INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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Mike Braun
Governor

Clint Woods
Commissioner

Notice of 30-Day Period for Public Comment

Dear Sir or Madam,

The purpose of this letter is to notify you that a draft of the Indian Creek White River Watershed Total Maximum Daily Load (TMDL) report is available for public comment and to invite you to review the report on the IDEM website. The 30-day public comment period for the Draft TMDL report will begin on January 9, 2026, and will end on February 8, 2026. The draft TMDL report for the Indian Creek White River Watershed will be posted on IDEM's website at:

www.idem.IN.gov/nps/resources/total-maximum-daily-load-reports/indian-creek-white-river-watershed

At the stakeholder meeting, the Indiana Department of Environmental Management (IDEM) provided an overview of the draft TMDL report and provided an opportunity for public comments. The stakeholder meeting was held on **September 23, 2025, at 6:00 PM EDT** at:

Knox County SWCD
604 S Quail Run Rd,
Vincennes, IN 47591

A hard copy of the report can also be requested in writing. **All comments must be in writing and postmarked, emailed, or faxed by close of business (5:00 p.m.) on February 8, 2026.** Written comments and requests for a hard copy of the report can be sent to:

Zoey Benton
MC65-44 SHADELAND
100 North Senate Avenue
Indianapolis, IN 46204-2251

Comments can be emailed to: ZBenton@idem.IN.gov or faxed to: (317) 308-3237.

If you have questions regarding this stakeholder meeting, please contact Zoey Benton at (317) 308-3237. If you know of anyone else who might be interested in this meeting, please pass on this information. IDEM looks forward to your continued input to complete these TMDLs.

Sincerely,

Caleb Rennaker, Section Chief
Watershed Planning and Restoration Section
Office of Water Quality

To learn more about watersheds, TMDLs, and nonpoint source pollution, visit www.watersheds.in.gov

Total Maximum Daily Load Report for the Indian Creek White River Watershed

Public Notice Draft TMDL

Prepared for: U.S. Environmental Protection Agency Region 5

Prepared by: Indiana Department of Environmental Management

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Executive Summary

The Indian Creek White River watershed (HUC 0512020208) is located in southwest Indiana, covers an area of approximately 99 square miles, and drains approximately 5,077 square miles. The watershed originates in the southeast corner of Sullivan County. It flows south into Knox County and eventually Daviess County, where the White River intersects along the Knox-Daviess border. Ultimately, Indian Creek White River Watershed drains into the White River just before hitting US-50 near Maysville. Land throughout the watershed is predominantly used for agriculture, while forested areas are the second most abundant type of land use.

The Clean Water Act (CWA) and U.S. Environmental Protection Agency (U.S. EPA) regulations require that states develop Total Maximum Daily Loads (TMDLs) for waters on the Section 303(d) List of Impaired Waters. A TMDL is the total amount of a pollutant that can be assimilated by receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual waste load allocations (WLAs) for regulated sources and load allocations (LAs) for sources that are not directly regulated. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this is defined by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

This TMDL has been developed to address *E. coli*, biotic communities, nutrients, pH, and dissolved oxygen (DO) impairments in the Indian Creek White River watershed, in accordance with the TMDL Program Priority Framework. Parameters chosen for TMDL development include *E. coli,* total suspended solids (TSS), total phosphorus (TP), and hydrogen ions (H+). These parameters will be referred to cumulatively in this report as “pollutants”.

The Indian Creek White River Watershed TMDL was prioritized to be completed at this time based on local interest in addressing water quality, Indiana Department of Environmental Management (IDEM) interest in conducting baseline water quality monitoring for local planning, and a competitive Section 319 application from the local partners to develop a watershed management plan in conjunction with the IDEM sampling and TMDL development for streams impaired for *E. coli*, biological communities, nutrients, pH, and DO.

After IDEM identifies a waterbody as having an impairment and places the waterbody on Indiana’s Section 303(d) List of Impaired Waters, IDEM implements a sampling plan to determine the extent and the magnitude of the impairment. The next task is to reassess each of the identified waterbodies using new sampling data and to examine the watershed as a whole. The reassessment data helps IDEM identify the area of concern for TMDL development. As a result of the reassessment of the Indian Creek White River watershed, the pollutants and the impaired segments for which TMDLs were developed differ from those appearing on the 2024 Section 303(d) List because sampling performed by IDEM in 2023 and 2024 generated new

water quality data that were not available at the time the 2024 Section 303(d) List was developed.

Both historical and recent data were used for the TMDL analysis. Surveys of the Indian Creek White River watershed have been conducted as far back as 1957, when IDEM began conducting fixed station monitoring at a site along the White River. Fixed station monitoring is still conducted at that site to this day. Other historical surveys within the Indian Creek White River watershed include: 1987 Fish Tissue and Sediment, 1996 Synoptic and Watershed, 2006 Corvallis *E. coli*, 2011 Corvallis *E. coli* and Fish Tissue, 2019 Fish Tissue, and 2020 White River Mainstem.

Sampling data were collected at 16 sampling sites from November 2023 to October 2024 by IDEM for the TMDL analysis. The data indicates that 13 of the sample sites violated one or more of the Indiana Water Quality Standards (327 IAC 2).

Potential sources of high *E. coli*, impaired biological communities (IBC), excessive nutrients, low pH, and low DO levels in the watershed include both regulated point sources and nonpoint sources. Point sources (including municipal and industrial wastewater treatment plants (WWTPs), Public Water Supply (PWS) backwash, surface coal mining operations, and stormwater originating from categories of construction activities and industrial facilities) are regulated through the National Pollutant Discharge Elimination System (NPDES). Nonpoint sources such as unregulated urban stormwater, agricultural run-off, stream bank erosion, inappropriate waste disposal, wildlife, confined feeding operations (CFOs), pasture animals with access to streams, and faulty and failing septic systems are also potential sources.

Determining the specific reasons for high *E. coli* counts in any given waterbody is challenging. There are many potential sources, and *E. coli* counts are inherently variable. Within the Indian Creek White River watershed, subwatersheds with the greatest areas of hay and pastureland have the highest average *E. coli* counts. It is therefore possible that small unregulated farming operations that allow livestock to have direct access to streams in these subwatersheds are contributing to the elevated *E. coli* levels. However, with even more land being forested or in agricultural use throughout all of the subwatersheds, wildlife excrement, or the land application of manure, could also contribute to high *E. coli* levels. Additionally, being a rural watershed, other factors such as failing septic systems or illegal straight pipes could be affecting subwatersheds that also tend to experience lower flows and thus have less dilution. This is further supported by the lack of high *E. coli* levels on sites along the White River where flows are higher and thus more diluted. Specific sources of *E. coli* to each impaired waterbody should be further evaluated during follow-up implementation activities.

All subwatersheds in the Indian Creek White River watershed have IBC. Biological communities include fish and aquatic invertebrates. These in-stream organisms are indicators of the cumulative effects of activities that affect water quality conditions over time. An IBC listing on Indiana’s 303(d) List suggests that one or more of the aquatic biological communities is unhealthy as determined by IDEM’s monitoring data. IBC is not a source of impairment but a symptom of other sources. To address these impairments in the Indian Creek White River watershed, high TSS has been identified as a pollutant for TMDL development.

Within the Indian Creek White River watershed, Pickel Ditch subwatershed had cooccurring high TP and nitrogen loads, leading to a nutrient impairment. Run off from CFOs or other agricultural land use practices may be contributing to elevated TP and nitrogen loads. To address this impairment in the Pickel Ditch subwatershed, TP will be used as the pollutant for TMDL development

In Bens Creek, another subwatershed within the Indian Creek While River watershed, several instances of low pH were observed. Low pH in a stream can be caused by several potential sources and activities, including mine waste, historic mining activity, power plants and other sources of acidic gases, coal pile runoff, and the presence of heavy metals (https://www.epa.gov/caddis/ph#low). Low pH levels could be a result of historical mining practices in this subwatershed. pH is a characteristic of water quality rather than a quantifiable pollutant. pH is an expression of hydrogen ion concentration in water. Specifically, pH is the negative logarithm of hydrogen ion (H+) concentration (mol/L) in an aqueous solution. Because of this relationship, H+ will be used as the pollutant for TMDL development.

Two subwatersheds within the Indian Creek White River Watershed received DO impairments due to low DO levels. Industrial and municipal point sources, agricultural runoff, lack of riparian vegetation, and channel alteration are some of the ways DO levels can become too low or too high. Low dissolved oxygen levels can also be correlated with elevated levels of TSS by reducing light availability to aquatic plants and increasing oxygen demand. TSS was identified as the pollutant to address this impairment.

An important step in the TMDL process is the allocation of the allowable loads to individual point sources, as well as sources that are not directly regulated. The Indian Creek White River Watershed TMDL includes these allocations, which are presented for each of the 12-digit hydrologic unit code (HUC) subwatersheds containing impairments.

There are eight NPDES permitted facilities located in the Indian Creek White River watershed. These facilities include three municipal wastewater treatment plants, a public water supply facility, three surface coal mining operations and one major industrial facility. None of these facilities have been found to be in violation with their permitted limits for any of the pollutants of concern.

There are several types of documented and suspected nonpoint sources located in the Indian Creek White River watershed, including unregulated livestock operations with direct access to streams, agricultural row crop land use, straight pipes, leaking or failing septic systems, wildlife, historical mining practices and erosion. Although Indiana does not have a permitting program for nonpoint sources, many nonpoint sources are addressed through voluntary programs intended to reduce pollutant loads, minimize flow, and improve water quality.

This TMDL report identifies which locations could benefit the most from implementation activities. These areas throughout the Indian Creek White River watershed are referred to as critical conditions. This TMDL report also provides recommendations on the types of implementation activities, including best management practices (BMPs), that key implementation partners in the Indian Creek White River watershed can consider in order to achieve the pollutant load reductions calculated for each subwatershed. Table 1 presents potential critical areas which can be used to recommend BMPs identified as having a high likely degree of effectiveness to achieve the *E. coli*, TSS, TP, and H+ load reductions allocated to sources in each subwatershed. The critical condition for each TMDL is identified as the flow condition requiring the largest percent reduction based on a 90th percentile concentration of observed water quality data in each subwatershed and flow regime combination. A more detailed explanation of critical conditions can be found in Section 5.2.

Table 1: Critical Conditions for TMDL Parameters

Parameter	Subwatershed (HUC)	Critical Condition (% Reduction Needed)				
		High	Moist	Mid-Range	Dry	Low
E. coli (MPN/100mL)	Pollard Ditch (051202020801)	5.2	9.1	79.0	73.0	74.7
	Pickel Ditch (051202020802)	86.3	65.2	NA	97.7	95.4
	Bens Creek (051202020804)	—	92.0	NA	94.5	96.2
Total Suspended Solids (mg/L)	Pollard Ditch (051202020801)	31.9	NA	NA	NA	NA
	Pickel Ditch (051202020802)	NA	NA	NA	83.7	NA
	Smothers Creek (051202020803)	58.7	52.6	22.0	40.1	36.6
	Bens Creek (051202020804)	—	50.4	32.0	40.2	43.3
H+(mg/L)	Bens Creek (051202020804)	—	NA	NA	NA	88.6

Note: "—" = No Data Collected in Flow Regime; "NA" = No reduction needed

Table 2: Critical Conditions for Total Phosphorus TMDL

Parameter	Subwatershed (HUC)	Critical Condition (% Reduction Needed)
		Low Flow (25th Percentile)
Total Phosphorus (mg/L)	Pickel Ditch (051202020802)	57.3

Public participation is an important and required component of the TMDL development process. The following public meetings and public comment periods have been held to further develop this project:

- A kickoff public meeting was held in Vincennes, IN on September 26, 2023, to introduce the project and solicit public input. IDEM explained the TMDL process and presented initial information regarding the Indian Creek White River watershed. Questions from the public were answered, and information was solicited from stakeholders in the area.
- On July 16th and 17th, 2025, IDEM worked with the Knox County Soil and Water Conservation District (SWCD) to host a booth at the Knox County Fair. IDEM staff were on-site to explain their process for collecting water chemistry, fish (through electrofishing techniques), and macroinvertebrates. Results were discussed for the 2023-2024 IDEM sampling of the watershed. The details of the partnership between the Knox County SWCD and IDEM were detailed as well.
- On March 10, 2025, a notice was posted to the Indiana Register to inform stakeholders of new impairments discovered during the 2023-2024 watershed characterization study in the Indian Creek White River watershed. The notice outlined the findings of the study and listed proposed additions/deletions to the 2026 303(d) List of Impaired Waters. Public comments were solicited through April 24, 2025. IDEM received no comments regarding the notice.
- A draft TMDL public meeting was held in the watershed at the Knox County SWCD office in Vincennes, IN on September 23, 2025, at 6:00 PM. The draft findings of the TMDL were presented at the meeting and the public had the opportunity to ask questions and provide information to be included in the final TMDL report. Multiple representatives from the Knox County SWCD were in attendance. A public comment period was from January 9, 2026, to February 8, 2026. IDEM received no comments regarding the notice.

1.0 INTRODUCTION

This section of the Total Maximum Daily Load (TMDL) provides an overview of the Indian Creek White River watershed location and the regulatory requirements that have led to the development of this TMDL to address impairments in the Indian Creek White River watershed.

The Indian Creek White River Watershed TMDL was prioritized to be completed at this time based on local interest from the Knox County Soil and Water Conservation District (SWCD) in addressing water quality, IDEM interest in conducting baseline water quality monitoring for local planning, and a competitive Section 319 application from the local partners to develop a watershed management plan in conjunction with the IDEM sampling and TMDL development for streams impaired for *E. coli*, biological communities, nutrients, pH, and DO.

The Indian Creek White River watershed (HUC 0512020208), shown in Figure 1, is located in southwest Indiana and drains a total of 5077 square miles. The watershed originates in the southeast corner of Sullivan County. It flows south into Knox County and eventually Daviess County, where the White River intersects along the Knox-Daviess border. Ultimately, Indian Creek White River Watershed drains into the White River just before hitting US-50 near Maysville. Land throughout the watershed is predominantly used for agriculture, while forested areas are the second most abundant type of land use.

The Clean Water Act (CWA) and U.S. Environmental Protection Agency (U.S. EPA) regulations require that states develop TMDLs for waters on the Section 303(d) List of Impaired Waters. U.S. EPA defines a TMDL as the sum of the individual WLA for point sources and load allocations (LA) for nonpoint sources, and a margin of safety (MOS) that addressed the uncertainty in the analysis.

The overall goals and objectives of the TMDL study for the Indian Creek White River watershed are to:

- Assess the water quality of the impaired waterbodies and identify key issues associated with the impairments and potential pollutant sources.
- Determine current loads of pollutants to the impaired waterbodies.
- Use the best available science and available data to determine the total maximum daily load the waterbodies can receive while fully supporting the impaired designated use(s) that are impaired.
- If current loads exceed the maximum allowable loads, determine the load reduction that is needed.
- Inform and involve the public throughout the project to ensure that key concerns are addressed and the best available information is used.
- Identify critical flow conditions that watershed stakeholders can use to identify critical areas.

- Recommend activities for purposes of TMDL implementation.
- Submit a final TMDL report to the U.S. EPA for review and approval.

Watershed stakeholders and partners can use the final approved TMDL report to create a watershed management plan (WMP) that meets both U.S. EPA's nine minimum elements under the CWA Section 319 Nonpoint Source Program, as well as the additional requirements under IDEM's WMP Checklist.

Figure 1: Location of the Indian Creek White River Watershed

1.1 Water Quality Standards

Under the CWA, every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the CWA's goal of "swimmable/fishable" waters. Water quality standards consist of three different components:

- **Designated uses** reflect how the water can potentially be used by humans and how well it supports a biological community. Examples of designated uses include aquatic life support, drinking water supply, and full body contact recreation. Every waterbody in Indiana has a designated use or uses; however, not all uses apply to all waters. The Indian Creek White River watershed TMDLs focus on protecting the designated aquatic life support and full body contact recreational uses of the waterbodies.
- Criteria express the condition of the water that is necessary to support the designated uses. **Numeric criteria** represent the concentration of a pollutant that can be in the water and still protect the designated use of the waterbody. **Narrative criteria** are the general water quality criteria ("free from…") that apply to all surface waters. A combination of numeric and narrative criteria, using numeric targets, was used for *E. coli*, DO, nutrients, pH, and Impaired Biotic Communities (IBC) as the basis of the Indian Creek White River Watershed TMDLs. In absence of state adopted numeric water quality standards, target values were used through interpretation of the narrative criteria.
- **Antidegradation** policies provide protection of existing uses and extra protection for high-quality or unique waters.

The water quality standards in Indiana pertaining to *E. coli*, DO, nutrients, pH, and IBC are described below.

1.1.1 *E. coli*

E. coli is an indicator of the possible presence of pathogenic organisms (e.g., enterococcal *E. coli*, viruses, and protozoa) which may cause human illness. Direct monitoring of these pathogens is difficult; therefore, *E. coli* is used as an indicator of potential fecal contamination. *E. coli* is a sub-group of fecal coliform; the presence of *E. coli* in a water sample indicates recent fecal contamination is likely. Concentrations are typically reported as the count of organisms in 100 milliliters of water (count/100 mL) or most probable number (MPN/100 mL) and may vary at a particular site depending on the baseline *E. coli* level already in the river, inputs from other sources, dilution due to precipitation events, and die-off or multiplication of the organism within the river water and sediments.

The numeric *E. coli* criteria associated with protecting the recreational use are described below.

> *"The criteria in this subsection are to be used to evaluate waters for full body contact recreational uses, to establish wastewater treatment requirements, and to establish effluent limits during the recreational season, which is defined as the months of April through October, inclusive. E. coli bacteria, shall not exceed one hundred twenty-five (125) per one*

hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period. . . However, a single sample shall be used for making beach notification and closure decisions." [Source: Indiana Administrative Code Title 327 Water Pollution Control Board. Article 2. Section 1-6(a).]

1.1.2 DO

DO found in water is essential to healthy streams and lakes. The DO measurement can indicate the level of pollution in the water and how well the water can support aquatic plant and animal life. Generally, a higher DO level indicates better water quality. If DO levels are too low, some fish and other organisms may not be able to survive.

Much of the DO in water comes from oxygen in the air that has dissolved in the water. Some of the DO in the water is a result of photosynthesis of aquatic plants. Stream turbulence may also increase DO levels when air is trapped under rapidly moving water, dissolving the oxygen into the water. In addition, the amount of oxygen that can dissolve in water depends on temperature. Colder water can hold more oxygen than warmer water. Similarly, a difference in DO levels may be apparent at different depths of the water if there is a significant change in water temperature.

There are several reasons why a stream may have low DO. Industrial and municipal point sources, agricultural runoff, lack of riparian vegetation, and channel alteration are some of the potential contributors to low DO. Low DO levels can also be correlated with elevated levels of TSS by reducing light availability to aquatic plants and increasing oxygen demand. Temperature, turbulence, and the time the sample was taken could all contribute to the reading (www.idem.IN.gov/nps/watershed-assessment/water-monitoring-and-you/common-watershed-parameters). The target value used for the Indian Creek White River Watershed TMDL was based on the water quality criterion [327 IAC 2-1-6] which states the following:

"Concentrations of dissolved oxygen must: average at least five (5.0) milligrams per liter per calendar day; and not be less than four (4.0) milligrams per liter at any time." [Source: Indiana Administrative Code Title 327 Water Pollution Control Board. Article 2. Section 1-6 (a)(9)(b)(3).]

1.1.3 Nutrients

The term "nutrients" refers to the various forms of nitrogen and phosphorus found in a waterbody. Both nitrogen and phosphorus are necessary for aquatic life, and both elements are needed at some level in a waterbody to sustain life. The natural amount of nutrients in a waterbody varies depending on the type of system. A pristine mountain spring might have little to almost no nutrients, whereas a lowland, mature stream flowing through wetland areas might have naturally high nutrient concentrations. Streams draining larger areas are also expected to have higher nutrient concentrations.

Nutrients generally do not pose a direct threat to the designated uses of a waterbody. However, excess nutrients can cause an undesirable abundance of plant and algae growth through a process called eutrophication. Eutrophication can have many effects on a stream. One possible effect is low dissolved oxygen concentrations caused by excessive plant respiration and/or decay. Ammonia, which is toxic to fish at high concentrations, can be released from decaying organic matter when eutrophication occurs. For these reasons, excessive nutrients can result in the non-attainment of bio-criteria and impairment of the designated use.

Like most states, Indiana has not yet adopted numeric water quality criteria for nutrients. The relevant narrative criteria that apply to the TMDLs presented in this report state the following:

> *"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:" [327 IAC 2-1-6. Sec. 6. (a)(1)] …*
>
> *(a)re in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses." [327 IAC 2-1-6. Sec. 6. (a) (1)(D)]*
>
> *(a)re in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans." [327 IAC 2-1-6. Sec. 6. (a) (1)(E)]*

1.1.4 pH

pH is an expression of hydrogen ion concentration in water. Specifically, pH is the negative logarithm of hydrogen ion (H^+) concentration (mol/L) in an aqueous solution:

$$pH = -log10(H+)e$$

The term is used to indicate basicity or acidity of a solution on a scale of 0 to 14, with pH 7 being neutral. As the concentration of H^+ ions in a solution increases, acidity increases and pH gets lower. pH is a logarithmic function, one unit change in pH (e.g., 7 to 6) indicates a 10x change in H^+ concentration in that solution. However, what is actually measured is hydrogen ion activity, not concentration.

pH affects most chemical and biological processes in water. It is one of the most important environmental factors limiting species distributions in aquatic habitats. Fluctuating pH or sustained pH outside this range physiologically stresses many species and can result in decreased reproduction, decreased growth, disease or death. This can ultimately lead to reduced biological diversity in streams.

Even small changes in pH can shift community composition in streams. This is because pH alters the chemical state of many pollutants (e.g., copper, ammonia), changing their solubility, transport and bioavailability. This can increase exposure to and toxicity of metals and nutrients to aquatic plants and animals (https://www.epa.gov/caddis/ph). The target value used for the

Indian Creek White River Watershed TMDL was based on the water quality criterion [327 IAC 2-1-6] which states the following:

> *"In addition to subsection (a), the following minimum conditions are applicable in the surface waters outside of a mixing zone to ensure conditions necessary for the maintenance of a well-balanced aquatic community:" [327 IAC 2-1-6. Sec. 6. (9)(b)] …*
>
> *"No pH values below six (6.0) or above nine (9.0) are permitted, except daily fluctuations that: exceed pH nine (9.0); and are correlated with photosynthetic activity." [327 IAC 2-1-6. Sec. 6. (9)(b)(2)]*

1.1.5 Biological Communities

The water quality regulatory definition of a "well-balanced aquatic community" is *"an aquatic community which is diverse in species composition, contains several different trophic levels, and is not composed mainly of strictly pollution tolerant species"* [327 IAC 2-1-9(49)].

Impaired biotic communities (IBC) is not a source of impairment but a symptom of other sources. To address these impairments in the Indian Creek White River watershed, TSS has been identified as a pollutant for TMDL development. IDEM has not yet adopted numeric water quality criteria for total suspended solids (TSS). The relevant narrative criteria that apply to the TMDLs presented in this report state the following:

> *"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:" [327 IAC 2-1-6. Sec. 6. (a)(1)] …*
>
> *(a)re in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses." [327 IAC 2-1-6. Sec. 6. (a) (1)(D)]*
>
> *(a)re in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill, aquatic life, other animals, plants, or humans." [327 IAC 2-1-6. Sec. 6. (a) (1)(E)]*

In addition, the narrative biological criterion [327 IAC 2-1-3(2)] states the following:

> *"All waters, except those designated as limited use, will be capable of supporting a well-balanced, warm water aquatic community."*

Biological assessments for streams are based on the sampling and evaluation of either the fish communities, the benthic aquatic macroinvertebrate communities, or both. Indices of biotic integrity (IBI) for fish and macroinvertebrate (mIBI) assessment scores, or both, were calculated and compared to regionally calibrated models. In evaluating fish communities, streams rating as "poor" or worse are classified as non-supporting for aquatic life uses. For benthic aquatic macroinvertebrate communities, individual sites are compared to a statewide calibration at the lowest practical level of identification for Indiana. All sites at or above background for the calibration are considered to be supporting aquatic life uses. Those sites rated as moderately or severely impaired in the calibration are considered to be non-supporting. Waters with identified impairments to one or more biological communities are considered not supporting aquatic life use. The biological thresholds Indiana uses to make use attainment decisions are shown in Table 3 to provide greater context for understanding the range of biological conditions that is considered either fully supporting or impaired.

IDEM's aquatic life use assessments are never based solely on habitat evaluations. However, habitat evaluations are used as supporting information in conjunction with biological data to determine aquatic life use support. Such evaluations, which take into consideration a variety of habitat characteristics as well as stream size, help IDEM to determine the extent to which habitat conditions may be influencing the ability of biological communities to thrive. If habitat is determined to be driving a biotic community impairment (IBC) and no other pollutants that might be contributing to the impairment have been identified, the IBC may not be considered for inclusion on IDEM's 303(d) List of Impaired Waters (Category 5). In such cases, the waterbody is instead placed in Category 4C for the biological impairment.

Table 3: Indian Creek White River Watershed Aquatic Life Use Support Criteria for Biological Communities

Biotic Index Score and Associated Assessment Decision	Integrity Class	Corresponding Integrity Class Score	Attributes
Fish community Index of Biotic Integrity (IBI) Scores (Range of possible scores is 0-60)			
Fully Supporting IBI ≥ 36 Indicates Full Support	Excellent	53-60	Comparable to "least impacted" conditions, exceptional assemblage of species
	Good	45-52	Decreased species richness (intolerant species in particular), sensitive species present
	Fair	36-44	Intolerant and sensitive species absent, skewed trophic structure
Not Supporting IBI < 36 Indicates Impairment	Poor	23-35	Many expected species absent or rare, tolerant species dominant
	Very Poor	12-22	At least one species present, tolerant species dominant
	No Organisms	0	No fish captured during sampling.
Benthic aquatic macroinvertebrate community Index of Biotic Integrity (mIBI) Scores Multihabitat (MHAB) Methods (Range of possible scores is 12-60)			
Fully Supporting mIBI ≥ 36 Indicates Full Support	Excellent	53-60	Comparable to "least impacted" conditions, exceptional assemblage of species
	Good	45-52	Decreased species richness (intolerant species in particular), sensitive species present
	Fair	36-44	Intolerant and sensitive species absent, skewed trophic structure
Not Supporting mIBI < 36 Indicates Impairment	Poor	23-35	Many expected species absent or rare, tolerant species dominant
	Very Poor	12-22	At least one species present, tolerant species dominant
	No Organisms	0	No macroinvertebrates captured during sampling.

Table 4: Target Values Used for Development of the Indian Creek White River Watershed TMDLs

Parameter	Target Value
Total Phosphorus	No value should exceed 0.30 mg/L
Total Suspended Solids	No value should exceed 30.0 mg/L
E. coli	No value should exceed 235 counts/100 mL (single sample maximum)
Hydrogen Ions	No value should exceed 1.0E-03 mg/L (pH minimum 6.0)

1.2 Water Quality Targets

Target values are needed for the development of TMDLs because of the need to calculate allowable daily loads. For parameters that have numeric criteria, such as *E. coli*, the target equals the numeric criteria. For parameters that do not have numeric criteria, target values must be identified from some other source. The target values used to develop the Indian Creek White River Watershed TMDL are presented below.

1.2.1 *E. coli* TMDLs

The target value used for the Indian Creek White River Watershed TMDL was based on the 235 counts/100 mL single sample maximum component of the water quality standard (i.e., daily loading capacities were calculated by multiplying flows by 235 counts/100 mL). The U.S. EPA report, "An Approach for Using Load Duration Curves in the Development of TMDLs" describes how the monthly geometric mean (125 counts/100mL) is likely to be met when the single sample maximum value (235 counts/100mL) is used to develop the loading capacity (U.S. EPA, 2007). The process calculates the daily maximum bacteria value that is possible to observe and still attain the monthly geometric mean. If the single sample maximum is set as a never-to-be surpassed value then it becomes the maximum value that can be observed, and all other bacteria values would have to be less than the maximum.

1.2.2 IBC and DO TMDLs

The following section describes the TMDL target values used for TSS when developing IBC and DO TMDLs.

Total Suspended Solids

Although Indiana has not yet adopted numeric water quality criteria for TSS, IDEM has identified a target value based on IDEM's NPDES permitting process. A target of 30.0 mg/L for TSS has been identified as a permit limit for NPDES facilities. A target value of 30.0 mg/L TSS was therefore used as the TSS TMDL target value to ensure consistency with IDEM's NPDES permitting process. IDEM has determined that meeting the TSS target will result in achieving the narrative biological criterion by improving water quality and promoting a well-balanced aquatic community.

Various subwatersheds in the Indian Creek White River watershed have IBC impairments. Biological communities include fish and aquatic invertebrates, such as insects. These in-stream organisms are indicators of the cumulative effects of activities that affect water quality conditions over time. An IBC listing on Indiana's 303(d) List of Impaired Waters means that IDEM's monitoring data show one or both of the aquatic communities are not as healthy as they should be. IBC is not a source of impairment but a symptom of other sources. To address these impairments in the Indian Creek White River watershed, TSS has been identified as a pollutant for TMDL development.

Two subwatersheds in the Indian Creek White River watershed have a DO impairment. DO is not a source of impairment but a symptom of other sources. To address these impairments in the Indian Creek White River watershed, TSS has been identified as a pollutant for TMDL development.

1.2.3 Nutrient TMDLs

The following section describes the TMDL target values used for TP when developing Nutrient TMDLs.

Total Phosphorus

Although Indiana has not yet adopted numeric water quality criteria for nutrients, IDEM has identified the following nutrient benchmarks that are used to assess potential nutrient impairments:

- Total phosphorus should not exceed 0.30 mg/L (U.S. EPA's nationwide 1986 Quality Criteria for Waters also known as the *Gold Book*).

The total phosphorus value (0.30 mg/L) was used as the TMDL target during the development of the Indian Creek White River watershed TMDL. IDEM has determined that meeting this target will result in achieving the narrative nutrient criterion by improving water quality and promoting a well-balanced aquatic community.

1.2.4 pH TMDLs

The following section describes the TMDL target values used for H+ when developing pH TMDLs.

Hydrogen Ions

Indiana has not adopted numeric water quality criteria for H+, however numeric water quality criteria for pH can be used to calculate a benchmark for H+. For the purposes of this TMDL, a lower pH limit of 6 was converted to a maximum H+ concentration using the following method (KDEP, 2006):

> *"The magnitude of the associated hydrogen ion load in a water column (in terms of activity) can be determined by measuring the pH of the water. The relationship between hydrogen load and pH can be expressed as follows:*
>
> $$\{H+\} = 10^{-pH}$$
>
> *Where pH is the negative log of the H+ ion activity in mol/L. To convert between the measured activity {H+} and the actual molar concentration [H+], the activity is divided by an activity coefficient, γ.*
>
> $$[H+] = \frac{\{H+\}}{\gamma}$$

The activity coefficient, γ, is dependent on the ionic strength μ of the source water under consideration… the ionic strength of a given source of water may be related to the measured specific conductance (SC) through the following relationship (Snoeyink and Jenkins, 1980):

$$\mu = (1.6 * 10^{-5}) * SC$$

Ionic strength can be converted to an associated activity coefficient using the functional relationship…" (Snoeyink and Jenkins, 1980).

$$\log f = -Az^2 \sqrt{I},$$

Where:

f - Activity coefficient

A – a constant that relates to the solvent:

For water at 25°C, A = 0.509

For water at 15°C, A = 0.50

For water at 0°C, A = 0.488

z – Charge number

I – Ionic strength

"…To develop a TMDL for an impaired stream, the most conservative approach would be to assume an activity coefficient of 1.0, which would yield the lowest value for the TMDL for a given range of activity coefficients…"

The product of these calculations is in the units g/L. For ease of use throughout the rest of the TMDL, these results have been converted to mg/L by multiplying the results by 1000.

IDEM used the methodology outlined above to calculate H+ concentrations in the Bens Creek subwatershed of the Indian Creek White River Watershed. The calculated activity coefficient for each site was subtracted from the protective activity coefficient 1.0. The difference between these two figures was then averaged for each sample site. These results informed an implicit Margin of Safety (MOS) for the H+ TMDL in Bens Creek Subwatershed. Based upon the results of this process and the numeric water quality criteria for pH, an H+ maximum value of 1.0E-03 mg/L will be used for the purposes of this TMDL.

1.3 Listing Information

1.3.1 Understanding Subwatersheds and Assessment Units

This section presents information concerning IDEM's segmentation process as it applies to the Indian Creek White River watershed. IDEM identifies the Indian Creek White River watershed and its tributaries using a watershed numbering system developed by United States Geological Survey (USGS), Natural Resource Conservation Service (NRCS), and the U.S. Water

Resources Council referred to as hydrologic unit codes (HUCs). HUCs are a way of identifying watersheds in a nested arrangement from largest (i.e., those with shorter HUCs) to smallest (i.e., those with longer HUCs) (IDEM, 2010). Figure 2 shows the 12-digit HUCs located in the Indian Creek White River watershed.

Within each 12-digit HUC subwatershed, IDEM has identified several Assessment Unit IDs (AUIDs), which represent individual stream segments. Through the process of segmenting waterbodies into AUIDs, IDEM identifies stream reaches and stream networks that are representative for the purposes of assessment. In practice, this process leads to grouping tributary streams into smaller catchment basins of similar hydrology, land use, and other characteristics such that all tributaries within the catchment basin can be expected to have similar potential water quality impacts. Catchment basins, as defined by the aforementioned factors, are typically very small, which significantly reduces the variability in the water quality expected from one stream or stream reach to another. Given this, all tributaries within a catchment basin are assigned a single AUID. Grouping tributary systems into smaller catchment basins also allows for better characterization of the larger watershed and more localized recommendations for implementation activities. Variability within the larger watershed will be accounted for by the differing AUIDs assigned to the different catchment basins.

Table 5 and Table 11 contain the AUIDs in the subwatersheds of the Indian Creek White River watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

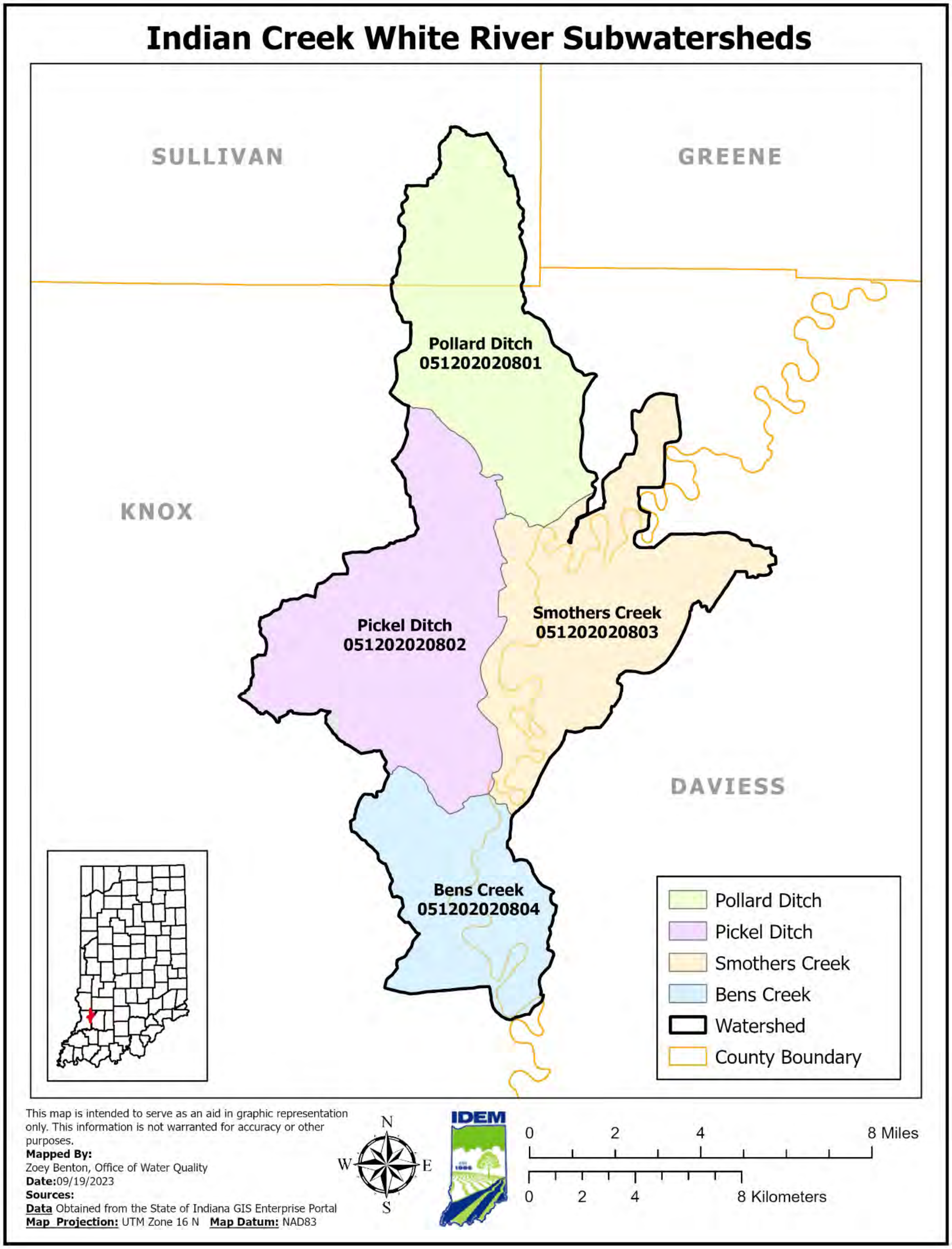

Figure 2: Subwatersheds (12-Digit HUCs) in the Indian Creek White River Watershed

1.3.2 Understanding 303(d) Listing Information

There are a number of existing impairments in the Indian Creek White River watershed from the approved 2024 303(d) List of Impaired Waters (Table 5). The listings and causes of impairment have been adjusted as a result of reassessment data collected at 16 sampling locations in the watershed. Within the Indian Creek White River watershed a total of 6 AUIDs will be cited as impaired for *E. coli*, 8 AUIDs cited as impaired for IBC, 1 AUID cited as impaired for nutrients, 2 AUIDs cited as impaired for DO, and 1 AUID cited as impaired for pH on Indiana's 2026 303(d) List of Impaired Waters (Table 5). These impaired segments account for approximately 72 miles. Table 5 presents listing information for the Indian Creek White River watershed, including a comparison of the updated listings with the 2024 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Indian Creek White River watershed are available in Appendix B.

Below is an inventory assessment of the available biological and chemistry data for the Indian Creek White River watershed.

Table 5: Section 303(d) Category 5 Impairments for the Indian Creek White River for 2024 and 2026

Name of Subwatershed	Current AUID	Length (mi)	2024 Section 303(d) Listed Impairment	Updated Impairments to be listed 2026 303(d)
Pollard Ditch 051202020801	INW0281_01	8.08		*E. coli*
	INW0281_02	14.60		*E. coli*, IBC
	INW0281_T1001	5.62		
	INW0281_T1002	4.51		
Pickel Ditch 051202020802	INW0282_01B	0.54		
	INW0282_01C	0.80		
	INW0282_02	15.72		*E. coli*, Nutrients
	INW0282_03	1.87		*E. coli*, IBC
	INW0282_T1001A	0.76		
	INW0282_T1001C	0.90		
	INW0282_T1001D	0.70		
	INW0282_T1002	8.51		
	INW0282_T1002A	0.89		
	INW0282_T1003	10.45		
	INW0282_T1004	1.25		*E. coli*, IBC
	INW0282_T1005	1.88		
Smothers Creek 051202020803	INW0283_02A	0.94		
	INW0283_03	4.43	*E. coli*, IBC	IBC
	INW0283_04	0.98	*E. coli*, IBC	
	INW0283_05	0.41	*E. coli*	IBC
	INW0283_06	6.34	*E. coli*, IBC	IBC
	INW0283_07	3.87	*E. coli*	
	INW0283_T1001	0.57		DO
	INW0283_T1002	7.78		

Name of Subwatershed	Current AUID	Length (mi)	2024 Section 303(d) Listed Impairment	Updated Impairments to be listed 2026 303(d)
Bens Creek 051202020804	INW0284_02	3.69	*E. coli*	
	INW0284_03	6.27	*E. coli*, IBC	IBC
	INW0284_T1001	10.80		*E. coli*, DO
	INW0284_T1002	1.22	*E. coli*, IBC	
	INW0284_T1003	2.12	*E. coli*, IBC	IBC, pH

Understanding Table 5:

- Column 1: Name of Subwatershed (12-digit HUC). Shows the name of the subwatershed at the 12-digit HUC scale. The subwatershed is the appropriate scale for what the IDEM's Watershed Management Plan (WMP) Checklist defines as a subwatershed for the purposes of watershed management planning.
- Column 2: Current AUID. Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2024 Section 303(d) listing assessment process.
- Column 3: Length (mi). Provides the length in miles of the associated AUID.
- Column 4: 2024 Section 303(d) Listed Impairment. Identifies the cause of impairment associated with the 2024 Section 303(d) listing.
- Column 5: Updated Impairments to be listed 2026 303(d). Provides the updated causes of impairment if new data and information are available.

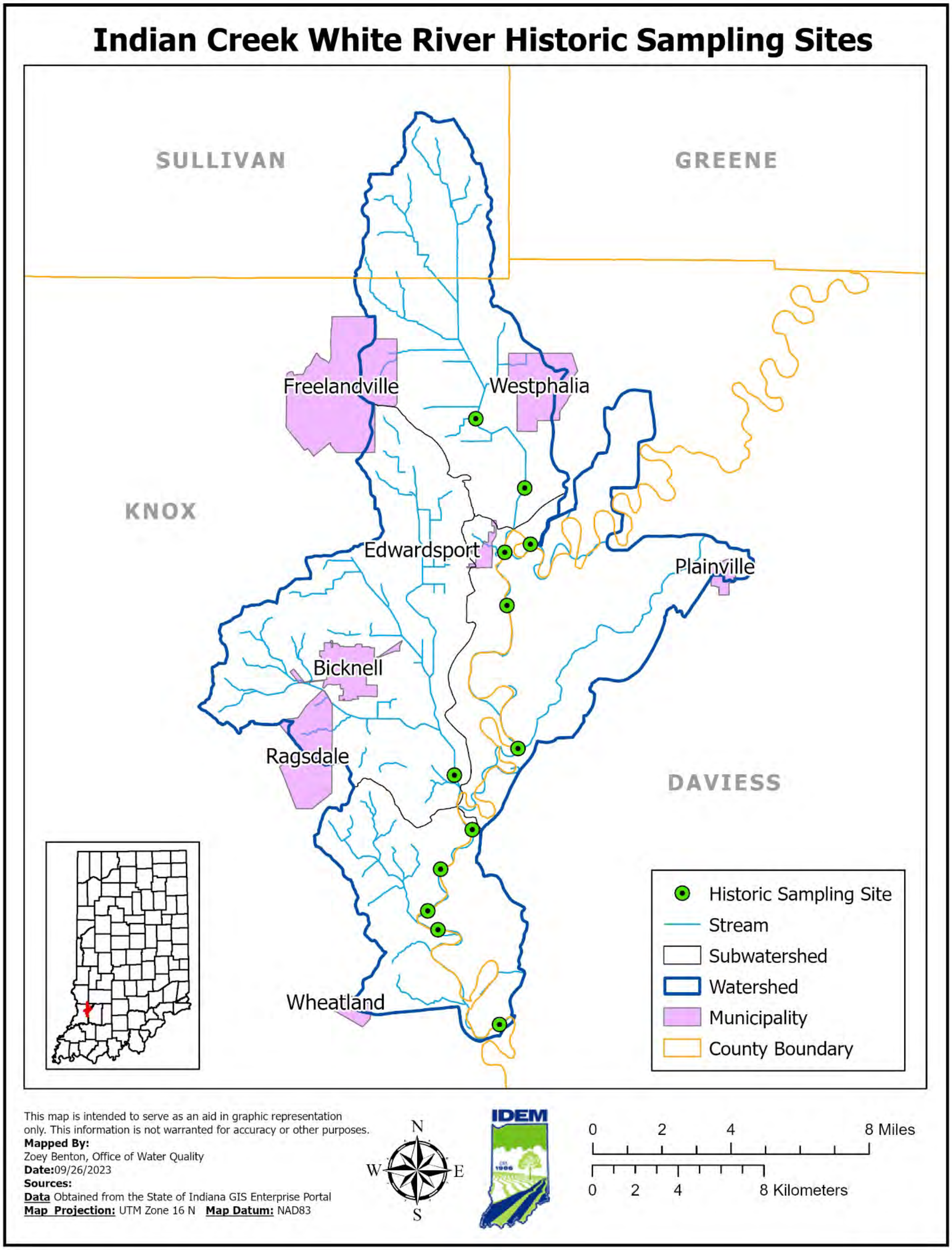

Figure 3: Location of Historical Sampling Sites in the Indian Creek White River Watershed

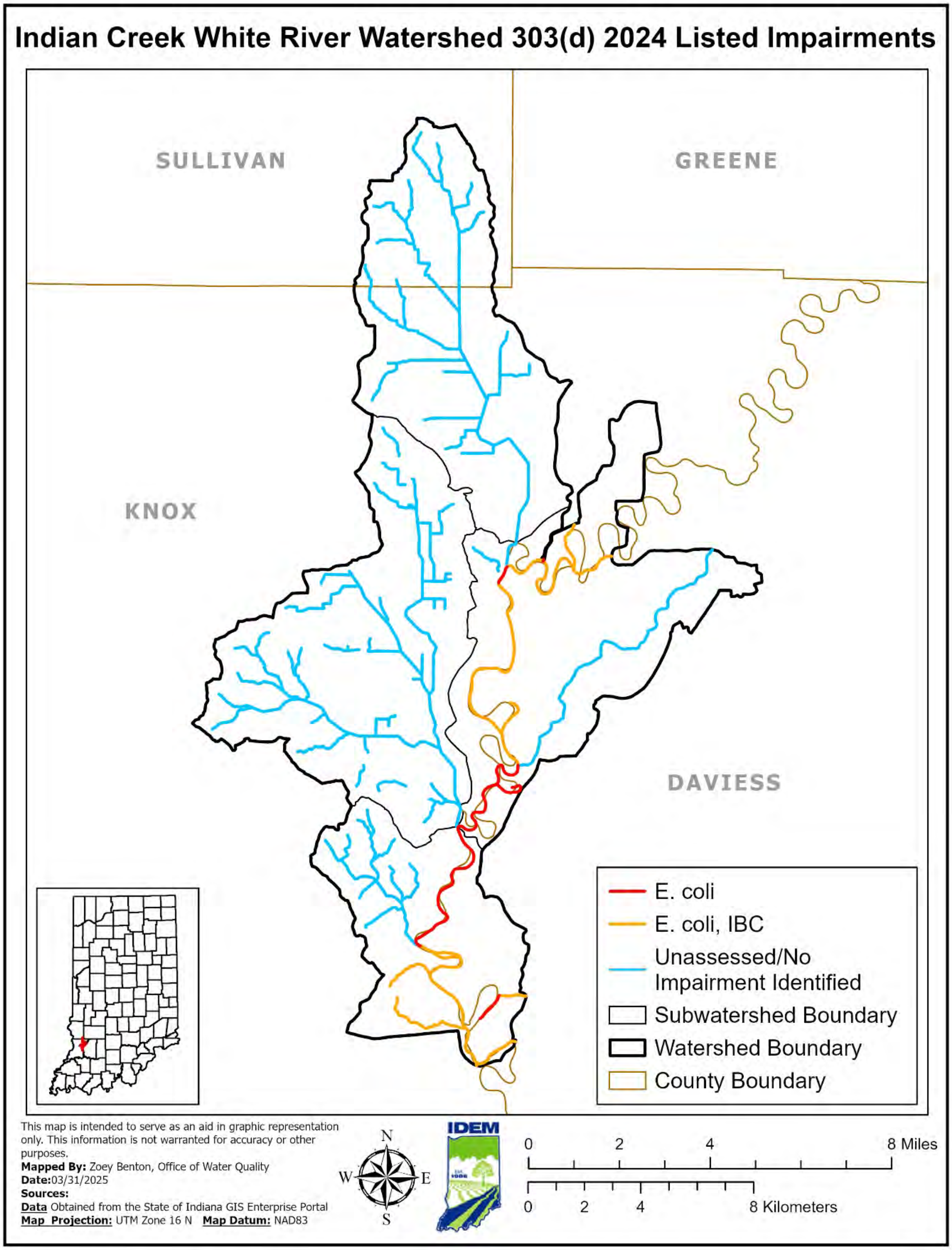

Figure 4: Streams Listed on the 2024 Section 303(d) List of Impaired Waters in the Indian Creek White River Watershed

1.4 Water Quality Data

This section of the TMDL report contains a brief characterization of the Indian Creek White River watershed water quality information that was collected in development of this TMDL. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

1.4.1 Water Quality Data

Data collected by IDEM from November 2023 through October 2024 were used for the TMDL analysis. 16 sites were sampled for pathogens, water chemistry, and biological data in the Indian Creek White River watershed. Table 6 and Figure 5 show the sampling site locations and information. 1.4.2 E*. coli* Data

Table 7 summarizes the pathogen data, and Table 8 and Table 9 summarize the water chemistry data within the Indian Creek White River watershed in addition to the maximum concentrations at all impaired sites along with the reduction needed to meet the TMDL.

The percent reductions were calculated as follows:

$$\%\ \text{Reduction} = \frac{(\text{Observed Concentration} - \text{Target Value or WQS})}{\text{Observed Concentration}}\, x\ 100$$

Appendix A shows the individual sample results and summaries of all the water quality data for all 16 monitoring sites.

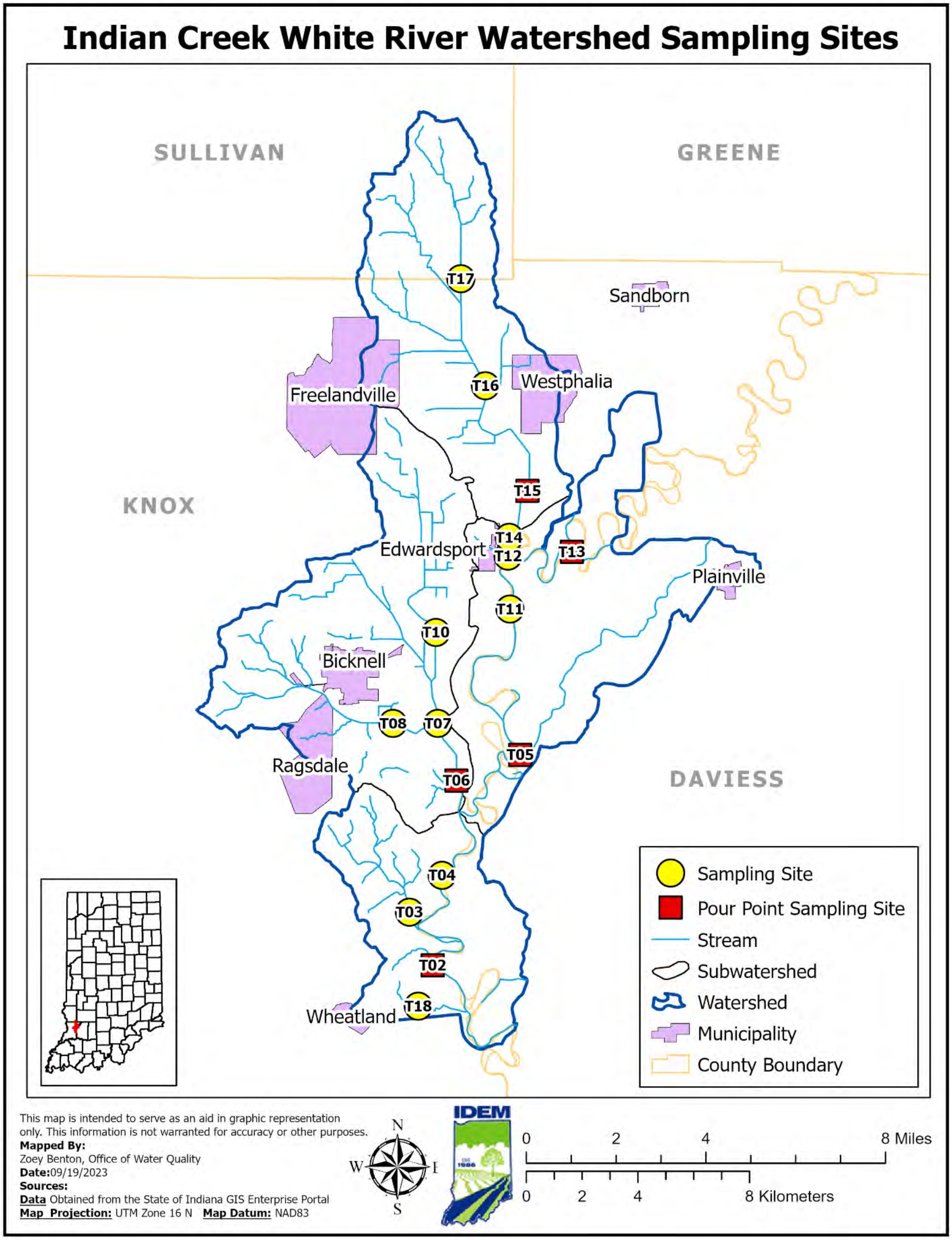

Figure 5: 2023-2024 Sampling Locations for the Indian Creek White River TMDL Study

Table 6: Indian Creek White River Sampling Site Information

Site #	EPA Site ID	IDEM Station ID	Stream Name	Road Name	AUID
T02	24T-002	WWL-08-0009	White River	Washington Road	INW0284_03
T03	24T-003	WWL-08-0021	Bens Creek	Apraw Road	INW0284_T1001
T04	24T-004	WWL-08-0008	White River	Apraw Road	INW0284_02
T05	24T-005	WWL-08-0010	White River	CR 650 North	NW0283_07
T06	24T-006	WWL-08-0011	Indian Creek	River Road	NW0282_03
T07	24T-007	WWL-08-0012	Pickel Ditch	McGlone Road	INW0282_T1004
T08	24T-008	WWL-08-0013	Indian Creek	Mine Road	INW0282_02
T10	24T-010	WWL-08-0018	Purdy-Marsh Ditch	Snyder Road	INW0282_T1003
T11	24T-011	WWL070-0003	West Fork White River	SR 358	INW0283_06
T12	24T-012	WWL-08-0015	White River	CR 1000 North	INW0283_04
T13	24T-013	WWL-08-0016	White River	Dinkens Road	INW0283_03
T14	24T-014	WWL-08-0017	Pollard Ditch	Unnamed Farm Lane	INW0283_T1001
T15	24T-015	WWL070-0002	Pollard Ditch	CR 725 North	INW0281_02
T16	24T-016	WWL-08-0019	Pollard Ditch	SR 58	INW0281_02
T17	24T-017	WWL-08-0020	Pollard Ditch	County Line Road	INW0281_01
T18	24T-018	WWL-08-0022	Nimnicht Creek	Nimnicht Road	INW0284_T1003

Understanding Table 6:

- Column 1: Site #. Lists the site number that corresponds to the site location in Figure 5.
- Column 2: EPA Site ID. Provides the EPA assigned site number.
- Column 3: IDEM Station ID. Provides the IDEM assigned site number.
- Column 4: Stream Name. Identifies the stream name that the site is located on.
- Column 5: Road Name. Identifies the road name that the site is located on.
- Column 6: AUID. Identifies the AUID given to waterbodies within the 12-digit HUC subwatershed for purposes of the 2024 Section 303(d) listing assessment process.

1.4.2 *E. coli* Data

Table 7: Summary of Pathogen Data in Indian Creek White River by Subwatershed

Subwatershed	Site #	IDEM Station ID	AUID	Period of Record (month/year)	Total Number of Samples	Percent of Samples Exceeding *E. coli* WQS (#/100 mL)		Geomean (#/100 mL)	*E. coli* Percent Reduction Based on Geomean (125/100mL)	Single Sample Maximum (SSM) (#/100 mL)	*E. coli* Percent Reduction Based on SSM (#/100 mL)
						125	235				
Bens Creek	T02	WWL-08-0009	INW0284_03	11/23 - 10/24	10	20%	10%	18.1	0	1732.9	86.44
	T03	WWL-08-0021	INW0284_T1001	4/24 – 10/24	10	40%	50%	213.47	41.44	34480	99.32
	T04	WWL-08-0008	INW0284_02	4/24 – 10/24	10	20%	10%	7.84	0	488.4	51.88
	T18	WWL-08-0022	INW0284_T1003	4/24 – 10/24	10	20%	40%	41.61	0	17200	98.63
Pickel Ditch	T06	WWL-08-0011	NW0282_03	11/23 - 10/24	9	80%	44%	365.13	65.77	17200	98.63
	T07	WWL-08-0012	INW0282_T1004	4/24 – 10/24	10	40%	30%	154.48	19.08	1203.3	80.47
	T08	WWL-08-0013	INW0282_02	4/24 – 10/24	10	60%	60%	295.16	57.65	19560	98.80
	T10	WWL-08-0018	INW0282_T1003	4/24 – 10/24	10	40%	40%	89.97	0	5880	96.00
Smothers Creek	T05	WWL-08-0010	INW0283_07	11/23 - 10/24	10	20%	10%	10.89	0	248.9	5.58
	T11	WWL070-0003	INW0283_06	4/24 – 10/24	10	0%	0%	3.92	0	167.4	0
	T12	WWL-08-0015	INW0283_04	4/24 – 10/24	9	0%	0%	9.54	0	54.6	0
	T13	WWL-08-0016	INW0283_03	11/23 - 10/24	9	0%	0%	4.9	0	40.2	0
	T14	WWL-08-0017	INW0283_T1001	4/24 – 10/24	9	20%	22%	99.67	0	648.8	63.78
Pollard Ditch	T15	WWL070-0002	INW0281_02	11/23 - 10/24	10	60%	50%	178.71	30.05	686.7	65.78
	T16	WWL-08-0019	INW0281_02	4/24 – 10/24	10	20%	20%	29.92	0	547.5	57.08
	T17	WWL-08-0020	INW0281_01	4/24 – 10/24	10	20%	10%	127.49	1.95	1732.9	86.44

Understanding Table 7: Pathogen data for the Indian Creek White River watershed indicated the following:

- Reductions of 99 percent or greater are needed to meet the TMDL target values for *E. coli* in Bens Creek.
- Reductions of 99 percent or greater are needed to meet the TMDL target values for *E. coli* in Pickel Ditch.
- Reductions of 86 percent or greater are needed to meet the TMDL target values for *E. coli* in Pollard Ditch.

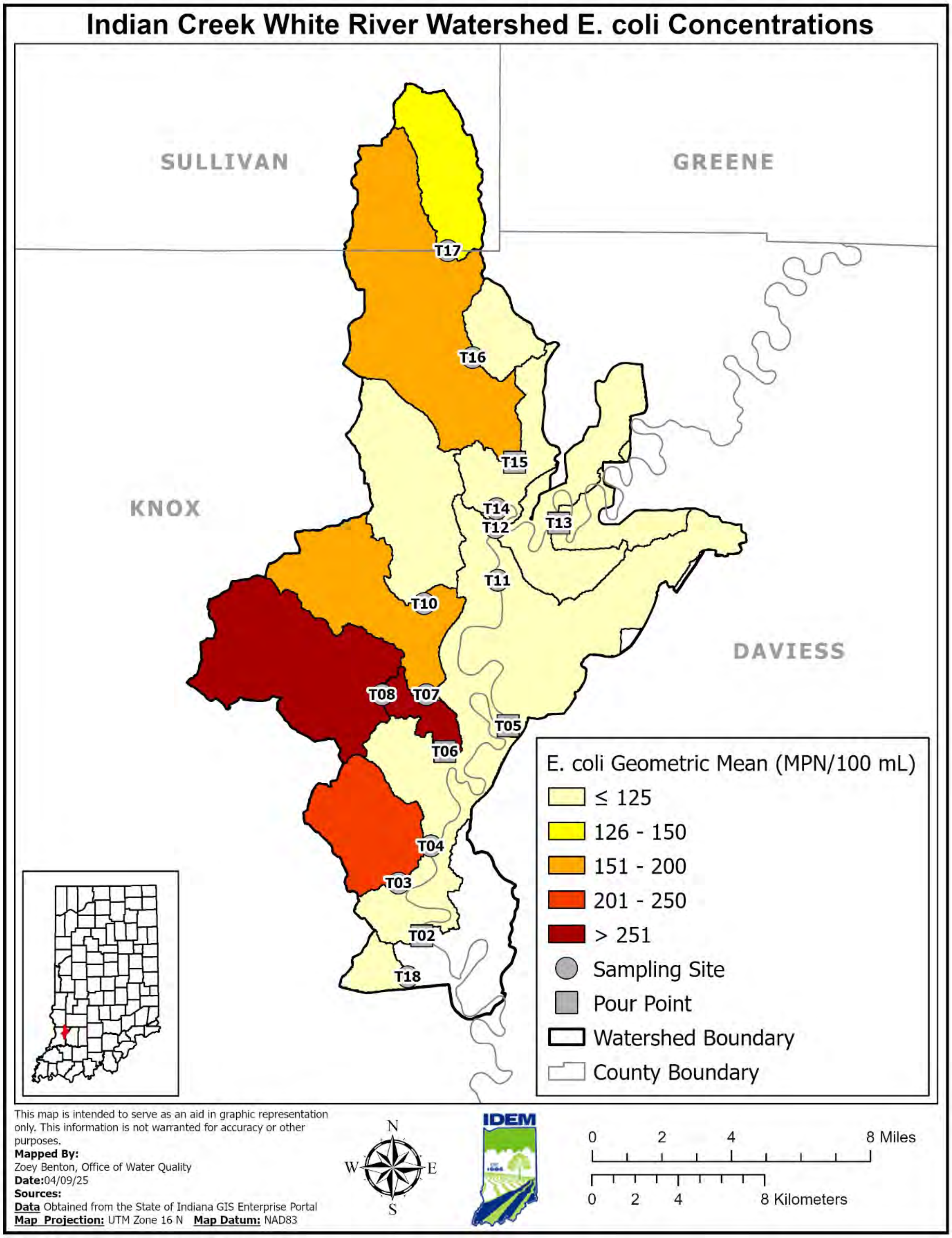

Figure 6: *E. coli* concentrations based on 5-week geometric mean (MPN/100mL) and sampling site drainage areas for 2023 and 2024. Values over 125 MPN/100mL do not meet the current water quality standard for *E. coli*.

1.4.3 Water Chemistry Data

Table 8: Summary of Chemistry Data in Indian Creek White River Watershed for Total Phosphorus and Total Suspended Solids

Subwatershed	Site #	IDEM Station ID	AUID	Total Phosphorus Single Sample Maximum (mg/L)	Total Phosphorus % Reduction	Total Suspended Solids Single Sample Maximum (mg/L)	Total Suspended Solids % Reduction
Bens Creek	T02	WWL-08-0009	INW0284_03	0.2	0	81.4	63.14
	T03	WWL-08-0021	INW0284_T1001	0.44	31.82	84.6	64.54
	T04	WWL-08-0008	INW0284_02	0.19	0	48.3	37.89
	T18	WWL-08-0022	INW0284_T1003	0.4	25.00	54.3	44.75
Pickel Ditch	T06	WWL-08-0011	NW0282_03	0.8	62.50	454	93.39
	T07	WWL-08-0012	INW0282_T1004	0.16	0	101	70.30
	T08	WWL-08-0013	INW0282_02	0.76	60.53	83.2	63.94
	T10	WWL-08-0018	INW0282_T1003	0.55	45.45	116	74.14
Smothers Creek	T05	WWL-08-0010	INW0283_07	0.26	0	74.9	59.95
	T11	WWL070-0003	INW0283_06	0.16	0	55.2	45.65
	T12	WWL-08-0015	INW0283_04	0.27	0	64.8	53.70
	T13	WWL-08-0016	INW0283_03	0.22	0	62.2	51.77
	T14	WWL-08-0017	INW0283_T1001	0.17	0	16.1	0
Pollard Ditch	T15	WWL070-0002	INW0281_02	0.29	0	16.7	0
	T16	WWL-08-0019	INW0281_02	0.11	0	15.1	0
	T17	WWL-08-0020	INW0281_01	0.11	0	51.2	41.41

Understanding Table 8: Water chemistry data for the Indian Creek White River watershed indicated the following:

- Reductions of 65 percent or greater are needed to meet the TMDL target values for TSS in Bens Creek.
- Reductions of 93 percent or greater are needed to meet the TMDL target values for TSS in Pickel Ditch.
- Reductions of 63 percent or greater are needed to meet the TMDL target values for TP in Pickel Ditch.
- Reductions of 60 percent or greater are needed to meet the TMDL target values for TSS in Smothers Creek.
- Reductions of 41 percent or greater are needed to meet the TMDL target values for TSS in Pollard Ditch.

Table 9: Summary of Chemistry Data in Indian Creek White River Watershed for Hydrogen Ions

Subwatershed	Site #	IDEM Station ID	AUID	Calculated H+ Single Sample Maximum (mg/L)	Total H+ % Reduction
Bens Creek	T02	WWL-08-0009	INW0284_03	2.34E-05	0
	T03	WWL-08-0021	INW0284_T1001	8.91E-05	0
	T04	WWL-08-0008	INW0284_02	2.57E-05	0
	T18	WWL-08-0022	INW0284_T1003	1.95E-02	94.87

Understanding Table 9: Water chemistry data for the Indian Creek While River watershed indicated the following:

- Reductions of 95 percent or greater are needed to meet the TMDL target values for H+ in Bens Creek.

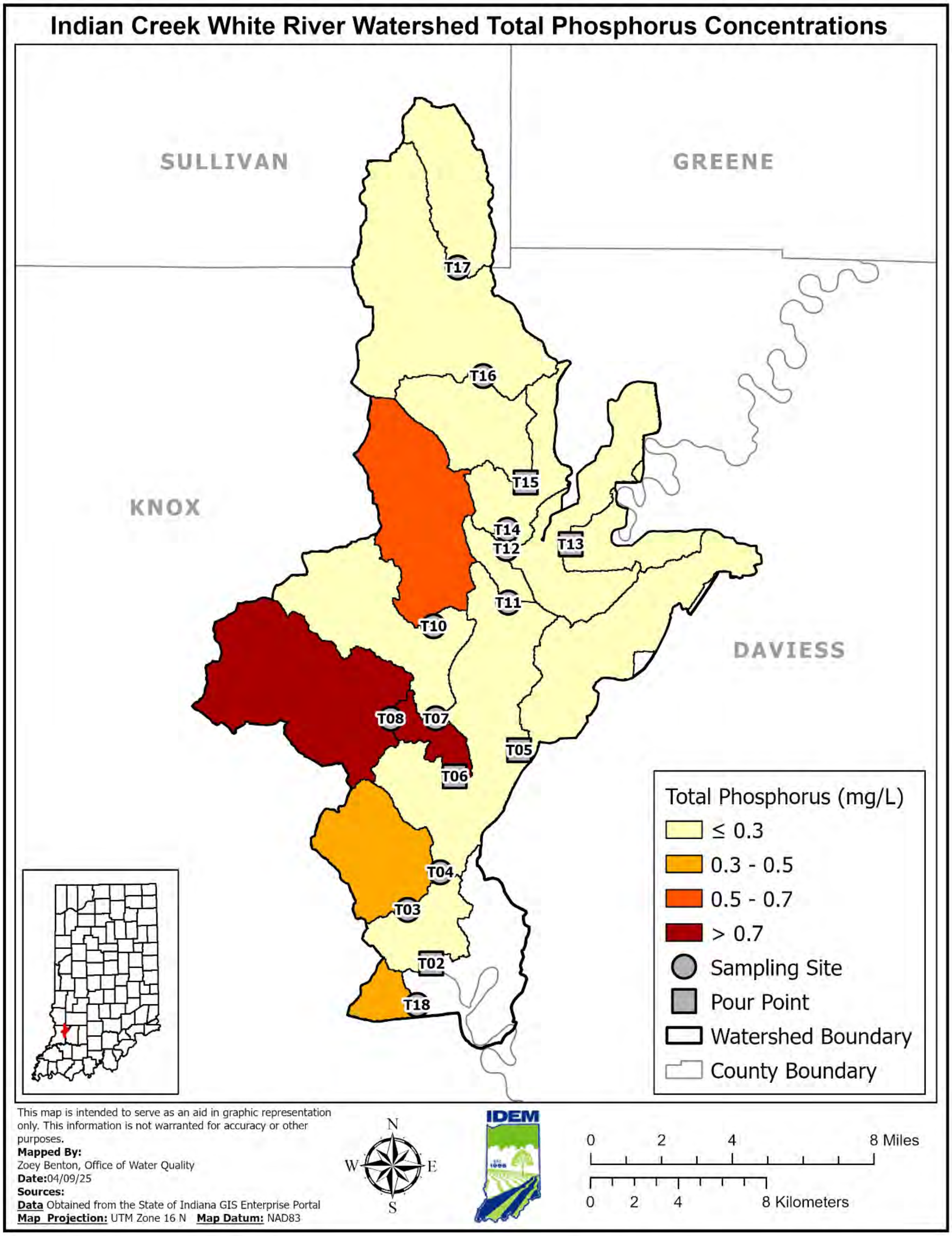

Figure 7: Total phosphorus concentrations based on single sample maximum concentration (mg/L) and sampling site drainage areas for 2023 and 2024. Values over 0.30 mg/L do not meet the water quality target value for total phosphorus.

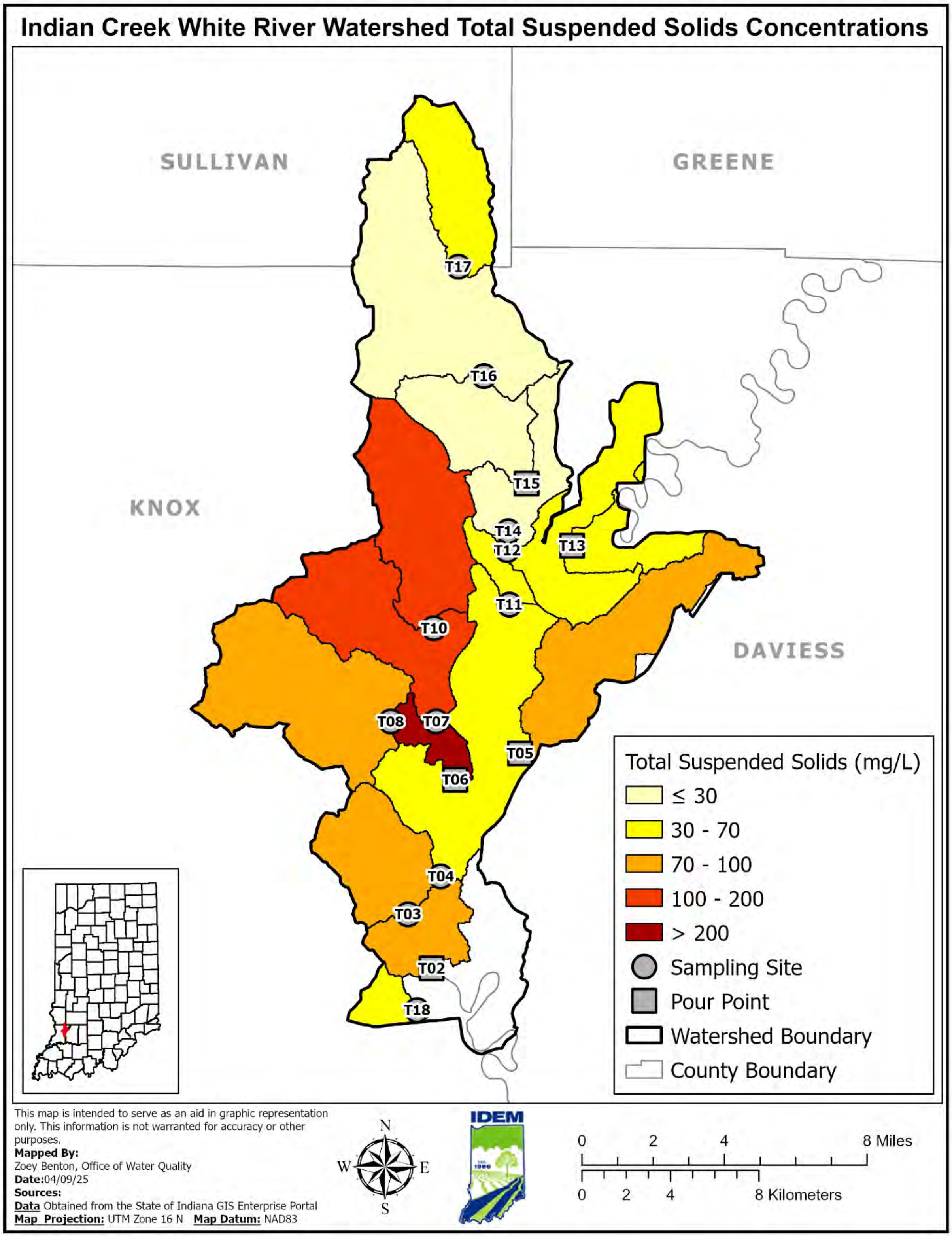

Figure 8: Total Suspended Solids concentrations based on single sample maximum concentration (mg/L) and sampling site drainage areas for 2023 and 2024. Values over 30 mg/L do not meet the water quality target value for TSS.

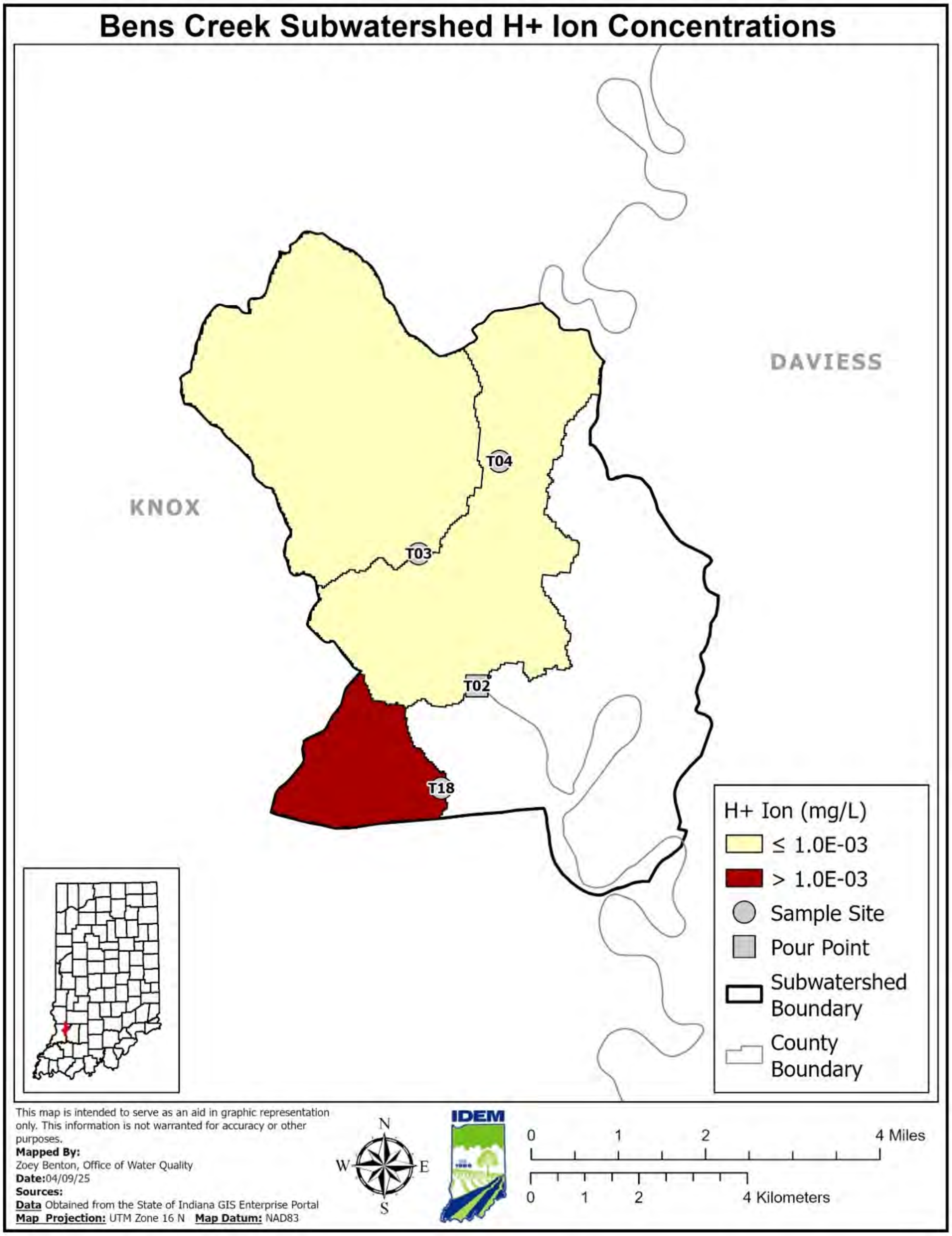

Figure 9: H+ ion concentrations based on single sample maximum concentration (mg/L) and sampling site drainage areas for 2023 and 2024. Values over 1.0E-03 mg/L do not meet the water quality target value for H+ ions (i.e., pH minimum of 6).

1.4.4 Biological Data

Sampling performed by IDEM in July – September 2024 documented widespread biological impairments in the Indian Creek White River watershed as summarized in Table 10. Fish community sampling took place at 16 sample sites in the Indian Creek White River watershed. Sampling data indicate that the overall biological integrity of the Indian Creek White River watershed was fair. Sampling resulted in 8 of the 16 sites failing established criteria for aquatic life support for fish and/or macroinvertebrates.

Through the TMDL efforts, IDEM has identified several potential reasons for the widespread impairments. TSS can reduce plants available for consumption by inhibiting growth of submerged aquatic plants, lower dissolved oxygen levels by reducing light penetration which impairs algal growth, impair the ability of fish to see and catch food, increase stream temperature, clog fish gills which may decrease disease resistance, slow growth rates, and prevent the development of eggs and larvae. Attaining the TSS target value shown in Table 4 will address the causes of IBC impairments.

Table 10: Impaired Biotic Community Stream Segments in the Indian Creek White River Watershed Identified During July-September 2024 Sampling

Subwatershed	Stream Name	Site #	IDEM Station ID	Score	Integrity Class	QHEI	Score	Integrity Class	QHEI
				mIBI	mIBI	mIBI	IBI	IBI	IBI
Bens Creek	White River	T02	WWL-08-0009	32	Poor	46	34	Poor	64
	Bens Creek	T03	WWL-08-0021	48	Good	38	44	Fair	28
	White River	T04	WWL-08-0008	36	Fair	51	34	Poor	81
	Nimnicht Creek	T18	WWL-08-0022	28	Poor	51	18	Very Poor	49
Pickel Ditch	Indian Creek	T06	WWL-08-0011	30	Poor	30	42	Fair	32
	Marsh Ditch	T07	WWL-08-0012	32	Poor	25	44	Fair	19
	Indian Creek	T08	WWL-08-0013	36	Fair	51	44	Fair	62
	Marsh Ditch	T10	WWL-08-0018	34	Poor	38	44	Fair	30
Smothers Creek	White River	T05	WWL-08-0010	38	Fair	52	36	Fair	66
	West Fork White River	T11	WWL070-0003	32	Poor	58	38	Fair	66
	White River	T12	WWL-08-0015	32	Poor	43	16	Very Poor	60
	White River	T13	WWL-08-0016	34	Poor	64	32	Poor	67
	Pollard Ditch	T14	WWL-08-0017	36	Fair	26	36	Fair	31
Pollard Ditch	Pollard Ditch	T15	WWL070-0002	38	Fair	38	40	Fair	58
	Pollard Ditch	T16	WWL-08-0019	32	Poor	47	36	Fair	46
	Pollard Ditch	T17	WWL-08-0020	30	Poor	46	36	Fair	32

Notes: IBI = Index of Biotic Integrity for fish community, mIBI = Index of Biotic Integrity for macroinvertebrate community, QHEI = Qualitative Habitat Evaluation Index. Scores were calculated using IDEM's Procedures for Completing the Qualitative Habitat Evaluation Index Technical Standard Operating Procedure (IDEM, 2023).

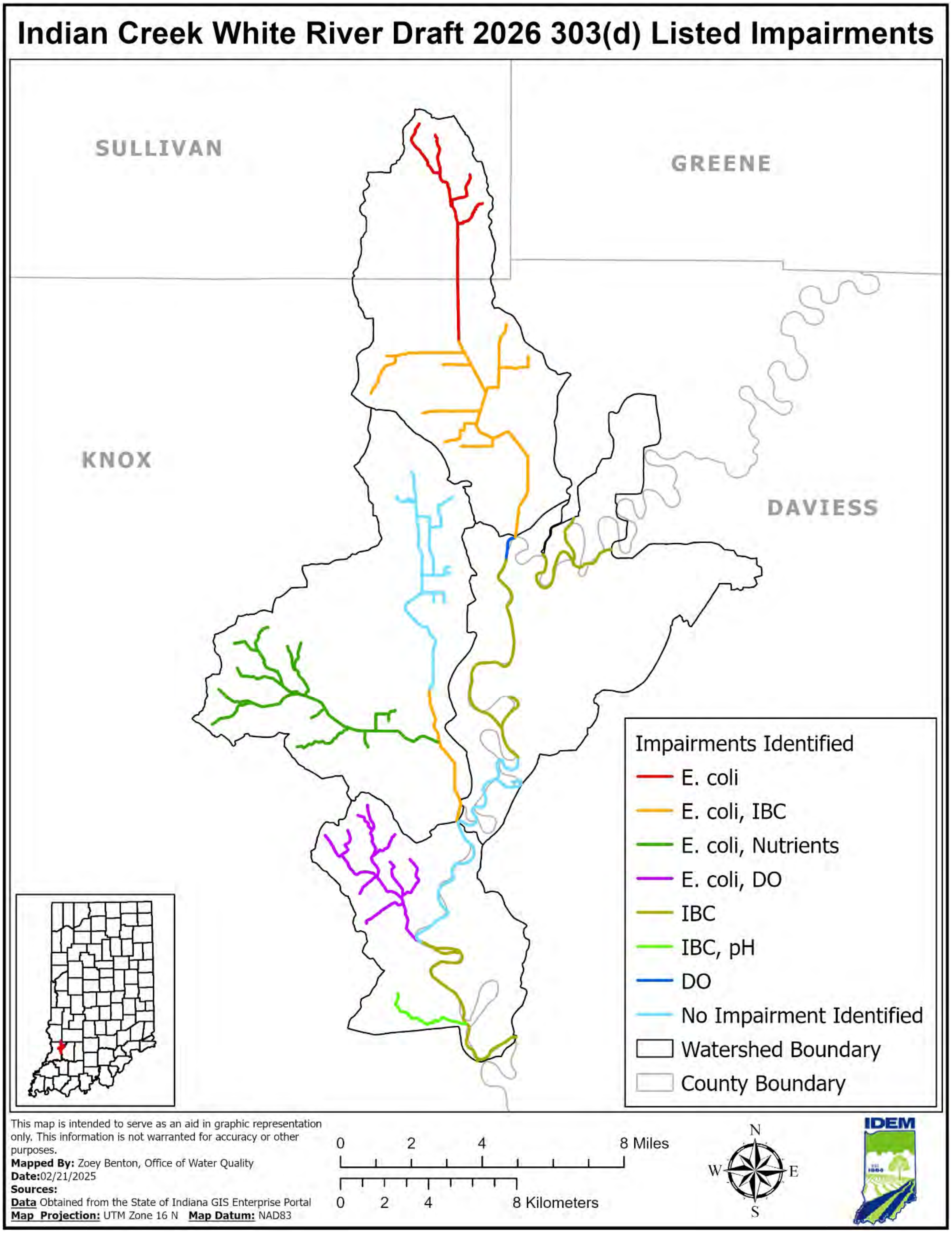

Figure 10: Streams to be listed on the Draft 2026 Section 303(d) List of Impaired Waters in the Indian Creek White River Watershed

2.0 DESCRIPTION OF THE WATERSHED AND SOURCE ASSESSMENT

This section of the TMDL report contains a brief characterization of the Indian Creek White River watershed to provide a better understanding of the historic and current conditions of the watershed that affect water quality and contribute to the impairments. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

As discussed in Section 1.3.1, the Indian Creek White River watershed contains four 12-digit HUC subwatersheds. Examining subwatersheds enables a closer examination of key factors that affect water quality. The subwatersheds include:

- Bens Creek (051202020801)
- Pickel Ditch (051202020802)
- Smothers Creek (051202020803)
- Pollard Ditch (051202020804)

The following table contains the names of the four subwatersheds of the Indian Creek White River watershed and their associated drainage area.

Table 11: Indian Creek White River Subwatershed Drainage Areas

Name of Subwatershed	12-digit HUC	Area Within Watershed (sq. miles)	Percent of Watershed Area	Drainage Area (sq miles)	Percent of Total Drainage Area
Bens Creek	051202020801	16.7	16.7%	5,077.2	100%
Pickel Ditch	051202020802	30.6	30.8%	30.6	0.6%
Smothers Creek	051202020803	26.6	26.8%	5,030.4	99%
Pollard Ditch	051202020804	25.5	25.6%	25.5	0.5%

Understanding Table 11: Land area helps IDEM to define the pollutant load reductions needed for each AU in each 12-digit HUC subwatershed that comprises the Indian Creek White River watershed. Information in each column is as follows:

- Column 1: Name of Subwatershed. Lists the name of the subwatersheds.
- Column 2: 12-digit HUC. Identifies the subwatershed's 12-digit HUC.
- Column 3: Area Within Watershed. Provides the area of each subwatershed within the overall watershed in square miles.
- Column 4: Percent of Watershed Area. Indicates the percent of land area of each subwatershed, providing a relative understanding of the portions of each subwatershed compared to the overall Indian Creek White River watershed.

- Column 5: Drainage Area. Quantifies the area the specific subwatershed drains in square miles. Note that the White River passes through the Bens Creek and Smothers Creek subwatersheds, making the drainage area in Bens Creek and Smothers Creek significantly larger than the drainage area in Pickel Ditch and Pollard Ditch.
- Column 6: Percent of Total Drainage Area. Indicates the percent of the total drainage area, providing a relative understanding of the portion of the subwatershed in the overall Indian Creek White River watershed.

IDEM bases load calculations on the drainage area for each of the 12-digit HUC subwatersheds. The information contained in this table is the foundation for the technical calculations found in Sections 3.0 and 4.0 of this report. This table will help watershed stakeholders look at the smaller subwatersheds within the Indian Creek White River watershed and understand the smaller areas contributing to the impaired waterbody, helping to quantify the geographic scale that influences source characterization and areas for implementation.

The term “point source” refers to any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel, or conduit, by which pollutants are transported to a waterbody. It also includes vessels or other floating craft from which pollutants are or may be discharged. By law, the term “point source” also includes confined feeding operations (which are places where animals are confined and fed); and illicitly connected “straight pipe” discharges of household waste. Permitted point sources are regulated through the National Pollutant Discharge Elimination System (NPDES).

Nonpoint sources include all other categories not classified as point sources. In urban areas, nonpoint sources can include leaking or faulty septic systems, run-off from lawn fertilizer applications, pet waste, and other sources. In rural areas, nonpoint sources can include run-off from cropland, pastures and animal feeding operations, and inputs from streambank erosion, leaking, failing or straight-piped septic systems, and wildlife.

2.1 Land Use

Land use patterns provide important clues to the potential sources of impairments in a watershed. Land use information for the Indian Creek White River watershed is available from the National Agricultural Statistics Service (NASS) cropland data layer. These data categorize the land use for each 30 meters by 30 meters parcel of land in the watershed based on satellite imagery from circa 2022. Figure 11 displays the spatial distribution of the land uses and the data are summarized in Table 12. Additionally, Table 13 displays the breakdown of land uses within each of the four subwatersheds.

Land use in the Indian Creek White River watershed is primarily agriculture, comprising 63 percent of the Indian Creek White River watershed. Of the agricultural land, most crops are either soybean or corn. Corn and soybean crops are not typically associated with high *E. coli* loads, unless they have been fertilized with manure, however nutrient leaching from fertilizer application and other forms of agricultural runoff can be sources of TSS and nutrients. The second most abundant type of land use is forested land, comprised of 13 percent of the land in the Indian Creek White River watershed. Forested land homes a plethora of wildlife, the waste from these animals can runoff into streams, potentially leading to high *E. coli.* Pasture/hay represents 12 percent of the watershed and could indicate the presence of animal feedlots which can be significant sources of *E. coli*, TSS, and/or nutrients. The remaining land categories each represent less than 10 percent of the total land area.

The Indian Creek White River watershed has a diverse network of streams. Tributaries include Pollard Ditch, Smothers Creek, Pickel Creek, and Bens Creek among others. The watershed is unique in that the White River runs through two of the four subwatersheds. The watershed originates in the southeast corner of Sullivan County. It flows south into Knox County and eventually Daviess County, where the White River intersects along the Knox-Daviess border. Ultimately, Indian Creek White River Watershed drains into the White River just before hitting US-50 near Maysville. Agricultural land use can be found all over the watershed, whereas forested areas are more pronounced in the northern and western portions surrounding Pollard Ditch and Pickel Ditch. There are a few developed areas around Bicknell, IN, Edwardsport, IN, and Plainville, IN.

Table 12: Land Use of the Indian Creek White River Watershed

Land Use	Watershed		
	Area		Percent
	Acres	Square Miles	
Agricultural Land	39,990	62.5	62.8%
Developed Land	4,495	7.0	7.1%
Forested Land	8,183	12.8	12.9%
Hay/Pasture	7,514	11.7	11.8%
Open Water	2,132	3.3	3.3%
Shrub/Scrub	38	0.1	0.1%
Wetlands	1,300	2.0	2.0%
Total	**63,653**	**99.5**	**100%**

Understanding Table 12: The predominant land use types in the Indian Creek White River watershed can indicate potential sources of E. coli, TSS, TP, and H+ loadings. Different types of land uses are characterized by different types of hydrology. For example, developed lands are characterized by impervious surfaces that increase the potential of stormwater events during high flow periods delivering E. coli, TSS, TP, and H+ to downstream streams and rivers. Forested land and wetlands allow water to infiltrate slowly thus reducing the risks of polluted water running off into waterbodies. In addition to differences in hydrology, land use types are associated with different types of activities that could contribute pollutants to the watershed. Understanding types of land uses will help identify the type of implementation approaches that watershed stakeholders can use to achieve E. coli, TSS, TP, and H+ load reductions.

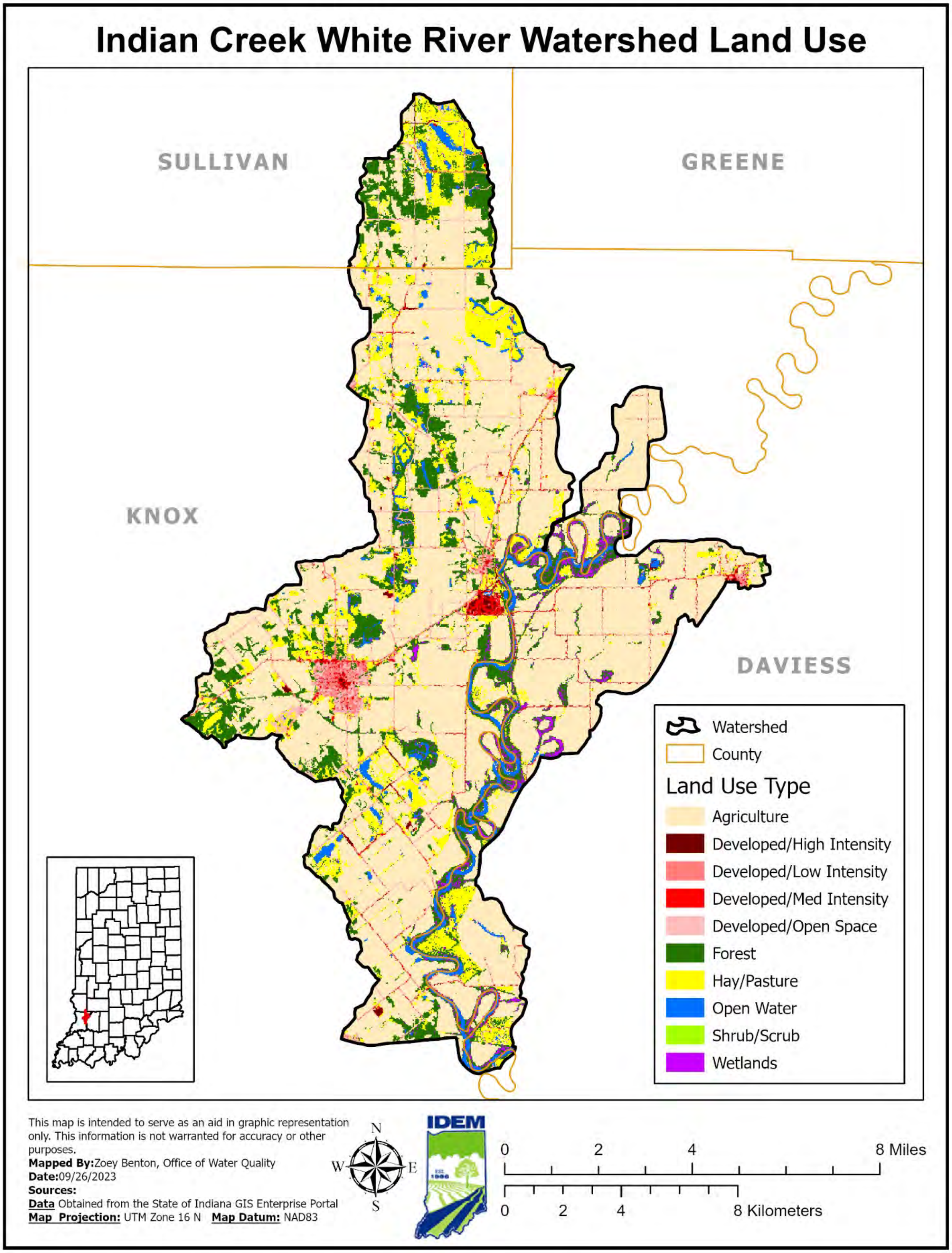

Figure 11: Land use in the Indian Creek White River Watershed

Table 13: Land Use in the Indian Creek White River Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	**Developed**	**Forest**	**Hay/ Pasture**	**Open Water**	**Shrub/ Scrub**	**Wetlands**	
Bens Creek (051202020801)	Acres	6,967	482	1,089	1220	614	6	280	10,658
	Sq. Mi.	10.9	0.8	1.7	1.9	1	0.0	0.4	16.65
	Percent	65%	5%	10%	11%	6%	0%	3%	100%
Pickel Ditch (051202020802)	Acres	11,673	2,036	2,989	2,419	331	9	144	19,600
	Sq. Mi.	18.2	3.2	4.7	3.8	0.5	0.0	0.2	30.63
	Percent	60%	10%	15%	12%	2%	0%	1%	100%
Smothers Creek (051202020803)	Acres	11,608	989	1,984	876	742	3	821	17,022
	Sq. Mi.	18.1	1.5	3.1	1.4	1.2	0.0	1.3	26.6
	Percent	68%	6%	12%	5%	4%	0%	5%	100%
Pollard Ditch (051202020804)	Acres	9,698	1,005	2,100	2,994	435	19	53	16,306
	Sq. Mi.	15.2	1.6	3.3	4.7	0.7	0.0	0.1	25.48
	Percent	59%	6%	13%	18%	3%	0%	0%	100%

2.1.1 Cropland

Croplands can be a source of *E. coli*, TP, and H+. Accumulation of *E. coli*, TP, and H+ on cropland occurs from fertilization with chemical (e.g., anhydrous ammonia) fertilizers, manure fertilizers, inorganic fertilizers, wildlife excreta, irrigation water, and application of waste products from municipal and industrial wastewater treatment facilities. The majority of nutrient loading from cropland occurs from fertilization with commercial and manure fertilizers (Patwardhan, 1997). Use of manure for nitrogen supplementation often results in excessive phosphorus loads relative to crop requirements (Patwardhan, 1997). Data available from the National Agricultural Statistic Service (NASS) were downloaded to estimate crop acreage in the subwatersheds. The 2022 NASS statistics were used in the analysis as shown in Table 14 and displayed in Figure 12 (USDA, 2022).

Table 14: Major Cash Crop Acreage in the Indian Creek White River Watershed

Subwatershed	Crop	Total Acreage	% of Subwatershed Cash Crop Acreage
Bens Creek (051202020801)	Soybean	4,017	57%
	Corn	2,870	41%
	Dbl Crop Winter Wheat/Soybean	71	1%
	Total	6,987	100%
Pickel Ditch (051202020802)	Soybean	6,737	58%
	Corn	4,746	41%
	Dbl Crop Winter Wheat/Soybean	156	1%
	Total	11,703	99%
Smothers Creek (051202020803)	Soybean	8,207	71%
	Corn	3,387	29%
	Winter Wheat	28	<1%
	Total	11,641	100%
Pollard Ditch (051202020804)	Soybean	5,737	59%
	Corn	3,640	37%
	Dbl Crop Winter Wheat/Soybean	317	3%
	Total	9,715	100%

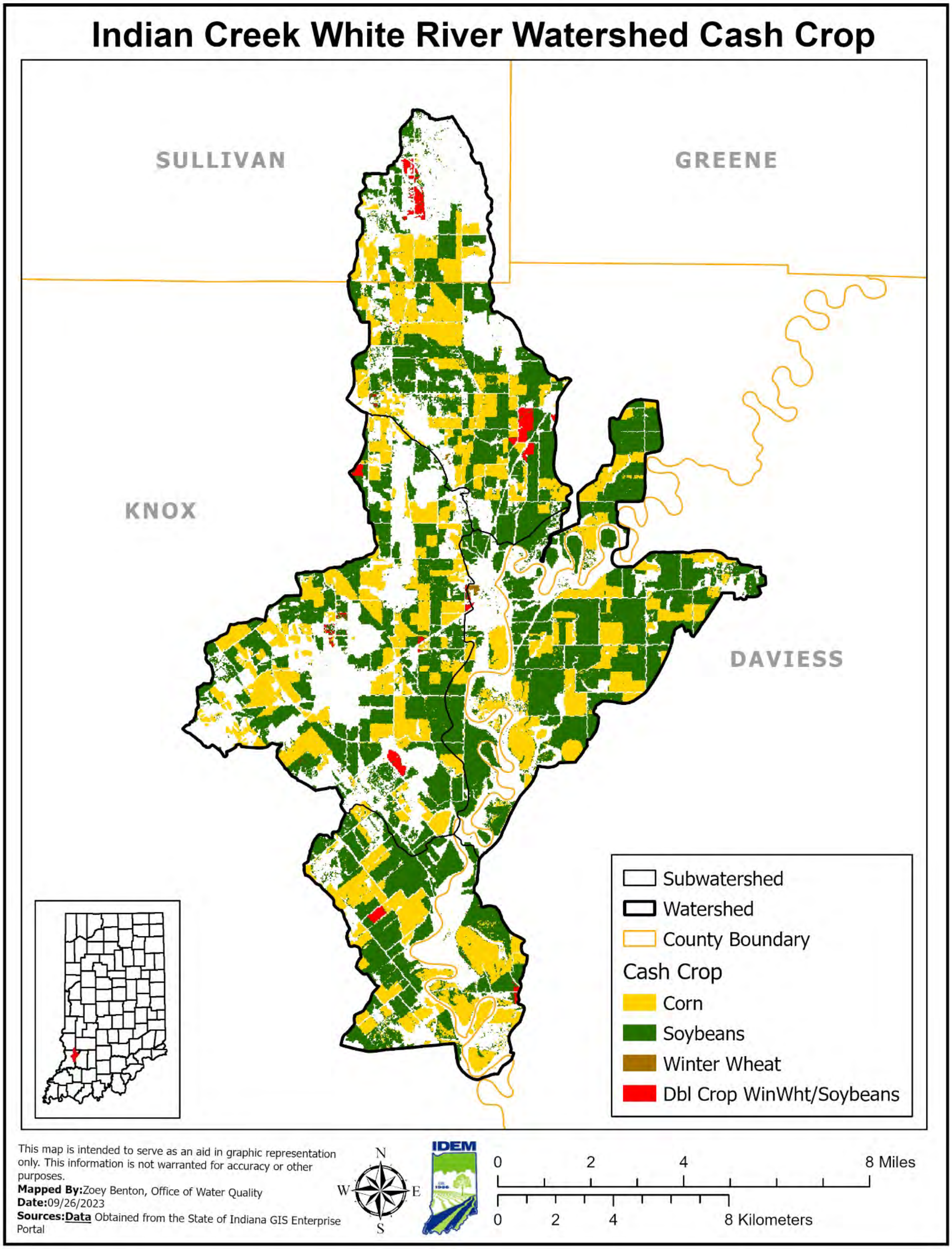

Figure 12: Cash Crop Acreage in the Indian Creek White River Watershed

2.1.2 Hay/Pastureland

Run-off from pastures and livestock operations can be potential agricultural sources of *E. coli*, TP, TSS, and H+. For example, animals grazing in pasturelands deposit manure directly upon the land surface. Even though a pasture may be relatively large and animal densities low, the manure will often be concentrated near the feeding and watering areas in the field. These areas can quickly become barren of plant cover, increasing the possibility of erosion and contaminated run-off during a storm event.

Livestock is a potential source of *E. coli*, TP, H+ and TSS to streams, particularly when direct access is unrestricted and/or where feeding structures are located adjacent to riparian areas. The amount of hay/pastureland across the landscape can be used as an indicator for potential areas of higher densities of livestock. Information on permitted livestock facilities within the Indian Creek White River watershed are presented in Figure 13 and Table 15.

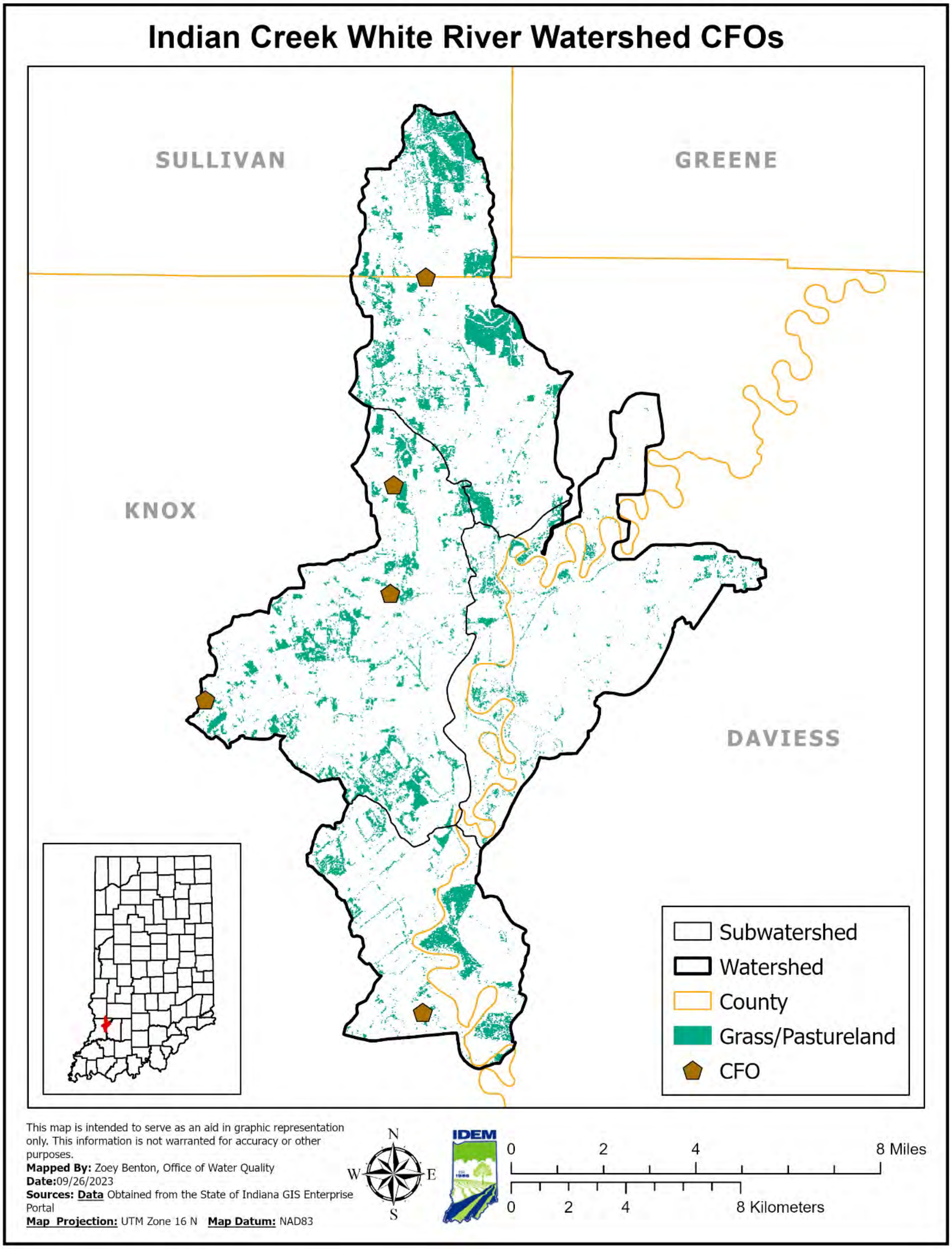

Figure 13: Grassland and Pastureland in the Indian Creek White River Watershed with CFO locations

2.1.3 Confined Feeding Operations (CFOs) and Animal Feeding Operations (AFOs)

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:

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

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 a few 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

As of 2012, only farms with ongoing discharges need an NPDES permit. CAFOs that are not discharging enter the CFO program instead. There are currently zero NPDES CAFO permits in Indiana. CFOs are considered nonpoint sources by U.S. EPA. Indiana's CFOs have state issued permits and are therefore categorized as nonpoint sources for the purposes of this TMDL. CFO permits are "no discharge" permits. Therefore, it is prohibited for these facilities to discharge to any waters of the State.

The CFO regulations (327 IAC 19, 327 IAC 15-16) require that operations “not cause or contribute to an impairment of surface waters of the state.” IDEM regulates these CFOS under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 19, which implement the statute regulating CFOs, were effective on July 1, 2012. The rule at 327 IAC 15-16, which regulates CAFOs and incorporates by reference the federal NPDES CAFO regulations, became effective on July 1, 2012.

The animals raised in CFOs produce manure that is stored in pits, lagoons, tanks and other storage devices. The manure can then be applied to area fields as fertilizer. CFO owners can either apply manure to land they own or market and sell manure to other landowners per regulations outlined in 327 IAC 19-14. When stored and applied properly, this beneficial re-use of manure provides a natural source for crop nutrition. It also lessens the need for fuel and other natural resources that are used in the production of fertilizer. However, CFOs can be a potential source of *E. coli*, TP, TSS, and H+. Contamination from mismanaged animal waste can lead to excess nutrients and pathogens in surface water, groundwater, and soil. Runoff from CFOs practicing improper mitigation and/or application of manure can lead to high TSS in surface water. Additionally, nitrification from high levels of ammonia in manure can cause an increase in H+.

There are five CFOs (two CAFO sized and three CFO sized) permitted through the CFO program in the Indian Creek White River watershed, as shown in Table 15 and in Figure 13. Manure used for land application in the Indian Creek White River watershed may also originate from CAFOs and CFOs in adjacent watersheds.

Table 15: CFO Programs in the Indian Creek White River Watershed

Subwatershed	Program	Farm Size	CFO Permit ID	Operation Name	County	Animal Type and Permitted number
Pollard Ditch	CFO	CAFO	856	PitchCo Incorporated Finishing Site	Knox	Nursery Pigs: 4,950 Finishers: 8,400
Pickel Ditch	CFO	CFO	4164	PitchCo Incorporated Sow Site	Knox	Sows: 1,446
	CFO	CFO	4167	Worland Brothers Hog Farm LLC	Knox	Sows: 600 Boars: 3
	CFO	CAFO	6763	Farbest Farms Incorporated Brooder Hub 5	Knox	Turkeys: 180,000
Bens Creek	CFO	CFO	4617	Mark Harlow Prahdan Farm	Knox	Turkeys: 44,000

2.2 Topography and Geology

Topographic and geologic features of a watershed play a role in defining a watershed’s drainage pattern. Figure 14 below displays the topography of the watershed. Information concerning the topography and geology within the Indian Creek White River watershed is available from the Indiana Geological and Water Survey (IGWS). The Indian Creek White River watershed spans across the southeast corner of Sullivan County, the northeast/eastern portion of Knox County, and some of the western side of Daviess County. The Indian Creek White River Watershed is located in the Wabash Lowland-Southern Hills and Lowlands physiographic region, which is characterized by rugged uplands, deeply carved valleys, and entrenched streams. The Wabash Lowland region is unique in that a thin layer of glacial materials blankets the bedrock in the area. These glacial tills are too thin to have a noticeable effect on the landforms.

The entire bedrock surface of Indiana consists of sedimentary rocks. The major kinds of sedimentary rock in Indiana include limestone, dolomite, shale, sandstone, and siltstone. The northern two-thirds of Indiana are composed of glacial deposits containing groundwater. These glacial aquifers exist where sand and gravel bodies are present within clay-rich glacial till (sediment deposited by ice) or in alluvial, coastal, and glacial outwash deposits. Groundwater availability is much different in the southern unglaciated part of Indiana. There are few unconsolidated deposits above the bedrock surface, and the voids in bedrock (other than karst dissolution features) are seldom sufficiently interconnected to yield useful amounts of groundwater. Reservoirs in the state, such as Monroe Lake and Patoka Lake, are used for water supply in lieu of water wells in southern Indiana. The IGWS website contains information about the geology of Indiana (https://igws.indiana.edu/).

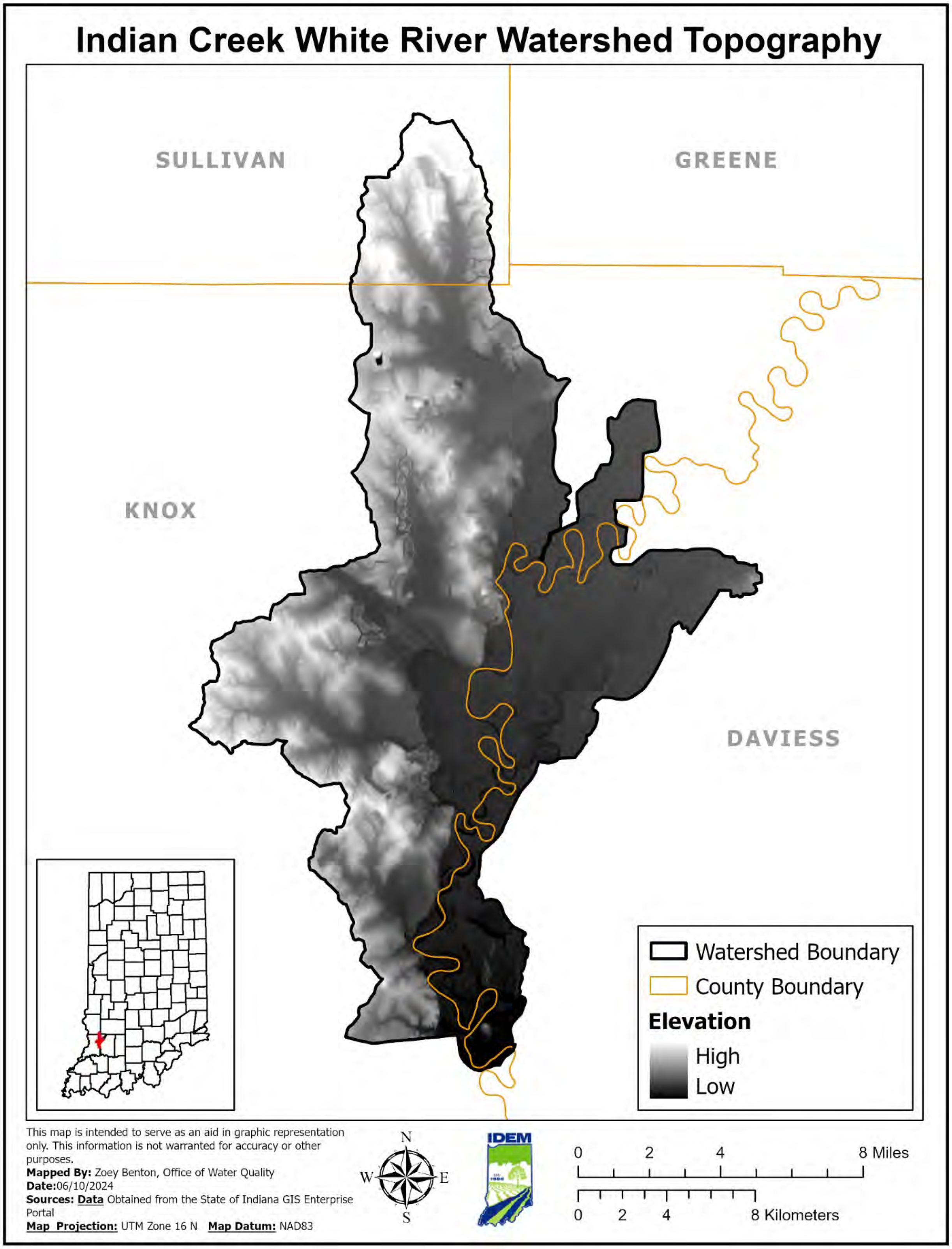

Figure 14: Topography of the Indian Creek White River Watershed. Digital Elevation Data (DEM) was taken from the state of Indiana's Geographic Information Office (GIO).

2.2.1 Karst Geology

Karst regions are characterized by the presence of limestone or other soluble rocks, where drainage has been largely diverted into subsurface routes. The topography of such areas is dominated by sinkholes, sinking streams, large springs, and caves. The only karst features within the Indian Creek White River watershed are a few sinkholes, most of which are located in the Pickel Ditch subwatershed. Figure 15 displays the location of the karst features of the watershed.

The Indiana Karst Conservancy is a 501(c)(3) non-profit organization dedicated to the preservation and conservation of Indiana's unique karst features. Unfortunately, many karst features are subject to incompatible or damaging uses. Most are on private land, occasionally with owners unaware of their significance or apathetic to their preservation. The IKC provides protection and awareness of karst features and the unique habitat they provide. For more information regarding the IKC, visit their website at http://www.ikc.caves.org/.

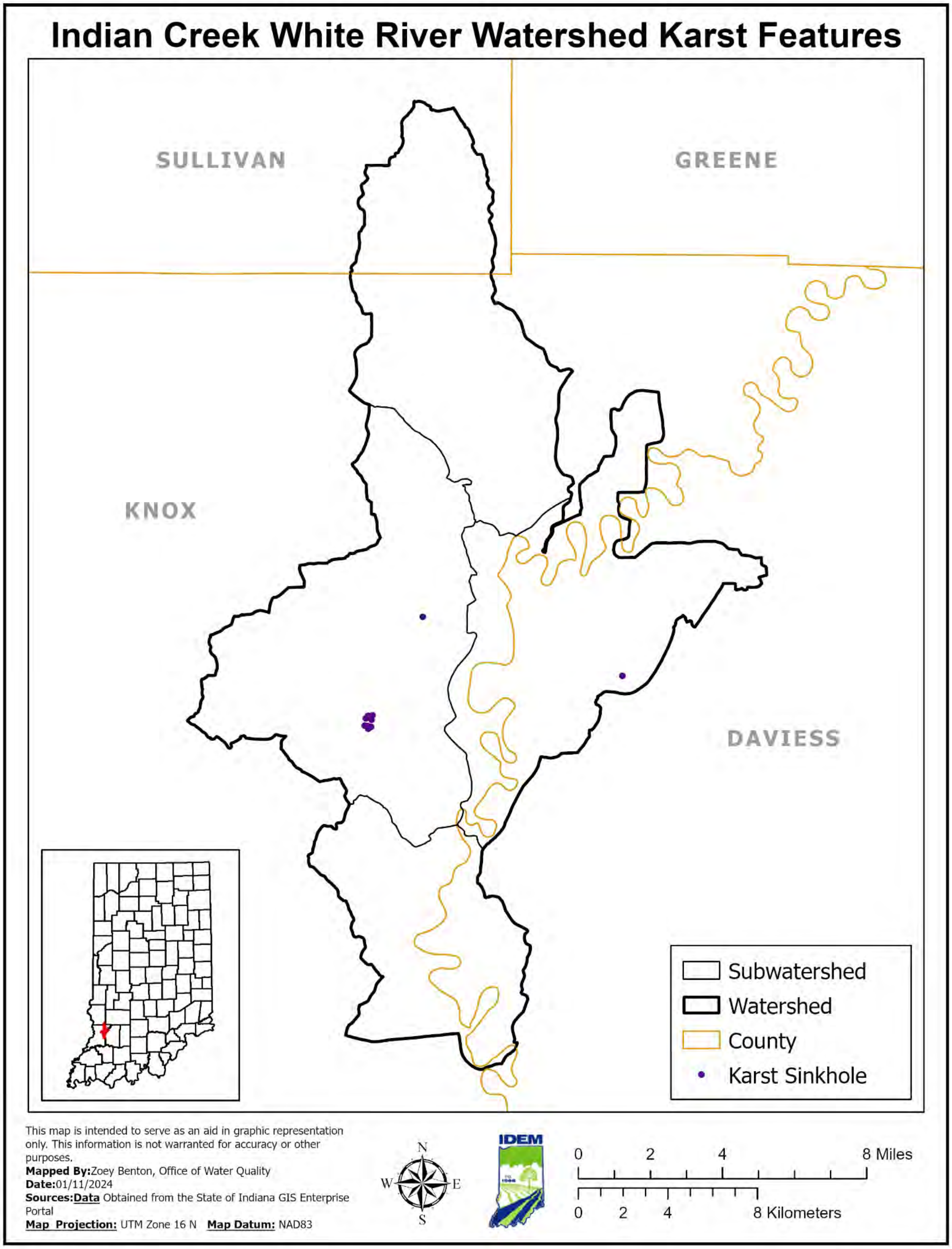

Figure 15: Karst Features in the Indian Creek White River Watershed

2.3 Soils

There are different soil characteristics that can affect the health of the watershed. Some of these characteristics include soil drainage, septic tank suitability, soil saturation, and soil erodibility.

2.3.1 Soil Drainage

The hydrologic soil group classification is a means for categorizing soils by similar infiltration and run-off characteristics during periods of prolonged wetting. The NRCS has defined four hydrologic groups for soils, described in Table 16 (USDA, 2009). Data for the Indian Creek White River watershed were obtained from the USDA Soil Survey Geographic (SSURGO) database. Downloaded data were summarized based on the major hydrologic group in the surface layers of the map unit and are displayed below in Figure 16 and Table 17.

The majority of the watershed is covered by category D soils (59 percent) followed by category B soils (28 percent), category A soils (7 percent), and category C soils (6 percent). Category D soils have very slow infiltration rates with high clay content and poor drainage. Category B soils are moderately deep and well drained with moderate infiltration rates. Given these are the two most dominant hydrologic soil groups, regular flooding is likely typical in much of the watershed. Flood events contribute to the distribution of pollutants across the landscape.

Of the soils identified as category D, 25 percent are specified as dual hydrologic group B/D, and 46 percent are specified as dual hydrologic group C/D. Dual hydrologic groups are identified for certain wet soils that can be adequately drained. The first letter applies to the drained condition, and the second letter applies to the undrained, natural condition. Due to the watershed scale of this report, soils with dual hydrologic groups are classified as category D. However, a site-specific study should consider whether the site has been drained when soils with a dual hydrologic group are present.

Table 16: Hydrologic Soil Groups

Hydrologic Soils Group	Description
A	Soils with high infiltrations rates. Usually deep, well drained sands or gravels. Little run-off.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of run-off.

Understanding Table 16: Typically, clay soils that are poorly drained have lower infiltration rates, while well-drained sandy soils have the greatest infiltration rates. Soil infiltration rates can affect pollutant loading within a watershed. During high flows, areas with low soil infiltration capacity can flood and therefore discharge high pollutant loads to nearby waterways. In contrast, soils with high infiltration rates can slow the movement of pollutants to streams.

Table 17: Hydrologic Soil Groups in the Indian Creek White River Subwatersheds

Subwatershed	Hydrologic Soil Group			
	A	B	C	D
Bens Creek	1.59%	37.83%	3.16%	52.25%
Pickel Ditch	8.29%	16.32%	10.17%	63.65%
Smothers Creek	6.33%	48.04%	0.48%	40.32%
Pollard Ditch	7.12%	10.31%	8.02%	62.46%

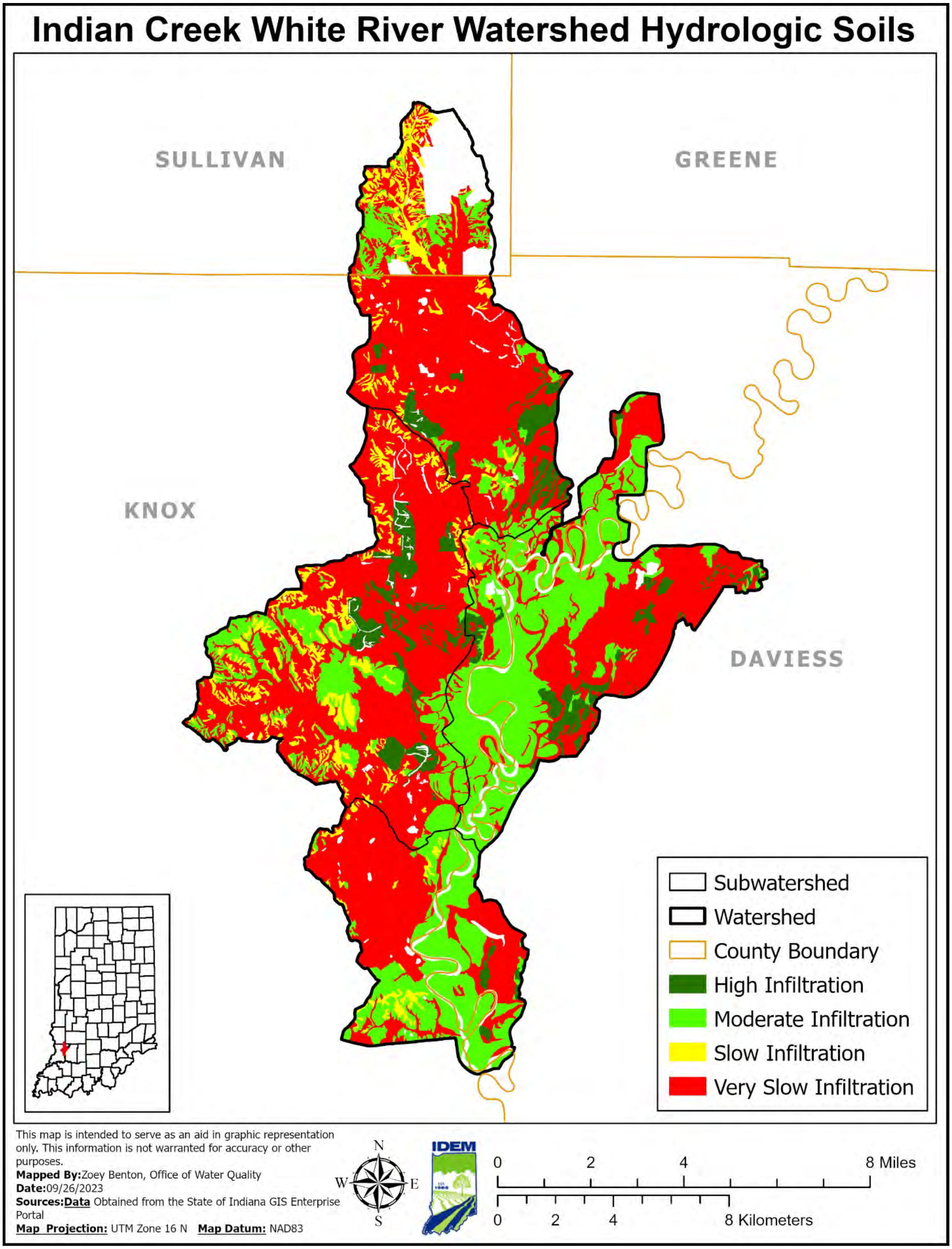

Figure 16: Hydrological Soil Groups in the Indian Creek White River Watershed

2.3.2 Septic Tank Absorption Field Suitability

Septic systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high-water tables, shallow compact till, and coarse soils present limitations for septic systems. Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems. Hydrologic soil group A and B soils have good infiltration rates and have less risk for failing septic systems due to this factor. Group C and D soils have slow infiltration rates with finer textures and slow water movement. Table 17 illustrates the hydrologic soil groups for the Indian Creek White River subwatersheds.

While system design can often overcome these limitations (i.e., perimeter drains, mound systems or pressure distribution), sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system. Common soil type limitations which contribute to septic system failure are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash, and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeological (inadequate soil filtration), there can be adverse effects to surface waters due to *E. coli* and nutrients (Horsley and Witten, 1996). Refer to Section 2.6.1 for additional information regarding septic systems within the Indian Creek White River watershed.

Figure 17 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Indian Creek White River watershed. Only that part of the soil between depths of 24 and 60 inches is evaluated for septic system suitability. The ratings are based on the soil properties that affect absorption of the effluent, construction, maintenance of the system, and public health.

Soils labeled “very limited” indicate that the soil has at least one feature that is unfavorable for septic systems. Approximately 86 percent of the Indian Creek White River watershed is considered “very limited” in terms of soil suitability for septic systems. These limitations generally cannot be overcome without major soil reclamation or expensive installation designs. Approximately 3 percent of the soils within the Indian Creek White River watershed are “not rated,” meaning these soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations. Approximately 10 percent of the soils in the Indian Creek White River watershed are designated “somewhat limited,” meaning that the soil type is suitable for septic systems.

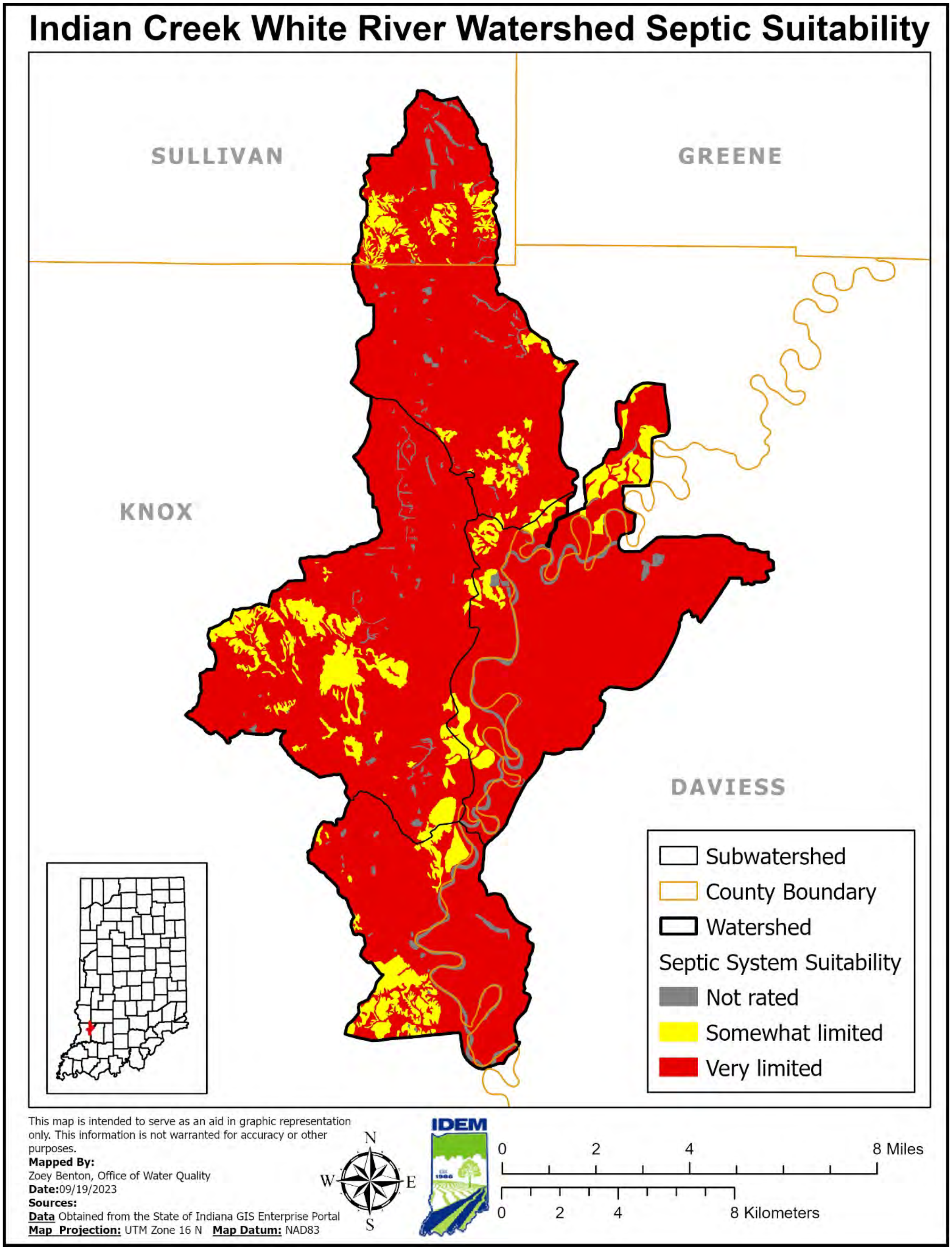

Figure 17: Suitability of Soils for Septic Systems in the Indian Creek White River watershed

2.3.3 Soil Saturation and Wetlands

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Hydric soils have been identified in the Indian Creek White River watershed and are important in consideration of wetland restoration activities. Approximately 27,612 acres or 43 percent of the Indian Creek White River watershed area contains soils that are considered hydric or have hydric inclusions. Table 18 includes a list of each map unit within the Indian Creek White River watershed with a hydric rating greater than 0. Hydric ratings indicate the percentage of the map unit that meets the criteria for hydric soils. For example, map units with a hydric rating of 6 or less likely have small areas of hydric soils, and map units with a hydric rating of 95 or more have more significant coverage of hydric soils. Figure 18 displays the hydric ratings for each map unit within the Indian Creek White River watershed. The Smothers Creek subwatershed appears to have the most significant hydric soil coverage by acreage in the watershed. However, a large majority of these soils have been drained for either agricultural production or urban development and in their current condition would no longer support a wetland. The location of remaining hydric soils can be used to consider possible locations of wetland creation or enhancement. There are many components in addition to soil type that must be considered before moving forward with wetland design and creation.

Table 18: Hydric Ratings for Map Units with Hydric Soils in the Indian Creek White River Watershed

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
Bens Creek	Ar	Armiesburg silty clay loam, occasionally flooded	3	301
	Ar	Armiesburg silty clay loam, rarely flooded	3	0
	Ay	Ayrshire fine sandy loam	3	7
	Bd	Birds silt loam, rarely flooded	100	66
	ClF	Chetwynd loam, 25 to 50 percent slopes	3	8
	Hb	Haymond silt loam, rarely flooded	3	160
	IvA	Iva silt loam, 0 to 2 percent slopes	5	79
	MbB2	Markland silt loam, 2 to 6 percent slopes, eroded	2	17
	McA	McGary silt loam, 0 to 2 percent slope	10	196
	No	Nolin silty clay loam, frequently flooded	6	664
	No	Nolin silty clay loam, rarely flooded	2	3
	Pb	Patton silt loam	100	522
	Po	Petrolia silty clay loam, 0 to 2 percent slopes, frequently flooded	95	737

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
	Ra	Ragsdale silt loam	100	36
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	74
	Ro	Ross loam, frequently flooded	3	249
	Vn	Vincennes clay loam	100	568
	Wa	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	5	110
	Zp	Zipp silty clay loam, 0 to 2 percent slopes, rarely flooded	100	219
	Zp	Zipp silty clay, 0 to 2 percent slopes	95	46
	Zs	Zipp silty clay loam, 0 to 2 percent slopes, rarely flooded, overwash	100	11
	Zt	Zipp silty clay, frequently flooded	100	1
			Total Acreage:	**4,075**
Pickel Ditch	AnC	Alvin fine sandy loam, 6 to 12 percent slopes	3	26
	Ar	Armiesburg silty clay loam, rarely flooded	3	219
	Ay	Ayrshire fine sandy loam	3	522
	Bd	Birds silt loam, rarely flooded	100	476
	BlB	Bloomfield loamy fine sand, 2 to 10 percent slopes	3	135
	BlD	Bloomfield loamy fine sand, 12 to 18 percent slopes	3	0
	HeA	Henshaw silt loam, 0 to 2 percent slopes	3	81
	IvA	Iva silt loam, 0 to 2 percent slopes	5	416
	Kn	Kings silty clay	100	479
	Ly	Lyles fine sandy loam	100	257
	MbB2	Markland silt loam, 2 to 6 percent slopes, eroded	2	32
	McA	McGary silt loam, 0 to 2 percent slope	10	169
	No	Nolin silty clay loam, rarely flooded	2	440
	Pb	Patton silt loam	100	1,238
	Po	Petrolia silty clay loam, 0 to 2 percent slopes, frequently flooded	95	159
	Ra	Ragsdale silt loam	100	67
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	363
	Vn	Vincennes loam	100	97
	Wa	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	5	1,133
	Zp	Zipp silty clay, 0 to 2 percent slopes	95	465
	Zt	Zipp silty clay, frequently flooded	100	516

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
			Total Acreage:	7,292
Smothers Creek	AdB	Ade loamy fine sand, 2 to 6 percent slopes	3	2
	AnC	Alvin fine sandy loam, 6 to 12 percent slopes	3	27
	AnD	Alvin fine sandy loam, 12 to 18 percent slopes	3	6
	Ar	Armiesburg silty clay loam, occasionally flooded	3	1,040
	Ar	Armiesburg silty clay loam, rarely flooded	3	1,036
	Ay	Ayrshire fine sandy loam	3	1,148
	Bd	Birds silt loam, rarely flooded	100	24
	BlB	Bloomfield loamy fine sand, 2 to 10 percent slopes	3	18
	BlD	Bloomfield loamy fine sand, 12 to 18 percent slopes	3	9
	ElA	Elston sandy loam, 0 to 3 percent slopes	3	18
	Hb	Haymond silt loam, rarely flooded	3	43
	Hc	Haymond variant loamy sand, frequently flooded	2	31
	Kn	Kings silty clay, rarely flooded	100	116
	Ls	Lyles fine sandy loam	100	340
	Ly	Lyles fine sandy loam	100	33
	Ly	Lyles loam	100	524
	Mo	Montgomery silty clay loam	100	28
	No	Nolin silty clay loam, frequently flooded	6	235
	No	Nolin silty clay loam, rarely flooded	2	1,133
	Pb	Patton silt loam	100	101
	Po	Petrolia silty clay loam, 0 to 2 percent slopes, frequently flooded	95	1365
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	25
	Sa	Selma loam	100	178
	Sc	Selma clay loam	100	56
	Vn	Vincennes clay loam	100	244
	Vn	Vincennes loam	100	282
	Vo	Vincennes clay loam, gravelly substratum	100	39
	Wa	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	5	16
	Zp	Zipp silty clay loam, 0 to 2 percent slopes, rarely flooded	100	1,370
	Zp	Zipp silty clay, 0 to 2 percent slopes	95	67

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
	Zs	Zipp silty clay loam, 0 to 2 percent slopes, rarely flooded, overwash	100	747
	Zt	Zipp silty clay, frequently flooded	100	22
			Total Acreage:	**10,323**
Pollard Ditch	AdB	Ade loamy fine sand, 2 to 6 percent slopes	3	28
	AnC	Alvin fine sandy loam, 6 to 12 percent slopes	3	45
	Ar	Armiesburg silty clay loam, rarely flooded	3	59
	Ay	Ayrshire fine sandy loam	3	181
	Bd	Birds silt loam, rarely flooded	100	431
	BlB	Bloomfield loamy fine sand, 2 to 10 percent slopes	3	7
	EkA	Elkinsville silt loam, 0 to 2 percent slopes	3	37
	ElA	Elston sandy loam, 0 to 3 percent slopes	3	393
	HeA	Henshaw silt loam, 0 to 2 percent slopes	3	44
	HeA	Henshaw silt loam, 0 to 2 percent slopes	6	11
	IvA	Iva silt loam, 0 to 2 percent slopes	5	636
	IvB2	Iva silt loam, 2 to 4 percent slopes, eroded	3	21
	Kn	Kings silty clay	100	1196
	Ly	Lyles fine sandy loam	100	96
	McA	McGary silt loam, 0 to 2 percent slope	10	30
	No	Nolin silty clay loam, rarely flooded	2	77
	Pb	Patton silt loam	100	427
	Ra	Ragsdale silt loam	100	133
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	175
	Sa	Selma loam	100	280
	Sc	Selma clay loam	100	127
	Sn	Stendal silt loam	3	7
	VgA	Vigo silt loam, 0 to 2 percent slopes	3	84
	VgB2	Vigo silt loam, 2 to 4 percent slopes, eroded	3	7
	Vn	Vincennes loam	100	71
	Wa	Wakeland silt loam, 0 to 2 percent slopes, frequently flooded	5	936
	Zp	Zipp silty clay, 0 to 2 percent slopes	95	386
			Total Acreage:	**5,923**

Understanding Table 18: Areas with the most acreage of hydric soils might contain opportunities for wetland restoration activities that could help address water quality impairments. The hydric rating indicates the percentage of the map unit with hydric soils. Map units with a hydric rating of 100 have 100% hydric soils.

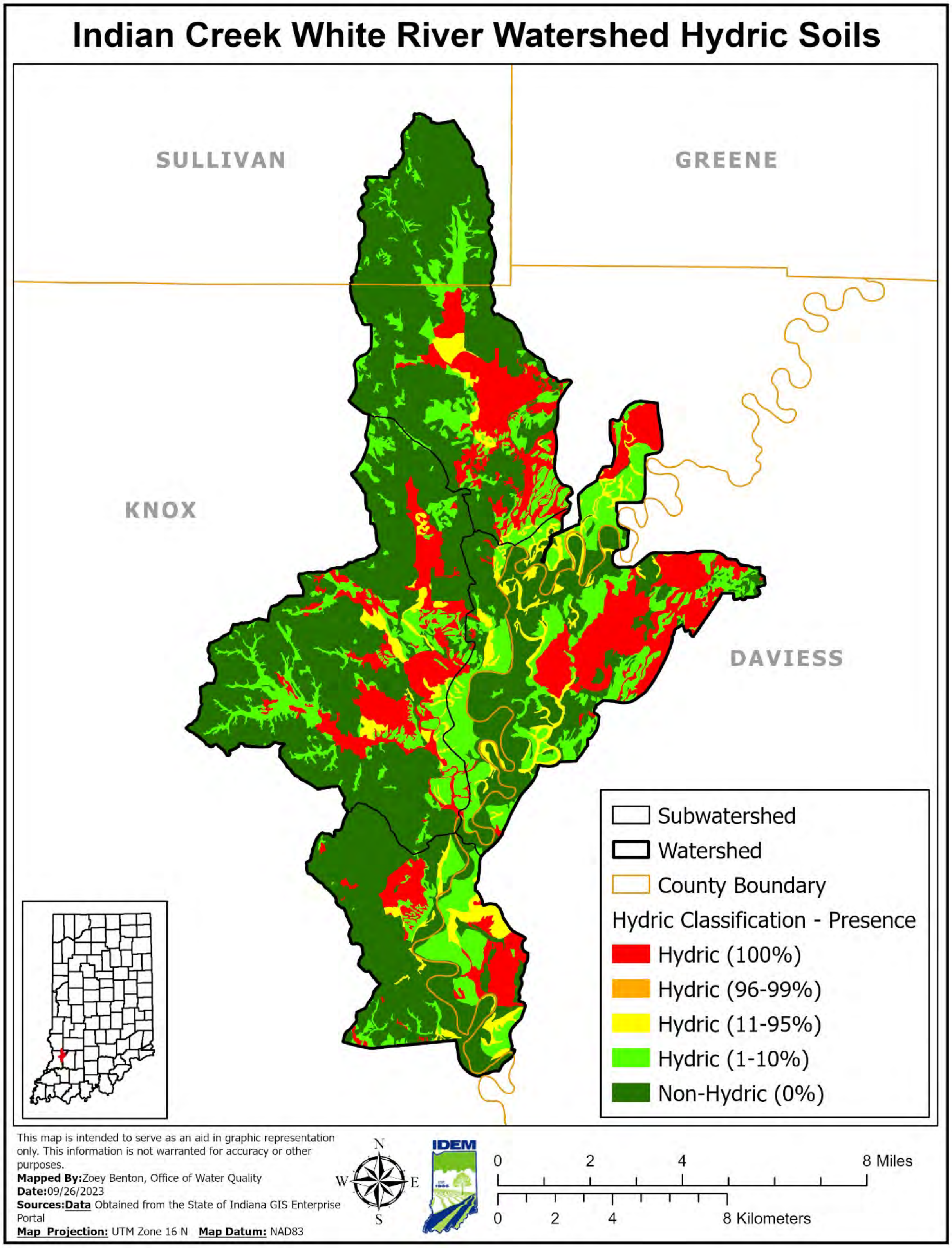

Figure 18: Hydric Soils in the Indian Creek White River Watershed
(https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey)

Nationally, since the late 1600s roughly 50 percent of the wetlands in the lower 48 states have been lost. Indiana has lost a large number of its wetlands, approximately 85 percent (USGS, 1999). In the 1800s and 1900s millions of acres of wetlands were drained or converted into farms, cities, and roads. In the early 1700s, wetlands covered 25 percent of the total area of Indiana. That number has been greatly reduced. By the late 1980s, over 4.7 million acres of wetlands had been lost. Before the conversion of wetlands, there were over 5.6 million acres of wetlands in the state, wetlands such as bogs, fens, wet prairies, dune and swales, cypress swamps, marshes, and swamps. Wetlands now cover less than 4 percent of Indiana. (www.idem.IN.gov/wetlands/importance-of-wetlands)

Wetlands are home to wildlife. More than one-third (1/3) of America's threatened and endangered species live only in wetlands, which means they need them to survive. Over 200 species of birds rely on wetlands for feeding, nesting, foraging, and roosting. Wetlands provide areas for recreation, education, and aesthetics. More than 98 million people hunt, fish, birdwatch, or photograph wildlife. Americans spend $59.5 billion annually on these activities.

Wetland plants and soils naturally store and filter nutrients and sediments. Calm wetland waters, with their flat surface and flow characteristics, allow these materials to settle out of the water column, where plants in the wetland take up certain nutrients from the water. As a result, our lakes, rivers and streams are cleaner and our drinking water is safer. Constructed wetlands can even be used to clean wastewater, when properly designed. Wetlands also recharge our underground aquifers. Over 70 percent of Indiana residents rely on groundwater for part or all of their drinking water needs.

Wetlands protect our homes from floods. Like sponges, wetlands soak up and slowly release floodwaters. This lowers flood heights and slows the flow of water down rivers and streams. Wetlands also control erosion. Shorelines along rivers, lakes, and streams are protected by wetlands, which hold soil in place, absorb the energy of waves, and buffer strong currents.

Wetland areas act to buffer wide variations in flow conditions that result from storm events. They also allow water to infiltrate slowly thus reducing the risks of contaminated water run-off into waterbodies. Agencies such as the USGS and U.S. Fish and Wildlife Service (USFWS) estimate that Indiana has lost approximately 85 percent of the state's original wetlands. Currently, the Indian Creek White River watershed contains approximately 5,583 acres of wetlands or 8.78 percent of the total surface area. Additional information on wetlands can be found on the IDEM website https://www.idem.IN.gov/wetlands.

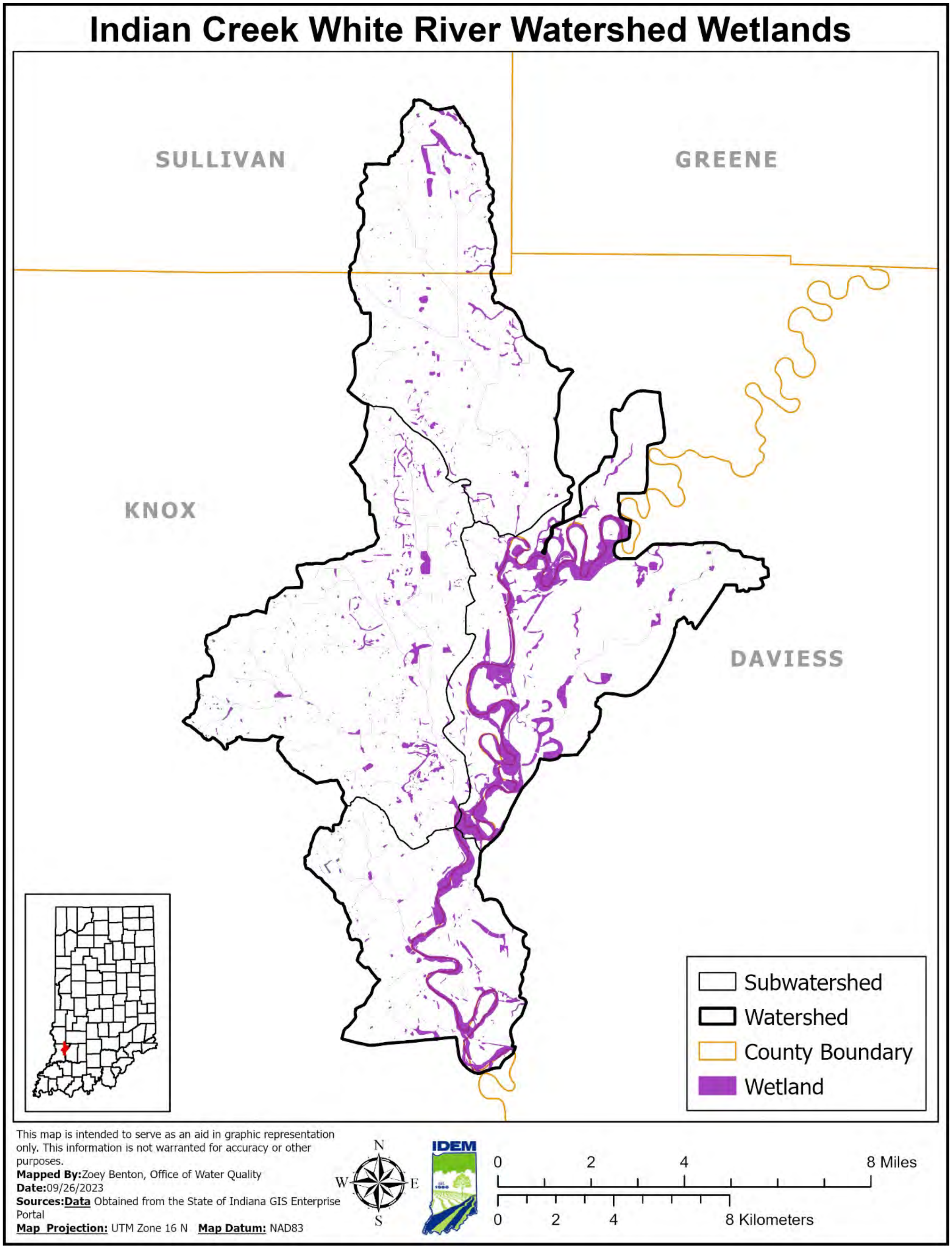

Figure 19: Location of Wetlands in the Indian Creek White River Watershed

The USFWS has the responsibility for mapping wetlands in the United States. Those map products are currently held in the Fish and Wildlife Service Wetland Database (sometimes referred to as the National Wetlands Inventory or NWI). Figure 19 shows estimated locations of wetlands as defined by the USFWS's NWI. Wetland data for Indiana is available from the U.S. Fish and Wildlife Service's NWI at https://www.fws.gov/wetlands/data/Mapper.html. The NWI was not intended to produce maps that show exact wetland boundaries comparable to boundaries derived from ground soil surveys, and boundaries are generalized in most cases. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis. Therefore, the estimate of the current extent of wetlands in the Indian Creek White River watershed from the NWI may not agree with those listed in Section 2.1, which are based upon the National Agricultural Statistics Service. For more information on the wetland classification codes visit http://www.fws.gov/wetlands/Data/Wetland-Codes.html. The USFWS uses data standards to increase the quality and compatibility of its data.

Changes to the natural drainage patterns of a watershed are referred to as hydromodifications. Historically, drain tiles have been used throughout Indiana to drain marsh or wetlands and make it either habitable or tillable for agricultural purposes. While tile drainage is understood to be pervasive – estimated at thousands of miles in Indiana – it is extremely challenging to quantify on a watershed basis because these tiles were established by varying authorities including County Courts, County Commissioners, or County Drainage Boards.

In addition to tile drainage, regulated drains are another form of hydromodification. A regulated drain is a drain which was established through either a Circuit Court or Commissioners Court of the County prior to January 1, 1966, or by the County Drainage Board since that time. Regulated drains can be an open ditch, a tile drain, or a combination of both. The County Drainage Board can construct, maintain, reconstruct, or vacate a regulated drain.

2.3.4 Soil Erodibility

Although erosion is a natural process within stream ecosystems, excessive erosion negatively impacts the health of watersheds. Erosion increases sedimentation of the streambeds, which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as run-off, it carries pollutants and other nutrients that are attached to the sediment. Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms.

The NRCS maintains a list of highly erodible lands (HEL) units for each county based upon the potential of soil units to erode from the land (https://efotg.sc.egov.usda.gov/references/public/NE/HEL_Intro.pdf). HELs are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive topsoil from one place and depositing it in another. The classification for HELs is based upon an erodibility index for a soil, which is determined by dividing the potential average annual rate of erosion by the soil unit's soil loss tolerance (T) value, which is the maximum annual rate of erosion that could occur without causing a decline in long-term productivity. The soil types and acreages in the Indian Creek White River watershed are listed in Table 19. HELs and potential HELs in the Indian Creek White River watershed are mapped in Figure 20. A total of approximately 21,679 acres or 34 percent of the Indian Creek White River watershed is considered highly erodible or potentially highly erodible.

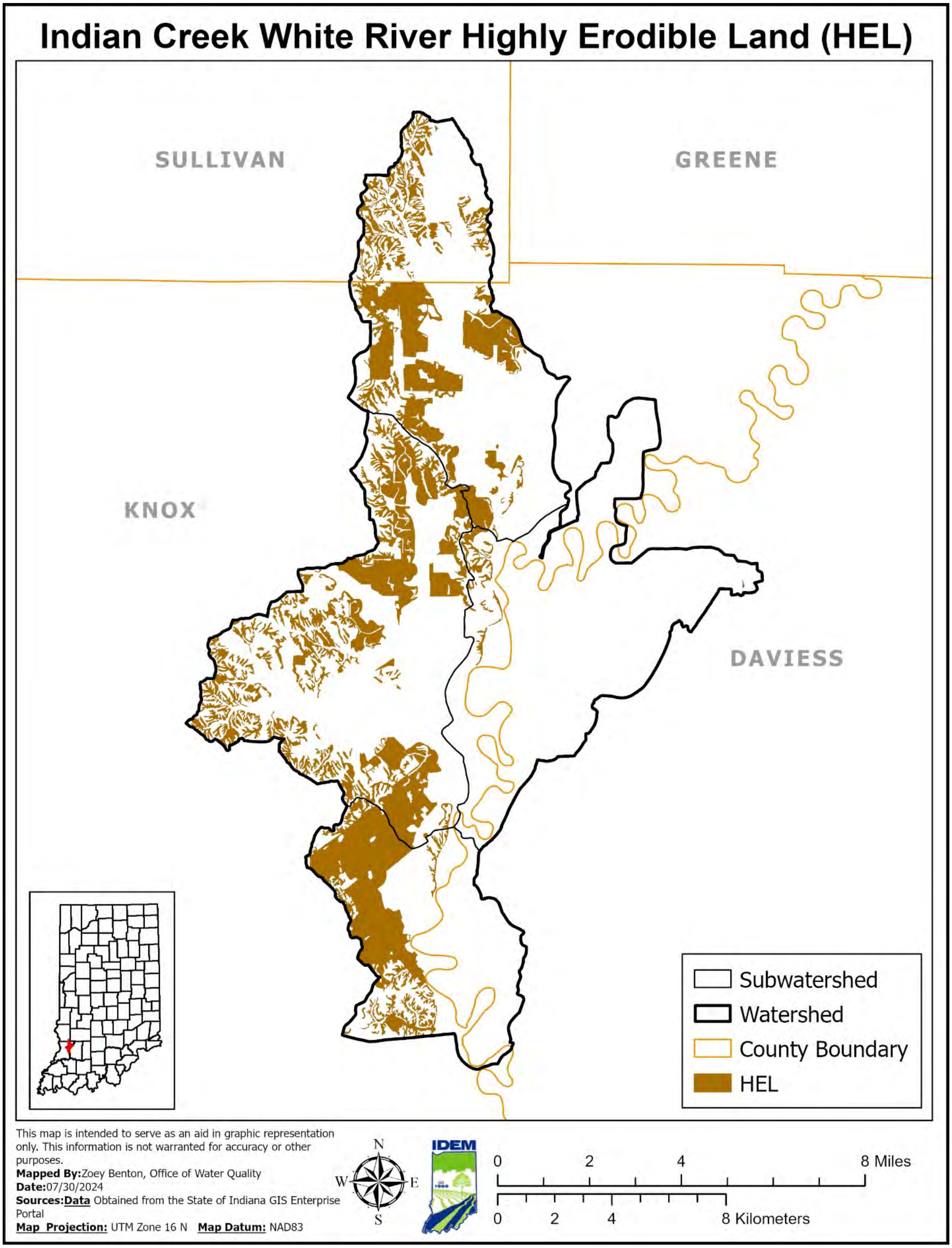

Figure 20: Location of Highly Erodible Lands (HEL) in the Indian Creek White River Watershed

Table 19: HEL/Potential HEL Total Acres in the Indian Creek White River Watershed

Map Symbol	HEL/Potential HEL Soil Types	Acres
AfC2	Alford silt loam, 5 to 10 percent slopes, eroded	105
AfC3	Alford silt loam, 5 to 10 percent slopes, severely eroded	245
AfD2	Alford silt loam, 10 to 18 percent slopes, eroded	53
AfD3	Alford silt loam, 10 to 18 percent slopes, severely eroded	101
AfE	Alford silt loam, 18 to 35 percent slopes	7
AfF	Alford silt loam, 25 to 50 percent slopes	3
AlB3	Ava silt loam, 2 to 6 percent slopes, severely eroded	56
AlC2	Alford silt loam, 5 to 10 percent slopes, eroded	1,079
AlD3	Alford silt loam, 10 to 18 percent slopes, severely eroded	712
AnD	Alvin fine sandy loam, 12 to 18 percent slopes	6
ClF	Chetwynd loam, 25 to 50 percent slopes	8
CnC2	Cincinnati silt loam, Wabash Lowland, 6 to 12 percent slopes, eroded	70
CnC3	Cincinnati silt loam, Wabash Lowland, 6 to 12 percent slopes, severely eroded	344
CnD2	Cincinnati silt loam, 12 to 18 percent slopes, eroded	49
CnD3	Cincinnati silt loam, 12 to 18 percent slopes, severely eroded	159
FaB	Fairpoint parachannery silt loam, 0 to 8 percent slopes	7,180
FbG	Fairpoint very parachannery silt loam, 35 to 90 percent slopes	3,121
HkE	Hickory silt loam, 18 to 25 percent slopes	26
HkF	Hickory loam, 25 to 50 percent slopes	1,263
HkF	Hickory silt loam, 25 to 35 percent slopes	6
HkF3	Hickory silt loam, 18 to 35 percent slopes, severely eroded	30
HoC3	Hosmer silt loam, 5 to 10 percent slopes, severely eroded	3,817
HoD3	Hosmer silt loam, 10 to 18 percent slopes, severely eroded	1,854
PrD2	Princeton fine sandy loam, 12 to 18 percent slopes, eroded	7
SyC3	Sylvan silt loam, 6 to 12 percent slopes, severely eroded	137
SyD3	Sylvan silt loam, 12 to 18 percent slopes, severely eroded	102
SyF	Sylvan silt loam, 25 to 40 percent slopes	43
	Total	20,584

Understanding Table 19 and Figure 20: Areas with the most acreage of HEL might contribute to water quality impairments associated with excessive erosion, including IBC/TSS, and might contain opportunities for restoration to decrease erosion.

The Indiana State Department of Agriculture (ISDA) tracks trends in conservation and cropland through annual county conservation transects. Data collected through the conservation transect (https://secure.in.gov/isda/divisions/soil-conservation/cover-crop-and-tillage-transect-data/) can help estimate the adoption of conservation practices and the average annual soil loss from Indiana's agricultural lands. The latest figures for the counties in the Indian Creek White River watershed are shown in Table 20. Conditions captured in ISDA's conservation transect include the acreage of living cover and the percent of crop acres where living cover was present. The conservation transect also includes the percentage of crop acres that had not been tilled during the time the survey was conducted. According to ISDA, the conservation survey was conducted in the late winter to early spring of 2024. The early spring survey is not intended to quantify pre-planting tillage. (ISDA, 2024).

Table 20: Tillage Transect Data for 2023 by County in the Indian Creek White River Watershed

County	Tillage Practice 2023			
	Living Cover		No Till	
	Corn	Soybean	Corn	Soybean
Sullivan	4,129 acres 7.3%	11,691 acres 13.8%	60%	86%
Knox	27,590 acres 28.4%	48,146 acres 36.3%	58%	45%
Daviess	17,112 acres 21.8%	12,464 acres 15.9%	50%	71%

Understanding Table 20: According to the table, in the early spring of 2024, Knox County had the greatest amount of living cover for both corn and soybean crops. Sullivan County had tilled the least amount of both corn and soybean crop acres.

2.3.5 Streambank Erosion

Streambank erosion is potentially a significant source of pollutants in the Indian Creek White River watershed. Streambank erosion is a natural process but can be accelerated due to a variety of human activities including the following:

- Vegetation located adjacent to streams flowing through crop or pasture fields is often removed to promote drainage or cattle access to water. The loss of vegetation makes the streambanks more susceptible to erosion due to the loss of plant roots.
- Extensive areas of agricultural tiles promote much quicker delivery of rainfall into streams than would occur without subsurface drainage, which could potentially contribute to streambank erosion, due to high velocities and shear stress.
- The creation of impervious surfaces (e.g., streets, rooftops, driveways, parking lots) can also lead to rapid run-off of rainfall and higher stream velocities that might cause streambank erosion.

2.4 Wildlife and Classified Lands

2.4.1 Wildlife

The Indiana Department of Natural Resources (IDNR) is the primary entity responsible for monitoring wildlife populations and habitats throughout Indiana. Wildlife such as deer, waterfowl, raccoon, beaver, etc. can be sources of *E. coli* and nutrients. The animal habitat and proximity to surface waters are important factors that determine if animal waste can be transported to surface waters. Waterfowl and riparian mammals deposit waste directly into streams while other riparian species deposit waste in the flood-plain, which can be transported to surface waters by runoff from precipitation events. Animal waste deposited in upland areas can also be transported to streams and rivers; however, due to the distance from uplands to surface streams, only larger precipitation events can sustain sufficient amounts of runoff to transport upland animal waste to surface waters.

Little information exists surrounding feces depositional patterns of wildlife, and a direct inventory of wildlife populations is generally not available. However, based on the *Bacteria Source Load Calculator* developed by the Center for TMDL and Watershed Studies, bacteria production by animal type is estimated as well as their preferred habitat. High *E. coli* and nutrient levels are a concern in areas with higher concentrations of wildlife in the habitats described in Table 21, particularly during high flow conditions or flooding events.

Table 21: Bacteria Source Load by Species

Wildlife Type	*E. coli* Production Rate (cfu/day – animal)	Habitat
Deer	1.86×10^8	Entire Watershed
Raccoon	2.65×10^7	Low density on forests in rural areas; high density on forest near a permanent water source or near cropland
Muskrat	1.33×10^7	Near ditch, medium sized stream, pond or lake edge
Goose	4.25×10^8	Near main streams and impoundments
Duck	1.27×10^9	Near main streams and impoundments
Beaver	2.00×10^5	Near streams and impoundments in forest and pastures

2.4.2 Classified Lands

Managed lands shown in Table 22 include natural and recreation areas which are owned or managed by the IDNR, federal agencies, local agencies, non-profit organizations, and conservation easements. Classified lands are public or private lands containing areas supporting the growth of native or planted trees, native or planted grasses, wetlands, or other acceptable types of cover that have been set aside for managed production of timber, wildlife habitat, and watershed protection. Natural areas provide ideal habitat for wildlife. Some of the more common wildlife often found in natural areas include white-tailed deer, raccoon, muskrat, fowl, and beaver. While wildlife is known to contribute *E. coli* and nutrients to the surface waters, natural areas provide economic, ecological, and social benefits and should be preserved and protected. Management practices such as impervious surfaces reduction, native vegetation plantings, wetland creation, and riparian buffer maintenance will help in reducing stormwater run-off transporting pollutants to the streams. Table 22 and Figure 21 show the managed lands within the Indian Creek White River watershed. Table 23 and Figure 21 show the classified lands within Indian Creek White River watershed.

Table 22: Managed Lands within the Indian Creek White River Watershed

Unit Name	Manager	Area (acres)
Carnahan Public Access Site	DNR Fish and Wildlife	2
White River Bend Wildlife Management Area	DNR Fish and Wildlife	710
Total		712

Table 23: Classified Lands within the Indian Creek White River Watershed

Classified Lands	
Subwatershed	**Area (acres)**
Pickel Ditch	268
Bens Creek	113
Smothers Creek	430
Pollard Ditch	0
Total	812

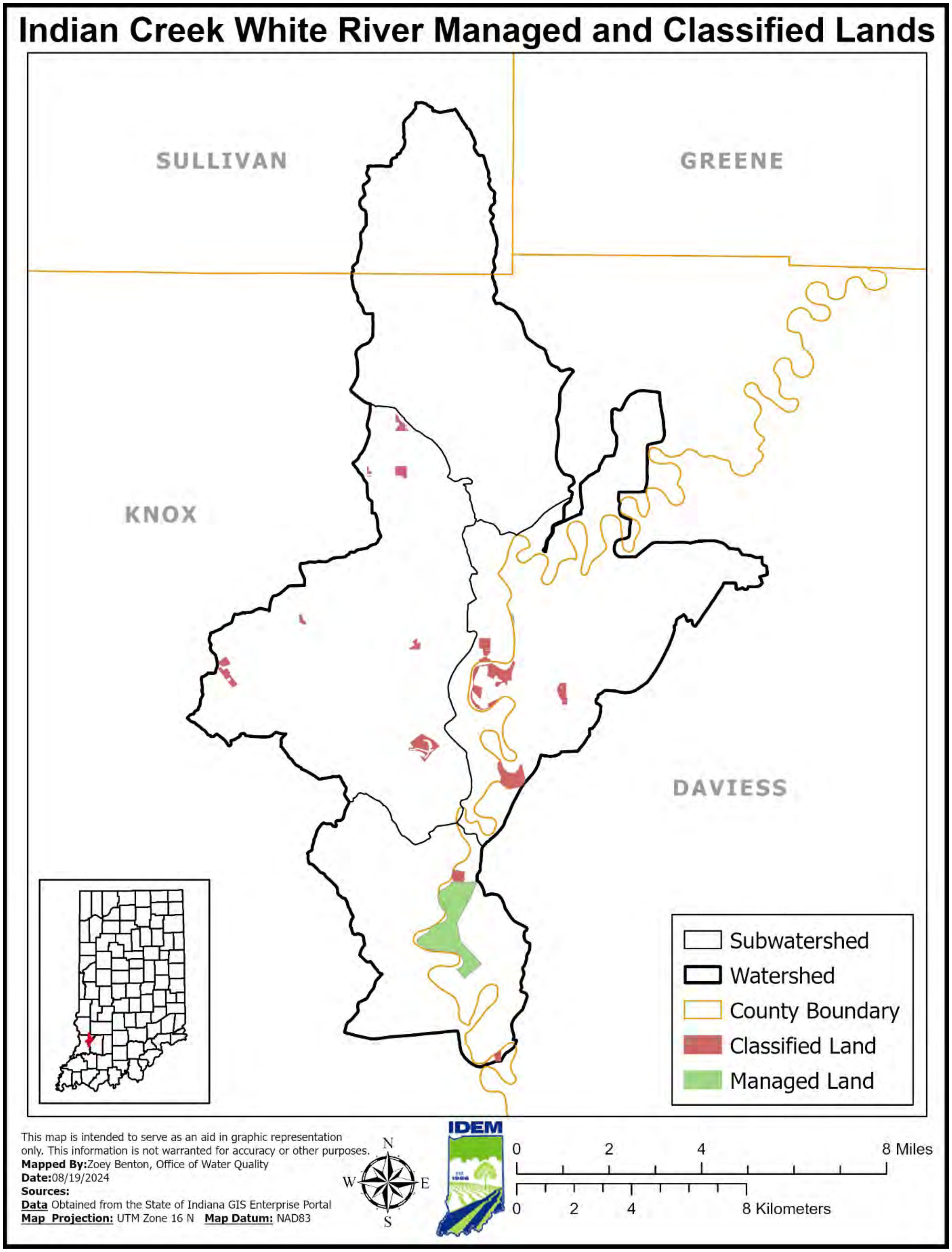

Figure 21: Managed and Classified Lands within the Indian Creek White River Watershed

2.5 Climate and Precipitation

Climate varies in Indiana depending on latitude, topography, soil types, and lakes. Information on Indiana's climate is available through sources including the Midwestern Regional Climate Center (https://mrcc.purdue.edu/).

Climate data from station USC00122620 located in Elnora, IN, just northeast of the Indian Creek White River watershed was used for climate analysis of this watershed. Monthly data from 2009 - 2025 were available at the time of analysis. In general, the climate of the region is continental with hot, humid summers and cold winters. From 2015 to 2024, the average winter temperature in Elnora was 35.6°F and the average summer temperature was 74.7°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 191 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of run-off on water quality. From 2015 to 2024, the annual average precipitation in Elnora at Station USC00122620 was approximately 49.4 inches, including approximately 14.3 inches on average of total annual snowfall. The Indian Creek White River watershed is considered moderately wet. The rainfall and climate data specific to the watershed is available from the Midwestern Regional Climate Center (https://mrcc.purdue.edu). Heavy rainfall increases flow rates within streams as the volume and velocity of water moving through the stream channels increases. The velocity of water also increases as streambank steepness increases.

The Indian Creek White River watershed falls within the southwest region, or Climatic Division 7, of the state according to DNR, Division of Water. As seen in Figure 22, in the past 72 months, division 7 has been moderately wet with a Standardized Precipitation Index (SPI) of 1.06. This means that over the past 6 years there has been more rain than what is considered normal based on the SPI methodology (https://wrcc.dri.edu/).

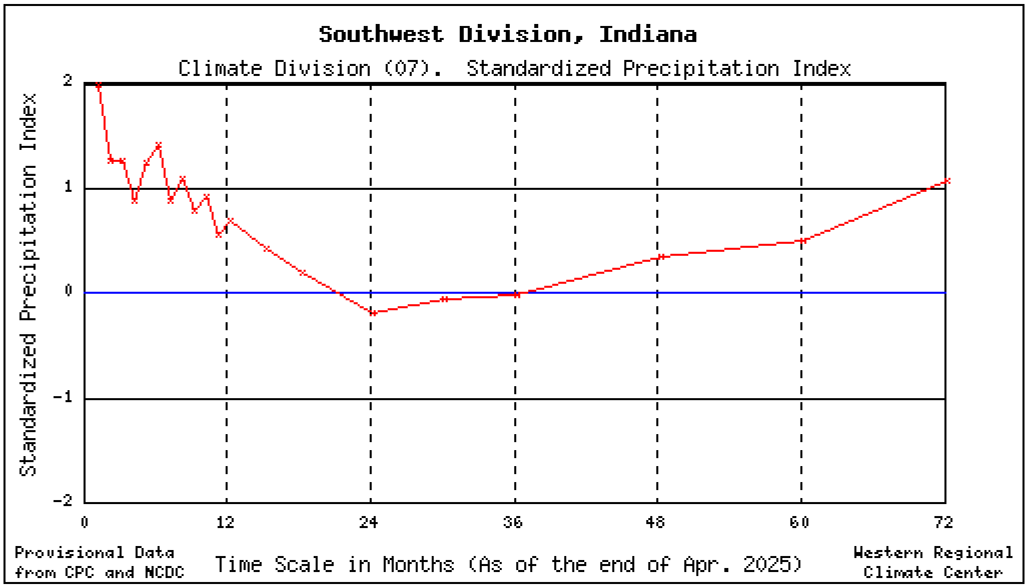

Figure 22: Standardized Precipitation Index (SPI) in Division 7 Over 72 Months

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of stormwater on the Indian Creek White River watershed. Using data from USC00122620 during 2015 to 2024, 82 percent of the measurable precipitation events were low intensity (i.e., less than 0.2 inches), while 4 percent of the measurable precipitation events were greater than one inch.

According to the “Impacts of Climate Change for the State of Indiana” report developed by the Purdue Climate Change Research Center, Indiana will face a number of potential impacts if greenhouse gas concentrations continue to increase. The occurrence and duration of extreme hot events is likely to increase in Indiana while the occurrence of extreme cold events is likely to decrease (Diffenbaugh et al., 2005). Indiana could experience a significant reduction in extreme cold temperatures leading to warmer winters (Diffenbaugh et al., 2005). Total annual average precipitation is likely to increase, but there may be a shift in when the precipitation occurs. Winter and spring precipitation are projected to increase by 21 and 30 percent, respectively, by the end of the century, but summer precipitation may decline by 9 percent. Warmer and wetter winters may result in higher streamflow and increased flooding frequency. Total runoff is also projected to increase annually by between 25 and 38 percent by the end of the century with the largest percent increase in total runoff occurring in the winter and spring (Purdue Climate Change Research Center, 2008).

Understanding when precipitation events occur helps in the linkage analysis in Section 4.0, which correlates flow conditions to pollutant concentrations and loads. Data indicates that the wet weather season in the Indian Creek White River watershed currently occurs between the months of March and July.

2.6 Human Population

Counties with land located in the Indian Creek White River watershed include Knox, Daviess, and Sullivan. There are several incorporated municipal governments within the Indian Creek White River watershed. These municipalities include four towns: Sandborn, Wheatland, Edwardsport, and Plainville, and one city: Bicknell. There are also several unincorporated municipalities called Census Designated Places (CDPs) including: Freelandville, Ragsdale, and Westphalia (www.census.gov). U.S. Census data for each county during the past three decades are provided in Table 24 (U.S. Census Bureau, 2020).

Table 24: Population Data for Counties in Indian Creek White River Watershed

County	2000	2010	2020
Knox	39,256	38,440	36,282
Daviess	29,820	31,648	33,381
Sullivan	21,751	21,475	20,817
Total	90,827	91,563	90,480

Understanding Table 24: Water quality is linked to population growth because a growing population often leads to more development, translating into more houses, roads, and infrastructure to support more people. The table provides information that shows how population has changed in each of the counties located in the Indian Creek White River watershed over time. In addition, understanding population trends can help watershed stakeholders to anticipate where pressures might increase in the future and where action in the Indian Creek White River could help prevent further water quality degradation.

Estimates of population within Indian Creek White River watershed are based on US Census data 2020 and the percentage of census blocks in urban and rural areas (Table 25). Based on this analysis, the estimated population of the watershed is 5,175 with approximately 100 percent of the population classified as rural residents. Figure 23 below indicates population density within the Indian Creek White River watershed.

Table 25: Estimated Population in the Indian Creek White River Watershed

County	2020 Population	Total Estimated Watershed Urban Population	Total Estimated Watershed Rural Population	Total Estimated Watershed Population	Percent of Total Watershed Population
Knox	36,282	0	4,735	4,735	91.5%
Daviess	33,381	10	425	435	8.4%
Sullivan	20,817	0	5	5	.1%
Total	90,480	10	5,165	5,175	100%

Understanding Table 25: Understanding where the greatest population is concentrated within the Indian Creek White River watershed will help watershed stakeholders understand where different types of water quality pressures might currently exist. In general, watersheds with large urban populations are more likely to have problems associated with lots of impervious surfaces, poor riparian habitat, flashy stormwater flows, and large wastewater inputs. Alternatively, watersheds with mostly a non-urban population are more likely to suffer problems from failing septic systems, agricultural run-off, and other types of poor riparian habitat (e.g., channelized streams). Comparing the information in Table 24 with the information in Table 25 can provide an understanding of how population might change in the Indian Creek White River watershed and which counties are experiencing the most growth and shifts in urban and non-urban population. Population change can serve as an indicator for changes in land uses. For example, growing populations might mean more development, resulting in increased impervious surfaces and more infrastructure (e.g., sanitary sewer and storm sewer). Declining population in areas of the Indian Creek White River watershed might signify communities with under-utilized infrastructure and indicate opportunities to "rightsize" existing infrastructure and promote changes to land use that would benefit water quality (e.g., green infrastructure).

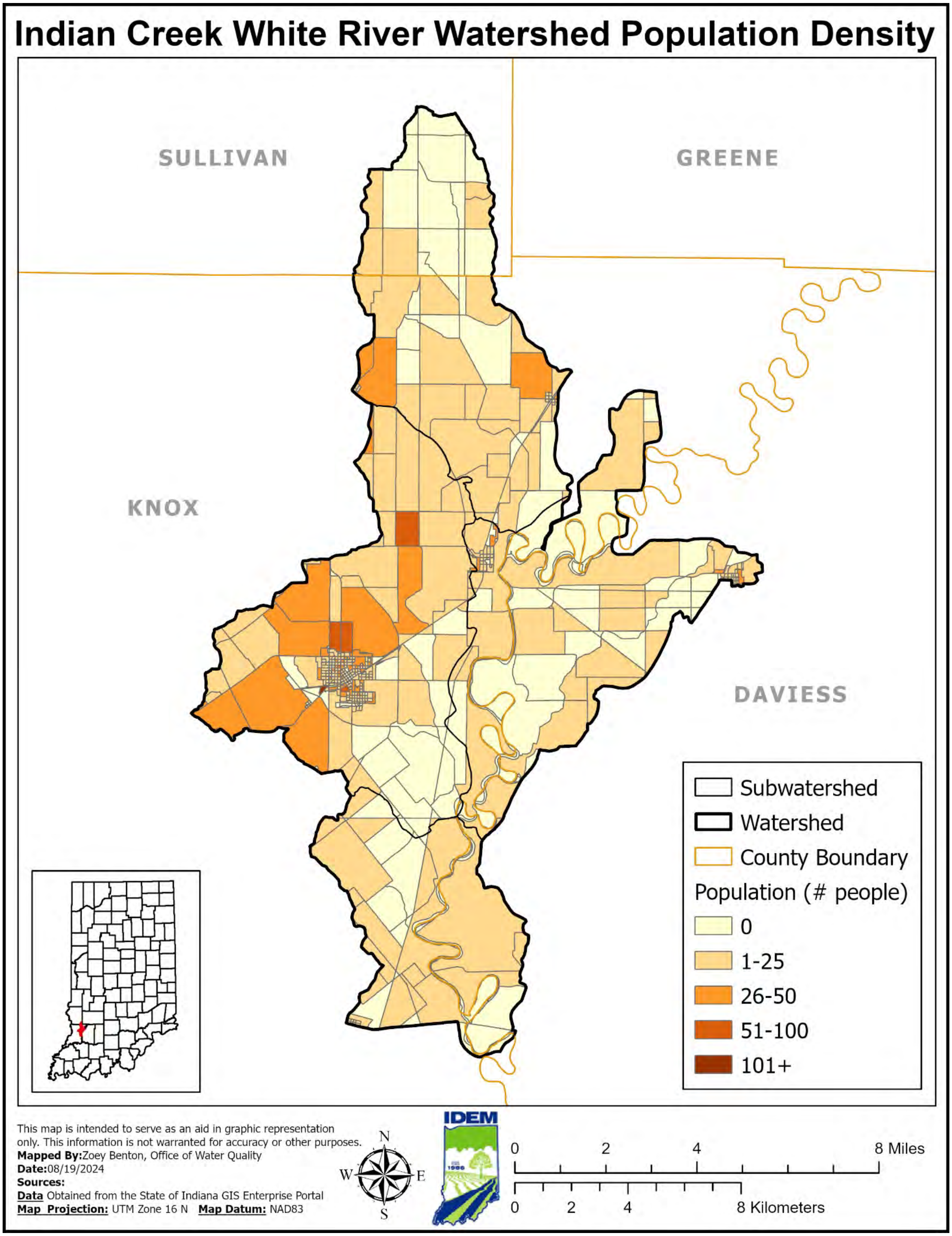

Figure 23: Population Density in the Indian Creek White River Watershed

2.6.1 Onsite Sewage Disposal Systems

Onsite sewage disposal systems (i.e., septic systems) are underground wastewater treatment structures most commonly used in rural areas without centralized sewer systems. According to the U.S. EPA's SepticSmart Homeowners program, one in five U.S. homes has a septic system (U.S. EPA, 2018). Local health departments regulate onsite residential sewage disposal systems via designated authority from the Indiana Department of Health (IDOH) (410 IAC 6-8.3). More than 800,000 onsite sewage disposal systems are currently used in Indiana. Local health departments issue more than 15,000 permits per year for new systems and about 6,000 permits for repairs (IDOH, 2020).

Septic systems typically consist of a septic tank to settle out and digest sewage solids followed by a system of perforated piping to distribute the treated wastewater for absorption into the soil, also known as the drainfield. The septic tank holds the wastewater to allow for separation of solids, fats, oil, and grease. The septic tank also contains microorganisms that aid in breaking down sludge and removing some contaminants from the wastewater. The drainfield allows for further removal of remaining contaminants through soil filtration.

Regular maintenance of septic systems, such as frequent inspections and pumping of the septic tank, is important to ensure the system is functioning safely and effectively. Septic systems that are properly designed and maintained should not serve as a source of contamination to surface waters. However, a septic system may fail if it is not properly installed or maintained or if it is installed in an unsuitable soil type as discussed in Section 2.3.2. A septic system that is not functioning properly may inadvertently contaminate groundwater and surface water due to elevated levels of nutrients and bacteria that can be found in untreated or inadequately treated household wastewater. A septic system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures.

2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters.

3. Effluent is discharged from the system causing contamination of a potable water supply, groundwater, or surface water.

The general sewage disposal requirements (410 IAC 6-8.3-52) in the residential onsite sewage systems rule state that:

- No person shall throw, run, drain, seep, or otherwise dispose into any of the surface waters or groundwaters of this state, or cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into such waters, any organic or inorganic matter from a dwelling or residential onsite sewage system that would cause or contribute to a health hazard or water pollution.

- The: (1) design; (2) construction; (3) installation; (4) location; (5) maintenance; and (6) operation; of residential onsite sewage systems shall comply with the provisions of this rule.

The violations and permit denial and revocation section (410 IAC 6-8.3-55) of the residential onsite sewage system rule states that:

- Should a residential onsite sewage system fail, the failure shall be corrected by the owner within the time limit set by the health officer.
- If any component of a residential onsite sewage system is found to be: (1) defective; (2) malfunctioning; or (3) in need of service; the health officer may require the repair, replacement, or service of that component. The repair, replacement, or service shall be conducted within the time limit set by the health officer.
- Any person found to be violating this rule may be served by the health officer with a written order stating the nature of the violation and providing a time limit for satisfactory correction thereof.

A comprehensive database of septic systems within the Indian Creek White River watershed is not available; therefore, the rural population of each subwatershed was calculated to obtain a general representation of the number of systems. The U.S. Census provides the total number of people within a county as well as the total urban and rural population of the county. Subwatershed population is estimated by using the census block population found within each area. It is assumed that the numbers of septic systems in the subwatersheds are directly proportional to rural household density. An additional estimate of septic systems can be made using the 1990 US Census, as that is the last Census that inventoried how household wastewater is disposed. The rural households in the Indian Creek White River subwatersheds are shown in Table 26, along with a calculated density (total rural households divided by total area). The rural household density can be used to compare the different subwatersheds within the Indian Creek White River watershed (U.S. Census Bureau, 2020).

Table 26: Rural and Urban Household Density in the Indian Creek White River Subwatersheds

Subwatershed	County	Area of County in Subwatershed (mi2)	County Households in Subwatershed	Urban Households	Rural Households	Rural Household Density (Houses/mi2)	Urban Household Density (Houses/mi2)
Pollard Ditch	Sullivan	8.47	4	0	4	7.85	0
	Knox	17.02	196	0	196		
	Total	25.49	200	0	200		
Pickel Ditch	Knox	30.62	1,962	0	1,962	64.08	0
	Total	30.62	1,962	0	1,962		
Smothers Creek	Knox	9.16	144	0	144	11.46	<1
	Daviess	17.45	162	1	161		
	Total	26.61	306	1	305		

Bens Creek	Knox	10.82	86	0	86	6.84	<1
	Daviess	5.84	33	5	28		
	Total	16.66	119	5	114		

A report by the Indiana Advisory Commission on Intergovernmental Relations (ACIR) surveyed county health department officials statewide from 2016 to 2017. Of the 444 unsewered communities reported statewide, the study was able to identify 192 of those communities where at least 25 percent of the individual wastewater treatment systems were failing. Unsewered communities were defined as "contiguous geographical areas containing at least 25 homes and/or businesses that are not served by sewers" (Palmer et. al, 2019). Table 27 reports unsewered communities by county relevant to the Indian Creek White River watershed.

Table 27: Unsewered residences/businesses reported by county in 2016-2017.

County	Unsewered Communities	Residences	Businesses
Daviess	No Report	No Report	No Report
Sullivan	8	530	14
Knox	7	497	13

2.6.2 Urban Stormwater

In areas not covered under the NPDES construction stormwater, industrial stormwater, or MS4 programs, as discussed in Section 2.8.3, stormwater run-off from developed areas is not regulated under a permit and is therefore a nonpoint source. Run-off from urban areas can carry a variety of pollutants originating from a variety of sources. Typically, urban sources of nutrients are fertilizer application to lawns and pet waste. Potential sources of *E. coli* in urban stormwater include pet waste, urban wildlife waste, homeless encampments, leaking sanitary sewers exfiltrating to storm drains, combined and sanitary sewer overflows, failing septic systems and more (Clary et al., 2014). Depending on the amount of developed, impervious land in a watershed, urban nonpoint source inputs can result in localized or widespread water quality degradation. The percent and distribution of developed land in the Indian Creek White River watershed is discussed in Section 2.1. However, inputs from urban sources are difficult to quantify. Estimates can be made of residential areas that might receive fertilizer treatment. These estimates provide insight into the potential of urban nonpoint sources as important sources of TP, TSS, H+ and *E. coli* in the Indian Creek White River watershed.

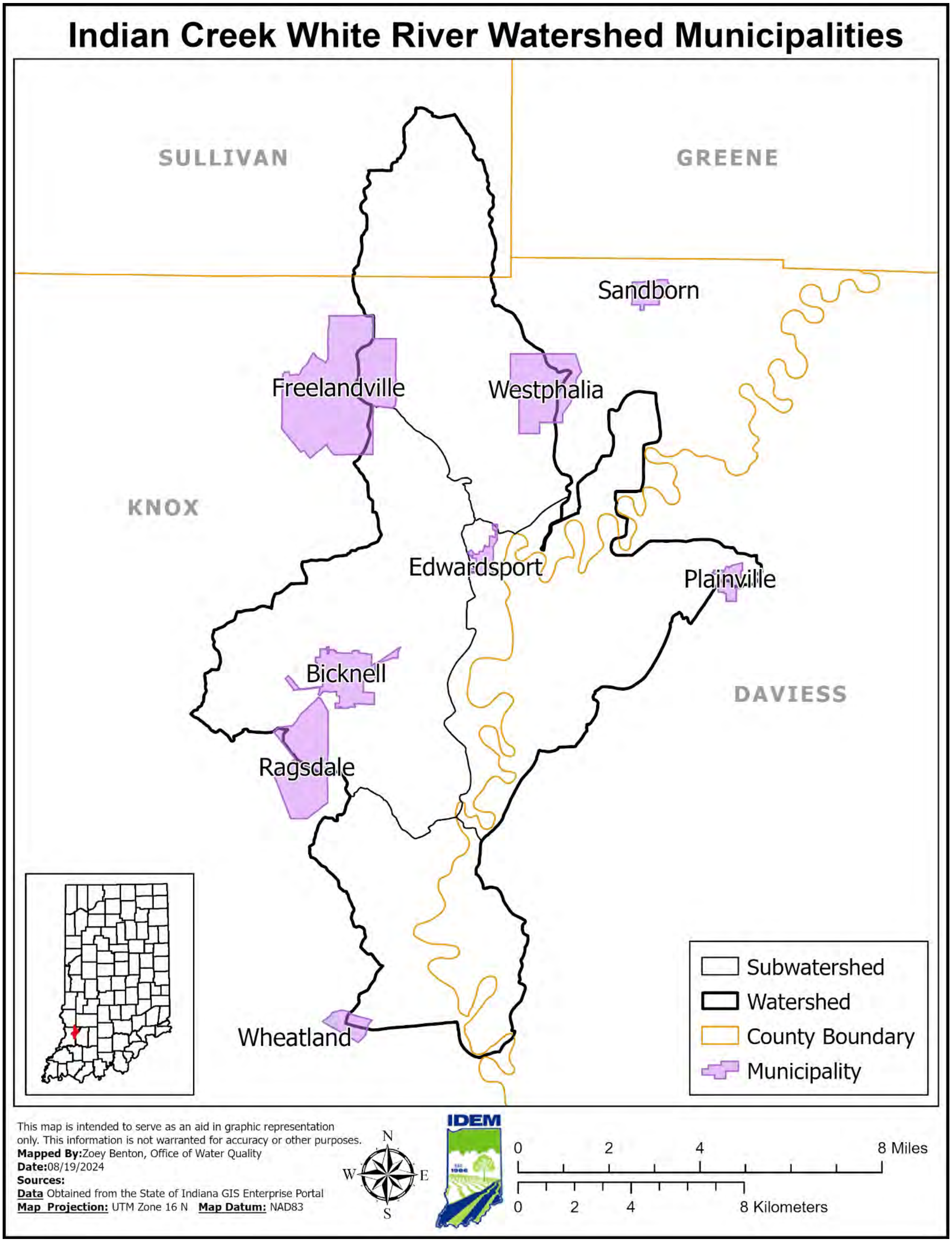

Figure 24: Municipalities in the Indian Creek White River Watershed

2.7 Abandoned Mine Lands

Indiana has been coal mined (surface and underground) from the late 1800’s until the mid-1900’s. Historic practices can have a significant impact on the streams and surrounding landscapes. Several of these impacts include:

- Residual strip mine ponds and mine waste piles (gob piles)
- Surface hydrology alteration
- Elimination of some headwater streams
- Altered topography and vegetation
- Increased stream bank erosion and sedimentation
- Alteration of fish habitat
- Increased in-stream metals concentrations

The residual effects of historic mining can have a significant influence on water quality as acid mine drainage (AMD) from seeps, mine tailings/gob piles, and exposed coal seams enter streams and their tributaries. AMD generally displays elevated levels of one or more parameters including acidity, metals, sulfates, and suspended solids (Bauers et al., 2006).

It should also be noted that there is an important distinction between abandoned mine lands and current mining practices. Current mines are required to comply with the Surface Mining Control and Reclamation Act of 1977, which addresses the water-quality problems associated with AMD and requires that extensive information about the probable hydrological consequences of mining and reclamation be included in mining-permit application so that the regulatory authority can determine the probable cumulative impact of mining on hydrology. Since the onset of the Act, best management practices have been employed at all current mine sites and are aimed at minimizing adverse effects to the hydrologic balance. As a result, the current mines in the Indian Creek White River watershed are not considered significant sources of the impairments noted in this TMDL.

For purposes of this TMDL, point sources are identified as permitted discharge points or discharges having responsible parties, and nonpoint sources are identified as any pollution sources that are not point sources. For example, there is not a single point of discharge associated with abandoned mine lands. Therefore, run-off from these areas consists of overland flow, and were treated in the allocations as nonpoint sources. As such, the discharges associated with these land uses were assigned LAs. The decision to assign LAs to nonpoint sources is not a determination by IDEM as to whether there are unpermitted point source discharges within these land uses. In addition, the assignment of LAs to nonpoint sources is not a determination that these discharges are exempt from NPDES permitting requirements.

2.8 Point Sources

This section summarizes the potential point sources of *E. coli*, TSS, TP, and H+ in the Indian Creek White River watershed, as regulated through the National Pollutant Discharge Elimination System (NPDES) Program. As authorized by the CWA, the NPDES permit program controls water pollution by regulating facilities that discharge pollutants into waters of the United States. Point sources with NPDES permits within the Indian Creek White River watershed include a public water supply (PWS), municipal WWTPs, a major industrial facility, surface coal mining operations, and construction sites. A summary of the potential point sources of *E. coli*, TSS, TP, and H+ in the Indian Creek White River watershed, including an overview of the facilities and WLAs, is provided in Appendix G.

2.8.1 Municipal Wastewater Treatment Plants (WWTPs)

Municipal WWTPs that discharge wastewater through a point source to a surface water of the state are required to obtain a municipal NPDES wastewater permit. Some of the functions of a WWTP include sewage treatment and industrial waste treatment. Municipal wastewater facilities are required to disinfect their effluent for *E. coli* during the recreational season (April 1 to October 31) in accordance with 327 IAC 5-10-6. WWTPs are critical for maintaining public sanitation and a healthy environment. However, WWTPs may discharge wastewater with elevated concentrations of pollutants into streams. Municipal wastewater permits include effluent limitations that are derived using water quality criteria developed to protect all designated and existing uses of the receiving waterbody and/or any more stringent technology-based limitations. There are three active WWTPs that discharge wastewater within the Indian Creek White River watershed (Table 28 and Figure 25).

The City of Bicknell operates a minor municipal WWTP (IN0039276). The WWTP currently operates a Class II, 0.97 MGD oxidation ditch-type treatment facility consisting of an influent flow meter, a mechanical fine screen, a wet well and raw sewage pump station, an oxidation ditch, two final clarifiers, ultraviolet light disinfection, a post aeration basin, and an effluent flow meter. Solids management includes four aerobic digesters and geotextile dewatering bags. Final sludge is hauled off-site to a landfill. The collection system is comprised of 100% separate sanitary sewers by design with two Sanitary Sewer Overflow (SSO) points. The facility has one outfall (Outfall 001) that discharges to Indian Creek. The receiving water has a seven-day, ten-year low flow ($Q_{7,10}$) of 0.0 cubic feet per second at the outfall location.

The Town of Wheatland operates a minor municipal WWTP (IN0064925). This facility completed construction in May of 2025, eliminating discharge from both the Town of Wheatland Water Works (IN0064777) and 190 failing septic systems. Compliance with the NPDES permit has been an issue for the Town of Wheatland Water Works, and there have been several instances of TSS violations in the past 5 years (Table 32). As a short-term solution, the facility constructed a settling pond to hold filter backwash in 2021. This settling pond served as a temporary solids removal system. As a long-term solution, the Town of Wheatland has constructed a WWTP (Town of Wheatland WWTP, IN0064925) to treat the filter backwash from Wheatland Water Works. Due to the successful transition to the Town of Wheatland WWTP, further discussion of the Town of Wheatland Water Works will not be included in this TMDL. The WWTP operates a Class I, 0.0589 MGD Aeromod-type extended aeration treatment facility consisting of an influent flow meter, a manual influent bar screen, activated sludge aeration tanks, secondary clarification, ultraviolet light disinfection, post aeration, and an effluent flow meter. Solids management includes an aerobic digester, sludge holding tank, and covered sludge drying bed. Final solids are hauled off-site to a landfill. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. The facility has one outfall (Outfall 001) that discharges to an unnamed tributary to Nimnicht Creek. The receiving water has a seven-day, ten-year low flow ($Q_{7,10}$) of 0.0 cubic feet per second at the outfall location.

The Town of Edwardsport operates a minor municipal WWTP (IN0064378). The WWTP currently operates a Class I, 0.035 MGD package treatment facility consisting of a fine screen, surge tank, fine bubble aeration, secondary clarification, post aeration, ultraviolet light disinfection, and aerobic digestion. Sludge is hauled off site by a licensed contractor. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points. The facility has one outfall (Outfall 001) that discharges to the West Fork of the White River. The receiving water has a seven-day, ten-year low flow ($Q_{7,10}$) of 395 cubic feet per second (255 MGD) at the outfall location

Effluent from these facilities are potential point sources of *E. coli*, TSS, TP, and H+. As discussed in Section 1.2, the TMDL target value for TSS is 30.0 mg/L or interpreted from current permit limits. The TMDL target value for *E. coli* is the 235 counts/100 mL single sample maximum component of the water quality standard. The target value for H+ is 1.03E-03 mg/L. The TMDL target value for total phosphorus is 0.3 mg/L. These target values can be used to establish potential permit limits. Flows used to calculate pollutant loads from each treatment plant are the design flows provided from the facility permits. Pollutant concentrations used to calculate WLAs from each treatment plant are based on known technological limitations of the facilities.

The facilities' permit effluent limits for *E. coli*, TSS, TP, and H+ are used to determine WLAs for each treatment plant. The effluent limit for TSS is set at the NPDES permit limit of 10 mg/L monthly average for the City of Bicknell WWTP. The effluent limit for TSS is set at the NPDES permit limit of 12 mg/L monthly average for the Town of Wheatland WWTP and the Town of Edwardsport WWTP. The effluent limit for *E. coli* is set at the 235 counts/100 mL single sample maximum component of the water quality standard for the City of Bicknell WWTP and the Town of Wheatland WWTP. The effluent limit for TP is set at 1.0 mg/l for the City of Bicknell WWTP based on implementation of phosphorus limits with the next permit renewal. As discussed in Section 1.2.3, treatment plants in compliance with the 1.0 mg/L total phosphorus permit limit typically meet the in-stream target for phosphorus (0.30 mg/L). The effluent limit for H+ ions is based on associated pH values set at the NPDES permit limit range of 6-9 for the Town of Wheatland WWTP. Compliance with current NPDES permit limits for each facility is consistent with the assumptions used to determine WLAs in the TMDL for protection of applicable water quality standards.

Table 28: Municipal Wastewater Treatment Plant Facilities Discharging within the Indian Creek White River Watershed

Subwatershed	Facility Name	NPDES Permit Number	AUID	Receiving Stream	Average Design Flow (MGD)
Smothers Creek	Town of Edwardsport WWTP	IN0064378	INW0283_05	West Fork White River	0.035
Bens Creek	Town of Wheatland WWTP	IN0064925	INW0284_T1003	Unnamed Tributary to Nimnicht Creek	0.0589
Pickel Ditch	City of Bicknell WWTP	IN0039276	INW0282_02	Indian Creek	0.97

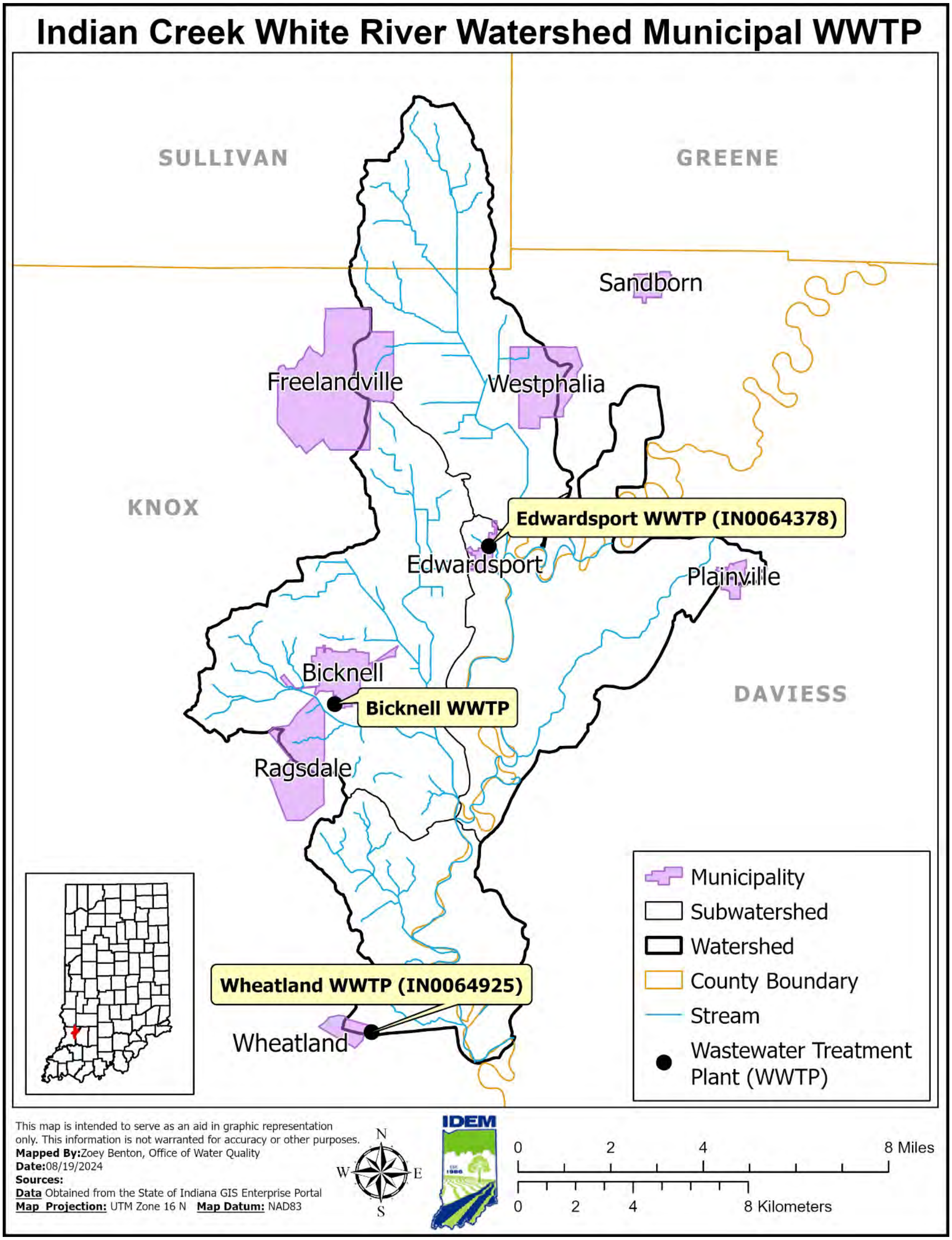

Figure 25: Municipal Wastewater Treatment Plant Facilities Discharging within the Indian Creek White River Watershed

Permit Compliance

Table 29: Summary of Municipal Wastewater Treatment Plant Permit Compliance in the Indian Creek White River Watershed for the Five-Year Period of 2020-2024.

Subwatershed	**Facility Name**	**NPDES Permit Number**	**Receiving Stream**	**Inspections over the Last Five Years**	**Effluent Violations**					
					Outfall	**Month**	**Year**	**Parameter**	**Type**	**Exceedance**
Smothers Creek	Town of Edwardsport WWTP	IN0064378	West Fork White River	01/17/2020: IDEM Inspection/Evaluation 05/05/2021: IDEM Inspection/Evaluation 06/30/2022: IDEM Inspection/Evaluation 11/15/2023: IDEM Inspection/Evaluation 07/08/2024: IDEM Inspection/Evaluation	001	Oct.	2020	*E. coli*	Daily Max.	85%
					001	Jan	2021	Nitrogen	Mx. Wk. Avg.	137%
					001	June	2021	Nitrogen	Mx. Wk. Avg.	107%
					001	June	2021	Nitrogen	Mo. Avg.	519%
					001	June	2021	Nitrogen	Mx. Wk. Avg.	1125%
					001	June	2021	Nitrogen	Mx. Wk. Avg.	1075%
					001	June	2021	Nitrogen	Mo. Avg.	900%
					001	June	2021	Nitrogen	Mx. Wk. Avg.	35%
					001	June	2021	Nitrogen	Mo. Avg.	34%
					001	July	2021	Nitrogen	Mo. Avg.	188%
					001	July	2021	Nitrogen	Mx. Wk. Avg.	193%
					001	July	2021	Nitrogen	Mo. Avg.	1173%
					001	July	2021	Nitrogen	Mx. Wk. Avg.	919%
					001	July	2021	*E. coli*	Daily Max.	99999%
Bens Creek	Town of Wheatland WWTP	IN0064925	Unnamed Tributary to Nimnicht Creek	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Pickel Ditch	City of Bicknell WWTP	IN0039276	Indian Creek	03/16/2021: IDEM Inspection/Evaluation 07/26/2022: IDEM Inspection/Evaluation 11/14/2023: IDEM Inspection/Evaluation	001	May	2024	TSS	Mo. Avg.	10%
					001	May	2024	TSS	Mx. Wk. Avg	517%
					001	May	2024	TSS	Mo. Avg.	197%
					001	May	2024	TSS	Mx. Wk. Avg	49%
					001	May	2024	Nitrogen	Mx. Wk. Avg	43%
					001	May	2024	BOD	Mx. Wk. Avg	21%

** Town of Wheatland WWTP is a brand-new facility that was not yet fully operational at the time of the Indian Creek White River TMDL development*

2.8.2 Industrial Wastewater

Industrial facilities that discharge wastewater through a point source to a surface water of the state are required to obtain an industrial NPDES wastewater permit. Industrial facilities typically generate wastewater through the production of a product. Wastewater discharges from these industrial sources may contain pollutants at levels that could affect the quality of receiving waters. Industrial wastewater permits include effluent limitations that are derived using water quality criteria developed to protect all designated and existing uses of the receiving waterbody and/or any more stringent technology-based limitations.

An industrial facility may be required to obtain an individual or a general industrial wastewater permit, depending on the activities that occur at the facility. An individual permit includes effluent limitations and operating requirements that are tailored to the specific activities of the facility. A general permit is a “one size fits all” type of activity-specific permit. General permit requirements were originally contained in Indiana Administrative Code (IAC) and set by Indiana’s Environmental Rules Board through its formal rulemaking process. Unlike individual permits, general permits apply universally to all entities that apply for and receive coverage under the general permit and are required to operate in accordance with the general permit. However, IDEM is currently in the process of changing its approach to general permits from permit-by-rule to administrative general permits. There are currently four industrial facilities with industrial wastewater permits within the Indian Creek White River Watershed.

Effluent from these facilities are potential point sources of TSS. As discussed in Section 1.2, the TMDL target value for TSS is 30.0 mg/L or interpreted from current permit limits. This target value can be used to establish potential permit limits. Flows used to calculate pollutant loads from each treatment plant are estimated based on current flow data from discharge monitoring reports (DMR) or design flows from the facility permits when actual flow data is not available.

Major Industrial

Under IAC 327 IAC 5-1.5-30, "major discharger" is defined as any point source discharger which is designated as such annually by an agreement between the commissioner and EPA. Classification of a discharger as a major facility generally involves consideration of factors relating to the significance of the discharger's impact on the environment. All other permits are considered “minor dischargers”. The purpose of distinguishing between major and minor dischargers is to accommodate and effectively monitor facilities depending on factors such as the nature and quantity of pollutants discharged, character and assimilative capacity of the receiving waters, presence of toxic pollutants in the discharge, and/or compliance history of the discharger.

Within the Indian Creek White River there is one major discharger, Duke Energy Indiana, LLC – Edwardsport IGCC Generating Station (IN0002780) (Table 30 and Figure 26). Discharges from Edwardsport IGCC are regulated under an Individual Major Industrial permit. In accordance with 327 IAC 15-2-2(a), the commissioner may regulate storm water discharges associated with industrial activity, as defined in 40 CFR 122.26(b)(14), consistent with the EPA 2008 NPDES

Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, as modified, effective May 27, 2009, under an NPDES general permit. Therefore, using Best Professional Judgment to develop case-by-case technology-based limits as authorized by 327 IAC 5-2-10, 327 IAC 5-5, and 327 IAC 5-9 (see also 40 CFR 122.44, 125.3, and Section 402(a)(1) of the Clean Water Act (CWA)), IDEM has developed storm water requirements for individual permits that are consistent with the EPA 2008 NPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity. The facility is an Integrated Gasification Combined Cycle (IGCC) electric generating station that uses a coal gasification system to convert coal into synthesis gas. Within Edwardsport IGCC, there are 4 active outfalls: Outfalls 002, 003, 004, and 005. Outfall 002 is the only wastewater outfall and discharges into the West Fork of the White River (INW0283_06). Outfalls 002, 003, 004, and 005 discharge stormwater.

The discharge of Outfall 002 consists of site storm water, coal pile runoff, coal pile runoff pond effluent, treated sanitary wastewater, oil/water separator effluent from miscellaneous wastewaters, unused makeup water, RO reject water and water softener regenerant, cooling tower blowdown, gasification block and power block quench and drain water, and treated gasification process wastewater (grey water treatment system).Outfall 003 consists of storm water runoff from a parking lot area and discharges to the West Fork of the White River (INW0283_06). Outfall 004 also consists of storm water from perimeter areas. Outfall 004 discharges to an unnamed tributary to the White River located in an existing storm water channel under State Road 358 along the southern boundary of the IGCC Station. Outfall 004 also has the potential to discharge an emergency overflow from an internal pond via an internal outfall. Outfall 005 consists of storm water from the eastern portion of the facility and discharges to the West Fork White River (INW0283_06).

Average design flow was determined to be 4.65 MGD based on a calculated average over two years, using daily discharge data reported by the facility. The facility's permit effluent limit for TSS is set at 30 mg/L monthly average. Compliance with the NPDES permit is believed to be consistent with the TMDL in protecting water quality.

Table 30: Major Facility Discharging within the Indian Creek White River Watershed

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Average Design Flow (MGD)
Smothers Creek	Duke Energy Indiana, LLC – Edwardsport IGCC Generating Station	IN0002780	INW0283_06	West Fork White River	4.65

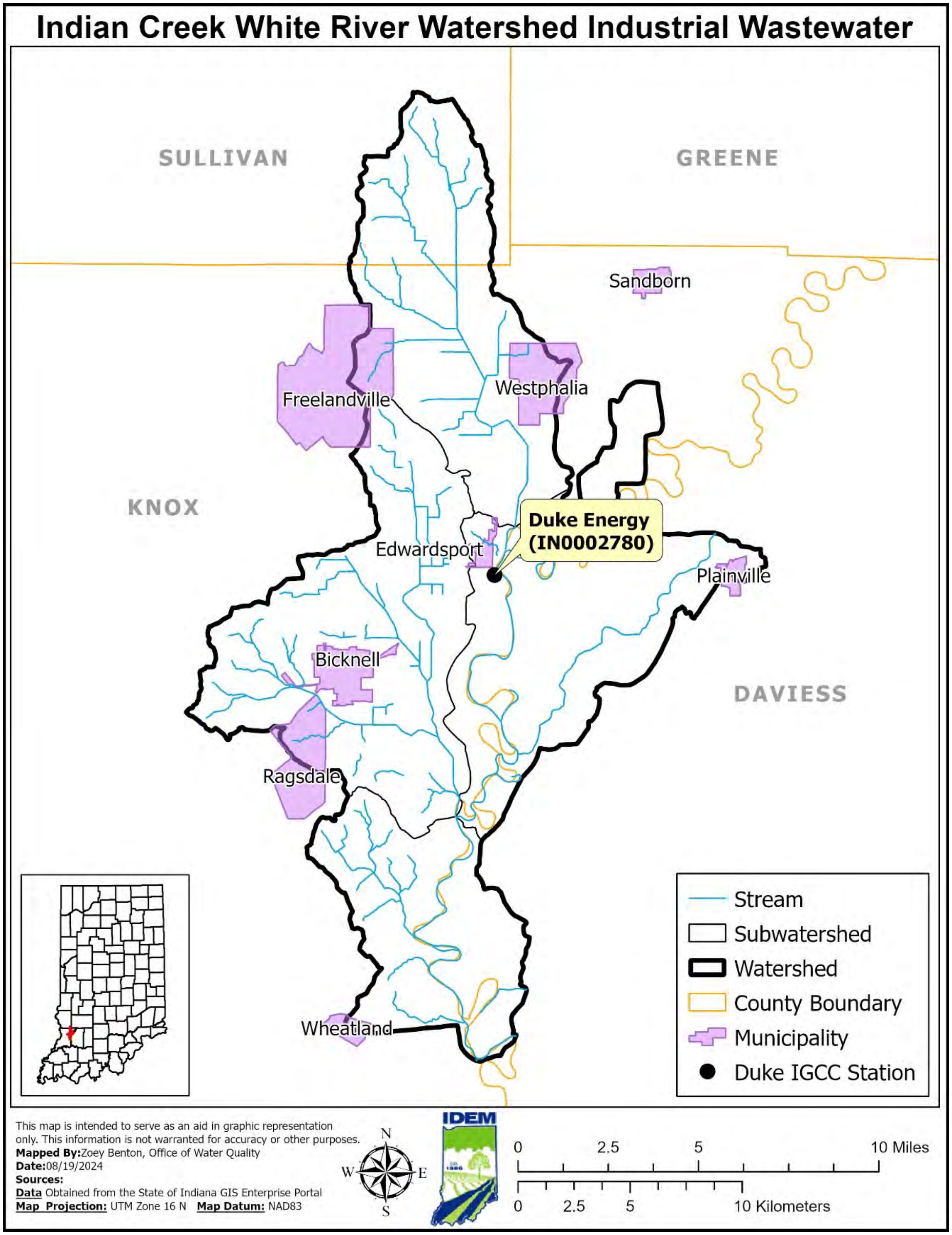

Figure 26: Major Industrial Facility Discharging Wastewater within the Indian Creek White River Watershed

<u>Coal Mining</u>

Discharges from facilities engaged in mining of coal, coal processing, and reclamation activities may be regulated through a NPDES General Permit under 327 IAC 15-7 or through an individual NPDES permit. The purpose of the coal mining general permit rule is to regulate wastewater discharges from surface mining, underground mining, and reclamation projects which utilize sedimentation basin treatment for pit dewatering and surface run-off and to require best management practices for stormwater run-off to protect the public health, existing water uses, and aquatic biota. The coal mining general permit rule provides a standard set of conditions for discharges attributed to typical coal mining operations. An individual NPDES permit for discharges associated with coal mining operations may have similar conditions as the general permit rule but will also include more stringent or facility specific permit requirements as warranted.

There are three surface mining operations located within the Indian Creek White River watershed with active permits, Bear Run Mine (ING040239), Freelandville Mine (ING040030), and Viking Mine (ING040002) (Table 31 and Figure 27). Discharges from all three mines are regulated by the coal mining general permit rule and are potential sources of TSS. Bear Run Mine currently has two active outfalls (Outfalls 053, 064) that discharge within the Indian Creek White River watershed. Freelandville Mine currently has 10 active outfalls (Outfalls 002, 008A, 010, 014, 019, 047, 048, 049, 050, 111) that discharge within the Indian Creek White River watershed. Viking Mine does not currently have any active outfalls that discharge within the Indian Creek White River watershed. While this facility does not have any active outfalls listed in the permit, there are two outfalls under post-mining status (Outfalls 006 and 025). Due to the former operation of these outfalls in the subwatershed, a discussion of their use is relevant to the development of this TMDL.

These permits have varying discharge limits based on dry and wet weather discharge flow rates. For wet weather discharges, dilution rates are assumed, and limits for TSS are suspended. WLAs for coal mining facilities regulated through the general permit rule are based on the NPDES permit effluent limit of 70 mg/L daily maximum for TSS and are implemented through compliance with their NPDES permit. The WLA for each coal mining operation outfall will be achieved through compliance with the facility's NPDES general permit coverage. The WLAs were estimated based upon consideration of TSS contributions from current operating conditions and current permit limits of each facility. This TMDL does not preclude new or modified mining activities that employ the 70 mg/L daily maximum or 35 mg/L monthly average for TSS under the general permit rule. New or modified discharges under individual permits will be addressed through the NPDES permit process and must follow the assumptions set forth in the TMDL.

Table 31: Coal Mining Facilities with General Permits Discharging within the Indian Creek White River Watershed

<table>
<tr><th>Facility Name</th><th>Permit Number</th><th>Subwatershed</th><th>Outfall ID</th><th>AUID</th><th>Receiving Stream</th><th>Permitted Area in Subwatershed (Acres)</th></tr>
<tr><td rowspan="2">Peabody Midwest Mining LLC—Bear Run Mine</td><td rowspan="2">ING040239</td><td rowspan="2">Pollard Ditch</td><td>053</td><td rowspan="2">INW0281_01</td><td rowspan="2">Pollard Ditch</td><td rowspan="2">2,341.7</td></tr>
<tr><td>064</td></tr>
<tr><td rowspan="10">Triad Mining LLC—Freelandville Mine</td><td rowspan="10">ING040030</td><td rowspan="10">Pollard Ditch</td><td>010</td><td>INW0281_T1002</td><td>Pollard Ditch – Unnamed Tributary</td><td rowspan="10">4,528.9</td></tr>
<tr><td>008A</td><td rowspan="9">INW0281_02</td><td rowspan="9">Pollard Ditch</td></tr>
<tr><td>002</td></tr>
<tr><td>014</td></tr>
<tr><td>019</td></tr>
<tr><td>047</td></tr>
<tr><td>048</td></tr>
<tr><td>049</td></tr>
<tr><td>050</td></tr>
<tr><td>111</td></tr>
<tr><td rowspan="2">Peabody Midwest Mining LLC—Viking Mine</td><td rowspan="2">ING040002</td><td>Pickel Ditch</td><td>025</td><td>INW0282_T1005</td><td>Indian Creek -- Unnamed Tributary</td><td>2,180.6</td></tr>
<tr><td>Bens Creek</td><td>006</td><td>INW0284_T1001</td><td>Bens Creek</td><td>1,470.8</td></tr>
</table>

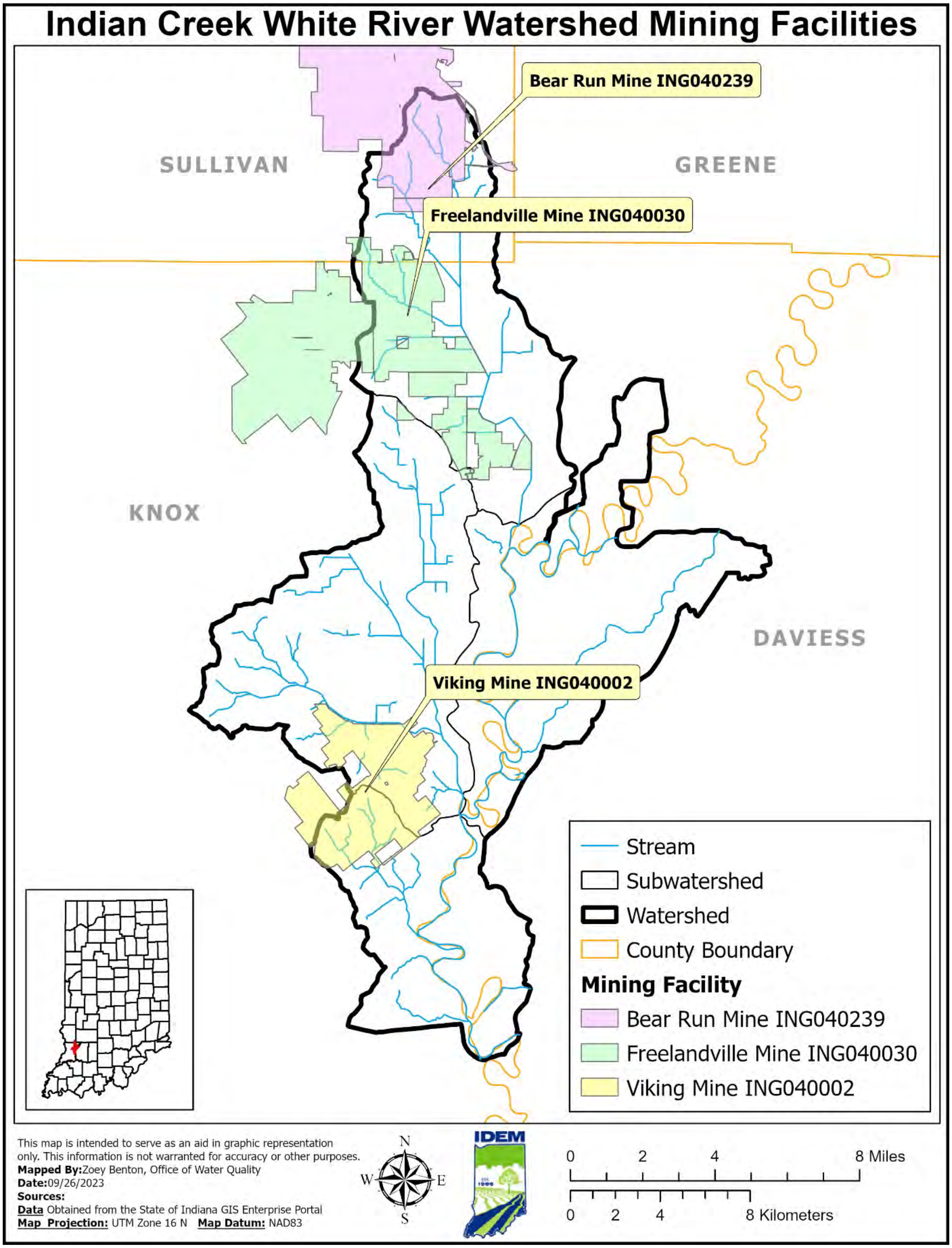

Figure 27: Coal Mining Facilities Discharging within the Indian Creek White River Watershed

<u>Permit Compliance</u>

Table 32: Summary of Industrial Wastewater Permit Compliance for the Five-Year Period of 2020-2024

Subwatershed	**Facility Name**	**NPDES Permit Number**	**Stream**	**Inspections for the Last Five Years**	**Effluent Violations**					
					Outfall	**Month**	**Year**	**Parameter**	**Type**	**Exceedance**
Pollard Ditch	Peabody Midwest Mining, LLC – Bear Run Mine	ING040239	Pollard Ditch	03/23/2020: IDEM Inspection/Evaluation 04/23/2020: IDEM Inspection/Evaluation 09/23/2020: IDEM Inspection/Evaluation 11/30/2020: IDEM Inspection/Evaluation 03/24/2021: IDEM Inspection/Evaluation 09/15/2021: IDEM Inspection/Evaluation 09/20/2021: IDEM Inspection/Evaluation 03/02/2022: IDEM Inspection/Evaluation 06/08/2022: IDEM Inspection/Evaluation 06/13/2022: IDEM Inspection/Evaluation 09/19/2022: IDEM Inspection/Evaluation	081 081 081 081	May May May May	2020 2020 2020 2020	Solids, total suspended Solids, total suspended Iron, total [as Fe] Iron, total [as Fe]	DAILY AV DAILY MX DAILY AV DAILY MX	234% 67% 360% 130%
Pickel Ditch	Triad Mining LLC— Freelandville Mine	ING040030	Pollard Ditch, Pollard Ditch-- Unnamed Tributary	01/08/2020: IDEM Inspection/Evaluation 04/01/2020: IDEM Inspection/Evaluation 07/06/2020: IDEM Inspection/Evaluation 10/14/2020: IDEM Inspection/Evaluation 10/14/2020: IDEM Inspection/Evaluation 11/12/2020: IDEM Inspection/Evaluation 01/21/2021: IDEM Inspection/Evaluation 04/06/2021: IDEM Inspection/Evaluation 04/09/2021: IDEM Inspection/Evaluation 06/22/2021: IDEM Inspection/Evaluation 07/14/2021: IDEM Inspection/Evaluation 10/28/2021: IDEM Inspection/Evaluation 01/25/2022: IDEM Inspection/Evaluation 03/17/2022: IDEM Inspection/Evaluation 05/17/2022: IDEM Inspection/Evaluation 06/13/2022: IDEM Inspection/Evaluation 09/16/2022: IDEM Inspection/Evaluation 11/02/2022: IDEM Inspection/Evaluation 11/23/2022: IDEM Inspection/Evaluation 01/27/2023: IDEM Inspection/Evaluation 02/20/2023: IDEM Inspection/Evaluation 03/10/2023: IDEM Inspection/Evaluation	014	Sept.	2023	pH	Daily Max	NA
		ING040002		01/07/2020: IDEM Inspection/Evaluation	-	-	-	-	-	-

Subwatershed	Facility Name	NPDES Permit Number	Stream	Inspections for the Last Five Years	Effluent Violations					
					Outfall	Month	Year	Parameter	Type	Exceedance
Bens Creek	Peabody Midwest Mining LLC—Viking Mine		Bens Creek, Unnamed Tributary	01/07/2020: IDEM Inspection/Evaluation 04/14/2020: IDEM Inspection/Evaluation 09/15/2020: IDEM Inspection/Evaluation 10/22/2020: IDEM Inspection/Evaluation 02/12/2021: IDEM Inspection/Evaluation 03/17/2021: IDEM Inspection/Evaluation 06/11/2021: IDEM Inspection/Evaluation 08/05/2021: IDEM Inspection/Evaluation 11/19/2021: IDEM Inspection/Evaluation 01/06/2022: IDEM Inspection/Evaluation						

	Town of Wheatland Water Works*	IN0064777	Unnamed Tributary to Nimnicht Creek	01/09/2020: IDEM Inspection/Evaluation 09/08/2021: IDEM Inspection/Evaluation 09/08/2022: IDEM Inspection/Evaluation 01/05/2024: IDEM Inspection/Evaluation 06/24/2024: IDEM Inspection/Evaluation	001	Feb.	2020	TSS	MO AVG	1160%
					001	Feb.	2020	TSS	DAILY MX	530%
					001	Mar.	2020	TSS	DAILY MX	2975%
					001	Mar.	2020	TSS	MO AVG	4840%
					001	April	2020	TSS	MO AVG	2750%
					001	April	2020	TSS	DAILY MX	1500%
					001	May	2020	TSS	DAILY MX	2921%
					001	May	2020	TSS	MO AVG	5256%
					001	June	2020	TSS	MO AVG	6160%
					001	June	2020	TSS	DAILY MX	3065%
					001	July	2020	TSS	MO AVG	8710%
					001	July	2020	TSS	DAILY MX	4313%
					001	Aug.	2020	TSS	MO AVG	12665%
					001	Aug.	2020	TSS	DAILY MX	7645%
					001	Sept.	2020	TSS	DAILY MX	10530%
					001	Sept.	2020	TSS	MO AVG	17915%
					001	Oct.	2020	TSS	MO AVG	15015%
					001	Oct.	2020	TSS	DAILY MX	7505%
					001	Nov.	2020	TSS	DAILY MX	3565%
					001	Nov.	2020	TSS	MO AVG	7080%
					001	Dec.	2020	TSS	MO AVG	1810%
					001	Dec.	2020	TSS	DAILY MX	855%
					001	Jan.	2021	TSS	MO AVG	14110%
					001	Jan.	2021	TSS	DAILY MX	8175%
					001	Feb.	2021	TSS	MO AVG	8135%
					001	Feb.	2021	TSS	DAILY MX	4065%
					001	Mar.	2021	TSS	MO AVG	3015%
					001	Mar.	2021	TSS	DAILY MX	1680%
					001	April	2021	TSS	MO AVG	630%
					001	April	2021	TSS	DAILY MX	270%
					001	May	2021	TSS	DAILY MX	5635%
					001	May	2021	TSS	MO AVG	11185%
					001	June	2021	TSS	MO AVG	8670%
					001	June	2021	TSS	DAILY MX	4490%
					001	July	2021	TSS	DAILY MX	4195%
					001	July	2021	TSS	MO AVG	8460%
					001	Aug.	2021	TSS	MO AVG	8570%
					001	Aug.	2021	TSS	DAILY MX	4245%
					001	Sept.	2021	TSS	DAILY MX	2380%
					001	Sept.	2021	TSS	MO AVG	4725%
					001	Oct.	2021	TSS	MO AVG	4393%
					001	Oct.	2021	TSS	DAILY MX	2185%
					001	Nov.	2021	TSS	DAILY MX	4450%

Subwatershed	Facility Name	NPDES Permit Number	Stream	Inspections for the Last Five Years	Effluent Violations					
					Outfall	Month	Year	Parameter	Type	Exceedance
					001 001 001	Nov. May June	2021 2022 2022	TSS TSS TSS	MO AVG MO AVG MO AVG	8530% 25% 25%
Smothers Creek	Duke Energy Indiana, LLC–Edwardsport IGCC Generating Station	IN0002780	White River	01/05/2021: IDEM Inspection/Evaluation 06/28/2023: IDEM Inspection/Evaluation	002 002 002 002 201 201 201 201	NA NA NA NA Dec. Dec. Jan. Jan.	NA NA NA NA 2021 2021 2022 2022	Toxicity [acute], Ceriodaphnia dubia Toxicity [chronic], Ceriodaphnia dubia Toxicity [acute], Pimephales promelas Toxicity [chronic], Pimephales promelas BOD, carbonaceous BOD, carbonaceous BOD, carbonaceous BOD, carbonaceous	Max. Max. Max. Max. Mo. Avg. Daily Max Daily Max Mo. Avg	NA NA NA NA 19% 84% 256% 95%

** The Town of Wheatland Water Works is no longer an active facility in the Indian Creek White River watershed. The facility is included in this table to provide further context to the discussion of the facility in Section 2.8.1.*

2.8.3 Regulated Stormwater

Activities that discharge stormwater are typically regulated through NPDES stormwater general permits. The stormwater general permit requirements were originally contained in IAC and set by Indiana's Environmental Rules Board through its formal rulemaking process. General permits apply universally to all entities required to operate in accordance with the rule. However, IDEM is currently in the process of changing its approach to general permits from permit-by-rule to administrative general permits. The construction stormwater and municipal separate storm sewer system (MS4) administrative general permits have been finalized and are currently active. The industrial stormwater administrative general permit is also currently being developed.

Construction Stormwater

Stormwater run-off associated with construction activity is currently regulated under the Construction Stormwater General Permit (CSGP). The CSGP is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land disturbing activities. The requirements of the CSGP applies to all persons who are involved in construction activity (which includes clearing, grading, excavation and other land disturbing activities) that results in the disturbance of one (1) acre or more of total land area. If the land disturbing activity results in the disturbance of less than one (1) acre of total land area but is part of a larger common plan of development or sale, the project must obtain permit coverage under the CSGP.

The CGP requires the development and implementation of a construction plan that includes a stormwater pollution prevention plan (SWP3). The SWP3 outlines how erosion and sedimentation will be controlled on the project site to minimize the discharge of sediment off-site or to a water of the state. The SWP3 addresses other pollutants that may be associated with construction activity. This can include disposal of building materials, management of fueling operations, etc. The SWP3 should also address pollutants that will be associated with the post-construction land use. It is the responsibility of the project site owner to implement the SWP3. In addition, it is critical that the site is monitored during the construction process and in-field modifications are made to address the discharge of sediment and other pollutants from the project site. This may require modification of the SWP3 and field changes on the project site, as necessary, to prevent pollutants, including sediment, from leaving the project site.

If an adverse environmental impact from a project site is evident, IDEM may require the site to obtain an individual stormwater permit. An individual stormwater permit is typically required only if IDEM determines the discharge will significantly lower water quality. If an individual stormwater permit is required, notice will be given to the project site owner. An individual stormwater permit is a written document developed specifically for the project site.

The average annual land disturbance associated with construction sites permitted under the CGP are reported in Table 33. The estimated land disturbance was calculated for each subwatershed using data from permitted construction sites for the past five years.

Table 33: Average Annual Land Disturbance from Permitted Construction Activity in the Indian Creek White River Subwatersheds from 2019-2024

Subwatershed	Estimated Annual Land Disturbance (Acres)
Bens Creek	310
Pickel Ditch	9
Smothers Creek	1
Pollard Ditch	5

Municipal Separate Storm Sewer Systems (MS4)

Stormwater run-off from certain types of urbanized areas are currently regulated under the administrative municipal storm sewer system (MS4) general permit. 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 state and is designed or used for collecting or conveying stormwater. 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. Municipalities with a population served by a MS4 of 100,000 or more are regulated as a Phase I MS4 entity. Municipalities with a population served by a MS4 of 7,000 or more are regulated as a Phase II MS4 entity. There are currently no MS4 entities in the Indian Creek White River watershed.

2.9 Summary

The information presented in Section 1.0 helps to provide a better comprehensive understanding of the conditions and characteristics in the Indian Creek White River watershed that, when coupled with the sources presented in Section 2.0, affect both water quality and water quantity. In summary, the predominant land uses in the Indian Creek White River watershed of agriculture and forestry serve as indicators as to the type of sources that are likely to contribute to water quality impairments in the Indian Creek White River watershed. Human population in the Indian Creek White River watershed indicates where more infrastructure-related pressures on water quality might exist. The subsections on topography and geology, as well as soils, provide information on the natural features that affect hydrology in the Indian Creek White River watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Indian Creek White River watershed. Lastly, the subsection on climate and precipitation provides information on water quantity and the factors that influence flow, which ultimately affects the influence of stormwater on the watershed. Collectively, this information plays an important role in understanding the sources that contribute to water quality impairment during TMDL development and crafting the linkage analysis that connects the observed water quality impairment to what has caused that impairment.

3.0 TECHNICAL APPROACH

Previous sections of the report have provided a description of the Indian Creek White River watershed and summarized the applicable water quality standards, water quality data, and identified the potential sources of *E. coli*, TSS, TP and H+ for assessment units in each subwatershed. This section presents IDEM's technical approach for using water quality sampling data and flow data for each subwatershed as described in Section 4.0 to estimate the current allowable loads of *E. coli*, TSS, TP and H+ in each subwatershed. This section focuses on describing the methodology and is helpful in understanding subsequent sections of the TMDL report.

3.1 Load Duration Curves

To determine allowable loads for the TMDL, IDEM uses a load duration curve approach. This approach helps to characterize water quality problems across flow conditions and provides a visual display that assists in determining whether loadings originate from point or nonpoint sources. Load duration curves present the frequency and magnitude of water quality violations in relation to the allowable loads, communicating the magnitude of the needed load reductions.

Developing a load duration curve is a multi-step process. To calculate the allowable loadings of a pollutant at different flow regimes, the load duration curve approach involves multiplying each flow by the TMDL target value or water quality standard and an appropriate conversion factor. The steps are as follows:

- A flow duration curve for the stream is developed by generating a flow frequency table and plotting the observed flows in order from highest (left portion of curve) to lowest (right portion of curve).
- The flow curve is translated into a load duration (or TMDL) curve. To accomplish this, each flow value is multiplied by the TMDL target value or water quality standard with the appropriate conversion factor and the resulting points are graphed. Conversion factors are used to convert the units of the target (e.g., #/100 mL for *E. coli*) to loads (e.g., MPN/day for *E. coli*) with the following factors used for this TMDL:
- *E. coli*: Flow (cfs) x TMDL Concentration Target (#/100mL) x Conversion Factor (24,465,758.4) = Load (MPN/day)
- TSS and H+: Flow (cfs) x TMDL Concentration Target (mg/L) x Conversion Factor (5.39) = Load (lb/day)
- To estimate existing loads, each water quality sample is converted to a load by multiplying the water quality sample concentration by the estimated daily flow on the day the sample was collected and the appropriate conversion factor. Then, the existing individual loads are plotted on the TMDL graph with the curve.

- Points plotting above the curve represent violations of the applicable water quality standard or exceedances of the applicable target and the daily allowable load. Those points plotting below the curve represent compliance with standards and the daily allowable load.
- The area beneath the load duration curve is interpreted as the loading capacity of the stream. The difference between this area and the area representing the current loading conditions above the curve is the load that must be reduced to meet water quality standards.

The load duration curve approach can consider seasonal variation in TMDL development as required by the CWA and U.S. EPA's implementing regulations. Because the load duration curve approach establishes loads based on a representative flow regime, it inherently considers seasonal variations and critical conditions attributed to flow conditions.

The stream flows displayed on water quality or load duration curves may be grouped into various flow regimes to aid with interpretation of the load duration curves. The flow regimes are typically divided into the following five "hydrologic zones" (U.S. EPA, 2007):

- High Flows: Flows in this range represent flooding or near flooding stages of a stream. These flows are exceeded 0 – 10 percent of the time.
- Moist Conditions: Flows in this range are related to wet weather conditions. These flows are exceeded 10 – 40 percent of the time.
- Mid-Range Flows: Flows in this range represent median stream flow conditions. These flows are exceeded 40 – 60 percent of the time.
- Dry Conditions: Flows in this range are related to dry weather flows. These flows are exceeded 60 -90 percent of the time.
- Low Flows: Flows in this range are seen in drought-like conditions. These flows are exceeded 90 -100 percent of the time.

The load duration curve approach helps to identify the sources contributing to the impairment and to roughly differentiate between sources. Exceedances of the load duration curve at higher flows (0-40 percent ranges) are indicative of wet weather sources (e.g., nonpoint sources, regulated stormwater discharges). Exceedances of the load duration curve at lower flows (60 to 100 percent range) are indicative of point source sources (e.g., wastewater treatment facilities, livestock in the stream). Table 34 summarizes the general relationship between the five hydrologic zones and potentially contributing source areas (the table is not specific to any individual pollutant). For example, the table indicates that impacts from wastewater treatment plants are usually most pronounced during dry and low flow zones because there is less water in the stream to dilute their loads. In contrast, impacts from channel bank erosion is most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur.

Table 34: Relationship between Load Duration Curve Zones and Contributing Sources

Contributing Source Area	Duration Curve Zone				
	High	Moist	Mid-Range	Dry	Low
Livestock direct access to streams				M	H
Wildlife direct access to streams				M	H
Pasture Management	H	H	M		
On-site wastewater systems/Unsewered Areas	M	M-H	H	H	H
Riparian Buffer areas		H	H	M	
Abandoned mines	H	H	H	H	H
Stormwater: Impervious		H	H	H	
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	M			

Note: Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low)

3.2 Stream Flow Estimates

Daily stream flows are necessary to implement the load duration curve approach. Load duration assessment locations in the Indian Creek White River watershed were chosen based on the location of the impaired stream segments and the availability of water quality samples to estimate existing loads.

The USGS does not operate any stream flow gaging stations in the Indian Creek White River watershed. Since there are no continuous flow data for the Indian Creek White River watershed, flow data were estimated for the Indian Creek White River watershed using flow data from a neighboring "surrogate" watershed. This is a standard practice when developing TMDLs for ungaged watersheds and is appropriate when the two watersheds are located close to one another and have similar land use and soil characteristics.

The USGS gage for the Indian Creek White River at Newberry, IN (03360500) located upstream of the watershed along the White River was used for the development of the *E. coli*, TSS, TP and H+ load duration curve analysis for the Indian Creek White River watershed TMDL. USGS gage 03360500 is located in Greene County. Gage 03360500 drains approximately 4,688 sq. miles in the Indian Creek White River (HUC 10: 0512020208) watershed as shown in Figure 28.

Table 35: USGS Site Assignment for Development of Load Duration Curve

Gauge Location	Gauge ID	Period of Record Used in Analysis
White River at Newberry, IN	03360500	2014-2024

Since the load duration approach requires a stream flow time series for each site included in the analysis, stream flows were extrapolated from USGS gauge 03360500 for each assessment location by using a multiplier based upon the ratio of the upstream drainage area for a given location to the drainage area of the Indian Creek White River watershed.

Flows were estimated using the following equation:

$$Q_{ungaged} = \frac{A_{ungaged}}{A_{gaged}} \times Q_{gaged}$$

Where,

$Q_{ungaged}$:	Flow at the ungauged location
Q_{gaged}:	Flow at surrogate USGS gauge station
$A_{ungaged}$:	Drainage area of the ungauged location
A_{gaged}:	Drainage area of the gauged location

In this procedure, the drainage area of each of the load duration stations was divided by the drainage area of the surrogate USGS gauge. The flows for each of the stations were then calculated by multiplying the flows at the surrogate gage by the drainage area ratios. Additional flows were added to certain locations to account for municipal wastewater treatment plants that discharge upstream and are not directly reflected in the load duration curve method.

Table 36: Load Duration Curve Key Flow Percentile Estimates

Subwatershed	Drainage Area (sq. miles)	Flow Duration Exceedance Interval Flows (cfs)				
		High (5%)	Moist (25%)	Mid-Range (50%)	Dry (75%)	Low (95%)
Bens Creek	5,077.2	22,644	8,259	4,168	1,818	726
Pickel Ditch	30.6	138	51	27	12	6
Smothers Creek	5,030.4	22,434	8,181	4,128	1,799	718
Pollard Ditch	25.5	114	41	21	9	4

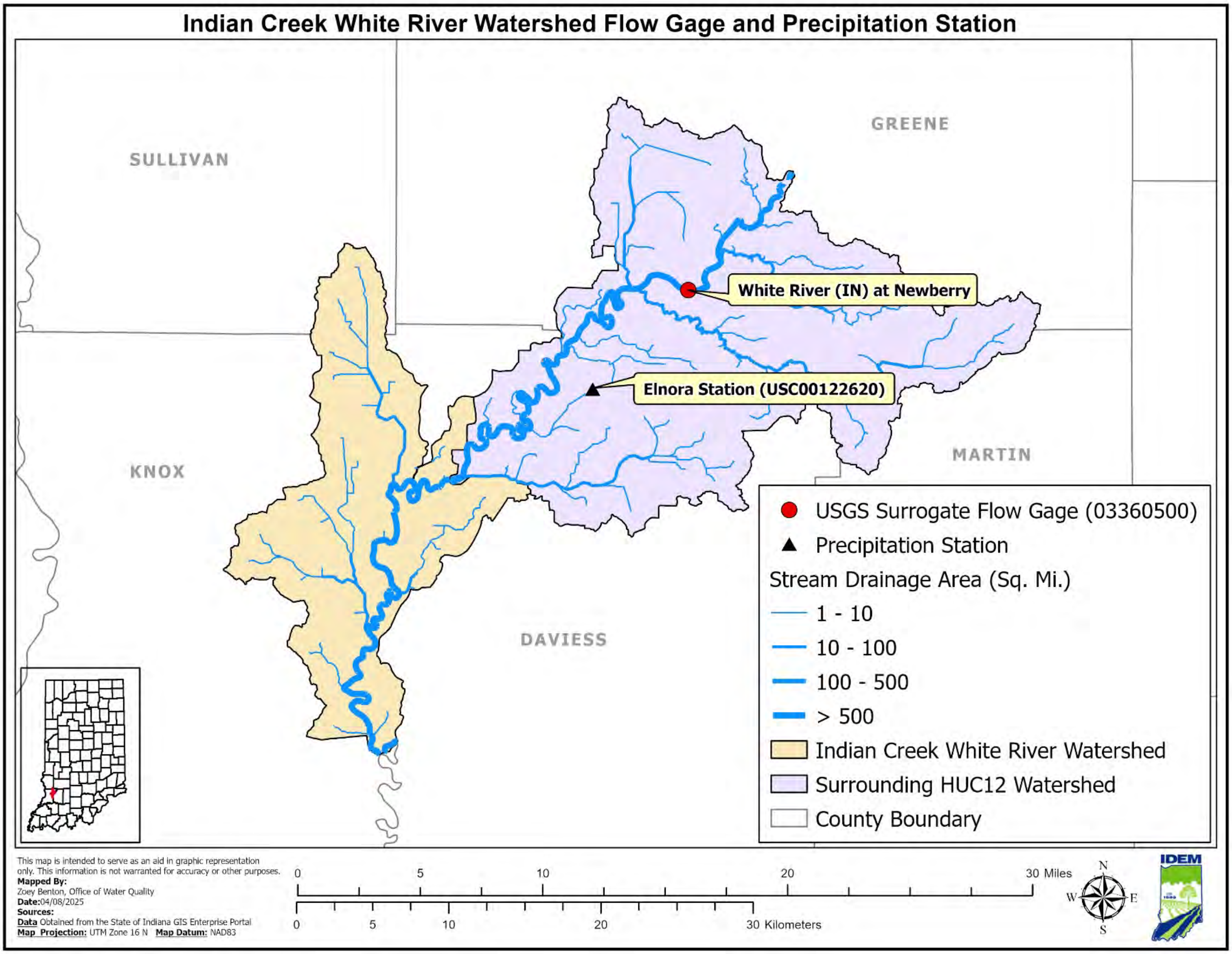

Figure 28: Location of Surrogate Flow Gage and Precipitation Station

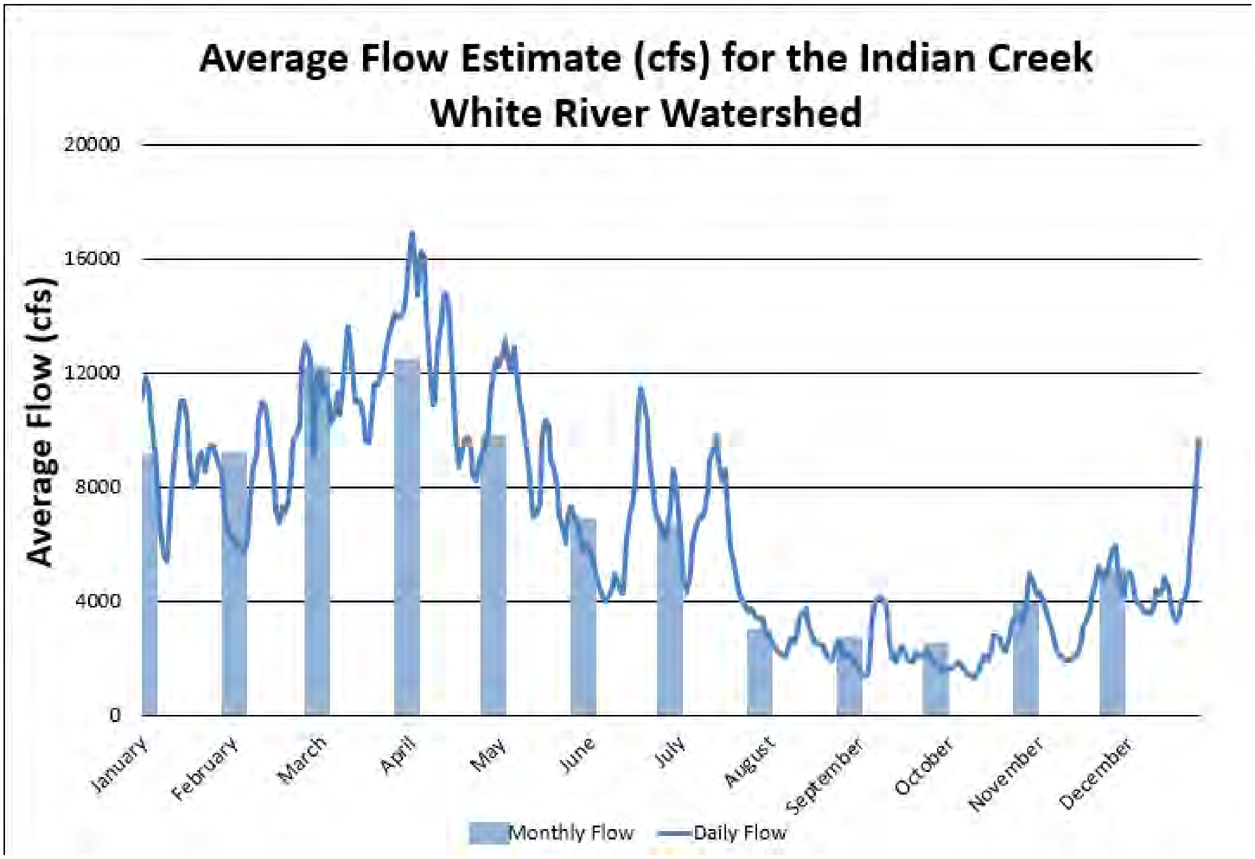

Figure 29: Average Daily Flow Estimate for the Indian Creek White River Watershed for data from 2014-2024

3.3 Margin of Safety (MOS)

Section 303(d) of the Clean Water Act and U.S. EPA regulations at 40 CFR 130.7 require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a MOS which takes into account any lack of knowledge concerning the relationship between limitations and water quality." U.S. EPA guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS). This TMDL uses both an implicit and explicit MOS. An implicit MOS was used to calculate the H+ TMDL. More information on how an implicit MOS was formed for the H+ TMDL can be found in Section 1.2.4. For all TSS and *E. coli* TMDLs, a moderate explicit MOS has been applied by reserving 10 percent of the allowable load. Ten percent was considered an appropriate MOS based on the following considerations:

- The use of the load duration curve approach minimizes a great deal of uncertainty associated with the development of TMDLs because the calculation of the loading capacity is simply a function of flow multiplied by the target value. Most of the uncertainty is therefore associated with the estimated flows in each assessed segment which were based on extrapolating flows from the nearest USGS gage.

- An additional implicit MOS for *E. coli* is included because the load duration analysis does not address die-off of pathogens.
- An additional implicit MOS for pollutants is realized in that when in compliance NPDES permitted sources are seldom discharging at their allowable limits.

3.4 Future Growth Calculations

Uncertainty in future populations in the Indian Creek White River watershed have led IDEM to choose to allocate 5 percent of the loading capacity toward future growth. IDEM anticipates that land uses will likely be changing in the watershed in the future and, in anticipation of those land use changes, has set aside 5 percent of the loading capacity to address increased bacteria and nutrient loads from those future contributors. Mining activity continues to play an important role in land use activities and disturbance in the Indian Creek White River watershed. Mining operations are not static in the landscape and may move outfall locations as activities are conducted. Additionally, new sources of mining activities can change based on new technology for extracting coal and/or economic feasibility. As such, IDEM has chosen to allocate 10 percent of the loading capacity to address increased sediment loads from future contributors.

3.5 Approach for Nutrient TMDLs

To address nutrient impairments with a TP TMDL, an adaptive percentile approach is used. The adaptive percentile approach allows for an ecologically defensible way of identifying a critical condition for TP by isolating one flow percentile where TP exceedances were observed during 50% or more sampling events. Using methodology from the load duration curve approach (Section 3.1), the flow percentile during each exceedance event is observed. There are three flow regimes used to determine which flow percentile is appropriate for calculating the critical condition based on exceedance pattern: low flow (0 - 25th percentile) moderate flow (26th – 74th percentile), and high flow (75th - 100th percentile). If 50% or more flow percentiles during exceedance events fall in one of the aforementioned ranges, that flow regime will be used for TMDL development. There may not be one predominant flow regime, in which case the exceedance pattern would either be uniform, or mixed/uncertain. Each exceedance pattern has a corresponding percentile that will ultimately be used for TMDL establishment (U.S. EPA, 2007). See Table 37 for details.

Table 37: Exceedance Pattern and Associated Flow Regime

Exceedance Pattern	Definition of Flow Regime	Selected Flow Regime for TMDL Establishment
Low-flow	> 50% of exceedances on days when flow is less than or equal to the 25th percentile	Q25 (25th percentile)
Moderate-flow	> 50% of exceedances on days when flow is greater than the 25th percentile and less than the 75th percentile	Q40 (40th percentile)
High-flow	> 50% of exceedances on days when flow is greater than or equal to the 75th percentile	Q75 (75th percentile)
Uniform	Exceedances evenly spread across flow ranges	Q50 (median flow)
Mixed/Uncertain	Other cases	Best Professional Judgement

Algae and periphyton grow and show nutrient effects during stable, non-scouring flow periods when there is enough residence time, light, and habitat stability; high flows often move nutrients but do not allow sustained algal growth, and extreme drought conditions compress habitat and create atypical stress that is not representative of routine biological conditions (U.S. EPA, 2000a; U.S. EPA, 2000b). Therefore, using percentiles closer to the median better reflects actual in-stream conditions in which fish, macroinvertebrates thrive, as well as conditions more likely to result in eutrophication. The flow regimes chosen in Table 37 were drawn from USGS's definition of "normal" conditions (https://help.waterdata.usgs.gov/faq/surface-water/what-is-a-percentile).

Nutrient impairments are intended to address existing or probable eutrophic conditions. The growing season creates conditions that encourage eutrophication through agricultural runoff, warmer water temperatures, and abundant sunlight. The culmination of these factors may provide an ideal environment for algae and other aquatic plants to grow rapidly. When utilizing the adaptive percentile approach, an appropriate range of months for flow data must be chosen based on the date/s of sampling events which resulted in a nutrient impairment. Sampling events that result in nutrient impairments require a co-occurrence of two or more relevant parameters on the same date (IDEM, 2024). Once these dates have been identified, flow data from the most applicable of the following should be chosen:

- Growing Season: Use if all sampling events resulting in a nutrient impairment were observed between May 1st and September 30th
- Adjusted Growing Season: Use if any sampling events resulting in a nutrient impairment were observed in April and/or October, and were otherwise observed within the Growing Season
- Annual (full year): Use if any sampling events resulting in a nutrient impairment were observed outside of Growing Season or Adjusted Growing Season.
- Best Professional Judgement (BPJ): Use if unique circumstances support a range of flow data not described.

More than 50% of TP exceedances in the Pickel Ditch subwatershed were observed during low-flow conditions, meaning the 25th percentile should be used for TMDL development. Due to the dates of sampling events resulting in a nutrient impairment, flow data from the Adjusted Growing Season (May-October) should be used. The 25th percentile of the Adjusted Growing Season over 10 years is the critical condition for TP TMDL development.

In order to use the adaptive percentile approach in conjunction with LDC methodology, the TMDL calculation for TP in Pickel Ditch is as follows:

$$TMDL = \sum WLAs + \sum LAs + MOS + FG$$

- WLA: Flow (i.e., facility design flow) x TP concentration (i.e., TMDL Target or facility permit limit) x 5.39 (conversion factor)
- LA: TMDL – WLA – MOS – FG
- MOS: 0.10 × TMDL
- FG: 0.05 × TMDL
- TMDL: TP Target × Critical Condition Flow × Conversion Factor

See Table 39 for more details on the TP TMDL in Pickel Ditch.

4.0 LINKAGE ANALYSIS

A linkage analysis connects the observed water quality impairment to what has caused that impairment. An essential component of developing a TMDL is establishing a relationship between the source loadings and the resulting water quality. Potential point and nonpoint sources are inventoried in Section 2.0, and water quality data within the Indian Creek White River watershed are discussed in Section 1.4. The purpose of this section is to evaluate which of the various potential sources is most likely to be contributing to the observed water quality impairments.

Load duration curves were created for each subwatershed in the Indian Creek White River watershed that were sampled by IDEM in 2023 and 2024. The load duration curve method considers how stream flow conditions relate to a variety of pollutant loadings and their sources (point and nonpoint). Load duration curves illustrate water quality standard and target value violations during all flow ranges that occurred during sampling events. Section 3.1 summarizes the load duration curve approach.

To further investigate sources, water quality precipitation graphs have been created. Elevated levels of pollutants during rain events indicate contributions of pollutants due to run-off. The precipitation data was taken from a weather station in Elnora, IN and managed by the Midwestern Regional Climate Center.

A linkage analysis for each subwatershed is included in this section. The analysis includes a summary of the subwatershed, including information regarding sampling sites, land use, NPDES facilities, CFOs, and soil characteristics. A summary table of each subwatershed is also provided that includes the load allocations (LAs), WLAs, and margin of safety (MOS) values for pollutants of concern. Evaluating the load duration curves and precipitation graphs with consideration of these watershed characteristics allows for identification of potential point and nonpoint sources that are contributing to elevated concentrations of pollutants. Pollutants of concern for the Indian Creek White River watershed identified by sampling data include *E. coli*, TP, TSS, and H+.

4.1 Pollutants of Concern

4.1.1 *E. coli*

Establishing a linkage analysis for *E. coli* is challenging because there are so many potential sources, and *E. coli* counts have a high degree of variability. While it is difficult to perform a site-specific assessment of the causes of high *E. coli* for each location in a watershed, it is reasonable to expect that general patterns and trends can be used to provide some perspective on the most significant sources. Additional information is outlined in Section 1.1.1.

E. coli sources typically associated with high flow and moist conditions include failing onsite wastewater systems, urban stormwater/CSOs, run-off from agricultural areas, and bacterial re-suspension from the streambed. *E. coli* sources typically associated with low flow conditions include a large number of homes on failing or illicitly connected septic systems that would provide a constant source. Elevated *E. coli* levels at low flow could also result from inadequate disinfection at wastewater treatment plants or animals with direct access to streams.

4.1.2 Total Phosphorus (TP)

Nutrients come in many forms, including nitrogen, phosphorus, ammonia, total Kjeldahl nitrogen (TKN), nitrite, and nitrate. Information presented in the water quality assessment describes nutrient conditions in the Indian Creek White River watershed. Additional information is outlined in Section 1.1.3.

Total phosphorus concentrations are naturally low in surface waters but high in rivers and streams located in agricultural and urban areas, or that receive wastewater discharges. High phosphorus levels in streams increase the growth of plants and algae, reducing the quality of the habitat and causing low oxygen levels at night when the plants and algae are respiring but not photosynthesizing.

4.1.3 Total Suspended Solids (TSS)

Developing a linkage analysis to address the connection between siltation and its effect on aquatic life use often involves an evaluation of multiple factors. The interaction between erosion processes and hydrology is an important part of the assessment, with land use, riparian areas, and channel conditions being key considerations. Each can play a potential role in both creating and solving sediment problems. The sediment issues can occur when external inputs (e.g., sediment, run-off volume) to the stream become excessive, or when stream characteristics are altered so that it can no longer assimilate the loads, or a combination of both occur. Additional information is outlined in Section 1.1 2.

Sheet erosion is the detachment of soil particles by raindrop impact and their removal by water flowing overland as a sheet instead of in channels or rills. Rill erosion refers to the development of small, ephemeral concentrated flow paths, which function as both sediment source and sediment delivery systems for erosion on hillslopes. Sheet and rill erosion occurs more frequently in areas that lack or have sparse vegetation.

Bank and channel erosion refers to the wearing away of the banks of a stream or river. High rates of bank and channel erosion can often be associated with water flow and sediment dynamics being out of balance. This may result from land use activities that either alter flow regimes, adversely affect the flood-plain and streamside riparian areas, or a combination of both. Hydrology is a major driver for both sheet/rill and stream channel erosion. Bank and channel erosion are made worse when streams are straightened or channelized because channelization shortens overall stream lengths and results in increased velocities, bed and bank erosion, and sedimentation. Modified stream channels often have little habitat structure and variability necessary for diverse and abundant aquatic species. Channelization also disconnects streams from flood-plain and riparian areas that are often converted to developed or agricultural lands.

In addition to TSS, siltation within a stream may be analyzed by taking a closer look into the Qualitative Habitat Evaluation Index (QHEI) scores assigned to each sampling location. Habitat assessments were completed at each sampling site after both fish community and macroinvertebrate community sample collections using a slightly modified version of the Ohio Environmental Protection Agency (OHEPA) QHEI (OHEPA, 2006). The QHEI allows for a quantitative assessment of physical characteristics of the sampled stream. Each sampling site was assigned a QHEI score in relation to the habitat quality for both fish and macroinvertebrate communities. Completed QHEI forms for the Indian Creek White River watershed are available in Appendix C.

The overall QHEI score is composed of a total of six metric scores. The six individual metrics include substrate, instream cover, channel morphology, bank erosion/riparian zone, pool/glide and riffle/run quality, and gradient. Of these metrics, the substrate metric is the most indicative of excessive siltation within a stream, while the bank erosion/riparian zone metric provides an explanation for excessive amounts of observed siltation. The substrate and bank erosion/riparian zone metric scores were analyzed for each sampling location throughout the watershed to determine if excessive siltation is linked to poor fish community IBI scores and macroinvertebrate community mIBI scores. Additional information regarding IBI and mIBI scores is available in Section 1.1.5.

4.1.4 H+ Ions

Developing a linkage analysis to address the connection between a pH impairment and the sources causing the impairment requires careful consideration of the circumstances unique to the area being impaired. It is important to keep in mind that pH is a characteristic, not a pollutant. The term is used to indicate basicity or acidity of a solution on a scale of 0 to 14, with pH 7 being neutral. pH is an expression of H+ concentration in water. As the concentration of H^+ ions in a solution increases, acidity increases and pH gets lower (https://www.epa.gov/caddis/ph).

In the Indian Creek White River watershed, the site impaired for pH is believed to be located on a historical mining area. Historical mining practices, prior to 1941, were often abandoned or not reclaimed in a manner that could support productive uses. These sites can be a source of water pollution. Acid mine drainage (AMD) is the cause of many environmental problems associated with abandoned mine lands. Historically, many coal-preparation facilities generated coarse-grained refuse (commonly referred to as "gob") and fine-grained refuse ("tailings" or "slurry") in an effort to remove incombustible rock and acid-generating pyrite that were mixed with the coal. Pyrite, or iron sulfide (FeS_2), is a mineral that is commonly found within Indiana coal seams and the adjacent rock strata. When coal beds and surrounding rock units are disturbed during mining, the associated pyrite is exposed to oxygen and water, and chemical reactions produce highly mineralized AMD.

Pyritic deposits of gob and slurry continue to shed AMD that finds its way into groundwater and surface streams. See Section 6.3.2 or visit https://legacy.igws.indiana.edu/Reclamation/Features for more information on abandoned mine lands.

4.2 Linkage Analysis by Subwatershed

The following sections discuss the load duration curves, precipitation graphs, water quality duration graphs, and linkage of sources to the water quality exceedances for each subwatershed. Load duration curves, precipitation graphs, and water quality duration graphs were created for each subwatershed.

4.2.1 Pollard Ditch

The Pollard Ditch subwatershed has a drainage area and surface area of approximately 25 square miles. The subwatershed drains into a tributary of the White River just east of Edwardsport, IN. The land use is primarily agriculture (59 percent) followed by hay/pasture (18 percent) and forested land (13 percent). There are two NPDES permitted surface mine facilities in the subwatershed. Peabody Midwest Mining LLC-Bear Run Mine (ING040239) is a surface mining facility that has nine permitted outfalls in the Pollard Ditch subwatershed. Of those nine outfalls, two are listed as active (outfall 053 and outfall 064). Both active outfalls discharge to Pollard Ditch. Triad Mining LLC-Freelandville Mine (ING040030) is a surface mining facility that has 17 permitted outfalls in the Pollard Ditch subwatershed. Of those 17 outfalls, 10 are listed as active (outfalls: 002, 008, 010, 014, 019, 047, 048, 049, 050, and 111). All active outfalls discharge to Pollard Ditch, with the exception of outfall 010, which discharges to an unnamed tributary of Pollard Ditch. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is very limited. Maintenance and inspections of septic systems in the area are important to ensure proper function and capacity. The landscape in the area is relatively flat leading to its intense conversion to agricultural production and use. In many areas of the subwatershed there are little to no remaining riparian buffers left along its banks due to agricultural practices. Despite its flat nature, the subwatershed does contain significant amounts of highly erodible soil types. These soil types can be susceptible to sheet, rill, and isolated gully erosion and can contribute to sediment loss from agricultural lands, as well as lands from high gradient slopes.

Many of the waterways in this subwatershed are identified as having hydric soil types in their riparian zones. These areas could be potential locations for wetland restoration or high functioning two-stage ditch implementation. With 18 percent of land used as pastureland, a moderate presence of pasture animals is expected. There is one permitted CFO in the subwatershed.

There are three monitoring sites located in the Pollard Ditch subwatershed: T15, T16, T17 (Figure 30). In 2023 and 2024 this watershed was sampled 38 times between the three sites resulting in 2/3 sites failing water quality standards for *E. coli*. The *E. coli* geomean for site T15 was 178.7 MPN with 5/10 samples in exceedance of the single sample max, while site T16 had a geomean of 29.9 with 2/10 samples in exceedance of the single sample max, and site T17 had a geomean of 127.5 with 1/10 samples in exceedance of the single sample max. Note that while the results of site T16 did not fail water quality standards for *E. coli*, site T15 and T16 are located on the same AUID; therefore, all three sites were impaired for *E. coli*. The *E. coli* water quality samples from sites T15, T16, and T17, used to calculate the geomean, were taken on the same day approximately one hour apart for five consecutive weeks.

The fish community IBI score for site T15 was 40 (fair) and the QHEI was 58 (fair). The macroinvertebrate community mIBI score was 38 (fair) and the QHEI was 38 (poor). The fish community IBI score for site T16 was 42 (fair) and the QHEI was 49 (fair). The macroinvertebrate community mIBI score was 32 (poor) and the QHEI was 47 (fair). The fish community IBI score for site T17 was 36 (fair) and the QHEI was 32 (poor). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 44 (fair).

TSS concentrations ranged from 2.5 mg/L to 51.2 mg/L across 26 sampling events within the watershed and exceeded the target value two times. Given that targets for TSS were violated within the subwatershed, a TSS TMDL was developed to address the impaired biological communities within the subwatershed.

There are approximately 33 miles of streams in the subwatershed. Based on IDEM data collected in 2023 and 2024, there will be approximately 23 stream miles impaired for *E. coli*, and approximately 15 stream miles with an impaired biotic community. These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, *E. coli* TMDLs have been developed to address all *E. coli* impairments, and TSS TMDLs have been developed to address all impaired biotic communities in this subwatershed. The load duration curve for each impairment in the Pollard Ditch subwatershed are shown in Figure 31 and Figure 33. Table 38 provides a summary of the Pollard Ditch subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, NPDES facilities, CFOs, as well as LA, WLAs, and MOS values for *E. coli* and IBC.

Precipitation graphs (Figure 32 and Figure 34) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Evaluating these graphs, with consideration of the watershed characteristics, allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli* and TSS concentrations. Elevated levels of pollutants during rain events can indicate contributions due to run-off. Based on the load duration curves, it can be concluded that the sources of TSS in this subwatershed are likely flow driven, nonpoint sources, while sources of *E. coli* in this subwatershed appear to primarily be a result of both point sources and nonpoint sources. The precipitation graph for *E. coli* shows several instances at site T15 where *E. coli* concentrations become elevated and do not correspond to a rain event. Additionally, the load duration curve for *E. coli* shows that *E. coli* concentrations remain consistently high at sites T15 and T16 even during dry and low flow. These graphs indicate that nonpoint sources, including small animal operations, wildlife, animals with direct access to streams, illegal straight pipes, leaking and failing septic systems, streambank erosion, and agricultural practices are potential issues in the subwatershed. If animals have direct access to streams, this could contribute to *E. coli* violations at dry and wet conditions as indicated by the precipitation graph.

Table 38: Summary of Pollard Ditch Subwatershed Characteristics

Pollard Ditch (051202020801)					
Drainage Area	25.48 square miles				
Surface Area	25.48 square miles				
Site # [IDEM Station ID]	T15 [WWL070-0002], T16 [WWL-08-0019], T17 [WWL-08-0020]				
Listed Segments	INW0281_02, INW0281_01				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*], Impaired Biotic Communities [TSS]				
Land Use	Agricultural Land: 59% Forested Land: 13% Developed Land: 6% Open Water: 3% Pasture/Hay: 18% Grassland/Shrubs: <1% Wetland: <1%				
NPDES Facilities	Bear Run Mine (ING040239), Freelandville Mine (ING040030)				
CAFO Program	NA				
CFO Program	PitchCo Incorporated Sow Site (Farm ID: 856)				
TMDL *E. coli* Allocations (MPN/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
LA	5.551E+11	2.023E+11	1.020E+11	4.436E+10	1.759E+10
MOS (10%)	6.531E+10	2.380E+10	1.200E+10	5.219E+09	2.069E+09
Future Growth (5%)	3.266E+10	1.190E+10	6.000E+09	2.609E+09	1.035E+09
TMDL = LA+WLA+MOS	**6.531E+11**	**2.380E+11**	**1.200E+11**	**5.219E+10**	**2.069E+10**
TMDL Total Suspended Solid Allocations (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows** 5%	**Moist Conditions** 25%	**Mid-Range Flows** 50%	**Dry Conditions** 75%	**Low Flows** 95%
LA	6,280.72	2,289.17	1,154.76	502.20	199.15
WLA (Total)	8,423.13	3,069.99	1,546.80	672.70	266.76
MOS (10%)	1,837.98	669.90	337.70	146.86	58.24
Future Growth (10%)	1,837.98	669.90	337.70	146.86	58.24
TMDL = LA+WLA+MOS	**18,379.81**	**6,698.96**	**3,376.96**	**1,468.63**	**582.39**
WLA (Stormwater) (lbs/day)					
Bear Run Mine (ING040239)	4,999.13	1,822.05	918.50	399.45	158.41
Freelandville Mine (ING040030)	3,419.68	1,246.38	628.30	273.25	108.36
Construction	4.32	1.56			

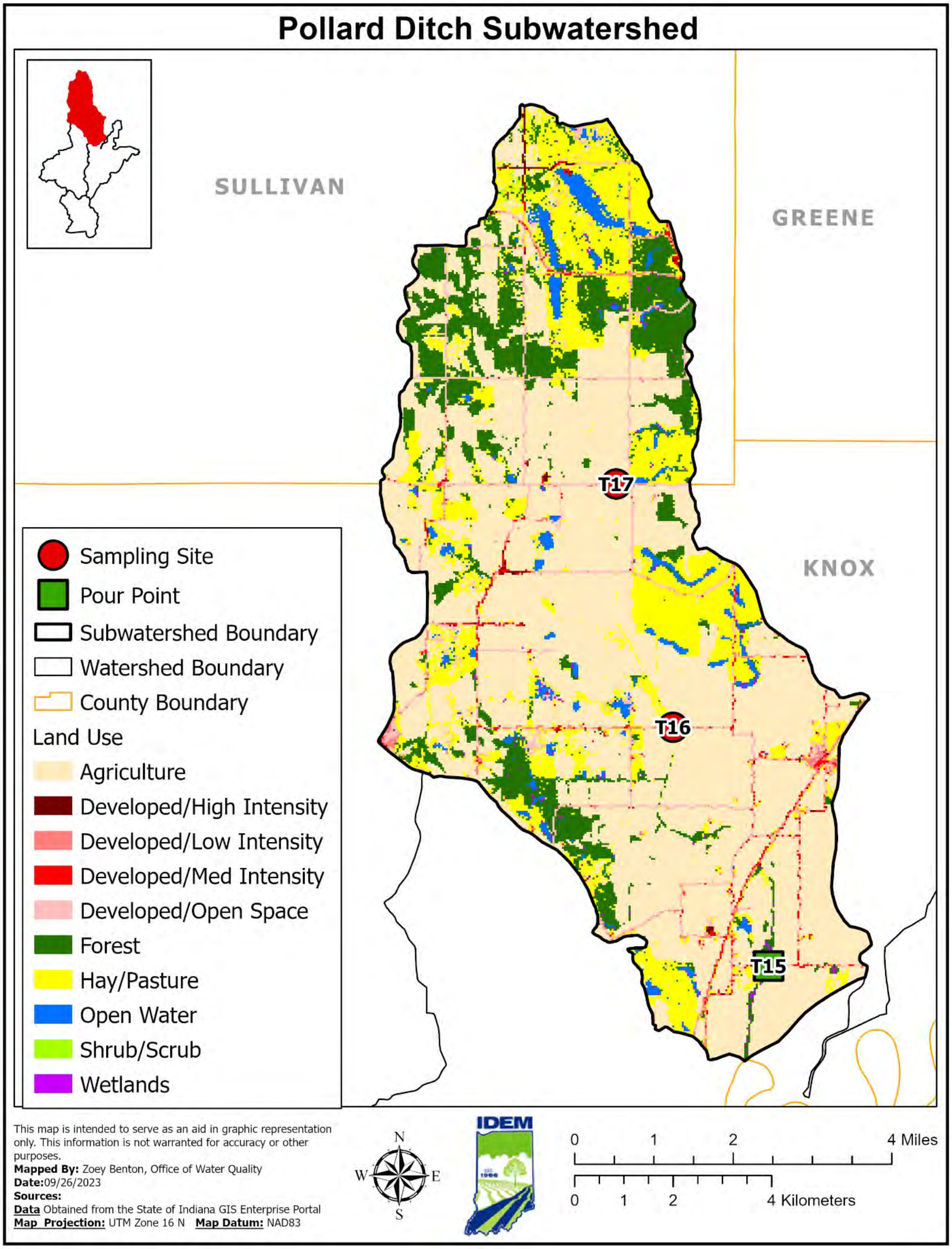

Figure 30: Land Use and Sampling Stations in Pollard Ditch Subwatershed

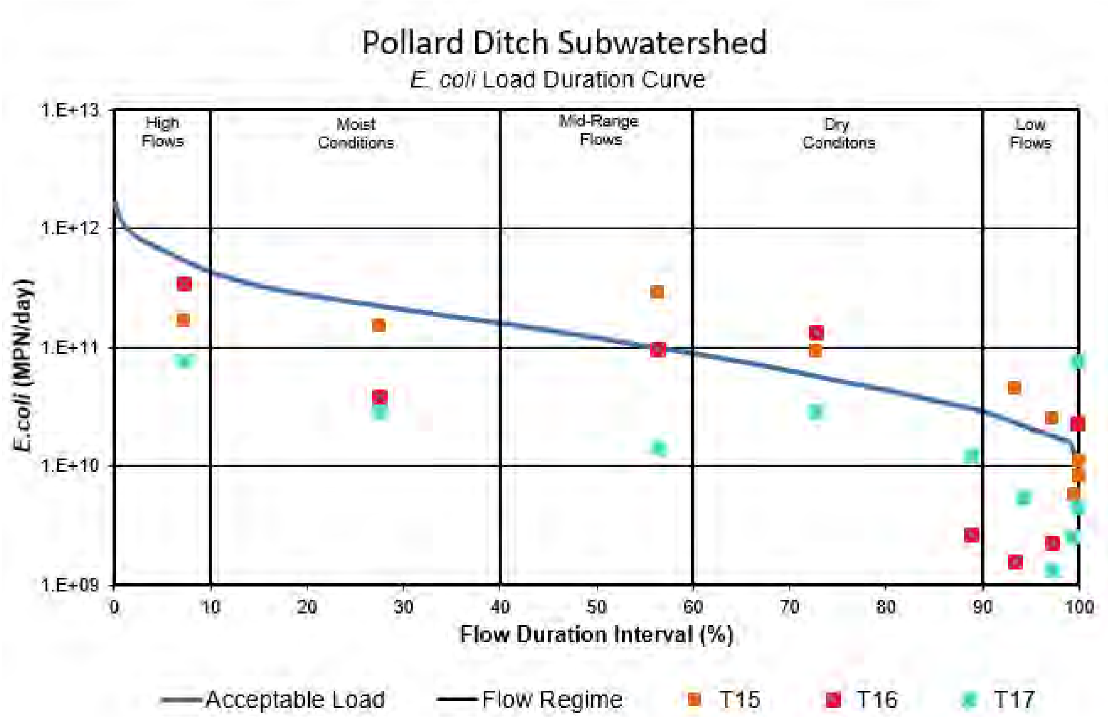

Figure 31: *E. coli* Load Duration Curve for Pollard Ditch Subwatershed

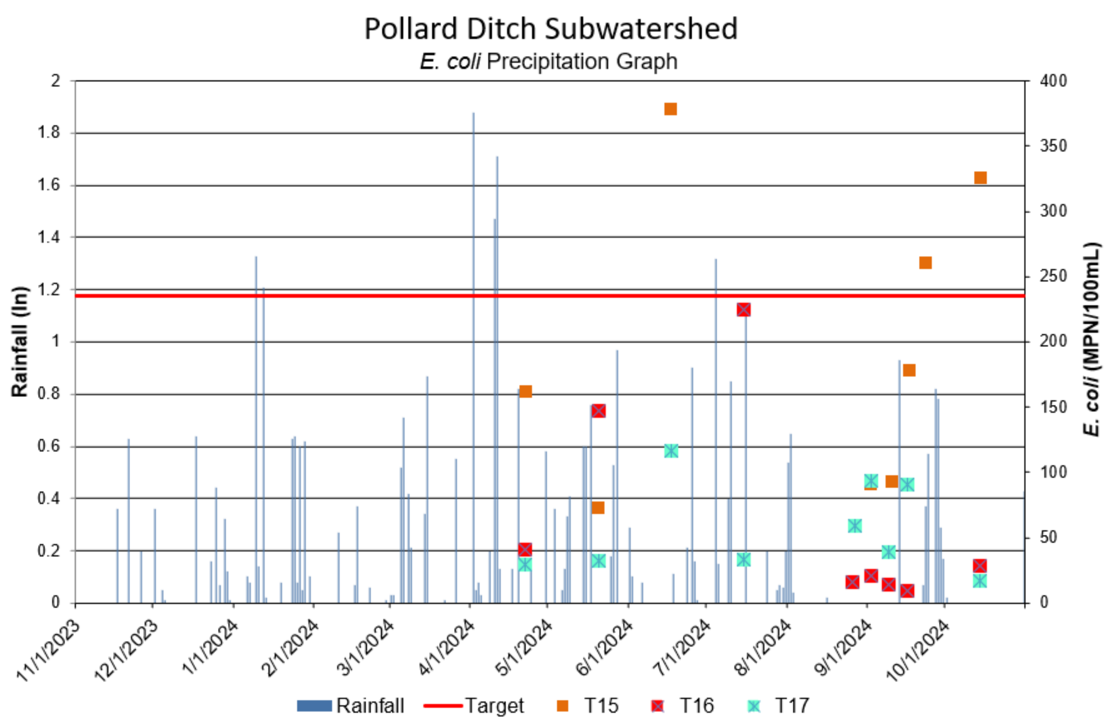

Figure 32: Graph of Precipitation and *E. coli* Data Pollard Ditch Subwatershed

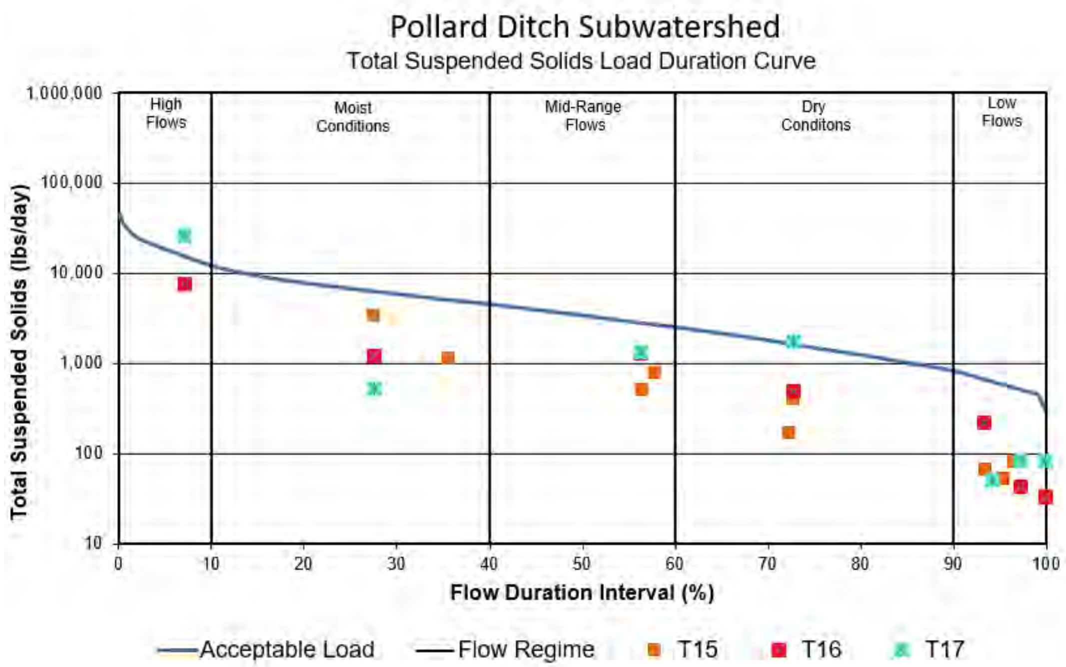

Figure 33: Total Suspended Solids Load Duration Curve for Pollard Ditch Subwatershed

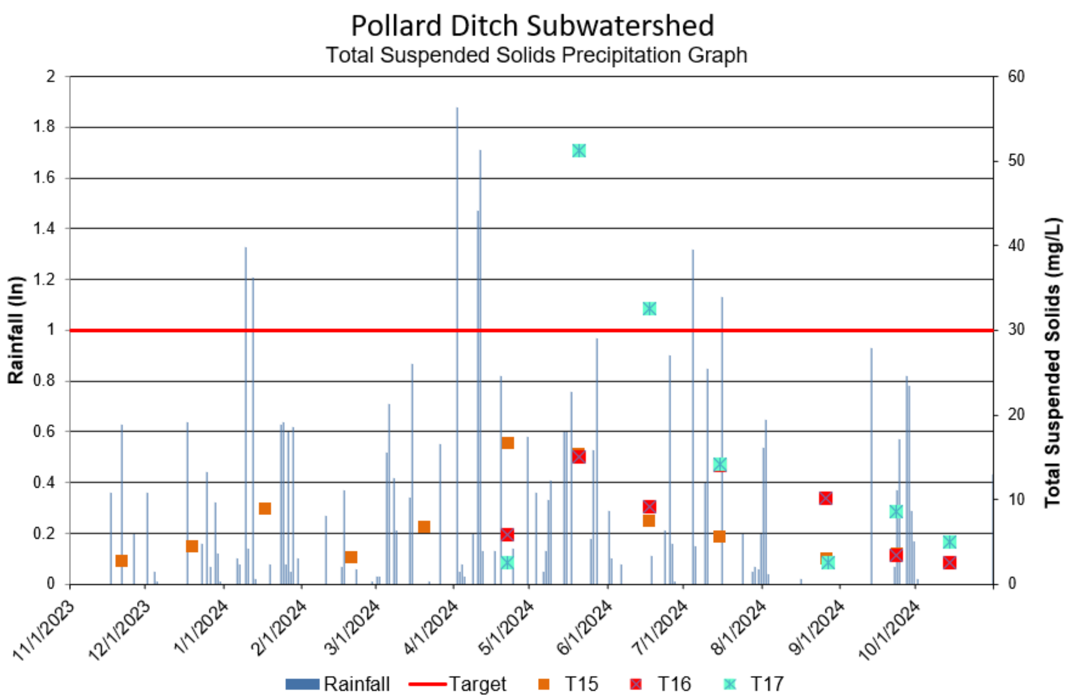

Figure 34: Graph of Precipitation and Total Suspended Solids Data in Pollard Ditch Subwatershed

4.2.2 Pickel Ditch

The Pickel Ditch subwatershed has a drainage area and surface area of approximately 31 square miles. The subwatershed consists of tributaries that ultimately drain into the White River. The land use is primarily agriculture (60 percent), followed by forested (15 percent) and hay and pastureland (12 percent). There are three NPDES permitted facilities in the subwatershed. City of Bicknell WWTP (IN0039276) has one permitted outfall (outfall 001) in the Pickel Ditch subwatershed. Outfall 001 is an active outfall that discharges to Indian Creek. Peabody Midwest Mining LLC-Viking Mine (ING040002) is a surface mining facility that has one permitted outfall (outfall 025) in the subwatershed. Outfall 025 is a post-mining outfall that discharges to an unnamed tributary to Indian Creek. While outfall 025 is no longer considered active, due to the former operation of this outfall, a WLA for this facility was included in the calculation of the TSS TMDL for this subwatershed. Triad Mining LLC-Freelandville Mine (ING040030) is a surface mining facility that has one permitted outfall (outfall 052) in the Pickel Ditch subwatershed. Outfall 052 is a proposed outfall. While outfall 052 is not yet considered active, due to the future potential for discharge at this outfall, 10% FG will be included in the TSS TMDL calculation. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is somewhat or very limited. Maintenance and inspections of septic systems in the area are important to ensure proper function and capacity. The landscape in the area is relatively flat leading to its intense conversion to agricultural production and use. In many areas of the subwatershed there are little to no remaining riparian buffers along the stream banks due to agricultural practices. Despite its flat nature the subwatershed does contain significant amounts of highly erodible soil types. These soil types can be susceptible to sheet, rill, and isolated gully erosion and can contribute to sediment loss from agricultural lands, as well as lands from high gradient slopes.

Many of the waterways in this subwatershed are identified as having hydric soil types in their riparian zones. These areas could be potential locations for wetland restoration or high functioning two-stage ditch implementation. With 12 percent of land used as pastureland a heavy presence of pasture animals is not expected. There are three permitted CFOs in the subwatershed.

There are four monitoring sites located in the Pickel Ditch subwatershed: T06, T07, T08, T10 (Figure 35). In 2023 and 2024 this watershed was sampled 48 times between the four sites. Three of the four sites failed water quality standards for *E. coli*. The *E. coli* geomean for site T06 was 365.1 MPN with 4/9 samples in exceedance of the single sample max. The *E. coli* geomean for site T07 was 154.5 MPN with 3/10 samples in exceedance of the single sample max. The *E. coli* geomean for site T08 was 295.2 MPN with 6/10 samples in exceedance of the single sample max. The *E. coli* geomean for site T10 was 90 MPN with 4/10 samples in exceedance of the single sample max. The *E. coli* water quality samples from sites T06, T07, T08, and T10, used to calculate the geomean, were taken on the same day approximately one hour apart for five consecutive weeks.

The fish community IBI score for site T06 was 42 (fair) and the QHEI was 32 (fair). The macroinvertebrate community mIBI score was 30 (poor) and the QHEI was 30 (poor). The fish community IBI score for site T07 was 44 (fair) and the QHEI was 19 (very poor). The macroinvertebrate community mIBI score was 32 (poor) and the QHEI was 25 (very poor). The fish community IBI score for site T08 was 44 (fair) and the QHEI was 62 (good). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 51 (fair). The fish community IBI score for site T10 was 44 (fair) and the QHEI was 30 (poor). The macroinvertebrate community mIBI score was 40 (fair) and the QHEI was 39 (poor).

TSS concentrations ranged from 2.5 mg/L to 454 mg/L across 32 sampling events within the watershed and exceeded the target value six times. Given that targets for TSS were violated within the subwatershed, a TSS TMDL was developed to address the impaired biological communities within the subwatershed.

A nutrient impairment was determined in this subwatershed as a result of cooccurring nitrogen and TP loads during sampling. Nitrogen concentrations ranged from .1 mg/L to 23.5 mg/L across 32 sampling events within the subwatershed and exceeded the target value of 10 mg/L twice. TP concentrations ranged from .05 mg/L to .8 mg/L across 31 sampling events within the subwatershed and exceeded the target value eight times. Given the targets for TP were violated within the subwatershed, a TP TMDL was developed to address the nutrient impairment within the subwatershed.

There are approximately 44 miles of streams in the subwatershed. Based on IDEM data collected in 2023 and 2024, there will be approximately 19 stream miles impaired for *E. coli*, approximately 3 stream miles with an impaired biotic community, and approximately 16 stream miles impaired for nutrients. These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, *E. coli* TMDLs have been developed to address all *E. coli* impairments, TSS TMDLs have been developed to address all impaired biotic communities, and a TP TMDL has been developed to address the nutrient impairment in this subwatershed. The load duration curve for each impairment in the Pickel Ditch subwatershed are shown in Figure 36, Figure 38, and Figure 40. Table 39 provides a summary of the Pickel Ditch subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, NPDES facilities, CFOs, as well as LA, WLAs, and MOS values for *E. coli*, TSS, and TP.

Precipitation graphs (Figure 37, Figure 39, Figure 41) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Evaluating these graphs, with consideration of the watershed characteristics, allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli,* TSS, and TP concentrations. Elevated levels of pollutants during rain events can indicate contributions due to run-off. Based on the load duration curves, it can be concluded that the sources of pollutants in this watershed are likely nonpoint sources, with potential input from point sources. The *E. coli* load duration curve for these sites shows that high levels of *E. coli* are generally flow driven and are likely coming from nonpoint sources. Site T08 has consistently high levels of *E. coli* even during low flow, which could be related to a point source. A pipe of unknown origin was observed during sampling at this site. Discharge from this pipe was not observed while high TP or nitrogen levels were recorded. The TSS load duration curve for these sites shows that generally TSS loads observed in streams tend to rise and fall with flow conditions and are likely coming from nonpoint sources. The load duration curve for TP shows the sources of TP are generally behavioral of nonpoint sources, however at some sites excessive TP occurs during dry and low flow. Excessive TP loads at site T08 are isolated to late summer and fall months. During that time organic buildup was observed during sampling which could explain the rise of TP during low flow events. Trash and other human waste were consistently observed at site T06. As waste containing organic matter breaks down, phosphorus is released. This process could contribute to high TP during low flow events. These graphs indicate that nonpoint sources, including small animal operations, wildlife, animals with direct access to streams, illegal straight pipes, leaking and failing septic systems, streambank erosion, and agricultural practices are potential issues in the subwatershed. If animals have direct access to streams, this could contribute to *E. coli* violations at dry and wet conditions as indicated by the precipitation graph.

Table 39: Summary of Pickel Ditch Subwatershed Characteristics

Pickel Ditch (051202020802)					
Drainage Area	30.63 square miles				
Surface Area	30.63 square miles				
Site # [IDEM Station ID]	T06 [WWL-08-0011], T07 [WWL-08-0012], T08 [WWL-08-0013], T10 [WWL-08-0018]				
Listed Segments	INW0282_03, INW0282_T1004, INW0282_02				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*], Impaired Biotic Communities [TSS], Nutrients [Total Phosphorus]				
Land Use	Agricultural Land: 60% Forested Land: 15% Developed Land: 10% Open Water: 2% Pasture/Hay: 12% Grassland/Shrubs: <1% Wetland: 1%				
NPDES Facilities	Bicknell WWTP (IN0039276), Freelandville Mine (ING040030), Viking Mine (ING040002)				
CAFO Program					
CFO Program	Worland Brothers Hog Farm LLC (Farm ID: 4167), PitchCo Incorporated Sow Site (Farm ID: 4164), Farbest Farms Incorporated Brooder Hub 5 (Farm ID: 6763)				
TMDL *E. coli* Allocations (MPN/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
LA	6.66E+11	2.42E+11	1.21E+11	5.20E+10	1.99E+10
WLA (Total)	8.63E+09	8.63E+09	8.63E+09	8.63E+09	8.63E+09
MOS (10%)	7.94E+10	2.95E+10	1.53E+10	7.14E+09	3.35E+09
Future Growth (5%)	3.97E+10	1.47E+10	7.64E+09	3.57E+09	1.68E+09
TMDL = LA+WLA+MOS	**7.94E+11**	**2.95E+11**	**1.53E+11**	**7.14E+10**	**3.35E+10**
WLA (Non-Stormwater)					

Bicknell WWTP (IN0039276)	8.63E+09	8.63E+09	8.63E+09	8.63E+09	8.63E+09
TMDL TSS (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
LA	16,531.67	6,088.86	3,122.57	1,414.57	621.37
WLA (Total)	1,338.35	547.74	319.28	192.04	132.95
MOS (10%)	2,233.75	829.57	430.23	200.83	94.29
Future Growth (10%)	2,233.75	829.57	430.23	200.83	94.29
TMDL = LA+WLA+MOS	**22,337.53**	**8,295.74**	**4,302.31**	**2,008.26**	**942.90**
WLA (Non-Stormwater) (lbs/day)					
Bicknell WWTP (IN0039276)	80.93	80.93	80.93	80.93	80.93
WLA (Stormwater) (lbs/day)					
Viking Mine (ING040002)	1,238.66	459.84	238.35	111.11	52.02
Construction	18.75	6.96			

TMDL Total Phosphorus (lbs/day)	
Allocation Category	Low Flow 75%*
LA	5.12
WLA (Total)	8.09
MOS (10%)	1.55
Future Growth (5%)	0.78
TMDL	**15.54**
WLA (Non-Stormwater) (lbs/day)	
Bicknell WWTP	8.09

** See Table 37 for more information regarding allocation category.*

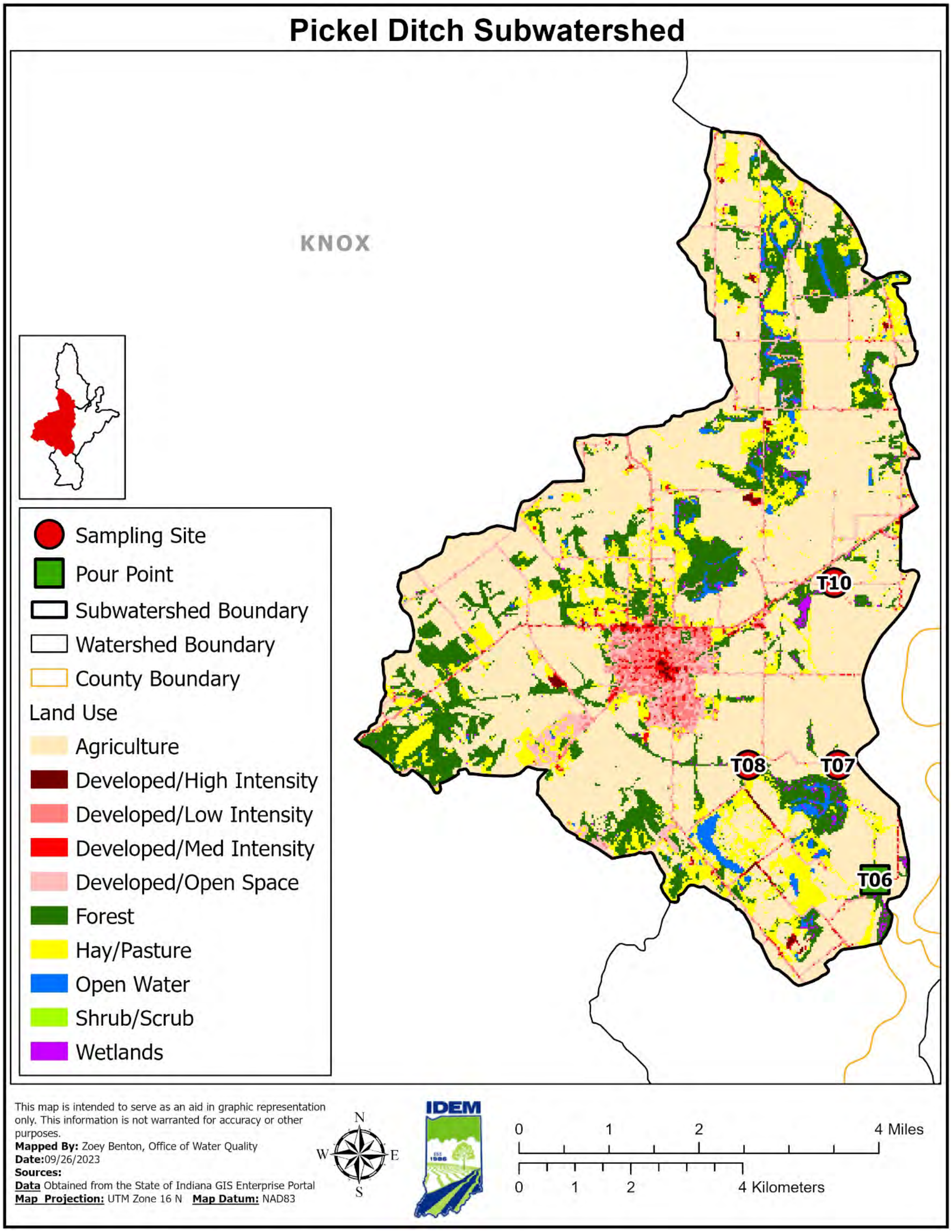

Figure 35: Sampling Stations in Pickel Ditch Subwatershed

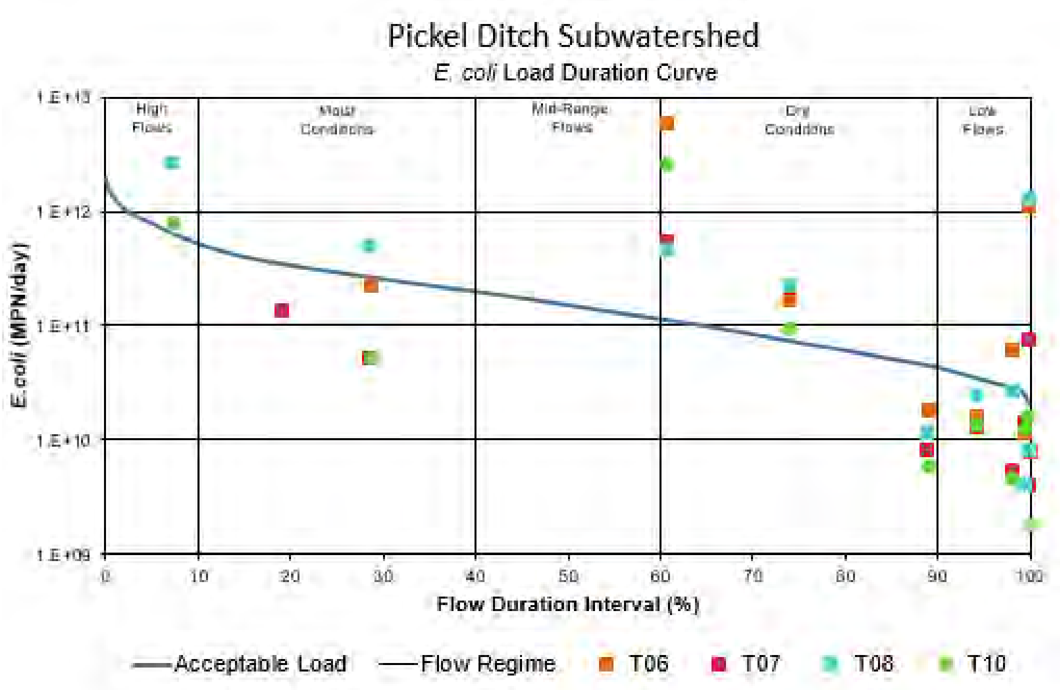

Figure 36: *E. coli* Load Duration Curve for Pickel Ditch Subwatershed

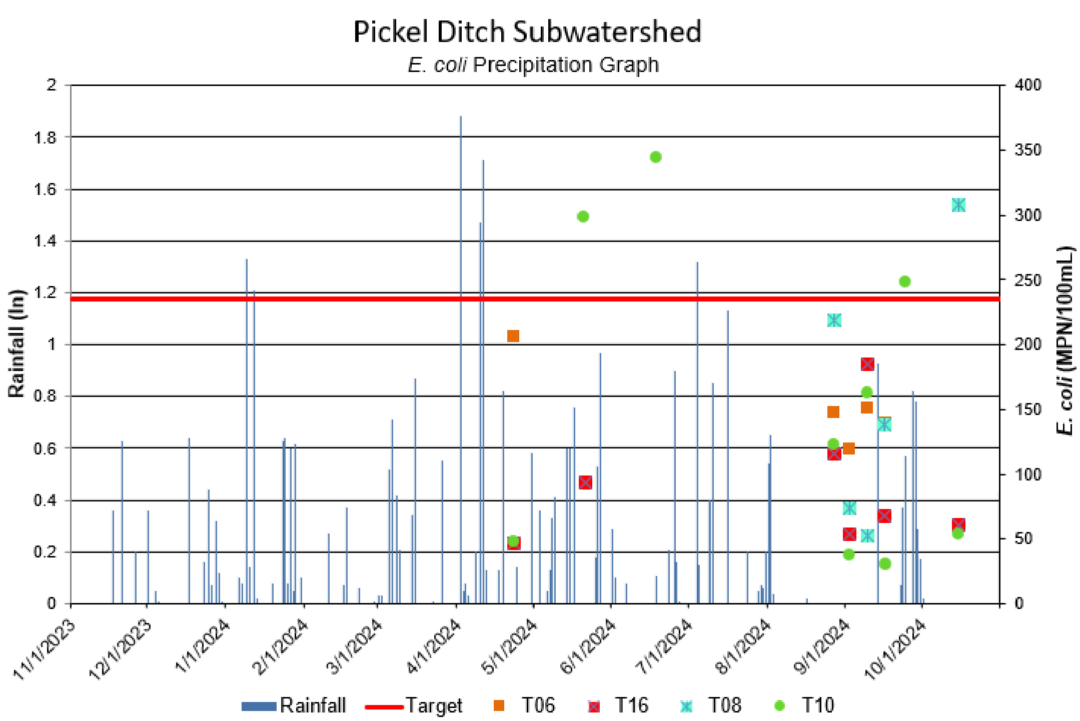

Figure 37: Graph of Precipitation and *E. coli* Data in Pickel Ditch Subwatershed

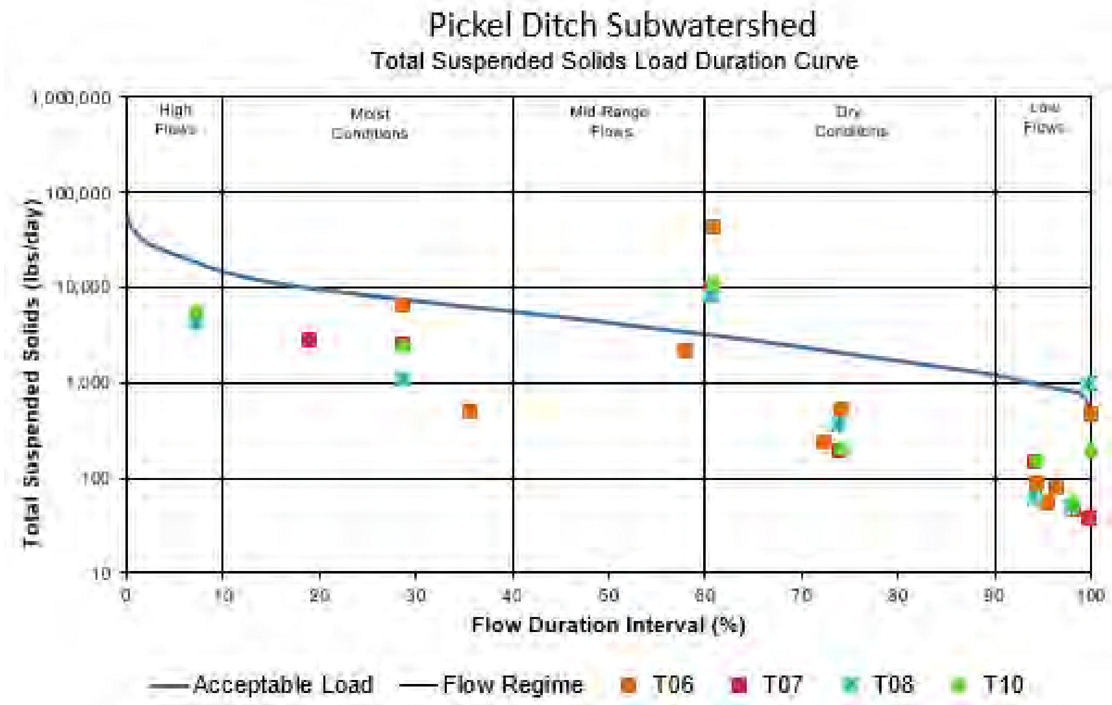

Figure 38: Total Suspended Solids Load Duration Curve for Pickel Ditch Subwatershed

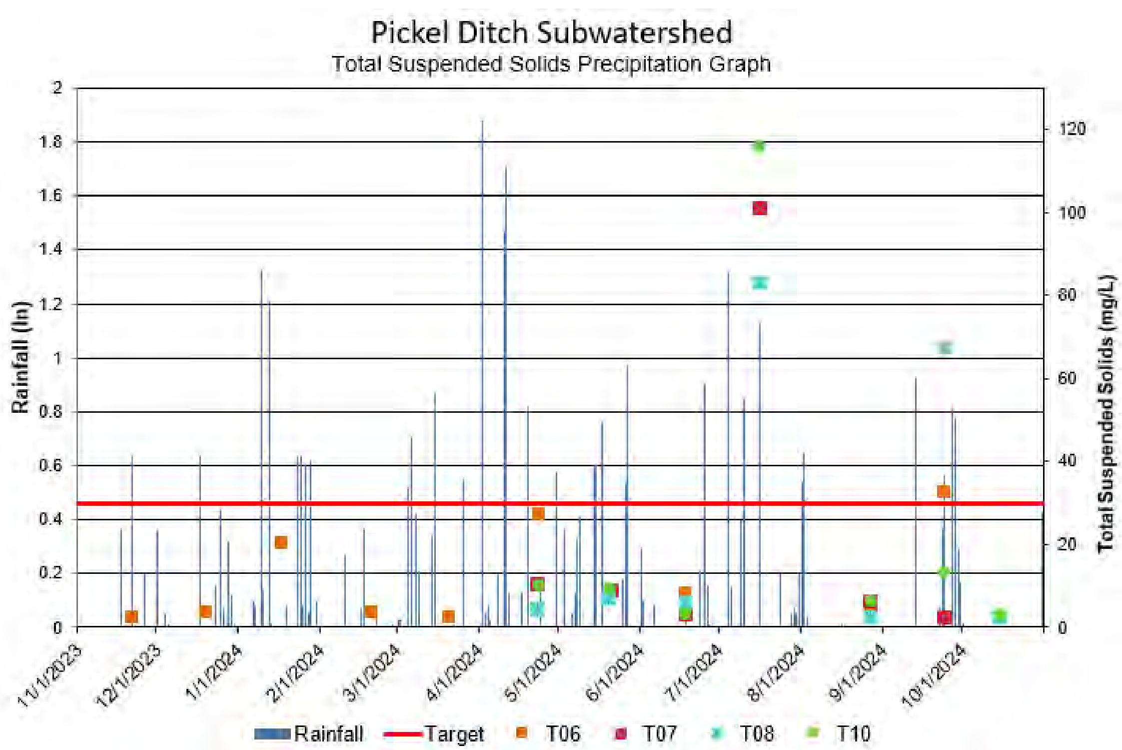

Figure 39: Graph of Precipitation and Total Suspended Solids Data in Pickel Ditch Subwatershed

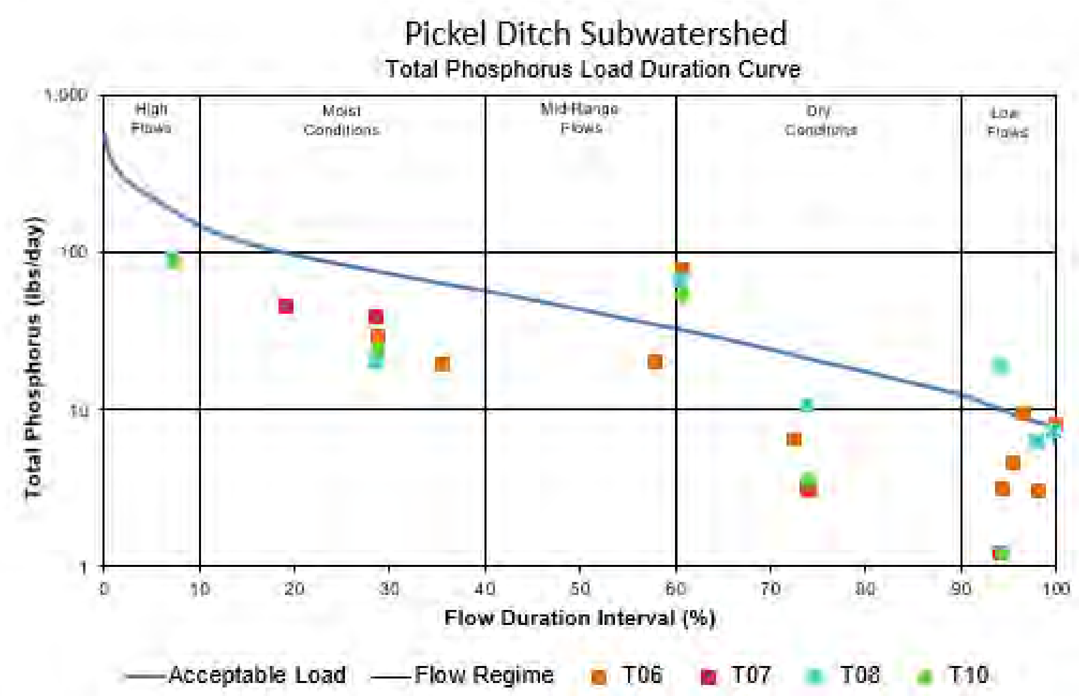

Figure 40: Total Phosphorus Load Duration Curve for Pickel Ditch Subwatershed

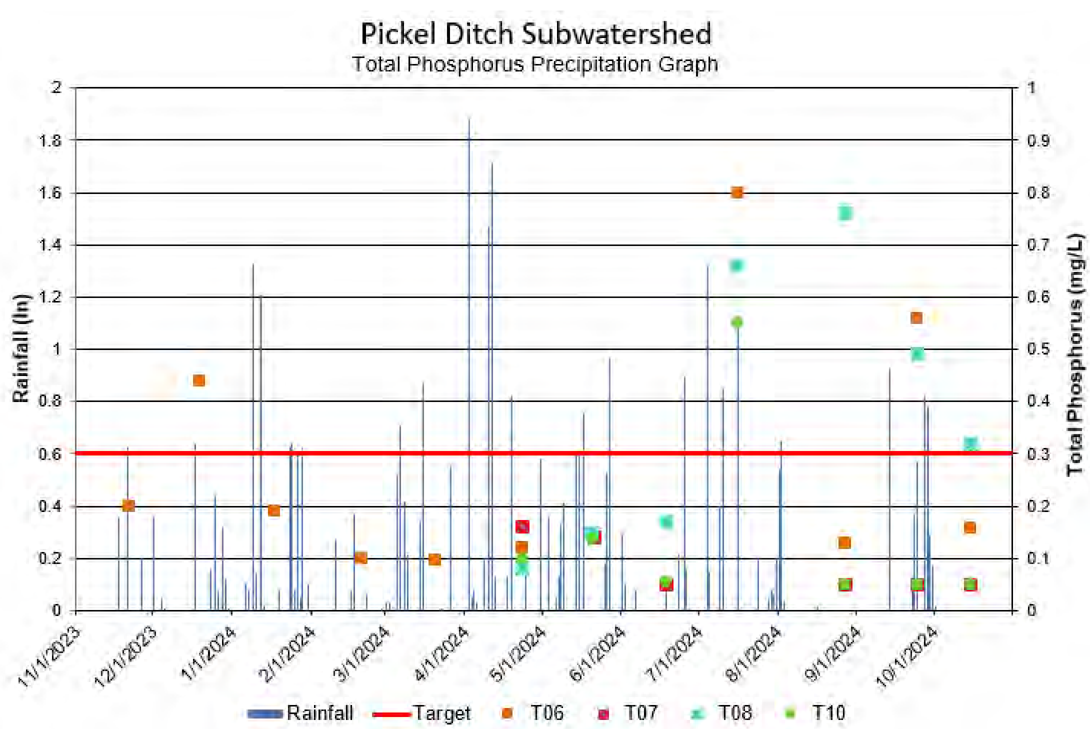

Figure 41: Graph of Precipitation and Total Phosphorus Data in Pickel Ditch Subwatershed

4.2.3 Smothers Creek

The Smothers Creek subwatershed has a drainage area of approximately 5,030 square miles and a surface area of approximately 27 square miles. The drainage area in the subwatershed mainly consists of the White River. The land use is primarily agriculture (68 percent) followed by forested (12 percent) and developed land (6 percent). There are two NPDES permitted facilities in the subwatershed. Duke Energy Indiana Edwardsport IGCC (IN0002780) has four permitted outfalls (outfall 002, 003, 004, and 005) that discharge in the Smothers Creek subwatershed. Of those four outfalls, outfall 002 is the only outfall permitted to discharge wastewater and stormwater. Outfall 002 discharges to West Fork White River. All other outfalls are only permitted to discharge stormwater. Outfall 003 and 005 discharge to West Fork White River, and outfall 004 discharges to an unnamed tributary of West Fork White River. As a result of having both wastewater and stormwater, this facility will be given both a non-stormwater WLA and a stormwater WLA for the TSS TMDL in this subwatershed. Town of Edwardsport WWTP (IN0064378) has one permitted outfall (outfall 001) in the Smothers Creek subwatershed. Outfall 001 is an active outfall that discharges to West Fork White River. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is either somewhat or very limited. Maintenance and inspections of septic systems in the area are important to ensure proper function and capacity. The landscape in the area is relatively flat leading to its intense conversion to agricultural production and use. In many areas of the subwatershed there are little to no remaining riparian buffers left along its banks due to agricultural practices.

Many of the waterways in this subwatershed are identified as having non-hydric soil types in their riparian zones. These areas are not ideal locations for wetland restoration or high functioning two-stage ditch implementation. With 5 percent of land used as pastureland a significant presence of pasture animals is not expected. There are no permitted CFOs in the subwatershed.

There are five monitoring sites located in the Smothers Creek subwatershed: T05, T11, T12, T13, and T14 (Figure 42). In 2023 and 2024 this watershed was sampled 62 times between the five sites.

The fish community IBI score for site T05 was 36 (fair) and the QHEI was 66 (good). The macroinvertebrate community mIBI score was 38 (fair) and the QHEI was 52 (fair). The fish community IBI score for site T11 was 38 (fair) and the QHEI was 66 (fair). The macroinvertebrate community mIBI score was 32 (poor) and the QHEI was 58 (fair). The fish community IBI score for site T12 was 16 (very poor) and the QHEI was 60 (good). The macroinvertebrate community mIBI score was 32 (poor) and the QHEI was 43 (poor). The fish community IBI score for site T13 was 32 (poor) and the QHEI was 67 (good). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 64 (good). The fish community IBI score for site T14 was 36 (fair) and the QHEI was 31 (poor). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 26 (very poor).

TSS concentrations ranged from 2.5 mg/L to 74.9 mg/L across 42 sampling events within the watershed and exceeded the target value 21 times. Additionally, DO was found to be below water quality standards twice at site T14, resulting in a DO impairment. Given that targets for TSS were violated within the subwatershed, a TSS TMDL was developed to address the DO impairment and impaired biological communities within the subwatershed.

There are approximately 25 miles of streams in the subwatershed. Based on IDEM data collected in 2023 and 2024, there will be approximately 11 stream miles with impaired biotic communities and .57 stream miles impaired for DO. These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, TSS TMDLs have been developed to address all impaired biotic communities and DO impairments. The load duration curve for each impairment in the Smothers Creek subwatershed are shown in Figure 43. Table 40 provides a summary of the Smothers Creek subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, NPDES facilities, CFOs, as well as LA, WLAs, and MOS values for IBC and DO.

Precipitation graphs (Figure 44) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Evaluating these graphs, with consideration of the watershed characteristics, allows for identification of potential point and nonpoint sources that are contributing to elevated TSS concentrations. Elevated levels of pollutants during rain events can indicate contributions due to run-off. Based on the load duration curve, it can be concluded that excessive TSS observed in this subwatershed are flow driven. The sources of TSS in this subwatershed are likely nonpoint sources. TSS loads are very consistent with observed flow. Nonpoint sources causing consistently high TSS could include streambank erosion, sediment in runoff, and agricultural practices in the subwatershed.

Table 40: Summary of Smothers Creek Subwatershed Characteristics

Smothers Creek (051202020803)					
Drainage Area	5,030.4 square miles				
Surface Area	26.6 square miles				
Site # [IDEM Station ID]	T05 [WWL-08-0010], T11 [WWL070-0003], T12 [WWL-08-0015], T13 [WWL-08-0016], T14 [WWL-08-0017]				
Listed Segments	INW0283_06, INW0283_04, INW0283_03, INW0283_T1001				
Listed Impairments [TMDL(s)]	Impaired Biotic Communities [TSS], Dissolved Oxygen [TSS]				
Land Use	Agricultural Land: 68% Forested Land: 12% Developed Land: 6% Open Water: 4% Pasture/Hay: 5% Grassland/Shrubs: 0% Wetland: 5%				
NPDES Facilities	Edwardsport WWTP (IN0064378), Duke Energy (IN0002780)				
CAFO Program	NA				
CFO Program	NA				
TMDL Total Suspended Solids Allocations (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
Upstream Drainage*	3,609,123.00	1,315,430.36	663,111.59	288,384.47	114,360.85
LA	15,737.71	5,620.97	2,744.64	1,091.35	323.57
WLA	1,853.62	1,424.09	1,301.10	1,231.41	1,199.04
MOS (10%)	2,069.57	828.83	475.97	273.27	179.13
Future Growth (5%)	1,034.78	414.42	237.98	136.63	89.57
TMDL = LA+WLA+MOS	3,629,818.67	1,323,718.66	667,871.28	291,117.13	116,152.15
WLA (Non-Stormwater) (lbs/day)					
Duke Energy (IN0002780)	1,163.93	1,163.93	1,163.93	1,163.93	1,163.93
Edwardsport WWTP (IN0064378)	3.5	3.5	3.5	3.5	3.5
WLA (Stormwater) (lbs/day)					
Duke Energy (IN0002780)	681.54	254.98	133.66	63.97	31.61
Construction	4.65	1.68			

** Note that the upstream drainage accounts for the presence of the White River in the Smothers Creek subwatershed.*

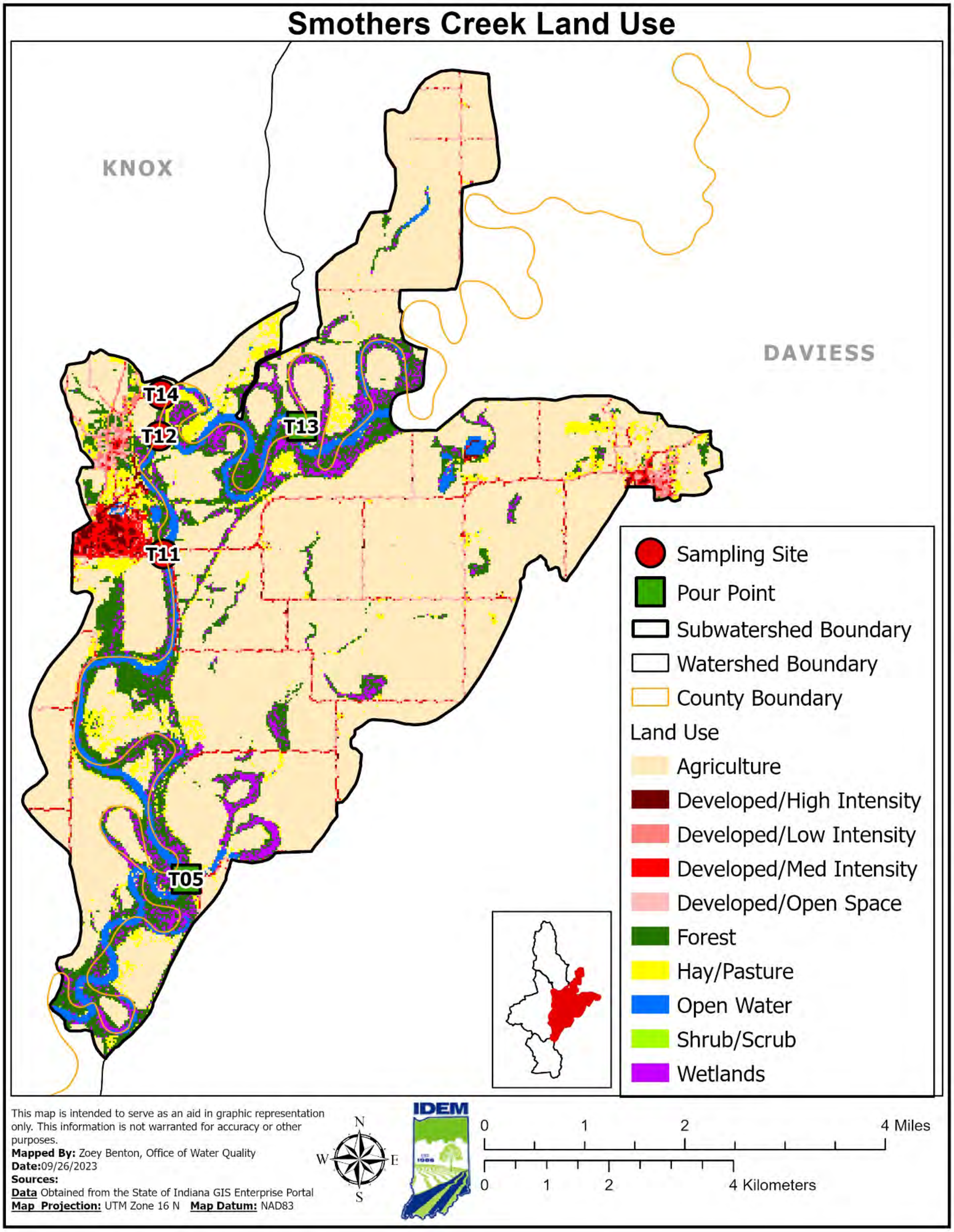

Figure 42: Sampling Stations in Smothers Creek Subwatershed

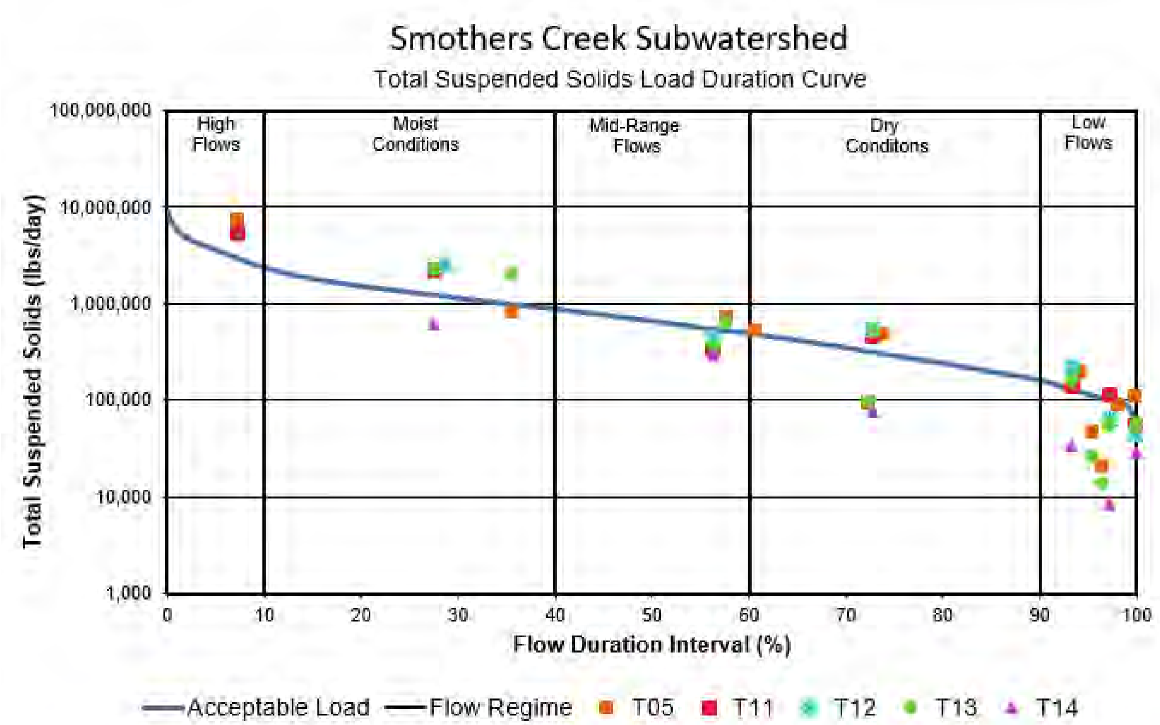

Figure 43: TSS Load Duration Curve for Smothers Creek Subwatershed

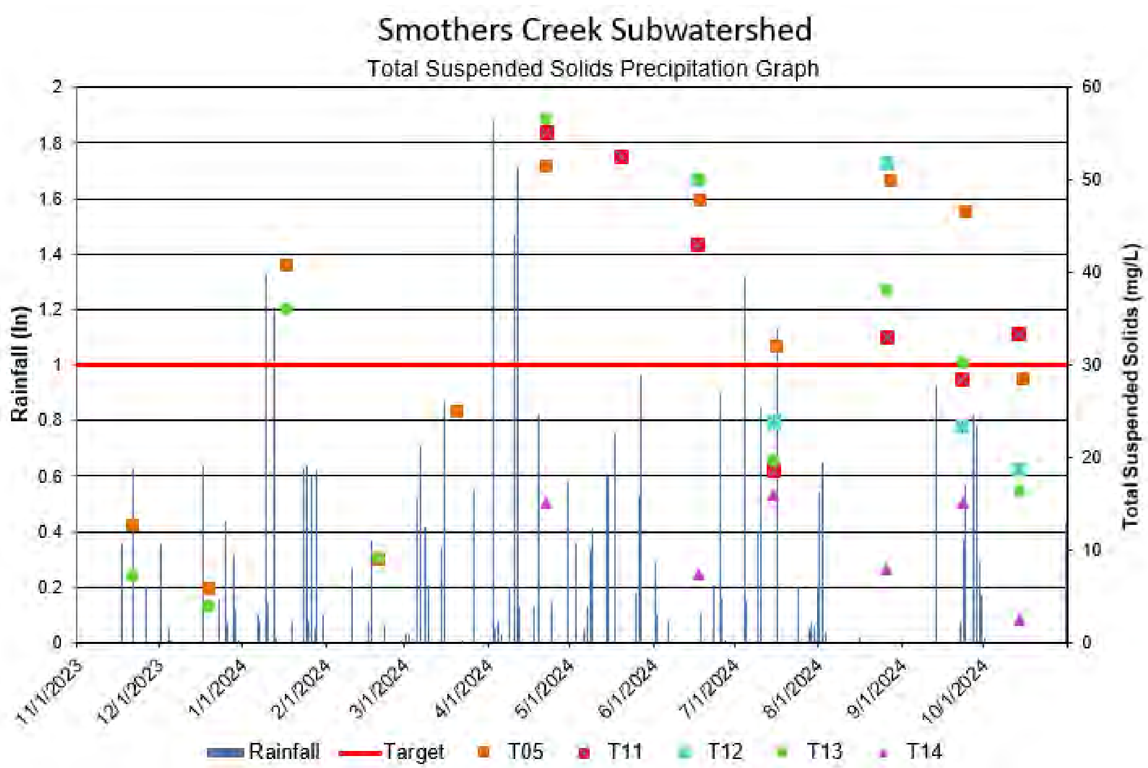

Figure 44: Graph of Precipitation and TSS Data at Smothers Creek Subwatershed

4.2.4 Bens Creek

The Bens Creek subwatershed has a drainage area of approximately 5,077 square miles and a surface area of approximately 17 square miles. The drainage area in the subwatershed mainly consists of the White River. The land use is primarily agriculture (65 percent) followed by hay/pasture (11 percent) and forested land (10 percent). There are three NPDES permitted facilities in the subwatershed. The Town of Wheatland WWTP (IN0064925) has one permitted outfall (outfall 001) in the Bens Creek subwatershed. Outfall 001 is an active outfall that discharges to an unnamed tributary to Nimnicht Creek. Peabody Midwest Mining LLC-Viking Mine (ING040002) is a surface mining facility that has one permitted outfall (outfall 006) in the subwatershed. Outfall 006 is a post-mining outfall that discharges to Bens Creek. While outfall 006 is no longer considered active, due to the former operation of this outfall, a WLA for this facility was included in the calculation of the TSS TMDL for this subwatershed. The majority of the subwatershed is rural, indicating homes pump to on-site septic systems. Based on the septic suitability of the soil, this entire subwatershed is either somewhat or very limited. Maintenance and inspections of septic systems in the area are important to ensure proper function and capacity. The landscape in the area is relatively flat leading to its intense conversion to agricultural production and use. In many areas of the subwatershed there are little to no remaining riparian buffers left along its banks due to agricultural practices. Despite its flat nature, the subwatershed does contain significant amounts of highly erodible soil types. These soil types can be susceptible to sheet, rill, and isolated gully erosion and can contribute to sediment loss from agricultural lands, as well as lands from high gradient slopes.

Many of the waterways in this subwatershed are identified as having non-hydric soil types in their riparian zones. These areas are not ideal locations for wetland restoration or high functioning two-stage ditch implementation. With 11 percent of land used as pastureland, a moderate presence of pasture animals is expected. There is one permitted CFO in the subwatershed.

There are four monitoring sites located in the Bens Creek subwatershed: T02, T03, 04, T18 (Figure 45). In 2023 and 2024 this watershed was sampled 49 times between the four sites. As a result, one site (T03) was identified as failing water quality standards for *E. coli*. The *E. coli* geomean for site T02 was 18.1 with 1/10 samples in exceedance of the single sample max, the geomean for site T03 was 213.5 MPN with 5/10 samples in exceedance of the single sample max, the geomean for site T04 was 7.8 with 1/10 samples in exceedance of the single sample max, and the geomean for site T18 was 41.6 with 4/10 samples in exceedance of the single sample max. The *E. coli* water quality samples taken from all sites, used to calculate the geomean, were taken on the same day approximately one hour apart for five consecutive weeks.

The fish community IBI score for site T02 was 34 (poor) and the QHEI was 64 (good). The macroinvertebrate community mIBI score was 32 (poor) and the QHEI was 46 (fair). The fish community IBI score for site T03 was 44 (fair) and the QHEI was 28 (very poor). The macroinvertebrate community mIBI score was 48 (good) and the QHEI was 38 (poor). The fish community IBI score for site T04 was 34 (poor) and the QHEI was 81 (excellent). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 62 (good). The fish community IBI score for site T18 was 18 (very poor) and the QHEI was 49 (fair). The macroinvertebrate community mIBI score was 28 (poor) and the QHEI was 51 (fair).

TSS concentrations ranged from 2.5 mg/L to 84.6 mg/L across 33 sampling events within the watershed and exceeded the target value 13 times. Additionally, DO was found to be below water quality standards twice at site T03, resulting in a DO impairment. Given that targets for TSS were violated within the subwatershed, TSS TMDLs were developed to address DO and impaired biological communities within the subwatershed.

Across 11 sampling events at site T18, pH values were below the standard range five times, resulting in a pH impairment. To address this impairment H+ concentrations associated with each sampling event were used to calculate an H+ TMDL for site T18.

There are approximately 24 miles of streams in the subwatershed. Based on IDEM data collected in 2023 and 2024, there will be approximately 11 stream miles impaired for *E. coli*, 11 stream miles impaired for DO, 8 stream miles with impaired biotic communities, and 2 stream miles impaired for pH. These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, an *E. coli* TMDL has been developed to address the *E. coli* impairment, TSS TMDLs have been developed to address all impaired biotic communities and DO impairments, and an H+ TMDL has been developed to address the pH impairment in this subwatershed. The load duration curve for each impairment in the Bens Creek subwatershed are shown in Figure 46, Figure 48, and Figure 50. Table 41 provides a summary of the Bens Creek subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, NPDES facilities, CFOs, as well as LA, WLAs, and MOS values for *E. coli*, IBC, DO, and pH.

Precipitation graphs (Figure 47, Figure 49, and Figure 51) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Evaluating these graphs, with consideration of the watershed characteristics, allows for identification of potential point and nonpoint sources that are contributing to elevated *E. coli,* TSS, and H+ concentrations. Elevated levels of pollutants during rain events can indicate contributions due to run-off. Based on the load duration curves, it can be concluded that the sources of pollutants in this watershed are likely nonpoint sources and point sources. The *E. coli* and TSS load duration curves for these sites show high loads of pollutants are likely flow driven. *E. coli* and TSS loads are likely coming from nonpoint sources. Nonpoint sources contributing to *E. coli* and TSS could include small animal operations, wildlife, animals with direct access to streams, illegal straight-pipes, leaking and failing septic systems, streambank erosion, and agricultural practices are potential issues in the subwatershed. The H+ load duration curve clearly indicates H+ loads at site T18 are not flow driven. H+ loads at site T18 are consistently very elevated during low flow. While it behaviorally appears to be a point source contributing to the excessive loads of H+, H+ loads are likely a result of historic mining practices in the area.

Table 41: Summary of Bens Creek Subwatershed Characteristics

Bens Creek (051202020804)					
Drainage Area	5,077.22 square miles				
Surface Area	16.65 square miles				
Site # [IDEM Station ID]	T02 [WWL-08-0009], T03 [WWL-08-0021], T04 [WWL-08-0008], T18 [WWL-08-0022]				
Listed Segments	INW0284_T1001, INW0284_03, INW0284_T1003				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*], Impaired Biotic Communities [TSS], DO [TSS], pH [H+]				
Land Use	Agricultural Land: 65% Forested Land: 10% Developed Land: 5% Open Water: 6% Pasture/Hay: 11% Grassland/Shrubs: <1% Wetland: 3%				
NPDES Facilities	Town of Wheatland WWTP (IN0064925), Viking Mine (IG040002)				
CAFO Program	NA				
CFO Program	Mark Harlow Prahdan Farm Inc. (Farm ID: 4617)				
TMDL *E. coli* Allocations (MPN/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
Upstream Drainage*	1.298E+14	4.733E+13	2.388E+13	1.042E+13	4.161E+12
LA	3.526E+11	1.284E+11	6.471E+10	2.810E+10	1.109E+10
WLA	5.239E+08	5.239E+08	5.239E+08	5.239E+08	5.239E+08
MOS (10%)	4.154E+10	1.517E+10	7.677E+09	3.369E+09	1.369E+09
Future Growth (5%)	2.077E+10	7.587E+09	3.838E+09	1.685E+09	6.844E+08
TMDL = LA+WLA+MOS	1.302E+14	4.748E+13	2.396E+13	1.045E+13	4.175E+12
WLA (Non-Stormwater) (lbs/day)					
Town of Wheatland WWTP (IN0064925)	5.239E+08	5.239E+08	5.24E+08	5.239E+08	5.239E+08
TMDL Total Suspended Solids Allocations (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
Upstream Drainage*	3,652,156.20	1,332,014.40	672,173.59	293,125.39	117,095.06
LA	4,575.62	1,622.03	1,573.25	686.88	275.24

WLA	4,776.37	1,794.02	154.64	71.24	32.51
MOS (10%)	1,169.00	427.01	215.99	94.76	38.47
Future Growth (10%)	1,169.00	427.01	215.99	94.76	38.47
TMDL = LA+WLA+MOS	3,663,846.19	1,336,284.47	674,333.45	294,073.04	117,479.75
WLA (Non-Stormwater) (lbs/day)					
Town of Wheatland WWTP (IN0064925)	5.90	5.90	5.90	5.90	5.90
WLA (Stormwater) (lbs/day)					
Viking Mine (IG040002)	804.38	293.91	148.74	65.34	26.61
Construction	3,966.09	1,494.21			
TMDL H+ Ions (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows** 5%	**Moist Conditions** 25%	**Mid-Range Flows** 50%	**Dry Conditions** 75%	**Low Flows** 95%
Upstream Drainage*	1.22E+02	4.44E+01	2.24E+01	9.77E+00	3.90E+00
LA	3.70E-01	1.35E-01	6.76E-02	2.92E-02	1.14E-02
WLA	4.91E-04	4.91E-04	4.91E-04	4.91E-04	4.91E-04
MOS (Imp)					
Future Growth (5%)	1.95E-02	7.11E-03	3.59E-03	1.56E-03	6.25E-04
TMDL = LA+WLA+MOS	1.22E+02	4.45E+01	2.25E+01	9.80E+00	3.92E+00
WLA (Non-Stormwater) (lbs/day)					
Town of Wheatland WWTP** (IN0064925)	4.91E-04	4.91E-04	4.91E-04	4.91E-04	4.91E-04

** Note that the upstream drainage accounts for the presence of the White River in the Bens Creek subwatershed.*

*** There is currently no H+ limit in the permit for this facility, however there is a pH daily minimum of 6 in the permit, which is equivalent to an H+ concentration of 1.00E-03 mg/L. Furthermore, because pH and H+ are inversely related, the H+ value of 1.00E-3 mg/L is the maximum daily H+ concentration that can exist while staying above the pH daily minimum of 6. Therefore, facilities meeting the daily minimum pH of 6 will also meet their H+ ion loading limits and be consistent with the assumptions set forth in the TMDL.*

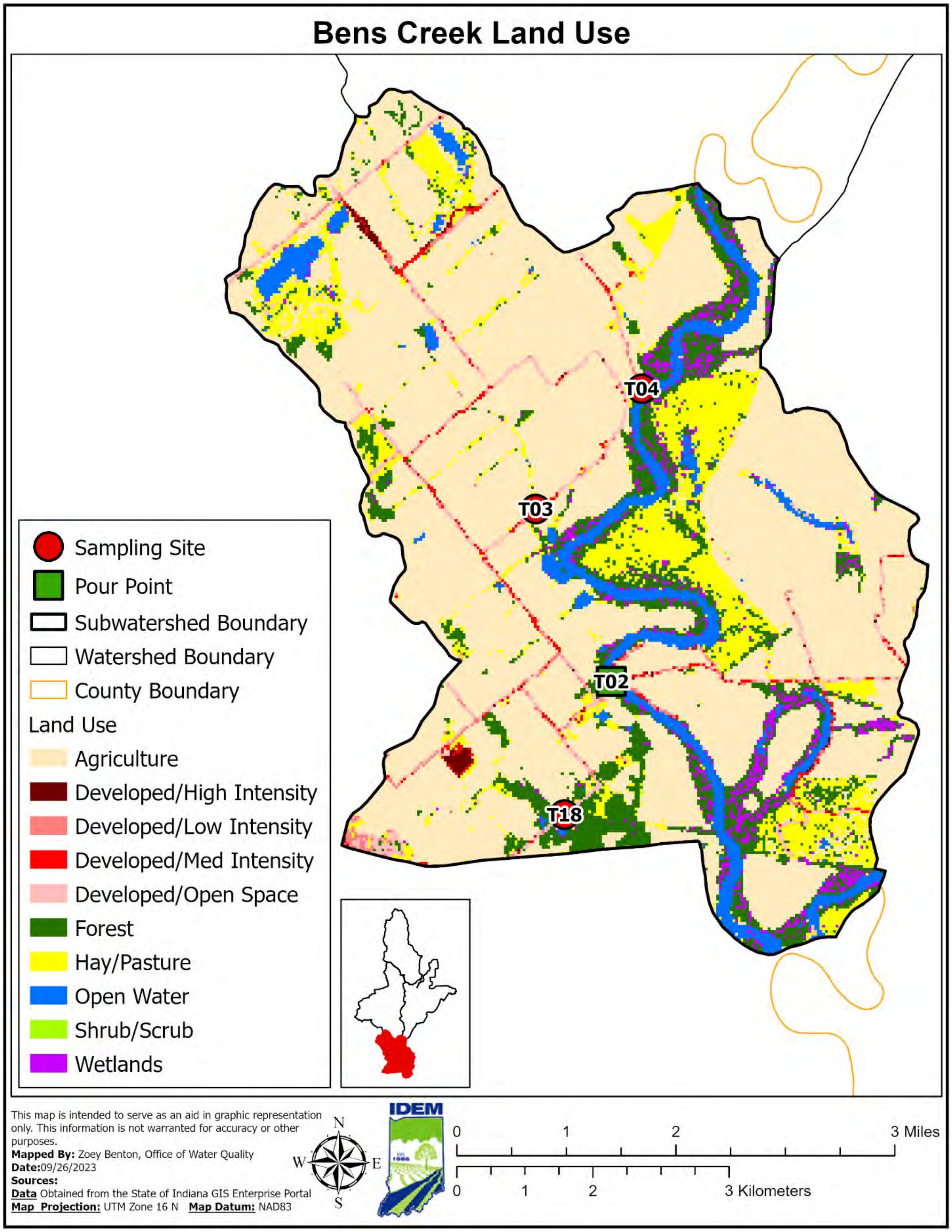

Figure 45: Sampling Stations in Bens Creek Subwatershed

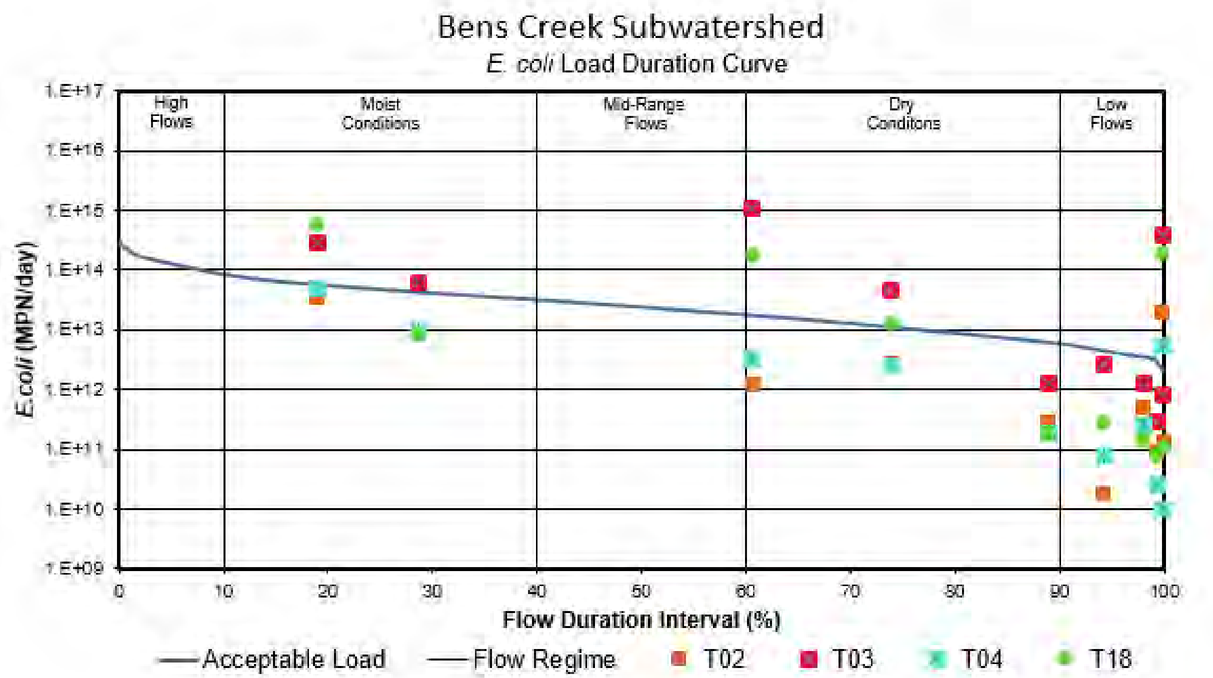

Figure 46: E. coli Load Duration Curve for Bens Creek Subwatershed

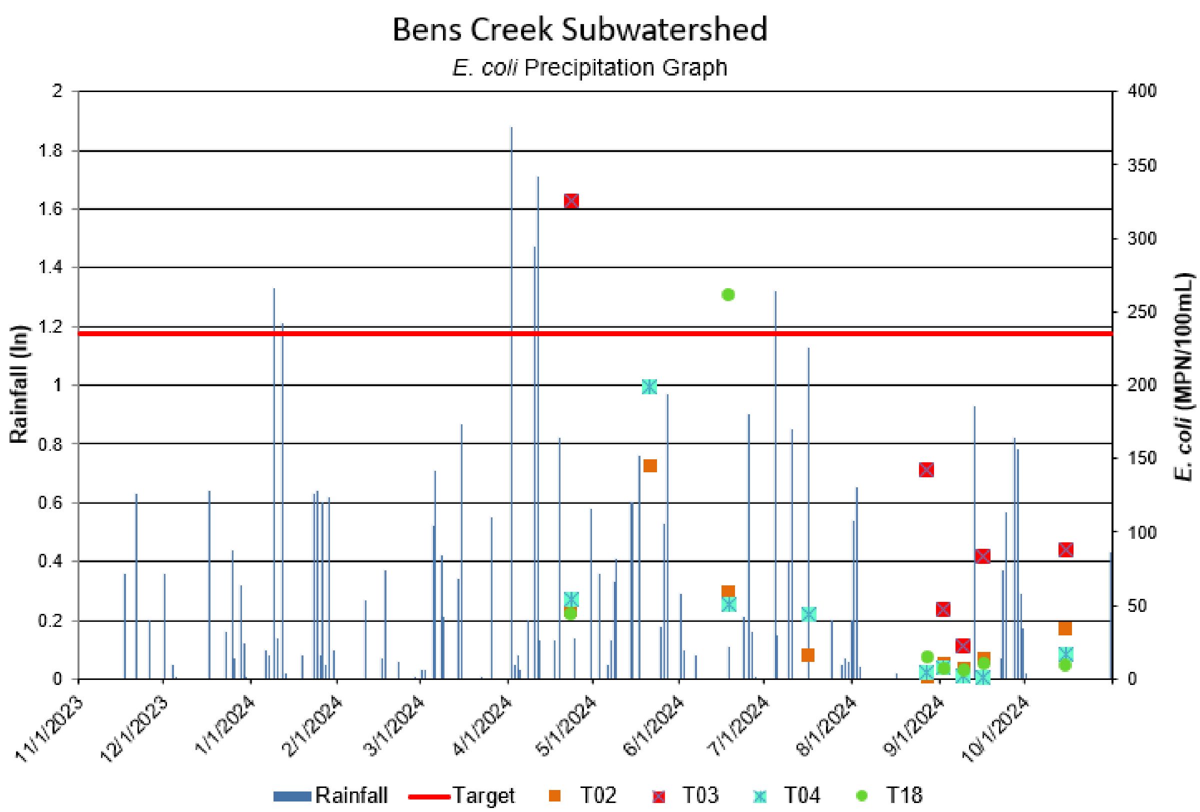

Figure 47: Graph of Precipitation and *E. coli* Data at Bens Creek Subwatershed

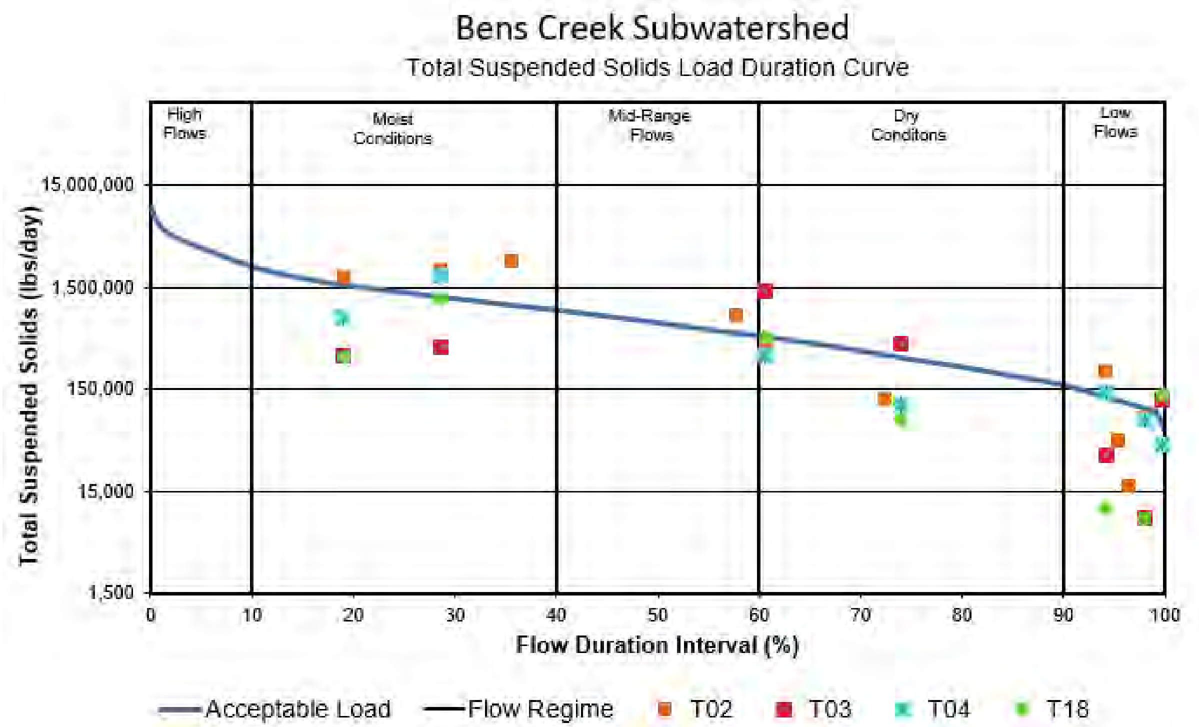

Figure 48: Total Suspended Solids Load Duration Curve for Bens Creek Subwatershed

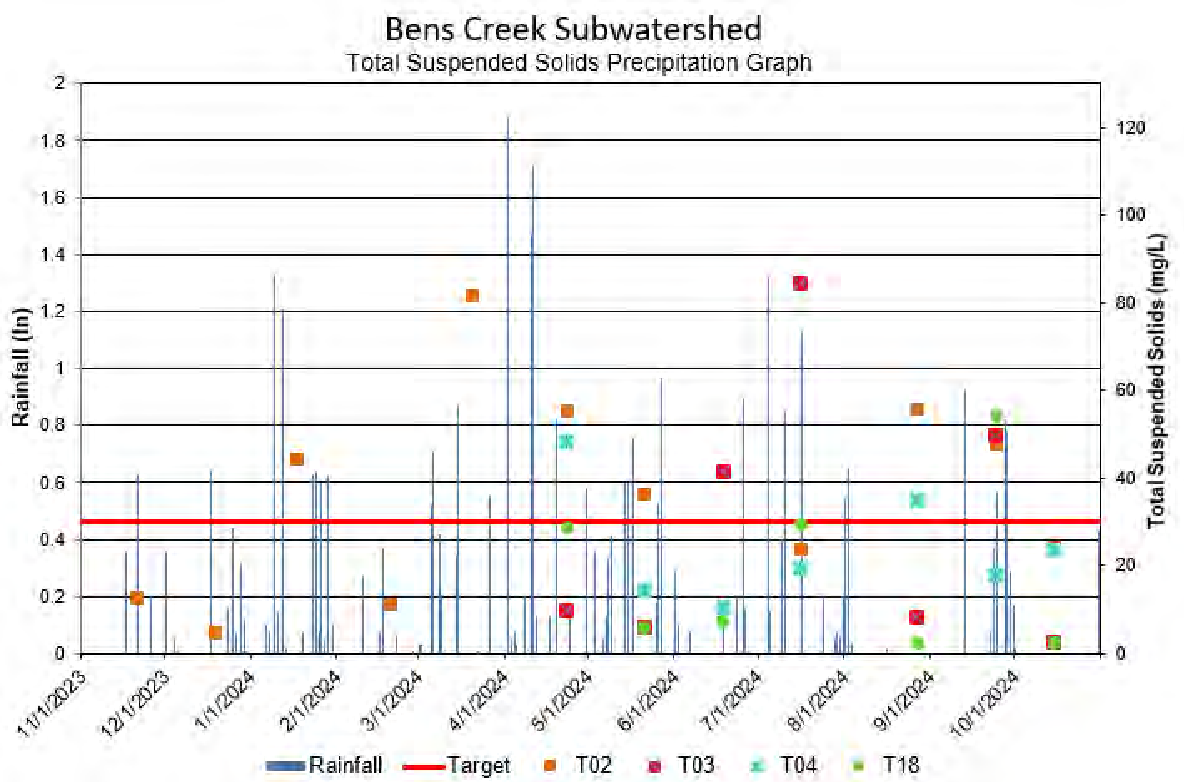

Figure 49: Graph of Precipitation and Total Suspended Solids Data at Bens Creek Subwatershed

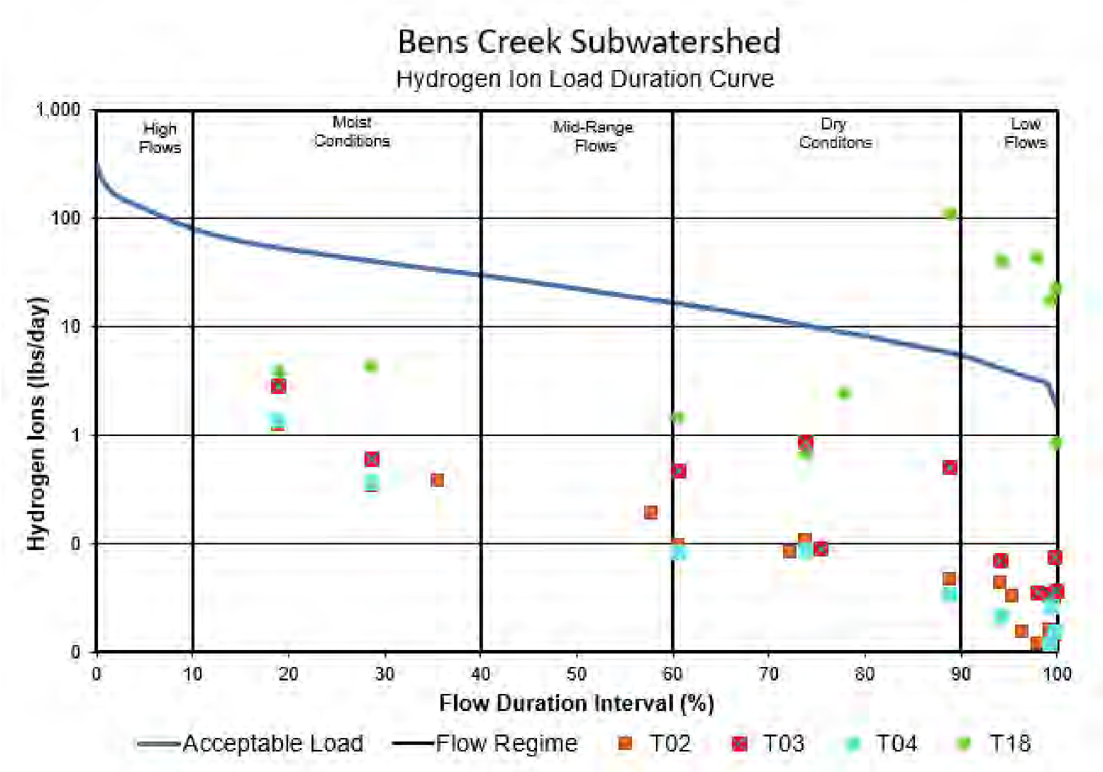

Figure 50: Hydrogen Ion Load Duration Curve for Bens Creek Subwatershed

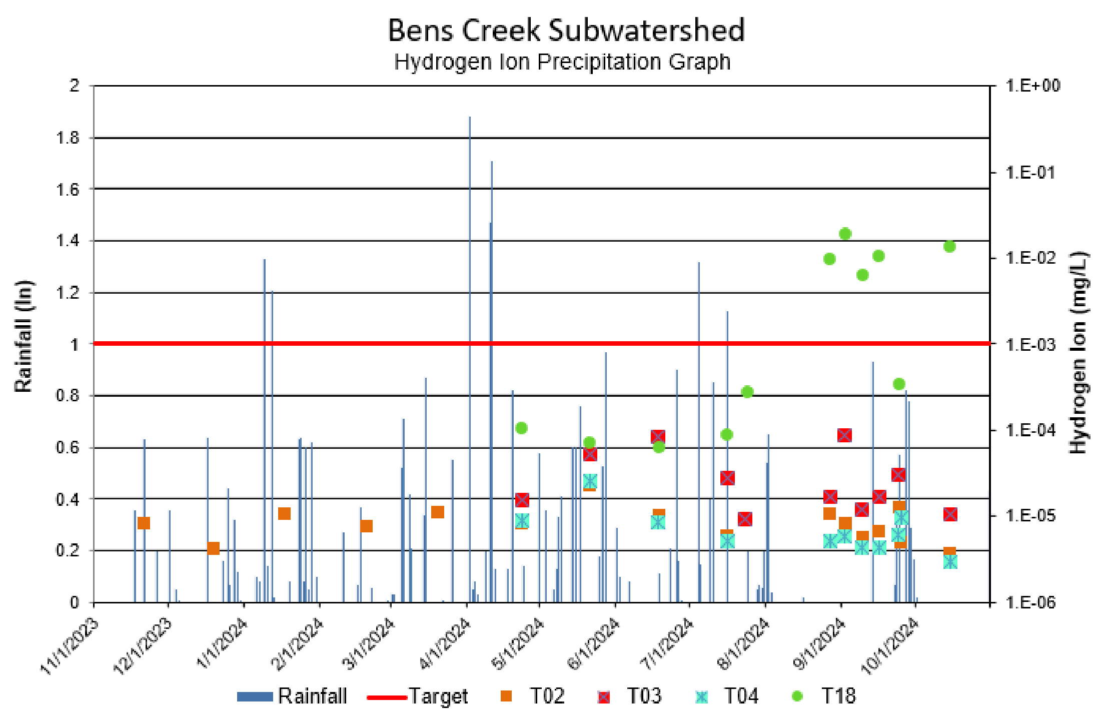

Figure 51: Graph of Precipitation and Hydrogen Ion Data at Bens Creek Subwatershed

5.0 ALLOCATIONS

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual WLAs for regulated sources and LAs for sources not directly regulated by a permit. In addition, the TMDL must include a MOS, either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this is defined by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

5.1 Individual Allocations

This section presents the allowable pollutant loads and associated allocations for each of the subwatersheds and associated assessment units in the Indian Creek White River watershed. Allocations were calculated for each 12-digit HUC (subwatershed). WLAs are typically calculated based on the design flow or estimated flow of the facility and the TMDL target or applicable permit limit. The following tables presents the individual WLAs for NPDES facilities in the Indian Creek White River watershed by subwatershed.

Table 42: Individual WLAs for NPDES Individual Permit Municipal and Industrial Facilities in the Indian Creek White River Watershed

Sub-watershed	**Facility Name**	**Permit Number**	**AUID**	**Receiving Stream**	**Flow Regime**	**Estimated Design Flow (MGD)**	***E. coli* WLA (MPN/day)**	**NPDES Permit *E. coli* Limit**	**TSS WLA (lbs/day)**	**NPDES Permit TSS Limit**	**TP WLA (lbs/day)**	**NPDES Permit TP Limit**	**H+ WLA (lbs/day)**	**NPDES Permit H+ Limit**
Pickel Ditch	City of Bicknell WWTP	IN0039276	INW0282_02	Indian Creek	All	0.97	8.63E+09	235 MPN/100 mL Daily Max.	80.93	10 mg/L Monthly Avg.	8.09	**1.0 mg/L Monthly Avg.**	**NA**	**NA**
Smothers Creek	Town of Edwardsport WWTP	IN0064378	INW0283_05	West Fork White River	All	0.035	NA	NA	3.5	12 mg/L Monthly Avg.	NA	**NA**	**NA**	**NA**
	Duke Energy Indiana Edwardsport IGCC	IN0002780	INW0283_06	West Fork White River	All	4.65	NA	NA	1,163.93	30 mg/L Monthly Avg.	NA	**NA**	**NA**	**NA**
Bens Creek	Town of Wheatland WWTP	IN0064925	INW0284_T 1003	Unnamed Tributary to Nimnicht Creek	All	0.0589	5.24E+08	235 MPN/100 mL Daily Max.	5.9	12 mg/L Daily Max.	NA	**NA**	**4.91E-04**	**1.00E-03 mg/L Daily Max***

Understanding Table 42: The WLA for each NPDES permitted facility will be achieved through compliance with the facility's NPDES individual permit.

** There is currently no H+ limit in the permit for this facility, however there is a pH daily minimum of 6 in the permit, which is equivalent to an H+ concentration of 1.00E-03 mg/L. Furthermore, because pH and H+ are inversely related, the H+ value of 1.00E-3 mg/L is the maximum daily H+ concentration that can exist while staying above the pH daily minimum of 6. Therefore, facilities meeting the daily minimum pH of 6 will also meet their H+ ion loading limits and be consistent with the assumptions set forth in the TMDL*

5.1.1 Approach for Calculating General Permit Waste Load Allocations

A number of permittees in the Indian Creek White River watershed have general rather than individual permits. An individual permit is site-specific and is developed to address discharges from a specific facility. A general permit is used to cover a category of similar discharges, rather than a specific site. IDEM may issue a general permit when there are several sources or activities involved in similar operations that may be adequately regulated with a standard set of conditions.

Calculating WLAs for facilities with individual permits is straightforward; all the necessary information regarding allowable flows and effluent limits is contained within the permit. Calculating WLAs for facilities with general permits is more difficult because only limited information is available on historical flow and pollutant concentrations. For example, several of the current mines in the watershed have general permits for treating run-off; discharge is therefore related to precipitation events rather than a "design" flow as is available for WWTPs. WLAs were calculated using the drainage area of each permittee to estimate run-off flow volumes and using existing permit limits to calculate the allowable loadings. The total performance acres bonded were used to estimate the size of the mine for each subwatershed. As total permitted boundaries and not bonded acreage are typically available for spatial analysis, bonded acreage for each subwatershed was estimated by an area weighted approach using permitted area within each subwatershed. For example, Bear Run Mine (ING040239) is permitted for approximately 17,749 acres of which approximately 2,342 acres, or 13.2% of the permitted area is located within the Pollard Ditch subwatershed. Using the total bonded area reported at approximately 9,417 acres, the estimated bonded acreage within the subwatershed was determined by multiplying 9,417 by 13.2% to result in 1,242 acres. To determine the WLA, 1,242 was divided by the subwatershed area, and multiplied by the corresponding flow values for the subwatershed to determine flow from the facility [(1,242 / 16,306 acres in Pollard Ditch) * flow (cfs)]. Flow-based WLA were thus calculated by multiplying the flow values by the permit limit of 70 mg/L daily maximum. These permits have varying discharge limits based on dry and wet weather discharge flow rates. Individual WLAs for coal mining facilities are implemented through compliance with their NPDES permit.

Table 43: Individual WLA for NPDES General Permit Coal Mining Facilities in the Indian Creek White River

Facility Name	Permit Number	Sub watershed	AUID	Receiving Stream	Bonded Acres within Subwatershed	High Flow Regime TSS WLA (lbs/day)	Low Flow Regime TSS WLA (lbs/day)	NPDES Permit TSS Limit
Peabody Midwest Mining LLC—Bear Run Mine	ING040239	Pollard Ditch	INW0281_01	Pollard Ditch	1,242.37	4,999.13	158.41	**70 mg/L daily max**
Triad Mining LLC—Freelandville Mine	ING040030	Pollard Ditch	INW0281_T1 002	Pollard Ditch – Unnamed Tributary	1,300.21	2,844.96	90.15	**70 mg/L daily max**
			INW0281_02	Pollard Ditch				
Peabody Midwest Mining LLC—Viking Mine	ING040002	Pickel Ditch	INW0282_T1 005	Indian Creek -- Unnamed Tributary	465.9	1,238.94	52.3	**70 mg/L daily max**
		Bens Creek	INW0284_T1 001	Bens Creek	3,14.24	804.38	26.61	**70 mg/L daily max**

Table 43: The WLA for each NPDES permitted facility will be achieved through compliance with the facility's NPDES general permit coverage.

Stormwater run-off associated with construction activity is regulated under the CSGP. More information on the CSGP regulation can be found in Section 2.8.3. The WLA for sites regulated under the CSGP was determined based on the average annual land disturbance associated with total overall acreage for all sites in the subwatershed. The average annual land disturbance was calculated for each subwatershed using data from permitted constructions sites for the past five years.

5.2 Critical Conditions

The CWA requires that TMDLs take into account critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. The load duration curve approach helps to identify the sources contributing to the impairment and to roughly differentiate between sources.

Exceedances of the load duration curve at higher flows (0-40 percent ranges) are indicative of wet weather sources (e.g., nonpoint sources, regulated stormwater discharges). Exceedances of the load duration curve at lower flows (60 to 100 percent range) are indicative of point sources (e.g., wastewater treatment facilities, livestock in the stream). Table 44 summarizes the general relationship between the five hydrologic zones and potentially contributing sources (the table is not specific to any individual pollutant). Existing loading is calculated as the 90th percentile of measured *E. coli* concentrations under each hydrologic condition class multiplied by the flow at the middle of the flow exceedance percentile.

For example, calculating the existing loading under dry conditions (flow exceedance percentile = 60-90 percent), the 75th percentile exceedance flow is *multiplied* by the 90th percentile of pollutant concentrations measured under 60-90th percentile flows. Through the load duration curve approach, it has been determined that load reductions for *E. coli*, TSS, H+ and TP are needed for specific flow conditions. The critical conditions (the periods when the greatest reductions are required) vary by location and are summarized in Table 45 and Table 46. After existing loading and percent reductions are calculated under each hydrologic condition class, the critical condition for each TMDL is identified as the flow condition requiring the largest percent reduction. For example, impacts from point sources are usually most pronounced during dry and low flow zones because there is less water in the stream to dilute their loads. In contrast, impacts from channel bank erosion is most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur. The table indicates that critical conditions for pollutants occur during all flow regimes, and, therefore, implementation of controls should be targeted for these conditions.

Table 44: Relationship between Load Duration Curve Zones and Contributing Sources

Contributing Source Area	Duration Curve Zone				
	High (0%-10%)	**Moist (10%-40%)**	**Mid-Range (40%-60%)**	**Dry (60%-90%)**	**Low (90%-100%)**
Wastewater treatment plants (point source)			L	M	H
Livestock direct access to streams			L	M	H
Wildlife direct access to streams			L	M	H
Pasture management	H	H	M		
On-site wastewater systems/Unsewered areas	L	M	H	H	H
Riparian buffer areas	H	H	M	M	
Stormwater: Impervious	H	H	H		
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M	L	
Bank erosion	H	M	L		

Note: Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low)(Modified from An Approach for Using Load Duration Curves in the Development of TMDLs (U.S. EPA, 2007))

Table 45: Critical Conditions for TMDL Parameters

Parameter	Subwatershed (HUC)	Critical Condition (Reduction Needed)				
		High	Moist	Mid-Range	Dry	Low
E. coli (MPN/100mL)	Pollard Ditch (051202020801)	5.2	9.1	79.0	73.0	74.7
	Pickel Ditch (051202020802)	86.3	65.2	NA	97.7	95.4
	Bens Creek (051202020804)	—	92.0	NA	94.5	96.2
Total Suspended Solids (mg/L)	Pollard Ditch (051202020801)	31.9	NA	NA	NA	NA
	Pickel Ditch (051202020802)	NA	NA	NA	83.7	NA
	Smothers Creek (051202020803)	58.7	52.6	22.0	40.1	36.6
	Bens Creek (051202020804)	—	50.4	32.0	40.2	43.3
H+ (mg/L)	Bens Creek (051202020804)	—	NA	NA	NA	88.6

Note: "—" = No Data Collected in Flow Regime; "NA" = No reduction needed

Table 46: Critical Conditions for Total Phosphorus TMDL

Parameter	Subwatershed (HUC)	Critical Condition (Reduction Needed)
		Low Flow (25th Percentile)
Total Phosphorus (mg/L)	Pickel Ditch (051202020802)	57.3

Table 44, Table 45, and Table 46 provide the foundation necessary to identify subwatersheds that are in need of the most significant pollutant reductions to achieve water quality standards in the Indian Creek White River watershed. Using these two tables, along with the Linkage Analysis in Section 4.0, watershed organizations will gain a better understanding of which subwatersheds require the most pollutant load reductions. This can assist in future efforts to identify critical areas in the Indian Creek White River watershed for implementation. The tables above focus on the information and data collected and analyzed through the TMDL development process for percent reduction purposes, whereas critical areas take into account other factors for consideration (e.g., political, social, economic) to help determine implementation feasibility that will affect progress toward pollutant load reductions and, ultimately, attainment of water quality standards. This information can be key to watershed organizations in the process of identifying and selecting critical areas and implementation activities for the purposes of watershed management plan development. IDEM recommends that watershed organizations take the percent reductions into consideration when selecting critical areas for purposes of watershed management planning. By also taking into account different flow regimes, watershed groups will be able to prioritize practices that give them the most efficient load reductions for each critical area that is chosen.

6.0 REASONABLE ASSURANCES/IMPLEMENTATION

This section of the Indian Creek White River watershed TMDL focuses on implementation activities that have the potential to achieve the WLAs and LAs presented in previous sections. The focus of this section is to identify and select the most appropriate structural and non-structural best management practices (BMPs) and control technologies to reduce *E. coli*, TSS, H+, and TP loads from sources throughout the Indian Creek White River watershed, particularly in the critical areas identified in Section 5.2. This section also addresses the programs that are available to facilitate implementation of structural and non-structural BMPs to achieve the allocations, as well as current ongoing activities in the Indian Creek White River watershed at the local level that will play a key role in successful TMDL implementation.

To select appropriate BMPs and control technologies, it is important to review the relevant sources in the Indian Creek White River watershed.

Point Sources

- Public Water Supply
- Surface coal mining facilities
- Illicitly connected straight pipe systems

Nonpoint Sources

- Cropland
- Pastures and livestock operations
- CFOs and CAFOs
- Streambank erosion
- Onsite wastewater treatment systems
- Wildlife
- Urban nonpoint source run-off
- Historic mining practices
- Loss of riparian habitat
- Inappropriate waste disposal

6.1 Implementation Activity Options for Sources in the Indian Creek White River Watershed

Keeping the list of significant sources in the Indian Creek White River watershed in mind, it is possible to review the types of BMPs that are most appropriate for the pollutants and the source type. Table 47 provides a list of implementation activities that are potentially suitable for the Indian Creek White River watershed based on the pollutants and the types of sources. The implementation activities are a combination of structural and non-structural BMPs to achieve the assigned WLAs and LAs. IDEM recognizes that actions taken in any individual subwatershed may depend on a number of factors (including socioeconomic, political, and ecological factors). The recommendations in Table 47 are not intended to be prescriptive. Any number or combination of implementation activities might contribute to water quality improvement, whether applied at sites where the actual impairment was noted or other locations where sources contribute indirectly to the water quality impairment.

Table 47: List of Potentially Suitable BMPs for the Indian Creek White River Watershed

Implementation Activities	Pollutant			Point Sources			Nonpoint Sources							
	Bacteria	**Nutrients**	**Sediment**	**WWTPs and Industrial Facilities**	**CAFOs**	**Illicitly Connected " Straight Pipe" Systems**	**Cropland**	**Pastures and Livestock Operations**	**CFOs**	**Streambank Erosion**	**Onsite Wastewater Treatment Systems**	**Wildlife/Domestic Pets**	**Urban NPS Run-off**	**Low pH/Acidic Water**
Inspection and maintenance	X	X	X	X	X						X		X	
Outreach and education and training	X	X	X	X	X	X	X	X	X	X	X	X	X	
System replacement	X	X				X					X			
Conservation tillage/residue management	X	X	X				X							
Cover crops	X	X	X				X			X				
Filter strips	X	X	X		X		X	X	X	X				
Grassed waterways	X		X		X		X		X	X				
Riparian forested/herbaceous buffers	X	X	X		X		X	X	X	X		X		
Manure handling, storage, treatment, and disposal	X	X			X				X					
Alternative watering systems	X		X		X			X	X	X				
Stream fencing (animal exclusion)	X	X	X		X			X		X				
Prescribed grazing	X	X	X					X		X				
Conservation easements	X	X	X											
Two-stage ditches		X	X											
Rain barrel		X	X										X	
Rain garden		X	X										X	
Porous pavement		X	X										X	
Stormwater planning and management	X	X	X	X						X	X	X	X	
Comprehensive Nutrient Management Plan	X	X					X		X					
Constructed Wetland	X	X	X	X		X	X					X		
Critical Area Planting			X					X		X				
Drainage Water Management		X					X						X	
Nutrient Management Plan		X					X			X				
Land Reconstruction of Mined Land			X							X				
Sediment Basin		X	X										X	
Pasture and Hay Planting	X	X	X				X	X	X	X		X		
Streambank and Shoreline Protection			X				X	X	X	X		X		
Conservation Crop Rotation		X	X				X	X	X					
Field Border	X	X					X	X	X			X		
Conservation Crop Rotation	X	X	X				X			X				

Implementation Activities	Pollutant			Point Sources			Nonpoint Sources								
	Bacteria	Nutrients	Sediment	WWTPs and Industrial Facilities	CAFOs	Illicitly Connected " Straight Pipe" Systems	Cropland	Pastures and Livestock Operations	CFOs	Streambank Erosion	Onsite Wastewater Treatment Systems	Wildlife/Domestic Pets	Urban NPS Run-off	Low pH/Acidic Water
Calcium Oxide Dosers (Carbondale doser)														X
Steel Slag Leach Beds														X
Successive Alkaline Producing Systems														X

The information provided in Section 5.2 assisted in the development of Table 47, which provides a more refined suite of recommended implementation activities targeted to the critical flow condition identified in Section 5.2. Watershed stakeholders can use the implementation activities identified in Table 47 for each critical flow condition and select activities that are most feasible in the Indian Creek White River watershed. This table can also help watershed stakeholders to identify implementation activities for critical areas that they select through the watershed management planning process.

6.2 Implementation Goals and Indicators

For each pollutant in the Indian Creek White River watershed, IDEM has identified broad goal statements and indicators. This information is to help watershed stakeholders determine how to track implementation progress over time and also provide the information necessary to complete a watershed management plan.

***E. coli* Goal Statement:** The waterbodies (or streams) in the Indian Creek White River watershed should meet the 235 colonies/100 mL daily maximum TMDL target value.

***E. coli* Indicator:** Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the *E. coli* target value.

Total Phosphorus Goal Statement: The waterbodies (or streams) in the Indian Creek White River watershed should meet the 0.30 mg/L TMDL total phosphorus target value.

Total Phosphorus Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the total phosphorus target value.

Total Suspended Solids Goal Statement: The waterbodies (or streams) in the Indian Creek White River watershed should meet the 30 mg/L TMDL total suspended solids target value.

Total Suspended Solids Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the total suspended solids target value.

H+ Ion Goal Statement: The waterbodies (or streams) in the Indian Creek White River watershed should meet the minimum .001 mg/L TMDL H+ ion target value. Consequently, the waterbodies should meet the minimum pH value of 6.0 target value.

H+ Ion Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the H+ ion target value.

6.3 Implementation of Total Phosphorus Goal using Pollution Load Estimation Tool (PLET)

To support the implementation TP goals associated with the TP TMDL in Pickel Ditch, IDEM used the Pollutant Load Estimation Tool (PLET) to estimate nonpoint source TP loads by land use. PLET combines land use data, precipitation data, and export coefficients from peer-reviewed literature to produce annual load estimates for each major land use category in the watershed.

While the TP TMDL allocations are based on observed flow and concentration data, the PLET results provide an additional layer of information for implementation planning. By identifying which land uses contribute the largest share of the estimated TP load, watershed partners can focus outreach, best management practices (BMPs), and funding on the areas and activities most likely to yield meaningful reductions.

For Pickel Ditch, PLET results indicate that:

- Row crop agriculture accounts for 61% of estimated nonpoint TP load, reflecting both the extent of this land use and its relatively high export coefficient.
- Pastureland and feedlots contribute a smaller but still notable share (approximately 24% combined), particularly where livestock have direct access to streams or where riparian buffers are absent.
- Developed land contributes TP primarily through stormwater runoff from impervious surfaces.

These estimates are not regulatory limits but planning tools that can help:

- Prioritize sub-areas for targeted BMP implementation (e.g., cover crops, nutrient management planning, riparian buffer restoration).
- Support grant applications by quantifying potential load reductions from proposed projects.
- Track progress over time by comparing updated PLET runs with baseline estimates.

By integrating PLET's load estimates with local knowledge, field assessments, and stakeholder priorities, the watershed can direct resources where they will have the greatest impact on meeting the TP target.

6.3 Summary of Programs

There are a number of federal, state, and local programs that either require or can assist with the implementation activities recommended for the Indian Creek White River watershed. A description of these programs is provided in this section. The following section discusses how some of these programs relate to the various sources in the Indian Creek White River watershed.

6.3.1 Federal Programs

Clean Water Act Section 319(h) Grants

Section 319 of the federal Clean Water Act contains provisions for the control of nonpoint source pollution. The Section 319 program provides for various voluntary projects throughout the state to prevent water pollution and also provides for assessment and management plans related to waterbodies in Indiana impacted by NPS pollution. The Watershed Planning and Restoration Section within the Watershed Assessment and Planning Branch of the IDEM Office of Water Quality administers the Section 319 program for the NPS-related projects.

U.S. EPA offers Clean Water Act Section 319(h) grant monies to the state on an annual basis. These grants must be used to fund projects that address nonpoint source pollution issues. Some projects which the Office of Water Quality has funded with this money in the past include developing and implementing Watershed Management Plans (WMPs), BMP demonstrations, data management, educational programs, modeling, stream restoration, and riparian buffer establishment. Projects are usually two to three years in length. Section 319(h) grants are intended to be used for project start-up, not as a continuous funding source. Units of government, nonprofit groups, and universities in the state that have expertise in nonpoint source pollution problems are invited to submit Section 319(h) proposals to the Office of Water Quality.

Clean Water Action Section 205(j) Grants

Section 205(j) provides for planning activities relating to the improvement of water quality from nonpoint and point sources by making funding available to municipal and county governments, regional planning commissions, and other public organizations. The CWA 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 those plans;
- Determining the nature, extent, and cause of water quality problems in various areas of the state.

The Section 205(j) program provides for projects that gather and map information on nonpoint and point source water pollution, develop recommendations for increasing the involvement of environmental and civic organizations in watershed planning and implementation activities, and develop watershed management plans.

HUD Community Development Block Grant Program (CDBG)

The Community Development Block Grant Program (CDBG) is authorized under Title I of the Housing and Community Development (HCD) Act of 1974, as amended. The main objective of the CDBG program is to develop viable communities by helping to provide decent housing and suitable living environments and expanding economic opportunities principally for persons of low- and moderate-income. The U.S. Department of Housing and Urban Development (HUD) provides federal CDBG funds directly to Indiana annually, through the Office of Community and Rural Affairs (OCRA), which then provides funding to small, incorporated cities and towns with populations less than 50,000 and to non-urban counties.

CDBG regulations define eligible activities and the National Objectives that each activity must meet. OCRA is responsible for ensuring projects that receive funding in Indiana are in accordance with the National Objectives and eligible activities.

OCRA is required to develop a Consolidated Plan that describes needs, resources, priorities, and proposed activities to be undertaken. Indiana's Consolidated Plan includes four goals for prioritizing fund allocations. These goals include: expand and preserve affordable housing opportunities throughout the housing continuum, reduce homelessness and increase housing stability for special needs populations, promote livable communities and community revitalization through addressing unmet community development needs, and promote activities that enhance local economic development efforts. OCRA has funded a variety of projects, including sanitary sewer and water systems.

USDA Conservation Stewardship Program (CSP)

The Conservation Stewardship Program (CSP) helps landowners build on their existing conservation efforts while strengthening their operation. Whether they are looking to improve grazing conditions, increase crop yields, or develop wildlife habitat, NRCS can custom design a CSP plan to help them meet those goals. NRCS can help landowners schedule timely planting of cover crops, develop a grazing plan that will improve the forage base, implement no-till to reduce erosion or manage forested areas in a way that benefits wildlife habitat. If landowners are already taking steps to improve the condition of the land, chances are CSP can help them find new ways to meet their goals.

USDA Conservation Reserve Program (CRP)

NRCS provides technical assistance to landowners interested in participating in the Conservation Reserve Program (CRP) administered by the USDA Farm Service Agency. 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 tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost-share funding is provided to establish the vegetative cover practices.

USDA Conservation Reserve Enhancement Program (CREP)

NRCS provides technical assistance to landowners interested in participating in the Conservation Reserve Program administered by the USDA Farm Service Agency. The Conservation Reserve Enhancement Program (CREP), an offshoot of CRP, targets high-priority conservation concerns identified by a state and federal funds are supplemented with non-federal funds to address those concerns. In exchange for removing environmentally sensitive land from production and establishing permanent resource conserving plant species, farmers and ranchers are paid an annual rental rate along with other federal and state incentives as applicable per each CREP agreement. Participation is voluntary, and the contract period is typically 10–15 years.

USDA Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program provides technical, educational, 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 provides assistance to farmers and ranchers in complying with federal, state, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved through the implementation of a conservation plan, which includes structural, vegetative, and land management practices on eligible land. Five-to-ten-year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more land management practices, such as nutrient management, pest management, and grazing land management. Fifty percent of the funding available for the program is targeted at natural resource concerns relating to livestock production. The program is carried out primarily in priority areas that may be watersheds, regions, or multi-state areas, and for significant statewide natural resource concerns that are outside of geographic priority areas.

USDA Farmable Wetlands Program (FWP)

NRCS provides technical assistance to landowners interested in participating in the Conservation Reserve Program administered by the USDA Farm Service Agency. The Farmable Wetlands Program (FWP) is designed to restore previously farmed wetlands and wetland buffer to improve both vegetation and water flow. FWP is a voluntary program to restore up to one million acres of farmable wetlands and associated buffers. Participants must agree to restore the wetlands, establish plant cover, and to not use enrolled land for commercial purposes. Plant cover may include plants that are partially submerged or specific types of trees. By restoring farmable wetlands, FWP improves groundwater quality, helps trap and break down pollutants, prevents soil erosion, reduces downstream flood damage, and provides habitat for water birds and other wildlife. Wetlands can also be used to treat sewage and are found to be as effective as “high tech” methods. The Farm Service Agency runs the program through the Conservation Reserve Program (CRP) with assistance from other government agencies and local conservation groups.

USDA Conservation Technical Assistance (CTA)

The purpose of the CTA program is to assist land users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. The purpose of the conservation systems is to reduce erosion, improve soil and water quality, improve and conserve wetlands, enhance fish and wildlife habitat, improve air quality, improve pasture and range condition, reduce upstream flooding, and improve woodlands.

One objective of the program is to assist individual land users, communities, conservation districts, and other units of state and local government and federal agencies to meet their goals for resource stewardship and assist individuals in complying with state and local requirements. NRCS assistance to individuals is provided through conservation districts in accordance with the Memorandum of Understanding signed by the Secretary of Agriculture, the Governor of the State, and the conservation district. Assistance is provided to land users voluntarily applying conservation practices and to those who must comply with local or state laws and regulations.

Another objective is to provide assistance to agricultural producers to comply with the highly erodible land (HEL) and wetland (Swampbuster) provisions of the 1985 Food Security Act, as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (16 U.S.C. 3801 et. seq.), the Federal Agriculture Improvement and Reform Act of 1996, and wetlands requirements of Section 404 of the Clean Water Act. NRCS makes HEL and wetland determinations and helps land users develop and implement conservation plans to comply with the law. The program also provides technical assistance to participants in USDA cost-share and conservation incentive programs.

NRCS collects, analyzes, interprets, displays, and disseminates information about the condition and trends of the Nation's soil and other natural resources so that people can make good decisions about resource use and about public policies for resource conservation. They also develop effective science-based technologies for natural resource assessment, management, and conservation.

USDA Section 504 Home Repair Program

USDA Rural Development administers the Section 504 Home Repair Program, or Single-Family Housing Repair Loans and Grants. The Section 504 Home Repair Program provides loans to very low-income homeowners to repair, improve, or modernize their home and provides grants to elderly very low-income homeowners to remove health and safety hazards. The purpose of this program is to help families stay in their own home and keep their home in good repair. Applicants must live in a rural area below 50 percent of the area median income. Grant applicants must be age 62 or older and unable to repay a repair loan. Loans may be used to repair, improve, or modernize homes or to remove health and safety hazards. Grants must be used to remove health and safety hazards. For example, repairing a failed septic system may be an applicable health and safety hazard. The maximum loan amount is $20,000, and the maximum grant amount is $7,500.

USDA Watershed Surveys and Planning

The Watershed and Flood Prevention Act, P.L. 83-566, August 4, 1954, (16 U.S.C. 1001-1008) authorized this program. Prior to fiscal year 1996, small watershed planning activities and the cooperative river basin surveys and investigations authorized by Section 6 of the Act were operated as separate programs. The 1996 appropriations act combined the activities into a single program entitled the Watershed Surveys and Planning program. Activities under both programs are continuing under this authority.

The purpose of the program is to assist federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries.

Types of surveys and plans include watershed plans, river basin surveys and studies, flood hazard analyses, and flood-plain management assistance. The focus of these plans is to identify solutions that use land treatment and non-structural measures to solve resource problems.

USDA Agricultural Conservation Easement Program (ACEP)

The Agricultural Conservation Easement Program (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements component, NRCS helps American Indian tribes, state and local governments and nongovernmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements component, NRCS helps to restore, protect, and enhance enrolled wetlands.

Agricultural Land Easements protect the long-term viability of the nation’s food supply by preventing conversion of productive working lands to non-agricultural uses. Land protected by agricultural land easements provides additional public benefits, including environmental quality, historic preservation, wildlife habitat, and protection of open space.

Wetland Reserve Easements provide habitat for fish and wildlife, including threatened and endangered species, improve water quality by filtering sediments and chemicals, reduce flooding, recharge groundwater, protect biological diversity, and provide opportunities for educational, scientific, and limited recreational activities.

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.

Under the Agricultural Land component, NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. Where NRCS determines that grasslands of special environmental significance will be protected, NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement.

USDA Regional Conservation Partnership Program (RCPP)

The Regional Conservation Partnership Program (RCPP) encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. Through the program, NRCS and its partners help producers install and maintain conservation activities in selected project areas. Partners leverage RCPP funding in project areas and report on the benefits achieved.

USDA Healthy Forests Reserve Program (HFRP)

The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance, and protect forestland resources on private lands through easements and financial assistance. HRFP aids the recovery of endangered and threatened species under the Endangered Species Act, improves plant and animal biodiversity, and enhances carbon sequestration.

HFRP provides landowners with 10-year restoration agreements and 30-year or permanent easements for specific conservation actions. For acreage owned by an Indian tribe, there is an additional enrollment option of a 30-year contract. Some landowners may avoid regulatory restrictions under the Endangered Species Act by restoring or improving habitat on their land for a specified period of time.

USDA Voluntary Public Access and Habitat Incentive Program (VPA-HIP)

The Voluntary Public Access and Habitat Incentive Program (VPA-HIP) is a competitive grants program that helps state and tribal governments increase public access to private lands for wildlife-dependent recreation, such as hunting, fishing, nature watching, or hiking.

State and tribal governments may submit proposals for VPA-HIP block grants from NRCS. These governments provide the funds to participating private landowners to initiate new or expand existing public access programs that enhance public access to areas previously unavailable for wildlife-dependent recreation. Nothing in VPA-HIP preempts liability laws that may apply to activities on any property related to grants made in this program.

U.S. Army Corps of Engineers

Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into Waters of the United States, including wetlands. Dredge and fill activities are controlled by a permit process administered by the U.S. Army Corps of Engineers and overseen by the U.S. Environmental Protection Agency. In addition, when a project is planned in Indiana that will impact a wetland, stream, river, lake, or other Water of the U.S., the Indiana Department of Environmental Management (IDEM) must also issue a Section 401 Water Quality Certification. A Section 401 WQC is a required component of a federal permit and must be issued before a federal permit or license can be granted. Depending on the extent of impact, mitigation may be required to offset the impacts. Stream and wetland mitigation is usually conducted onsite or offsite within the same 8-digit HUC watershed.

6.3.2 State Programs

IDEM Point Source Control Program

Point source pollution is regulated by several IDEM Office of Water Quality branches, including the Wastewater Compliance Branch, the Wastewater Permitting Branch, and the Surface Water, Operations, and Enforcement Branch. The Wastewater Permitting Branch issues NPDES and construction permits to sources that discharge wastewater to streams, lakes, and other waterbodies, including municipal wastewater treatment plants and industrial wastewater dischargers. The Stormwater Program, which is managed under the Surface Water, Operations, and Enforcement Branch, issues NPDES permits for stormwater discharges associated with industrial activities, active construction that results in a land disturbance of an acre or more, and municipal separate storm sewer systems (MS4). NPDES permits are issued in accordance with the Clean Water Act, federal laws, and state laws and regulations. The purpose of the NPDES permit is to control the point source discharge of pollutants into the waters of the state such that the quality of the water of the state is maintained in accordance with applicable water quality standards. The Wastewater Compliance Branch and Stormwater Program conduct inspections of facilities and projects with NPDES permits and review and evaluate compliance data to ensure permittees abide by the requirements of their permit. Control of discharges from point sources consistent with WLAs are implemented through the respective NPDES program.

IDEM Nonpoint Source Control Program

The state's Nonpoint Source Program, administered by the IDEM Office of Water Quality's Watershed Planning and Restoration Section, focuses on the assessment and prevention of nonpoint source water pollution. The program also provides for education and outreach to improve the way land is managed. Through the use of federal funding for the installation of BMPs, the development of watershed management plans, and the implementation of watershed restoration pollution prevention activities, the program reaches out to citizens so that land is managed in such a way that less pollution is generated.

Nonpoint source projects funded through the Office of Water Quality are a combination of local, regional, and statewide efforts sponsored by various public and not-for-profit organizations. The emphasis of these projects has been on the local, voluntary implementation of nonpoint source water pollution controls. The Watershed Planning and Restoration Section administers the Section 319 funding for nonpoint source-related projects, as well as Section 205(j) grants.

To award 319 grants, Watershed Planning and Restoration Section staff review proposals for minimum 319(h) eligibility criteria and rank each proposal. In their review, members consider such factors as: technical soundness; likelihood of achieving water quality results; strength of local partnerships; and competence/reliability of contracting agency. They then convene to discuss individual project merits and pool all rankings to arrive at final rankings for the projects. All proposals that rank above the funding target are included in the annual grant application to U.S. EPA, with U.S. EPA reserving the right to make final changes to the list. Actual funding depends on approval from U.S. EPA and yearly congressional appropriations.

Section 205(j) projects are administered through grant agreements that define the tasks, schedule, and budget for the project. 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.

<u>IDEM Hoosier Riverwatch Program</u>

Hoosier Riverwatch (HRW) is a statewide volunteer stream water quality monitoring program administered by the IDEM Office of Water Quality, Watershed Assessment and Planning Branch. The mission of HRW is to involve the citizens of Indiana in becoming active stewards of Indiana’s water resources and to increase public awareness of water quality issues and concerns. HRW accomplishes this through watershed education, hands-on training of volunteers, water monitoring, and clean-up activities. HRW collaborates with agencies and volunteers to educate local communities about the relationship between land use and water quality and to provide water quality information to citizens and governmental agencies working to protect Indiana’s rivers and streams.

<u>ISDA Division of Soil Conservation</u>

The Indiana State Department of Agriculture (ISDA) Division of Soil Conservation’s mission is to ensure the protection, wise use, and enhancement of Indiana’s soil and water resources. The Division’s employees are part of Indiana's Conservation Partnership, which includes the 92 soil and water conservation districts (SWCDs), the USDA Natural Resources Conservation Service, and the Purdue University Cooperative Extension Service. Working together, the partnership provides technical, educational, and financial assistance to citizens to solve erosion and sediment-related problems occurring on the land or impacting public waters.

ISDA Clean Water Indiana (CWI) Program

The ISDA Division of Soil Conservation administers the Clean Water Indiana (CWI) program under the direction of the State Soil Conservation Board. The CWI program provides financial assistance to landowners and conservation groups to support the implementation of conservation practices which will 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.

ISDA INfield Advantage (INFA) Program

The ISDA Division of Soil Conservation administers Infield Advantage (INFA). INFA is a collaborative opportunity for farmers to collect and understand personalized, on-farm data to optimize their management practices. Participating farmers use precision agricultural tools and technologies, such as aerial imagery and the corn stalk nitrate test, to conduct research on their own farms to determine nitrogen use efficiency in each field that they enroll. Peer to peer group discussions, local aggregated results, and collected data allow participants to make more informed decisions and implement personalized best management practices. INFA is available to farmers as a resource and a conduit to diverse on-farm research, innovative ideas, and technologies. INFA collaborates with local, regional, and national partners to help Indiana farmers improve their bottom line, adopt new management practices, protect natural resources, and benefit their surrounding communities.

IDNR Lake and River Enhancement (LARE) Program

The Lake and River Enhancement program is part of the Aquatic Habitat Unit of the Fisheries Section in the Indiana Department of Natural Resources (IDNR), Division of Fish and Wildlife. The goal of the LARE program is to protect and enhance aquatic habitat for fish and wildlife and to ensure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. This is accomplished through measures that reduce nonpoint source sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality standards. The LARE program provides technical and financial assistance to local entities for qualifying projects that improve and maintain water quality in public access lakes, rivers, and streams.

IFA State Revolving Fund (SRF) Loan Program

The SRF is a fixed rate, 20-year loan administered by the Indiana Finance Authority (IFA). The SRF provides low-interest loans to Indiana communities for projects that improve wastewater and drinking water infrastructure. The program's mission is to provide eligible entities with the lowest interest rates possible on the financing of such projects while protecting public health and the environment. SRF also funds nonpoint source projects that are tied to a wastewater loan. Any project where there is an existing pollution abatement need is eligible for SRF funding.

Abandoned Mine Land (AML) Program

The purpose of the Abandoned Mine Lands Program is to alleviate the safety, health, and environmental hazards of past coal mining practices while improving land productivity and enhancing the landscape. The program has been operating since the early 1980s and has reclaimed more than 10,000 acres.

The funding for the AML Program is based on a per ton fee paid by active coal operators and historic coal share. 100 percent of the construction and administrative expenses are reimbursed back to the AML Program through annual grants from the Federal Office of Surface Mining Reclamation Enforcement (OSMRE). The Surface Mine Reclamation and Control Act of 1977 also requires States to have a State Reclamation Plan approved by OSMRE to operate an Abandoned Mine Land Program. Find more information about the Abandoned Mine Lands Program here: www.dnr.IN.gov/reclamation/abandoned-mines/about-abandoned-mine-land-program

6.3.3 Local Programs

Programs taking place at the local level are key to successful TMDL implementation. Partners such as Knox, Daviess, and Sullivan SWCDs are instrumental to bringing grant funding into the Indian Creek White River watershed to support local protection and restoration projects. This section provides a brief summary of the local programs taking place in the Indian Creek White River watershed that will help to reduce pollutant loads, as well as provide ancillary benefits to the Indian Creek White River watershed.

Additional monitoring will likely take place in the Indian Creek White River watershed as a result of the Indian Creek White River Watershed Project. Local groups frequently conduct monitoring in watersheds with watershed management plans to engage the public through Hoosier Riverwatch volunteer monitoring events and through more formal monitoring efforts to determine if implementation activities have been successful in reducing nonpoint source pollutant loads. After best management practices are implemented by local groups, IDEM may also conduct performance monitoring at specific sites in the watershed through the Targeted Monitoring Program. Data collected through performance monitoring is compared to water quality standards and targets, as discussed in Section 1.0, to determine if previously impaired waterbodies can be delisted from the Section 303(d) List of Impaired Waters.

All three counties have been active participants in conservation efforts. As of 2023. Knox County had 616 active conservation practices, Daviess County has 141 active conservation practices, and Sullivan County had 309 active conservation practices. In that same year these practices helped to reduce 63,207,823 lbs. of sediment loading, 33,088 lbs. of phosphorus loading, and 65, 681 lbs. of nitrogen loading in Knox County, 16,409,872 lbs. of sediment loading, 8,678 lbs. of phosphorus loading, and 18,825 lbs. of nitrogen loading in Daviess County, and 24,696,475 lbs. of sediment loading, 12,399 lbs. of phosphorus loading, and 25,455 lbs. of nitrogen loading in Sullivan County

Knox County
Knox County has received the following funding to improve water quality and conservation in 2023:

- Local Total: $422,748
- State Total: $13,000
- Federal Total: $2,860,769

Total Funding: $3,296,517

Daviess County
Daviess County has received the following funding to improve water quality and conservation in 2023:

- Local Total: $165,152
- State Total: $62,588
- Federal Total: $1,715,028

Total Funding: $1,942,768

Sullivan County
Sullivan County has received the following funding to improve water quality and conservation in 2023:

- Local Total: $38,577
- State Total: $112,000
- Federal Total: $1,012,835

Tota Funding: $1,163,412

6.4 Implementation Programs by Source

Section 6.3 identified a number of federal, state, and local programs that can support implementation of the recommended management or restoration activities for the Indian Creek White River watershed. Table 48 and the following sections identify which programs are relevant to the various sources in the Indian Creek White River watershed.

Table 48: Summary of Programs Relevant to Sources in the Indian Creek White River Watershed

Source	IDEM NPDES program	Local agencies/programs	CWA 319(h) Grants	CWA 205(j) Grants	ISDA Division of Soil Conservation (INFA & CWI)	IDNR Division of Fish and Wildlife (LARE)	IFA State Revolving Fund (SRF) Loan Program)	HUD Community Development Block Grant Program (CDBG)	USDA Conservation Stewardship Program (CSP)	USDA Conservation Reserve Program (CRP)	USDA Conservation Reserve Enhancement Program (CREP)	USDA Conservation Technical Assistance (CTA)	USDA Environmental Quality Incentives Program (EQUIP)	USDA Farmable Wetlands Program	USDA Agricultural Conservation Easement Program (ACEP)	USDA Regional Conservation Partnership Program (RCPP)	USDA Healthy Forests Reserve Program (HFRP)	USDA Voluntary Public Access and Habitat Incentive Program (VPA-HIP)	USDA Watershed Surveys and Planning	USDA Section 504 Program	Abandoned Mine Land Program
Municipal & Industrial Wastewater	X			X			X														
Regulated Stormwater	X			X			X														
Illicitly Connected "Straight Pipe" Systems	X	X		X				X													
Cropland		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
Pastures and Livestock Operations		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		
CFOs	X			X		X															
Streambank Erosion		X	X	X	X	X						X	X	X	X	X		X	X		
Onsite Wastewater Treatment Systems		X		X			X	X												X	
In-stream Habitat	X	X	X																		
Past Coal Mining Practices																					X

6.4.1 Point Source Programs

Municipal Wastewater Treatment Plants (WWTPs)

Municipal Wastewater Treatment Plants (WWTPs) that discharge wastewater through a point source to a surface water of the state are required to obtain a municipal NPDES wastewater permit. Municipal wastewater permits include effluent limitations that are derived using water quality criteria developed to protect all designated and existing uses of the receiving waterbody and/or any more stringent technology-based limitations. The NPDES program provides IDEM the authority to ensure that recommended effluent limits are applied to the appropriate permit holders within the watershed.

Industrial Wastewater

Industrial facilities that discharge wastewater through a point source to a surface water of the state are required to obtain an industrial NPDES wastewater permit. Industrial wastewater permits include effluent limitations that are derived using water quality criteria developed to protect all designated and existing uses of the receiving waterbody and/or any more stringent technology-based limitations. The NPDES program provides IDEM the authority to ensure that recommended effluent limits are applied to the appropriate permit holders within the watershed.

Construction Stormwater

Stormwater run-off associated with construction activity is regulated under the Construction Stormwater General Permit (CSGP). The CSGP is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land-disturbing activities. The CSGP requires the development and implementation of a construction plan that includes a stormwater pollution prevention plan (SWPPP). The SWPPP outlines how erosion and sedimentation will be controlled on the project site to minimize the discharge of sediment off-site or to a water of the state. The primary pollutant of concern from active construction sites is sediment, or TSS. TSS TMDLs were developed to address impaired biotic communities in the Bens Creek, Smothers Creek, Pickel Ditch, and Pollard Ditch subwatersheds. Identification of impaired waters with TMDLs, specifically those with TSS TMDLs, in the SWPPP is recommended to ensure adequate stormwater control measures are implemented to minimize discharges of sediment to impaired waters. It is assumed that permitted construction sites that are in compliance with the CSGP meet the requirements of the TMDL. However, in order to ensure sediment-laden stormwater discharges from construction sites to impaired waters with TMDLs are minimized, implementation of additional measures may be considered, such as:

- Identify any waterbodies within the project site that have a U.S. EPA approved or established TMDL, including the name of the TMDL and pollutant(s) for which there is a TMDL.
- Increase self-monitoring in locations on the project site that discharge to impaired waters with TSS TMDLs.

- Improve construction sequencing to limit the amount of exposed soil at any given time as much as possible throughout the project.
- Increase frequency of stabilization of areas that are void of vegetative cover. When an area is left idle for seven days initiate stabilization. Stabilization includes permanent stabilization with structured armor, permanent seed mixes, or temporary seed mixes.
- Place signage or easily identifiable barriers, such as orange safety fencing, near impaired waters to alert construction crews of the sensitive resource.
- Increase the maintenance schedule of measures installed adjacent to impaired waters with TSS TMDLs to promote effective sediment removal.

<u>Industrial Stormwater</u>

Stormwater run-off associated with industrial activity is currently regulated under 327 IAC 15-6, which is commonly referred to as “Rule 6” or the industrial stormwater general permit. Facilities may also be required to obtain an individual stormwater permit as discussed in Section 2.8.3. There is a total of one industrial facility with an individual stormwater permit within the Indian Creek White River watershed. The industrial stormwater general permit and individual stormwater permits require the development and implementation of a stormwater pollution prevention plan (SWP3). The SWP3 must identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges exposed to industrial activity from the facility. Good housekeeping practices and stormwater control measures must be used in reducing the potential for pollutants to be exposed to stormwater. It is assumed that permitted facilities that are in compliance with their permit meet the requirements of the TMDL. However, in order to ensure pollutant-laden stormwater discharges from permitted facilities to impaired waters with TMDLs are minimized, implementation of additional measures may be considered, such as:

- Identify U.S. EPA approved or established TMDLs, including the name of the TMDL and the pollutant(s) for which there is a TMDL, in the SWP3.
- Increase the frequency of visual inspections of stormwater management measures in locations that discharge to impaired waters with TMDLs beyond the quarterly requirement.
- Increase the frequency of monitoring at outfalls that discharge to impaired waters with TMDLs beyond the annual requirement.
- Increase the maintenance schedule of stormwater management measures installed adjacent to impaired waters with TMDLs to promote effective pollutant removal.

Municipal Separate Storm Sewer Systems (MS4)

Stormwater run-off from certain types of urbanized areas are required to obtain permit coverage under the MS4 general permit. There are currently no MS4s in the Indian Creek White River watershed that have coverage under IDEM's MS4 general permit.

CAFOs

CAFOs are point sources regulated through the NPDES Program. Indiana regulations for CAFOs can be found in 327 IAC 15-15 and federal regulations for all CAFOs can be found in 40 CFR Parts 9, 122, and 412. The Effluent Limitations Guidelines and New Source Performance Standards for CAFOs require, in general, zero discharge from these areas and require proper design, construction, operation, and maintenance of the structures to contain all manure, litter, and process wastewater including the run-off and direct precipitation from a 25-year, 24-hour rainfall event. The NPDES general permit also requires that water quality standards shall not be exceeded in the event of an overflow from production areas. There are no CAFOs in the Indian Creek White River watershed.

Examples of requirements for CAFO operators include

- weekly inspections of waste storage facilities
- develop a Soil Conservation Practice Plan for all manure application sites controlled by the CAFO
- develop a Stormwater Pollution Prevention Plan for the area immediately around the production barns
- submit an annual report to IDEM
- adjust land application rates based on nitrogen and phosphorus

Illegal straight pipes

Local health departments are responsible for locating and eliminating illicit discharges and illegal connections to the sewer system.

6.4.2 Nonpoint Sources Programs

Cropland

Nonpoint source pollution from cropland areas is typically reduced through the voluntary implementation of BMPs by private landowners. Programs available to support implementation of cropland BMPs, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319(h) Grants
- Clean Water Act Section 205(j) Grants

- Indiana State Department of Agriculture Division of Soil Conservation/SWCDs (CWI & INFA)
- Indiana Department of Natural Resources Division of Fish and Wildlife (LARE)
- USDA Conservation Stewardship Program (CSP)
- USDA Conservation Reserve Program (CRP)
- USDA Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Technical Assistance (CTA)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Farmable Wetlands Program
- USDA Agricultural Conservation Easement Program (ACEP)
- USDA Regional Conservation Partnership Program (RCPP)
- USDA Healthy Forests Reserve Program (HFRP)
- USDA Voluntary Public Access and Habitat Incentive Program (VPA-HIP)
- USDA Watershed Surveys and Planning

Pastures and Livestock Operations

Nonpoint source pollution from pasture and livestock areas is typically reduced through the voluntary implementation of BMPs by private landowners. Programs available to support implementation of pasture and grazing BMPs, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319(h) Grants
- Clean Water Act Section 205(j) Grants
- Indiana State Department of Agriculture Division of Soil Conservation/SWCDs (CWI & INFA)
- Indiana Department of Natural Resources Division of Fish and Wildlife (LARE)
- USDA Conservation Stewardship Program (CSP)
- USDA Conservation Reserve Program (CRP)
- USDA Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Technical Assistance (CTA)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Farmable Wetlands Program
- USDA Agricultural Conservation Easement Program (ACEP)

- USDA Regional Conservation Partnership Program (RCPP)
- USDA Healthy Forests Reserve Program (HFRP)
- USDA Voluntary Public Access and Habitat Incentive Program (VPA-HIP)
- USDA Watershed Surveys and Planning

CFOs

While CAFOs are regulated by federal law, CFOs are not. However, Indiana has CFO regulations 327 IAC 16 and 327 IAC 15 that require that operations manage manure, litter, and process wastewater in a manner that "does not cause or contribute to an impairment of surface waters of the state." IDEM regulates CFOs under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 16, which implement the statute regulating CFOs, were effective on March 10, 2002. IDEM's Office of Land Quality administers the regulatory program, which includes permitting, compliance monitoring, and enforcement activities.

Streambank Erosion

Streambank erosion can be the result of changes in the physical structure of the immediate bank from activities such as removal of riparian vegetation or frequent use by livestock, or it can be the result of increased flow volumes and velocities resulting from increased surface run-off throughout the upstream watershed. Therefore, streambank erosion might be addressed through BMPs and restoration targeted to the specific stream reach, and further degradation could be addressed through the use of BMPs implemented to address stormwater issues throughout the watershed. Programs available to support implementation of BMPs to address streambank erosion, whether through cost-share or technical assistance and education, include:

- Clean Water Act Section 319(h) Grants
- Clean Water Act Section 205(j) Grants
- Indiana State Department of Agriculture Division of Soil Conservation/SWCDs (CWI & INFA)
- Indiana Department of Natural Resources Division of Fish and Wildlife (LARE)
- USDA Conservation Technical Assistance (CTA)
- USDA Environmental Quality Incentives Program (EQIP)
- USDA Farmable Wetlands Program
- USDA Agricultural Conservation Easement Program (ACEP)
- USDA Regional Conservation Partnership Program (RCPP)
- USDA Voluntary Public Access and Habitat Incentive Program (VPA-HIP)
- USDA Watershed Surveys and Planning

- Mitigation Funds

Onsite Wastewater Treatment Systems

Local health departments and the Indiana Department of Health (IDOH) regulate septic systems through local ordinances and the Onsite Sewage Disposal Program (410 IAC 6-8.3). Regulations include constraints on the location and design of current septic systems in an effort to prevent system failures. The onsite sewage system rule also prohibits failing systems, requiring that no system will contaminate groundwater, and no system will discharge untreated effluent to the surface. Programs available to address issues related to failing onsite wastewater treatment systems within a community include:

- Clean Water Act Section 205(j) Grants
- IFA State Revolving Fund Loan Program
- HUD Community Development Block Grant Program (CDBG)
- USDA Section 504 Program

Wildlife/Domestic Pets

Addressing pollutant contributions from wildlife and domestic pets is typically done at the local level through education and outreach efforts. For wildlife, educational programs focus on proper maintenance of riparian areas and discouraging the public from feeding wildlife. For domestic pets, education programs focus on responsible pet waste maintenance (e.g., scoop the poop campaigns) coupled with local ordinances.

6.5 Potential Implementation Partners and Technical Assistance Resources

Agencies and organizations at the federal, state, and local levels will play a critical role in implementation to achieve the WLAs and LAs assigned under this TMDL. Table 49 identifies key potential implementation partners and the type of technical assistance they can provide to watershed stakeholders. IDEM has also compiled a matrix of public and private grants and other funding resources available to fund watershed implementation activities. The matrix is available on IDEM's website at www.idem.IN.gov/nps/funding/non-idem-funding/funding-matrix.

Table 49: Potential Implementation Partners in the Indian Creek White River Watershed

Potential Implementation Partner	Funding Source
Federal	
USDA	Conservation Stewardship Program
USDA	Conservation Reserve Program
USDA	Conservation Reserve Enhancement Program
USDA	Conservation Technical Assistance (technical assistance only)

Potential Implementation Partner	Funding Source
USDA	Environmental Quality Incentives Program
USDA	Farmable Wetlands Program
USDA	Agricultural Conservation Easement Program
USDA	Regional Conservation Partnership Program
USDA	Healthy Forests Reserve Program
USDA	Voluntary Public Access and Habitat Incentive Program
USDA	Watershed Surveys and Planning
USDA	Section 504 Home Repair Program
HUD	Community Development Block Grant Program
State	
ISDA	Division of Soil Conservation – Clean Water Indiana Program
ISDA	Division of Soil Conservation – INfield Advantage Program
IDNR	Division of Fish and Wildlife - Lake and River Enhancement program
IDEM	Clean Water Act Section 319(h) Grants
IDEM	Clean Water Act Section 205(j) Grants
Local	
Soil and Water Conservation Districts	Local funds
County Health Departments	

In addition, several tools are available to assist local watershed stakeholders with the estimation of pollutant load reductions from the implementation of various BMPs within the Indian Creek White River watershed in order to optimize BMP selection. These tools include L-THIA LID, STEPL, the Region 5 Model, and the Indiana *E. coli* Calculator.

The Long-Term Hydrologic Impact Assessment (L-THIA) model is an online tool developed by Purdue University that estimates runoff, recharge, and pollutant loads for land use configurations based on precipitation data, soils, and land use data for an area. The L-THIA LID model is an enhancement to the original model, which can be used to simulate runoff and pollutant loads associated with low impact development (LID) practices at lot to watershed scales. The model can be used as a screening tool to evaluate the benefits of implementation of LID practices. LID practices included in the model include, but are not limited to, grass swales, rain barrel/cisterns, rain gardens, and porous pavement. The L-THIA LID tool is available online at Long Term Hydrologic Impac Analysis.

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various BMPs. STEPL provides a user-friendly Visual Basic (VB) interface to create a customized spreadsheet-based model in Microsoft Excel. It computes watershed surface runoff, nutrient loads, and sediment delivery based on land use distribution and management practices. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using known BMP efficiencies. The STEPL package can be downloaded at Spreadsheet Tool for Estimating Pollutant Loads (STEPL) | Polluted Runoff: Nonpoint Source (NPS) Pollution | US EPA.

The Pollutant Load Estimation Tool (PLET) is replacing the Spreadsheet Tool for Estimating Pollutant Loads (STEPL). PLET uses the same underlying formulas as STEPL, but in a more user-friendly web interface. Both tools employ simple algorithms to calculate:

- Nutrient and sediment loads from different land uses.
- The load reductions that would result from the implementation of various best management practices (BMPs).

Model documentation and training documents can be found on the U.S. EPA web site.

The Region 5 Model is a Microsoft Excel workbook that provides a gross estimate of sediment and nutrient load reductions from the implementation of agricultural and urban BMPs. The model was developed by the U.S. EPA Region 5 and the Michigan Department of Environmental Quality. It does not estimate pollutant load reductions for dissolved constituents. The algorithms for non-urban BMPs are based on the Michigan Department of Environmental Quality's "Pollutants controlled: Calculation and documentation for Section 319 watersheds training manual". The algorithms for urban BMPs are based on the data and calculations developed by Illinois EPA. The Region 5 Model download and training materials can be found at www.idem.IN.gov/nps/watershed-assessment/water-monitoring-and-you/estimating-current-loads/modelsload-reductions.

The Indiana *E. coli* Calculator (IEC) is a spreadsheet tool that estimates the *E. coli* contribution from multiple sources and calculates load reductions of BMP installations. The portions of the spreadsheet that calculate *E. coli* contributions are heavily based upon the U.S. EPA's Bacteria Indicator Tool (BIT). The BIT estimates the monthly accumulation rate of fecal coliform bacteria on four land uses (cropland, forest, built-up, and pastureland). The tool also estimates the direct input of fecal coliform bacteria to streams from grazing agricultural animals and failing septic systems. The IEC converts the fecal coliform values of the BIT to *E. coli* through a conversion equation based on Ohio water quality sampling results. The IEC is available in a condensed version as well as an expanded version. The IEC spreadsheet and user guide can be found at www.idem.IN.gov/nps/watershed-toolkit/planning.

7.0 PUBLIC PARTICIPATION

Public participation is an important and required component of the TMDL development process. The following public meetings were held in the watershed to discuss this project:

- A kickoff public meeting was held in Vincennes, IN on September 26, 2023, to introduce the project and solicit public input. IDEM explained the TMDL process and presented initial information regarding the Indian Creek White River watershed. Questions from the public were answered, and information was solicited from stakeholders in the area.
- On July 16th and 17th, 2025, IDEM worked with the Knox County Soil and Water Conservation District (SWCD) to host a booth at the Knox County Fair. IDEM staff were on site to explain their process for TMDL development. Results were discussed for the 2023-2024 IDEM sampling of the watershed. The details of the partnership between the Knox County SWCD and IDEM were discussed as well.
- On March 10, 2025, a notice was posted to the Indiana Register to inform stakeholders of new impairments discovered during the 2023-2024 watershed characterization study in the Indian Creek White River watershed. The notice outlined the findings of the study and listed proposed additions/deletions to the 2026 303(d) List of Impaired Waters. Public comments were solicited through April 24, 2025. IDEM received no comments regarding the notice.
- A draft TMDL public meeting was held in the watershed at the Knox County SWCD office in Vincennes, IN on September 23, 2025, at 6:00 PM. The draft findings of the TMDL were presented at the meeting and the public had the opportunity to ask questions and provide information to be included in the final TMDL report. Multiple representatives from the Knox County SWCD were in attendance. A public comment period was from January 9, 2026, to February 8, 2026. IDEM received no comments regarding the notice.

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