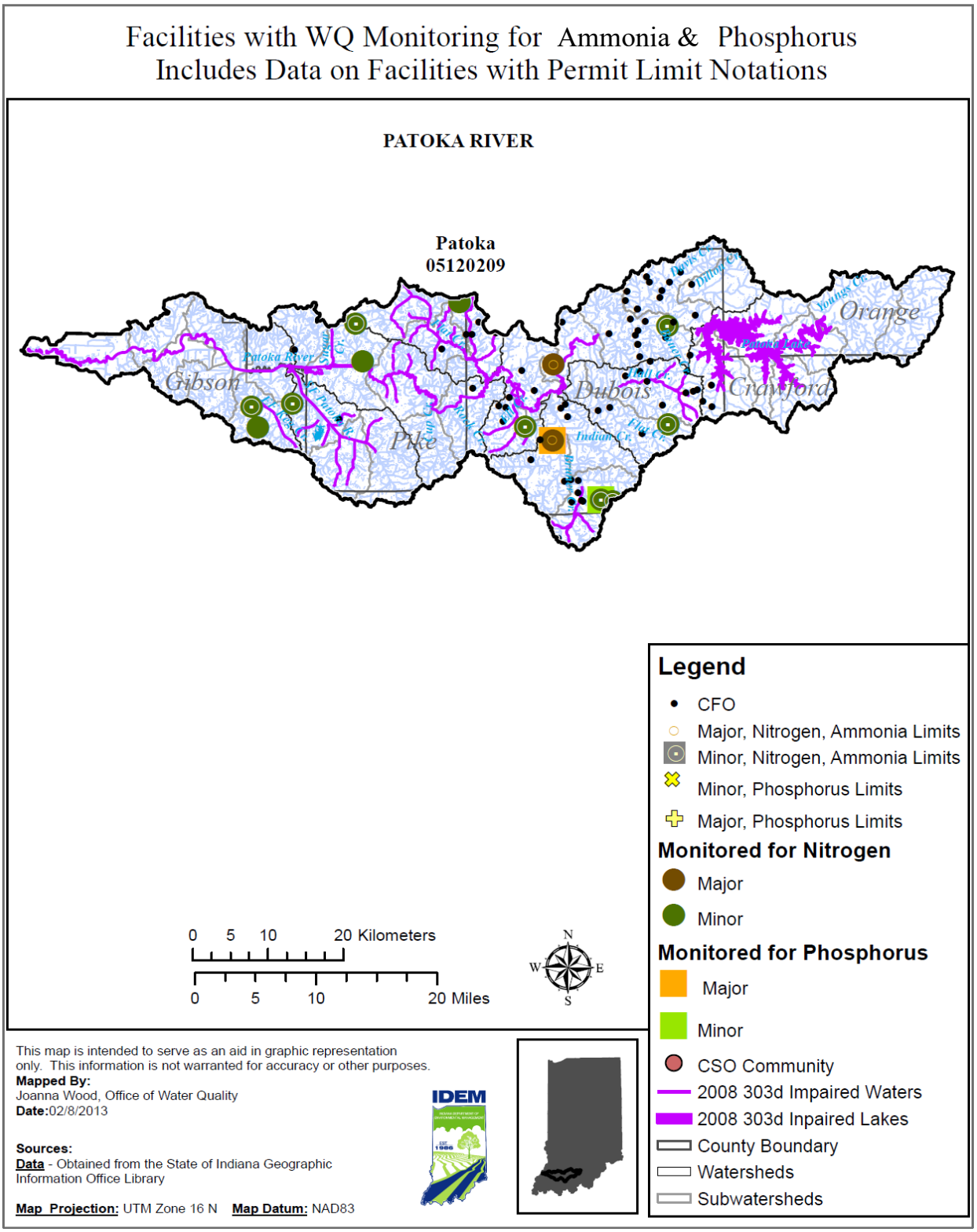
Appendix A – Acronyms

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
CEES	Center for Earth and Environmental Services (IUPUI)
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
EPRI	Electrical Power Research Institute
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	Ground Water
GWMN	Ground Water Monitoring Network
HAB	Harmful Algal Bloom
HFRP	Healthy Forest Reserve Program
HRI	Healthy Rivers Initiative (IDNR)
HTF	Hypoxia Task Force (Gulf of Mexico)
HUC	Hydrologic Unit Code
IANA	Indiana Agriculture Nutrient Alliance
IASWCD	Indiana Association of Soil and Water Conservation Districts
IAC	Indiana Administrative Code

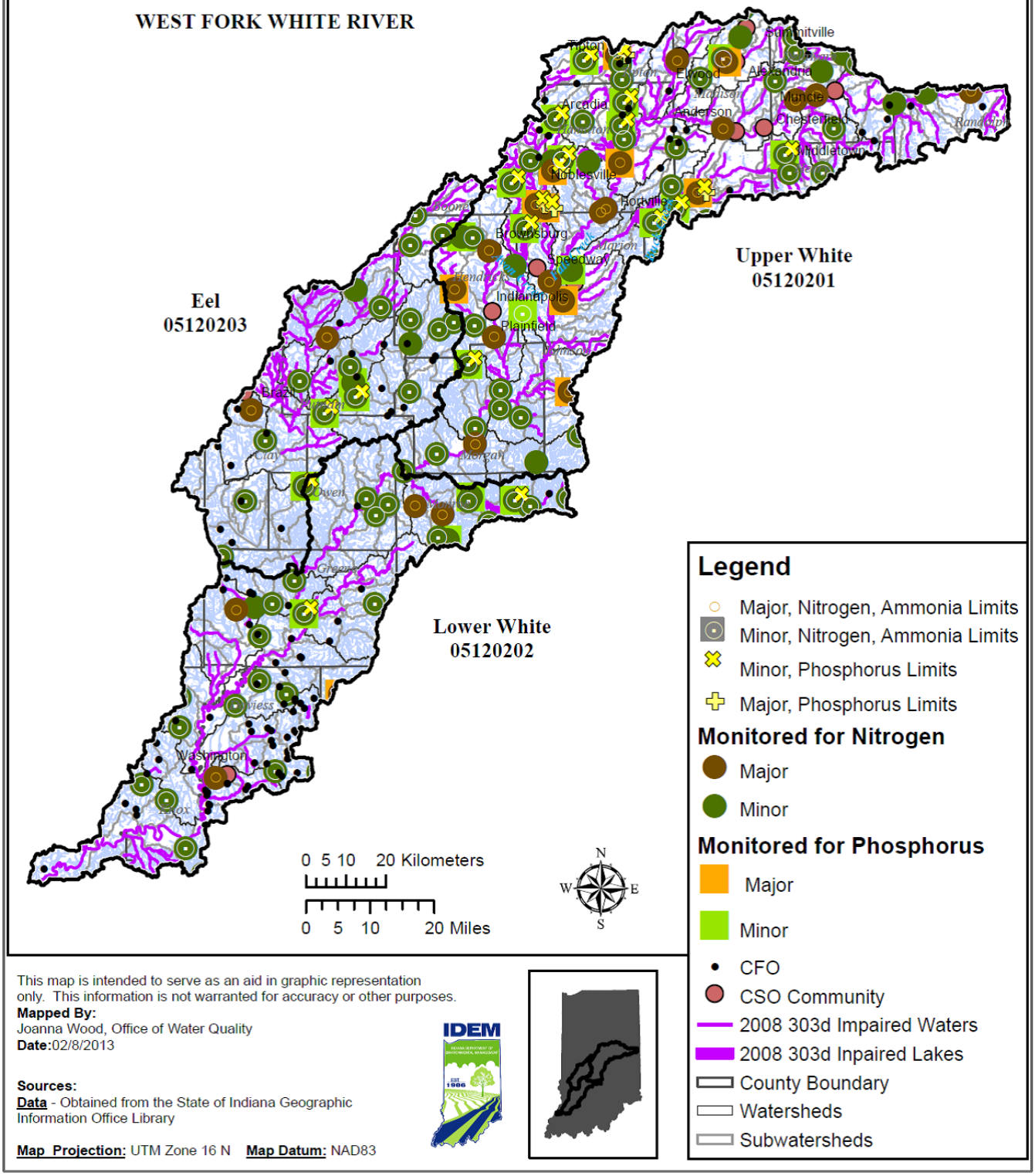
ICP	Indiana Conservation Partnership
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IGS	Indiana Geological Survey
INFA	INfield Advantage
INFB	Indiana Farm Bureau
InWMC	Indiana Water Monitoring Council
ISDA	Indiana State Department of Agriculture
ISDH	Indiana State Department of Health
IUPUI	Indiana University-Purdue University Indianapolis
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	Non-Point Source
NRCS	Natural Resources Conservation Service (USDA)
NREF	Nutrient Reduction Estimation Framework
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
USDA	United States Department of Agriculture
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 – Permitted Facilities with Water Quality Monitoring for Ammonia and Phosphorus



Facilities with WQ Monitoring for Ammonia & Phosphorus
Includes Data on Facilities with Permit Limit Notations



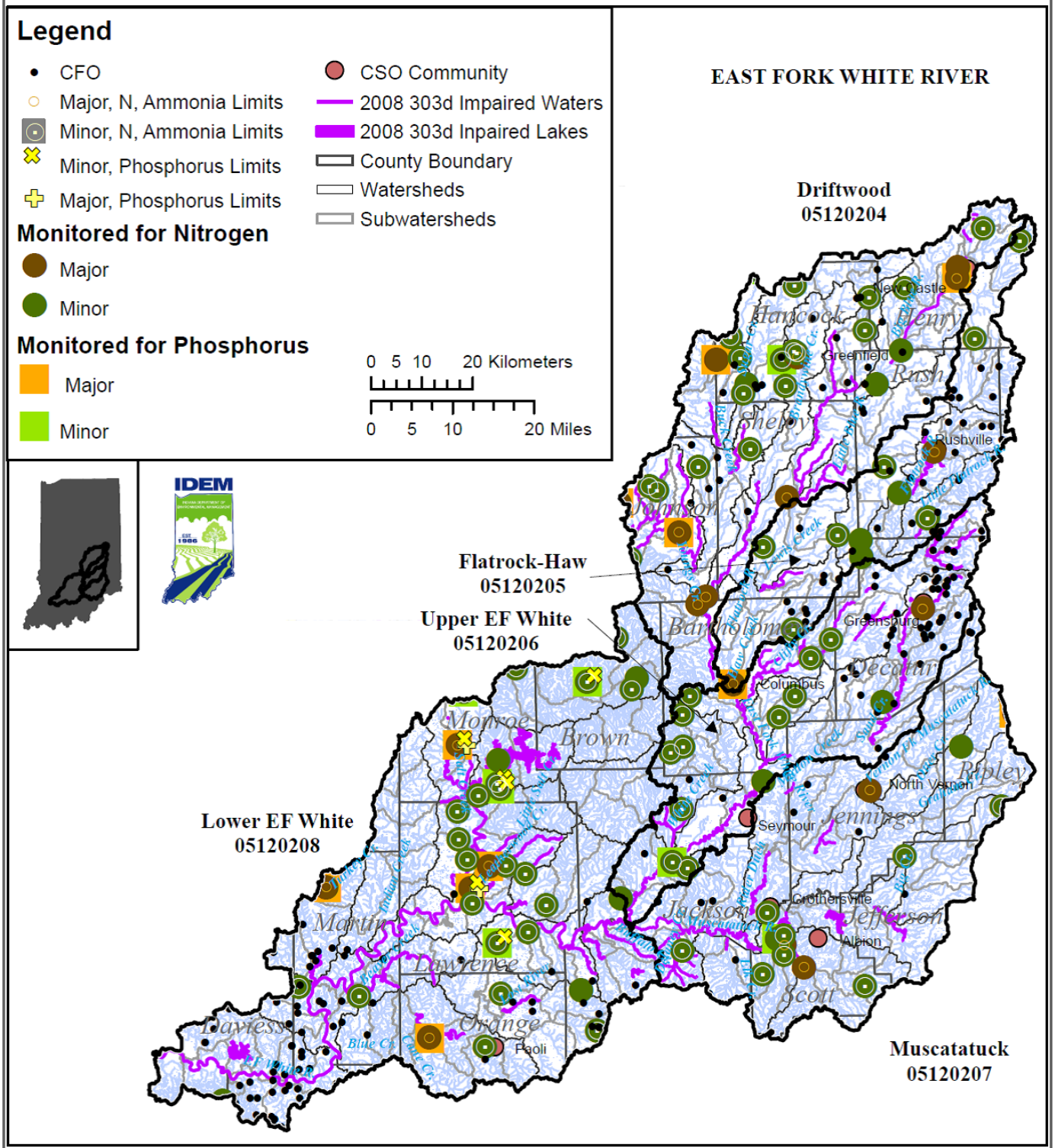
This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes.

Mapped By:
Joanna Wood, Office of Water Quality
Date:02/8/2013

Sources:
Data - Obtained from the State of Indiana Geographic Information Office Library

Map Projection: UTM Zone 16 N **Map Datum:** NAD83

Facilities with WQ Monitoring for Ammonia & Phosphorus
Includes Data on Facilities with Permit Limit Notations



Sources:
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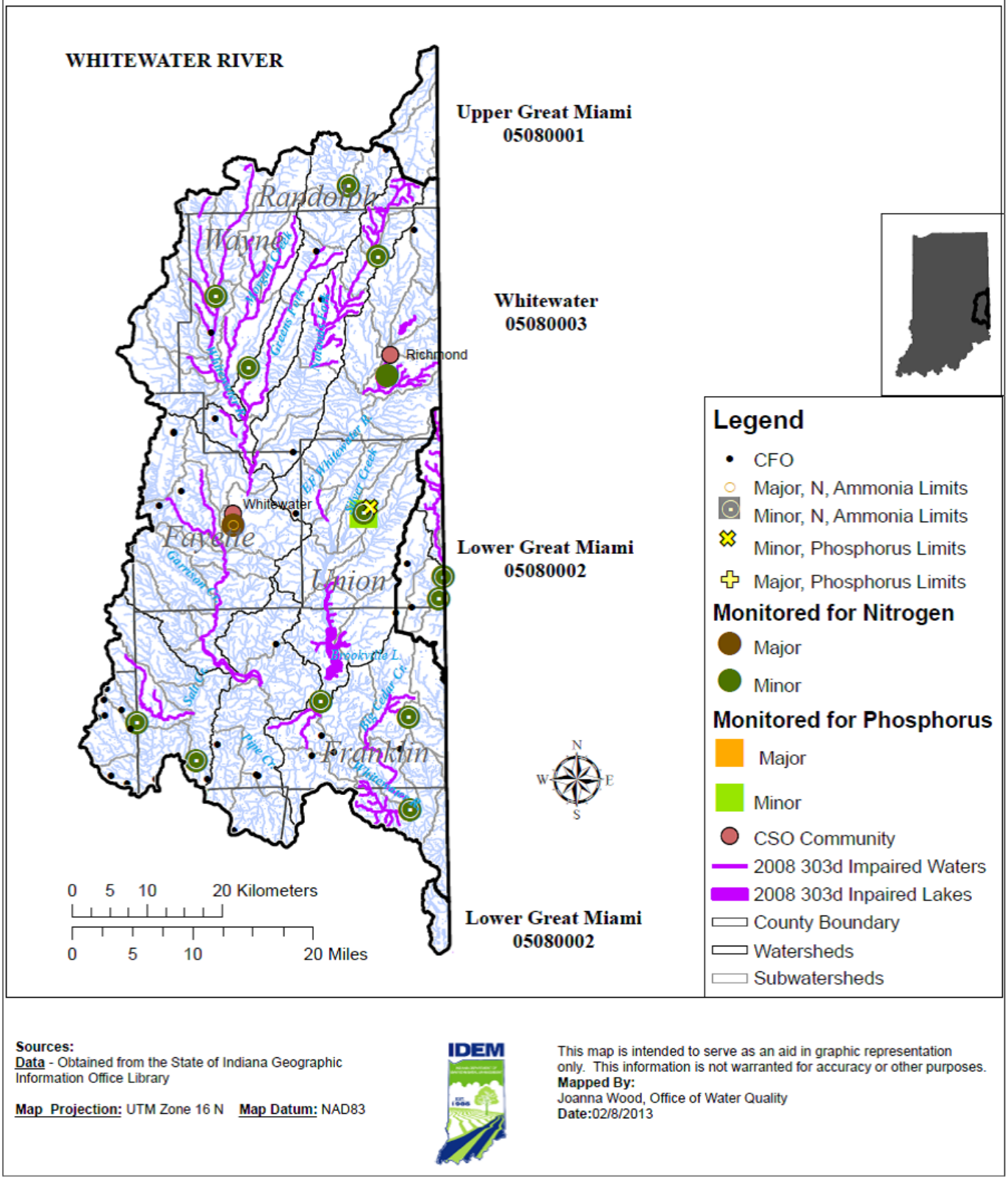

Sources:
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IDEM

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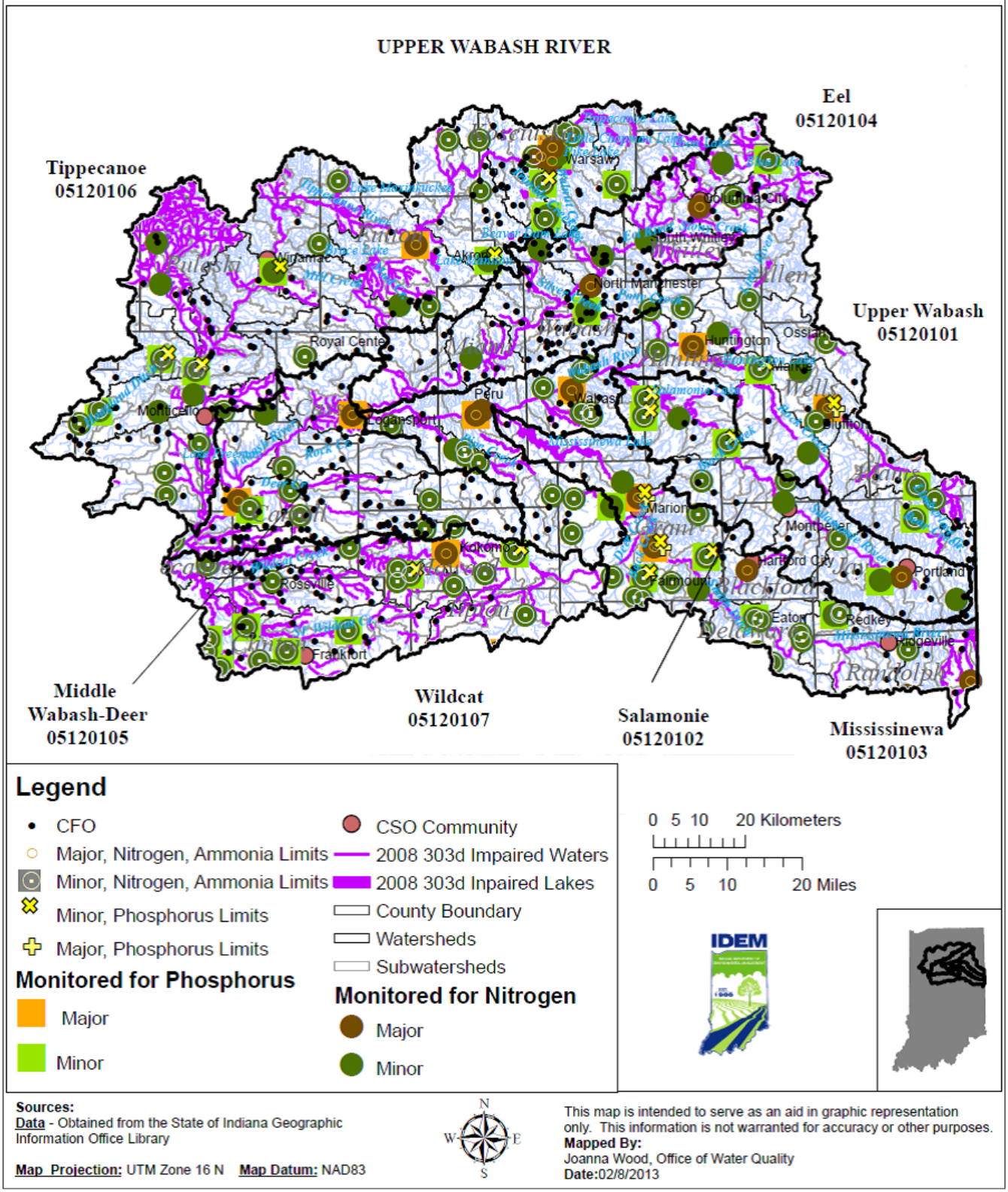

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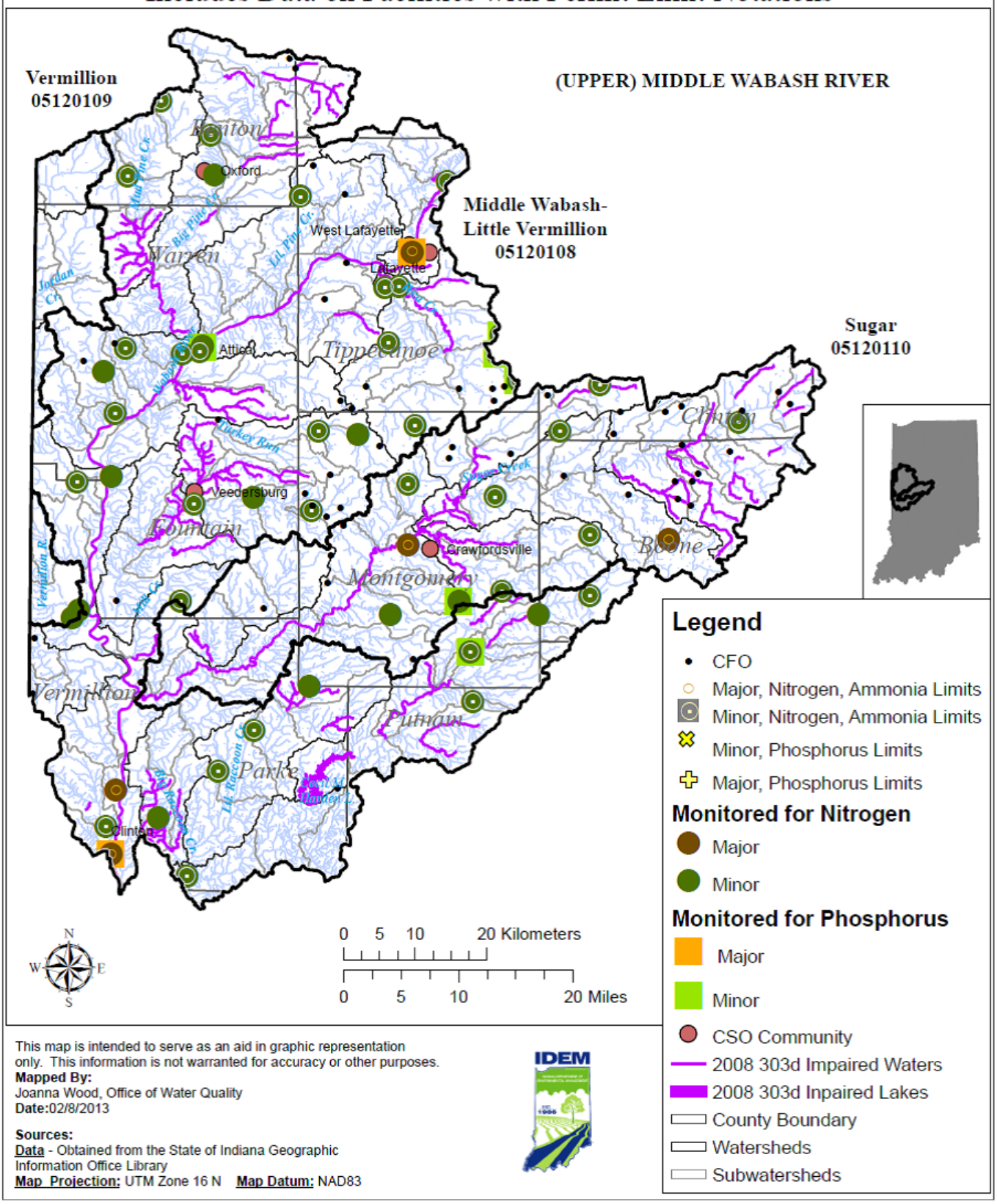

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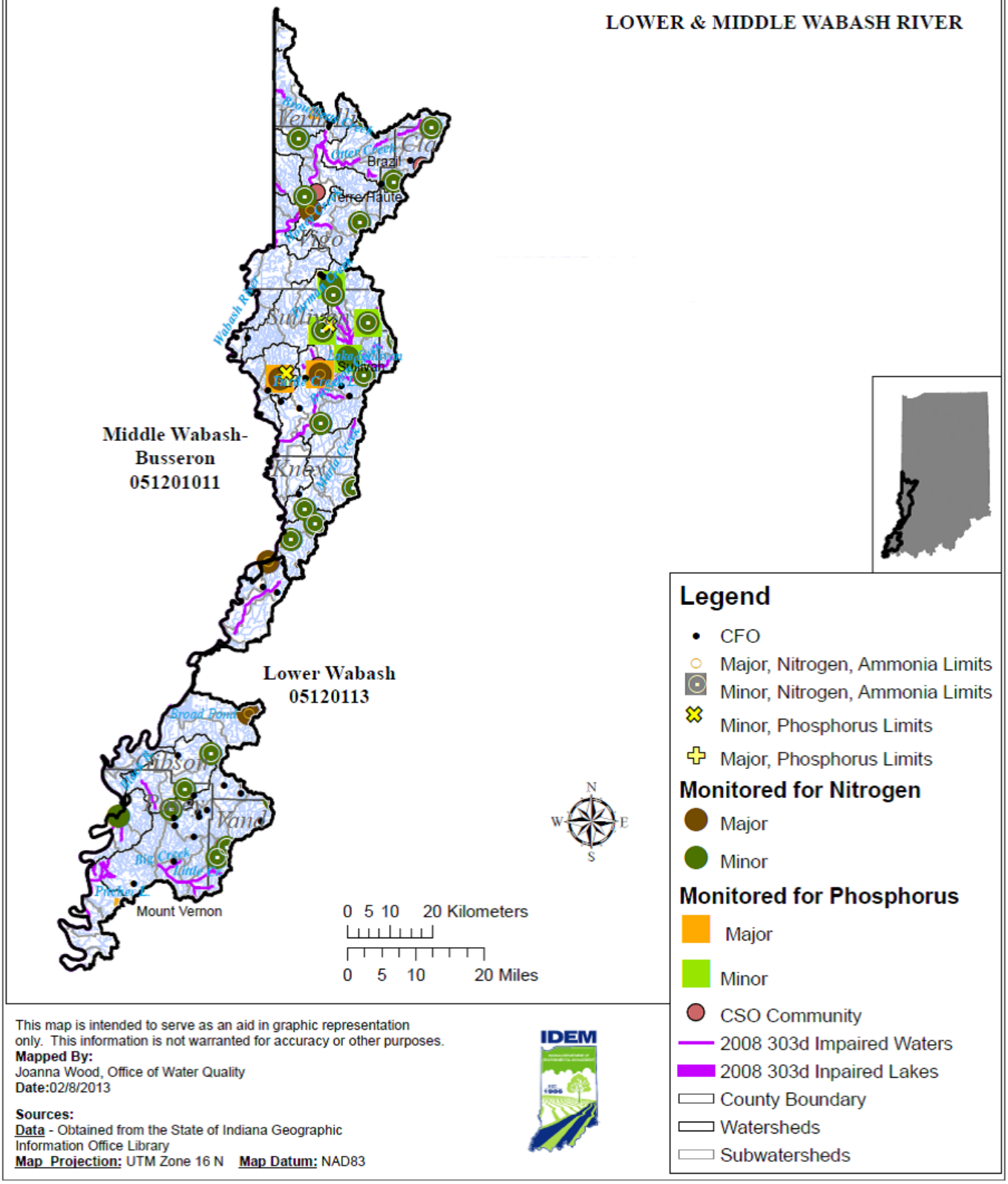

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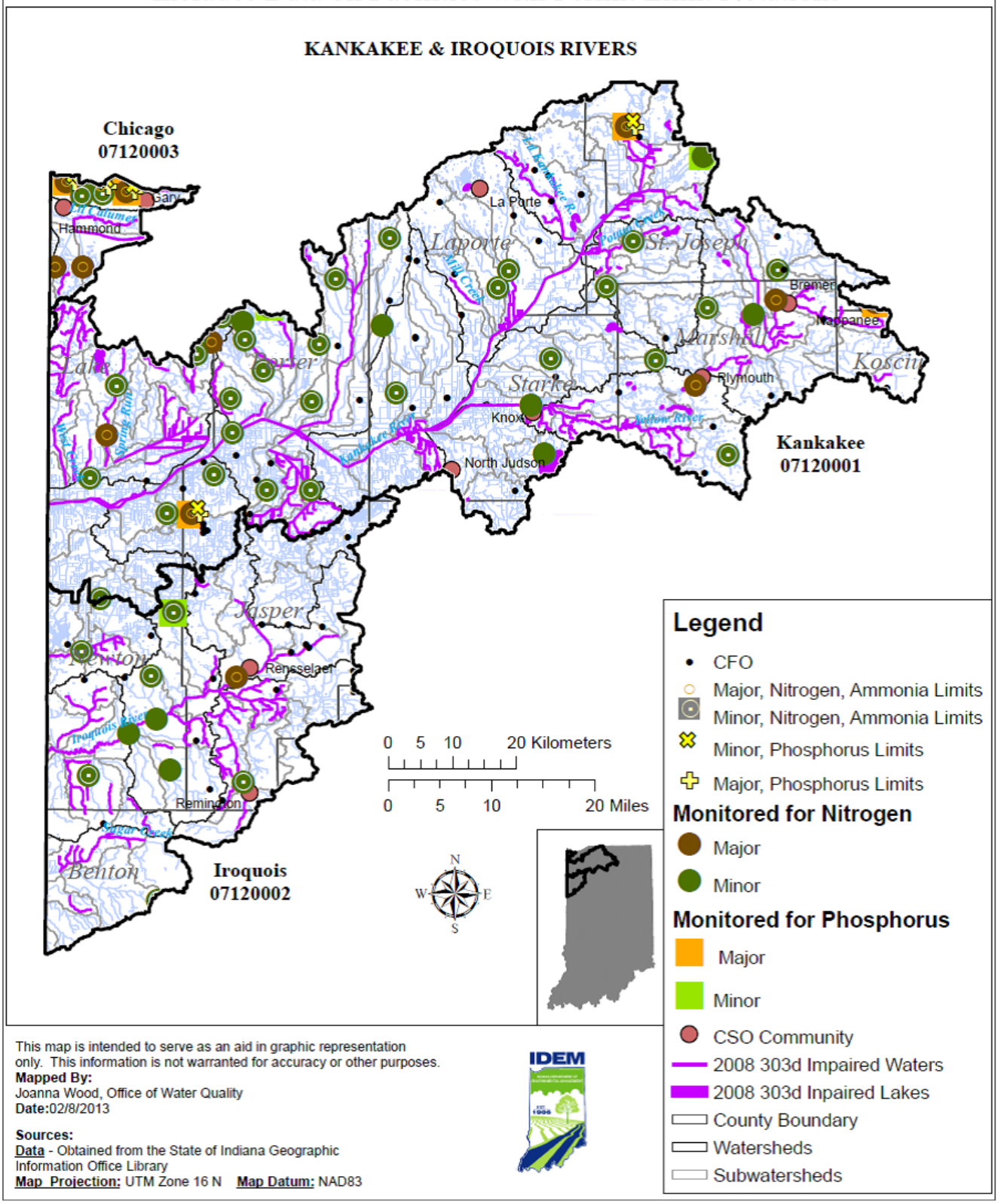

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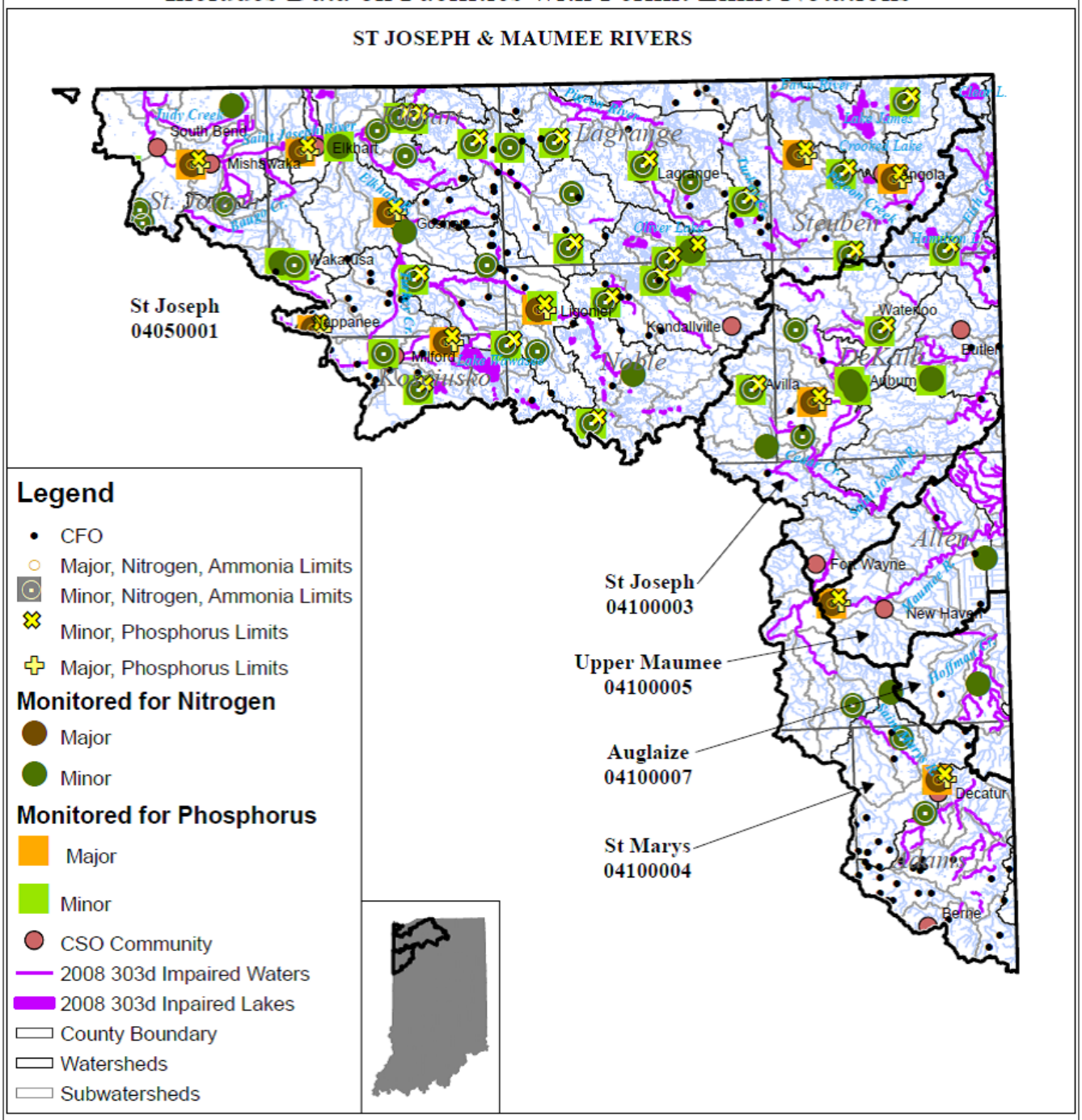

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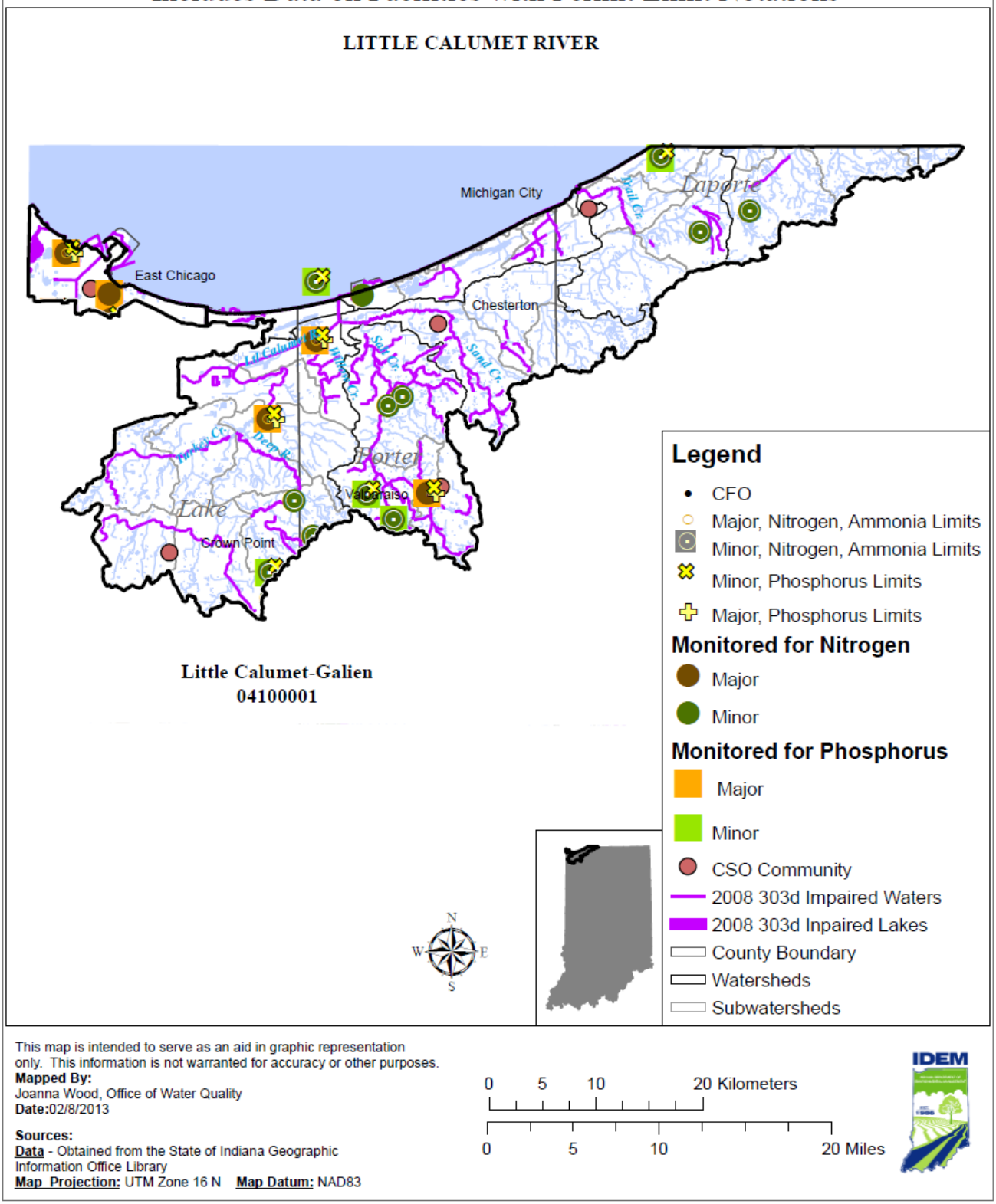
N W E S

0 5 10 20 Kilometers

0 5 10 20 Miles

IDEM

Facilities with WQ Monitoring for Ammonia & Phosphorus
Includes Data on Facilities with Permit Limit Notations



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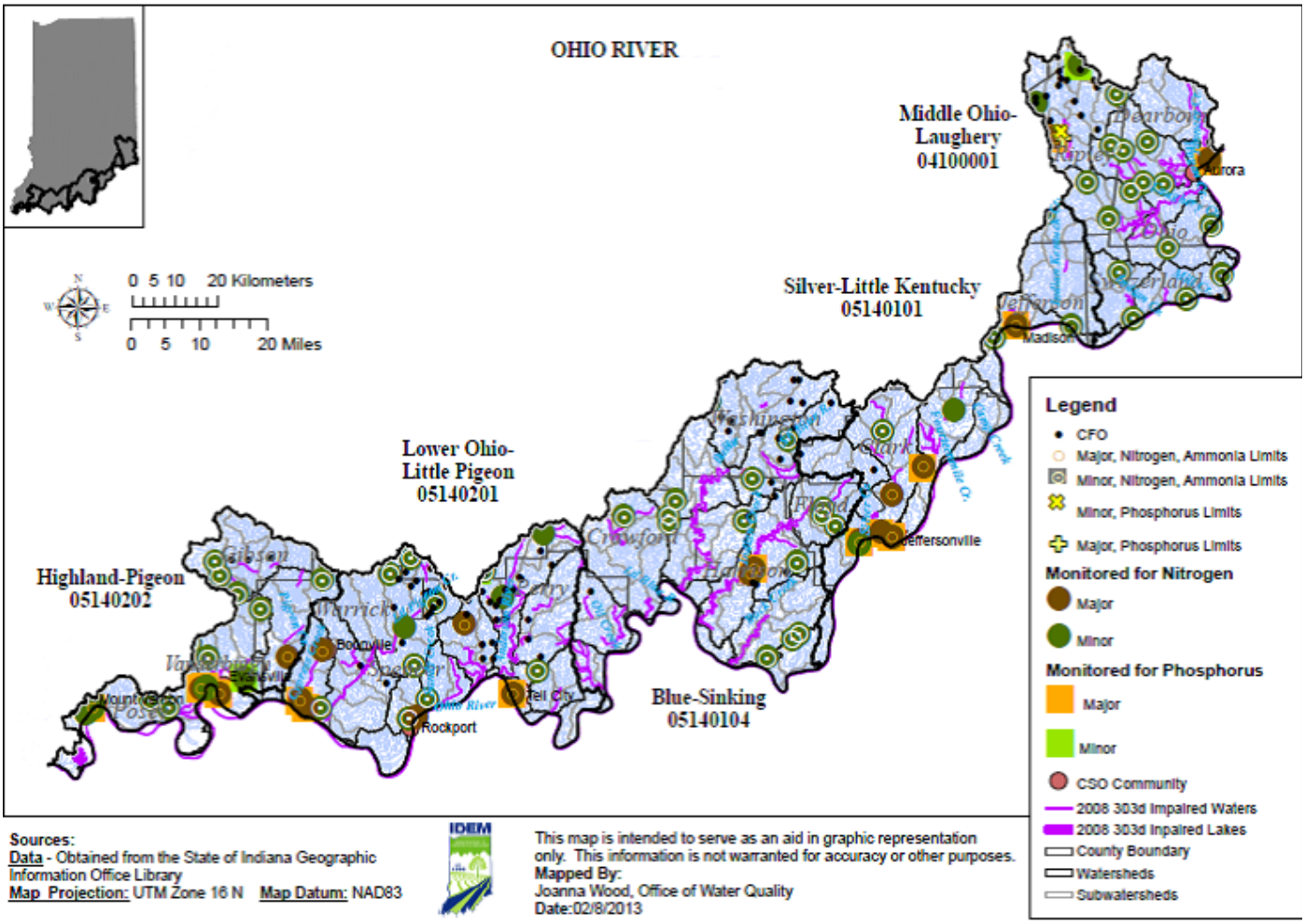

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Joanna Wood, Office of Water Quality
Date:02/8/2013

Appendix C – Indiana Science Assessment Strategy

Strategy for development of an Indiana Science Assessment
to Support the Indiana State Nutrient Reduction Strategy
September 2019

Background/Purpose

Indiana has developed a State Nutrient Reduction Strategy[1] (SNRS) to capture statewide, present and future endeavors in Indiana that positively impact the State's waters, as well as gauge the progress of conservation, water quality improvement and soil health practice adoption in Indiana. The Strategy has provided a foundation for nutrient reduction efforts across Indiana Conservation Partnership agencies and others, and has enhanced collaboration in conservation implementation.

This collaboration is demonstrated by Indiana's leadership in sharing conservation practice information among agencies within the Indiana Conservation Partnership[2] (ICP), which has allowed results of the Strategy and efforts across agencies to showcase the impacts of conservation practices. However, quantifying the nutrient load reductions and water quality improvement from individual conservation practices is scientifically challenging, and the current Indiana method for determining nutrient load reductions would benefit from using the most recent research and by including more parameters such as dissolved nutrients.

Indiana has made substantial progress in tracking sediment and nutrient load reductions statewide. Starting in 2013, the 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 Region 5 model is a model 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 dissolved nutrients such as nitrate and dissolved phosphorus are missing in the load calculations. Also, there are several practices that cannot be run through the Region 5 model due to the practice not being tied to sediment, such as nutrient management. The ICP would like to strengthen and improve this existing method of capturing nutrient load reductions so that dissolved nutrients and other practices not tied to sediment can be captured in the load calculations.

In November of 2018, Indiana held a workshop titled "Nutrient Reduction Estimation Framework" to coordinate the discussion on improving this method of nutrient load reduction estimation and tracking. The workshop included representatives from five agencies, five Indiana universities and colleges, as well as numerous agricultural and conservation organizations. The workshop had several goals, and it was agreed upon that Indiana needs a science assessment to:

1) Determine historic and ongoing nutrient loads leaving the state and also by basins, which can be used to set goals and provide an additional method for assessing progress,
2) Determine a load reduction method based on observed reductions,

[1] https://www.in.gov/isda/2991.htm
[2] The Indiana Conservation Partnership is comprised of eight agencies 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), and the Purdue Cooperative Extension Service (CES).

3) Provide agreed-on reduction estimates for conservation practices that could be used beyond the state's Nutrient Reduction Strategy,
4) Provide a foundation for speaking with one voice about conservation practices and priorities, and
5) Establish common statewide criteria for 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.

In other Midwest states (Illinois, Iowa, and Minnesota), science assessments have provided a strong scientific basis for their nutrient reduction strategies and led to a common voice describing needs and opportunities for nutrient reduction. A Science Assessment is critical for moving the Indiana's nutrient reduction strategy forward as well, and much work has been done in 2019 to move the Indiana Science Assessment forward. A Core Team of representatives from different conservation agencies around the state are working together to determine the scope of and components needed within the Assessment. The Core Team is made up of partners from the Indiana State Department of Agriculture (ISDA), the Indiana Natural Resources Conservation Service (NRCS), the Indiana Chapter of The Nature Conservancy (TNC), the Indiana Agriculture Nutrient Alliance[3] (IANA), the Indiana Department of Environmental Management (IDEM), and the Purdue University College of Ag. Refer to the organizational chart in Appendix A for more information on the partners involved and the components within the Indiana Science Assessment.

Components of the Science Assessment

The proposed Science Assessment would address two critical needs to move the State Nutrient Reduction Strategy forward.

1. **Component 1: Determine historic and ongoing nutrient loads leaving the state, and also by watershed basins used in the State Nutrient Reduction Strategy.** [4]

   Streamflow and nutrient concentrations collected at key locations will be combined using a statistically sound method for calculating the total load (in lbs. and concentration) and flow-weighted mean concentration leaving the state in each major river, and within each basin in the state.

[3] Partners of the Indiana Agriculture Nutrient Alliance include Agribusiness Council of Indiana, Indiana Farm Bureau, Indiana Soybean Alliance, Indiana Corn Marketing Council, Indiana Dairy Producers, American Dairy Association of Indiana, Indiana Pork, Indiana Poultry Association, Indiana Beef Cattle Association, USDA-NRCS, Indiana Association of SWCDs, Indiana State Department of Agriculture, Purdue University College of Agriculture, and The Nature Conservancy of Indiana.

[4] https://www.in.gov/isda/2991.htm - Version 5, page 25. The 10 major river and lake basins in the state are delineated to be consistent with IDEM's Probabilistic Water Quality Monitoring Strategy, with the exception of the Great Lakes Basin being split between Lake Erie and Lake Michigan watersheds.

The USGS Weighted Regressions on Time, Discharge, and Season (WRTDS)[5] model will be our method of processing concentration and flows into loads. The baseline period that we will use will be from 1980 – 1996 period, mirroring the Gulf of Mexico Hypoxia Task Force baseline period.

Action Steps (in no particular order):

A. Identify and use all relevant monitoring data, including USGS flow gages, USGS super gages, IDEM fixed stations, and USGS nutrient monitoring data where available, and possibly data from municipalities and local watershed groups.

B. IDEM will analyze the fixed-station network data for flow and concentration.

C. Data will be put into a consistent format that can be run through WRTDS.

D. Consensus by the Core-Team is that the computations of the monitoring data will be run through ISDA, similar to what was done at the New Harmony site in the Indiana SNRS.[6]

E. Analyzing water quality monitoring information to determine loads within each of the basins in the state will further help in prioritizing watersheds for more targeted conservation efforts in the future.

F. Communicate to conservation agencies and organizations, researchers, scientists are other important stakeholders on the monitoring data that is pulled together and explain the planned process of using the WRTDS and invite comments.

G. Secure and coordinate long-term monitoring support for identified key locations to illustrate progress towards SNRS and DAP efforts.

Key People: Mike Dunn (TNC), Julie Harrold and Trevor Laureys (ISDA), Marylou Renshaw (IDEM), and Jeff Fry (USGS)

2. **Component 2: 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 will be compiled, reviewed and be used to develop a standardized tool for calculating nutrient load reductions, and be used in determining the percent efficiency of certain conservation practices on reducing the nitrogen and phosphorus loads.

This component will also include having a collective list and consistent definitions of conservation practices while considering their estimated nitrogen and phosphorus loss reductions, as well as the economic and agronomic feasibility of the practices.

[5] https://nrtwq.uses.gov/mississippi_loads/#/
[6] https://www.in.gov/isda/2991.htm - Version 5, pages 12-14

Action Steps (in no particular order):

A. Determine and agree on definitions of conservation practices using the definitions in the NRCS Practice Standards as a starting point. May need to further define some of the definitions (example: types of nutrient management practices).

B. Determine and agree on the initial list of conservation practices that will be included under the Component #2 Work Plan for the EPA funds (described below). This selection will be based on past implementation data, and on the practices that tend to give the highest in load reductions. There is already a list of Ag practices/BMPs within the Indiana SNRS that are considered to be the most effective for nitrogen reduction and phosphorus reduction.[7]

C. Explore and compare existing models and calculators that could be used in determining nitrogen and phosphorus nutrient load reductions, including dissolved nutrients. Then use the outputs from these models, and compare the outputs and efficiencies. This will lead us to adopting a better, more scientific sound model for determining nutrient load reductions.

D. Have an "estimator" or "calculator" for determining reductions in tons and/or lbs., etc. that will be applied to practices implemented in Indiana. This will be implemented in a spreadsheet or similar computer software so that it is scalable to apply to thousands of practices. The method must also use good science, giving values that are "as real as possible".

E. The tool must be transparent, meaning a person with adequate expertise and exerting some effort can understand how reductions are determined. The tool must address both dissolved and particulate nutrients, transported through all key processes (attached to eroded soil, surface runoff, tile drains, etc.).

F. The ICP wants to continue to be able to use/show the data at many levels like we do now: by county, watershed, legislative district, significant waterbody, etc. – to share load reductions of conservation practices.

G. Need to also tie in in-field and edge-of-field monitoring data on conservation practices to help determine percent efficiencies of practices. This will help to ground truth the percent efficiencies.

H. The percent efficiencies determined from the models and the percent efficiencies determined from the in-field and edge-of-field monitoring studies can be compared.

I. Develop a table with a percent reduction (or range, or other format) for each practice. After determining the nutrient load reduction of a practice (through our adopted method), this will help determine what the efficiency is of that practice. Use the before and after load calculations for practices to determine a percentage.

J. This process will allow for prioritization of conservation practices on future conservation efforts.

[7] https://www.in.gov/isda/2991.htm - Version 5, Section 6, pages 44-49.

K. Following the completion of the Indiana Science Assessment, the list of practices and their associated load reductions and percent efficiencies will be reviewed each year to improve accuracy of the Science Assessment.

L. Communicate to conservation agencies and organizations, researchers, scientists are other important stakeholders on the information that has been found and compiled to enhance collaboration, and transparency and accuracy of the Indiana Science Assessment.

M. Determine the economic and agronomic feasibility of installing conservation practices by first determining the costs associated with installing certain conservation practices. This will lead us to understanding the dollars it will take to get a certain needed reduction, or a certain number of acres needed of a particular practice. We want to determine the scale of conservation needed in the state in order to reach a certain reduction in nutrient loading.

Key People: Julie Harrold (ISDA), Jane Frankenberger (Purdue University), Ben Wicker (IANA), Jill Reinhart (NRCS)

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.

Budget Narrative/Implementation Plan

Component #1 will be funded and carried out internally my members of the Core Team and the USGS. The goal for completion of Component #1 is to complete analysis and trends by the end of calendar year 2020, with a written report by the middle of calendar year 2021.

Budget needs within the Indiana Science Assessment are for carrying out Component #2. Within the Indiana Science Assessment, we seek to improve the existing method used by the ICP to calculate sediment, nitrogen and phosphorus loads reductions from implemented conservation practices, and to identify and list the efficiency of in-field and edge-field practices in reducing nutrient loads from agricultural sources to water. 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.

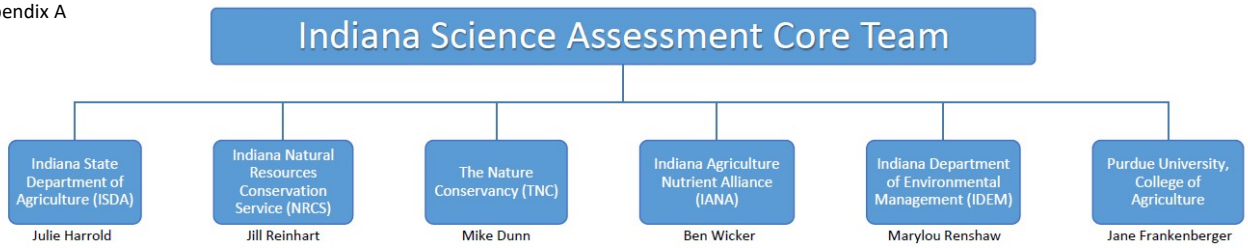
Needs for Component #2 include:

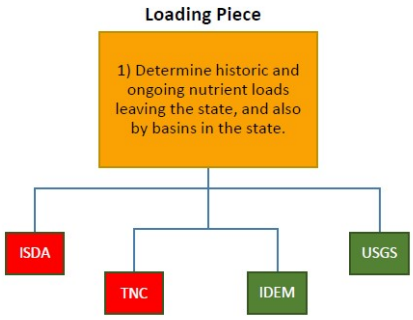
1. To compile the definitions of the conservation practices in the Science Assessment.
2. Conduct a literature review and meta-analysis of sediment and nutrient load reduction models, estimators, and/or calculators, which should include how to capture reductions from dissolved nutrients, as well as research and studies related to this topic.
3. Conduct a literature review and meta-analysis of water quality monitoring research and studies on conservation practice effectiveness, including in-field and edge-of-field research projects.
4. Compare analyses done on items 3 and 4 above to determine reductions of conservation practices in tons or lbs. and determine percent efficiencies of conservation practices.
5. Assist in the creation of a table that will show the reduction of conservation practices in tons or lbs. and in percent reduction for each practice.
6. Determine the costs associated with installing certain conservation practices and the economic feasibility of installing needed conservation practices (in order to reach a certain reduction in nutrient loading in the state).

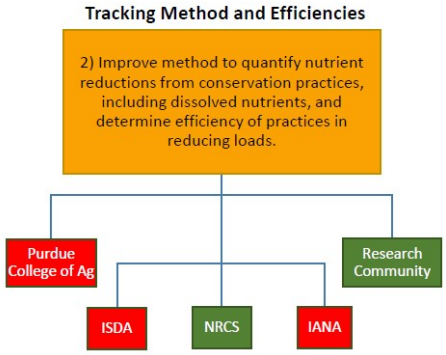
Component #2 will initially be funded with EPA dollars that were supplied to the state to support efforts within the Indiana State Nutrient Reduction Strategy. A work plan was submitted to EPA to hire a research associate who will work on the specific needs of Component #2 (further details are provided in the work plan). This individual will be interviewed and hired by the Core Team, and will work at Purdue University and be supervised by Dr. Jane Frankenberger. The goal for completion of Component #2 is by the end of calendar year 2022.

Throughout the development of the Indiana Science Assessment, the Core-Team will interact with the research associate and other stakeholders, making any modifications to ensure the assessment meets the State's needs, and makes the final product easily implementable and accessible in future years.

Appendix A


Indiana Science Assessment Core Team
Indiana State Department of Agriculture (ISDA)
Julie Harrold
Indiana Natural Resources Conservation Service (NRCS)
Jill Reinhart
The Nature Conservancy (TNC)
Mike Dunn
Indiana Agriculture Nutrient Alliance (IANA)
Ben Wicker
Indiana Department of Environmental Management (IDEM)
Marylou Renshaw
Purdue University, College of Agriculture
Jane Frankenberger


Loading Piece
1) Determine historic and ongoing nutrient loads leaving the state, and also by basins in the state.
ISDA
TNC
IDEM
USGS


Tracking Method and Efficiencies
2) Improve method to quantify nutrient reductions from conservation practices, including dissolved nutrients, and determine efficiency of practices in reducing loads.
Purdue College of Ag
ISDA
NRCS
IANA
Research Community