana.

Healthy Rivers Initiative (HRI) – The Healthy Rivers Initiative, led by Indiana DNR, includes a partnership of resource agencies and organizations who are working with willing landowners to permanently protect more than 43,000 acres located in the floodplain of the Wabash River and Sugar Creek in west-central Indiana, and 26,000 acres of the Muscatatuck River bottomlands in southeast Indiana (Figure 21).

Healthy Rivers INitiative

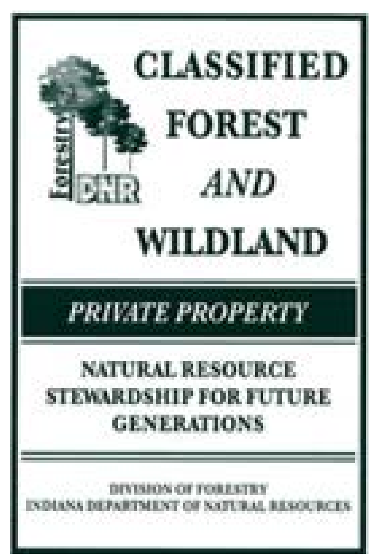
HRI projects have protected and restored riparian, floodplain, wetland and aquatic habitats for the wildlife species that depend on them including migratory birds and waterfowl and many threatened and endangered species. These projects also benefit local citizens and surrounding communities by providing flood protection, increasing public access to recreational opportunities, and leaving a legacy for future generations by providing a major conservation destination for Hoosiers and out-of-state visitors.

As of 2020, 37,848 acres of land are under permanent protection within the HRI project boundaries, over half of the overall goal of 70,000 protected acres. In the Wabash River and Sugar Creek project areas this includes 12,131 acres purchased by IDNR and 4,052 acres enrolled in NRCS WREs on private land, both of which complement the 12,723 acres of state-owned protected land in the project area prior to the launch of HRI. In the Muscatatuck River Project Area, 4,405 acres have been purchased by IN DNR and 2,048 acres have been enrolled in WRE on private lands, complementing 2,489 acres of existing state-owned or otherwise protected land.

For more information, visit https://www.in.gov/dnr/fish-and-wildlife/properties/healthy-rivers-initiative2

Figure 21 – HRI areas are shown in red

Classified Forest and Wildlands Program –
The Classified Forest and Wildlands Program encourages timber production, watershed protection, and wildlife habitat management on private lands in Indiana. Program participants/landowners receive a property tax reduction in return for following a professional written management plan. In addition to the tax reduction, landowners receive free technical assistance from DNR foresters and wildlife biologists, priority for cost-share to offset the cost of doing management, and the ability to "green" certify their forests. The minimum requirement for program enrollment is 10 acres of forest, wetland, shrubland, and/or grassland. https://www.in.gov/dnr/forestry/programs/classified-forest-and-wildlands/



8.3.3 Indiana Department of Environmental Management (IDEM)

IDEM Section 319 (h) Grant Funding - The Federal Clean Water Act (CWA) Section 319(h) provides funding for various types of projects that work to reduce nonpoint source water pollution. The Indiana State Nonpoint Source Management Plan guides the usage of the CWA Section 319 funds received by IDEM from the U.S. EPA. Funds may be used to conduct assessments, develop and implement TMDLs and watershed management plans, provide technical assistance, demonstrate new technology, and provide education and outreach. Organizations eligible for funding include nonprofit organizations, universities, and local, State or Federal government agencies. A 40 percent (non-federal) in-kind or cash match of the total project cost must be provided.

Projects are administered through grant agreements that spell out the tasks, schedule and budget for the project. Projects are normally two to three years long and work to reduce nonpoint source (NPS) pollution and improve water quality in the watershed primarily through:

- Education and outreach designed to bring about behavioral changes and best management practice (BMP) implementation that leads to reduced nonpoint source pollution;
- The development of watershed management plans that meet U.S. EPA's required nine elements; and,
- The implementation of watershed management plans through a cost-share program focusing on BMP implementation that address water quality concerns.

As a requirement of the 319 program, IDEM submits a NPS Program Annual Report to U.S. EPA. This is a comprehensive report that includes input from and cooperation with state, federal, local, and private partners, which is critical to Indiana's NPS Program's success. IDEM's NPS Program utilizes multiple partnerships to reach diverse stakeholder groups and further NPS management goals in Indiana. Annual reports including the most recent may be found at https://www.in.gov/idem/nps/resources/nonpoint-source-annual-report/.

IDEM Section 205(j) Grant Funding – (https://www.in.gov/idem/nps/funding/clean-water-act-section-205j-grants/) The federal Clean Water Act Section 205(j) provides funding for water quality management planning, which is then allocated by each state. The act states that the grants are to be used for water quality management and planning, including, but not limited to:

- Identifying most cost effective and locally acceptable facility and nonpoint source measures to meet and maintain water quality standards;
- Developing an implementation plan to obtain state and local financial and regulatory commitments to implement measures developed under subparagraph A;
- Determining the nature, extent, and cause of water quality problems in various areas of the state. In previous cycles, grants have been awarded to municipal governments, county governments, regional planning commissions, and other public organizations.

Projects are administered through grant agreements that spell out the tasks, schedule, and budget for the project. For both 205(j) and 319(h) projects, IDEM project managers work closely with the project sponsors to help ensure that the project runs smoothly and the tasks of the grant agreement are fulfilled. Site visits are conducted at least quarterly to touch base on the project, provide guidance and technical assistance as needed, and to work with the grantee on any issues that arise to ensure a successful project closeout.

In recent years, Indiana has generally received around three and a half million dollars each year for 319 grant funding. Since 1994, Indiana has directed over 74 million dollars of its U.S. EPA 319 nonpoint source grant funding to planning and implementing projects related to reducing nutrient loads to Indiana's surface waters. As of 2025, roughly 54% of 12-digit HUC watersheds have a WMP. This number nearly doubled over a decade of work since the previous management plan reported 32% of 12-digit HUC watersheds had a WMP in 2013. (Figure 22)

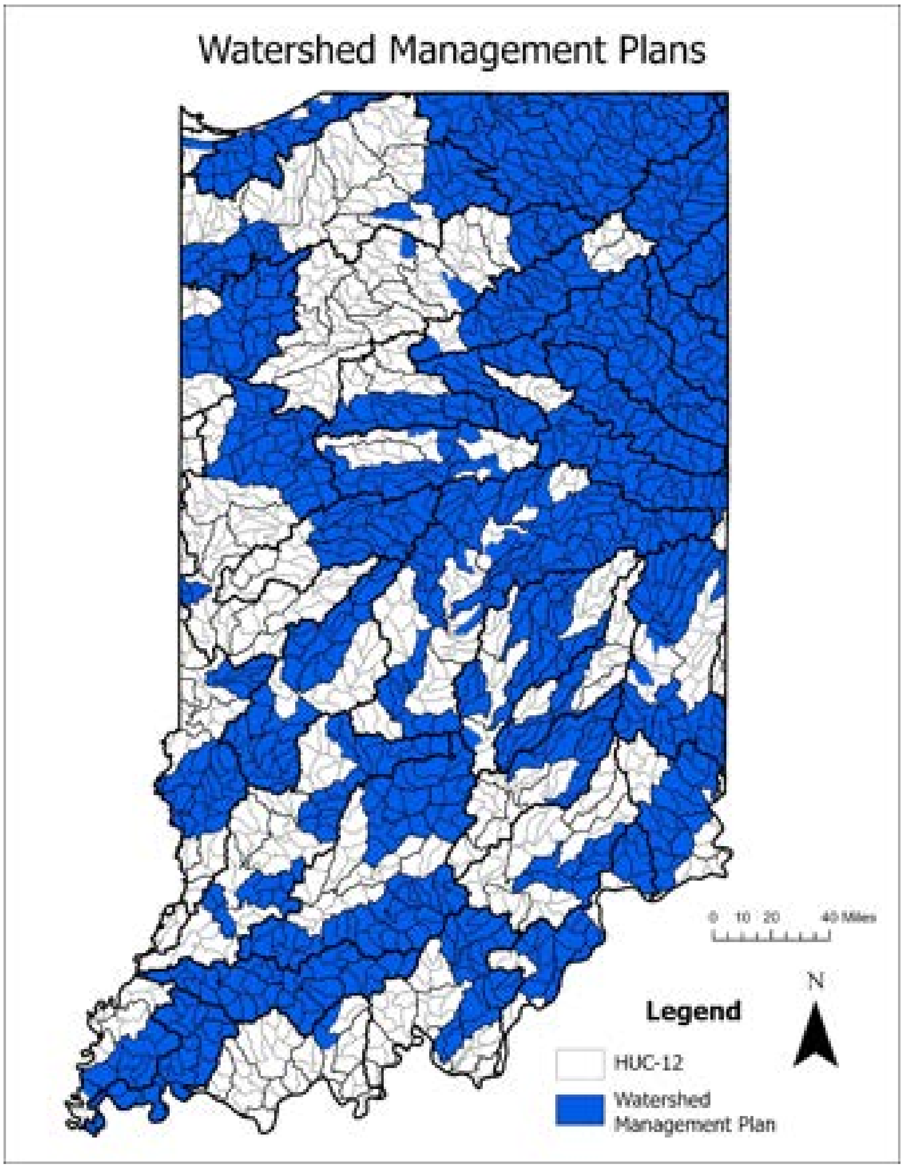


Figure 22 – Watersheds with an EPA approved 9 key element Watershed Management Plan in Indiana as of 2025.

Clean Water Act (CWA) Section 106 Supplemental Funding - The federal Clean Water Act (CWA) Section 106 provides funding for a wide range of water quality activities identified in *Indiana's Water Quality Monitoring Strategy 2022-20216*[31] as representing monitoring needs that have not been met or one that warrants enhancing. These activities may include water quality planning and assessments, ambient monitoring of surface water and wetlands, or monitoring groundwater to name a few. IDEM utilizes CWA Section 106 Supplemental funding to support many water quality activities, including the Groundwater Monitoring Network (GWMN), which is first mentioned on page 32, and is managed through IDEM's Drinking Water Branch, Groundwater Section.

The long-term goals of the statewide GWMN include:

- Determining the quality of groundwater in the state's 20 aquifer represented hydrogeologic settings;
- Identifying areas of notable contamination, which would include nonpoint source parameters of concern such as arsenic, nitrate-nitrite, pesticides and pesticide degradants;
- Determine potential nonpoint source pollution groundwater to surface water pathways;
- Work with stakeholder groups to reduce groundwater to surface water nonpoint source pollution to below a level of significance, and;
- Monitor groundwater quality trends statewide within the state's 20 hydrogeologic settings.

The statewide GWMN will meet these goals through:

- Analysis of the groundwater information gathered for the GWMN, which includes analysis for analytes such as nitrate-nitrite, pesticides and pesticide degradants in groundwater; and identifying areas where groundwater could contribute to nutrient rich surface waters;
- Identification and determining possible migration pathways of nutrient impaired groundwater contributing to impaired surface waters;
- Defining appropriate stakeholders to assist in future land management practice decisions to manage nutrients that may infiltrate from the surface down to groundwater;
- Begin the conversation with partner stakeholders to find long-term mitigation measures to improve urban and rural nutrient management practices;

Understanding the nutrient contributions of groundwater into the overall hydrologic cycle will assist Indiana in addressing the primary goal of the Federal Clean Water Act (CWA) to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The groundwater component to this cycle of water plays a fundamental role in this vast effort. The statewide GWMN goals and data collected to date for the statewide GWMN effort can be viewed at https://www.in.gov/idem/cleanwater/information-about/groundwater-monitoring-and-source-water-protection/statewide-groundwater-monitoring-network/.

[31] https://www.in.gov/idem/cleanwater/surface-water-monitoring/indiana-surface-water-quality-monitoring-strategy/

8.3.4 USDA, Natural Resources Conservation Service (NRCS)

Private citizens own over 90 percent of the land in Indiana which includes nearly 15 million acres of farmland and about 4 million acres of forestland, making stewardship and conservation absolutely critical to the health of our environment. NRCS offers financial assistance for conservation practices that reduce runoff, increase nutrient uptake and improve the health of our soils. The following Farm Bill programs are available through USDA's Natural Resources Conservation Service.

Environmental Quality Incentives Program (EQIP) - The Environmental Quality Incentives Program (EQIP) provides assistance to agricultural producers to address natural resource concerns. The program is a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as national goals. EQIP offers financial and technical assistance to farmers to address natural resource concerns through the development of a conservation plan on their farm(s), and financial assistance to install conservation management practices on eligible agricultural land, such as soil health practices like cover crops and no-till, nutrient management, livestock/animal waste systems, livestock watering facilities, pastureland management, wildlife enhancement and forestry management. For more information visit the Indiana NRCS EQIP website at https://www.nrcs.usda.gov/programs-initiatives/environmental-quality-incentives-program

Conservation Stewardship Program (CSP) - The Conservation Stewardship Program (CSP) helps agricultural producers take their conservation efforts to the next level. It is a voluntary program that encourages agricultural producers to improve conservation systems by improving, maintaining, and managing existing conservation systems and adopting additional conservation activities to address priority resource concerns, including soil, air and habitat quality, water quality and quantity, and energy conservation. The NRCS administers this program and provides financial and technical assistance to eligible producers. CSP is available on Tribal and private agricultural lands and non-industrial private forestland on a continuous application basis. Participants can earn CSP payments for conservation performance – the higher the performance, the higher the payment. For more information visit the Indiana NRCS CSP website at: https://www.nrcs.usda.gov/programs-initiatives/conservation-stewardship-program

Regional Conservation Partnership Program (RCPP) - The Regional Conservation Partnership Program (RCPP) brings together partners to expand the reach of NRCS conservation programs, and demonstrates the power of public-private partnerships in delivering results for agriculture and conservation. It promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. RCPP projects fall under two different categories: RCPP Classic and RCPP Alternative Funding Arrangements (AFAs). RCPP Classic projects are implemented using NRCS contracts and easements with producers, landowners and communities, in collaboration with project partners. Through RCPP AFAs, NRCS provides funding to partners to support conservation activities with eligible producers and landowners on eligible land. RCPP AFA funding reimburses partners for conservation activities done for or on behalf of producers, landowners, or other entities. To learn more about the program and to see the RCPP projects that have been approved in Indiana, visit: https://www.nrcs.usda.gov/programs-initiatives/regional-conservation-partnership-program

NRCS Easement Programs

Agricultural Conservation Easements Program (ACEP) – The Agricultural Conservation Easement Program provides financial and technical assistance to help protect and conserve agricultural lands, grasslands and wetlands and their related benefits for future generations. NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. ACEP has two components: the Agricultural Land Easements (ALE) and the Wetland Reserve Easements (WRE). https://www.nrcs.usda.gov/programs-initiatives/agricultural-conservation-easement-program

- ***Agricultural Land Easements (ALE)*** – NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. The program also protects grazing uses and related conservation values by conserving grassland, including rangeland, pastureland and shrubland. Eligible partners include American Indian tribes, state and local governments and non-governmental organizations that have farmland, rangeland or grassland protection programs. https://www.nrcs.usda.gov/programs-initiatives/ale-agricultural-land-easements

- ***Wetland Reserve Easements (WRE***) – The Wetland Reserve Easements program is voluntary conservation program that allows landowners to enroll sensitive land to help restore, protect and enhance wetland restorations. It is the Nation's premier wetlands restoration program. WRE provides habitat for fish and wildlife, including threatened and endangered species, improves water quality by filtering sediments and chemicals, reduces flooding, recharges groundwater, protects biological diversity and provides opportunities for educational, scientific and limited recreational activities. Through this program landowners can enroll eligible land through Permanent Easements, 30-year Easements, Term Easements or 30-year Contracts. https://www.nrcs.usda.gov/programs-initiatives/wetland-reserve-easements

    - ***Wetland Reserve Enhancement Program (WREP)*** – WREP is a special enrollment option under the Agricultural Conservation Easement Program's Wetland Reserve Easement component. Through WREP, states, local units of governments, non-governmental organizations and American Indian tribes collaborate with NRCS through cooperative and partnership agreements. These partners work with tribal and private landowners who voluntarily enroll eligible land into easements to protect, restore and enhance wetlands on their properties.

Indiana NRCS Special Program Initiatives

https://www.nrcs.usda.gov/state-offices/indiana/indiana-special-initiatives

Mississippi River Basin Healthy Watershed Initiative (MRBI) - To improve the health of the Mississippi River Basin, including water quality, wetland restoration, and wildlife habitat, the NRCS has established the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Through this Initiative, NRCS and its partners use existing conservation programs to help producers voluntarily implement conservation practices in targeted watersheds within the Mississippi River Basin. To learn more about the program and to see MRBI projects in Indiana, visit the Indiana Special Initiatives website link above.

National Water Quality Initiative (NWQI) - The National Water Quality Initiative will assist producers to address high-priority water resource concerns in watersheds identified as impaired by the Environmental Protection Agency (U.S. EPA). NRCS works with local partnerships and state water quality agencies to identify priority watersheds on an annual basis. The program provides a separate funding pool through EQIP. To learn more about the program and see NWQI projects in Indiana, visit the Indiana Special Initiatives website link above.

Great Lakes Restoration Initiative (GLRI) - The Great Lakes Restoration Initiative (GLRI) helps NRCS to accelerate conservation efforts on private lands located in targeted watersheds throughout the Great Lakes region. Through GLRI, NRCS works with farmers and landowners to implement avoiding, controlling and trapping practices that reduce the amount of nutrient loss from agricultural lands, such as nutrient management, drainage water management, waste storage facilities and cover crops, and to combat invasive species, protect watersheds and shorelines from nonpoint source pollution, and restore wetlands and other habitat areas. Indiana GLRI funds are targeted in the Western Lake Erie Basin. To learn more, visit the Indiana Special Initiatives website link above.

Western Lake Erie Basin (WLEB) – The United States and Canada have formed a partnership to prioritize the restoration of Lake Erie and the other Great Lakes. As part of that effort, NRCS, along with five other federal agencies, state and other non-government, industry and academic partners, are dedicated to accelerating Lake Erie's rehabilitation by reducing phosphorus loading through a number of collaborative projects and initiatives. By providing technical and financial assistance to farmers to implement conservation practices, NRCS can assist in the comprehensive effort to improve water quality, soil health and sustain the region's economic viability. By initiating a cooperative watershed planning process, both short and long-term water conservation needs in the basin can be met. To learn more, visit the Indiana Special Initiatives website link above.

Joint Chiefs' Landscape Restoration Partnership, Ready-Set-Fire Project – The Joint Chiefs' Landscape Restoration partnership is a collaborative effort between NRCS and the US Forest Service that aims to work with private, state, and Tribal landowners to conserve forest and agricultural land alongside federally managed lands while safeguarding communities by reducing the impact of wildfire threats and protecting water quality and supply. The Ready-Set-Fire in White Oak Woodlands project will fund private land forest management projects to restore oak woodlands across 16 counties in southern Indiana in an effort to improve habitat for at risk species and reduce wildfire risk. The project is an opportunity to expand woodland conservation and restore fire dependent plant communities, benefit local water supplies, improve habitat for at risk forest dependent songbirds and improve the continuity of habitat between public and private land. To learn more, visit the Indiana Special Initiatives website link above.

Source Water Protection – Source water refers to sources of water (such as rivers, streams, lakes, reservoirs, springs and groundwater) that provide water to public drinking water supplies and private wells. Source water protection includes a wide variety of actions and activities aimed at safeguarding, maintaining or improving the quality and/or quantity of sources of drinking water and their contributing areas. The Farm Bill has a provision that provides protection of source water through targeted conservation practices and efforts. To learn more, visit the Indiana Special Initiatives website link above.

Each year, Indiana NRCS approves millions of dollars to landowners to conserve natural resources. Below are a few of the program dollars spent in 2024 as noted in the Indiana NRCS 2024 Annual Report. To see past and future Indiana NRCS Annual reports showing accomplishments, visit https://www.nrcs.usda.gov/resources/education-and-teaching-materials/publications-0.

ACEP
28 new WRE applications statewide on 1,502 acres
3 new ALE easements on 704 acres

CSP
$21.5 million spent impacting 137,838 acres

EQIP
$48.6 million spent impacting 192,088 acres

RCPP
$1.3 million obligated impacting 4,063 acres
in 4 watershed or regional projects

8.3.5 USDA, Farm Service Agency (FSA)

The following Farm Bill programs are available through USDA's Farm Service Agency.

Conservation Reserve Program Funding - The Conservation Reserve Program (CRP), administered by the Farm Service Agency, is a voluntary program that provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS and other ICP technical staff providing technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning.

The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as native grasses, wildlife plantings, trees, filter strips, riparian buffers or wetlands. Participants receive an annual rental payment, cost-share assistance for establishing conservation practices, and other financial incentives for the term of a multi-year, 10-15 year contract. There are several enrollments options under CRP as described below. http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index

- ***General CRP:*** Annual signups where offers are ranked and selected based on environmental benefits.

- ***Continuous CRP:*** Allows enrollment of eligible land without competitive ranking. This includes high-priority practices like filter strips, riparian buffers, and grass waterways.

  - ***Conservation Reserve Enhancement Program (CREP)*** – The Conservation Reserve Enhancement Program is a component of the CRP and is a voluntary program available under the CRP continuous sign-up, and is done in partnership with the ISDA as mentioned on page 71-72. The aim of the program is to improve water quality and address wildlife issues by reducing erosion, sedimentation and nutrients, and enhancing wildlife habitats. Contracts with landowners under CREP are 15-year contracts.

  - ***Safe Acres for Wildlife Enhancement (SAFE)*** – This initiative is a voluntary program also available under the Conservation Reserve Program (CRP), designed to address state and regional high priority wildlife objectives. This program targets habitat restoration for specific wildlife species designated by the U.S. Fish and Wildlife Service as threatened or endangered including the lesser prairie chicken, the New England cottontail, bobwhite quail, and grassland birds. Producers within a SAFE area can submit offers to voluntarily enroll acres in CRP contracts for 10-15 years. In exchange, producers receive annual CRP rental payments, incentives and cost-share assistance to establish, improve, connect or create higher-quality habitat.

- ***Highly Erodible Land Initiative (HELI)*** – This Initiative offers a practical solution to create wildlife habitat while protecting cropland highly susceptible to erosion. Highly erodible cropland with an Erosion Index of 20 or greater are fragile and vulnerable to erosion. Establishing grass or tree cover will help maintain the long-term health of the land while providing habitat for numerous mammal and bird species. HELI contracts are 10-15 years.

- ***Clean Lakes, Estuaries, and River Initiative (CLEAR30)*** – This Initiative allows the opportunity for eligible producers to enroll certain practices into 30-year contracts under CRP. It is available nationwide.

- ***Farmable Wetland Program (FWP)*** – This option encourages farmers and landowners to restore farmable wetlands and establish conservation practices to improve environmental health. The program targets specific areas of non-floodplain wetlands that are suitable for restoration. FWP contracts are 10-15 years.

- ***Grassland CRP:*** Focuses on preserving grasslands and promoting sustainable grazing practices.

8.4 Agricultural Initiatives

The many programs and initiatives mentioned above are resources that can be used to encourage voluntary use of incentive based and cost-shared conservation by landowners both rural and urban to achieve a positive impact on nutrient reduction. In addition, there are many other agricultural initiatives and efforts taking place in Indiana by the ICP and other conservation organizations, and by non-governmental organizations that are practical and cost-effective.

For example, the NRCS soil health campaign consists of diligent outreach and education concerning the benefits of cover crops paired with no-till or reduced tillage systems to improve tilth and water infiltration as boons to soil health. While this campaign is directed at soil health rather than water quality, the impacts on the latter are both direct and positive through their reduction of surface erosion (through reduced rain impact on exposed soil) and nutrient loss (through improved nutrient uptake from living cover as well as increased infiltration due to greater soil porosity and increased organic matter). There are many efforts by NRCS and the ICP partners to advance this Soil Health Campaign toward addressing Indiana's primary resource concerns such as the ICP Soil Health Philosophy, and the concept of a System's Approach of Conservation Practices, which are methods used by ICP staff to promote and advance the use of soil health, nutrient management and a conservation cropping systems approach to farming.

8.4.1 Indiana's Conservation Partnership Soil Health Philosophy

http://www.in.gov/isda/files/ICP_Soil_Health_Philosophy_final.pdf
The Indiana Conservation Partnership (ICP) includes eight Indiana agencies and organizations that share a common goal of promoting conservation. To accomplish this goal, the ICP members provide technical, financial and educational assistance to support and implement economically and environmentally compatible land and water stewardship decisions, practices and technologies. The ICP and our primary customers – Indiana farmers – are recognized as national leaders in our collaborative efforts to incorporate soil health management systems into conservation planning, education activities and farm management.

Indiana's soil health strategy and priority focus has achieved tremendous success in addressing the state's primary natural resource concerns. The ICP endorses these four key **Soil Health Principles** for all lands:

- Minimize Disturbance
- Optimize Soil Cover
- Optimize Biodiversity
- Provide Continuous Living Roots

Regenerating soil health is a journey. Meeting the **Objectives of Soil Health Improvement** should be part of an overall approach to management decisions and field operations. To fully implement a *conservation cropping system* that improves soil health we will help farmers understand the importance of continually working toward the following objectives:

- Increas**ing** organic matter
- Increas**ing** aggregate stability
- Increas**ing** water infiltration
- Increas**ing** water-holding capacity
- Improv**ing** nutrient use efficiency
- Enhanc**ing** and diversify**ing** soil biology

The ICP works with farmers to help them implement a conservation cropping systems approach to improve the health of their soil. This "system" of practices and management results in improvements to soil health that helps to address Indiana's primary natural resource concerns. Although implementing a single management practice may slow the degradation of soil function, it will rarely achieve the broad improvements of our resource objectives.

The elements of a conservation cropping system go beyond the minimum standards. It is critical to emphasize descriptive adjectives associated with each practice element, such as:

- **Quality** No-till/Strip till
- **Adaptive** Nutrient Management
- **Integrated** Weed and Pest Management
- **Diverse** and **Strategic** Cover Crop Integration
- **Diverse** Conservation Crop Rotations
- **Precision** Farming Technology
- **Prescriptive** Conservation Buffers

These practices when incorporated into a profitable and sustainable soil health system can help farmers go beyond simply maintaining the soil to actually improving its health. Since the benefits achieved through this system can begin to degrade if the application of the system stops, soil health is a never-ending journey towards constantly improving the soil over time.

For many farmers, implementing a conservation cropping system may require significant changes in their operations and management. Building a successful conservation cropping system can take time, even years. The ICP commits to providing support for our customers through ongoing education, support and financial and technical assistance so that soil health improvement is possible across all agricultural sectors and becomes the management system of choice.

8.4.2 A System's Approach of Conservation Practices

One of the most wide-scale and effective efforts in Indiana on water quality improvement is the education and promotion of soil health systems and conservation cropping systems in agriculture. ISDA, NRCS, SWCDs and the other members of the ICP are actively promoting a total *conservation cropping systems* approach to farming which focuses on soil health and function. Soil health practices include no-till (never-till), conservation tillage, using diverse cover crops, adaptive nutrient management, integrated weed and pest management, diverse crop rotations, precision farming technology and prescriptive buffers. (Figure 23)

Conservation Tillage Practices, such as no-till, strip-till, ridge till and mulch till, are practices that leave crop residues on the soil surface to reduce soil erosion by water. Cover Crops are crops grown between regular cash crops like corn and soybeans so that there is a living root growing all year long. Cover crops reduce soil compaction; they cover the soil and protect it from erosion; improve soil structure; increase soil organic matter; fix nitrogen and scavenge nitrogen depending on the species of cover crop used; and can produce forage or pasture.

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

Soil Health is the Goal!
Integrated Conservation Cropping Systems is the Right System

November, 2011

SOIL HEALTH = CONSERVATION CROPPING SYSTEMS
No (NEVER)-Till / Strip-Till + Cover Crops and Crop Rotations + Precision Nutrient and Pest Management + Buffers

KEY POINTS
- Soil health addresses multiple priority resource issues
- NRCS has a focused message to farmers, the public, and employees
- Farmers perceive changes to their current management as RISK that impedes adoption

High Quality technical assistance, education, and planning directly to the farmer is essential = NRCS is the key agency capable of helping farmers achieve soil health and the associated benefits

WHY FARMERS *WANT* HEALTHY SOILS:
- Decreased inputs (diesel, time, labor, nutrients, pesticides)
- Increased Soil Health
  - Organic matter = carbon
  - Reduced compaction
  - Nutrient sequestration and cycling (less inputs)
  - Increased water holding capacity and infiltration
  - Structural stability
  - Yield protection
  - "Insurance" against extremes in weather, input costs, markets

WHY THE PUBLIC *NEEDS* HEALTHY SOILS:
- Less energy (irrigation, nutrients, pesticides) and fuel needs
- Water quality (reduces nutrient and sediment loading)
- Air quality (reduces sediment, carbon, and nitrous oxide emissions)
- Ensures a stable, sustainable, secure, healthy domestic food source
- Increased infiltration = reduced runoff = reduced flooding AND drought protection
- Wildlife habitats

WHY USDA/NRCS IS FOCUSING ON SOIL HEALTH
- Healthy soils address multiple resource concerns across the nation
- Soil Health ensures relevance and confidence in NRCS from all of agriculture
- Farmers see that conservation makes sense and money
- Low technical and financial assistance needs
- Less need for expensive, high technical assistance practices (structures, waterways, etc.)
- Applicable coast to coast, north to south; Large/small; traditional/organic; beginning/limited

RESULTS GET ON THE GROUND

Helping People Help the Land

USDA is an equal opportunity provider and employer

Figure 23 – "Soil Health is the Goal", an NRCS publication

8.4.3 Conservation Cropping Systems Initiative (CCSI)

The Conservation Cropping Systems Initiative is a program of the ICP with a mission of improving soil health on Indiana cropland. This mission is accomplished primarily through education and outreach efforts that are based on farmer-proven management practices and peer-reviewed agronomic and social science. Through a farmer-focused and farmer-driven process, the Initiative works with local level partnerships and others to promote the adoption of practices and cropping systems that can lead to improved soil health. CCSI continues to promote the adoption of science-based, farmer-proven practices through grassroots leadership.

Goals with CCSI's strategic plan include:

- Provide training to ICP staff in the concepts of soil health, conservation promotion, and the implementation of soil health practices.
- Expand knowledge, education, and collaboration with ag professionals, including farmers and youth advisors, on the long-term importance and management of soil health.
- Engage and involve farmers in increasing adoption and promotion of soil health management systems on Indiana cropland.
- Care for and encourage the growth and development of partnerships

Developed in partnership with technical experts from USDA-NRCS, Purdue University, and expert farmers, CCSI's full training curriculum is central to ICP soil health education. Since CCSI's inception in 2009, hundreds of individuals have attended soil health training events that have been instrumental in the delivery of consistent soil health information and technical assistance by conservation staff and ag professionals.

CCSI is also a resource for ICP partners, including Indiana's 92 Soil and Water Conservation Districts (SWCDs), in developing and supporting their own soil health outreach and education efforts. Via presentations by CCSI staff, engaging expert speakers, facilitating farmer panels, event promotion, and logistical support, CCSI workshop activities and events have reached thousands of attendees.

The unique multi-agency structure of CCSI has enabled the program to facilitate and support partnerships that span geographic, organizational, and expertise boundaries. These types of complex networks have been shown to facilitate the flow of ideas and spur innovative thinking. These networks have also enabled ICP and partner organizations to leverage both financial and human resources to help increase the adoption of soil health practices in Indiana.

More information on the Conservation Cropping Systems Initiative may be found at www.CCSIN.org.

8.4.4 Indiana Agriculture Nutrient Alliance (IANA)

The Indiana Agricultural Nutrient Alliance empowers farmers to improve nutrient use efficiency, enhance soil health, and protect water quality by vetting and promoting sustainable, proven practices that drive farm success and protect our natural resources.

Agricultural commodity groups in Indiana, including those of Corn, Soybean, Pork, Beef, Dairy and Poultry commodity groups, as well as the Indiana Farm Bureau (INFB), the Agribusiness Council of Indiana (ACI), and Purdue University Extension are actively engaged in identifying and approaching the challenges of nutrient loading and soil health, subsequently improving water quality. These groups with the addition of members from the ICP and The Nature Conservancy, worked to develop what was referred to as the nutrient management and soil health strategy, which complemented Indiana's state nutrient reduction strategy and was used as an agricultural industry implementation plan. As a result of this effort, the Indiana Agriculture Nutrient Alliance (IANA) was created in 2018 to further coordinate the efforts of the ag community beyond federal and state cost-share programs. The formation of IANA from the nutrient management/soil health strategy workgroup is an example of a key refinement of adaptively managing our needs. www.inagnutrients.org

IANA Partners include:	
❖ Agribusiness Council of Indiana	❖ Indiana Pork
❖ Indiana Farm Bureau	❖ Indiana Poultry Association
❖ Indiana Soybean Alliance	❖ Indiana State Department of Agriculture
❖ American Dairy Association of Indiana	❖ Indiana Association of SWCDs
❖ Indiana Beef Cattle Association	❖ USDA-NRCS
❖ Indiana Corn Marketing Council	❖ Purdue University College of Agriculture
❖ Indiana Dairy Producers	❖ The Nature Conservancy of Indiana

To further the adoption and implementation of practices that optimize nutrient use efficiency and enhance soil health, IANA will focus on 4 main areas:

1. Foundation: Shared Goals – Establish goals for statewide practice adoption that encourage fertilizer and nutrient loss reductions.
2. Collaboration: Shared Opportunities – Communicate IANA partnership organizations' efforts to strengthen synergies and maximize awareness, support and implementation of strategic objectives.
3. Education: Shared Information – Develop best management practice educational materials for our farmers and stakeholders to encourage fertilizer and nutrient loss reductions.
4. Research: Shared outcomes – Assist partners with pursuing collaborative nutrient-focused research, identifying synergies and compiling outcomes.

IANA Goals are shown in the table below:

Metric	Goal	2014	2024
% of Farmers Regularly Soil Sampling	100% of farmers	76%	86%
% of Farmers Planning for Nutrient Management	100% of farmers	27%	69%
% of Farmers Using In-Season Application	75% of farmers	62%	74%
% of Acres with Living Green Cover	40% of acres	10%	14%
Incease % of Reduced Tillage Acres	25% increase	3.06	4.284
Increase % of No-Tillage Acres	10% increase	4.95	4.726

Table 4 – Indiana Agriculture Nutrient Alliance Goals

8.4.5 4R Nutrient Stewardship Program in Indiana

nutrient stewardship

The 4R Nutrient Stewardship Certification Program is a voluntary program for ACI members that encourages agricultural retailers, nutrient service providers and other independent crop consultants to adopt proven best practices through the 4Rs, which refers to using the **Right Source** of nutrients at the **Right Rate** at the **Right Time** in the **Right Place**. This approach provides a science-based framework for plant nutrition management and sustained crop production while considering specific individual farms' needs. It is a proactive, responsible commitment aimed at the long-term improvement of water quality.

4R Nutrient Stewardship provides a framework to achieve cropping system goals, such as increased production, increased farmer profitability, enhanced environmental protection and improved sustainability.

Figure 24 – 4R Principles of Nutrient Stewardship

The Certification program audits ag retailers or Nutrient Service Providers (NSPs) on a set of standards developed by Indiana's Nutrient Stewardship Council. This set of standards outlines best practices (program requirements) to be implemented. Each requirement is evaluated during each audit period by a private, third party auditor via an in-person audit to earn or maintain certification. Depending on the services provided by the Nutrient Service Provider, some criteria will not be applicable. There are three sections to the program which include:

- Initial Training and Ongoing Education
- Monitoring of 4R Implementation; and
- Nutrient Recommendations and Application.

In 2025, the Indiana 4R Certification Program has certified 11 Nutrient Service Providers, covering 920,000 acres, and the program will continue to expand in future years. More information on the Indiana 4R Certification Program may be found at https://www.inagribiz.org/Indiana4RCertification.

Indiana 4R Survey – In 2026, Indiana 4R will be initiating an Ag Retailer 4R Survey. The Agribusiness Council of Indiana (ACI) and the Indiana Agriculture Nutrient Alliance (IANA) are partnering to gather statewide data from agricultural retailers on conservation and nutrient management practices. Randomly selected retailers and farm fields across the state will help generate actionable trendlines for Indiana growers and contribute data to the Indiana State Nutrient Reduction Strategy.

Key points:

- The survey is supported by Indiana's agricultural and commodity groups through IANA, ensuring consistent messaging and engagement with retailers and farmers.
- It will focus on nitrogen and phosphorus application rates, conservation practices, manure and soil testing utilization, and factors influencing nutrient management decisions.
- Results will help track adoption of nutrient management practices and quantify nutrient loss reductions over time.
- The survey supports Indiana agriculture in demonstrating progress and reinforcing the value of a voluntary conservation framework.

8.4.6 Indiana Small Farms Conservation

The Indiana Small Farms Conservation has a mission to educate and advocate to improve soil health, and support soil health on Indiana's urban and diversified small-scale farms and gardens. The program envisions a thriving, diversified local food system in Indiana where conservation practices are integrated on all farms no matter the size, and local partnerships in every county uplift environmental stewardship and success of urban and small-scale farmers and gardeners.

The program provides soil testing on small farms, technical assistance, education and outreach, and participation in local soil health working groups.
The program is supported by the Indiana NRCS, Indiana Association of Soil and Water Conservation Districts and by the Clean Water Indiana Program.
For more information about the program, visit, https://insmallfarms.org/.

Images are from the Indiana Small Farms Conservation website

8.4.7 Agricultural Landowner Educational Resources Available Online

Indiana NRCS has also developed many publications that are available on their website that provide sound advice on many different topics and issues related to phosphorus and nitrogen management, soil health, cover crops, drainage tile and drainage water management, pest management, forage and feed management and many more. To view these publications, visit: https://www.nrcs.usda.gov/resources/education-and-teaching-materials/publications-0.
There are Guide Sheets and Fact Sheets, Urban and Small Farm publications, Indiana Grazing Bites, and Soil Health Resources.

Online education and resources are also available through CCSI, IANA and the 4R Certification Program, and through the Small Farms Conservation program:

- https://www.ccsin.org/soil-health-practices
- https://inagnutrients.org/
- https://www.inagribiz.org/4r-resources
- https://insmallfarms.org/

Section 9 – Measuring Impacts

Best management practices within the regulatory framework and proactive, voluntary conservation measures matter. They matter because of the impact that conservation practices have on water quality both within the state of Indiana and in the water bodies outside of our state. They matter because the impact of the conservation practices results in reductions of nutrient loads. The many state and federal conservation programs, initiatives and actions illustrate the means by which the state can provide reports and accountability of assisted conservation practices reported by staff in the Indiana Conservation Partnership. These impacts are shown in a number of ways:

1. Continuation of the use of the Indiana Conservation and Cover Crop Transects and corresponding reports,
2. The use of the U.S. EPA Region 5 Nutrient Load Reduction Model as a means to annually estimate and track sediment, nitrogen and phosphorus load reductions from BMP implementation across Indiana on a watershed-wide scale,
3. An annual preparation of one page load reduction reports for significant waterbodies within Indiana,
4. The use of GIS Story Maps and interactive watershed tools to improve transparency, strengthen local engagement, show progress of NLRs, and tell the story of conservation going on in Indiana,
5. Instream water quality monitoring for performance measures to look for watershed improvements and trend analysis of data,
6. Reviewing Edge-of-Field (EOF) monitoring data, and
7. IDEM Nonpoint Source Success Stories

Regulatory framework nutrient reduction best management practices:

1. Publicly Owned Treatment Works (POTW) discharge monitoring reports are submitted monthly and will be graphed annually,
2. Pertinent information from MS4 annual reports will be compiled and reported annually,
3. Long-Term Control Plans (LTCP) pertinent progress will be reported annually.

9.1 Indiana's Conservation and Cover Crop Transects

The conservation transect is a cropland survey conducted annually in each Indiana county by ICP personnel and Earth Team volunteers. Using a predetermined route, staff look at farm fields in their county collecting data on tillage methods, plant cover, residue, cover crops, etc. in order to tell the story of conservation efforts in Indiana. The survey uses GPS technology and provides a statistically reliable method for estimating farm management and related annual trends. ISDA maintains transect reports dating back to 1990 on their website at https://www.in.gov/isda/divisions/soil-conservation/conservation-transect/ which includes the most recent transect results.

Due to the efforts through the conservation transect, Indiana can track tillage trends back to 1990 and cover crop trends back to 2011.

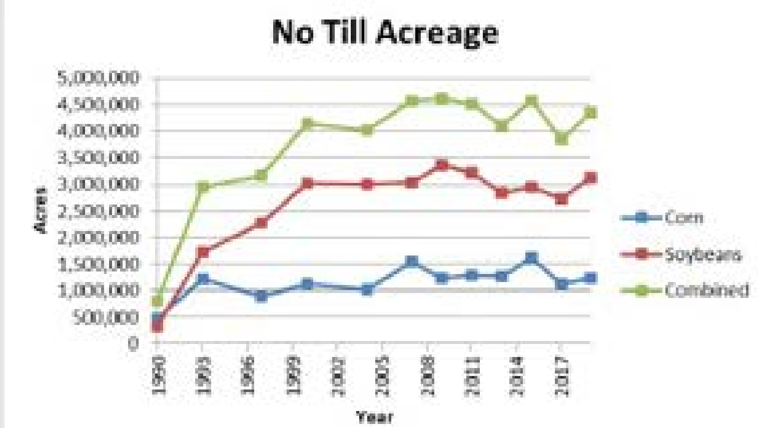
- Since 1990, Indiana landowners increased no-till acres on corn and soybean fields by 440%, and conservation tillage acres on corn and soybean fields by 332%. (Figure 25 and 26)
- Since 2011, Indiana landowners increased cover crop acres on corn and soybean fields by 359% (Figure 27).
- According to the most recent conservation transect conducted in 2025, approximately 1.6 million acres of overwinter living covers were planted by Indiana farmers, 70% of row crops were not tilled and 18% had employed reduced tillage over winter, after the 2024 harvest.
- In 2019, Indiana farmers planted 950,000 acres of living cover crops. Also, cover crops planted into fallow ground were tracked due to the increased number of prevent-plant ground seen in 2019. The data found that a total of 230,000 acres had prevent-plant.

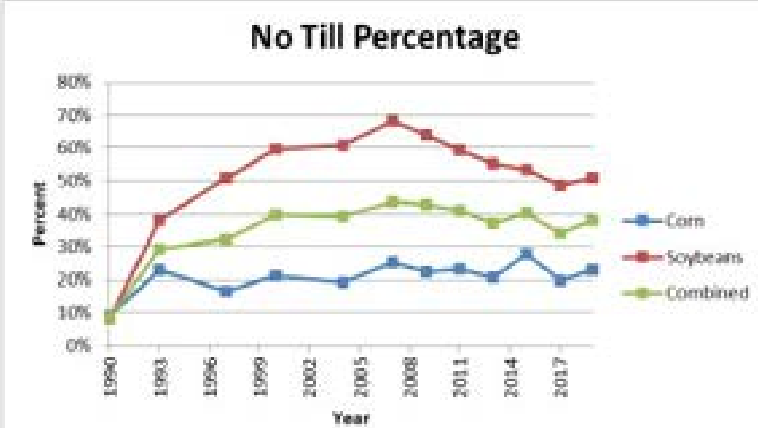
The ICP will continue the conservation and cover crop transects in future years. To review reports and maps from the transect data showing acres, percentages and trends of conservation tillage and cover crops, visit the Cover Crop and Tillage Transect Data page on the ISDA website.

As one of the national leaders in the use of cover crops, nutrient management and advocating of soil health and productivity, Indiana is a great example in the nation for the benefits that improving soils' nutrient uptake and water-holding capacities can do to reduce nutrient loss and excessive runoff from agricultural and other managed lands.

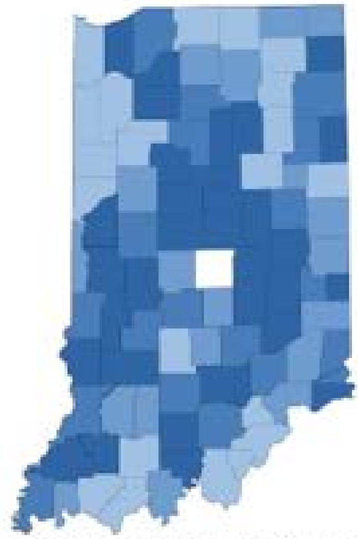
Indiana Statewide Tillage: 1990-2019

No Till: Any direct seeding system, including site preparation, with minimal soil disturbance (includes strip & ridge till).





* Please note that not all counties have data for all years. No tillage data is collected for Marion county.



*Note: Darker colors had a greater percent increase in total no till acres (corn and soybeans) from 1990-2019

No Till Percentage Change 1990-2019		
	Percentage Point Change	Percent Change
Corn	14	156%
Soybeans	43	538%
Combined	30	375%

No Till Acreage Change 1990-2019		
	Acres	Percent Change
Corn	751,225	157%
Soybeans	2,797,827	855%
Combined	3,549052	440%

No Till Implementation

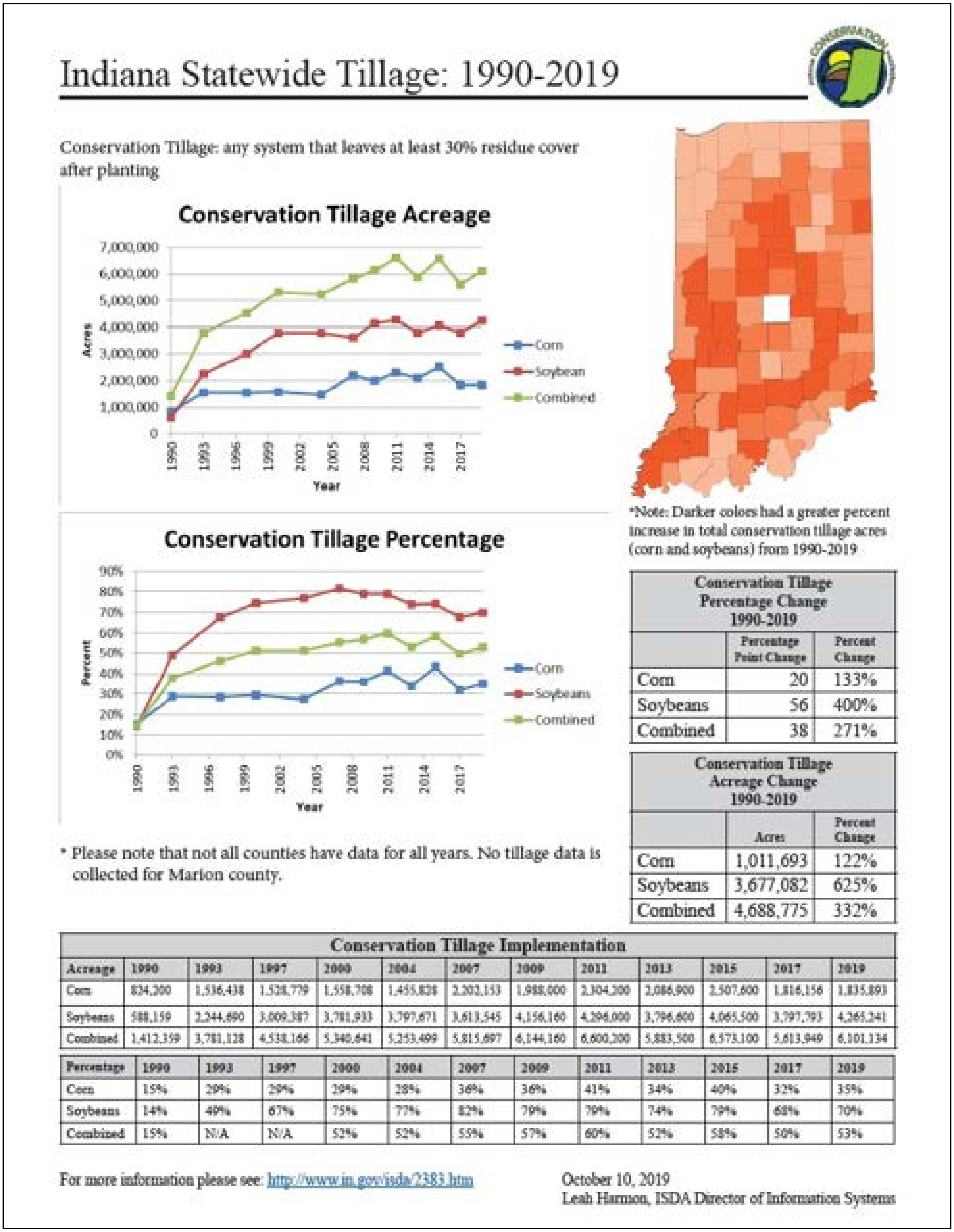
Acreage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017	2019
Corn	479,255	1,211,769	891,962	1,120,174	1,011,467	1,542,152	1,244,400	1,296,300	1,266,700	1,621,000	1,134,432	1,230,480
Soybeans	327,249	1,726,956	2,270,370	3,023,134	3,002,974	3,032,493	3,375,300	3,225,400	2,845,300	2,941,600	2,726,477	3,125,076
Combined	806,504	2,938,725	3,162,332	4,143,308	4,014,441	4,574,645	4,619,700	4,521,700	4,112,000	4,562,600	3,860,909	4,355,556

Percentage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017	2019
Corn	9%	23%	18%	21%	19%	25%	23%	23%	21%	28%	20%	23%
Soybeans	8%	38%	51%	60%	61%	69%	64%	59%	55%	54%	49%	51%
Combined	8%	29%	32%	40%	39%	44%	43%	41%	37%	40%	34%	38%

For more information please see: http://www.in.gov/isda/2383.htm

October 10, 2019
Leah Harmon, ISDA Director of Information Systems

Figure 25 – No-Till Trends from 1990-2019



Indiana Statewide Tillage: 1990-2019

Conservation Tillage: any system that leaves at least 30% residue cover after planting

Conservation Tillage Acreage

Conservation Tillage Percentage

*Note: Darker colors had a greater percent increase in total conservation tillage acres (corn and soybeans) from 1990-2019

Conservation Tillage Percentage Change 1990-2019		
	Percentage Point Change	Percent Change
Corn	20	133%
Soybeans	56	400%
Combined	38	271%

Conservation Tillage Acreage Change 1990-2019		
	Acres	Percent Change
Corn	1,011,693	122%
Soybeans	3,677,082	625%
Combined	4,688,775	332%

* Please note that not all counties have data for all years. No tillage data is collected for Marion county.

Conservation Tillage Implementation

Acreage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017	2019
Corn	824,200	1,536,438	1,528,779	1,558,708	1,455,828	2,202,153	1,988,000	2,304,200	2,086,900	2,507,600	1,816,156	1,835,893
Soybeans	588,159	2,244,690	3,009,387	3,781,933	3,797,671	3,613,545	4,156,160	4,296,000	3,796,600	4,065,500	3,797,793	4,265,241
Combined	1,412,359	3,781,128	4,538,166	5,340,641	5,253,499	5,815,697	6,144,160	6,600,200	5,883,500	6,573,100	5,613,949	6,101,134

Percentage	1990	1993	1997	2000	2004	2007	2009	2011	2013	2015	2017	2019
Corn	15%	29%	29%	29%	28%	36%	36%	41%	34%	40%	32%	35%
Soybeans	14%	49%	67%	75%	77%	82%	79%	79%	74%	79%	68%	70%
Combined	15%	N/A	N/A	52%	52%	55%	57%	60%	52%	58%	50%	53%

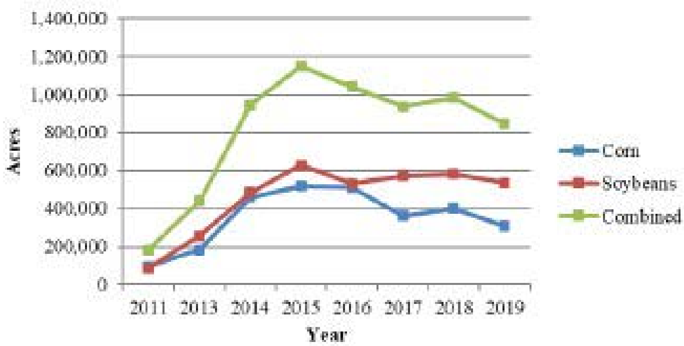
For more information please see: http://www.in.gov/isda/2383.htm

October 10, 2019
Leah Harmon, ISDA Director of Information Systems

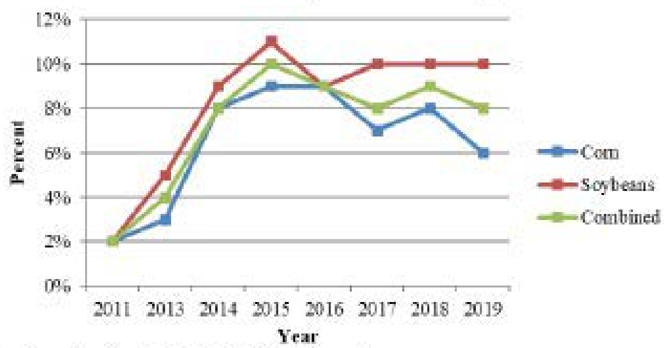
Figure 26 – Conservation Tillage Trends from 1990-2019

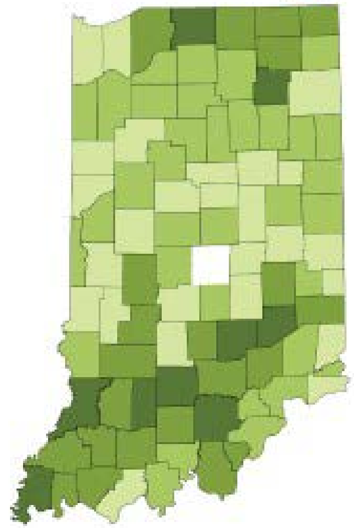
Indiana Cover Crops: 2011-2019

Cover Crop Acreage



Cover Crop Percentage





*Note: Darker colors indicate counties that reported a greater percentage of combined corn and soybean acres utilizing cover crops in 2019.

* Data is not collected for Marion County.
* 2011 and 2013 cover crop data was collected during the spring tillage transect. Figures collected in this manner may not be a true reflection of cover crop implementation because of winter kill and other factors.
* A fall cover crop transect has been completed annually since 2014. Data from these transects are included.
* Due to the COVID 19 pandemic, not all transects were completed. These surveys were supplemented using 5-year averages.
* A wet spring in 2019 made planting season a challenge. Subsequently, many landowners sowed cover crops in fields which had no cash crop. These fields are not reflected in this data.

Cover Crop Acreage Change 2011-2019		
	Acres	Percent Change
Corn	213,090	222%
Soybeans	448,615	511%
Combined	661,705	359%

Cover Crop Percentage Change 2011-2019		
	Percentage Point Change	Percent Change
Corn	4	200%
Soybeans	8	400%
Combined	6	300%

Cover Crop Implementation								
Acreage	**2011**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Corn	96,200	183,100	461,081	518,808	510,925	362,494	402,101	309,290
Soybeans	87,800	258,000	483,280	628,722	530,117	573,349	581,018	536,415
Combined	184,000	441,100	944,361	1,147,530	1,041,042	935,843	983,119	845,705
Percentage	**2011**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Corn	2%	3%	8%	9%	9%	7%	8%	6%
Soybeans	2%	5%	9%	11%	9%	10%	10%	10%
Combined	2%	4%	8%	10%	9%	8%	9%	8%

For more information about the transect program, including county level transect data, please see: http://in.gov/isda/2383.htm

December 7, 2020
Leah Harmon, ISDA Director of Information Systems

Figure 27 – Cover Crop Trends from 2011-2019

9.2 U.S. EPA Region 5 Nutrient Load Reduction Modeling and Mapping: Watershed-Wide

In 2011, ISDA adopted the use of the Region 5 Nutrient Load Reduction Model developed by U.S. EPA for three 319 funded watersheds, the Tippecanoe River, Upper Eel River, and the Upper Wabash River watersheds, in which three DSC staff were located to assist with the installation of conservation practices on the ground. IDEM regularly utilizes this Region 5 model for estimating load reductions for CWA 319 funded projects for reporting to U.S. EPA.

This model estimates sediment, nitrogen and phosphorus load reductions from individual BMPs on the ground. ISDA saw the value of using this model as a means to measure the load reductions coming from all technical assisted projects in Indiana that was being done by all of our staff, not just by the three staff working in the 319 funded watersheds. Its use has been standardized by ISDA, and the Region 5 model was adopted by the Indiana Conservation Partnership in 2013 and is now used statewide to model all the conservation practices that are implemented through assistance of all the ICP partnership staff through state and federal programs. Cooperation in this effort by local, state and federal partners in the ICP allows for conservation tracking and load reduction estimation at an order of magnitude greater than any single agency or entity could achieve alone. The methodology by which this process is done is explained in the Methodology report found here https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/#Conservation_Achievements.

Indiana ICP collects conservation practice data such as type of practice, practice locations, measurements and other necessary parameters from ICP partners for all federal, state and local programs, and through the process of data collection, we can see the impact of the number of conservations practices that are implemented annually. The collected data is then run through the Region 5 model to analyze the sediment, nitrogen and phosphorus load reductions for specific practices. Statewide watershed maps are prepared annually to illustrate the cumulative sediment, nitrogen, and phosphorus load reductions from all assisted conservation practices reported by staff in the ICP. These maps show the number of BMPs actively reducing loads in a given calendar year regardless of the year of practice installation.

While this model is project-specific, it provides a valuable perspective on a larger scale when showing the collective reductions of practices across several programs. The accountability/verification and annual reporting on implementation are current expectations among Indiana's Conservation Partners and are regularly being refined and improved. The ICP utilizes the end products of this process to measure load reduction trends by watershed for each calendar year, and serves as a tangible component of the Indiana State Nutrient Reduction Strategy. Annual Accomplishment reports are prepared each year and can be found on the ISDA State Nutrient Reduction Strategy webpage: https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/.

To align with evolving national guidance, Indiana (IDEM) recognizes the U.S. EPA's recommendation to use the Pollutant Load Estimation Tool (PLET) for estimating nutrient load reductions from nonpoint source conservation practices. PLET offers a standardized, transparent framework for calculating edge-of-field and watershed-scale nutrient reductions, enhancing consistency across state and federal reporting. While Region 5 modeling has historically supported Indiana's nutrient strategy, PLET provides a more robust platform for integrating practice-specific efficiencies, spatial data, and adaptive management scenarios. Indiana will explore opportunities to incorporate PLET outputs alongside existing tools to strengthen performance tracking and cross-state comparability.

9.2.1 Strengthening and Improving Our Method

The Region 5 model is used to determine nitrogen and phosphorus load reductions that are tied directly to sediment. As a result, nutrients that are dissolved and carried by runoff waters are not accounted for in the model; therefore we are missing the dissolved nutrients such as nitrate and dissolved phosphorus. Also, there are several practices that can't be run through the model due to the practice not being tied to sediment, such as nutrient management. The ICP is working to strengthen and improve this method of capturing nutrient load reductions in order to capture dissolved nutrients and other practices not tied to sediment, which will lead to more accurate reductions and better assess the progress being made on improving water quality.

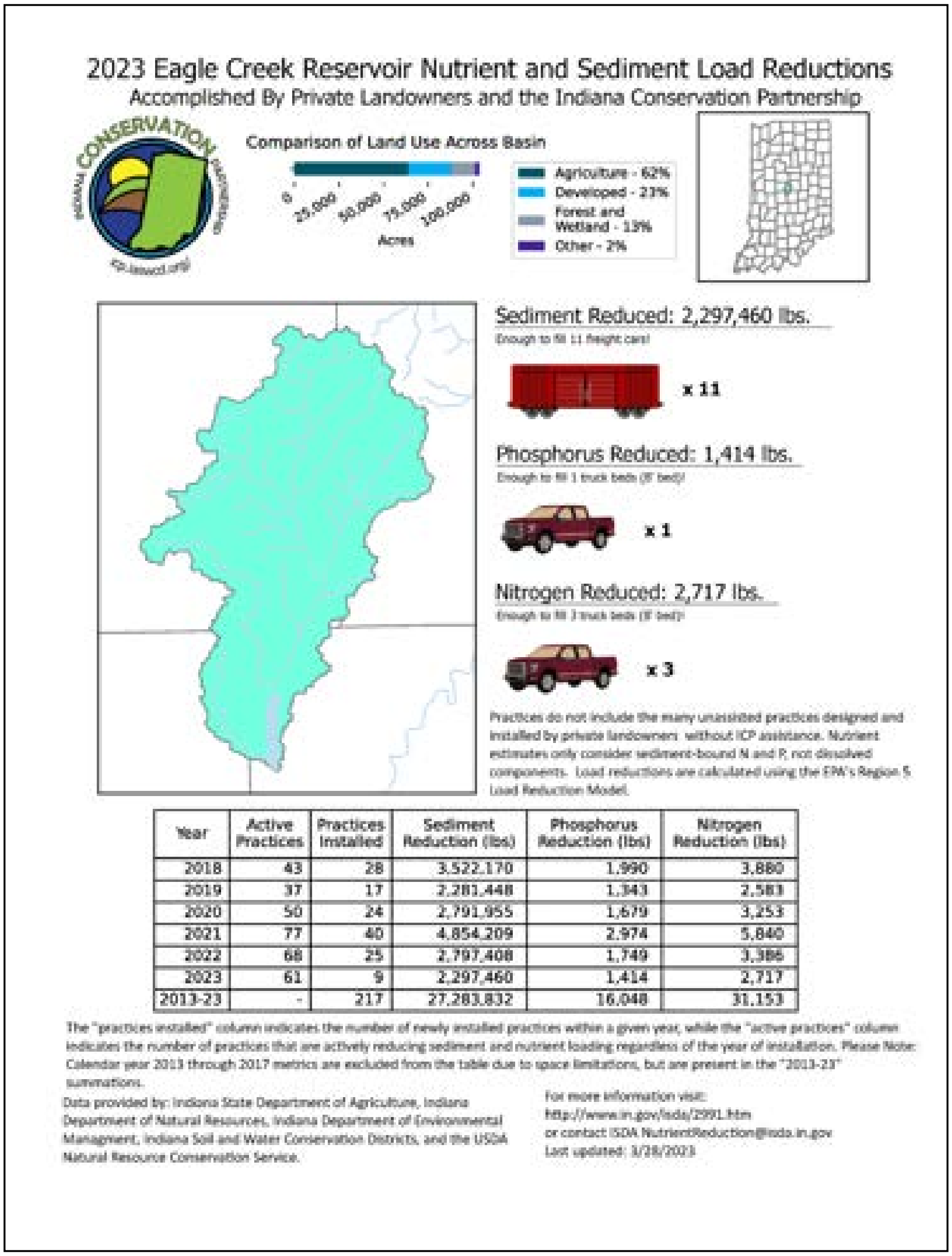
This work is being done through Component 2 of the Indiana Science Assessment as explained in Section 7. Monitoring and research conducted around the Midwest and in Indiana provides valuable understanding of the effectiveness of in-field and edge-of-field conservation practices in reducing nitrogen and phosphorus loads from agricultural fields. This research will be compiled, reviewed and be used to improve the current method that Indiana uses to calculate reductions in sediment, nitrogen, and phosphorus loads by identifying or developing a standardized tool and procedure for calculating nutrient load reductions from conservation practices, and be used in determining the percent efficiency of certain conservation practices on reducing the nitrogen and phosphorus loads.

9.3 Significant Waterbodies

ISDA prepares one page reports for several significant waterbodies in Indiana based on the Region 5 Load Reduction modeling efforts taking place. The ICP focuses on reporting the positive impacts of conservation practices to key drinking water sources throughout the state that have significant percentages of agricultural land use within their watershed. These reports are available for viewing on the Indiana State Nutrient Reduction Strategy webpage on the ISDA website at https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/. Figure 28 on the next page is an example of one these reports.

Significant Waterbody reports are prepared for:

- Eagle Creek Reservoir
- Geist Reservoir
- Kankakee River Basin
- Mississippi River Basin
- Morse Reservoir
- Patoka-White River Basin
- Wabash River Basin
- Western Lake Erie Basin



Year	Active Practices	Practices Installed	Sediment Reduction (lbs)	Phosphorus Reduction (lbs)	Nitrogen Reduction (lbs)
2018	43	28	3,522,170	1,990	3,880
2019	37	17	2,281,448	1,343	2,583
2020	50	24	2,791,955	1,679	3,253
2021	77	40	4,854,209	2,974	5,840
2022	68	25	2,797,408	1,749	3,386
2023	61	9	2,297,460	1,414	2,717
2013-23	-	217	27,283,832	16,048	31,153

Figure 28 – Eagle Creek Reservoir Watershed Sediment and Nutrient Load Reductions

9.4 Expanding Access Through Interactive Watershed Tools

To support the goals of the Indiana State Nutrient Reduction Strategy, particularly improving transparency, strengthening local engagement, and progressing nutrient load reductions, Indiana has deployed multiple interactive GIS-based tools that complement each other and advance statewide watershed planning.

The Major River and Lake Basin Web Application showcases Indiana's efforts to enhance water quality within the major river and lake basins in Indiana (Figure 29), as well as educates landowners, both rural and urban, about local, state and federal cost-share programs, educational opportunities, and rural and urban conservation practices. The application features interactive maps which allow users to click on watersheds, water monitoring locations along with links to water quality data, and educational sites to view detailed information about each basin. There is also information about local watershed groups and organizations, the number of conservation practices in specific subwatersheds, nutrient load reductions from BMPs, and links to active grants. The development and purpose of these GIS story maps is making Indiana's nutrient reduction strategy more interactive. https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/.

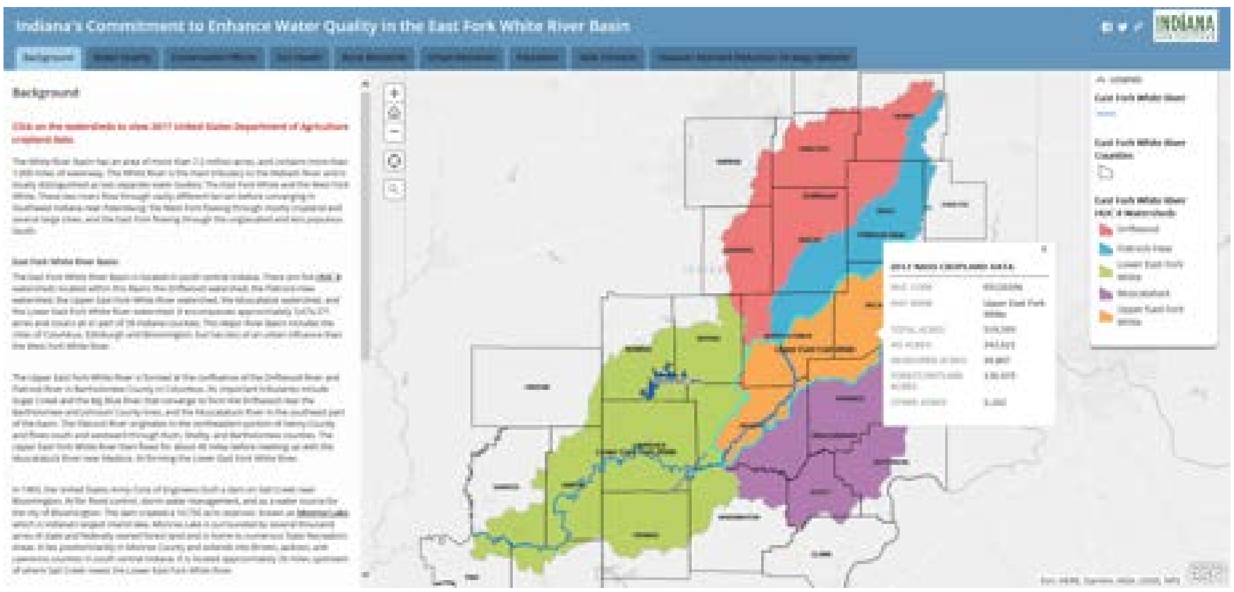


Figure 29 – Image of Background tab on the East Fork White River Basin Story Map

The WMP and TMDL Reports Search (WATRS) Tool streamlines access to IDEM-approved watershed management plans and Total Maximum Daily Load (TMDL) reports. Users can search by address, waterbody name, or HUC code to locate planning documents and status for HUC12 watersheds. By making these resources easily accessible, WATRS empowers local stakeholders to align their efforts with state priorities and track progress toward nutrient reduction targets. https://experience.arcgis.com/experience/a961cb488cc04d62b5c5749c860d6f59

The Indiana Watershed Groups Finder helps users identify active watershed organizations working within their area. By visualizing group boundaries and providing contact information, this tool supports collaboration, encourages community-led implementation, and strengthens the network of partners contributing to SNRS goals. https://www.in.gov/idem/nps/watershed-groups-finder/

Together, these tools reinforce Indiana's commitment to data accessibility, stakeholder empowerment, and coordinated restoration. They serve as practical extensions of the SNRS framework, enabling users to move from narrative context to actionable connections that drive measurable water quality improvements.

9.5 Performance Measures Monitoring

To determine if the BMPs installed are resulting in water quality improvements, IDEM conducts follow-up (performance measures) in-stream ambient water quality monitoring. IDEM consults with other members of the ICP to identify 12-digit HUCs where conservation practices have been in place for at least five years. The parameters sampled are based on the water quality impairments for which the stream is listed on the 303(d) List of Impaired Waters; most are for impaired biotic communities. IDEM's monitoring is showing that the watershed approach employed by the ICP is resulting in water quality improvements. Watershed success stories are found at https://www.epa.gov/nps/success-stories-about-restoring-and-protecting-water-bodies-impaired-nonpoint-source-pollution.

Indiana continues to expand its publications of U.S. EPA-recognized Nonpoint Source Success Stories, demonstrating measurable water quality improvements across many watersheds. These stories highlight the effectiveness of targeted BMP implementation, stakeholder collaboration, and adaptive watershed planning. Each success story reflects not only pollutant load reductions but also restored designated uses, such as aquatic life support and recreational use attainment. Indiana currently leads all U.S. EPA Region 5 states in both the number of approved success stories and the number of waterbodies with documented improvements, a testament to the state's strategic investment in watershed planning and performance tracking. Nationally, Indiana has risen to become one of the leading states in demonstrating nonpoint source program effectiveness through U.S. EPA's success story framework.

As part of Indiana's performance monitoring strategy, these success stories serve as key indicators of progress by complementing load reductions, BMP adoption rates, and practice longevity. The state will continue to prioritize reporting and leverage these stories to inspire local action, justify program investments, and inform future watershed strategies.

It is also important to note that accounting for nutrient time lags is crucial for understanding why water-quality improvements in Indiana's rivers, lakes, springs, and wells can take years, or even decades, to become apparent. In a karst-dominated region of southeastern Minnesota, Kuehner et al. (2025) showed that water emerging at many springs first entered the subsurface 10 to 40 years earlier, carrying with it legacy loads of nitrate (and likely phosphorus) applied long ago. Though that study focused on Minnesota's landscape, Indiana's aquifers can behave in much the same way. Once nutrients infiltrate soil profiles, streambed sediments, or groundwater, they continue to release downstream over multiple decades.

This environmental persistence means that today's best management practices may not yield immediate responses in nutrient concentrations. Instead, legacy stores mask the early gains achieved by practice adoption. Without accounting for these subsurface sources of nitrogen and phosphorus, we may easily underestimate both the early successes in practice adoption and the realistic timelines for measurable water-quality improvements.

The SNRS framework for measuring performance combines measurements such as rates of BMP implementation and modeled edge-of-field nutrient reductions with sustained, long-term monitoring of surface water. This approach allows Indiana to identify short-term progress through practice adoption, while maintaining realistic expectations that measurable declines in stream nutrient levels may not be seen for many decades as legacy pollutants gradually diminish.

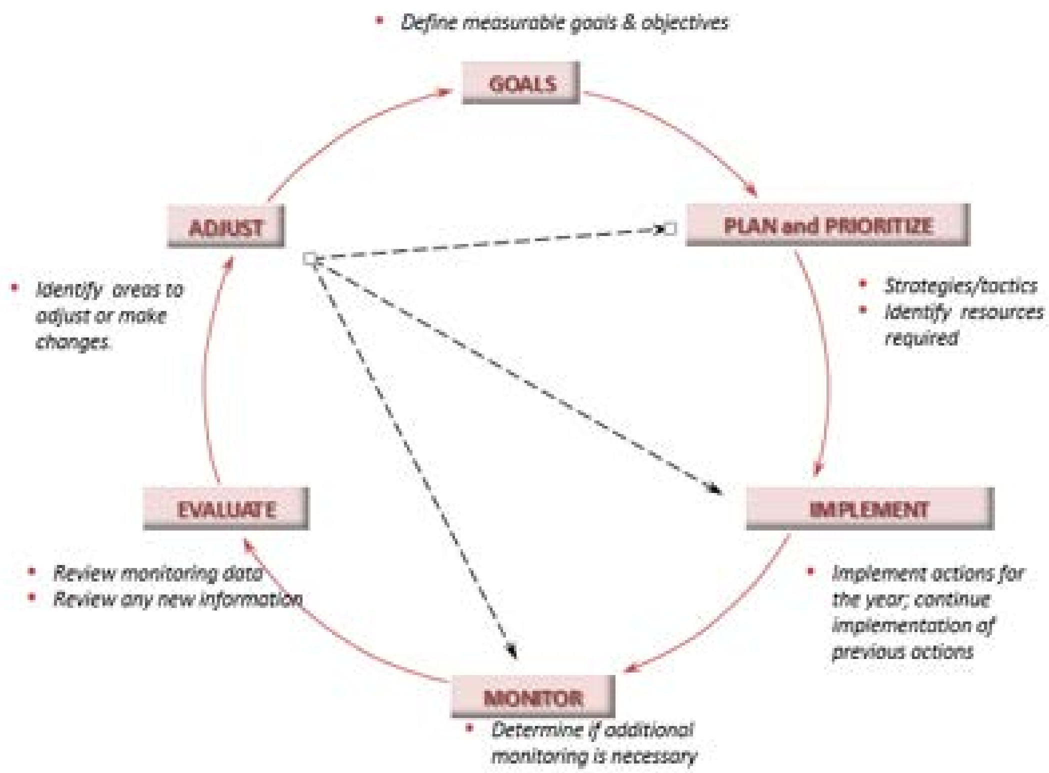
Section 10 – Milestones and Action Items

The current and on-going actions and goals to address the issue of nutrient pollution and water quality impairment are outlined in the Milestones and Action Items table on the following pages. Goals are listed out in five different categories, each with overarching goals followed up with action items. This table will be periodically reviewed and amended, with a goal to add 'progress indicators'. To see the Milestones and Action Items table, including future updates, visit the SNRS webpage at https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/.

10.1 Adaptive Management

Vital to Indiana's success in implementing this State Nutrient Reduction Strategy is an adaptive management approach that tests the hypotheses put forth in the Strategy and applies the lessons learned therefrom to future management decisions.

Figure 30 – Adaptive Management



Indiana will continue to evaluate the efficacy of the nutrient reduction goals, programs, and practices outlined in this Strategy. Based on that evaluation and new information/data arising from research and monitoring data, partner feedback, and funding availability, Indiana will modify this Strategy as necessary.

10.2 Goals and Action Items Table

Indiana's State Nutrient Reduction Strategy – Milestones and Action Items Table
Goals & Actions
Work with a sub-committee of the SNRS Workgroup to determine the "Progress Indicators" for each of the goals and actions items listed in this table (where applicable and as needed).
Indiana Science Assessment
Overarching Goal
Improve scientific understanding and quantification of nutrient reductions to guide data-driven conservation decisions.
Actions Items
Collect USGS Stream gage data and IDEM Fixed Station water quality data in order to continue to run the trend analysis of nutrient loads on sites chosen as part of the Indiana Science Assessment Component 1 using the WRTDS model on an annual basis.
Periodically evaluate the chosen WQ monitoring sites for the trend analysis to see if any sites need to be removed or added.
Monitor water quality trends in nitrogen and phosphorus to assess reductions.
Continue the work of the Indiana Science Assessment to improve the method to quantify nutrient reductions from conservation practices, including dissolved nutrients, and determine efficiency of practices in reducing loads. This includes the development of a tool for calculating nutrient load reductions and determining the efficiency of certain conservation practices on reducing nitrogen and phosphorus loads to Indiana waters.
Have a collective list and consistent definitions of conservation practices that are analyzed as part of the Indiana Science Assessment.
Develop list of the most effective Nitrogen reduction practices - Urban vs. Rural - Soil Health - Nutrient Management - Agricultural Drained Lands
Develop list of the most effective Phosphorus reduction practices - Urban vs. Rural - Soil Health - Nutrient Management - Erosion Control
Communicate the results of the conservation practice analyses completed from the work of the Indiana Science Assessment.
Continue to work with and collaborate with other states in the Midwest who are also working on Science Assessments and analyzing research studies and data for conservation practices effectiveness.
Water Quality Monitoring & Planning
Overarching Goal
Enhance Indiana's water quality monitoring network through coordinated monitoring efforts, permitting, and investment.

Actions Items
Determine WQ monitoring gaps that exist in order to expand or enhance water quality monitoring networks that can be used to evaluate nutrient trends and BMP effectiveness.
Prioritize new monitoring sites statewide and determine funding needs and funding sources for any new monitoring sites.
Determine existing monitoring locations that need continued funding in order to continue long-term water quality monitoring.
IDEM will continue to monitor (through monthly discharge monitoring reports) and require that all major wastewater treatment plants have 1mg/L phosphorus limits in their NPDES permits and are discharging at that limit or below.
Support upgrades to wastewater treatment facilities and municipal stormwater systems to reduce nutrient discharges through improved infrastructure and updated permits.
The Indiana Water Monitoring Council (InWMC) is having conversations with the Indiana Water Resources Association (IWRA) to combine efforts and become a water monitoring committee under IWRA, with the continued commitment of working together to communicate, coordinate, share data, and collaborate on water monitoring efforts around the state.
Assess the Funding needs and Research needs and gaps within Indiana for WQ monitoring both surface and groundwater, and for In-field and Edge-of-Field practice effectiveness.
Work with the State Department of Health and Indiana Finance Authority on addressing septic tank issues throughout the state, such as septic tank failures, cost needs for repairs and/or upgrades, and educational needs.
Measuring Impacts
Overarching Goal
Demonstrate and communicate the measurable impacts of conservation practices on sediment, nitrogen, and phosphorus reductions statewide.
Actions Items
Continue to inventory conservation practices implemented through conservation programs and show impacts of the *assisted* conservation practice implementation statewide.
Show impacts of assisted conservation practice implementation using the Region 5 model and the newly developed model that will come from the work of the Indiana Science Assessment. These models will show the sediment, nitrogen and phosphorus load reductions from practice implementation.
Use this inventory of implemented conservation practices to guide decisions on priority watersheds and work on the Indiana Science Assessment.
Continue to conduct the conservation and cover crop transect survey statewide, and to use the data results from these transects.
Continue to prepare annual one-page reports on load reductions in significant waterbodies within Indiana.
Use GIS Story Maps and interactive watershed tools to improve transparency, strengthen local engagement, show progress of NLRs, and tell the story of conservation going on in Indiana.
Continue to implement performance measures monitoring on BMP projects around the state to see if implementation has improved water quality.

Conservation Implementation and Program Implementation
Overarching Goal
Accelerate and increase conservation practice adoption to reduce nutrient and sediment loads and advance water quality improvements across priority watersheds.
Actions Items
Promote and implement conservation practices that are effective in reducing nitrogen loads.
Promote and implement conservation practices that are effective in reducing phosphorus loads.
Target priority watersheds with BMP implementation.
Explore funding opportunities for implementation of streambank stabilization projects.
Encourage and promote the use of cover crops with the result of seeing an increase in acres planted statewide.
Encourage and promote the use of no-till and conservation tillage implementation across the state in order to see an increase based on tillage transect results.
Increase the promotion of strip-till since it has many of the same benefits as no-till and can get nutrients injected below ground.
Encourage and support the use and implementation of nutrient management plans by Indiana farmers.
Provide technical assistance and funding support to farmers and landowners to perform regular soil sampling that aids in nutrient management on ag land.
Provide technical assistance and program support to landowners for implementing wetland restorations.
Promote and implement bottomland timber floodplain restorations (tree plantings).
Encourage and support SWCDs to use CWI funding as they increase the number of joint sediment and nutrient reduction projects.
Provide technical assistance and program support to landowners and participants wanting to enroll acres into the Indiana Conservation Reserve Enhancement Program (CREP).
Provide federal pass-through funding for watershed planning and implementation projects: provide CWA 319 and 205j funding with IDEM and other ICP staff technical assistance and grant management.
Work with landowners and participants to address natural resource concerns and enroll them in the right federal, state, or local program that will meet the landowner's conservation and stewardship needs: provide technical assistance, financial assistance and write conservation plans for landowners.
Support the work of conservation watershed organizations, watershed and river basin commissions, etc. that are doing work to promote, encourage, and educate on wildlife habitat, wetland restorations, edge-of-field practices, river-floodplain connection, and many other conservation practices.

Education and Outreach
Overarching Goal
Increase awareness and participation in conservation practices through strategic education, outreach, and professional development.
Actions Items

Explore opportunities to work with Certified Crop Advisers (CCAs) and private sector to help promote agronomic conservation practices and technologies. Support CCA Annual Meeting in December, hold field days and invite CCAs, and develop possible grant opportunities to work with CCAs.
Promote 4R Nutrient Stewardship Certification Program across Indiana, and the 4R of nutrient stewardship when working with ag landowners.
Expand cover crop use among farmers by promoting the new Cover Crop Premium Discount Program for growers.
Support the SWCDs around the state that provide educational events and field days to students, landowners, and the public on topics that include practice implementation, practice effectiveness, water quality, soil health, or other conservation related topics.
Promote Conservation Cropping Systems Initiative (CCSI) events to ICP staff for professional development opportunities.

Section 11 – "What You Can Do to Protect Water Quality in Indiana"

How can you protect and improve Indiana's water quality? Recall that a watershed[32] is the area of land that drains to a body of water. As a Hoosier, you live in a watershed that drains either to the Gulf of America or to the Great Lakes. It is important to understand that the quality of water coming from your lawn, roof, driveway, neighborhood streets, etc. has an effect on the water quality in the local streams and rivers, as well as on local storm drain systems, which eventually flow to the Gulf of America or to the Great Lakes. What you do on a day-to-day basis has an impact on the water quality in your watershed. You play a role, and you can make a positive difference!

Image source: IDEM

State and local governments, volunteer groups, water quality professionals, and concerned citizens are working together to clean up our lakes, rivers, streams, and wetlands. You can help! Whether you live in a big city or in the country, you can prevent nonpoint source pollution by taking simple actions on your property or in your community. The following are some simple solutions to a big problem (https://www.in.gov/idem/nps/what-is-nonpoint-source-pollution/what-you-can-do-to-reduce-or-stop-nonpoint-source-pollution/):

- **Dispose of oil and household chemicals properly**
  Keep oils and chemicals out of local streams by utilizing and supporting local toxic drop-off sites, maintaining vehicles to reduce leaks and never pouring any materials down a storm drain. https://www.in.gov/idem/recycle/

- **Maintain septic tanks**
  Just like any other tool or appliance, a septic tank needs to be maintained to function properly, and a properly working septic system should not release anything that is harmful to you or the environment. Pump it out regularly-at least once every three years-to avoid overload or failure.

- **Create and enhance riparian corridors**
  Riparian corridors are the buffer zones between used land and a stream, most often planted with vegetation. A well-established riparian corridor can help regulate water temperature, protect the bank from erosion, and filter pollutants from storm water. You can start improving your riparian corridor by allowing natural growth, rather than mowing along the stream bank. Allowing native plants to take over the area, as well as adding trees and bushes will help increase the function of your corridor.

[32] https://www.in.gov/idem/nps/what-is-a-watershed/

- **Pick up pet waste**
  It is simple to reduce nonpoint source pollution from pet waste – just pick up after your pet. Pet waste contributes to nutrient and E. coli nonpoint source pollution. Pet stores and large retail stores carry small plastic bags for picking up pet waste. Biodegradable bags are even available for purchase.

- **Take care of big issues on small farms**
  Depending on the type and number of animals you have, there are many options for reducing the impact of your small farm. First, consider isolating animals from water bodies and providing alternative drinking water sources. Animals trample vegetation on stream banks and deposit feces in the water. If you pasture animals, create a rotational grazing system that reduces pasture erosion and allows the vegetation time to grow. For other ideas more specific to your operation, contact your local Soil and Water Conservation District (https://www.in.gov/isda/divisions/soil-conservation/swcd-directory/), or the Indiana Small Farms Conservaiton program, https://insmallfarms.org/.

- **Read the label – Use lawn and garden fertilizer wisely**
  Fertilizer is composed of nitrogen, phosphorus, and potassium. The content of each is usually listed as a string of three numbers on the fertilizer bag. Although garden plants need varying levels of each chemical to grow properly, Indiana's soil provides plenty of phosphorus for established lawns. Using fertilizer with low or no phosphorous for established lawns will keep it green and minimize the impact on water quality. Starter fertilizer should only be used when growing grass from seeds. When you apply fertilizers, make sure you follow the directions. Over-application and sloppy application leads to fertilizer washing from lawns, sidewalks, and streets into storm drains.

- **Think before you dig**
  Construction sites that disturb one acre or more of land are required to use best management practices (BMPs) to keep sediment out of water bodies. Although it is likely your backyard project will not come close to the one acre size limit, it is still a good idea to avoid leaving bare soil on your property. If you need to disturb the soil for any reason, reseed and replant bare ground as soon as possible to keep soil on your yard and out of streams, rivers, and lakes.

- **Plant a rain garden**
  Rain gardens catch and infiltrate excess storm water as it flows across your yard.

- **Connect your downspouts to rain barrels**
  Rain barrels catch excess water from rooftops. Use that water to irrigate landscapes during dry periods. Make sure the barrel's overflow goes to a pervious surface like a garden or yard instead of your impervious driveway.

- **Use Porous pavement**

When it's time to replace your driveway, use some type of porous pavement. These materials allow storm water to soak through and infiltrate into the ground. If you cannot afford a whole driveway of porous pavement, consider using it at the driveway's apron where it meets the street.

- **Responsible car washing**
  Use a commercial car washing facility that collects the waste water that can be cleaned through a waste water treatment plant before it gets released to the local streams and rivers.

Clear Choices Clear Water program - *Clear Choices Clean Water* is a campaign to increase public awareness about the choices we make and the impacts they have on our streams, lakes and groundwater. Water quality friendly practices such as landscaping with native plants, maintaining septic systems, using less fertilizer on lawns, managing yard and pet wastes, fostering soil health, and using less water all help to protect our precious water resources. By educating individuals on these and other important actions and giving them the tools needed to make behavior changes, *Clear Choices Clean Water* empowers everyone to do their part for water quality and conservation. This program has action-oriented campaigns centered on water quality practices such as those mentioned above. On the *Clear Choices Clean Water* website, citizens can read educational information about the choices they make and can take pledges toward good water quality actions. The focus of this effort began in Indiana but is now spreading across the country.

An electronic version of this strategy can be found on the ISDA website at https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/

To submit questions, comments or feedback about this strategy, please use ISDANutrientReduction@isda.in.gov.

Appendix A – Acronyms

ACEP	Agricultural Conservation Easements Program
ACI	Agribusiness Council of Indiana
ALE	Agricultural Land Easements
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CALM	Consolidated Assessment and Listing Methodology
CC	Cover Crop
CCA	Certified Crop Adviser
CCSI	Conservation Cropping Systems Initiative
CES	Cooperative Extension Service (Purdue University)
CFO	Confined Feeding Operation
CIG	Conservation Innovative Grant
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSO	Combined Sewer Overflow
CSP	Conservation Stewardship Program
CWA	Clean Water Act
CWI	Clean Water Indiana
CWS	Community Water Systems
DAP	Domestic Action Plan
DMR	Discharge Monitoring Report
DRP	Dissolved Reactive Phosphorus
DSC	Division of Soil Conservation (ISDA)
DSS	District Support Specialist (ISDA)
EOF	Edge-of-Field
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
4Rs	Right Source, Right Rate, Right Time, Right Place
FSA	Farm Service Agency (USDA)
GIS	Geographic Information System
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
GW	Groundwater
GWMN	Groundwater Monitoring Network
HAB	Harmful Algal Bloom
HFRP	Healthy Forest Reserve Program
HRI	Healthy Rivers Initiative (IDNR)
HTF	Hypoxia Task Force (Gulf of America)
HUC	Hydrologic Unit Code
IANA	Indiana Agriculture Nutrient Alliance
IASWCD	Indiana Association of Soil and Water Conservation Districts
IAC	Indiana Administrative Code
ICP	Indiana Conservation Partnership
IDEM	Indiana Department of Environmental Management

IDNR	Indiana Department of Natural Resources
IGS	Indiana Geological Survey
INFA	INfield Advantage
INFB	Indiana Farm Bureau
InWMC	Indiana Water Monitoring Council
ISDA	Indiana State Department of Agriculture
ISDH	Indiana State Department of Health
IWRA	Indiana Water Resources Association
LARE	Lake and River Enhancement (IDNR)
LOADEST	Load Estimator
LTCP	Long-Term Control Plans
LUMCON	Louisiana Universities Marine Consortium
MARB	Mississippi/Atchafalaya River Basin
MCPHD	Marion County Public Health Department
MGD	Million Gallons/day
MOU	Memorandum of Understanding
MRBI	Mississippi River Basin Initiative
MS4	Municipal Separate Storm Sewer Systems
MSQA	Midwestern Stream Quality Assessment
NASS	National Agricultural Statistics Service
NAWQA	National Water Quality Assessment
NGO	Non-governmental Organization
NLR	Nutrient Load Reduction
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPD	Non-rule Policy Document
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service (USDA)
NSPs	Nutrient Service Providers
NWQI	National Water Quality Initiative
OISC	Office of Indiana State Chemist
OWQ	Office of Water Quality (IDEM)
ORSANCO	Ohio River Valley Water Sanitation Commission
POTW	Publicly Owned Treatment Works
PU	Purdue University
PS	Point Source
RCPP	Regional Conservation Partnership Program
RS	Resource Specialist (ISDA)
SAFE	State Acres for Wildlife Enhancement
SNRS	State Nutrient Reduction Strategy
SPARROW	Spatially Referenced Regressions on Watershed Attributes
SPEA	School of Public and Environmental Affairs, (IU)
SRA	State Resource Assessment
SRAs	State Recreation Areas
SSCB	State Soil Conservation Board

SWCD	Soil and Water Conservation District
SWQMP	Stormwater Quality Management Plan
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TNC	The Nature Conservancy
TP	Total Phosphorus
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WHO	World Health Organization
WLEB	Western Lake Erie Basin
WMP	Watershed Management Plan
WQ	Water Quality
WQS	Water Quality Standards
WREP	Wetland Reserve Enhancement Program
WRP	Wetland Reserve Program
WRTDS	Weighted Regressions on Time, Discharge, and Season
WWTP	Waste Water Treatment Plant

Appendix B – Watershed Prioritization for Indiana's State Nutrient Reduction Strategy (SNRS)

(October 2025 – March 2026)

Goal

Create and implement a method to prioritize Indiana's HUC8 level watersheds for targeted sediment and nutrient load reduction work to improve water quality.

Method

Identify factors that contribute to the prioritization of watersheds for sediment and nutrient load reduction. Evaluate and rank the factors, group them into categories, and tier the categories based on the score.

Six Factors Chosen

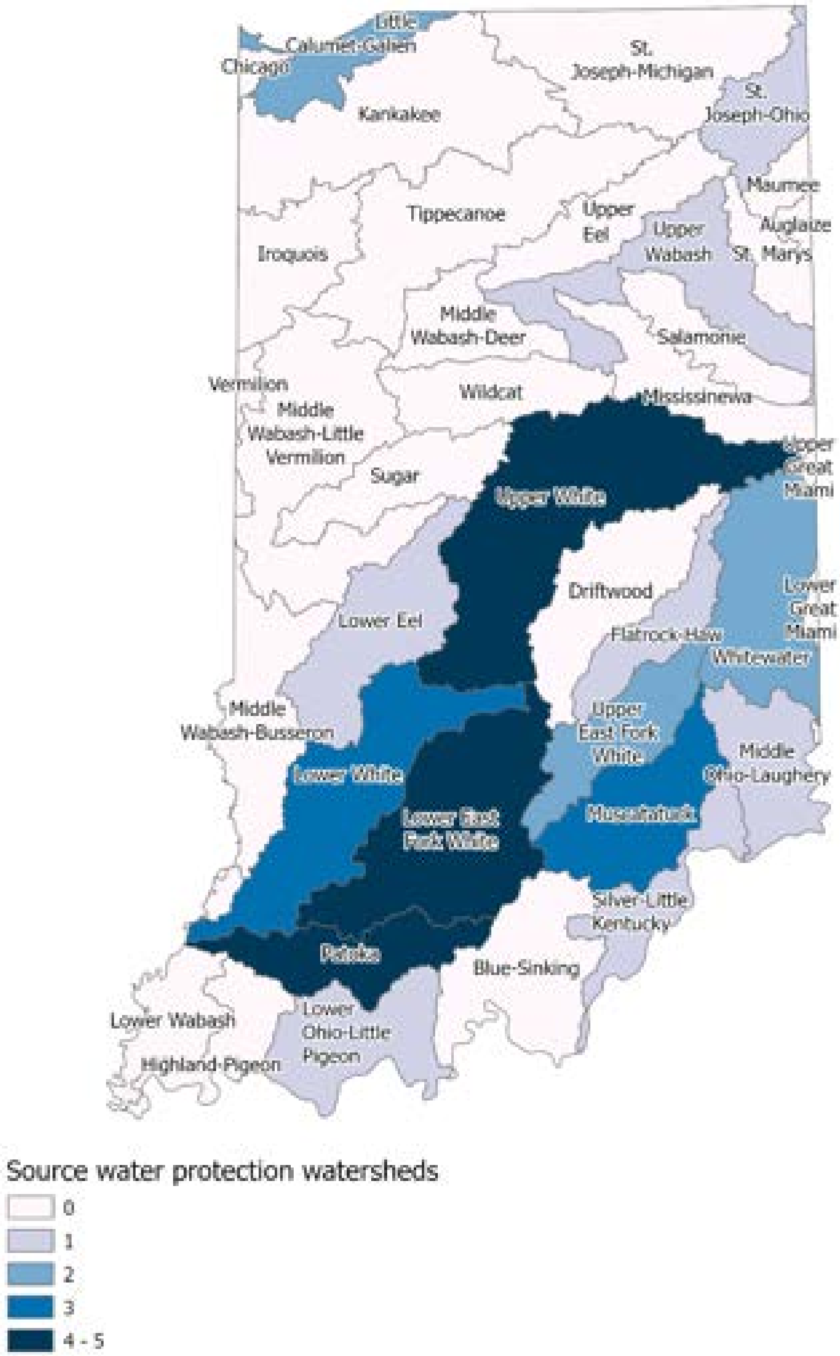
Each HUC8 watershed in the state was scored based on these six factors:

1) Source Water Protection watersheds
2) Water Quality Data/Trends results from WRTDS analysis
3) Impairments/Impaired Streams
4) Loading Data from SPARROW Model
5) Conservation Practice Implementation Data
6) Ground Water Vulnerability/Aquifer Sensitivity

1) **Source Water Protection watersheds** – This factor considered the number of source water protection watersheds within a HUC8 watershed, which are designated by the Indiana Department of Environmental Management's (IDEM) Source Water Assessment Program (SWAP). It is based on the source of public drinking waters susceptibility to contamination. It looked at watersheds with drinking water reservoirs and surface water intakes and scored them as being a higher priority than those that do not include reservoirs and intakes. (Figure 1)

Watershed Prioritization Factor – Surface Water Protection Watersheds (Figure 1)

- The higher the number (and darker the color) means more HUC12 watersheds with drinking water reservoirs per HUC8 watershed
- 0 means there are no intakes within the watersheds, 5 had the most intakes

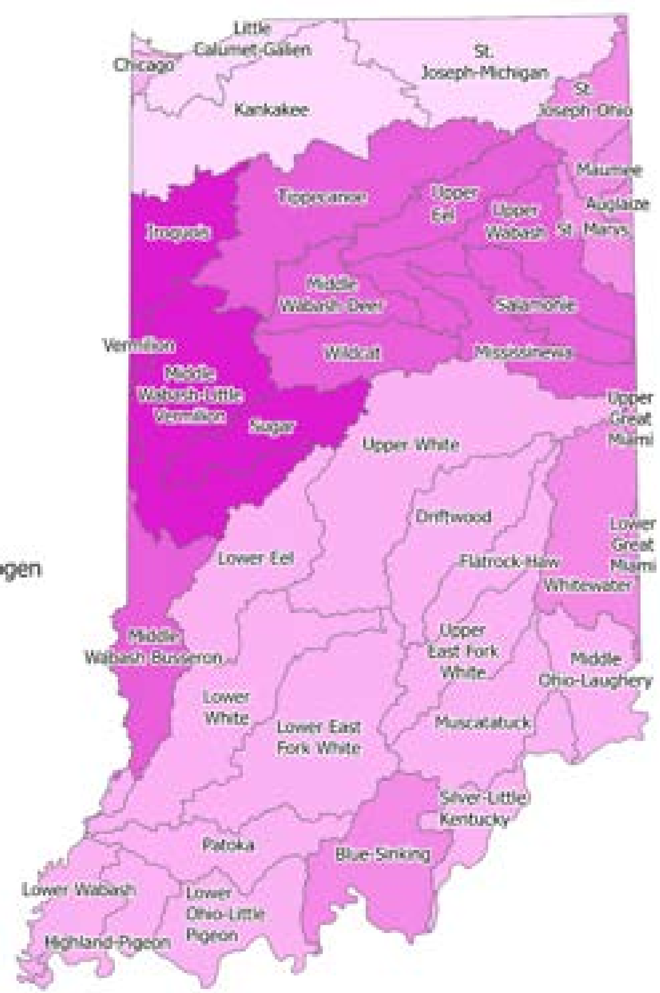


2) **Water Quality Monitoring Data/Trends results from the WRTDS analysis done as part of Component 1 of the Indiana Science Assessment** – Component 1 of the Indiana Science Assessment used the Weighted Regressions on Time, Discharge, and Season (WRTDS) model to assess nutrient load trends in various watersheds around the state of Indiana using IDEM Fixed Station water quality monitoring data and USGS streamgage data. Ascertaining nutrient loads at the state borders and within some basins in the state helps to inform the prioritization process.

- Average Nutrient Load per Acre WRTDS – Using the IDEM Fixed Station water quality monitoring data and USGS streamgage data, a recent 5-year period (2015-2020) of the mean load per year per acre within the watershed was calculated. Because the initial WRTDS analysis did not utilize HUC8-level watersheds, the data was resampled to the HUC8 scale. Where multiple contributing WRTDS watersheds mapped to a single HUC8, results were aggregated using an area-weighted average. This process was done for both phosphorus and nitrogen.
    - Average Nitrogen Load in lbs. / year / acre from WRTDS analysis (Figure 2)
    - Average Phosphorus Load in lbs. / year / acre from WRTDS analysis (Figure 3)

Watershed Prioritization Factor – Average Estimated Load of Total Nitrogen in Lbs. Per Year Per Acre from WRTDS (Figure 2)

- Higher values mean more total nitrogen load per acre



Watershed Prioritization Factor – Average Estimated Load of Phosphorus Load in Lbs. Per Year Per Acre from WRTDS (Figure 3)

- Higher values mean more phosphorus load per acre

3) **Impairments/Impaired Streams** – This factor considered impaired stream miles for nutrients within the HUC8 watersheds. This metric calculates the total stream miles impaired for nutrients and assessed for aquatic life use and divides it by the total stream miles assessed for aquatic life use.

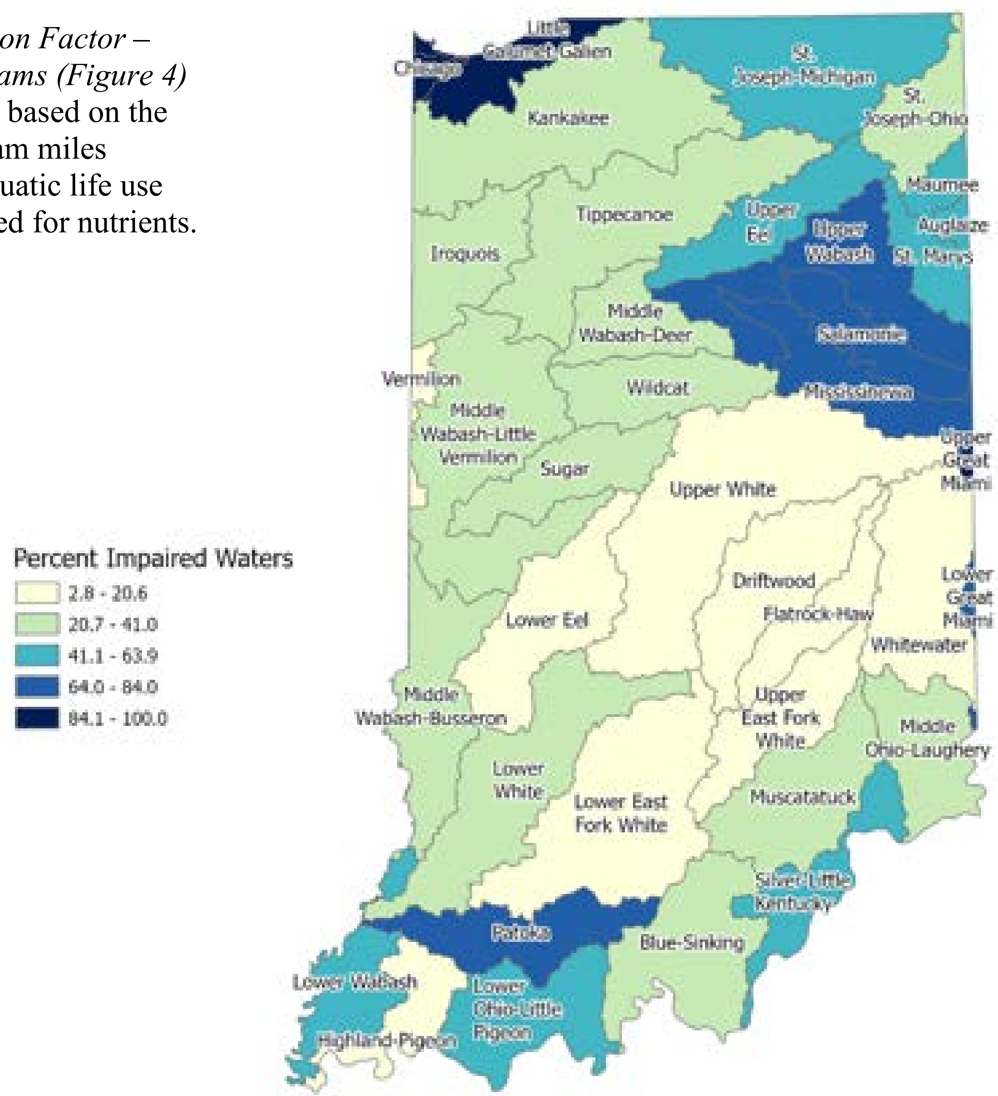
- Percent Impaired Waters- The percentage of waterways within HUC8s that are classified as impaired based on the IDEM 303(d) list of impaired waterways.

$$\frac{Number\ of\ stream\ miles\ classified\ as\ impaired}{Number\ of\ stream\ miles\ assessed} * 100$$

The denominator was limited to only assessed stream miles because including unassessed miles would artificially lower the percentage and misrepresent the extent of nutrient-related impacts within the assessed stream miles.

Watershed Prioritization Factor – Percent Impaired Streams (Figure 4)

- Map colors are based on the percent of stream miles assessed for aquatic life use that are impaired for nutrients.

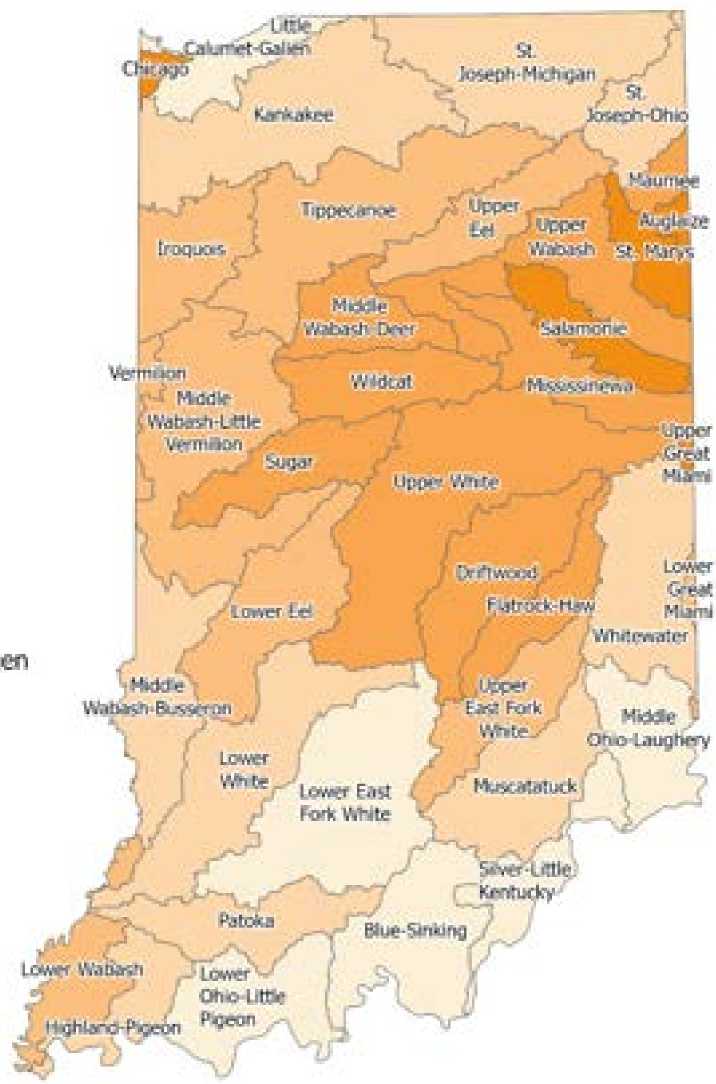


4) **Loading Data from SPARROW** - The USGS SPARROW (Spatially Referenced Regression on Watershed Attributes) model calculates nutrient yield in watersheds by estimating mass balance in small catchments.

- Aggregate Nutrient Yield SPARROW - The SPARROW model was used as a second method for estimating the nutrient yield in watersheds (it works in a different manner than WRTDS) by estimating mass balance in small catchments for factors like fertilizer, manure and point sources, and summing them to estimate values at the HUC8 scale. This process was done for both phosphorus and nitrogen.
    - Nitrogen Yield in kilograms / square kilometer / year from SPARROW (Figure 5)
    - Phosphorus Yield in kilograms / square kilometer / year from SPARROW (Figure 6)

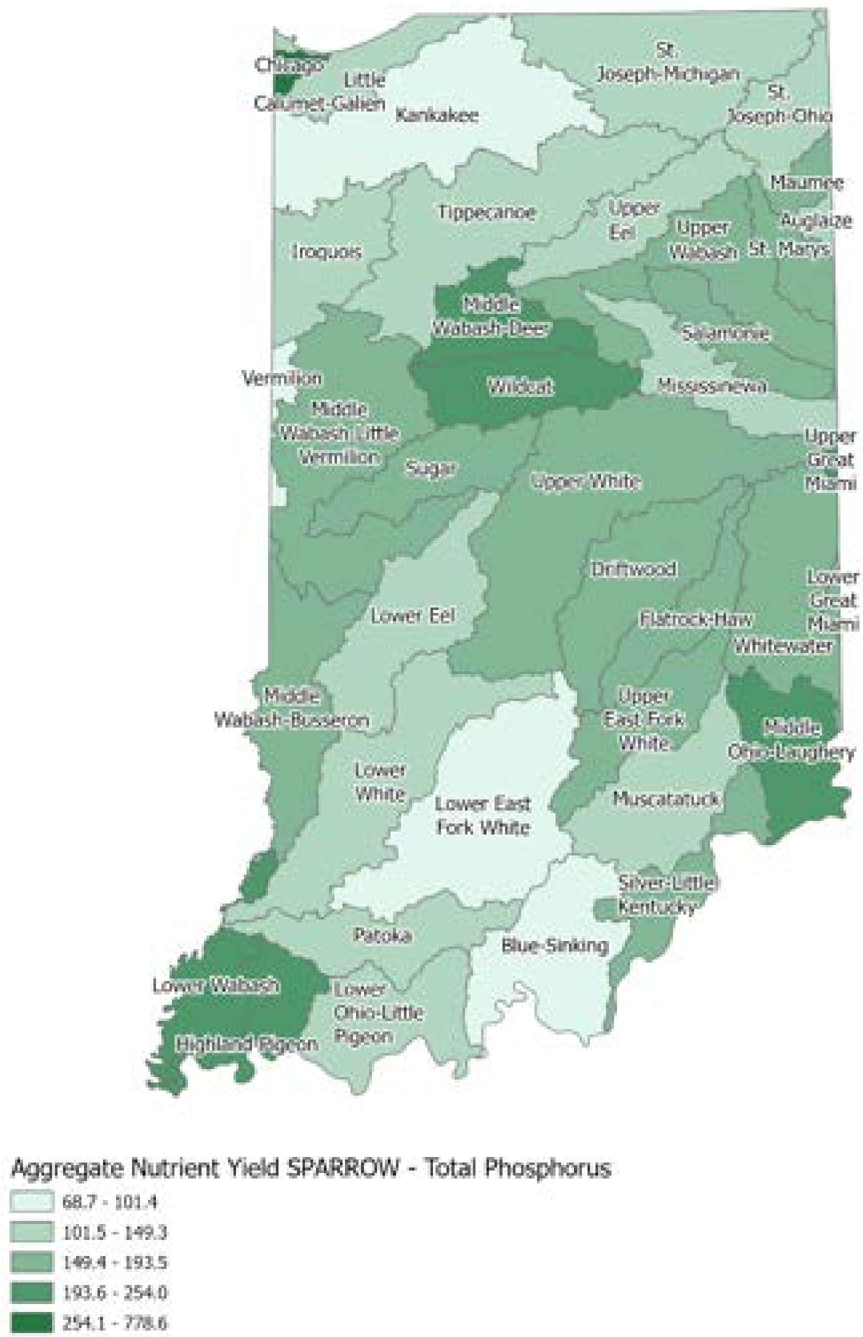
Watershed Prioritization Factor – Nitrogen Yield from SPARROW (Figure 5)

- in kilograms per square kilometer per year
- Higher values (darker colors) mean more nitrogen yield per watershed



Watershed Prioritization Factor – Phosphorus Yield from SPARROW (Figure 6)

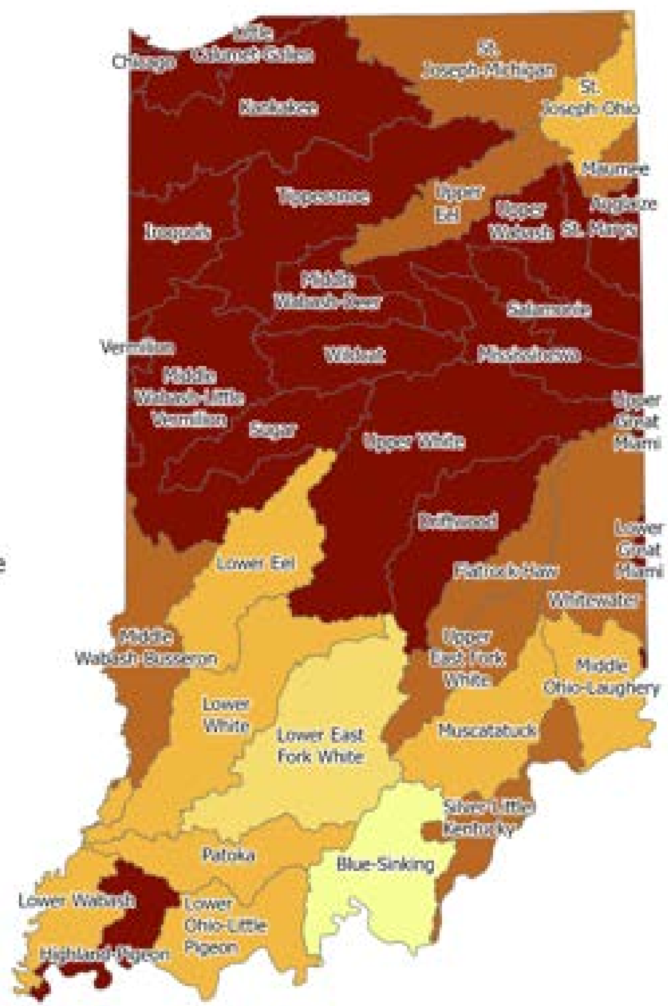
- Higher values (darker colors) mean more phosphorus yield per watershed
- in kilograms per square kilometer per year

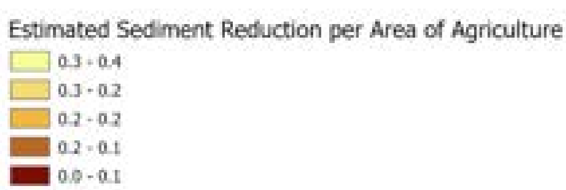


5) **Conservation Practice Implementation Data** – This factor was selected to evaluate the adoption of conservation practice supported by the Indiana public agencies, to help identify gaps in workload or areas of high priority that are not currently covered by Indiana Conservation Partnership (ICP) assistance. We looked at the 5-year average of implemented conservation practices in the watersheds based on sediment saved using the Region 5 Model. This allowed us to prioritize watersheds with low implementation rates or minimal sediment savings.

- Estimated Sediment Reduction in Tons per Acre of Agriculture – ICP uses the Region 5 sediment and nutrient reduction model to estimate the amount of sediment saved by implementing cost-shared conservation practices. This figure was aggregated by HUC8 watershed and then the mean of the 5-year time period was taken and divided by the 5-year mean of agriculture acres in the watershed based on NASS Crop Scape, which is a remote sensing data product geared towards estimating agriculture land cover. A higher number means more practices and more sediment saved, meaning a lower priority. (Figure 7)

Watershed Prioritization Factors – Estimated ICP Sediment Reduction in Tons per Acre of Agriculture (Figure 7)



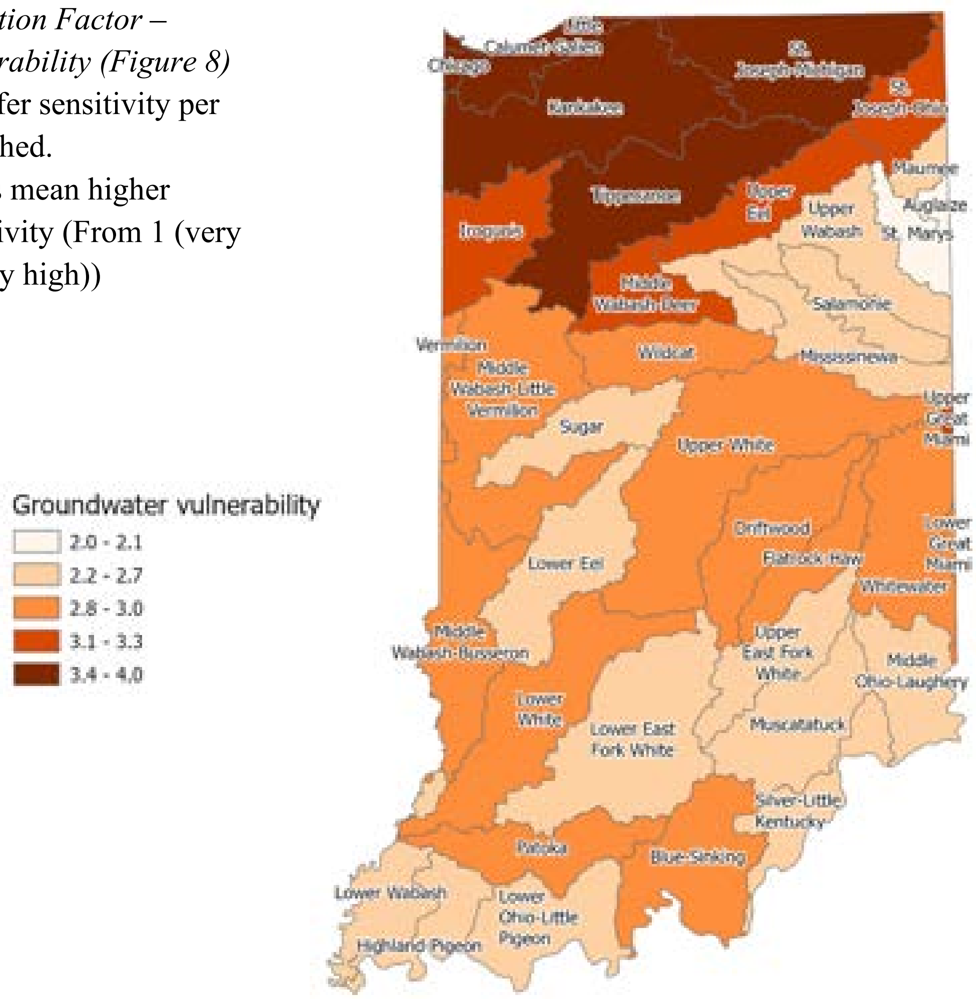


6) **Ground Water Vulnerability** – The Indiana Geological Survey (IGS) has compiled data on aquifer sensitivity for the state of Indiana based on estimated ground water recharge rates in shallow aquifers. This data was used to score which HUC8 watersheds have the lowest and highest aquifer sensitivity. (Figure 8)

- The Indiana Geologic and Water Survey (IGWS) published a classified raster dataset for the state of Indiana based on estimated rates of diffuse ground water recharge to shallow aquifers. This data was used to generate average values for each HUC8 based on zonal statistics utilizing GIS. The data was pre-classified into values of 1-5 with 5 being the highest level of aquifer sensitivity. https://www.indianamap.org/maps/INMap::aquifer-sensitivity-near-surface/about

Watershed Prioritization Factor – Ground Water Vulnerability (Figure 8)

- Average aquifer sensitivity per HUC8 watershed.
- Higher values mean higher aquifer sensitivity (From 1 (very low) to 5 (very high))



Categories and Method

The six factors were categorized into three different categories:

1) **Water Resource Protection** – These are factors that identify watersheds that have water resources, surface water and groundwater, that are valuable, and/or suspectable due to high levels of nutrients.
    a. Source Water Protection watersheds
    b. Ground Water Vulnerability
2) **Water Quality** – These factors identify the current state of water quality within HUC8 watersheds, focused on water quality as it relates to nutrients.
    a. Impaired Streams
    b. Water Quality Data results from WRTDS
    c. Loading Data from SPARROW
3) **Indiana Conservation Partnership (ICP) Conservation Adoption** – This factor was chosen to identify the amount of conservation practice adoption within the HUC8 watersheds based on sediment saved and its effect on water quality.
    a. Conservation Practice Implementation Data

Data Preparation

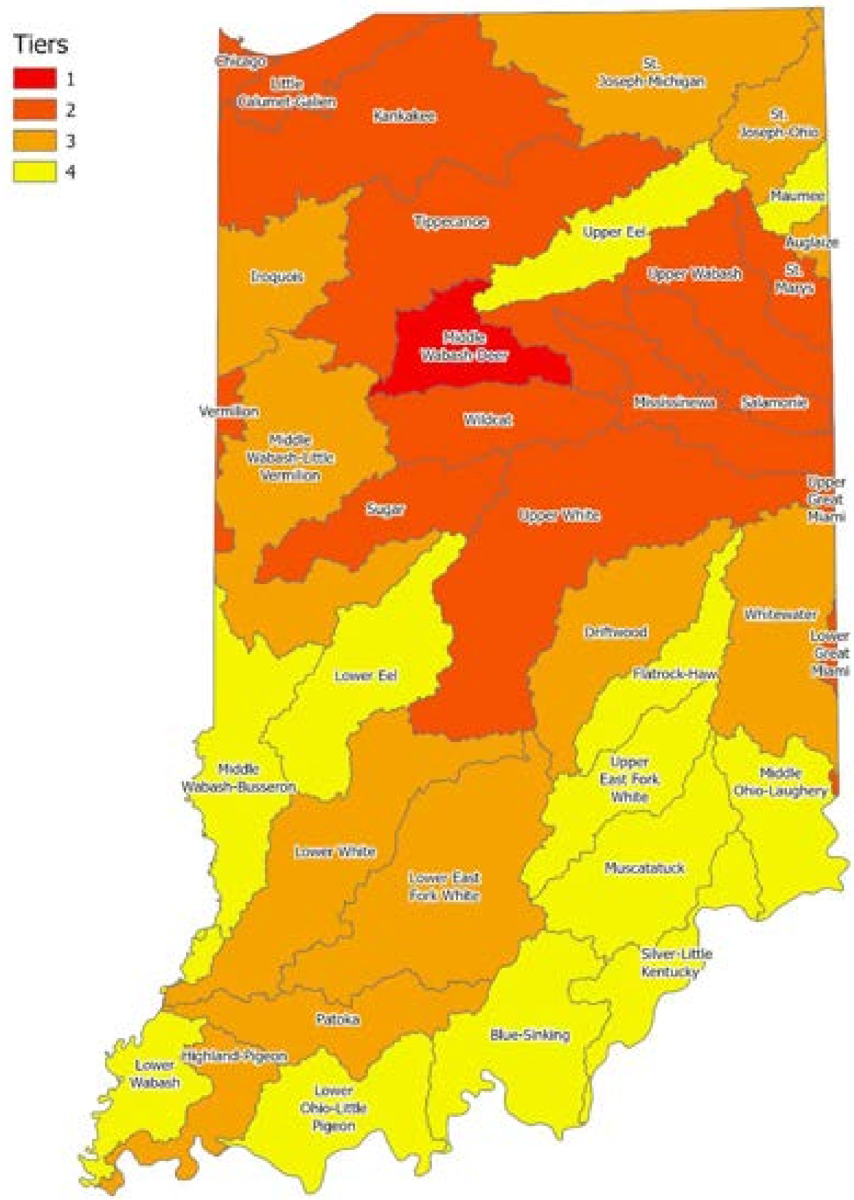
1. Values were produced for each HUC8 watershed for each factor using the sources and methods described above. These values were placed in a data table. (Table 1)
2. To unify the scales of the various factors, the values from the factors were converted into a scoring of 1-5 using the Jenks natural breaks classification method, which is a data clustering method designed to determine the arrangement of values into classes. A higher score value indicates that a watershed is a higher priority for a given factor. (Table 2 and Table 3)
3. The score values for each category of factors were averaged (mean) to make the different categories comparable. (Table 4)
4. The Water Quality category was split into two additional subcategories, one using only the nitrogen factors, and one using only the phosphorus factors. (Table 5)
5. Each category average score is split into thirds, creating low, medium, and high buckets for each category. (Table 5)
    a. The ICP investment score could not be cleanly split into thirds, so it was broken down as follows:
        i. 5 -3,
        ii. 4 -2
        iii. 3 or 2 or 1 - 1
6. Based on the respective buckets for each category, each HUC8 watershed is assigned a tier rank as described below. (Table 5)
    a. Tier 1 – High in all three categories
    b. Tier 2 – High in two of three categories

c. Tier 3 – High in one of three categories
d. Tier 4 – High in zero of three categories.

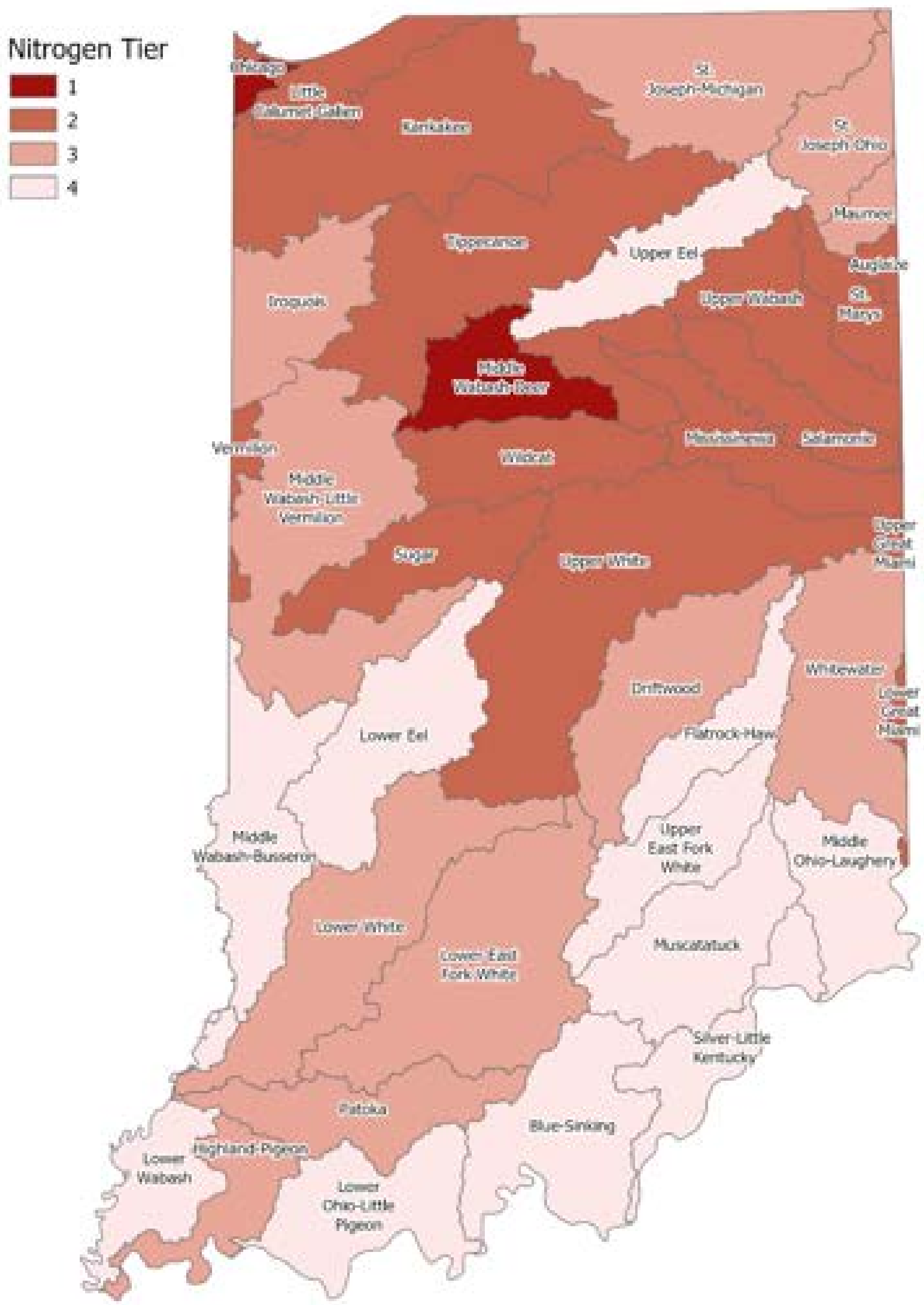
Results

The following three map figures show the results of this prioritization process. Figure 9 shows the overall results of the watershed prioritization ranking when taking all factors and categories into consideration. Figure 10 shows the watershed prioritization ranking based on nitrogen loads. Figure 11 shows the watershed prioritization ranking based on phosphorus loads. Tier 1 watersheds are the highest priority watersheds and Tier 4 are the lowest priority watersheds.

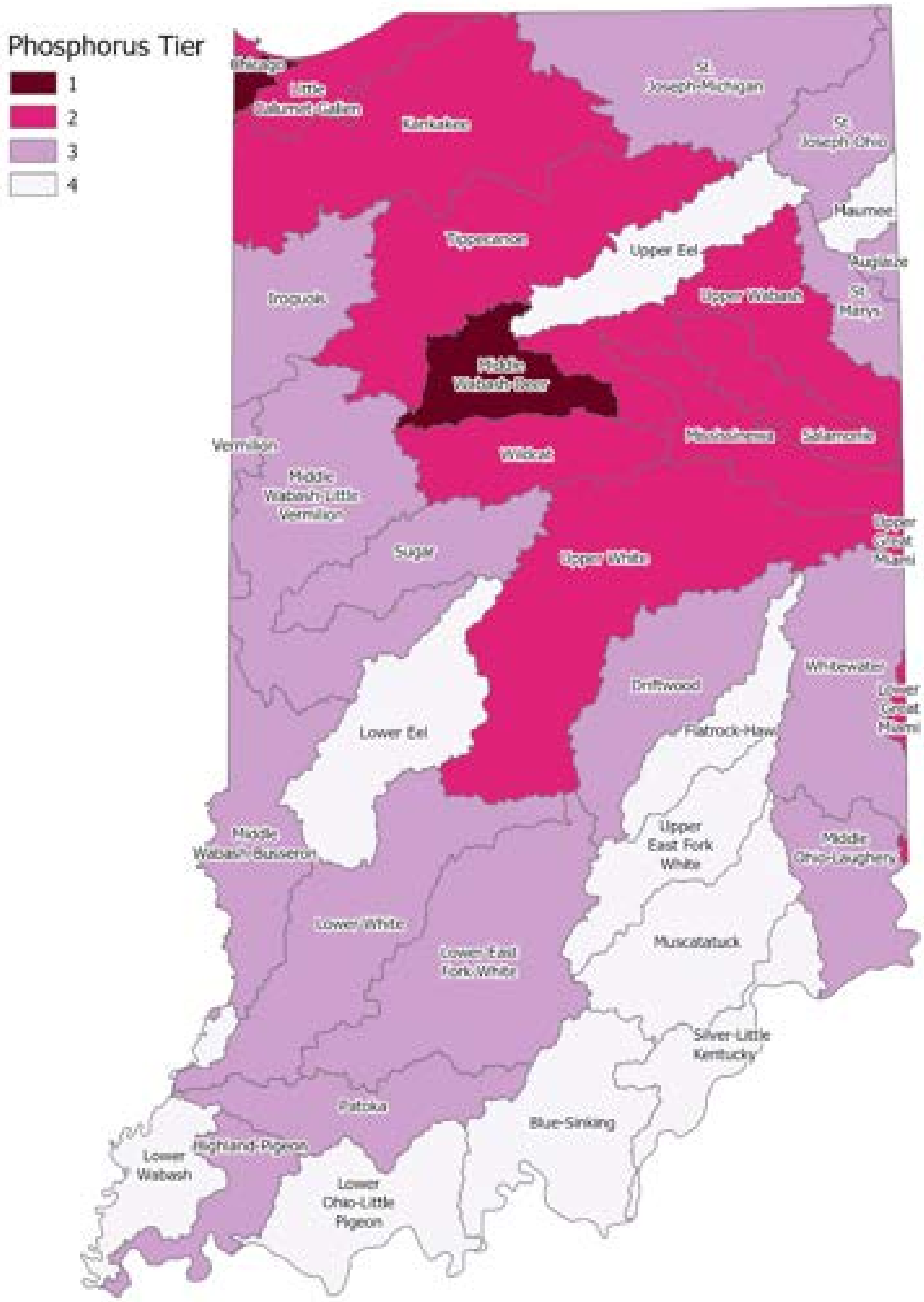
Watershed Prioritization Tiers – Watershed Priorities (Figure 9)



Watershed Prioritization Tiers – Watershed Priorities based on Total Nitrogen (Figure 10)



Watershed Prioritization Tiers – Watershed Priorities based on Total Phosphorus (Figure 11)



Watershed Prioritization Factors – Input Data Values (Table 1) **units are described below under the table*

HUC8	HUC Name	SWP Watersheds	GW Vulnerability	% Impaired Waters	WRTDS TN	WRTDS TP	SPARROW TP	SPARROW TN	Est. Sediment Red. (per ac)
*04040001	Little Calumet-Galien	2	3.64	89.9%	9.61	0.48	127.65	1244.89	0.044
*04050001	St. Joseph (Michigan)	0	4.00	50.9%	8.92	0.18	116.22	1803.30	0.079
*04100003	St. Joseph (Ohio)	1	3.22	36.3%	16.08	0.96	119.34	1866.57	0.180
*04100004	St. Marys	0	2.12	49.6%	16.76	1.00	187.57	3948.34	0.049
*04100005	Upper Maumee	0	2.40	60.3%	16.77	1.01	184.34	3594.18	0.079
*04100007	Auglaize	0	2.01	59.8%	16.76	1.00	148.15	3977.87	0.030
*05080001	Upper Great Miami	0	3.06	100.0%	18.50	1.55	214.37	4147.71	0.012
*05080002	Lower Great Miami	0	2.85	81.9%	13.53	2.15	172.52	2497.57	0.018
*05080003	Whitewater	2	2.97	20.0%	13.53	2.15	171.24	1772.16	0.057
*05090203	Middle Ohio-Laughery	1	2.54	33.9%	11.92	1.13	254.02	1203.72	0.148
*05120101	Upper Wabash	1	2.56	84.0%	22.10	1.51	167.05	3543.68	0.042
*05120102	Salamonie	0	2.45	71.6%	21.82	1.48	162.70	3904.58	0.026
*05120103	Mississinewa	0	2.59	63.9%	21.96	1.51	143.96	3568.08	0.024
*05120104	Eel	0	3.05	49.6%	21.82	1.48	141.77	2747.58	0.077
*05120105	Middle Wabash-Deer	0	3.26	33.6%	21.82	1.48	245.26	3360.34	0.040
*05120106	Tippecanoe	0	3.64	35.5%	21.82	1.48	138.09	2334.96	0.025
*05120107	Wildcat	0	2.92	29.8%	20.85	1.38	209.34	3600.14	0.034
*05120108	Middle Wabash-Little Vermillion	0	2.97	28.8%	23.47	1.67	166.65	2407.31	0.034
*05120109	Vermillion	0	2.81	2.9%	23.87	1.72	101.37	2334.95	0.011
*05120110	Sugar	0	2.68	29.8%	23.87	1.72	157.56	3253.98	0.025
*05120111	Middle Wabash-Busseron	0	2.86	36.2%	19.95	1.50	155.56	1752.54	0.058
*05120113	Lower Wabash	0	2.64	46.4%	13.06	1.10	202.85	2451.61	0.137
*05120201	Upper White	5	2.94	16.0%	11.32	0.92	189.85	2901.02	0.028
*05120202	Lower White	3	2.81	28.4%	11.39	0.93	136.32	1843.39	0.132

*05120203	Eel	1	2.59	9.4%	11.32	0.92	133.51	2229.35	0.155
*05120204	Driftwood	0	2.99	14.9%	11.37	0.78	160.97	3181.55	0.050
*05120205	Flatrock-Haw	1	2.86	2.8%	11.37	0.78	180.85	3647.80	0.079
*05120206	Upper East Fork White	2	2.64	14.3%	11.37	0.78	193.54	2736.82	0.105
*05120207	Muscatatuck	3	2.46	36.4%	11.37	0.78	145.91	1736.56	0.124
*05120208	Lower East Fork White	4	2.56	20.4%	11.45	0.84	82.20	1025.29	0.242
*05120209	Patoka	4	2.86	75.8%	11.97	1.11	138.07	1601.47	0.180
*05140101	Silver-Little Kentucky	1	2.60	48.6%	11.79	0.79	176.97	1262.02	0.101
*05140104	Blue-Sinking	0	2.82	38.0%	15.59	0.91	68.70	1005.26	0.416
*05140201	Lower Ohio-Little Pigeon	1	2.56	47.3%	11.89	1.11	119.28	1278.07	0.155
*05140202	Highland-Pigeon	0	2.51	20.6%	13.06	1.10	240.54	2072.50	0.053
*07120001	Kankakee	0	3.89	35.9%	8.97	0.30	89.84	1984.90	0.029
*07120002	Iroquois	0	3.19	41.0%	25.53	0.51	149.29	2643.25	0.013
*07120003	Chicago	0	3.68	100.0%	11.33	0.57	778.65	4530.93	0.037

* ***SWP Watersheds*** *– Number of source water protection HUC12 watersheds per HUC8 watershed*

* ***Ground Water (GW) Vulnerability*** *– Average Aquifer sensitivity per HUC8 watershed. From 1(very low) to 5 (very high)*

* ***% Impaired Waters*** *– Percent of streams within a HUC8 that are considered impaired*

* ***WRTDS Total Nitrogen*** *– Average estimated load of total nitrogen in lbs. per year per acre*

* ***WRTDS Total Phosphorus*** *– Average estimated load of total phosphorus in lbs. per year per acre*

* ***SPARROW Total Phosphorus*** *– Nutrient yield in kilograms per square kilometer per year*

* ***SPARROW Total Nitrogen*** *- Nutrient yield in kilograms per square kilometer per year*

* ***Estimated Sediment Reduction per Acre*** *– Estimated tons of sediment reduction per acre of agriculture*

Watershed Prioritization Scoring Buckets – Jenks Natural Breaks (Table 2) *(created intervals for scoring)*

Buckets	SWP Watersheds	Ground water vulnerability	% Impaired Waters	Average Nutrient Load per Acre WRTDS – Total Nitrogen	Average Nutrient Load per Acre WRTDS – Total Phosphorus	Aggregate Nutrient Yield SPARROW – Total Nitrogen	Aggregate Nutrient Yield SPARROW – Total Phosphorus	Estimated Sediment Reduction (per ac)
0	0	2.0	2.8%	8.90	0.2	1005	69	0.420
1	0	2.1	20.6%	9.60	0.6	1278	101	0.240
2	1	2.7	41.1%	13.50	0.9	2073	149	0.180
3	2	3.0	63.9%	18.50	1.1	2901	194	0.100
4	3	3.3	84.0%	22.10	1.7	3648	254	0.060

Watershed Prioritization Factors – Scoring Results (Table 3)

HUC8	SWP Watersheds	Groundwater vulnerability	% Impaired Waters	Average Nutrient Load per Acre WRTDS – Total Nitrogen	Average Nutrient Load per Acre WRTDS – Total Phosphorus	Aggregate Nutrient Yield SPARROW - Total Nitrogen	Aggregate Nutrient Yield SPARROW – Total Phosphorus	Estimated Sediment Reduction (per ac)
*04040001	2	5	5	2	1	1	2	5
*04050001	1	5	3	1	1	2	2	4
*04100003	2	4	2	3	3	2	2	3
*04100004	1	2	3	3	3	5	3	5
*04100005	1	2	3	3	3	4	3	4
*04100007	1	1	3	3	3	5	2	5
*05080001	1	4	3	4	4	5	4	5
*05080002	1	3	4	3	4	3	3	5
*05080003	2	3	1	2	5	2	3	5
*05090203	2	2	2	2	4	1	5	3
*05120101	2	2	5	5	4	4	3	5
*05120102	1	2	4	4	4	5	3	5
*05120103	1	2	4	4	4	4	2	5
*05120104	1	4	2	4	4	3	2	4
*05120105	1	5	2	4	4	4	4	5
*05120106	1	5	2	4	4	3	2	5
*05120107	1	3	2	4	4	4	4	5

*05120108	1	3	1	5	4	3	3	5
*05120109	1	3	2	5	5	3	2	5
*05120110	1	3	2	5	4	4	3	5
*05120111	1	3	3	4	4	2	3	4
*05120113	1	2	1	2	3	3	4	3
*05120201	5	3	2	2	2	4	3	5
*05120202	3	3	1	2	3	2	2	3
*05120203	2	2	1	2	2	3	2	3
*05120204	1	4	1	2	2	4	3	5
*05120205	2	3	1	2	2	5	3	4
*05120206	2	2	2	2	2	3	4	3
*05120207	3	2	1	2	2	2	2	3
*05120208	4	2	4	2	2	1	1	1
*05120209	4	3	3	2	3	2	2	2
*05140101	2	2	2	2	2	1	3	4
*05140104	1	3	3	3	2	1	1	4
*05140201	2	2	2	2	3	2	2	3
*05140202	1	2	2	2	3	3	4	5
*07120001	1	5	3	1	1	2	1	5
*07120002	1	4	3	1	1	3	3	5
*07120003	1	5	5	2	2	3	3	5

Watershed Prioritization Categories – Mean Category Scores (Table 4)

HUC8	Water Resource Protection - Mean	Water Quality - Mean	Water quality Nitrogen - Mean	Water quality Phosphorus - Mean	ICP Investment Category
*04040001	3.5	2.2	2.7	2.7	5.0
*04050001	3.0	1.8	2.0	2.0	4.0
*04100003	3.0	2.4	2.3	2.3	3.0
*04100004	1.5	3.4	3.7	3.0	5.0
*04100005	1.5	3.2	3.3	3.0	4.0
*04100007	1.0	3.2	3.7	2.7	5.0
*05080001	2.5	4.0	4.0	3.7	5.0
*05080002	2.0	3.4	3.3	3.7	5.0
*05080003	2.5	2.6	1.7	3.0	5.0
*05090203	2.0	2.8	1.7	3.7	3.0
*05120101	2.0	4.2	4.7	4.0	5.0
*05120102	1.5	4.0	4.3	3.7	5.0
*05120103	1.5	3.6	4.0	3.3	5.0
*05120104	2.5	3.0	3.0	2.7	4.0
*05120105	3.0	3.6	3.3	3.3	5.0
*05120106	3.0	3.0	3.0	2.7	5.0
*05120107	2.0	3.6	3.3	3.3	5.0
*05120108	2.0	3.2	3.0	2.7	5.0
*05120109	2.0	3.4	3.3	3.0	5.0
*05120110	2.0	3.6	3.7	3.0	5.0
*05120111	2.0	3.2	3.0	3.3	4.0
*05120113	1.5	2.6	2.0	2.7	3.0
*05120201	4.0	2.6	2.7	2.3	5.0
*05120202	3.0	2.0	1.7	2.0	3.0
*05120203	2.0	2.0	2.0	1.7	3.0
*05120204	2.5	2.4	2.3	2.0	5.0
*05120205	2.5	2.6	2.7	2.0	4.0
*05120206	2.0	2.6	2.3	2.7	3.0
*05120207	2.5	1.8	1.7	1.7	3.0
*05120208	3.0	2.0	2.3	2.3	1.0
*05120209	3.5	2.4	2.3	2.7	2.0
*05140101	2.0	2.0	1.7	2.3	4.0
*05140104	2.0	2.0	2.3	2.0	4.0
*05140201	2.0	2.2	2.0	2.3	3.0
*05140202	1.5	2.8	2.3	3.0	5.0
*07120001	3.0	1.6	2.0	1.7	5.0
*07120002	2.5	2.2	2.3	2.3	5.0
*07120003	3.0	3.0	3.3	3.3	5.0

Watershed Prioritization Categories - Buckets and Tier Results (Table 5)

HUC8	WRP Bucket	WQ Bucket	WQ N Bucket	WQ P Bucket	ICP Bucket	All Tier (Figure 9)*	N Tier (Figure 10)*	P Tier (Figure 11)*
*04040001	3	1	2	2	3	2	2	2
*04050001	3	1	1	1	2	3	3	3
*04100003	3	1	1	1	1	3	3	3
*04100004	1	3	3	2	3	2	2	3
*04100005	1	2	3	2	2	4	3	4
*04100007	1	2	3	2	3	3	2	3
*05080001	2	3	3	3	3	2	2	2
*05080002	1	3	3	3	3	2	2	2
*05080003	2	2	1	2	3	3	3	3
*05090203	1	2	1	3	1	4	4	3
*05120101	1	3	3	3	3	2	2	2
*05120102	1	3	3	3	3	2	2	2
*05120103	1	3	3	3	3	2	2	2
*05120104	2	2	2	2	2	4	4	4
*05120105	3	3	3	3	3	1	1	1
*05120106	3	2	2	2	3	2	2	2
*05120107	1	3	3	3	3	2	2	2
*05120108	1	2	2	2	3	3	3	3
*05120109	1	3	3	2	3	2	2	3
*05120110	1	3	3	2	3	2	2	3
*05120111	1	2	2	3	2	4	4	3

*05120113	1	2	1	2	1	4	4	4
*05120201	3	2	2	1	3	2	2	2
*05120202	3	1	1	1	1	3	3	3
*05120203	1	1	1	1	1	4	4	4
*05120204	2	1	1	1	3	3	3	3
*05120205	2	2	2	1	2	4	4	4
*05120206	1	2	1	2	1	4	4	4
*05120207	2	1	1	1	1	4	4	4
*05120208	3	1	1	1	1	3	3	3
*05120209	3	1	1	2	1	3	3	3
*05140101	1	1	1	1	2	4	4	4
*05140104	1	1	1	1	2	4	4	4
*05140201	1	1	1	1	1	4	4	4
*05140202	1	2	1	2	3	3	3	3
*07120001	3	1	1	1	3	2	2	2
*07120002	2	1	1	1	3	3	3	3
*07120003	3	2	3	3	3	2	1	1

* Results in column **All Tier** are shown visually in Figure 9

* Results in column **N Tier** are shown visually in Figure 10

* Results in column **P Tier** are shown visually in Figure 11

Table 6 – Overall Priority watersheds listed out by Tier according to Figure 9 and Table 5

Tier 1 watersheds	
Middle Wabash- Deer	*05120105
Tier 2 watersheds	
Little Calumet-Galien	*04040001
St. Marys	*04100004
Upper Great Miami	*05080001
Lower Great Miami	*05080002
Upper Wabash	*05120101
Salamonie	*05120102
Mississinewa	*05120103
Tippecanoe	*05120106
Wildcat	*05120107
Vermillion	*05120109
Sugar	*05120110
Upper White	*05120201
Kankakee	*07120001
Chicago	*07120003
Tier 3 watersheds	
St. Joseph (Michigan)	*04050001
St. Joseph (Ohio)	*04100003
Auglaize	*04100007
Whitewater	*05080003
Middle Wabash-Little Vermillion	*05120108
Lower White	*05120202
Driftwood	*05120204
Lower East Fork White	*05120208
Patoka	*05120209
Highland-Pigeon	*05140202
Iroquois	*07120002
Tier 4 watersheds	
Maumee	*04100005
Middle Ohio-Laughery	*05090203
Upper Eel	*05120104
Middle Wabash-Busseron	*05120111
Lower Wabash	*05120113
Lower Eel	*05120203
Flatrock-Haw	*05120205
Upper East Fork White	*05120206
Muscatatuck	*05120207
Silver-Little Kentucky	*05140101
Blue-Sinking	*05140104
Lower Ohio-Little Pigeon	*05140201

Table 7 – Priority watersheds based on TN listed out by Tier according to Figure 10 & Table 5

Tier 1 watersheds	
Middle Wabash- Deer	*05120105
Chicago	*07120003
Tier 2 watersheds	
Little Calumet-Galien	*04040001
St. Marys	*04100004
Auglaize	*04100007
Upper Great Miami	*05080001
Lower Great Miami	*05080002
Upper Wabash	*05120101
Salamonie	*05120102
Mississinewa	*05120103
Tippecanoe	*05120106
Wildcat	*05120107
Vermillion	*05120109
Sugar	*05120110
Upper White	*05120201
Kankakee	*07120001
Tier 3 watersheds	
St. Joseph (Michigan)	*04050001
St. Joseph (Ohio)	*04100003
Maumee	*04100005
Whitewater	*05080003
Middle Wabash-Little Vermillion	*05120108
Lower White	*05120202
Driftwood	*05120204
Lower East Fork White	*05120208
Patoka	*05120209
Highland-Pigeon	*05140202
Iroquois	*07120002
Tier 4 watersheds	
Middle Ohio-Laughery	*05090203
Upper Eel	*05120104
Middle Wabash-Busseron	*05120111
Lower Wabash	*05120113
Lower Eel	*05120203
Flatrock-Haw	*05120205
Upper East Fork White	*05120206
Muscatatuck	*05120207
Silver-Little Kentucky	*05140101
Blue-Sinking	*05140104
Lower Ohio-Little Pigeon	*05140201

Table 8 – Priority watersheds based on P listed out by Tier according to Figure 11 and Table 5

Tier 1 watersheds	
Middle Wabash- Deer	*05120105
Chicago	*07120003
Tier 2 watersheds	
Little Calumet-Galien	*04040001
Upper Great Miami	*05080001
Lower Great Miami	*05080002
Upper Wabash	*05120101
Salamonie	*05120102
Mississinewa	*05120103
Tippecanoe	*05120106
Wildcat	*05120107
Upper White	*05120201
Kankakee	*07120001
Tier 3 watersheds	
St. Joseph (Michigan)	*04050001
St. Joseph (Ohio)	*04100003
St. Marys	*04100004
Auglaize	*04100007
Whitewater	*05080003
Middle Ohio-Laughery	*05090203
Middle Wabash-Little Vermillion	*05120108
Vermillion	*05120109
Sugar	*05120110
Middle Wabash-Busseron	*05120111
Lower White	*05120202
Driftwood	*05120204
Lower East Fork White	*05120208
Patoka	*05120209
Highland-Pigeon	*05140202
Iroquois	*07120002
Tier 4 watersheds	
Maumee	*04100005
Upper Eel	*05120104
Lower Wabash	*05120113
Lower Eel	*05120203
Flatrock-Haw	*05120205
Upper East Fork White	*05120206
Muscatatuck	*05120207
Silver-Little Kentucky	*05140101
Blue-Sinking	*05140104
Lower Ohio-Little Pigeon	*05140201

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A. Individual Site-Specific Trend Results

Trends of Sediment and Nutrient Loads in Indiana Watersheds can be found on the Indiana Science Assessment website, https://www.in.gov/isda/divisions/soil-conservation/indiana-state-nutrient-reduction-strategy/indiana-science-assessment/.

Flow normalized loads and concentrations for each constituent were calculated annually by the WRTDS model for each individual site in the state that was selected for analysis. The trends report includes data through 2020, however using new data in recent years, each site has been re-calculated to add additional data through 2023. The maps and graphs on the following pages show these results for each individual site. More information, can also be found in the Trends Report. In addition, as more years of data are collected, future updates of the trends for these sites will be made available on the Indiana Science Assessment webpage on ISDA website.

B. Mississippi River Basin

Export Sites

Wabash River at New Harmony, IN (Ex1)
USGS Gage ID 03378500
USGS Gage ID 03377500

The USGS streamgage site #03378500 is located in New Harmony, IN in Posey County in southwest Indiana. The New Harmony USGS location on the Wabash River is the last station on the Wabash River before it flows into the Ohio River, collecting data from the Wabash River watershed as well as the White River Watershed. The USGS streamgage site #03377500 is located on the Wabash River in Mount Carmel, IL in Wabash County in Illinois. It is located upstream of the New Harmony gage location.

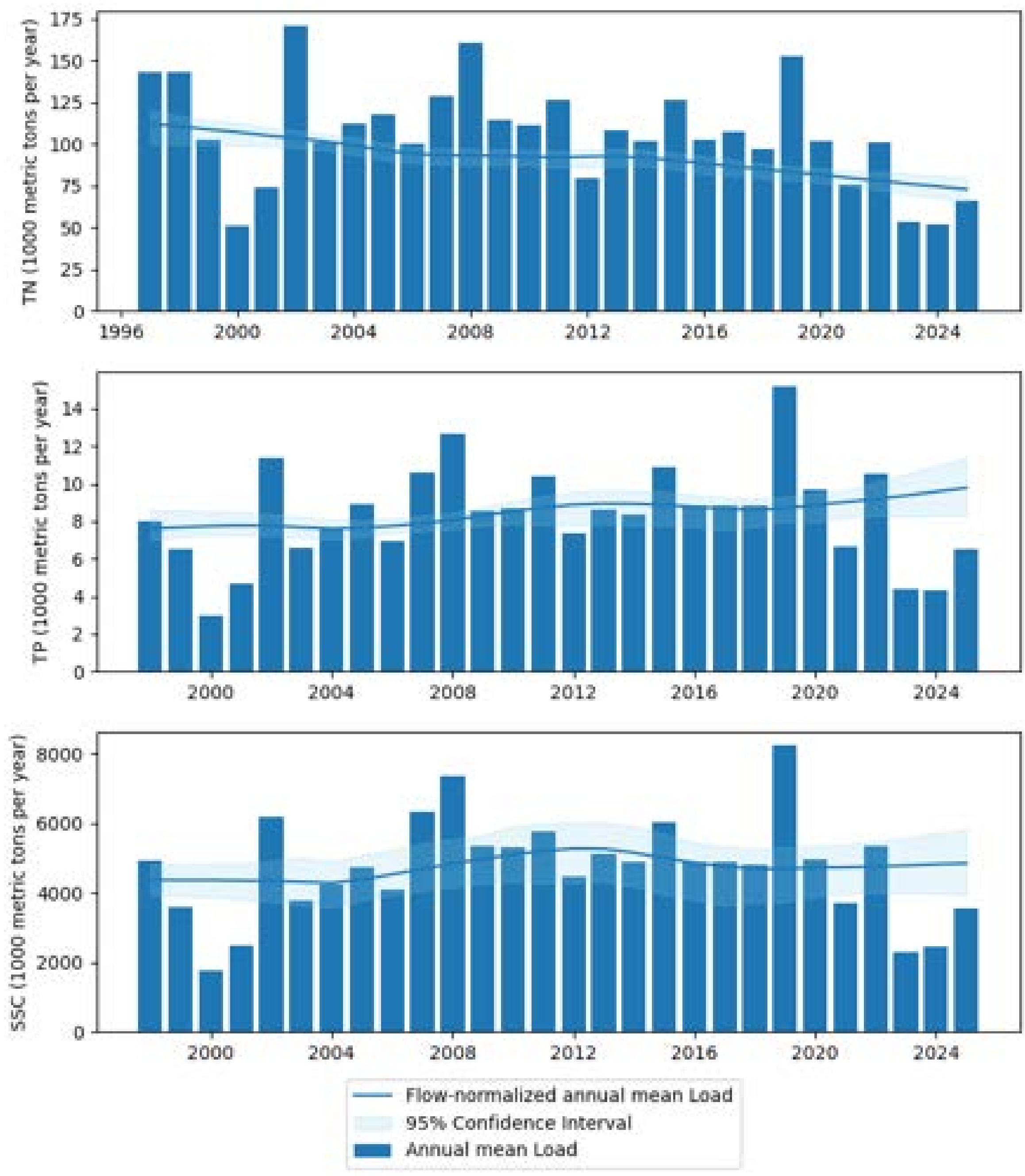


Figure 1A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **WabashRiver at New Harmony, IN (Ex1)**.

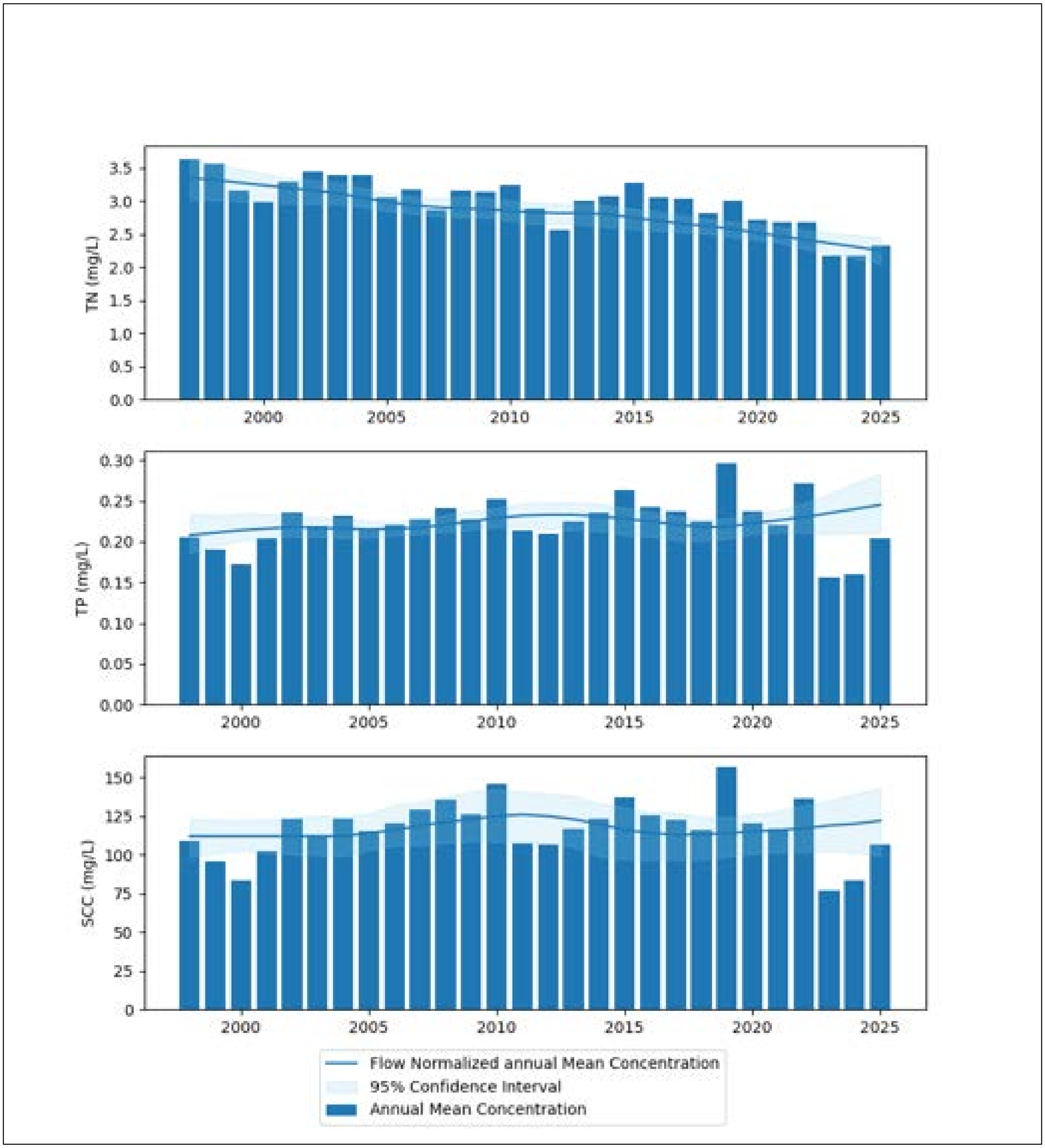
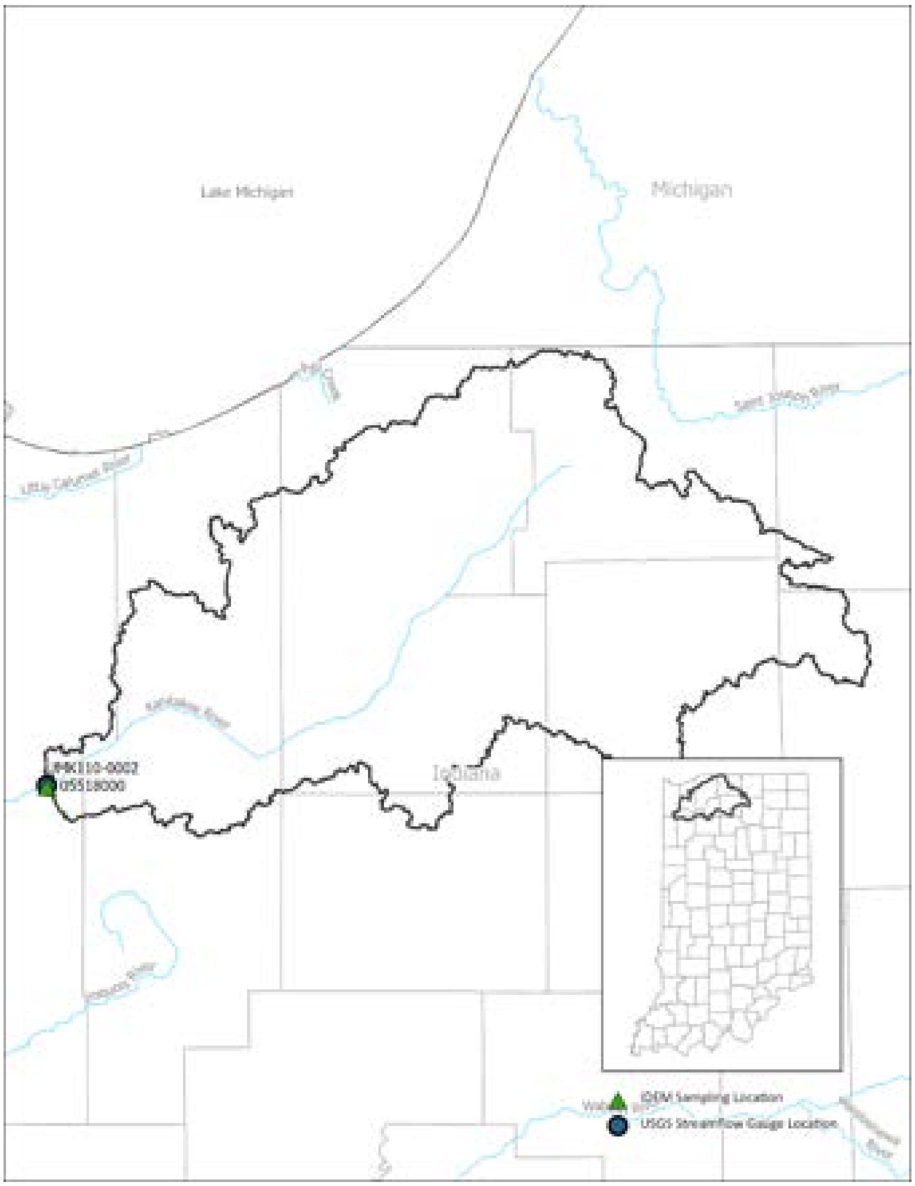


Figure 1B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Wabash River at New Harmony, IN (Ex1)**.

Kankakee River at Shelby, IN (Ex2)
USGS Gage ID 05518000 (Supergage)
IDEM station ID UMK110-0002

The USGS supergage site and the IDEM station are co-located at this location, and are located in northern Newton County in northwest Indiana near Shelby, IN. This location captures the Kankakee River exports into Illinois from Indiana. The Kankakee River is located in northwest Indiana and the watershed covers all or part of 11 Indiana counties. The Kankakee River stretches across northwest Indiana for 90 miles starting near South Bend in St. Joseph County flowing to the Illinois State line. The Yellow River and Iroquois Rivers are the important tributaries to the Kankakee River and join up with the river in the state of Illinois.



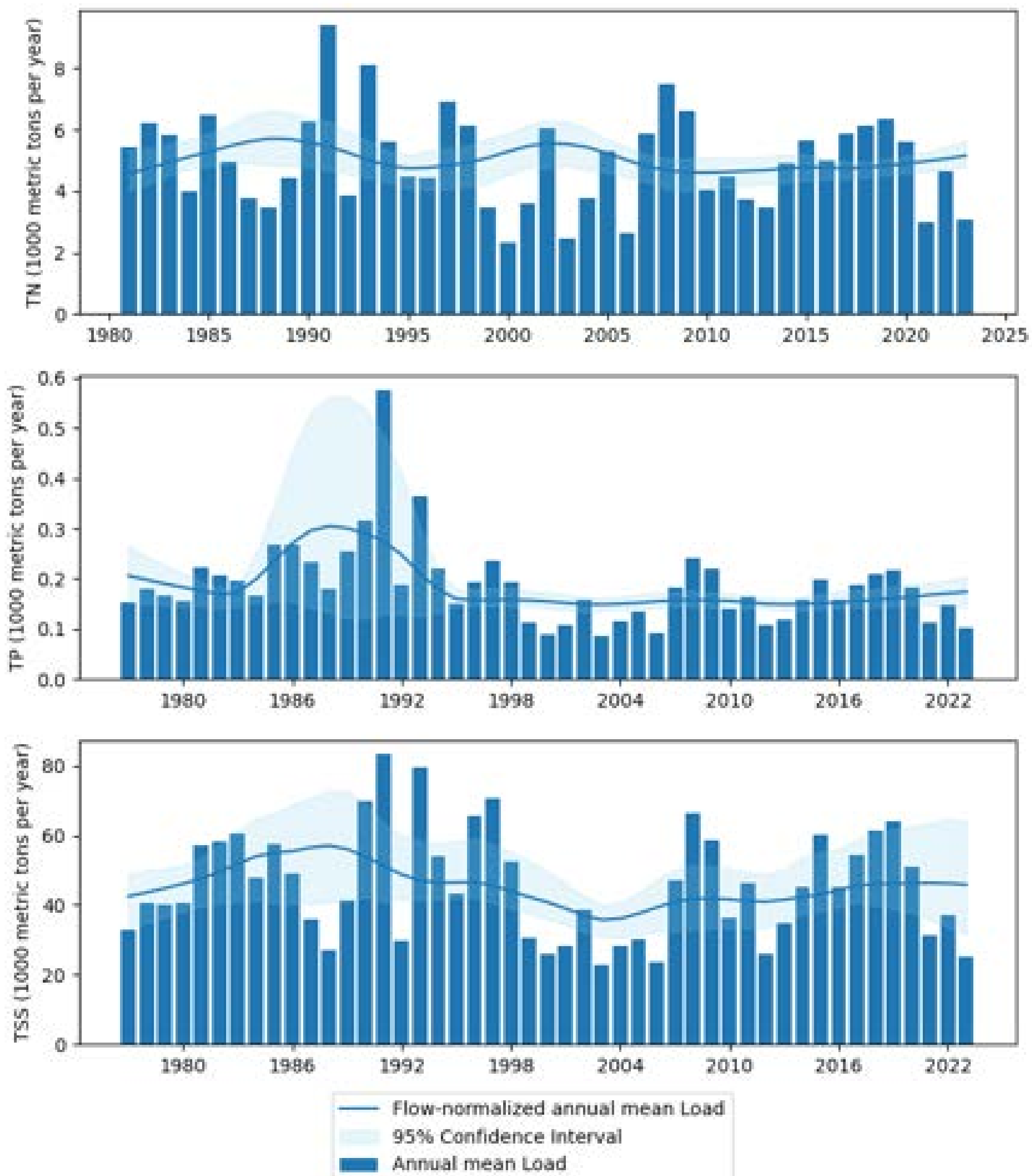


Figure 2A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Kankakee River at Shelby, IN (Ex2)**.

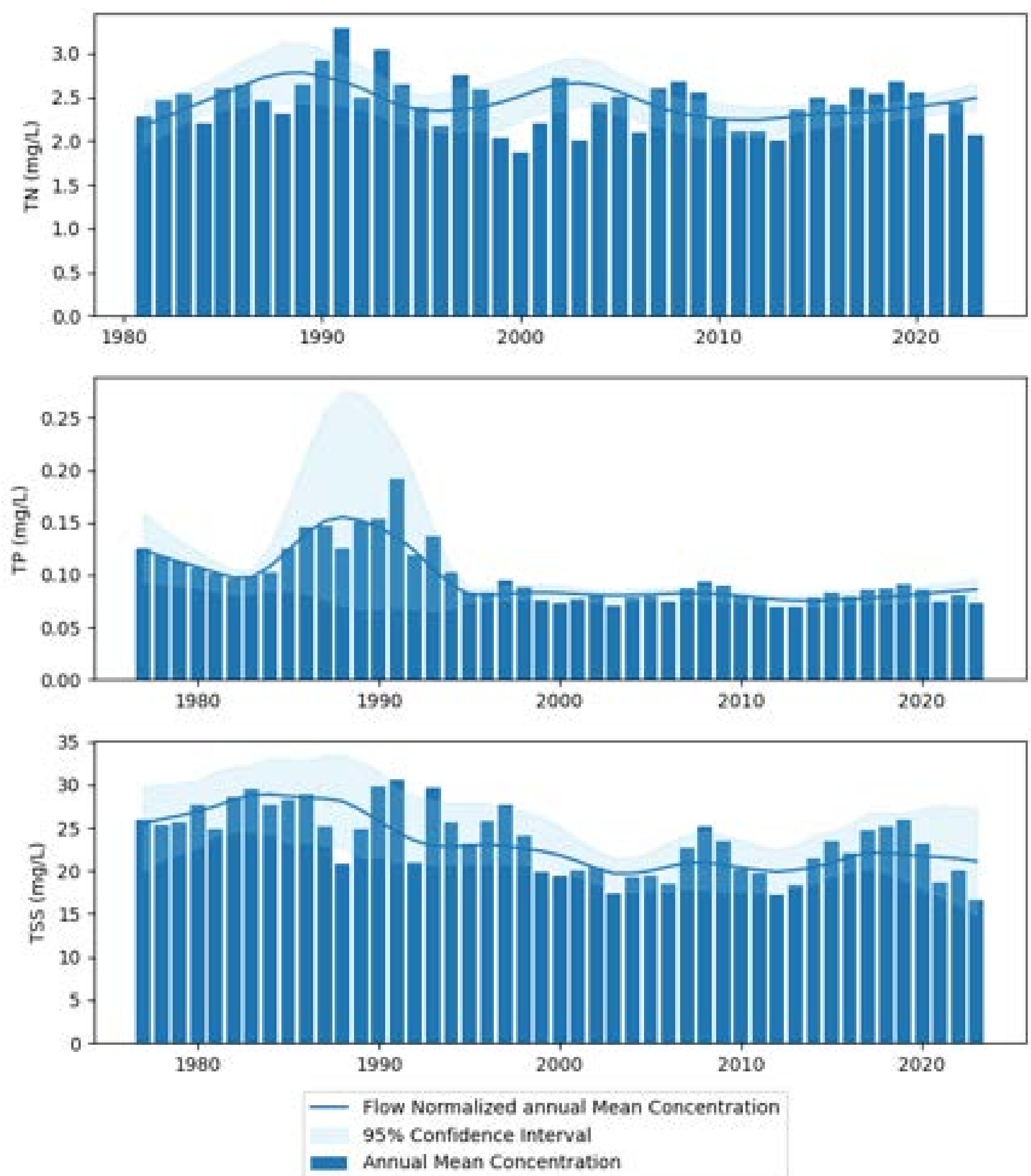


Figure 2B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Kankakee River at Shelby, IN (Ex2)**.

Whitewater River at Brookville, IN (Ex3)
USGS Gage ID 03276500
IDEM station ID GMW080-0001

The USGS streamgage site and the IDEM station are co-located at this location. The sites are located in Franklin County in southeast Indiana near Brookville, IN and downstream of the Brookville Reservoir. This location captures the Whitewater River exports into the state of Ohio and to the Ohio River from Indiana. The Whitewater River rises in southern Randolph and northern Wayne Counties and flows in two main branches which are just 10 miles apart as they flow southward before joining together in Brookville, IN. From the point at which the Whitewater River and the East Fork Whitewater come together, the river flows southeasterly toward the Great Miami River near the Indiana-Ohio state line, which then flows into the Ohio River.

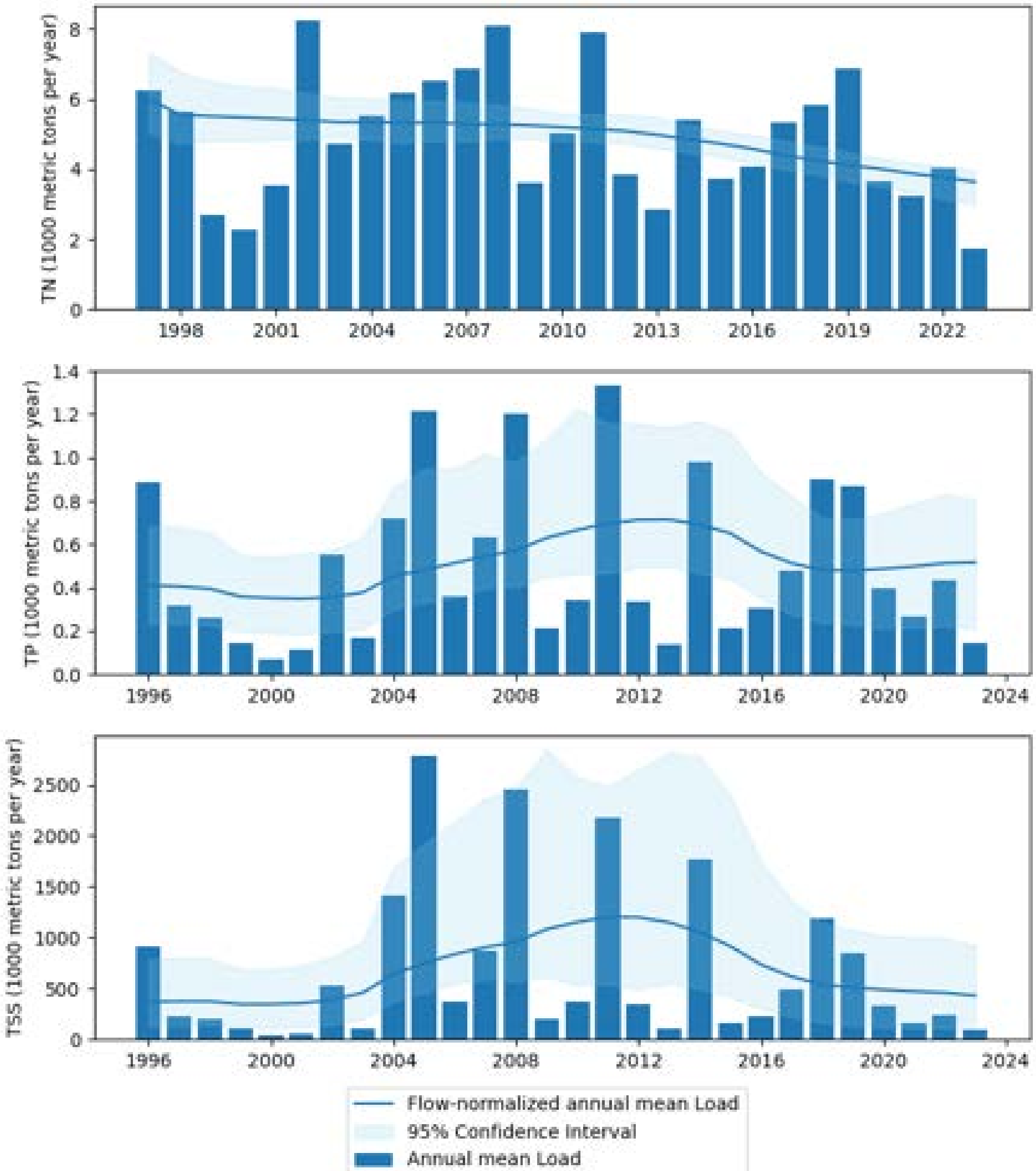


Figure 3A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Whitewater River at Brookville, IN (Ex3)**.

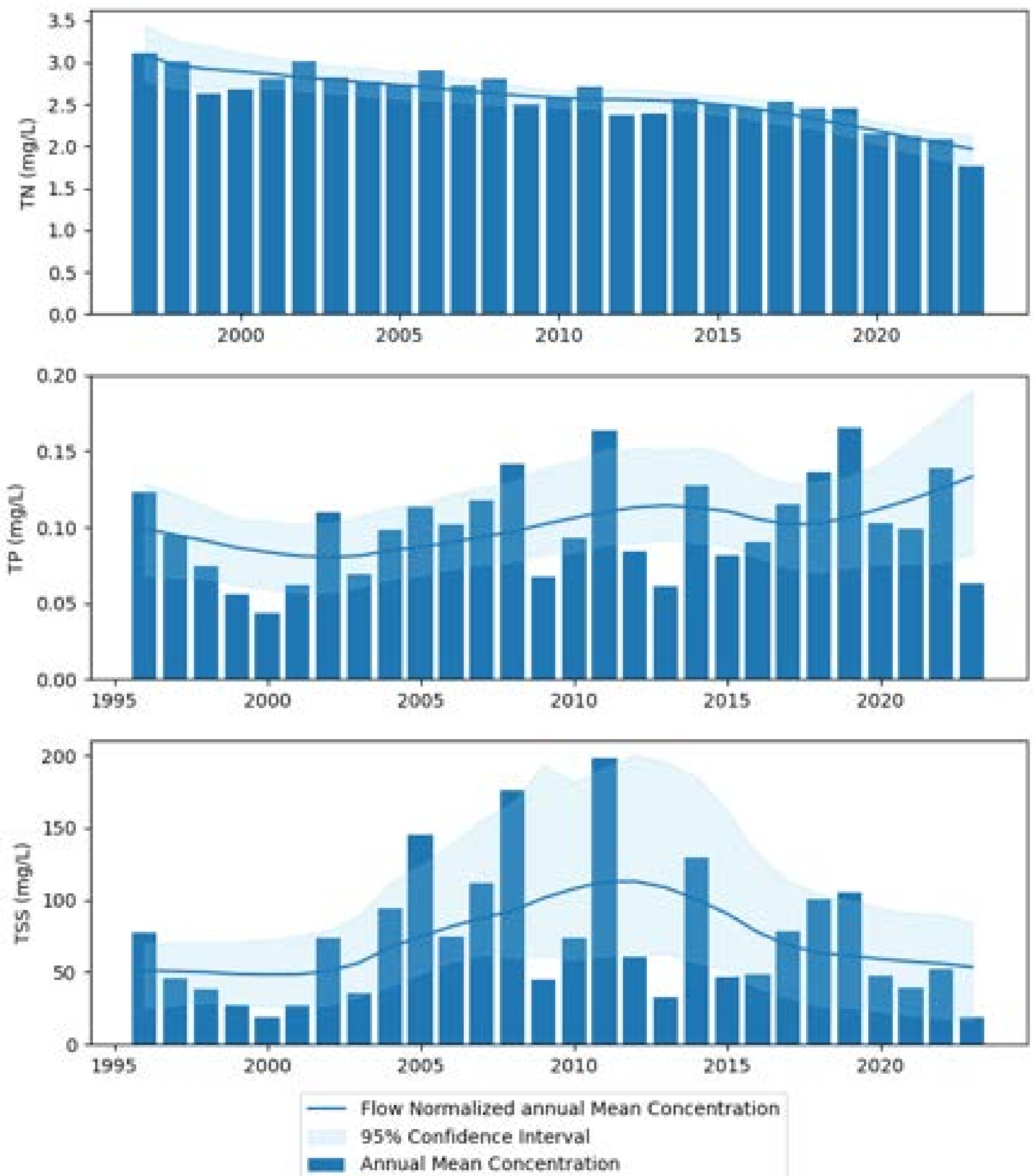
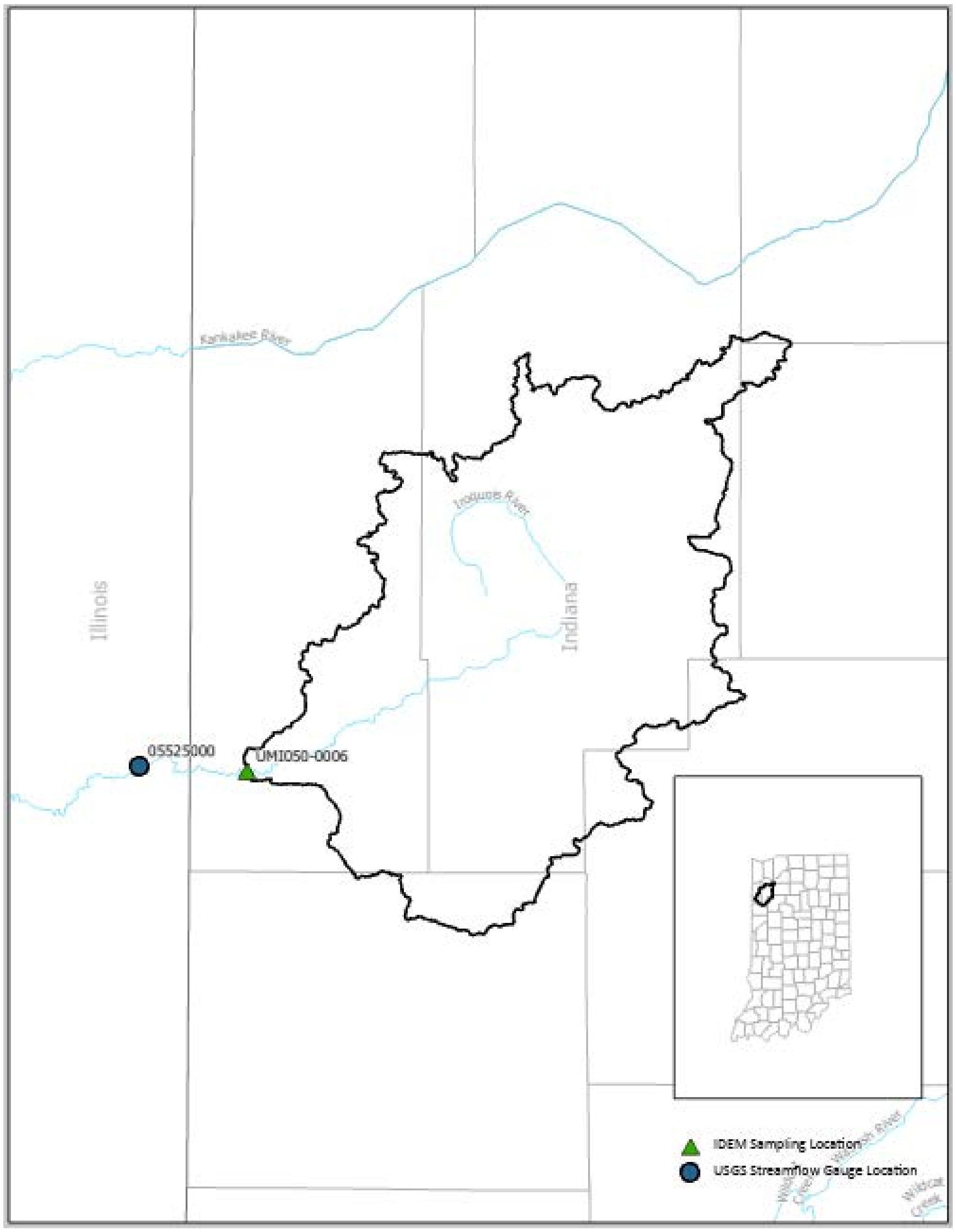


Figure 3B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Whitewater River at Brookville, IN (Ex3)**.

Iroquois River at Iroquois, IL (Ex4)
USGS Gage ID 05525000
IDEM station ID UMI050-0006

The USGS streamgage is located in Iroquois, IL downstream of the IDEM site which is located in southern Newton County in northwest Indiana. This location captures the Iroquois River exports into Illinois from Indiana. The Iroquois River is a major tributary in the Kankakee River Basin, and it joins up with the Kankakee River in the state of Illinois. The watershed covers parts of 6 Indiana counties.



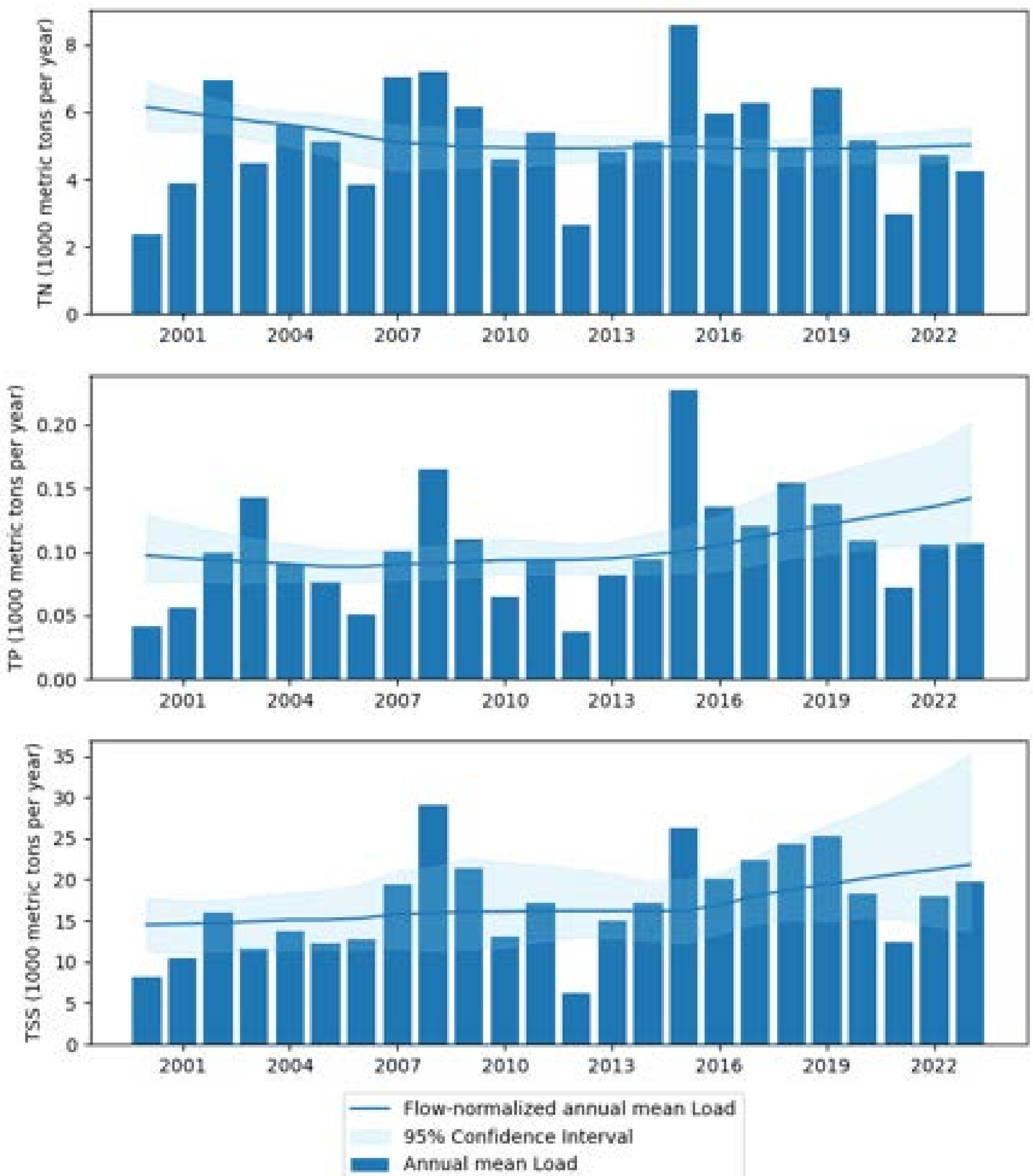


Figure 4A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Iroquois River at Iroquois, IL (Ex4)**.

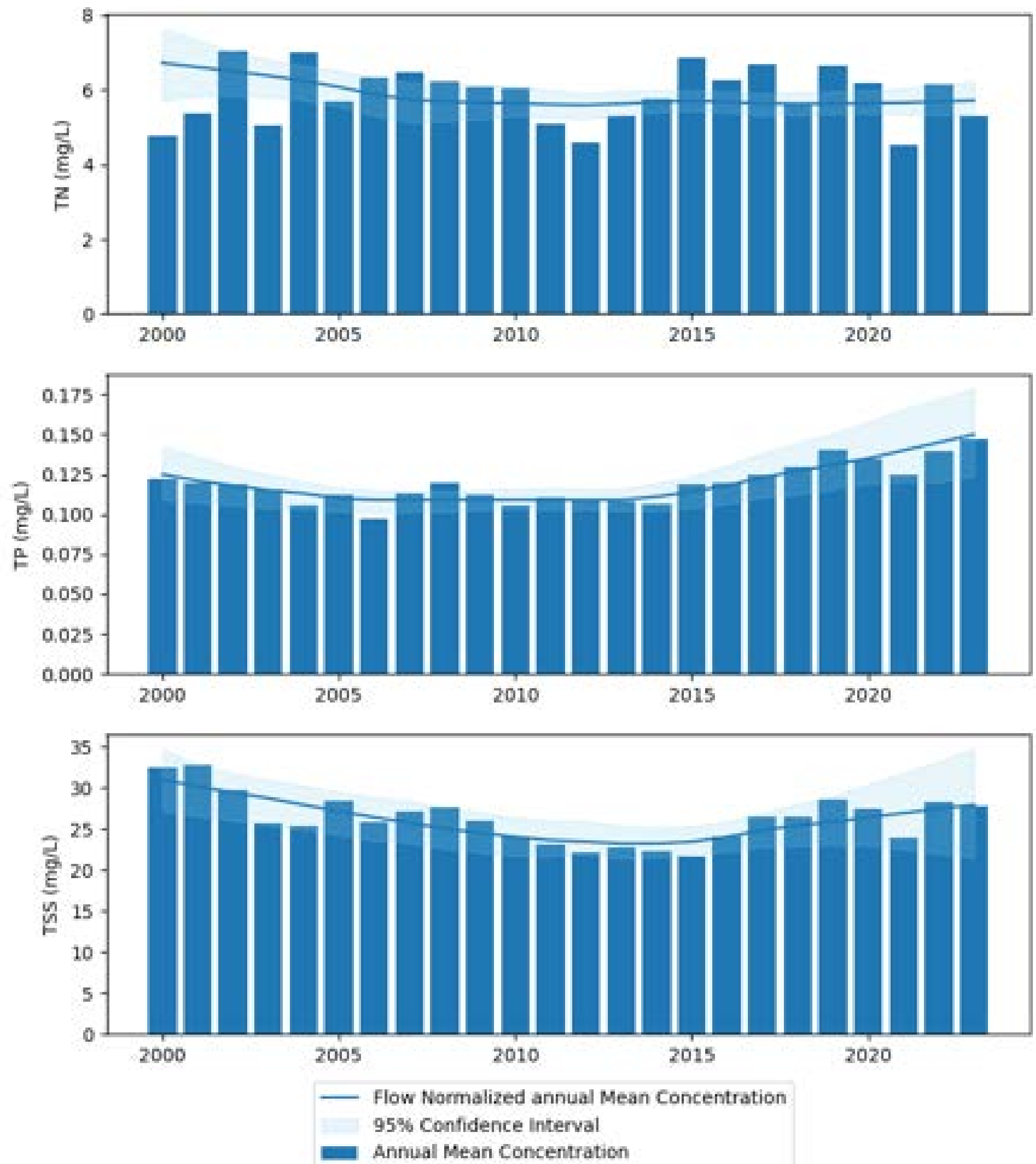
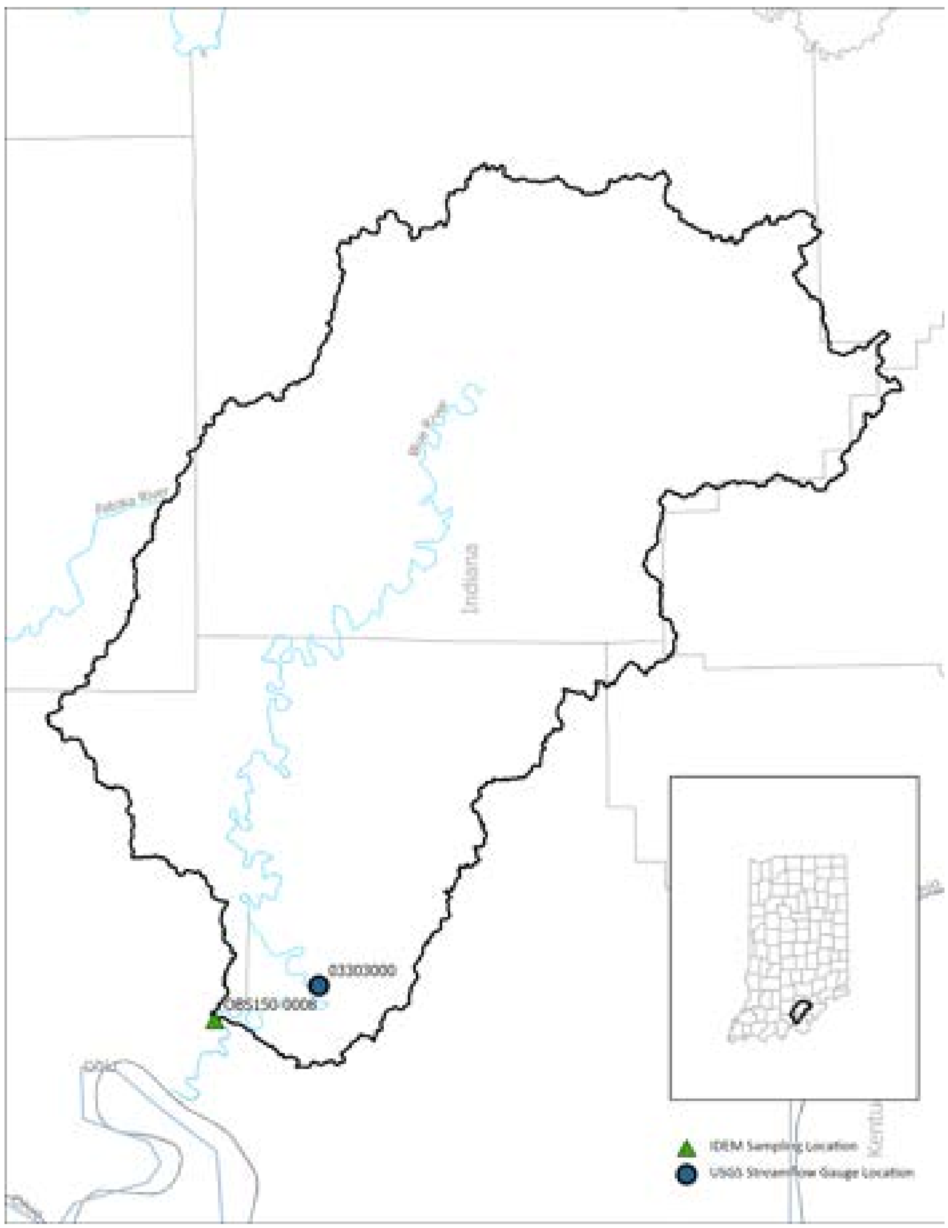


Figure 4B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Iroquois River at Iroquois, IL (Ex4)**.

Blue River near White Cloud, IN (Ex5)
USGS Gage ID 03303000
IDEM station ID OBS150-0008

The USGS streamgage is located in Harrison County upstream of the IDEM site that is located in Crawford County in southern Indiana. This location captures the Blue River exports to the Ohio River from Indiana. The Blue River originates in Washington County in southern Indiana, and for a portion of its journey to the Ohio River, it forms the boundary between Harrison and Crawford Counties. This area is known for karst (limestone) topography with many sink holes and caves that formed as water dissolved the rock.



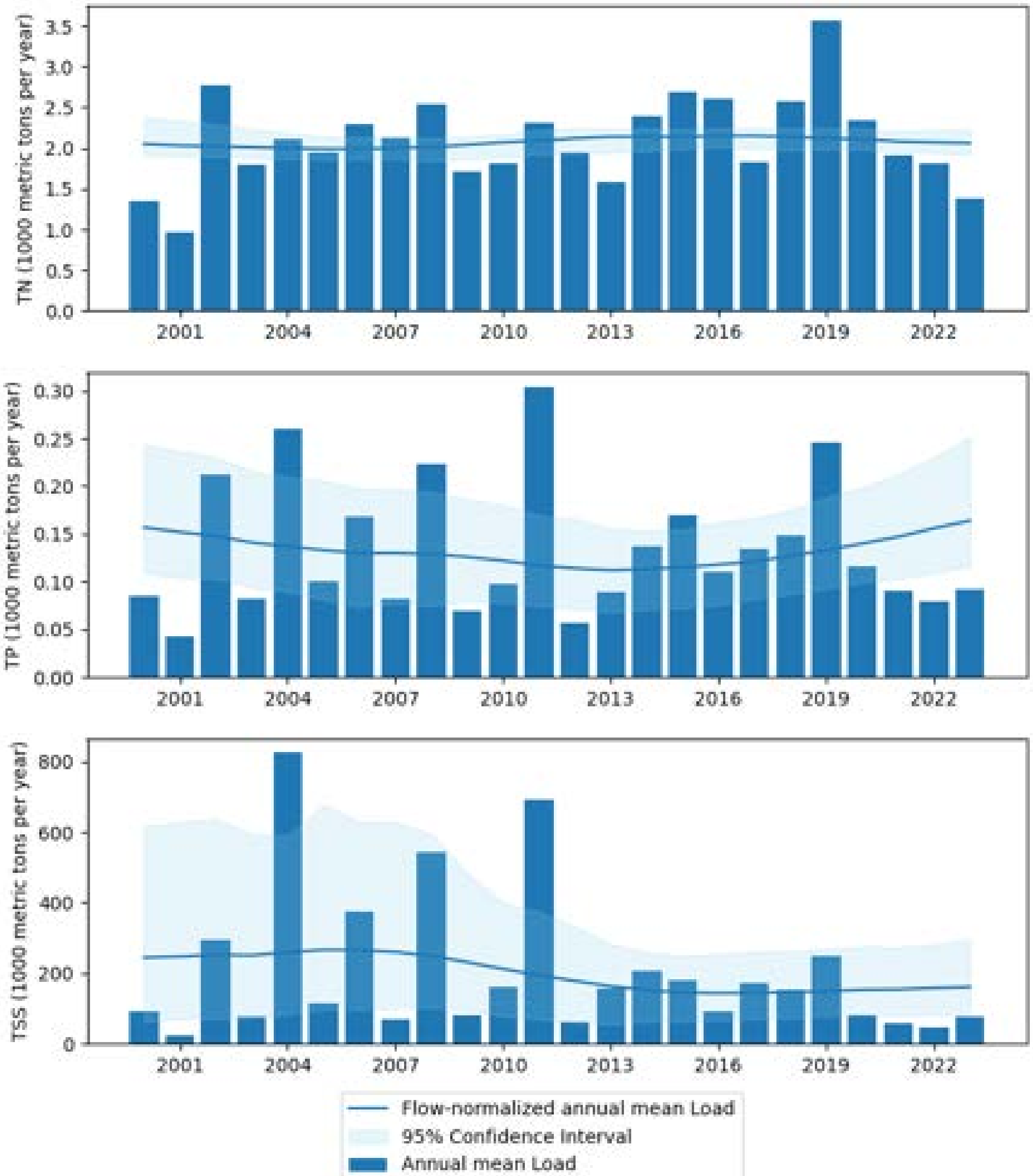


Figure 5A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Blue River near White Cloud, IN (Ex5)**.

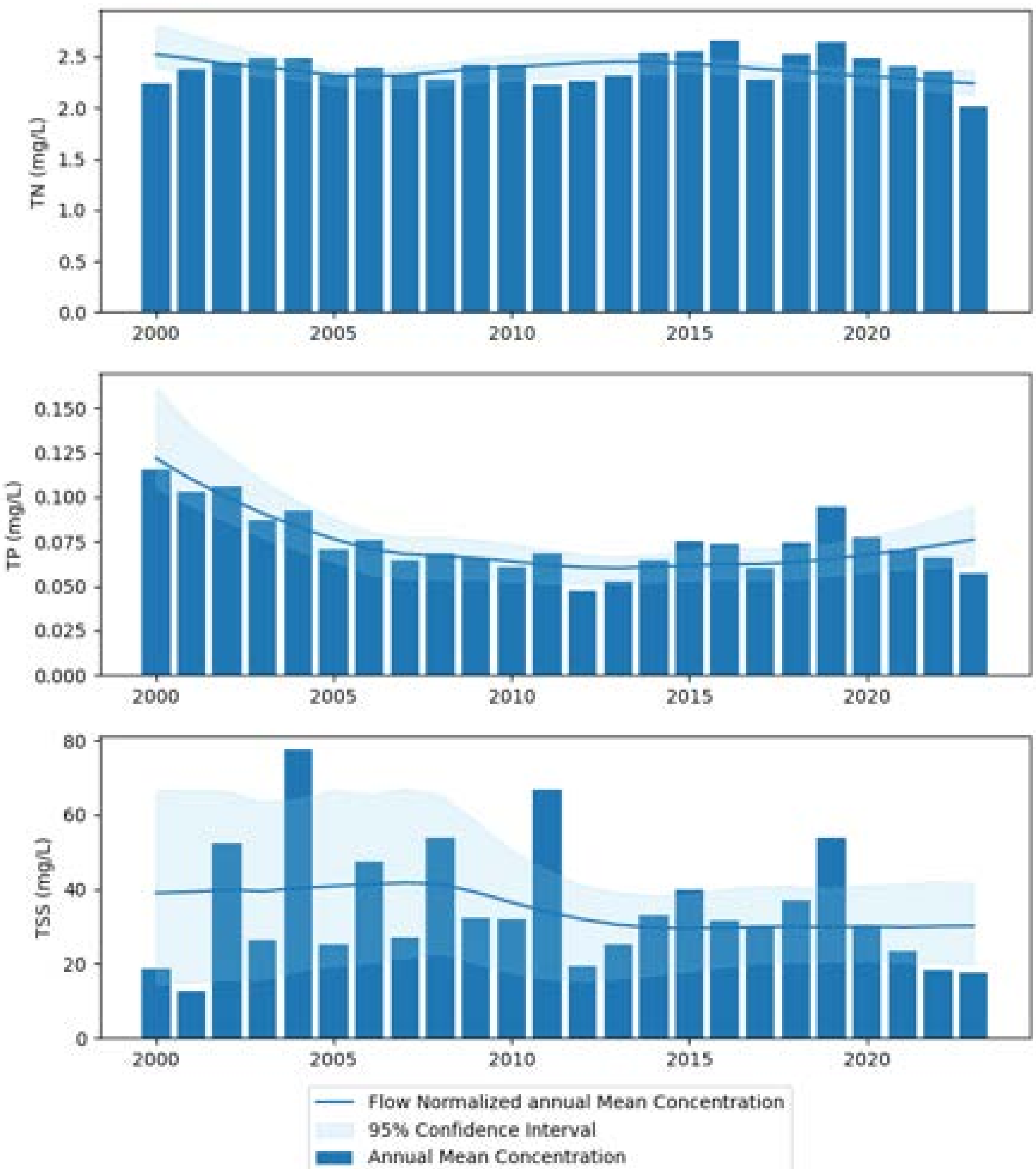


Figure 5B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Blue River near White Cloud, IN (Ex5)**.

Import Sites

Wabash River at Linn Grove, IN (Im1)
USGS Gage ID 03322900
IDEM Station ID WUW060-0007

The USGS streamgage site and the IDEM station site are both located in southern Adams County, IN. The USGS site is located downstream of the IDEM site. The watershed covers parts of three counties in Indiana and some land in Ohio. This particular site captures imports into the state as the Wabash River begins in Ohio and flows into Indiana. It is the headwaters of the Wabash River. The river rises in Ohio near Fort Recovery and flows for only thirty miles before it becomes entirely an Indiana river, crossing the border near the town of New Corydon in Jay County.

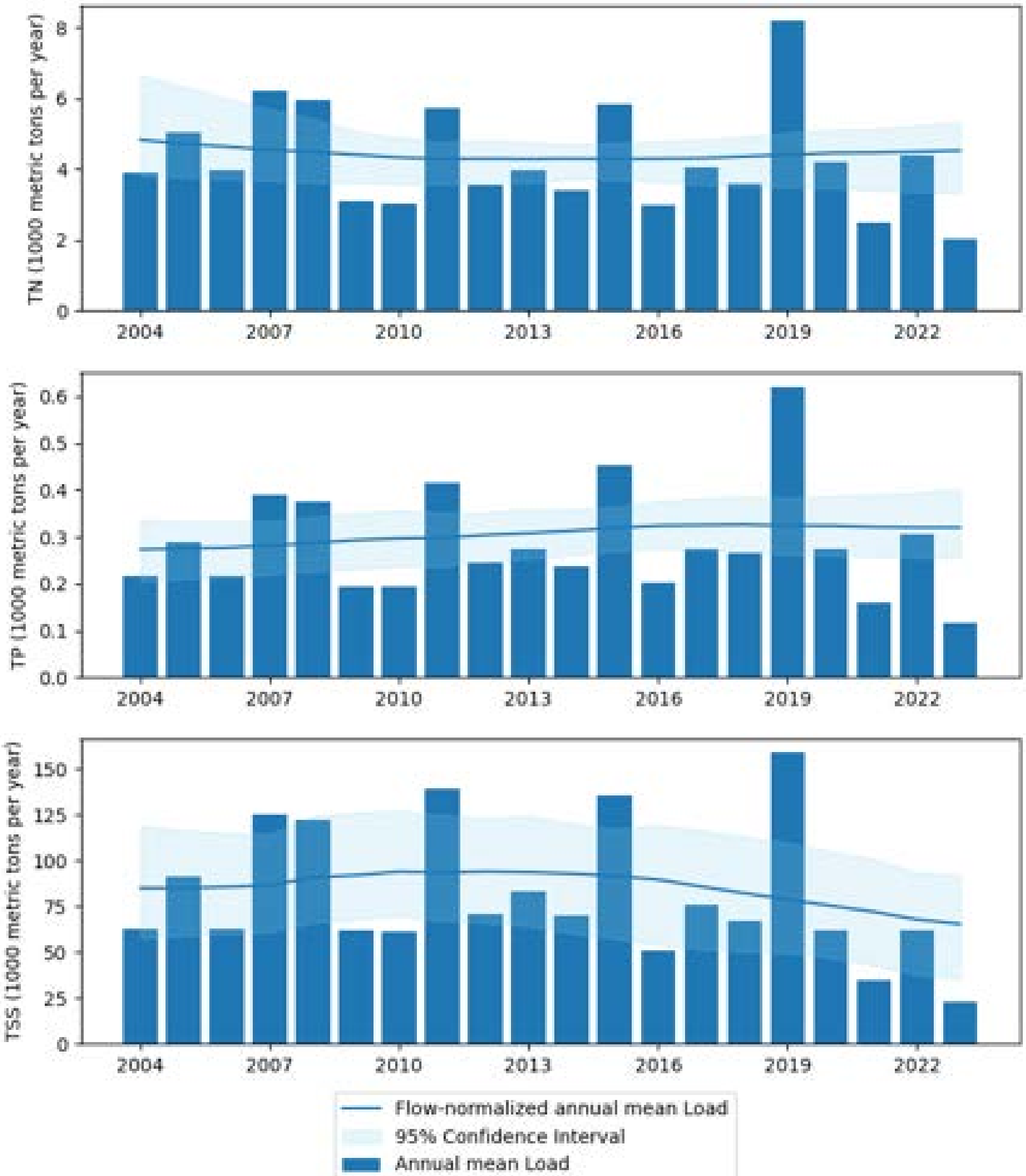


Figure 6A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Wabash River at Linn Grove, IN (Im1)**.

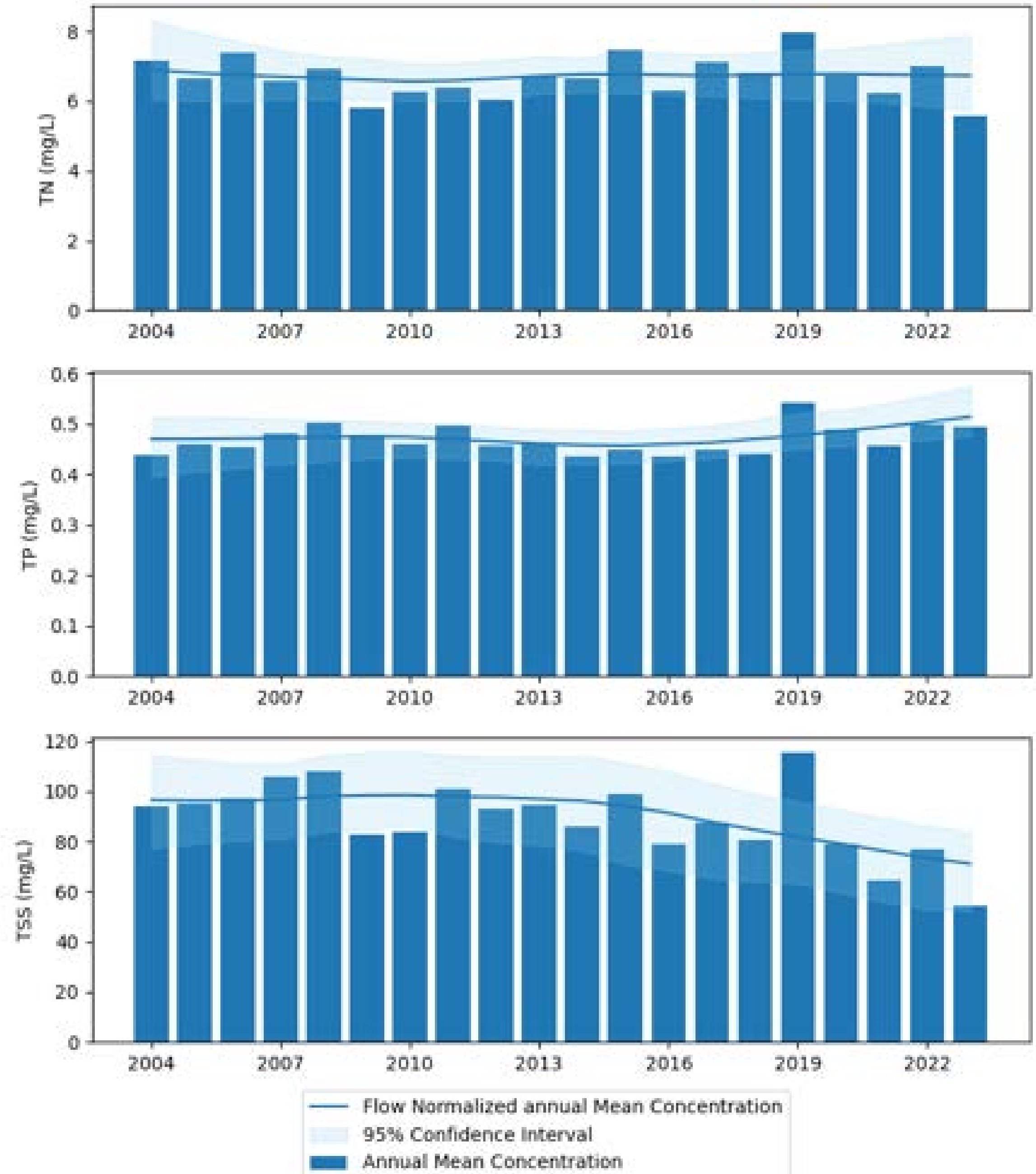


Figure 6B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Wabash River at Linn Grove, IN (Im1)**.

Mississinewa River near Ridgeville, IN (Im2)
USGS Gage ID 03325500
IDEM station ID WMI020-0002

Both the USGS streamgage and the IDEM site are located in northern Randolph County, IN. The watershed covers parts of two counties in Indiana and some land in Ohio. This particular site captures imports into the state as the Mississinewa River begins in Ohio and flows into Indiana. This is the headwaters of the Mississinewa River which is a tributary to the Wabash River.

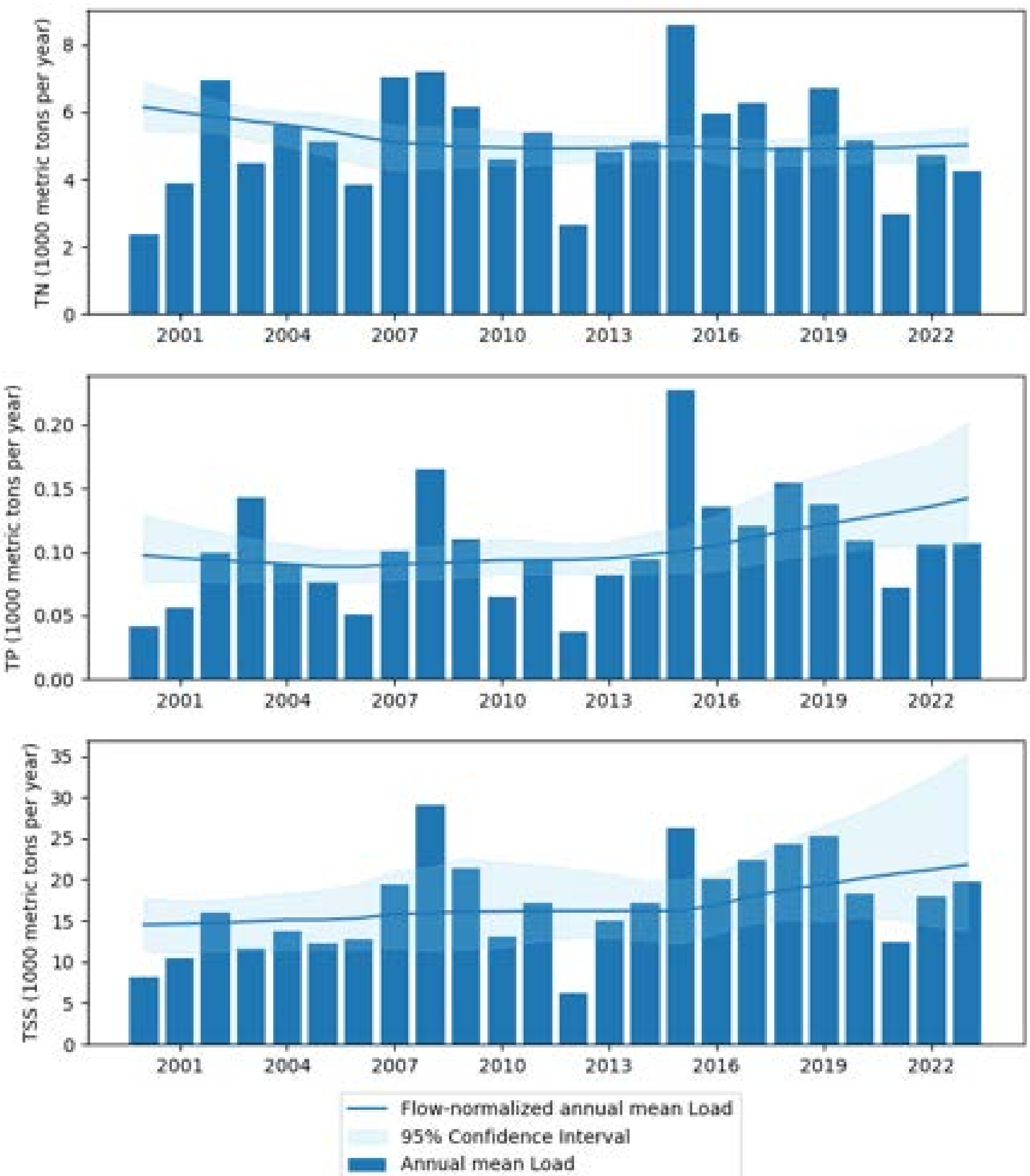
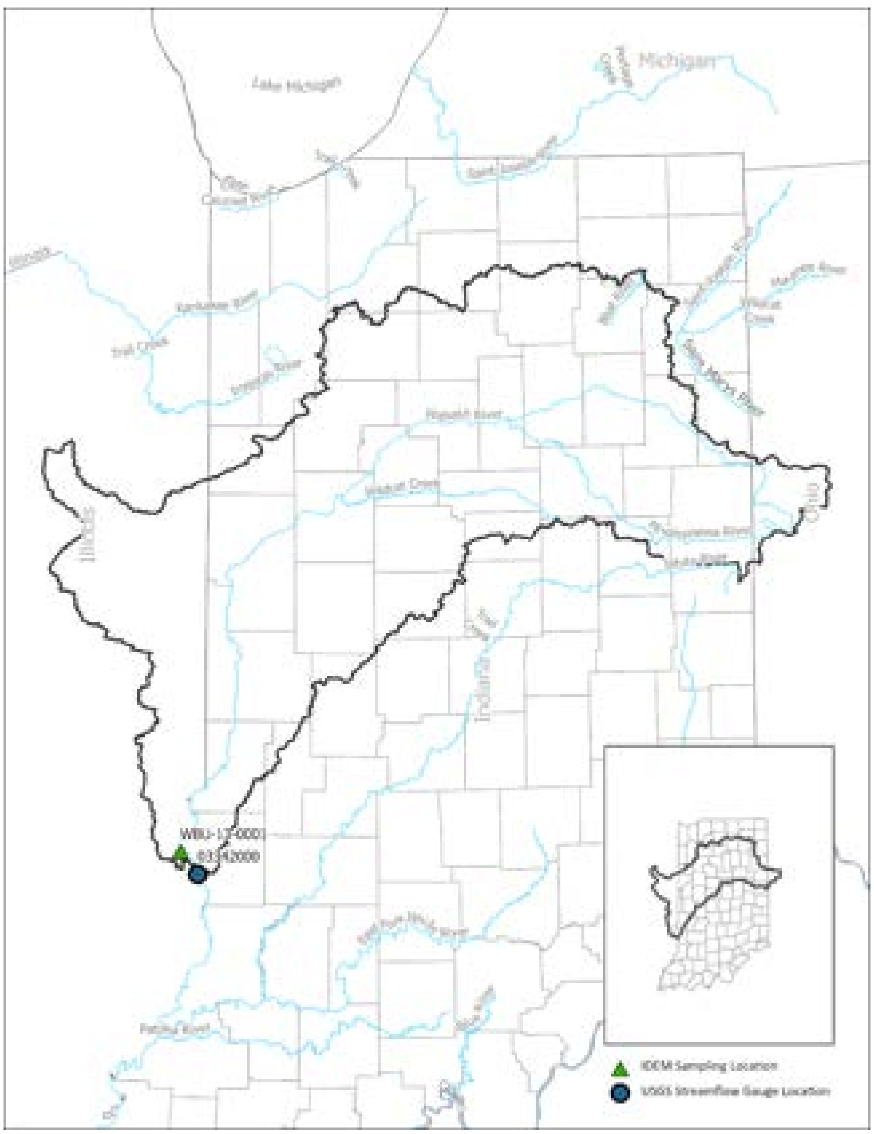


Figure 7B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Mississinewa River near Ridgeville, IN (Im2)**.

Interior Sites

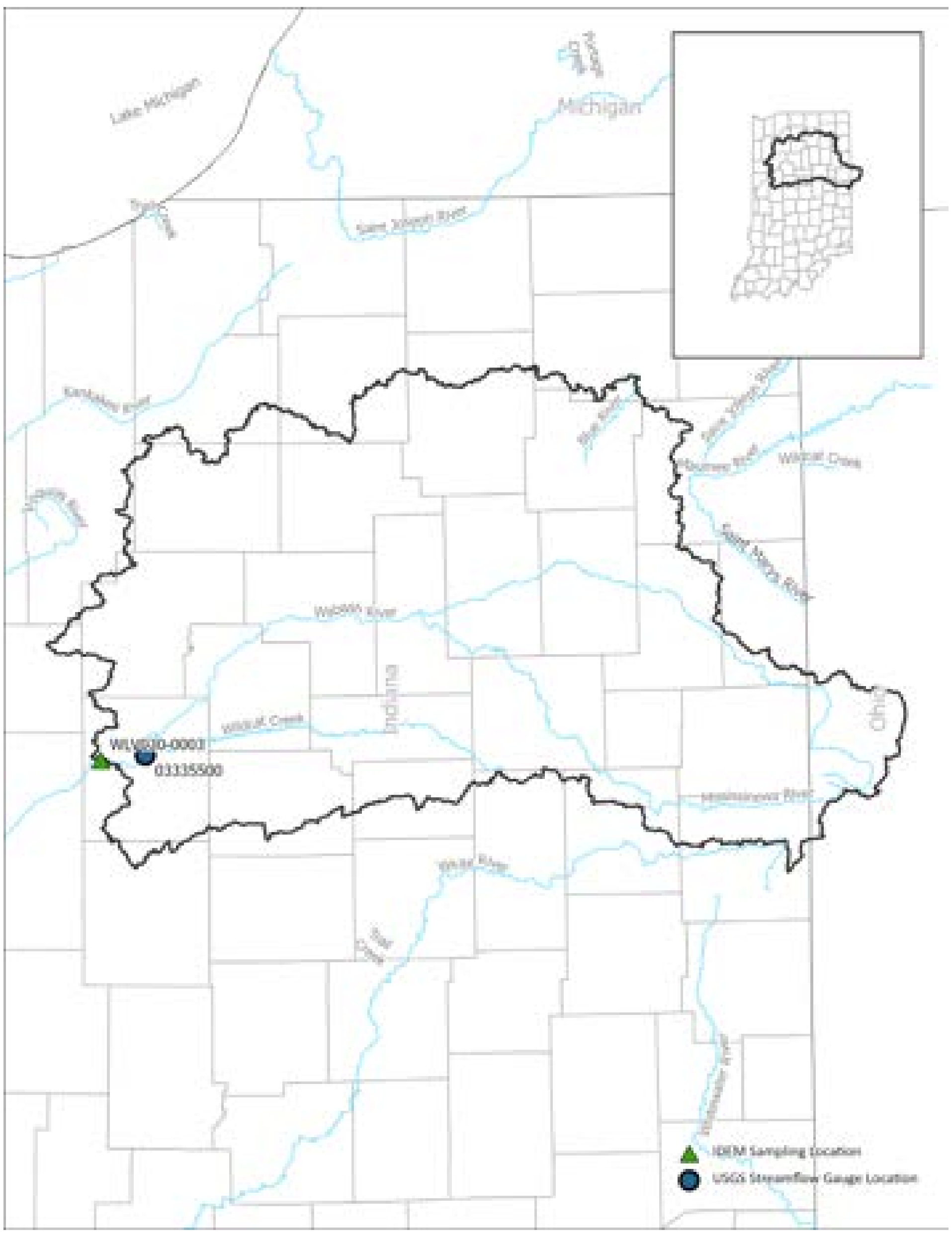
Wabash River at Riverton, IN (In1)
USGS Gage ID 03342000
IDEM station ID WBU-13-0001

The USGS streamgage site and the IDEM station site are both located in Sullivan County, IN near Riverton, IN. The USGS streamgage site is located downstream of the IDEM site. This particular site captures a large swath of the Wabash River in Indiana before the Patoka and White River confluence, as well as some watershed in Illinois. However, WRTDS analysis was not able to be performed for this site because discharge data was only available from 2011 to present. It is recommended that a minimum of 20 years is needed to accurately assess a trend with WRTDS.



Wabash River at Lafayette, IN (In2)
USGS Gage ID 03335500
IDEM station ID WLV030-0003

The USGS streamgage site and the IDEM station site are both located in Tippecanoe County near Lafayette, IN. The USGS streamgage site is located upstream of the IDEM site. This particular site captures the Upper Wabash watershed influence before the Lower Wabash watershed. The upper portion of the Wabash River flows for hundreds of miles through nine counties before it reaches Lafayette, IN.



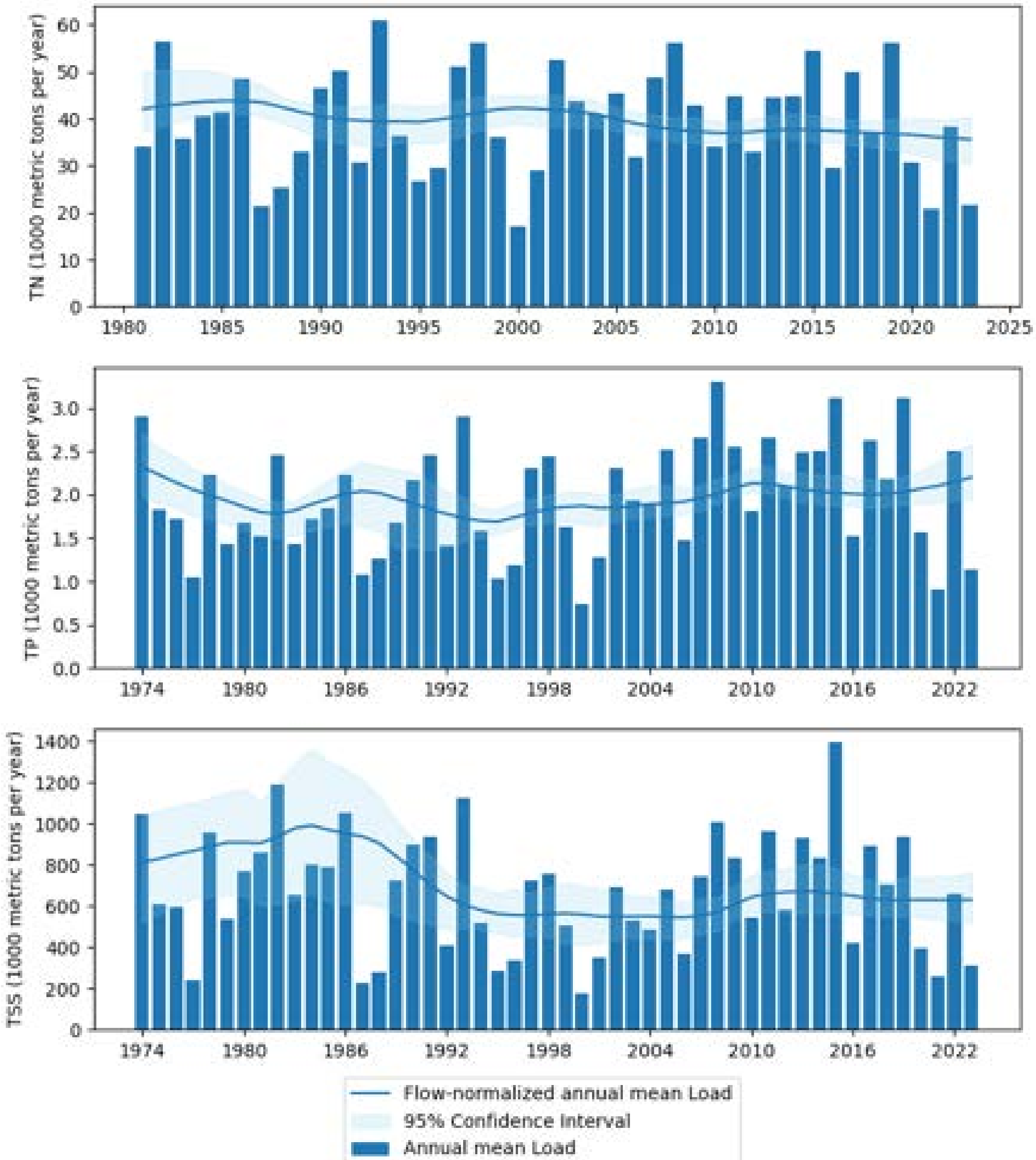


Figure 8A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Wabash River at Lafayette, IN (In2)**.

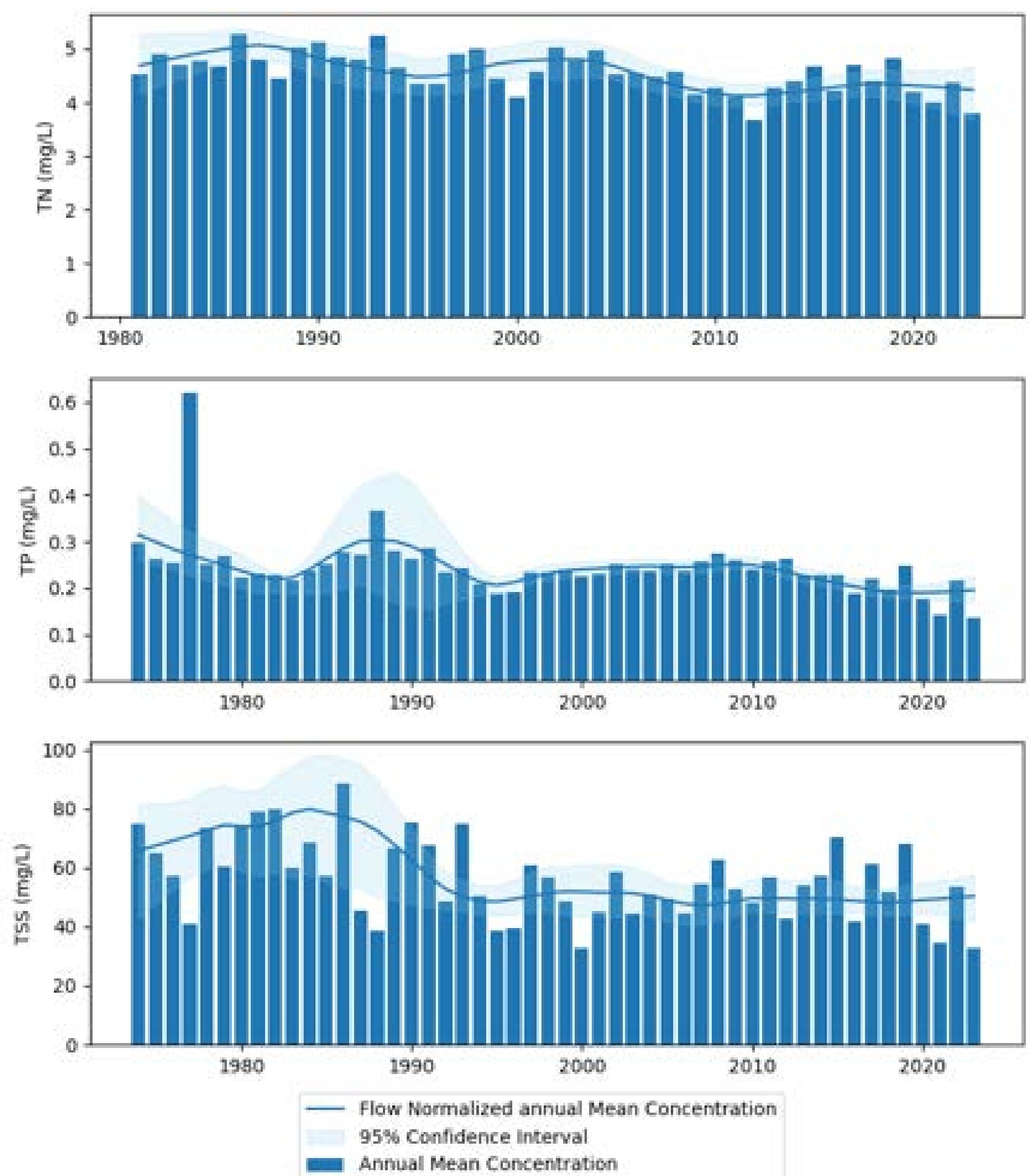
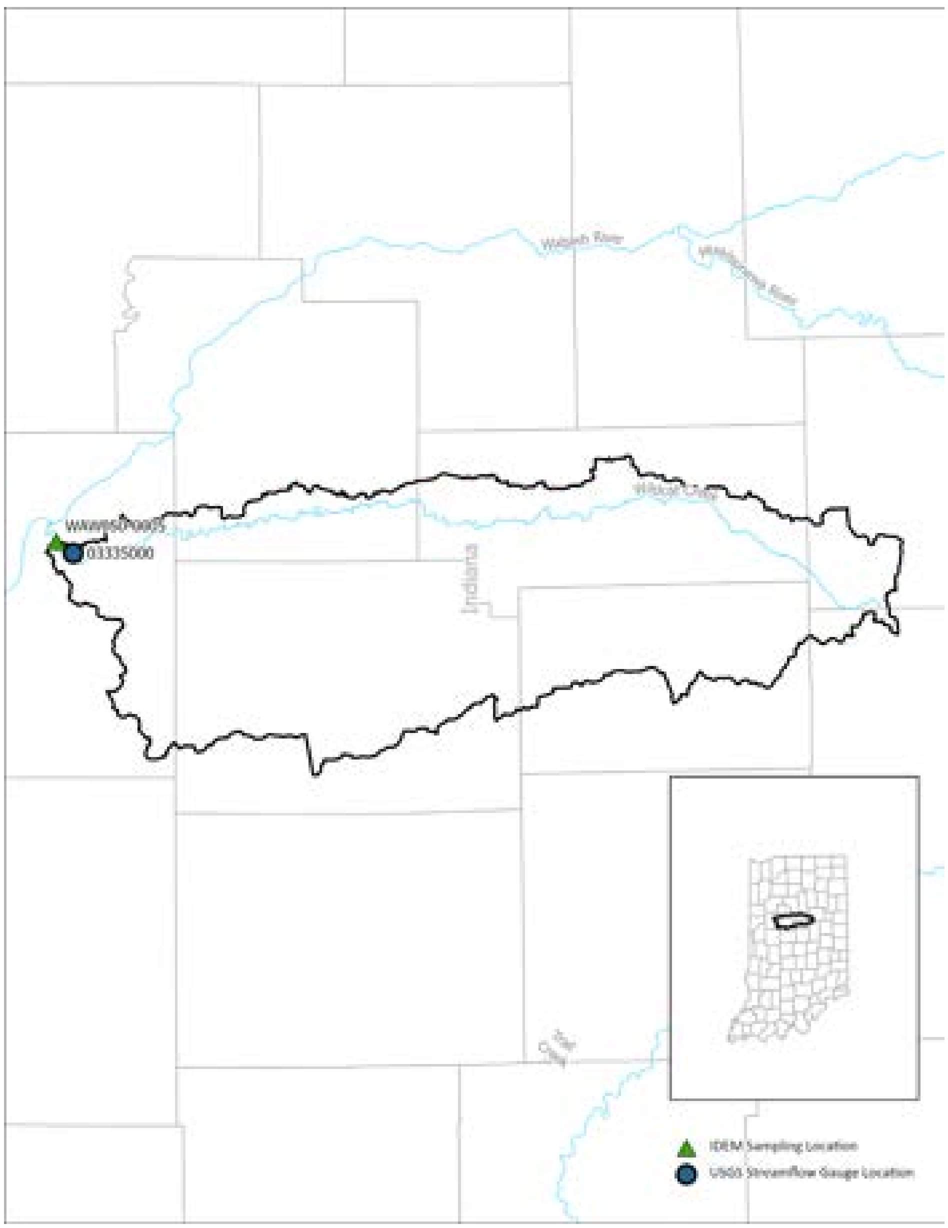


Figure 8B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Wabash River at Lafayette, IN (In2)**.

Wildcat Creek near Lafayette, IN (In3)
USGS Gage ID 03335000
IDEM station ID WAW050-0005

The USGS streamgage site and the IDEM station site are both located in Tippecanoe County north of Lafayette, IN and the USGS streamgage site is located just upstream of the IDEM site. This particular site captures the exports from Wildcat Creek to the Wabash River. The Wildcat Creek originates near the Grant County and Madison County lines, and flows through four counties before meeting up with the Wabash River. The watershed covers parts of seven counties in Indiana.



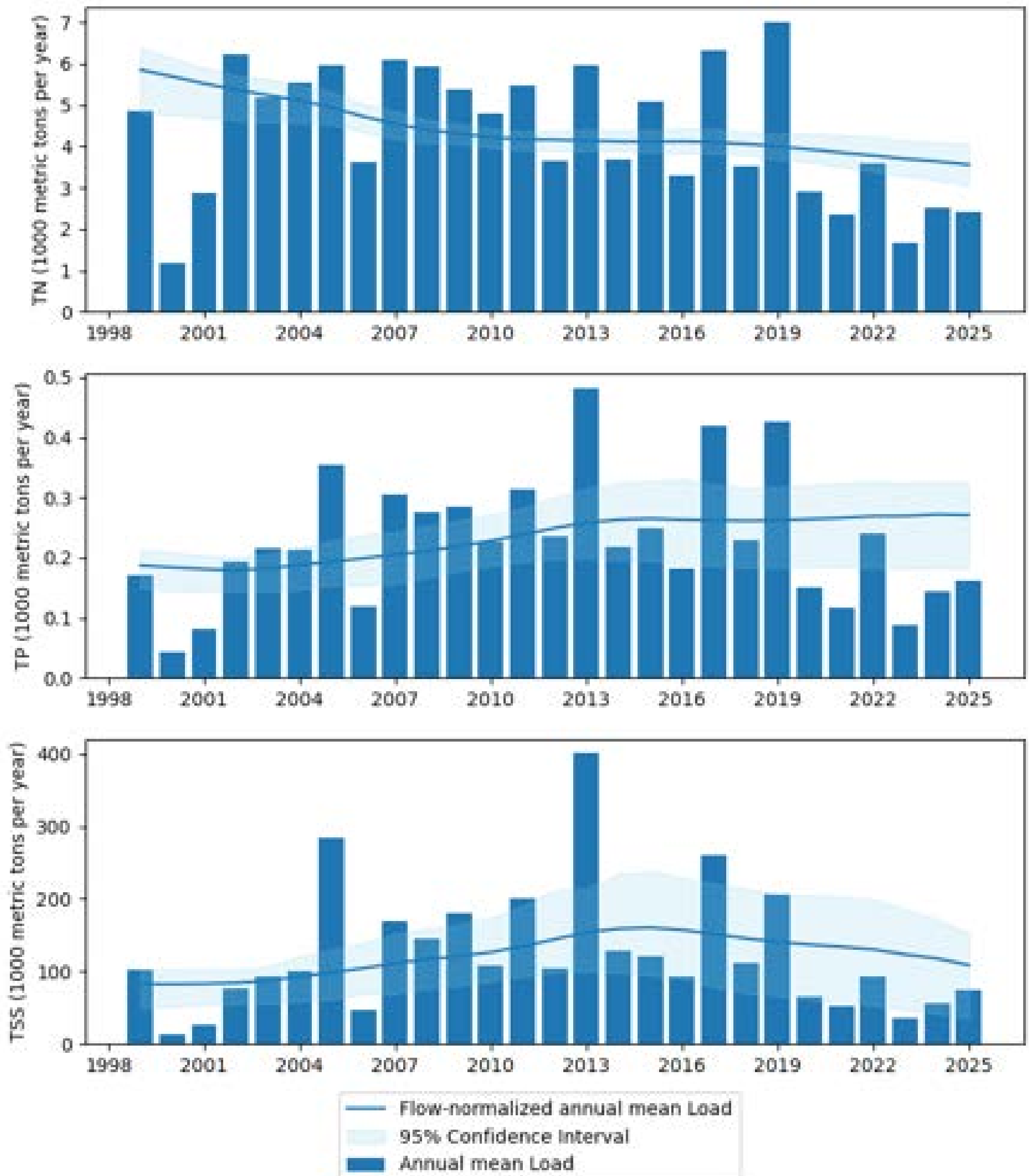


Figure 9A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on **Wildcat Creek near Lafayette, IN (In3)**.

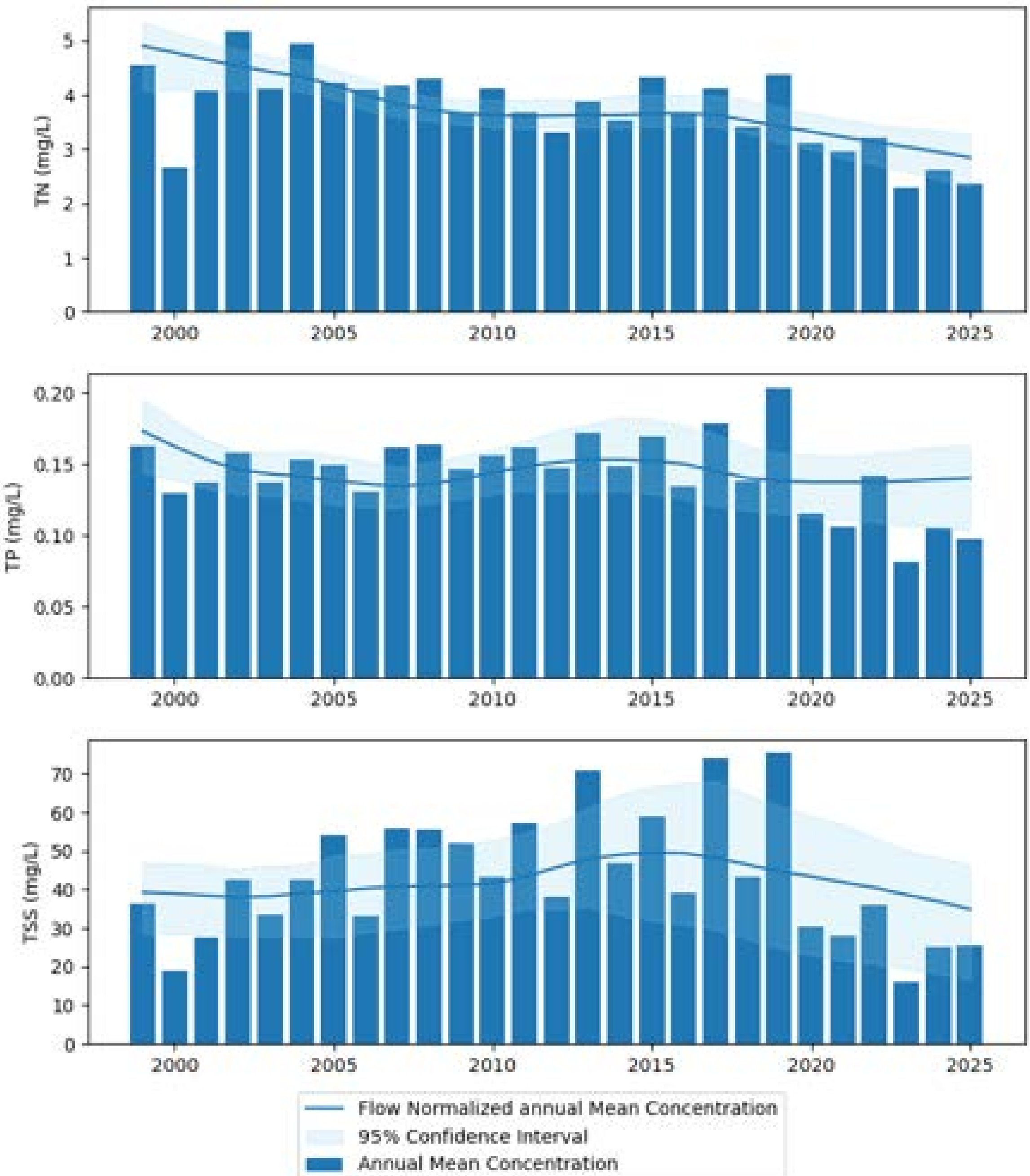


Figure 9B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on **Wildcat Creek near Lafayette, IN (In3)**.

White River at Petersburg, IN (In4)
USGS Gage ID 03374000 (Supergage)
IDEM station ID WWL100-0005

The USGS supergage is located on the White River near Petersburg in Pike County upstream of the IDEM site that is located in Gibson County in southwest Indiana. This location captures the White River after the confluence of the West Fork White River and the East Fork White River. The White River watershed is made up of two main tributaries, the West Fork White River and the East Fork White River, and it has more than 1,000 miles of waterway. It is the largest tributary to the Wabash River.

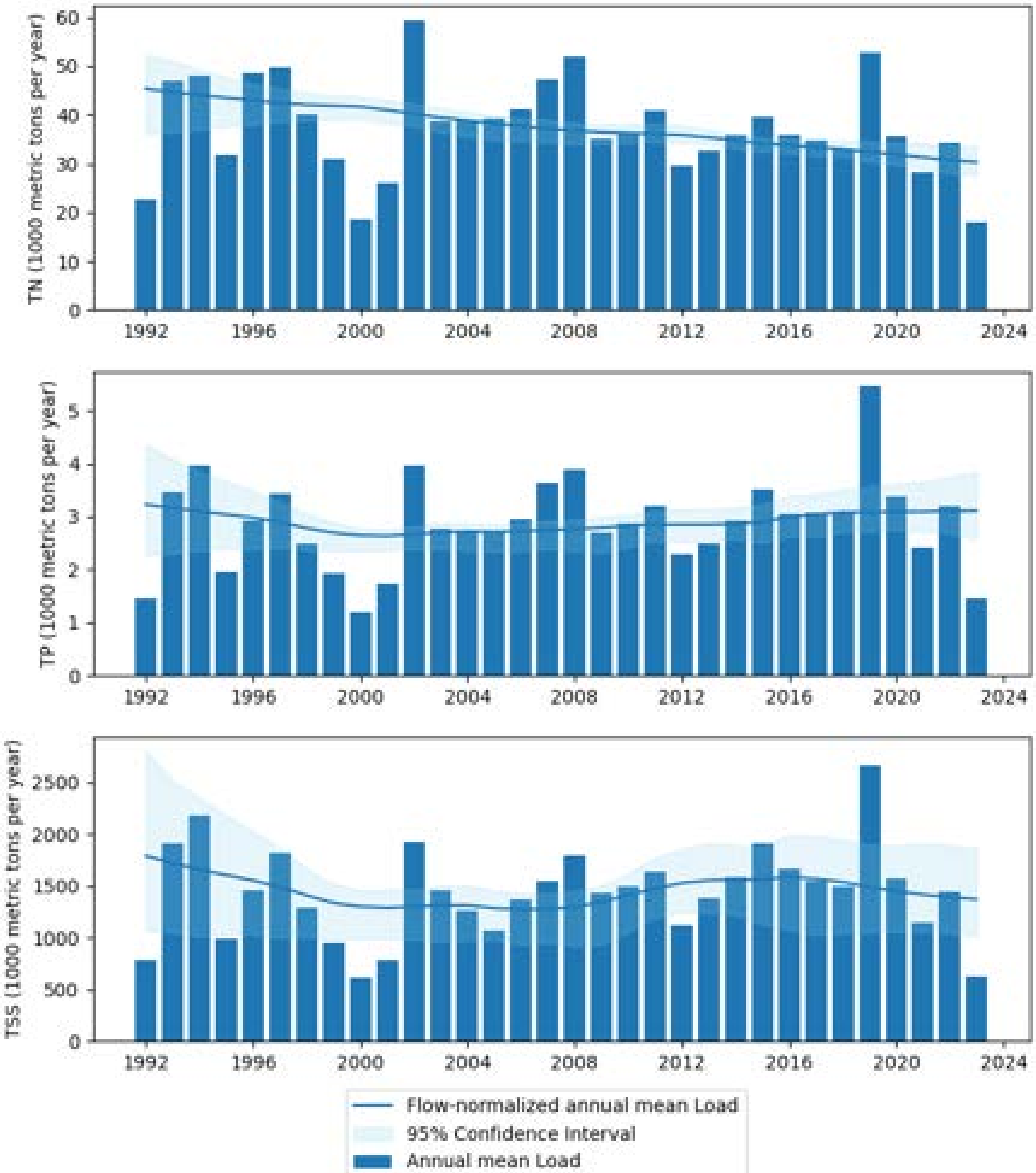


Figure 10A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **White River at Petersburg, IN (In4)**.

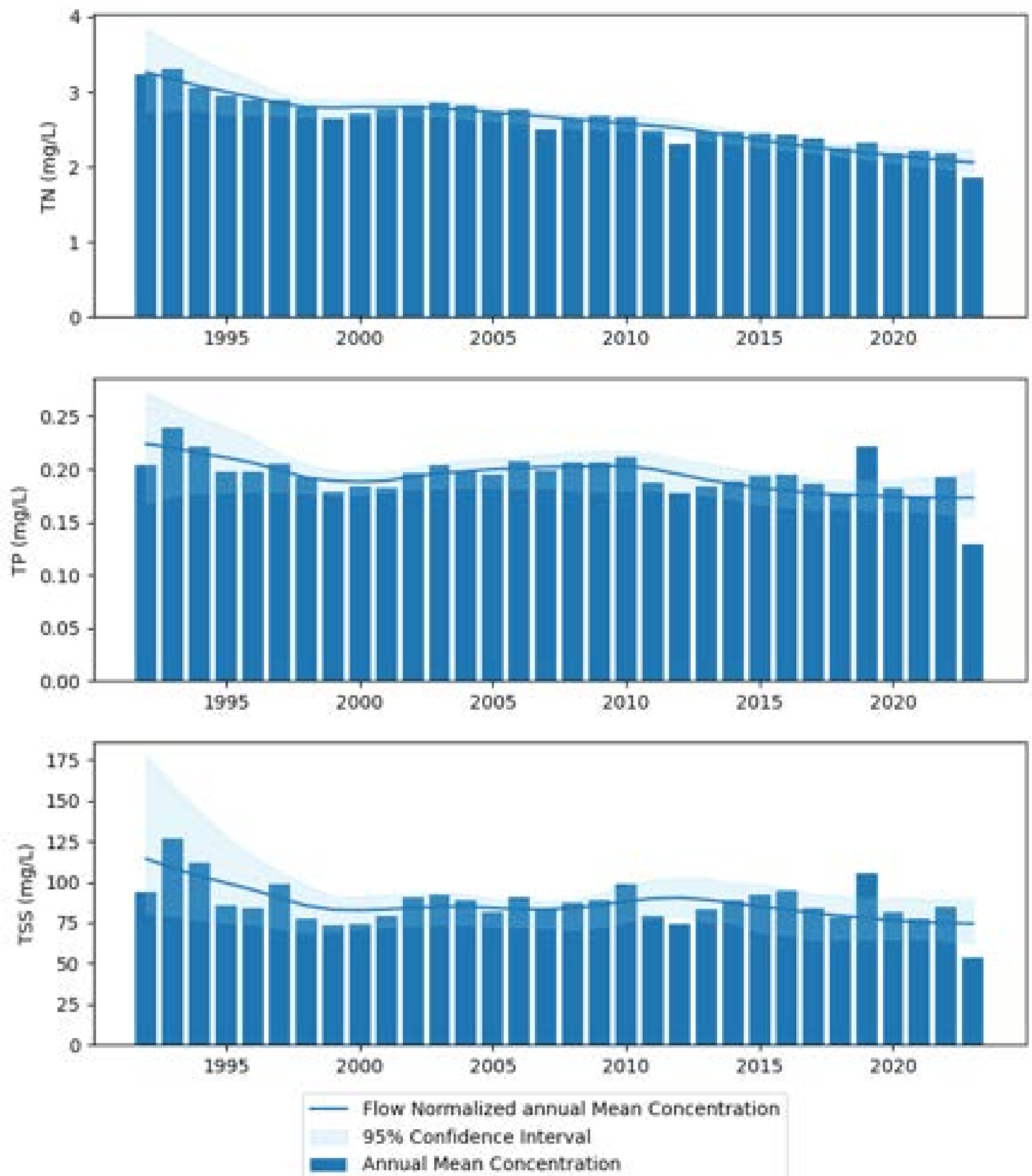


Figure 10B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **White River at Petersburg, IN (In4)**.

East Fork White River at Shoals, IN (In5)
USGS Gage ID 03373500
IDEM station ID WEL100-0002

The USGS streamgage is located in central Martin County downstream of the IDEM site that is located in west central Lawrence County in southern Indiana. This location captures the majority of the East Fork White River before its confluence with the West Fork White River. The East Fork White River beings in Bartholomew County in southeastern Indiana and travels approximately 200 miles before meeting up with the West Fork White River near Petersburg, Indiana. Important tributaries to the East Fork White River that help make up the large watershed are the Driftwood and Flatrock Rivers, the Upper East Fork White River, and the Muscatatuk River.

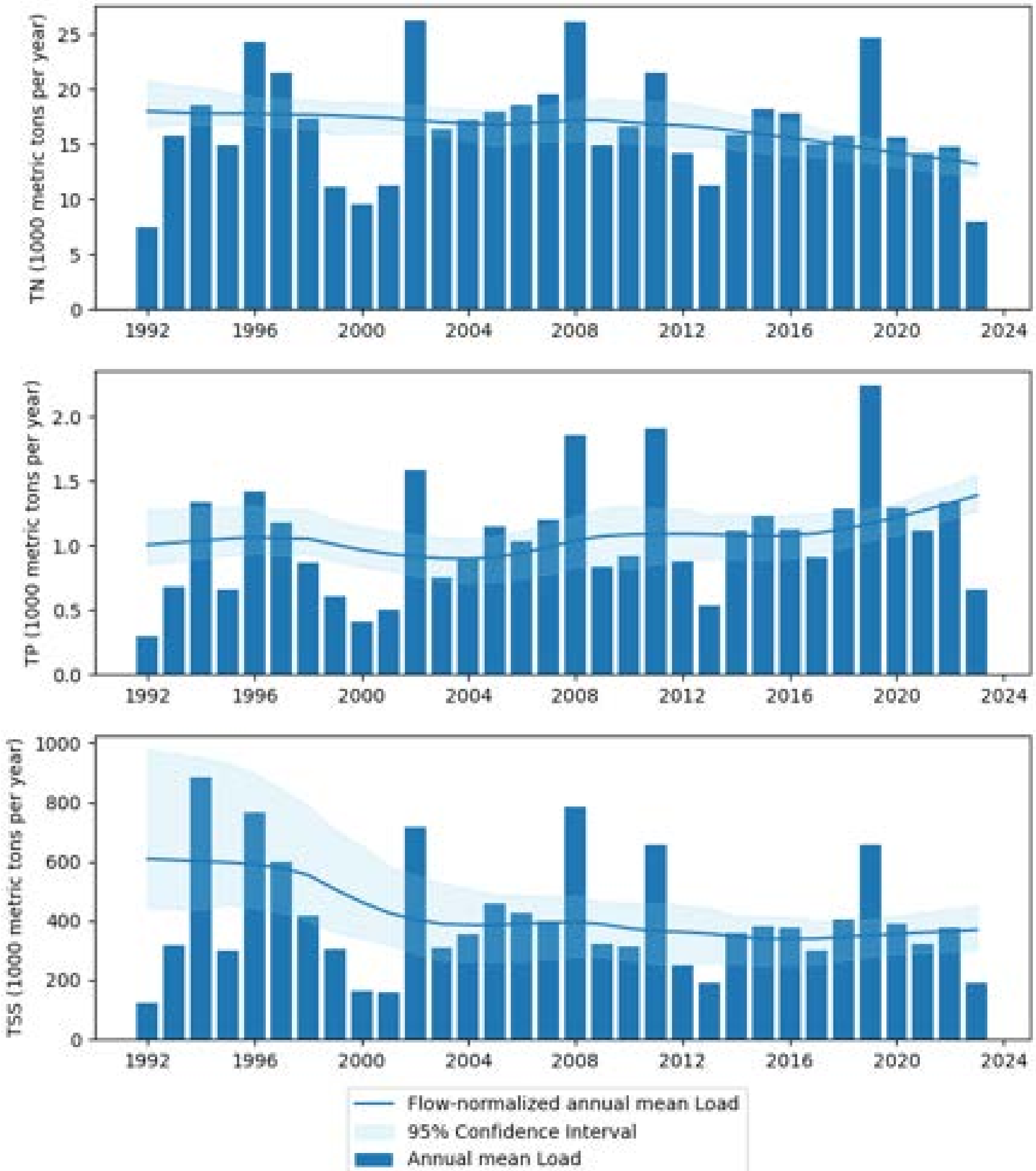


Figure 11A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **East Fork White River at Shoals, IN (In5)**.

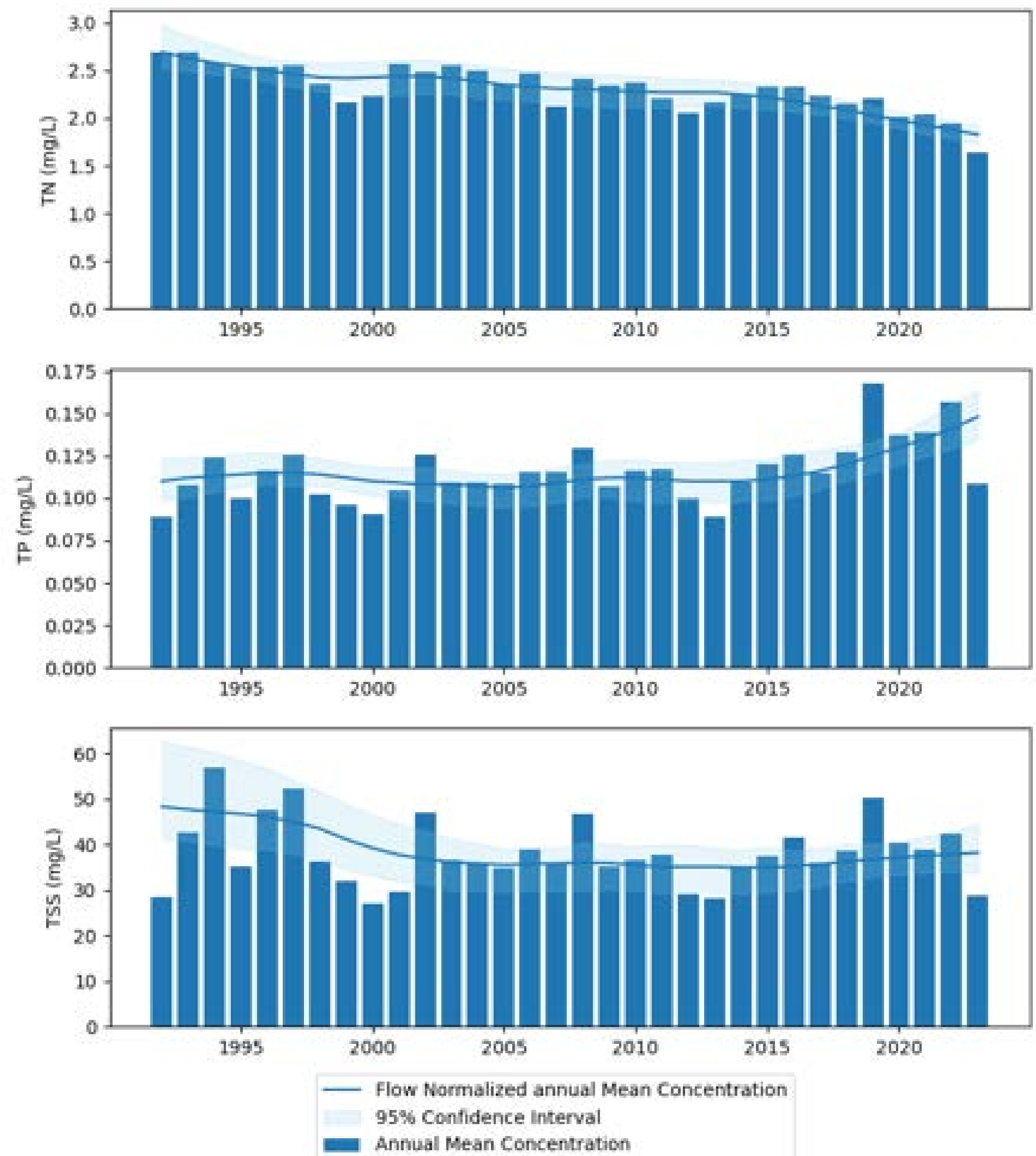
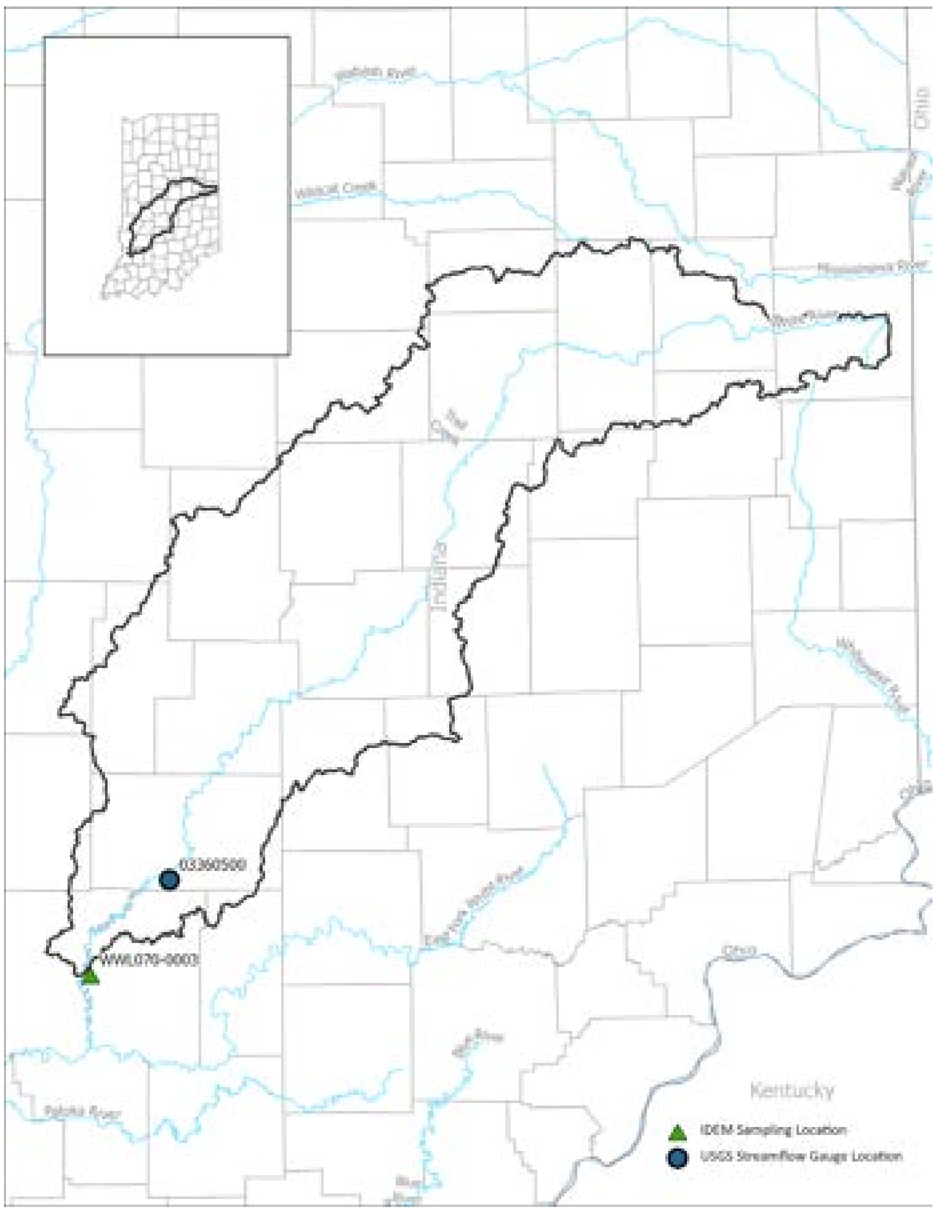


Figure 11B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **East Fork White River at Shoals, IN (In5)**.

White River at Newberry, IN (In6)
USGS Gage ID 03360500
IDEM station ID WWL070-0003

The USGS streamgage is located in southern Greene County upstream of the IDEM site that is located in west central Daviess County in southern Indiana. This location captures the West Fork White River after the confluence of the Eel River and before the confluence of the East Fork White River. The West Fork White River originates in Randolph County in east central Indiana and travels through 11 counties before meeting up with the East Fork White River near Petersburg, Indiana. The watershed covers all or parts of 22 Indiana counties.



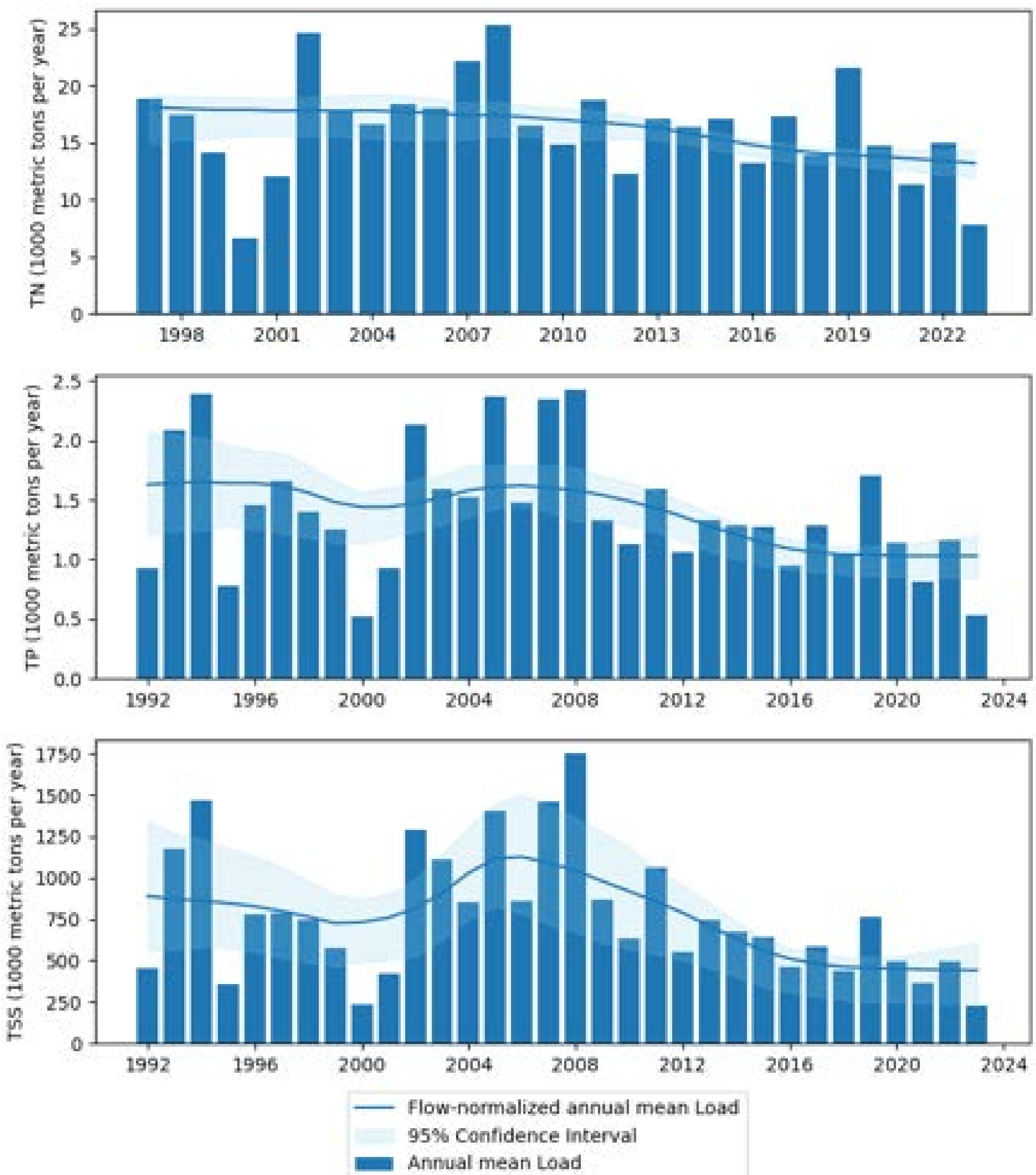


Figure 12A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **White River at Newberry, IN (In6)**.

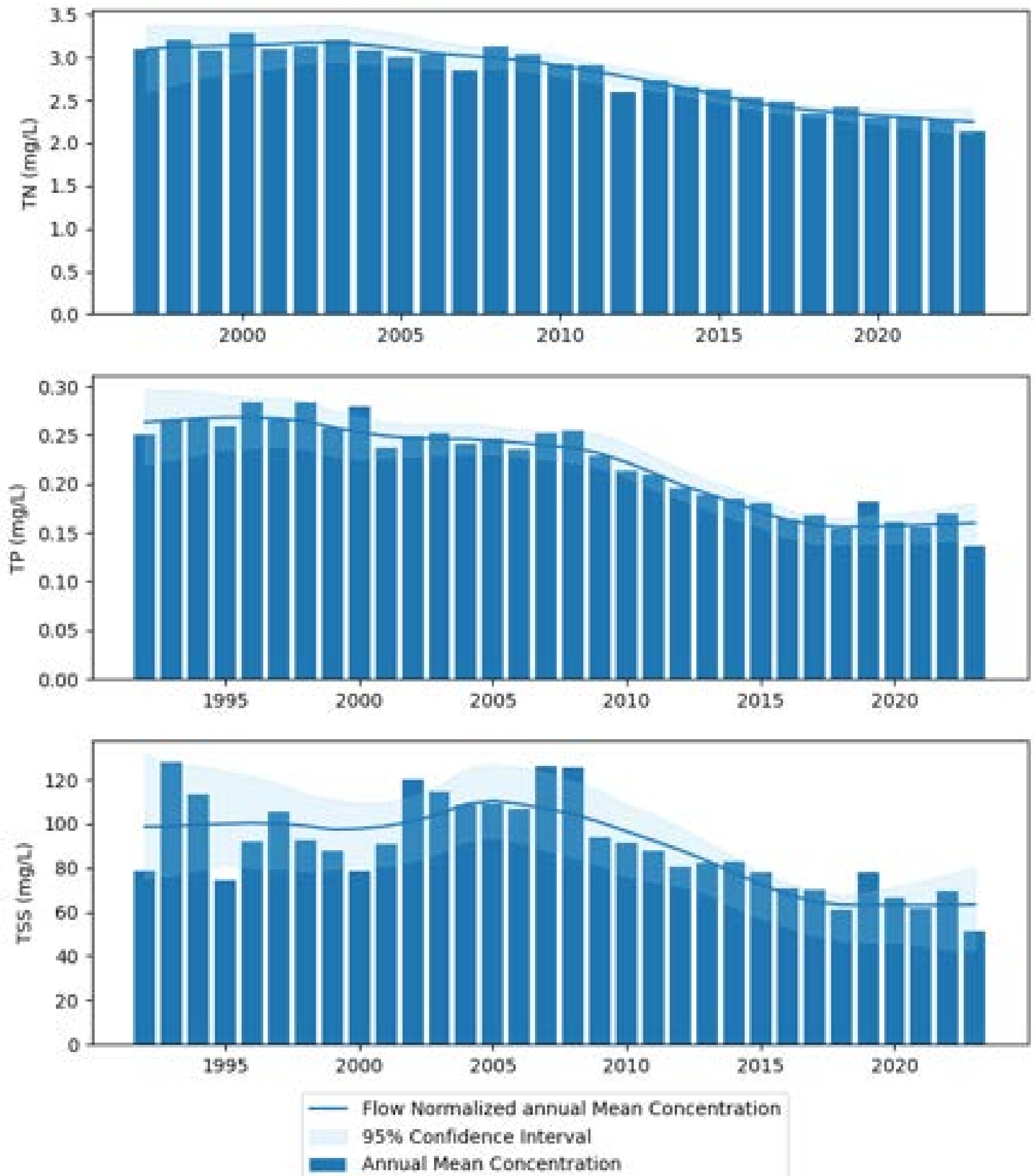
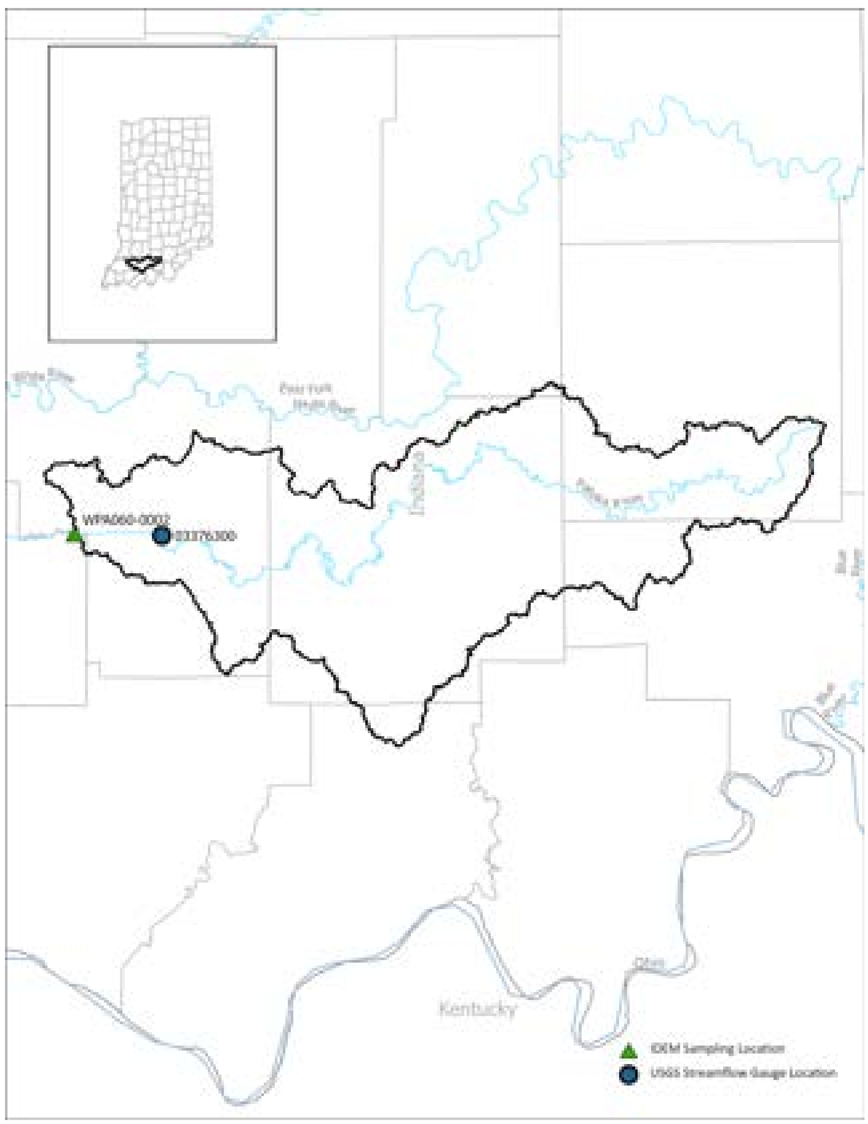


Figure 12B – Trend in flow-normalized mean **concentration** and annual mean concentration over time for the total trend period of data available for this site on the **White River at Newberry, IN (In6)**.

Patoka River at Winslow, IN (In7)
USGS Gage ID 03376300
IDEM station ID WPA060-0002

Both the USGS streamgage site and the IDEM station site are located in Pike County in southwestern Indiana. The USGS streamgage site is located upstream of the IDEM site. This location captures the majority of the Patoka River downstream of Patoka Lake, which is located in the headwaters of the Patoka River. This part of the watershed covers all or part of 6 Indiana counties, and is made up of a largely rural areas of forested bottomland and agricultural lands. The entire Patoka River flows approximately 165 miles from Orange County to the Wabash River on the western State border between Indiana and Illinois. The mouth of the Patoka River enters the Wabash River approximately 1 mile downstream (south) from the mouth of the White River.



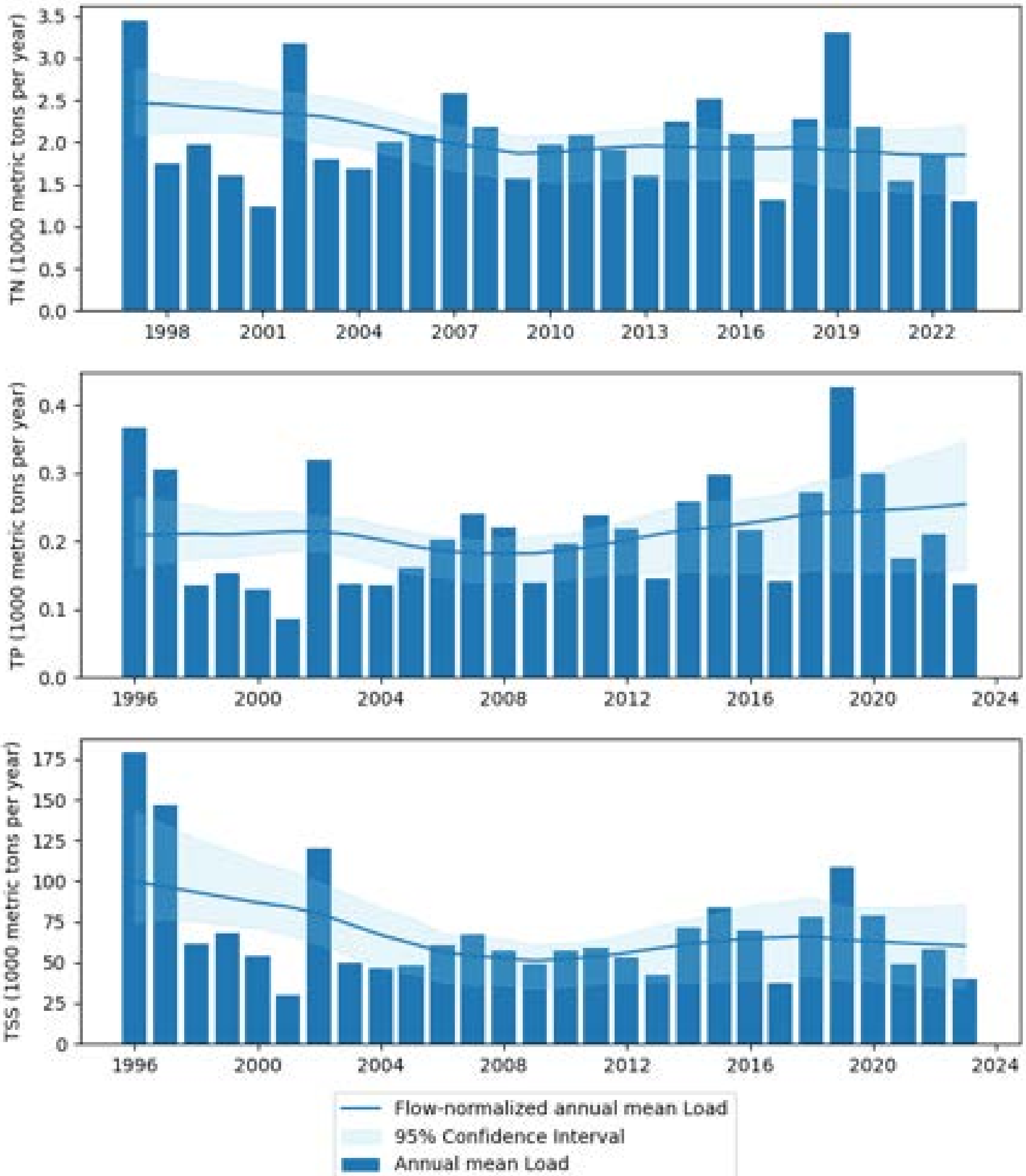


Figure 13A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Patoka River at Winslow, IN (In7)**.

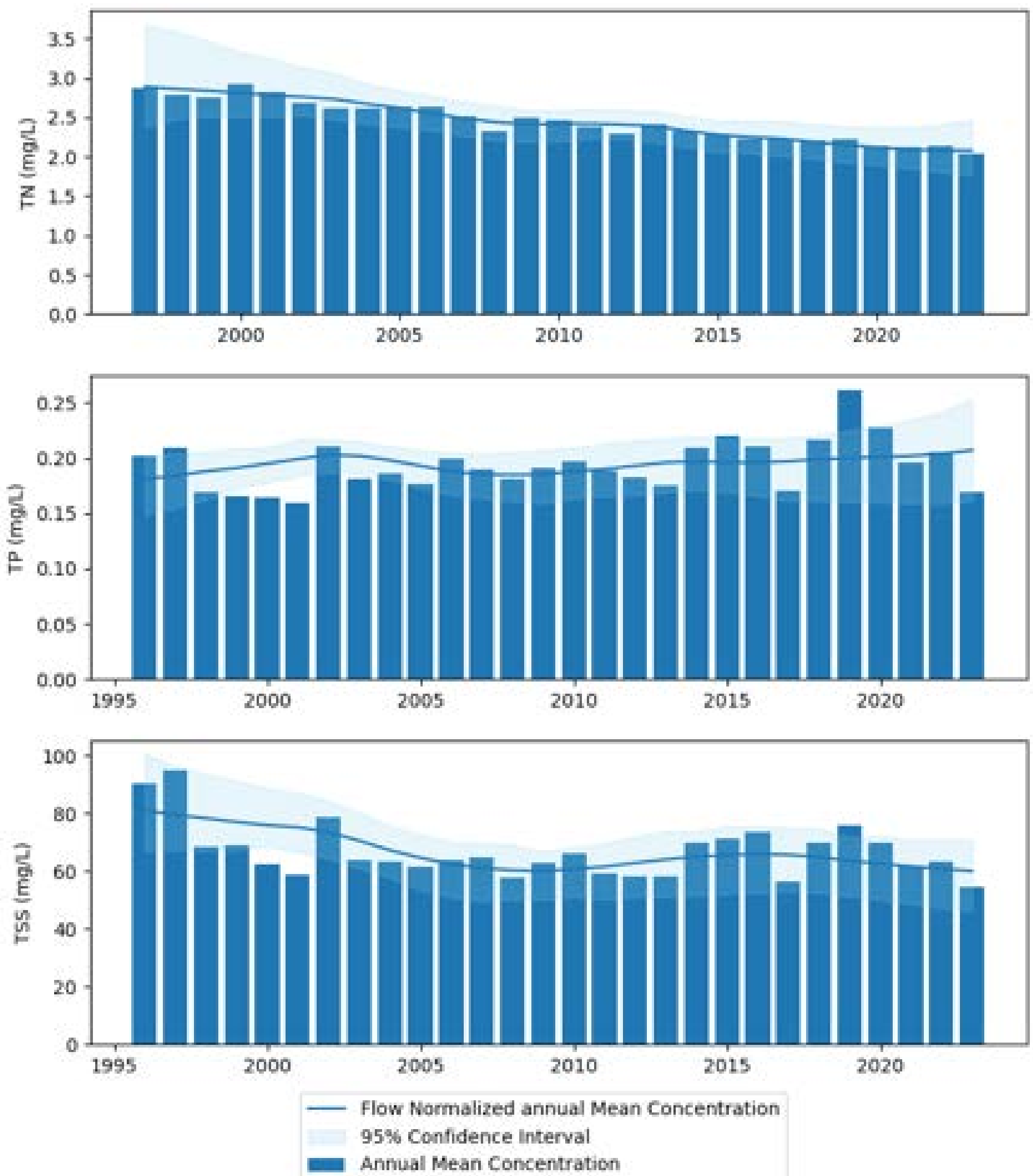


Figure 13B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Patoka River at Winslow, IN (In7)**.

C. Lake Michigan Basin

Export Sites

St. Joseph River at Niles, MI (Ex6)
USGS Gage ID 04101500
IDEM station ID LMJ240-0024

The USGS streamgage site is located in Berrien County, Michigan downstream of the IDEM station site that is located in St. Joseph County in northern Indiana. This location captures the St. Joseph River exports into the state of Michigan and to Lake Michigan from Indiana. The St. Joseph-Lake Michigan watershed is located in southwest Michigan and northeast Indiana. The St. Joseph River begins in Michigan's Hillsdale County at Baw Beese Lake, and flows in a northerly arc before turning south and entering Indiana. The river then flows west through Indiana before making an abrupt turn north in South Bend. It re-enters Michigan between the cities of St. Joseph and Benton Harbor.

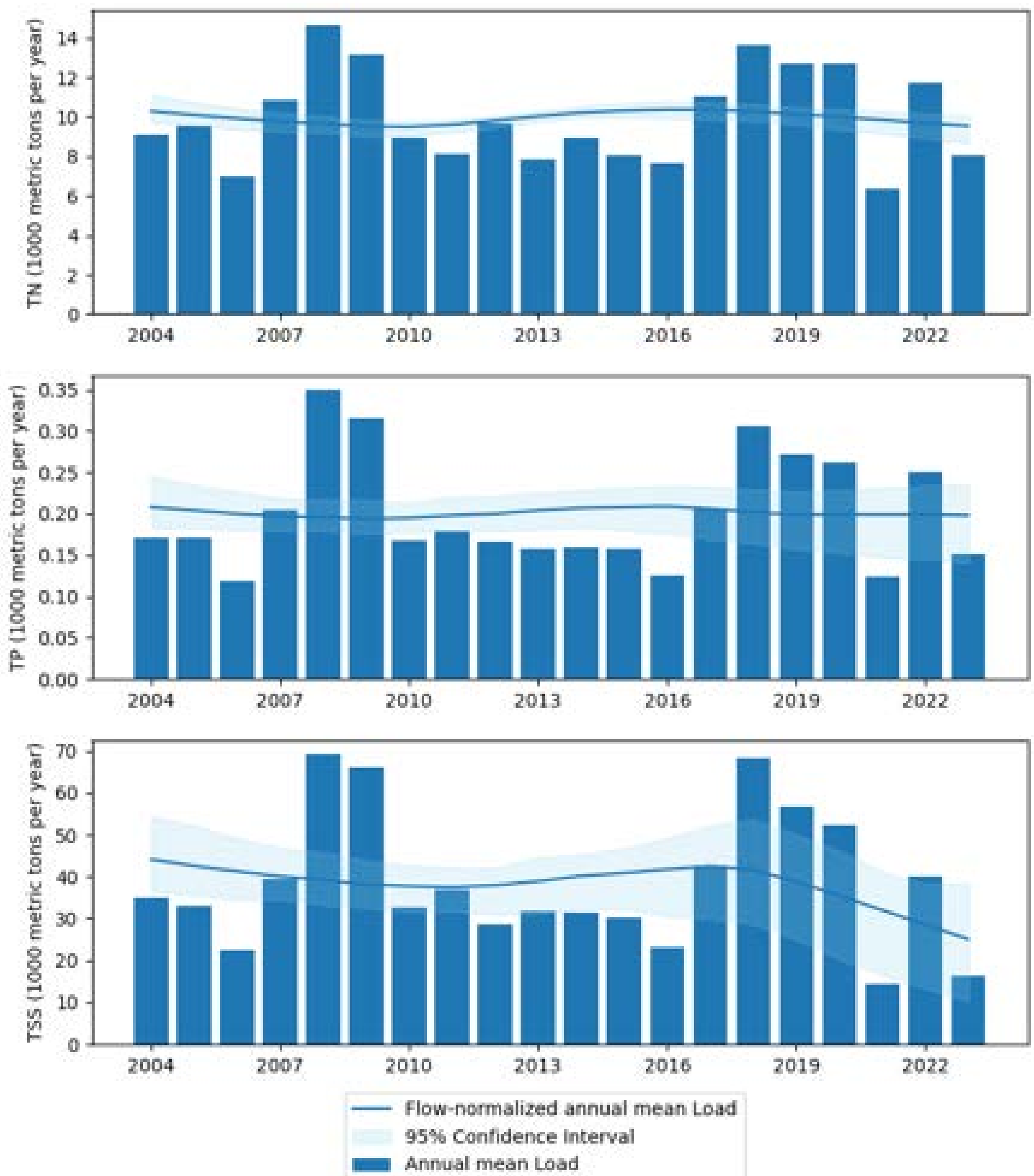


Figure 14A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **St. Joseph River at Niles, MI (Ex6)**.

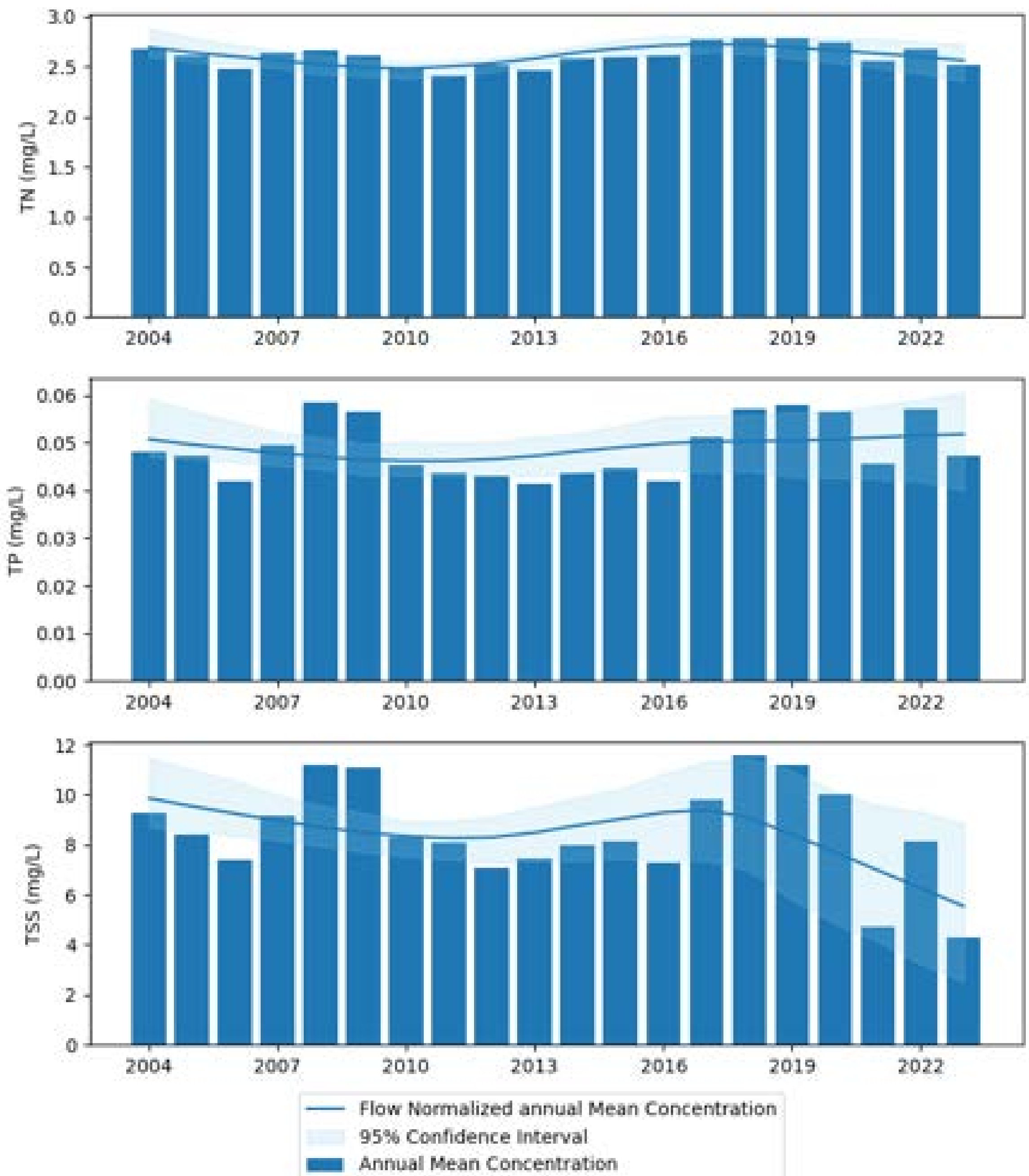
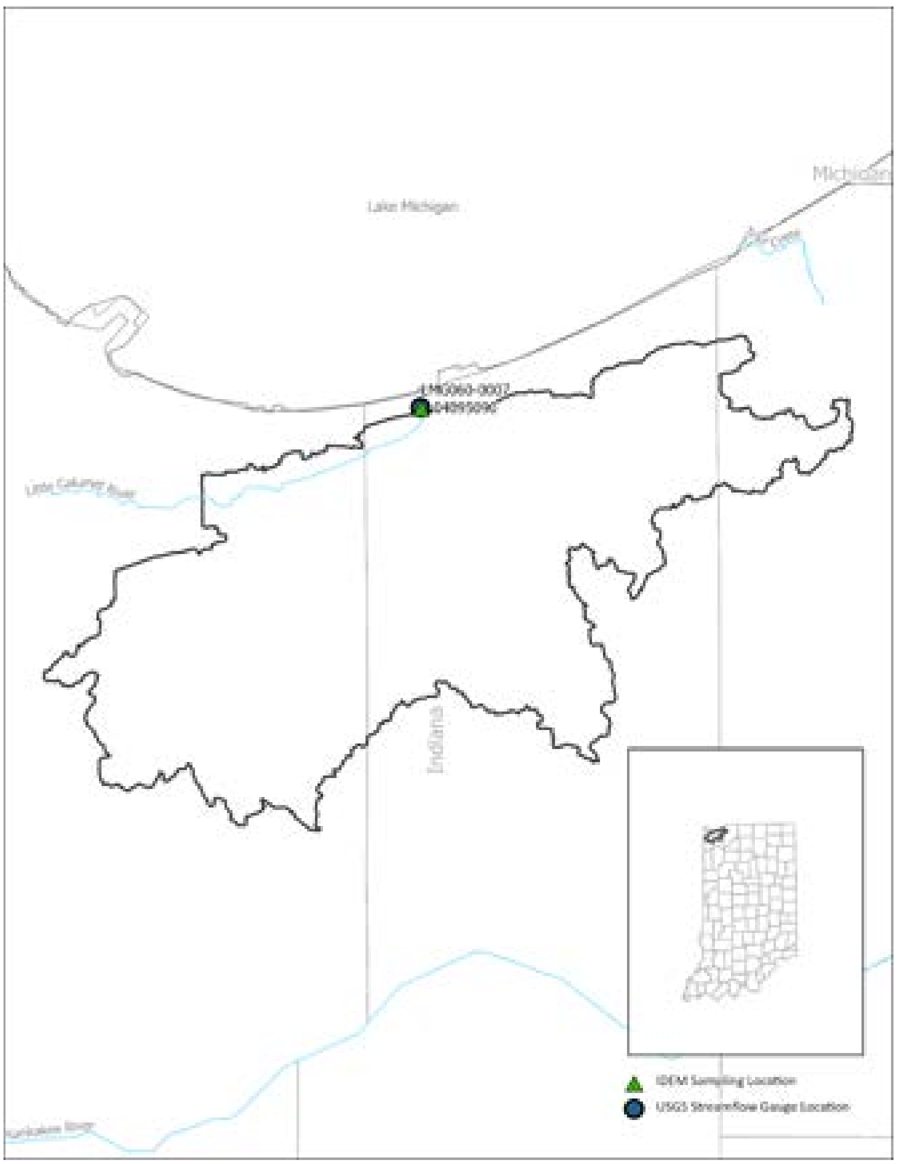


Figure 14B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **St. Joseph River at Niles, MI (Ex6)**.

Burns Ditch at Portage, IN (Ex7)
USGS Gage ID 04095090
IDEM station ID LMG060-0007

The USGS streamgage site and the IDEM station are co-located at this location. The sites are located in northern Porter County in northwest Indiana in Portage, IN. This location captures Burns Ditch exports to Lake Michigan from Indiana. The Little Calumet River collects it waters from many small streams and drainage ditches in northwestern Indiana before emptying into Lake Michigan via Burns Ditch in Indiana and the Calumet Harbor in Illinois. Most of the Little-Calumet-Galien watershed has been altered from its historic setting. Land use in this watershed is predominatley urban, suburban, and industrial. Some of the land is used for agriculture, while only a remnant of the historic wetlands remains (U.S. EPA 2002).



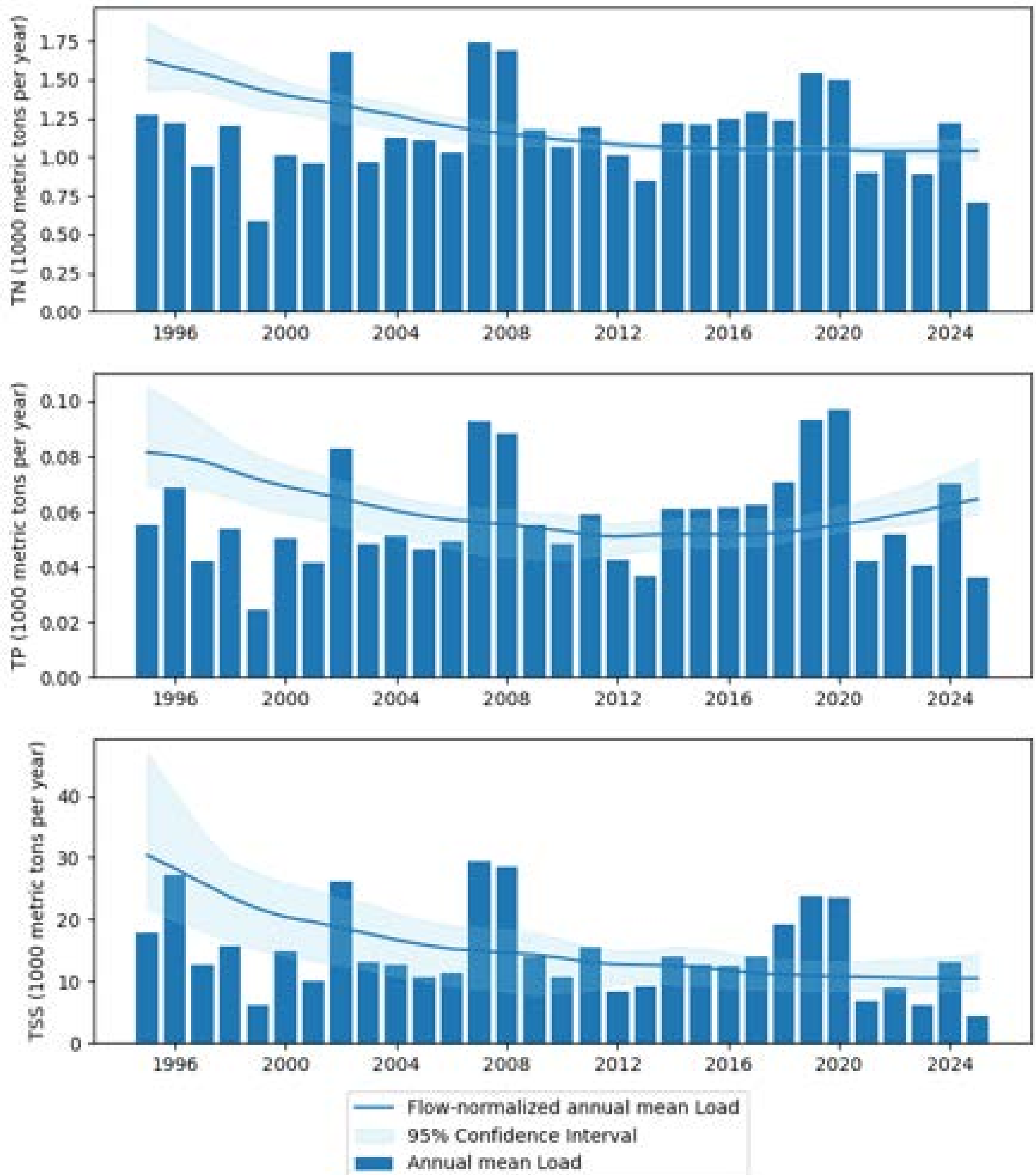


Figure 15A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on **Burns Ditch at Portage, IN (Ex7)**.

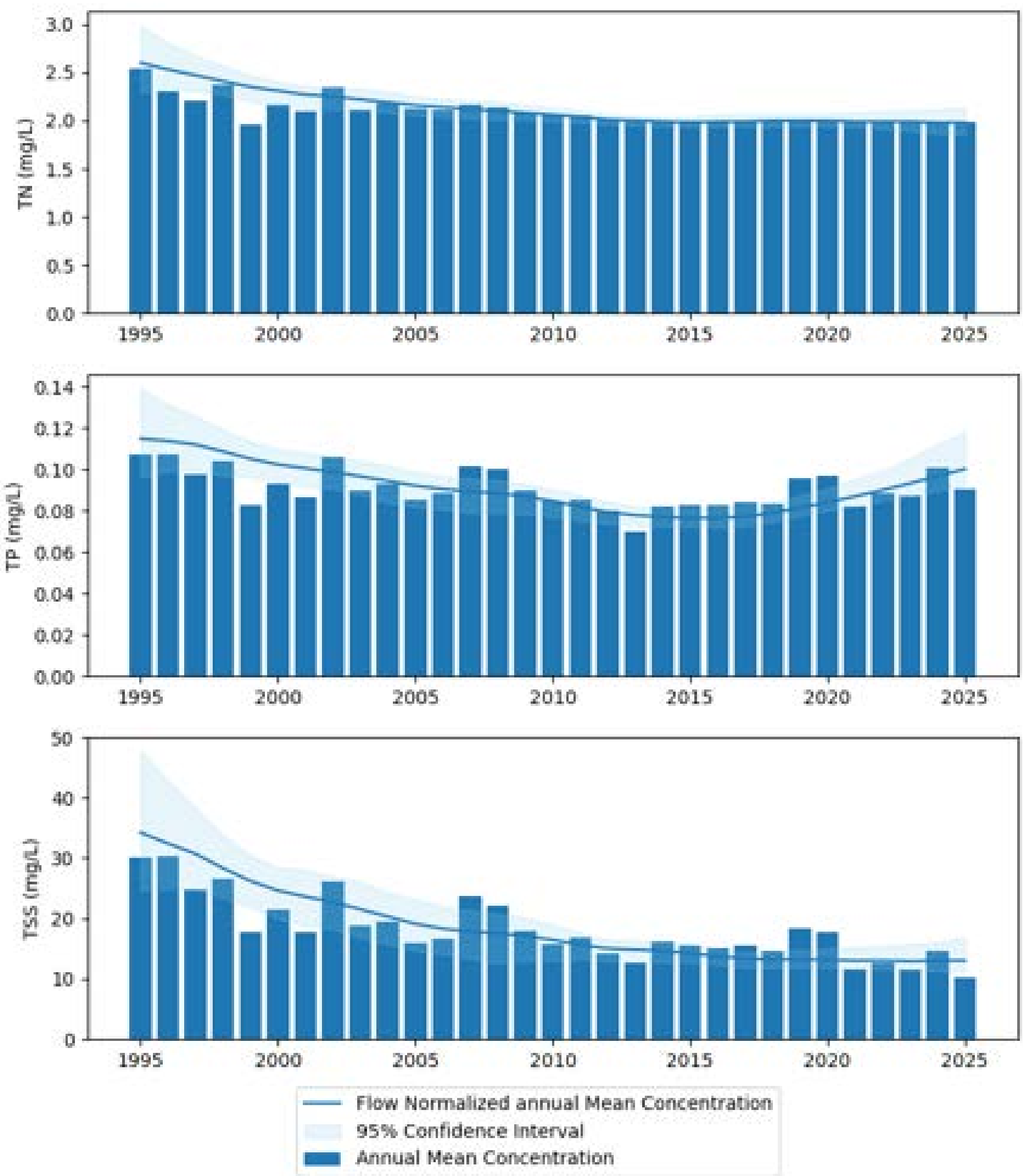
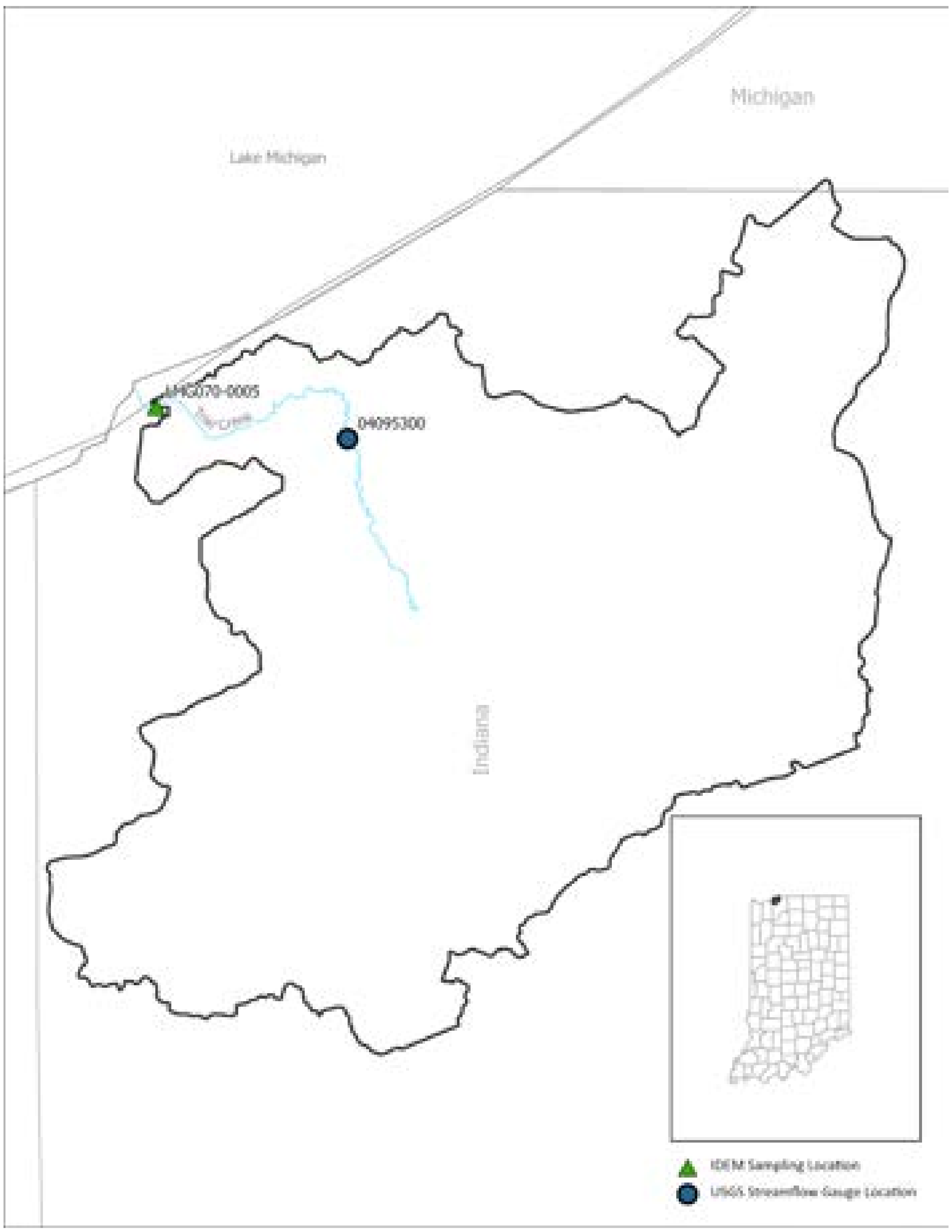


Figure 15B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on **Burns Ditch at Portage, IN (Ex7)**.

Trail Creek at Michigan City, IN (Ex8)
USGS Gage ID 04095300
IDEM station ID LMG070-0005

For this site, the USGS streamgage site and the IDEM site are both located in LaPorte County in northern Indiana in Michigan City. The USGS streamgage site is located upstream of the IDEM site. Unfortunately, the discharge data available from the USGS streamgage site had a gap in coverage of data from the mid-1990s to the mid-2000s, so it was not able to be analyzed for a trend in water quality. This location captures Trail Creek exports into Lake Michigan from Indiana.



D. Western Lake Erie Basin

<u>Export Site</u>

Maumee River at SR101 in IN near IN/OH State Line (Ex9)
USGS Gage ID 04183000
IDEM station ID LEM010-0013

Both the USGS streamgage site and the IDEM station site are located in Allen County in northeast Indiana, however the USGS streamgage site is located upstream of the IDEM site. This location captures the Maumee River exports into Ohio from Indiana. The watershed covers all or parts of 6 Indiana counties, as well as parts of Michigan and Ohio. The St. Joseph River and the St. Marys River come together in Fort Wayne, Indiana to form the Maumee River that drains to Ohio and eventually empties into the western basin of Lake Erie at Toledo, Ohio.

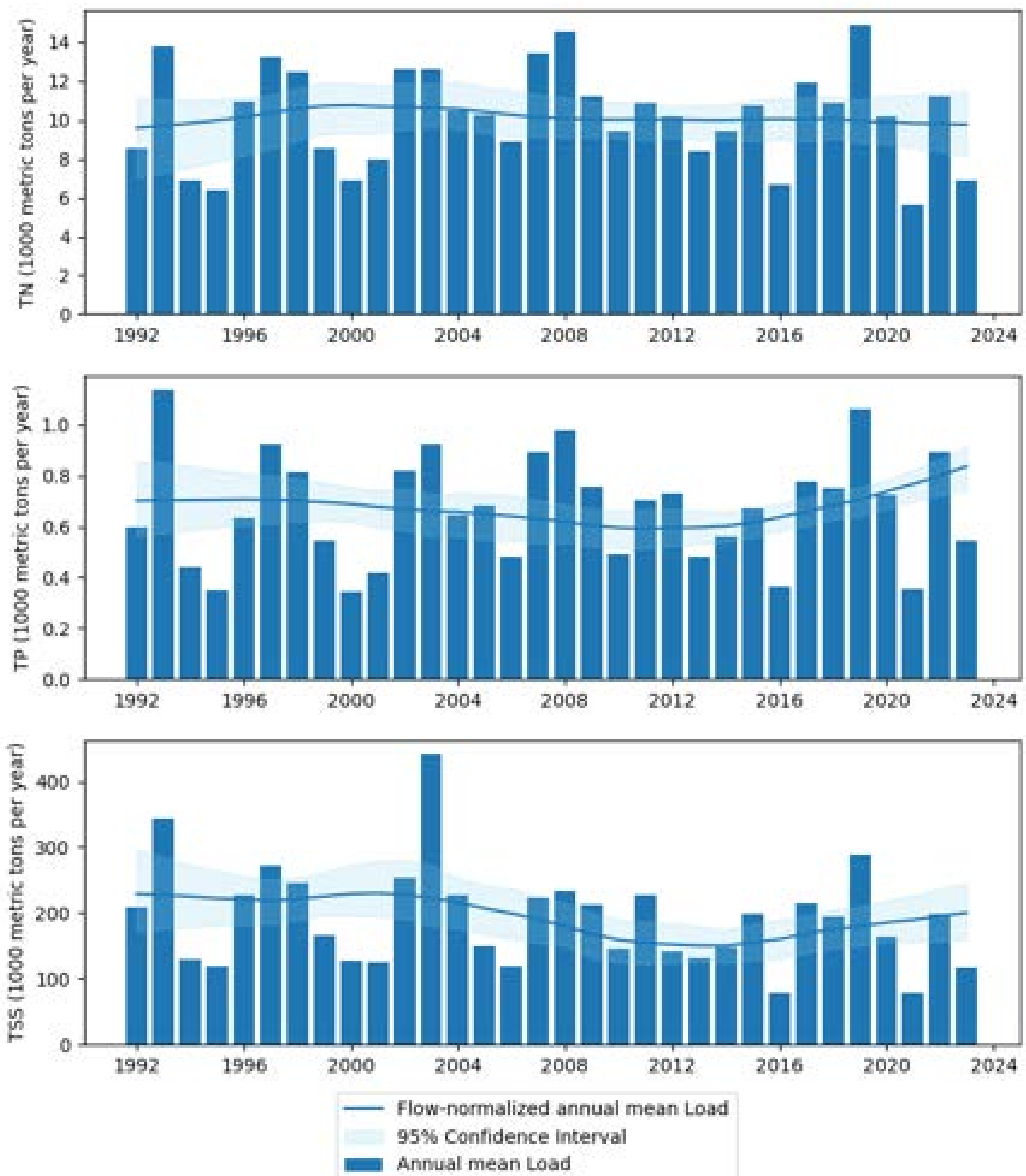


Figure 16A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Maumee River at SR101 in IN near IN/OH State Line (Ex9)**.

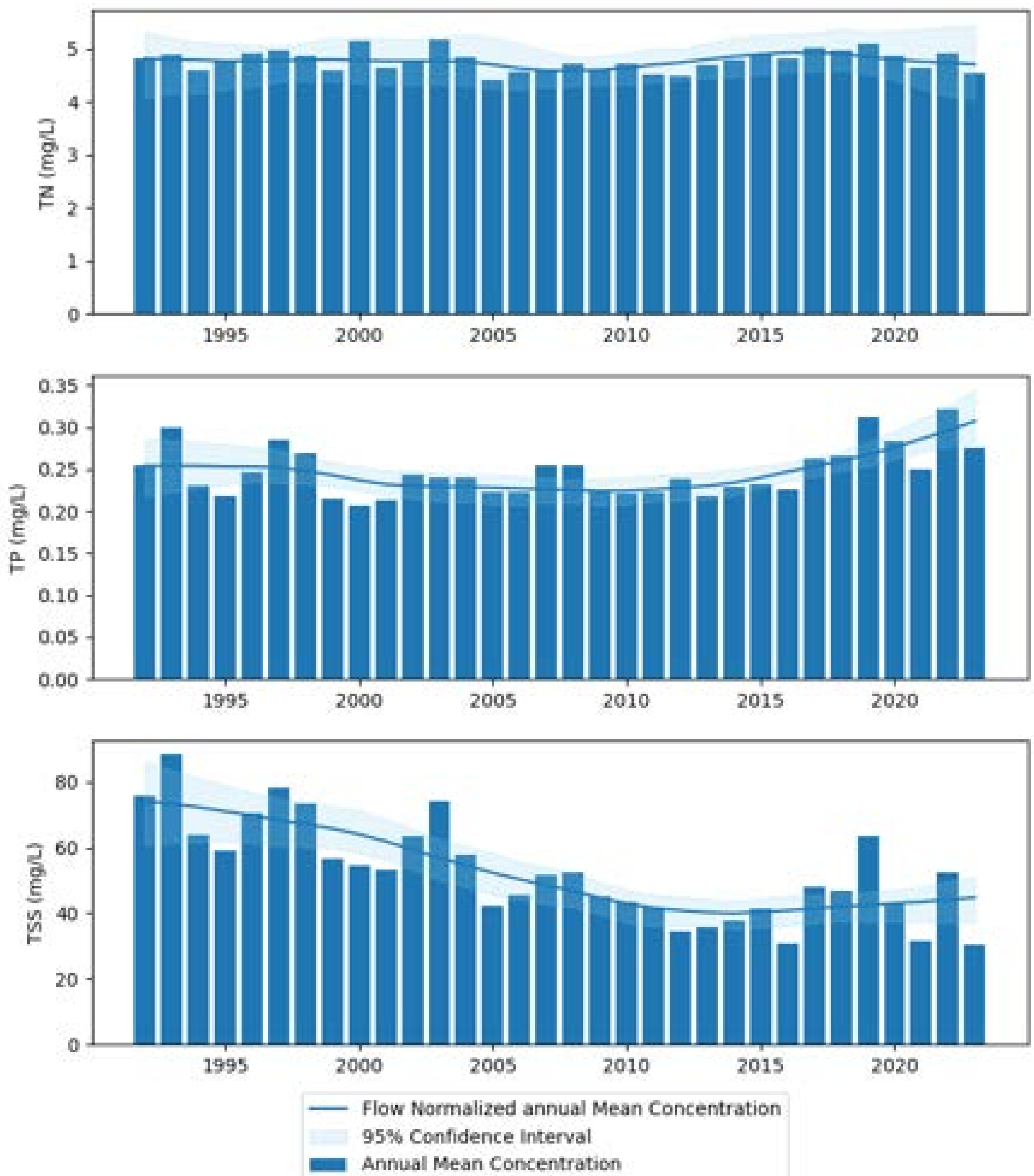
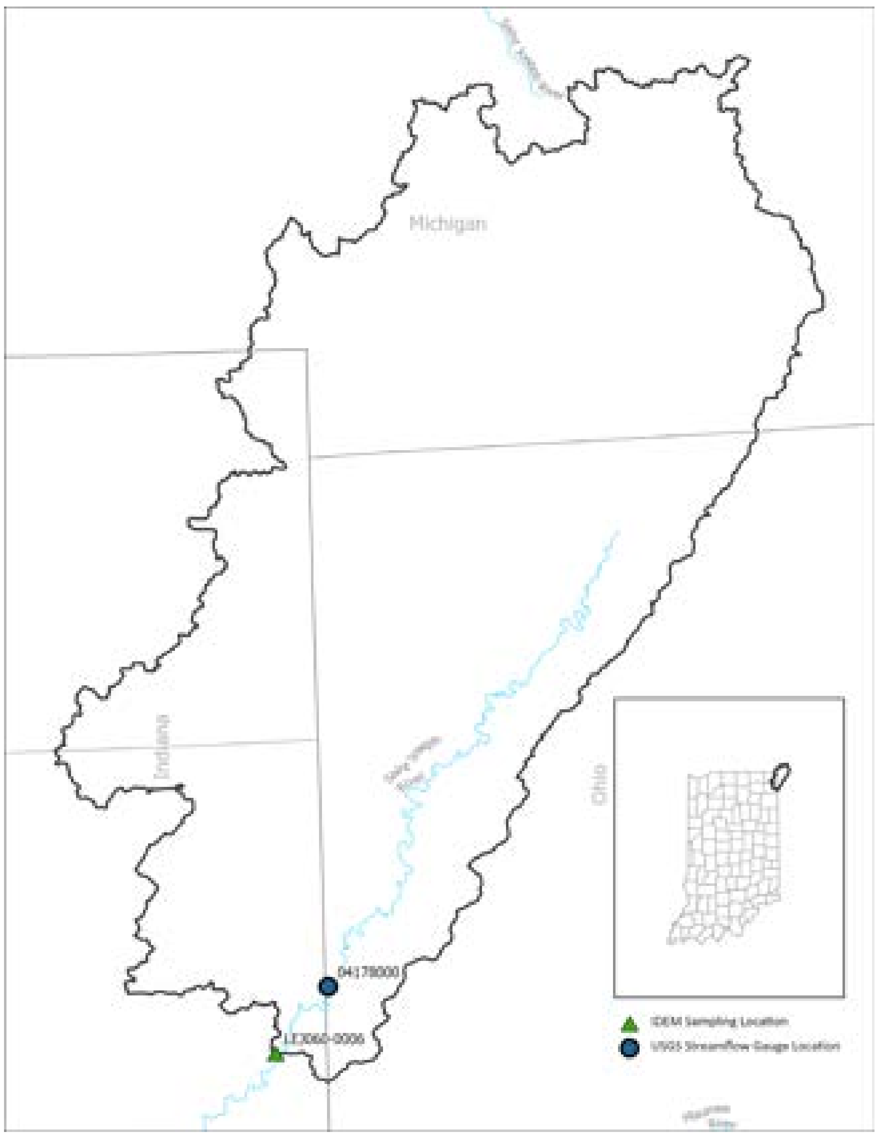


Figure 16B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Maumee River at SR101 in IN near IN/OH State Line (Ex9)**.

Import Site

St. Joseph River near Newville, IN (Im3)
USGS Gage ID 04178000
IDEM station ID LEJ060-0006

The USGS streamgage and the IDEM site are both located in Dekalb County in northeast Indiana near Newville, IN. The USGS streamgage is located upstream of the IDEM site. This particular site is an import into the state as the St. Joseph River originates in Michigan and flows through Ohio before entering into Indiana. The watershed covers parts of Michigan and Ohio and two counties in Indiana. The St. Joseph River and the St. Mary's River come together in Fort Wayne, Indiana to form the Maumee River that drains to Ohio and eventually empties into the western basin of Lake Erie at Toledo, Ohio.



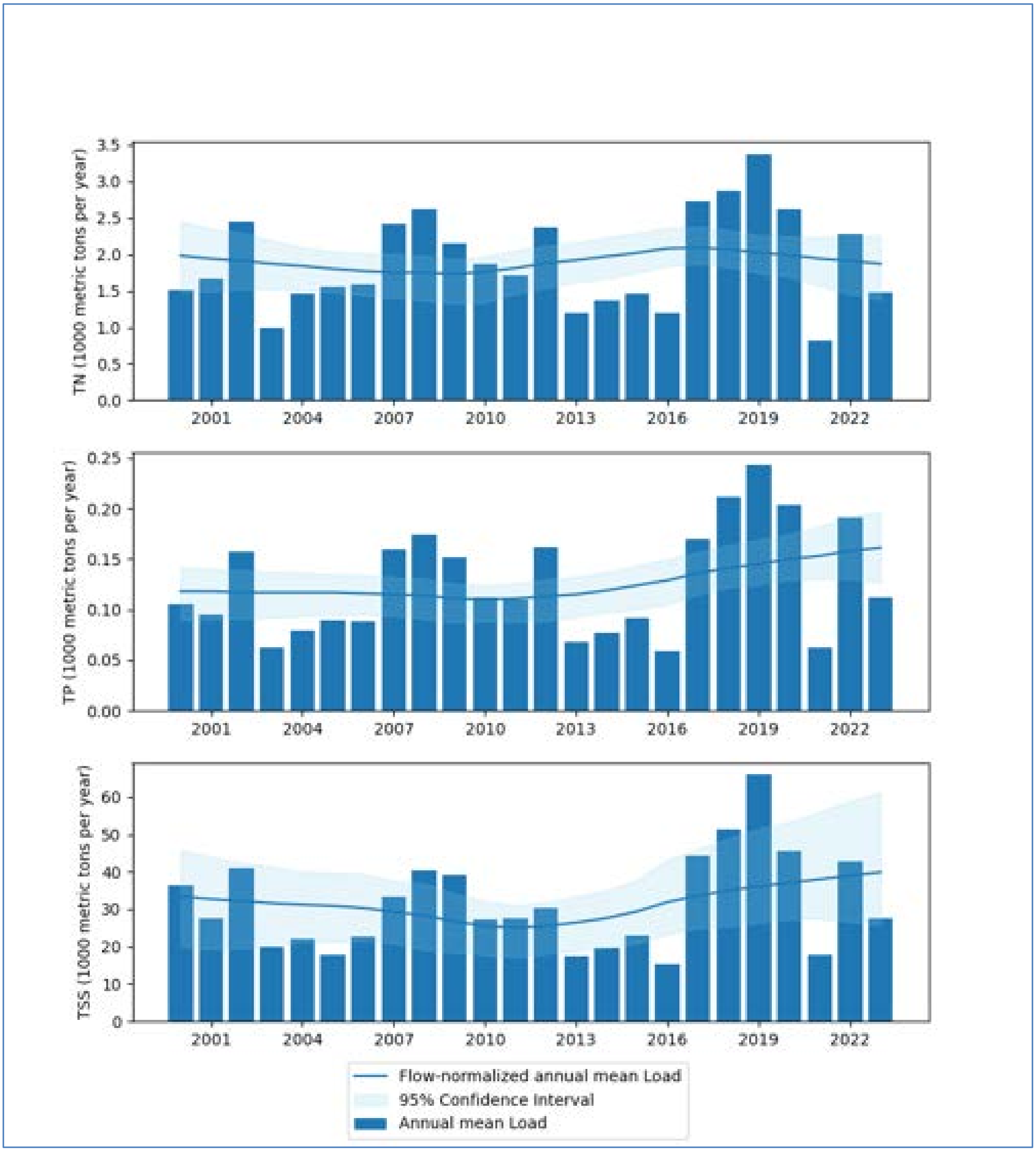


Figure 17A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **St. Joseph River near Newville, IN (Im3)**.

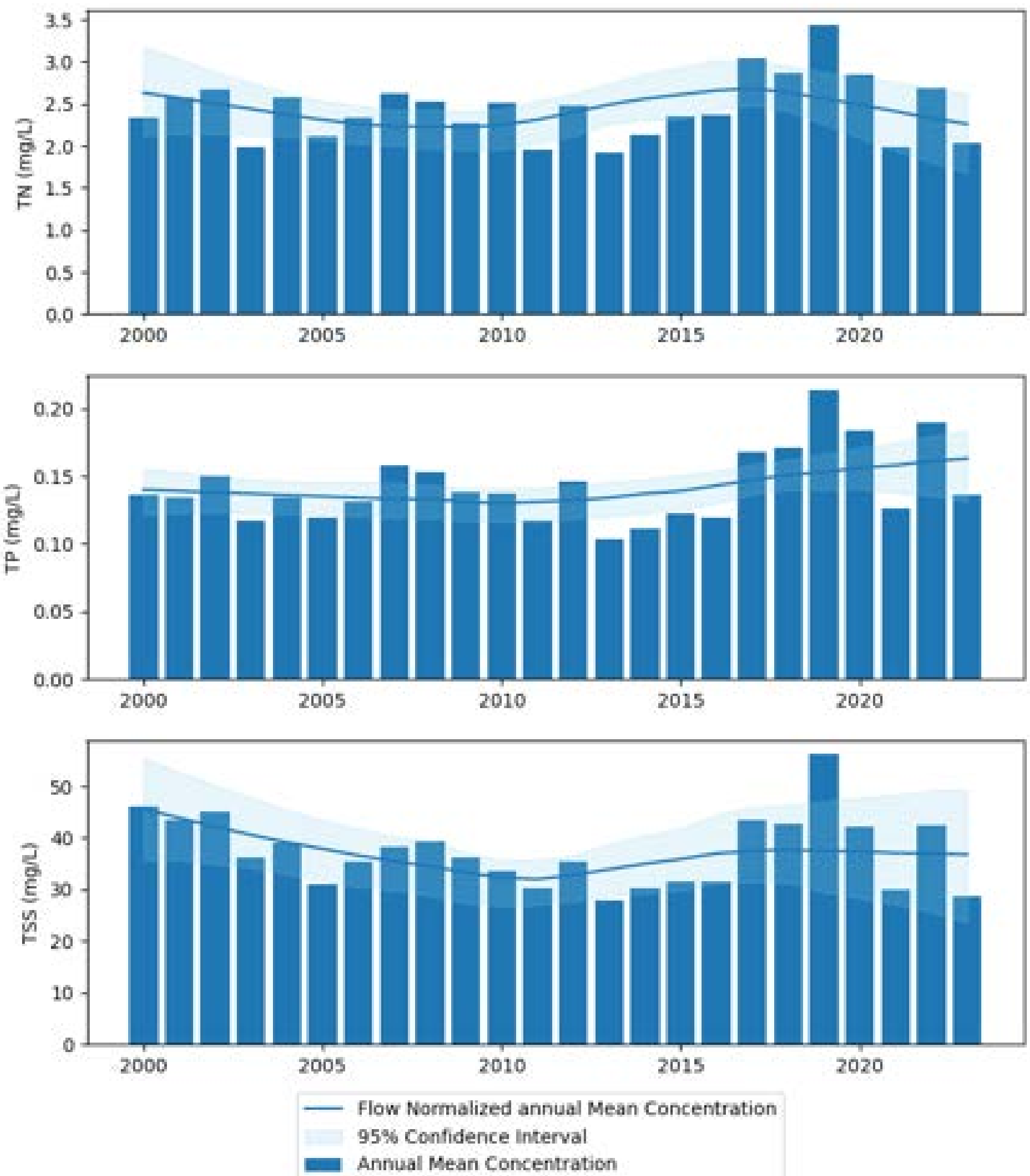


Figure 17B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **St. Joseph River near Newville, IN (Im3)**.

Interior Site

Maumee River at New Haven, IN (In8)
USGS Gage ID 04183000
IDEM station ID LEM010-0014

The USGS streamgage site and the IDEM station are co-located at this location, and they are located in New Haven, IN in Allen County in northeast Indiana. This location captures the impact of Fort Wayne, Indiana on the Maumee River, as well as the St. Marys River watershed and the St. Joseph River watershed. The watershed covers all or parts of 6 Indiana counties, as well as parts of Michigan and Ohio. The St. Joseph River and the St. Marys River come together in Fort Wayne, Indiana to form the Maumee River that drains to Ohio and eventually empties into the western basin of Lake Erie at Toledo, Ohio.

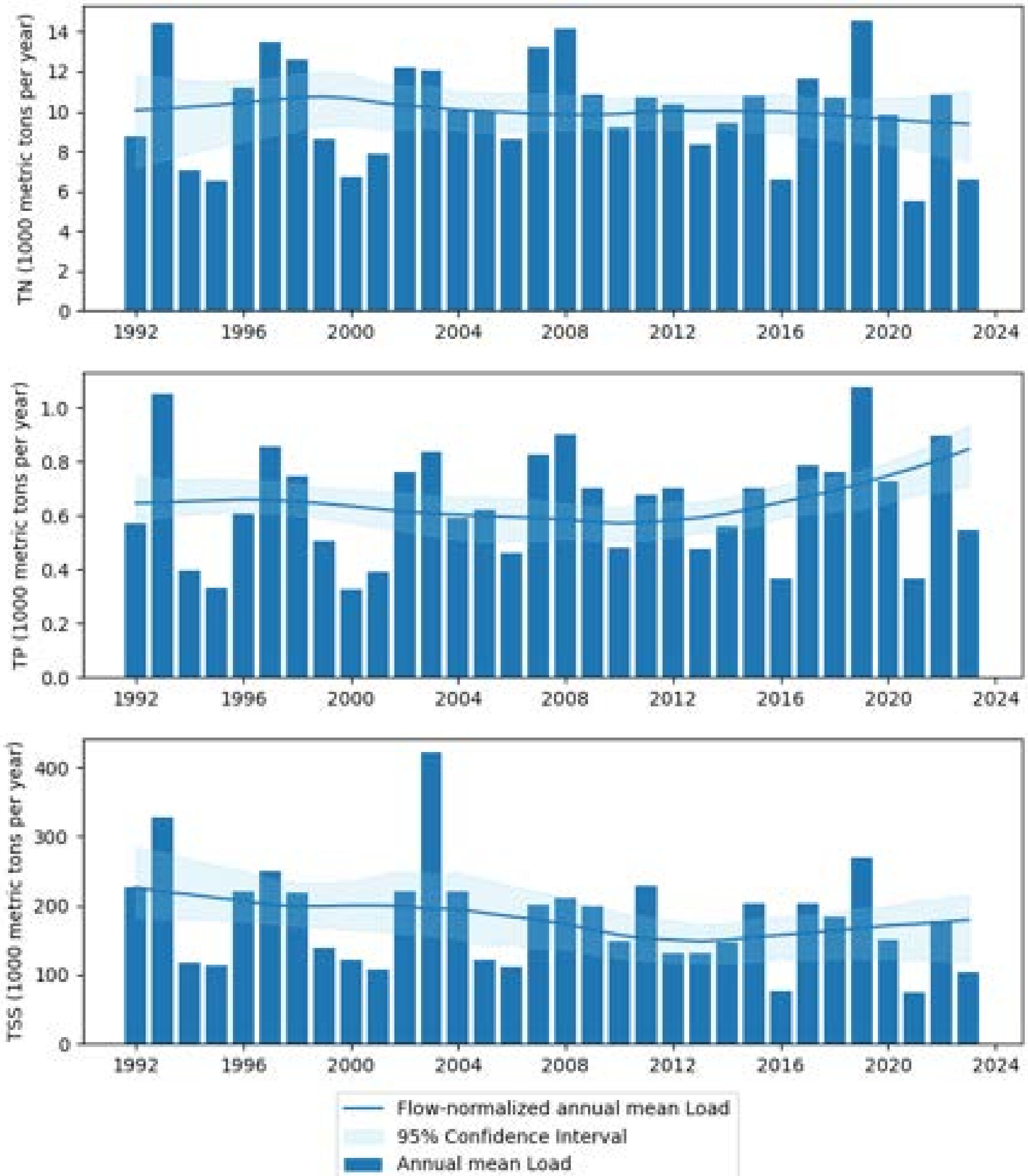


Figure 18A – Trend in flow-normalized mean **load** and annual mean **load** over time for the total trend period of data available for this site on the **Maumee River at New Haven, IN (In8)**.

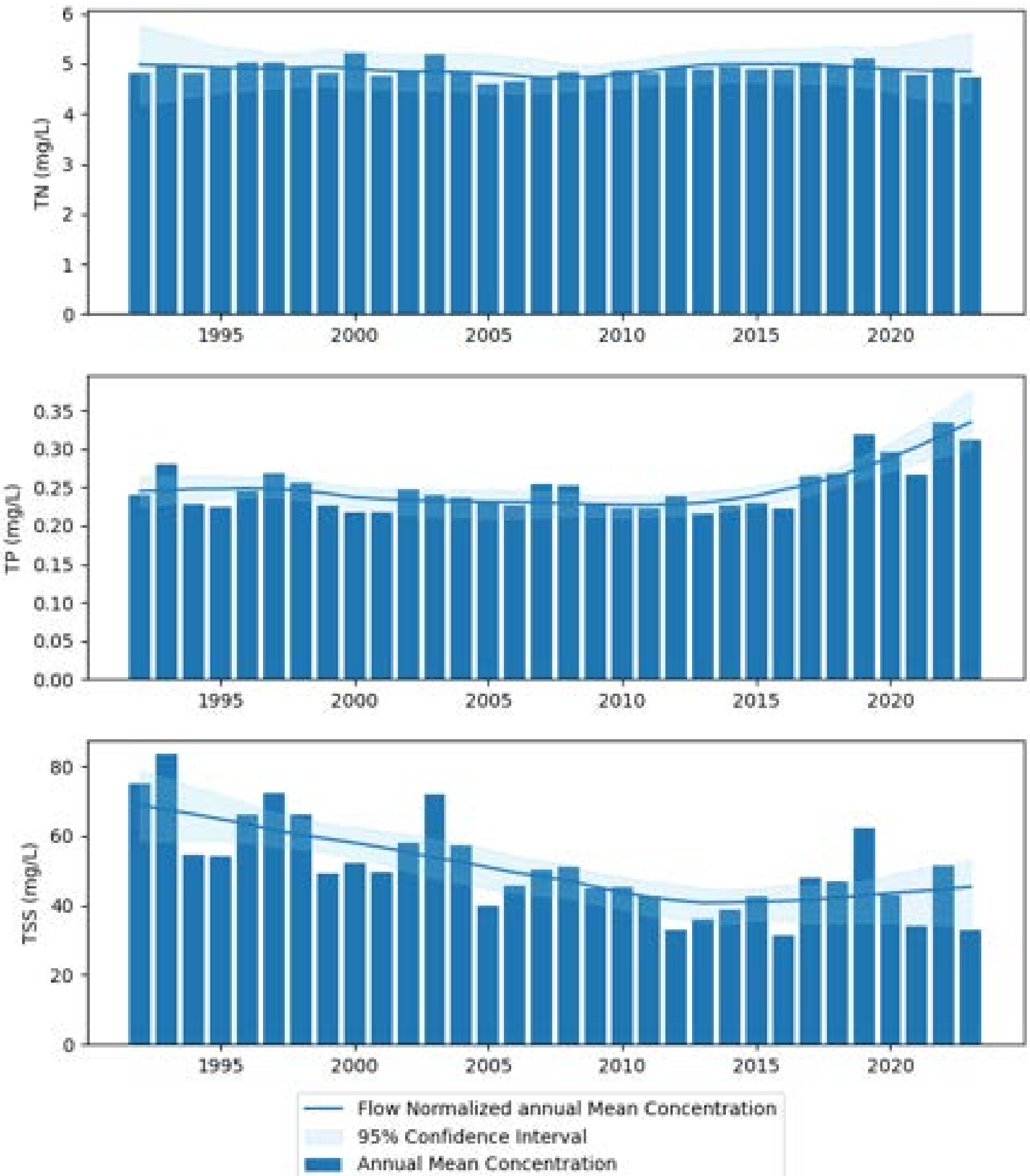


Figure 18B – Trend in flow-normalized mean **concentration** and annual mean **concentration** over time for the total trend period of data available for this site on the **Maumee River at New Haven, IN (In8)**.