Total Maximum Daily Load Report for the Big Raccoon-Wabash River Watershed

Draft TMDL

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Executive Summary

The Big Raccoon-Wabash River watershed (HUC 0512020815) is located in western Indiana and covers an area of approximately 74 square miles. The Big Raccoon-Wabash River watershed (HUC 0512020815), shown in Figure 1, is located in southwest Indiana and drains a total of 520 square miles, receiving approximately 448 square miles of drainage from three upstream HUC10 watersheds as shown in Figure 25. The watershed originates in Parke County, and then flows north, where it ultimately empties into the Wabash River in Vermillion County. Land use throughout the watershed is predominantly agriculture with forested areas being the second most abundant land use type.

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 the 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, and dissolved oxygen (DO) impairments in the Big Raccoon-Wabash River watershed, in accordance with the TMDL Program Priority Framework. Parameters chosen for TMDL development include *E. coli,* total suspended solids (TSS), and total phosphorus (TP). These parameters will be referred to cumulatively in this report as “pollutants.”

The Big Raccoon-Wabash River watershed TMDL was prioritized to be completed at this time based on local interest 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 (WMP) in conjunction with the Indiana Department of Environmental Management (IDEM) sampling and TMDL development for streams impaired for *E. coli*, biological communities, nutrients, and DO.

After the IDEM identifies a waterbody as having 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 waterbody 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 Big Raccoon-Wabash River watershed, the pollutants and the impaired segments for which TMDLs were developed differ from those appearing on the 2022 Section 303(d) List because sampling performed by IDEM in 2022 and 2023 generated new

water quality data that were not available at the time the 2022 Section 303(d) List was developed. This data was assessed in 2024 at the time the 2024 Section 303(d) List was developed and will be available in the 2026 Section 303(d) List.

Both historical and recent data were used for the TMDL analysis. Surveys of the Big Raccoon-Wabash River watershed have been conducted as far back as 1985, when IDEM performed fish tissue monitoring. Fixed station monitoring has been conducted in the watershed since 1998 and more extensive surveys of the watershed were conducted in 2000, 2005, 2010, 2011, and 2017 by both the probabilistic and targeted monitoring programs.

Sampling data were collected at 18 sampling sites from November 2022 to October 2023 by IDEM for the TMDL analysis. The data indicates that 18 of the sample sites violated one or more of the Indiana Water Quality Standards (327 IAC 2).

Potential sources of biotic impairment, *E. coli*, nutrients, and low DO levels in the watershed include both regulated point sources and nonpoint sources. Point sources including wastewater treatment plants (WWTPs) and Public Water Supply (PWS) facilities that discharge wastewater, and stormwater permitted construction activities are regulated through the National Pollutant Discharge Elimination System (NPDES). Nonpoint sources such as unregulated urban stormwater, agricultural run-off, wildlife, 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 Big Raccoon-Wabash 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 higher amounts of 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 very 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. Specific sources of *E. coli* to each impaired waterbody should be further evaluated during follow-up implementation activities.

Within the Big Raccoon-Wabash River watershed, Rock Run-Big Raccoon subwatershed had high total phosphorus loads and low DO hits resulting in TMDLs for TP to address nutrients. It is possible that field run-off in this subwatersheds is contributing to elevated phosphorus loads, resulting in lower DO. However, other factors could also explain the correlation, such as upstream loading, eroding banks, poor buffer zones in between streams and developed areas, failing septic systems, impeded flow, tillage practices, or point source contributions.

Subwatersheds Rock Run-Big Raccoon and Rocky Run-Leatherwood in the Big Raccoon-Wabash River watershed have impaired biotic communities (IBC). Biological communities include 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 suggests that one or more of the aquatic biological communities is unhealthy as determined by IDEM's monitoring data and biotic indices. IBC is not a source of impairment but a symptom of other sources. To address these impairments in the Big Raccoon-Wabash River watershed, Rocky Run-Leatherwood addressed IBC with a TSS TMDL and Rock Run-Big Raccoon addresses IBC with a TMDL for TP these have been identified as pollutants for TMDL development.

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 Big Raccoon-Wabash River watershed TMDL includes these allocations, which are presented for each of the 12-digit hydrologic unit code (HUC) subwatersheds containing impairments.

There are six NPDES permitted facilities located in the Big Raccoon-Wabash River watershed. These facilities include a wastewater treatment facility, four industrial facilities, and an industrial facility. There are also 4 recorded construction permits within the watershed. Although these NPDES facilities have been found to be in violation of their permit limits, the majority of the time effluent from permitted facilities meets water quality standards and/or targets. There is also a state cleanup site through the Indiana department of transportation in Rockville. The soil integrity indicates the possibility of groundwater contamination, but it is not conclusive at this time.

There are several types of documented and suspected nonpoint sources located in the Big Raccoon-Wabash River watershed, including unregulated livestock operations with direct access to streams, agricultural row crop land use, straight pipes, leaking or failing septic systems, wildlife, and erosion. Of these, agricultural row crop land use, livestock operations, and erosion are found most often in subwatersheds with elevated levels of *E. coli*, TSS, and TP. 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 most benefit from focusing on implementation activities. These areas throughout the Big Raccoon-Wabash River watershed are referred to as critical conditions. It also provides recommendations on the types of implementation activities, including best management practices (BMPs), that key implementation partners in the Big Raccoon-Wabash River watershed can consider achieving 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, and TP 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 90^{th} 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)	Cat Creek-Leatherwood (051201081501)	--	93%	95%	95%	95%
	Rocky Run-Leatherwood (051201081502)	--	57%	95%	92%	95%
	Rock Run-Big Raccoon (051201081503)	--	67%	77%	95%	93%
	Town of Mecca-Big Raccoon (051201081504)	--	NA	90%	62%	74%
Total Phosphorus (mg/L)	Cat Creek-Leatherwood (051201081501)	--	NA	NA	NA	NA
	Rocky Run-Leatherwood (051201081502)	--	NA	NA	NA	NA
	Rock Run-Big Raccoon (051201081503)	--	NA	NA	NA	NA
	Town of Mecca-Big Raccoon (051201081504)	--	NA	NA	NA	NA
Total Suspended Solids (mg/L)	Cat Creek-Leatherwood (051201081501)	--	NA	NA	NA	NA
	Rocky Run-Leatherwood (051201081502)	--	NA	NA	NA	NA
	Rock Run-Big Raccoon (051201081503)	--	76%	NA	NA	NA
	Town of Mecca-Big Raccoon (051201081504)	--	62%	NA	28%	NA

Note: -- = No Data Collected in Flow Regime; NA = No reduction needed (note: overall reductions still may be needed as critical condition reductions are based on 90th percentile concentrations. Some samples for TP and TSS surpassed the water quality target but not high enough to require reductions at the 90th percentile.)

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 Rockville, IN on October 12, 2022 to introduce the project and solicit public input. IDEM explained the TMDL process and presented initial information regarding the Big Raccoon-Wabash River watershed. Questions were answered from the public, and information was solicited from stakeholders in the area.

- On April 2, 2024, a notice was posted to the Indiana Register to inform stakeholders of new impairments discovered during the 2022-2023 watershed characterization study in the Big Raccoon-Wabash 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 May 16, 2024. IDEM received no comments regarding the notice.
- A draft TMDL public meeting was held in the watershed at the Parke County Extension Office, IN 47872 on June 26, 2024 at 6:00 PM. The 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. A representative from the Parke County SWCD was in attendance and presented information on the progress of the WMP. A public comment period was from July 3, 2024 to August 2, 2024.

1.0 INTRODUCTION

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

The Big Raccoon-Wabash River watershed TMDL was prioritized to be completed at this time based on local interest from the Parke 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 (WMP) in conjunction with the IDEM sampling and TMDL development for streams impaired for *E. coli*, biotic communities, nutrients, and dissolved oxygen (DO).

The Big Raccoon-Wabash River watershed (HUC 0512020815), shown in Figure 1, is located in southwest Indiana and drains a total of 520 square miles receiving approximately 448 square miles of drainage from 3 other watersheds as shown in Figure 25. The Big Raccoon-Wabash River watershed originates near the southwest corner of Parke County and then flows northeast, where it ultimately empties into the northeast part of Parke County and into Vermillion County. Land use throughout the watershed is split predominantly between forested areas and agricultural uses. There are no public water supply (PWS) intakes in the Big Raccoon-Wabash River watershed.

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 waste load allocations (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 Big Raccoon-Wabash 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 craft a 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash 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. Numeric criteria for *E. coli* and narrative criteria for Impaired Biotic Communities (IBC) were used as the basis of the Big Raccoon-Wabash River watershed TMDLs.
- **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*, IBC, and nutrients ("the impairments") 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. The 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 coliforms; 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 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 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 DO 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(a)(1)(E).

(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(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(a)(1)(E).

1.1.3 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)].

IBC are not a source of impairment but a symptom of other sources. To address these impairments in the Big Raccoon-Wabash River watershed, TSS has been identified as a pollutant for TMDL development. IDEM has not yet adopted numeric water quality criteria for

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(a)(1)(E).*
>
> *(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(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(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 2 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 biological impairment.

Table 2: Big Raccoon-Wabash 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.

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 Big Raccoon-Wabash River watershed TMDL are presented below.

1.2.1 *E. coli* TMDLs

The target value used for the Big Raccoon-Wabash 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 attains 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 sections describe the TMDL target values used for TP and TSS when developing TMDLs to address IBC, nutrients, and DO impairments.

Total Phosphorus (TP)

Although Indiana has not yet adopted numeric water quality criteria for TP, IDEM has identified the following TP benchmark of 0.3 mg/L that is used to assess potential nutrient impairments. This TP benchmark was based on IDEM’s best professional judgement as well as elements of 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 Big Raccoon-Wabash River watershed TMDL. IDEM has determined that meeting this target will result in achieving the narrative biological criterion by improving water quality and promoting a well-balanced aquatic community. Phosphorus is limited as a monthly average in NPDES permits. Monitoring data reviewed by IDEM during the TMDL development process, indicated that when WWTPs were in compliance with their individual permit limit for phosphorus (1.0 mg/L), the in-stream target for phosphorus (0.30 mg/L) was typically met.

Total Suspended Solids (TSS)

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 Big Raccoon-Wabash 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 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 Big Raccoon-Wabash River watershed, TSS has been identified as a pollutant for TMDL development.

A few subwatersheds in the Big Raccoon-Wabash River watershed have DO impairments. DO is not a source of impairment but a symptom of other sources. To address most of these impairments in the Big Raccoon-Wabash River watershed, TP and TSS, where applicable, have been identified as pollutants for TMDL development.

Table 3 reiterates the TMDL target values presented in Section 1.0. These are the target values IDEM uses to assess water quality data collected in the Big Raccoon-Wabash River watershed.

Table 3: Target Values Used for Development of the Big Raccoon-Wabash 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)

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 Big Raccoon-Wabash River watershed. IDEM identifies the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed.

Within each 12-digit HUC subwatershed, IDEM has identified several AUIDs, which represent individual stream segments. Through the process of segmenting waterbodies into AUIDs, IDEM identifies streams 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 4 and Table 9 contain the AUIDs in the subwatersheds of the Big Raccoon-Wabash River watershed and the associated drainage area. Subsequent sections of the TMDL report organize information by subwatershed (if applicable) and AUID.

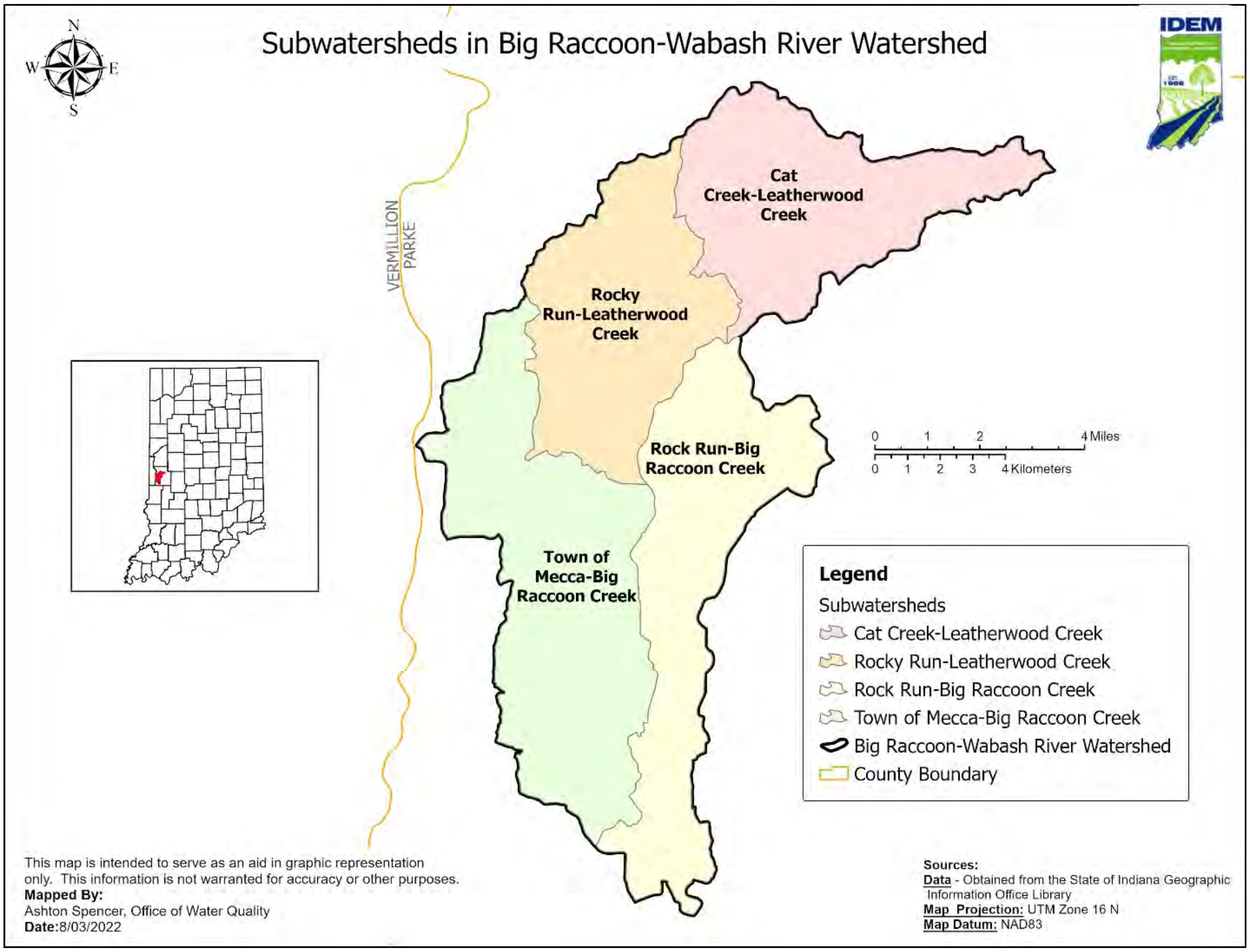

Figure 2: Subwatersheds (12-Digit HUCs) in the Big Raccoon-Wabash River Watershed

1.3.2 Understanding 303(d) Listing Information

There are several existing impairments in the Big Raccoon-Wabash River watershed from the approved 2022 303(d) List of Impaired Waters (Table 4). The listings and causes of impairment have been adjusted as a result of reassessment data collected at 18 sampling locations in the watershed. Within the Big Raccoon-Wabash River watershed a total of 17 assessment unit IDs (AUIDs) will be cited as impaired for *E. coli*, one AUID cited as impaired for nutrients, two AUIDs cited as impaired for DO, and five AUIDs cited as impaired for IBC on Indiana's 2026 303(d) List of Impaired Waters (Table 4). These impaired segments account for approximately 104 miles. Table 4 presents listing information for the Big Raccoon-Wabash River watershed, including a comparison of the updated listings with the 2022 listings and associated causes of impairments addressed by the TMDLs. The reassessment data used in updating the listings for the Big Raccoon-Wabash River watershed are available in Appendix B.

Below is an inventory assessment of the available biological and chemistry data for the Big Raccoon-Wabash River watershed.

Table 4: Section 303(d) List Information for the Big Raccoon-Wabash River for 2022 and 2026

Subwatershed	AUID	2022 303(d) Listing	Draft 2026 303(d) Listing
Cat Creek-Leatherwood (51201081501)	INB08F1_03		E. COLI, IBC
	INB08F1_T1006		E. COLI, IBC
	INB08F1_02	PCBs (FISH TISSUE)	E. COLI, PCBs (FISH TISSUE)
	INB08F1_02	PCBs (FISH TISSUE)	E. COLI, PCBs (FISH TISSUE)
Rocky Run-Leatherwood (51201081502)	INB08F2_T1004	E. COLI	E. COLI
	INB08F2_03		E. COLI
	INB08F2_02		E. COLI
	INB08F2_T1001		E. COLI, IBC
	INB08F2_01	E. COLI	E. COLI
Rock Run-Big Racoon (51201081503)	INB08F3_01		E. COLI
	INB08F3_T1004	IBC, E. COLI	E. COLI, IBC
	INB08F3_T1003	IBC, E. COLI	E. COLI. IBC, DO, NUTRIENTS
	INB08F3_T1002		E. COLI, IBC, DO
Town of Mecca-Big Raccoon (51201081504)	INB08F4_04		E. COLI
	INB08F4_T1008	PCBs (FISH TISSUE)	DO, PCBs (FISH TISSUE)
	INB08F4_03	PCBs (FISH TISSUE)	E. COLI, PCBs (FISH TISSUE)
	INB08F4_05	PCBs (FISH TISSUE)	E. COLI, PCBs (FISH TISSUE)

Understanding Table 4:

- Column 1: Name of Subwatershed (12-digit HUC). Shows the name of the subwatershed at the 12-digit HUC scale. The subwatershed found in this second column 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 2022 Section 303(d) listing assessment process.
- Column 3: 2022 Section 303(d) Listed Impairment. Identifies the cause of impairment associated with the 2022 Section 303(d) listing.
- Column 4: Updated Impairments to be listed 2026 303(d). Provides the updated causes of impairment if new data and information are available.

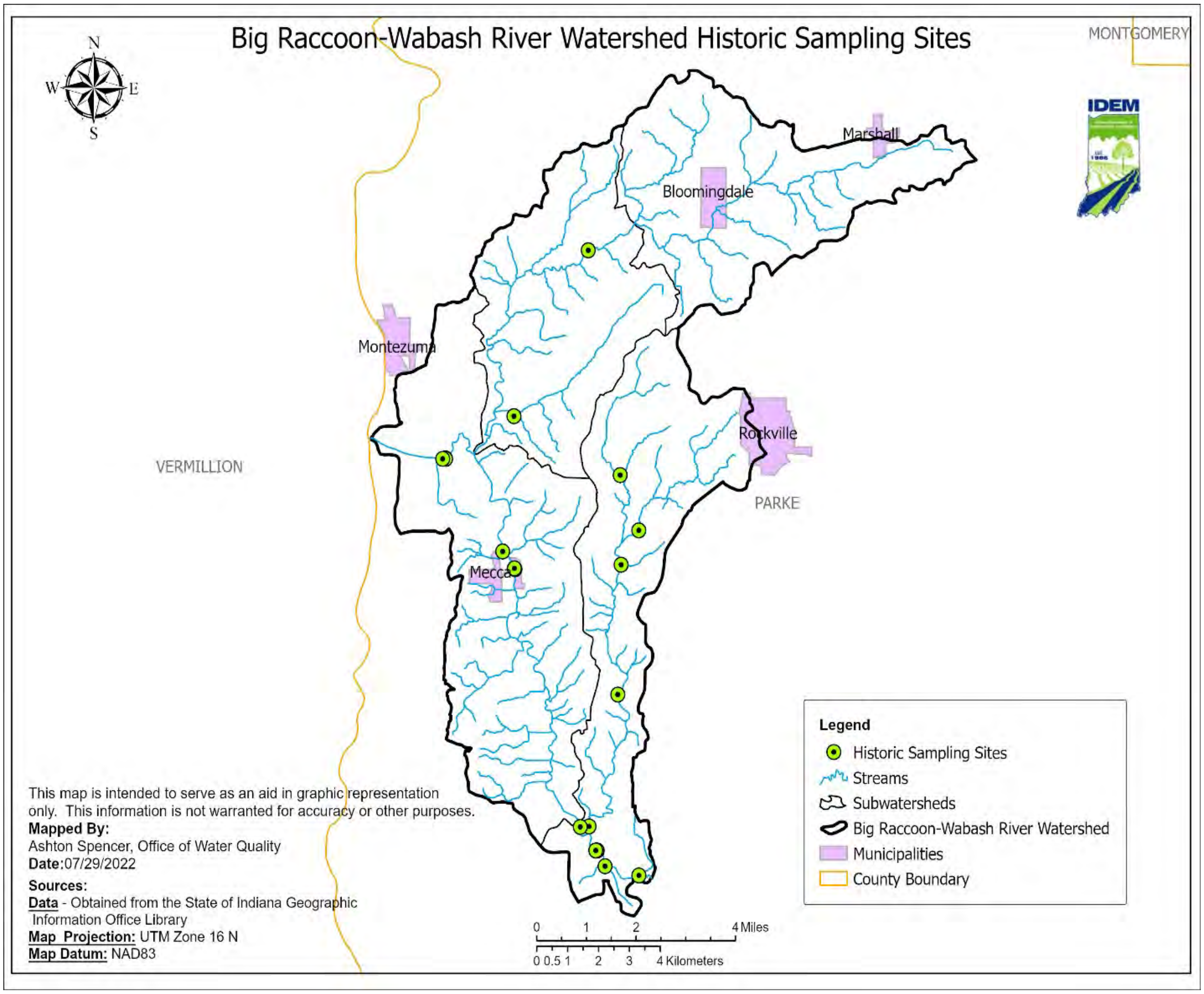

Figure 3: Location of Historical Sampling Sites in the Big Raccoon-Wabash River Watershed

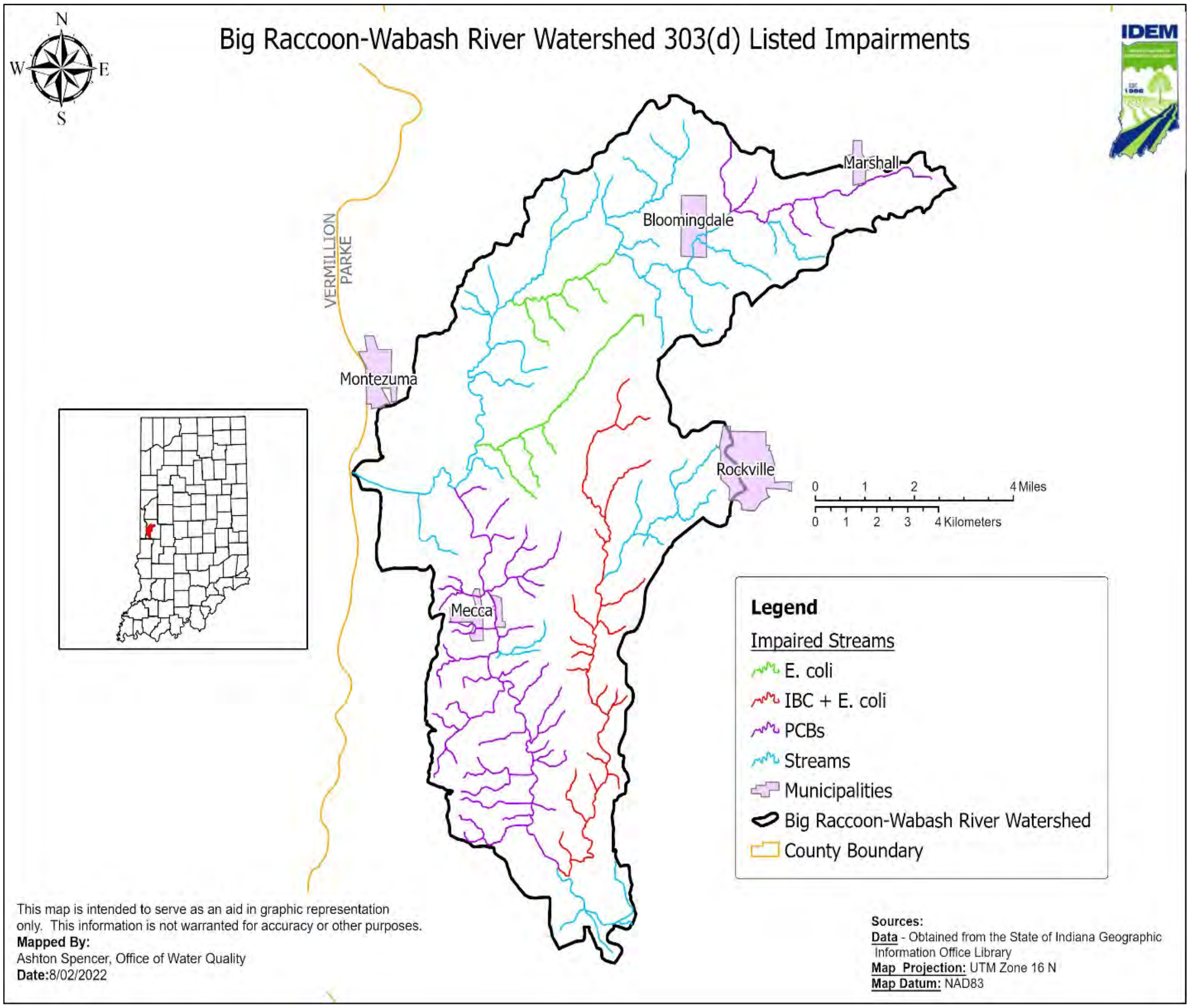

Figure 4: Streams Listed on the 2022 Section 303(d) List of Impaired Waters in the Big Raccoon-Wabash River Watershed

1.4 Water Quality Data

This section of the TMDL report contains a brief characterization of the Big Raccoon-Wabash 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 2022 through October 2023 was used for the TMDL analysis. Eighteen sites were sampled for pathogens, water chemistry, and biological data in the Big Raccoon-Wabash River watershed. Table 5 and Figure 5 show the sampling site locations and information. Table 6 summarizes the pathogen data, and Table 7 summarizes the water chemistry data within the Big Raccoon-Wabash 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:

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

Appendix A shows the individual sample results and summaries of all the water quality data for all 18 monitoring sites.

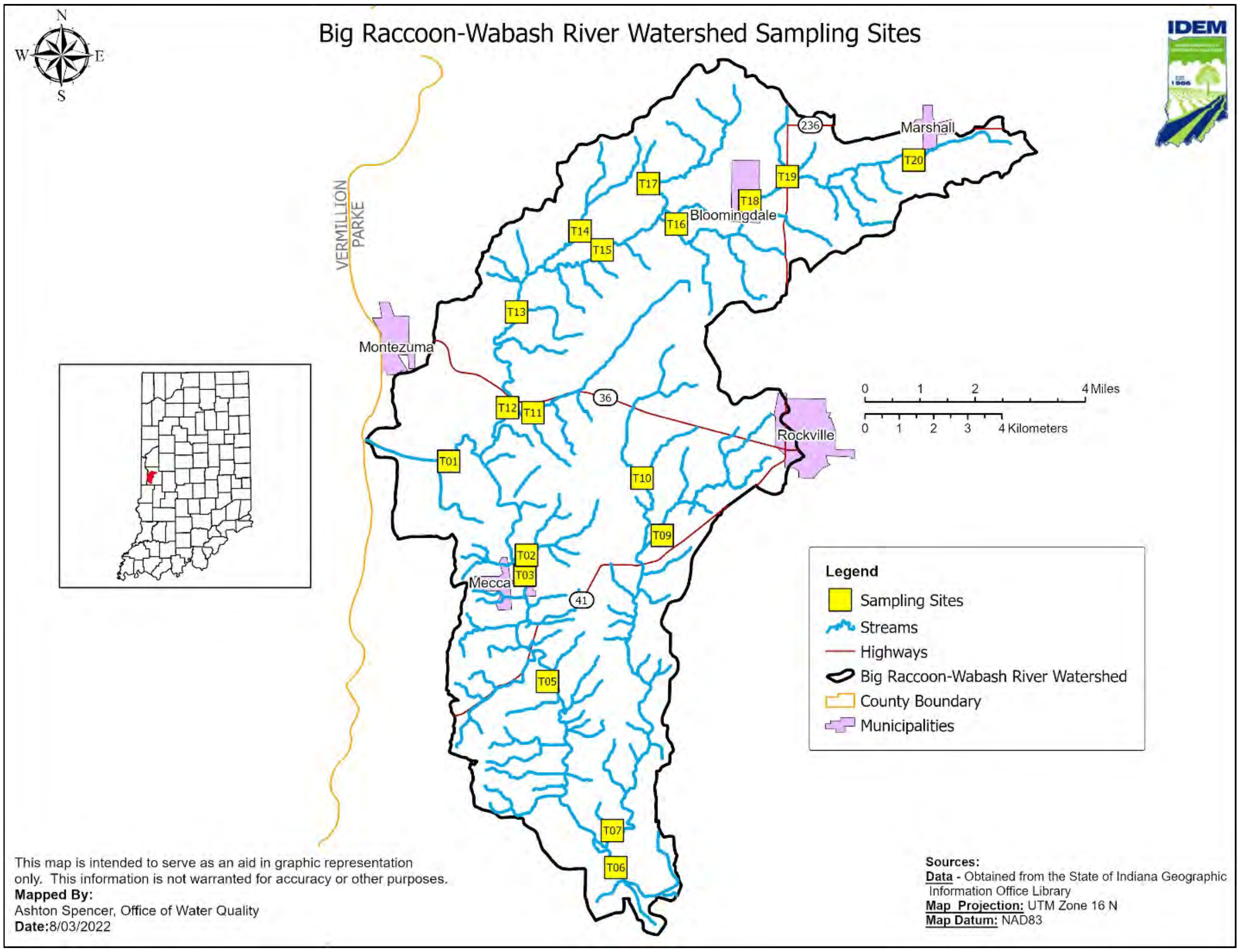

Figure 5: 2022-2023 Sampling Locations for the Big Raccoon-Wabash River TMDL Study

Table 5: Big Raccoon-Wabash River Sampling Site Information

Site #	EPA Site ID	IDEM Station ID	Stream Name	Road Name	AUID
T01	23T-001	WLV190-0010	Big Raccoon Creek	CR 600 West	INB08F4_04
T02	23T-002	WLV-15-0004	Tributary of Big Raccoon Creek	McAdams Road	INB08F4_T1008
T03	23T-003	WLV190-0012	Big Raccoon Creek	Wabash Street, Mecca	INB08F4_03
T05	23T-005	WLV-15-0017	Big Raccoon Creek	Unnamed Farm Lane	INB08F4_05
T06	23T-006	WLV190-0003	Big Raccoon Creek	CR 325 West	INB08F3_01
T07	23T-007	WLV-15-0006	Rock Run	CR 325 West	INB08F3_T1004
T09	23T-009	WLV190-0017	Tributary of Rock Run	Cooke Road	INB08F3_T1002
T10	23T-010	WLV190-0016	Rock Run	CR 100 South	INB08F3_T1003
T11	23T-011	WLV-15-0007	Rocky Run	Arabia Road	INB08F2_T1004
T12	23T-012	WLV-15-0008	Leatherwood Creek	CR 40 North	INB08F2_03
T13	23T-013	WLV-15-0009	Leatherwood Creek	Leatherwood Road	INB08F2_02
T14	23T-014	WLV-15-0010	Little Leatherwood Creek	10 O'clock Road	INB08F2_T1001
T15	23T-015	WLV-15-0011	Leatherwood Creek	10 O'clock Road	INB08F2_01
T16	23T-016	WLV-15-0012	Leatherwood Creek	Hill Top Road	INB08F1_03
T17	23T-017	WLV-15-0013	Cat Creek	Clay Plant Road	INB08F1_T1006
T18	23T-018	WLV-15-0014	Leatherwood Creek	Broadway Street	INB08F1_03
T19	23T-019	WLV-15-0015	Leatherwood Creek	US Highway 41	INB08F1_02
T20	23T-020	WLV-15-0016	Leatherwood Creek	Marshall Road	INB08F1_02

Understanding Table 5:

- 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 2022 Section 303(d) listing assessment process.

1.4.2 *E. coli* Data

Table 6: Summary of Pathogen Data in Big Raccoon-Wabash River by Subwatershed

Subwatershed	Site #	IDEM Station ID	AUID	Period of Record	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				
Town of Mecca-Big Raccoon	T01	WLV190-0010	INB08F4_04	11/14/22-10/4/23	16	80	31	376.2	66.8	1,299.7	81.9
	T02	WLV-15-0004	INB08F4_T1008	11/14/22-10/4/23	8	NA	NA	NA	NA	NA	NA
	T03	WLV190-0012	INB08F4_03	11/14/22-10/4/23	10	100	50	318.4	60.7	920.8	74.5
	T05	WLV-15-0017	INB08F4_05	11/14/22-10/4/23	11	100	60	396.5	68.5	1,119.9	79
Rock Run-Big Raccoon	T06	WLV190-0003	INB08F3_01	11/14/22-10/4/23	16	100	25	224.5	44.3	461.1	49
	T07	WLV-15-0006	INB08F3_T1004	11/14/22-10/4/23	16	100	25	351.6	64.4	648.8	63.7
	T09	WLV190-0017	INB08F3_T1002	11/14/22-10/4/23	11	100	54	646	80.7	>2,419.6	90.3
	T10	WLV190-0016	INB08F2_T1003	11/14/22-10/4/23	11	100	82	1,382.2	91	4040	94.2
	T11	WLV-15-0007	INB08F2_T1004	11/14/22-10/4/23	16	100	31	460.5	72.9	913.9	74.3
Rocky Run-Leatherwood	T12	WLV-15-0008	INB08F2_03	11/14/22-10/4/23	16	100	37	553.1	77.4	>2,419.6	90.3
	T13	WLV-15-0009	INB08F2_02	11/14/22-10/4/23	11	100	64	870.9	85.7	8,800	97.3
	T14	WLV-15-0010	INB08F2_T1001	11/14/22-10/4/23	11	100	91	5,399.1	97.7	198,630	99.9
	T15	WLV-15-0011	INB08F2_01	11/14/22-10/4/23	11	100	82	1,202.5	89.6	>2,419.6	90.3
	T16	WLV-15-0012	INB08F1_03	11/14/22-10/4/23	16	100	56	855.3	85.4	>2,419.6	90.3

Subwatershed	Site #	IDEM Station ID	AUID	Period of Record	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				
Cat Creek-Leatherwood	T17	WLV-15-0013	INB08F1_T1006	11/14/22-10/4/23	11	100	55	1,207.8	89.7	>2,419.6	90.3
	T18	WLV-15-0014	INB08F1_03	11/14/22-10/4/23	11	100	91	5,015	97.5	2,4810	99.1
	T19	WLV-15-0015	INB08F1_02	11/14/22-10/4/23	11	100	91	960.1	87	>2,419.6	90.3
	T20	WLV-15-0016	INB08F1_02	11/14/22-10/4/23	11	100	82	1,393.1	91	>2,419.6	90.3

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

Understanding Table 6: Pathogen data for the Big Raccoon-Wabash River watershed indicated the following:

- Reductions of 82 percent or greater are needed to meet the TMDL target values for E. coli in Town of Mecca-Big Raccoon.
- Reductions of 94 percent or greater are needed to meet the TMDL target values for E. coli in Rock Run-Big Raccoon.
- Reductions of 99 percent or greater are needed to meet the TMDL target values for E. coli in Rocky Run-Leatherwood.
- Reductions of 99 percent or greater are needed to meet the TMDL target values for E. coli in Cat Creek-Leatherwood.

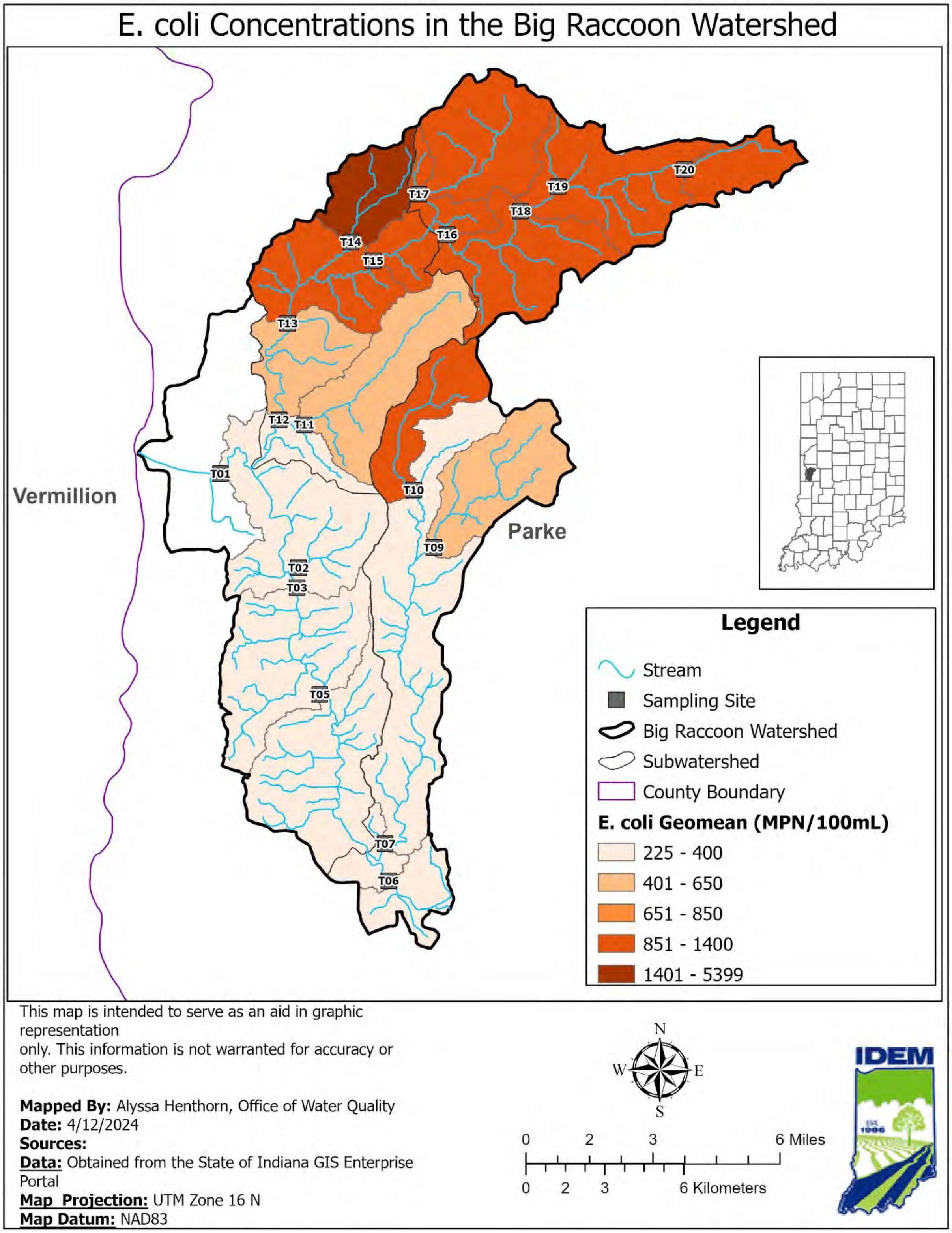

Figure 6: *E. coli* concentrations based on 5-week geometric mean (MPN/100mL) and sampling site drainage areas for 2022 and 2023. Values over 125 MPN/100mL are not meeting the current water quality standard for *E. coli*.

1.4.3 Water Chemistry Data

Table 7: Summary of Chemistry Data in Big Raccoon-Wabash River Watershed for Nutrients, Total Suspended Solids, and Dissolved Oxygen

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	Dissolved Oxygen Single Sample Minimum (mg/L)	Dissolved Oxygen % Below WQS
Town of Mecca-Big Raccoon	T01	WLV190-0010	INB08F4_04	0.26	NA	97.1	69.10	7.47	NA
	T02	WLV-15-0004	INB08F4_T1008	0.16	NA	13.8	NA	0.23	94.25
	T03	WLV190-0012	INB08F4_03	0.16	NA	38	21.05	7.15	NA
	T05	WLV-15-0017	INB08F4_05	0.16	NA	51.4	41.63	8.69	NA
Rock Run-Big Raccoon	T06	WLV190-0003	INB08F3_01	0.34	11.76	209	85.64	7.41	NA
	T07	WLV-15-0006	INB08F3_T1004	0.18	NA	44.4	32.43	4.73	NA
	T09	WLV190-0017	INB08F3_T1002	0.18	NA	28.4	NA	2.94	26.5
	T10	WLV190-0016	INB08F2_T1003	0.34	11.76	23.5	NA	1.76	56
	T11	WLV-15-0007	INB08F2_T1004	0.055	NA	6.3	NA	8.69	NA
Rocky Run-Leatherwood	T12	WLV-15-0008	INB08F2_03	0.083	NA	7.9	NA	8.76	NA
	T13	WLV-15-0009	INB08F2_02	0.16	NA	64.1	53.20	7.67	NA
	T14	WLV-15-0010	INB08F2_T1001	0.3	NA	39.6	24.24	4.4	NA
	T15	WLV-15-0011	INB08F2_01	0.12	NA	22.7	NA	10.2	NA
	T16	WLV-15-0012	INB08F1_03	0.12	NA	7.2	NA	7.83	NA
Cat Creek-Leatherwood	T17	WLV-15-0013	INB08F1_T1006	0.22	NA	11.1	NA	6.43	NA
	T18	WLV-15-0014	INB08F1_03	0.3	NA	3.9	NA	4.27	NA
	T19	WLV-15-0015	INB08F1_02	0.29	NA	5.2	NA	4.79	NA
	T20	WLV-15-0016	INB08F1_02	0.22	NA	14.9	NA	1.99	50.25

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

Understanding Table 7: Water chemistry data for the Big Raccoon-Wabash River watershed indicated the following:

- Reductions of 12 percent or greater are needed to meet the TMDL target values for TP in Rock Run-Big Raccoon.
- Reductions of 97 percent or greater are needed to meet the TMDL target values for TSS upstream of Town of Mecca-Big Raccoon.
- Reductions of 86 percent or greater are needed to meet the TMDL target values for TSS in Rock Run-Big Raccoon.
- Reductions of 53 percent or greater are needed to meet the TMDL target values for TSS in Rocky Run-Leatherwood.
- Reductions of 15 percent or greater are needed to meet the TMDL target values for TSS in Cat Creek-Leatherwood.

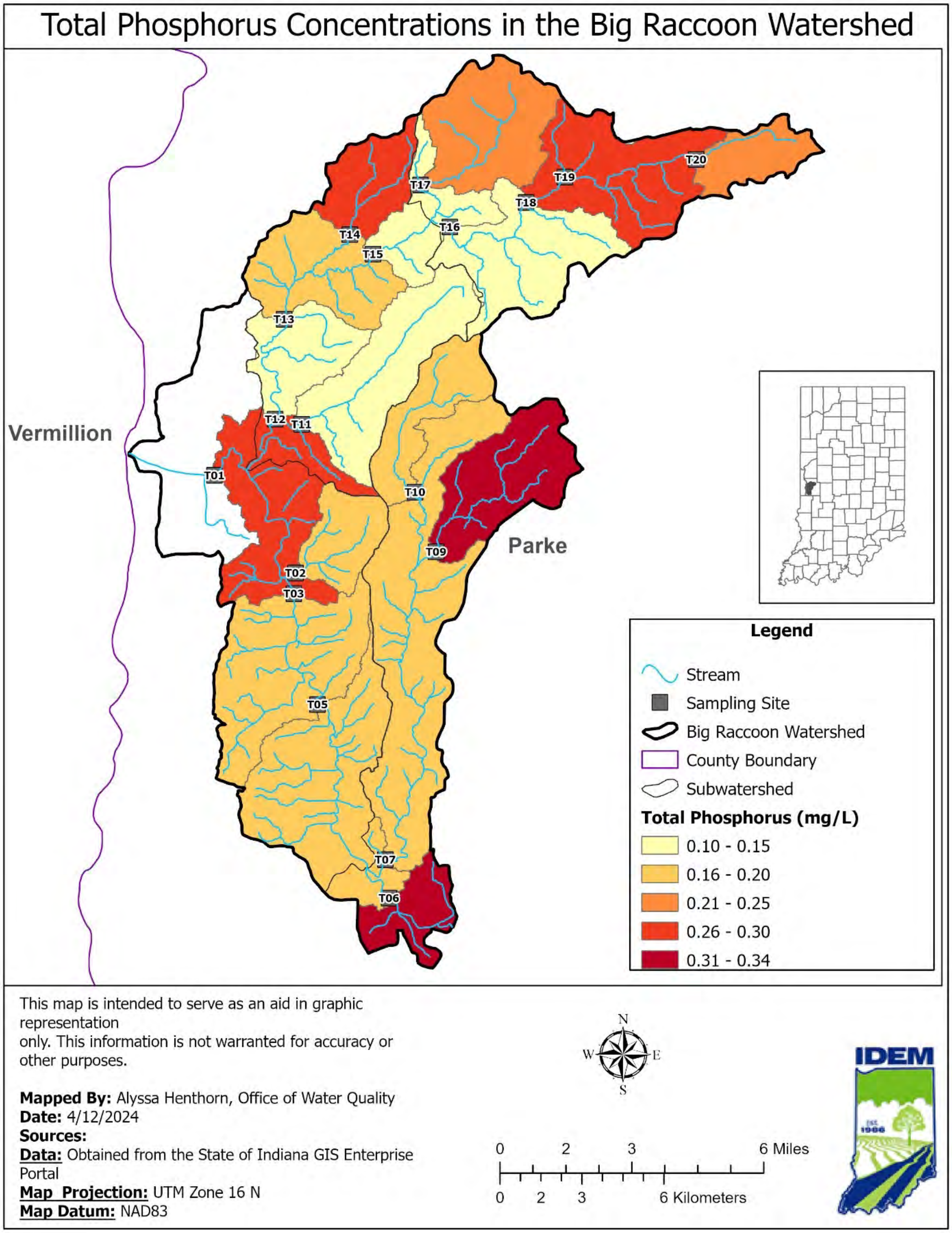

Figure 7: Total phosphorus concentrations based on single sample maximum concentration (mg/L) and sampling site drainage areas for 2022 and 2023. Values over 0.30 mg/L are not meeting the water quality target value for total phosphorus.

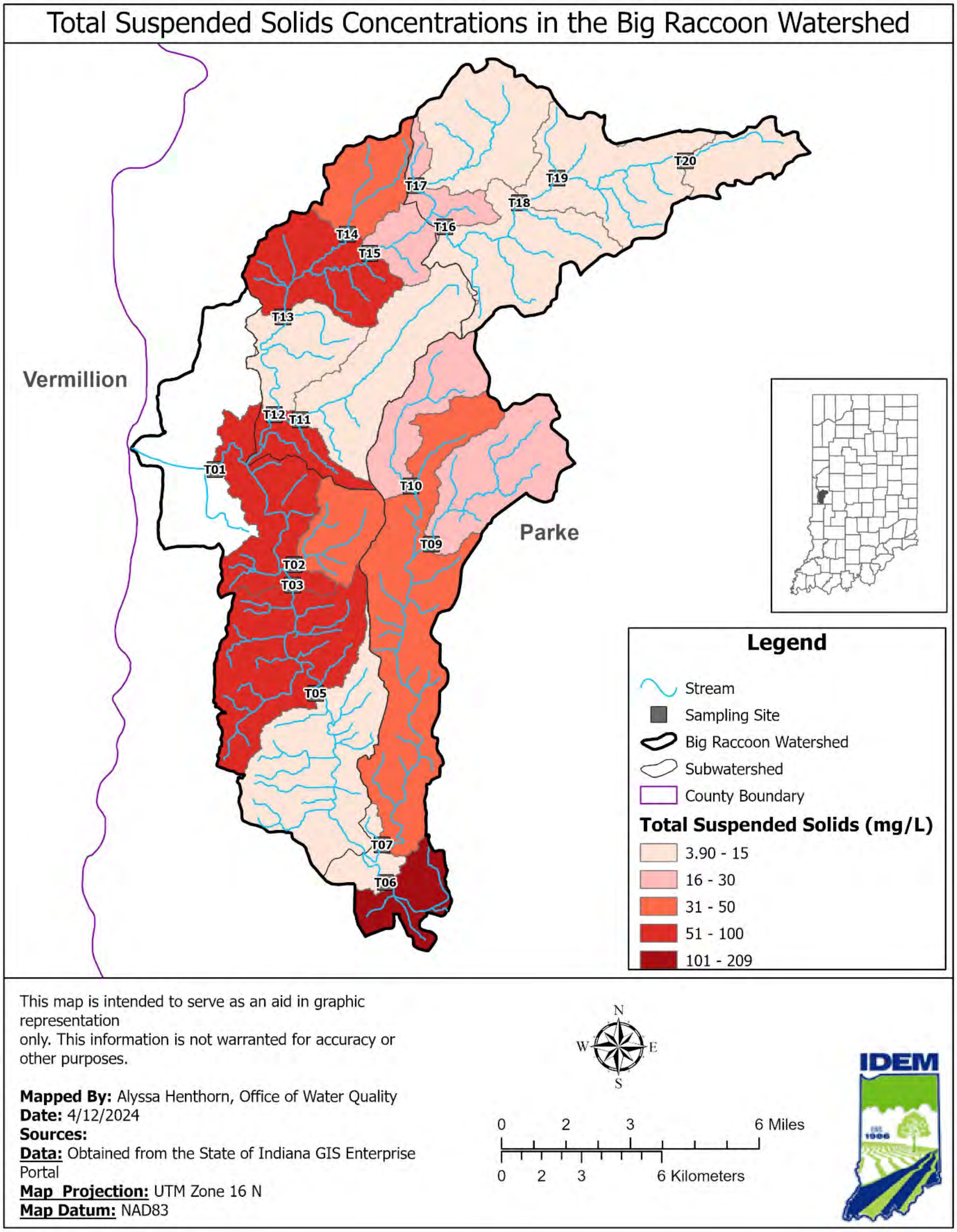

Figure 8: Total Suspended Solids concentrations based on single sample maximum concentration (mg/L) and sampling site drainage areas for 2022 and 2023. Values over 30 mg/L are not meeting the water quality target value for TSS.

1.4.4 Biological Data

Sampling performed by IDEM in July and August 2023 documented biological impairments in parts of the Big Raccoon-Wabash River watershed as summarized in Table 8. Fish community sampling took place at 18 sample sites in the Big Raccoon-Wabash River watershed. Sampling data indicate that the overall biological integrity of the Big Raccoon-Wabash River watershed was fair. Sampling resulted in 7 of the 18 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 DO 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. Total phosphorus can cause excessive plant production resulting in increased turbidity, decreased DO levels, and cause greater fluctuations in diurnal DO and pH levels resulting in lower stream diversity. Attaining the TSS and total phosphorus target value shown in Table 3 will address the causes of IBC impairments.

Table 8: Impaired Biotic Community Stream Segments in the Big Raccoon-Wabash River Watershed Identified During July/September 2023 Sampling

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).

Subwatershed	Stream Name	Site #	IDEM Station ID	Score	Integrity Class	QHEI	Score	Integrity Class	QHEI
				mIBI	mIBI	mIBI	IBI	IBI	IBI
Town of Mecca-Big Raccoon	Big Raccoon Creek	23T-001	WLV190-0010	36	Fair	55	52	Good	67
	Big Raccoon Creek	23T-003	WLV190-0012	44	Fair	52	52	Good	62
	Big Raccoon Creek	23T-005	WLV-15-0017	38	Fair	56	50	Good	64
Rock Run-Big Raccoon	Big Raccoon Creek	23T-006	WLV190-0003	36	Fair	52	54	Excellent	64
	Rock Run	23T-007	WLV-15-0006	36	Fair	52	40	Fair	52
	Tributary of Rock Run	23T-009	WLV190-0017	30	Poor	65	40	Fair	52
	Rock Run	23T-010	WLV190-0016	24	Poor	64	42	Fair	59
Rocky Run-Leatherwood	Rocky Run	23T-011	WLV-15-0007	34	Poor	52	50	Good	71
	Leatherwood Creek	23T-012	WLV-15-0008	42	Fair	67	48	Good	67
	Leatherwood Creek	23T-013	WLV-15-0009	36	Fair	57	48	Good	72

	Little Leatherwood Creek	23T-014	WLV-15-0010	34	Poor	48	44	Fair	48
	Leatherwood Creek	23T-015	WLV-15-0011	38	Fair	65	42	Fair	68
Cat Creek-Leatherwood	Leatherwood Creek	23T-016	WLV-15-0012	30	Poor	62	46	Good	61
	Cat Creek	23T-017	WLV-15-0013	34	Poor	65	44	Good	69
	Leatherwood Creek	23T-018	WLV-15-0014	34	Poor	44	42	Fair	61
	Leatherwood Creek	23T-019	WLV-15-0015	36	Fair	53	46	Good	53
	Leatherwood Creek	23T-020	WLV-15-0016	28	Poor	61	46	Good	63

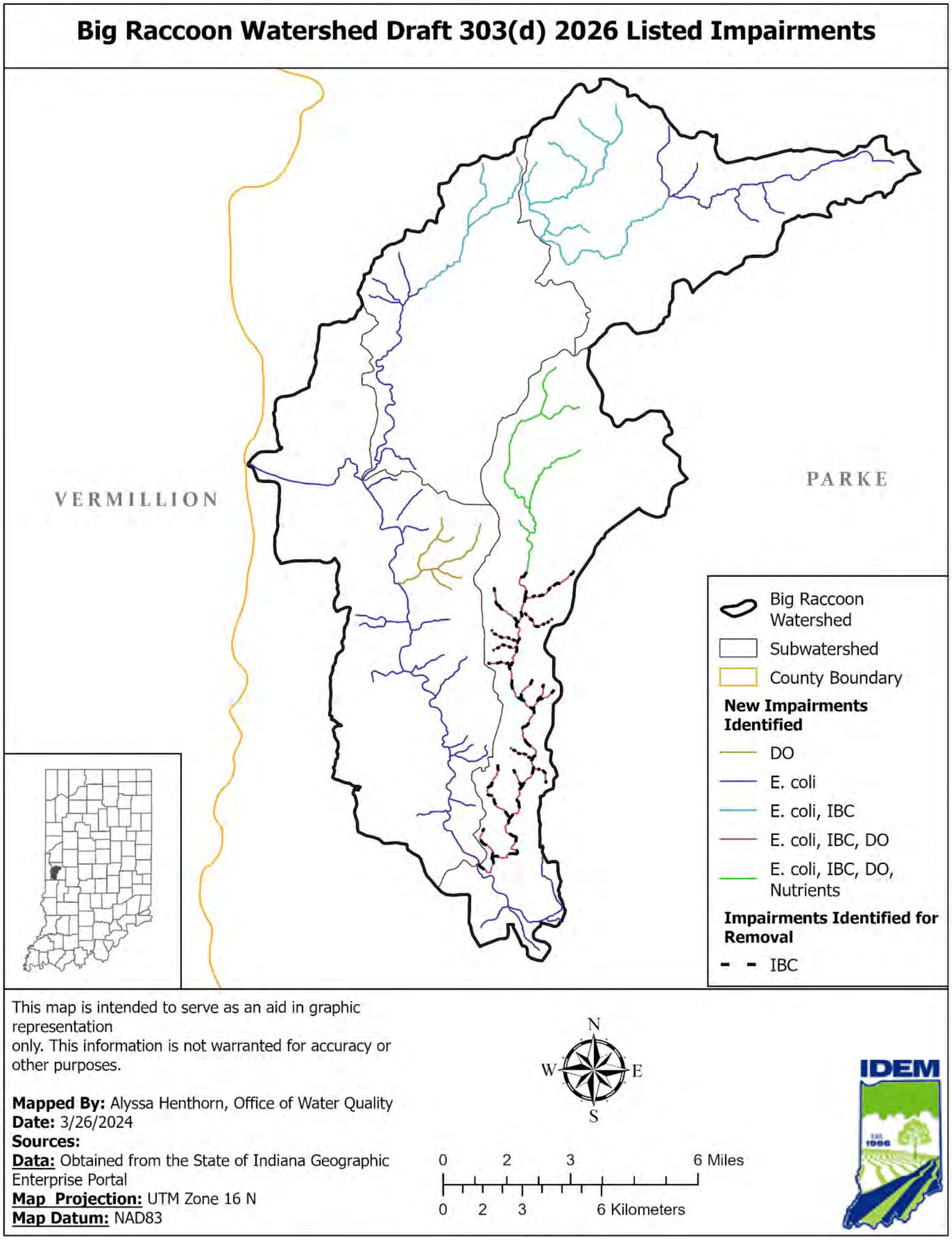

Figure 9: Streams to be listed on the Draft 2026 Section 303(d) List of Impaired Waters in the Big Raccoon-Wabash River Watershed

2.0 DESCRIPTION OF THE WATERSHED AND SOURCE ASSESSMENT

This section of the TMDL report contains a brief characterization of the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed contains four 12-digit HUC subwatersheds and receives around 448 square miles of drainage from three other watersheds bringing the square mileage total to approximately 520 square miles. Examining subwatersheds enables a closer examination of key factors that affect water quality. The subwatersheds include:

- Cat Creek-Leatherwood Creek (051201081501)
- Rocky Run-Leatherwood Creek (051201081502)
- Rock Run-Big Raccoon-Wabash River (051201081503)
- Town of Mecca-Big Raccoon-Wabash River (051201081504)

The following table contains the names of the four subwatersheds of the Big Racoon-Wabash River watershed and their associated drainage area.

Table 9: Big Raccoon-Wabash 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
Cat Creek-Leatherwood	051201081501	16.4	22.2%	16.4	3%
Rocky Run-Leatherwood	051201081502	15.7	21.3%	32.1	9%
Rock Run-Big Raccoon	051201081503	18.2	24.6%	464.6	86%
Town of Mecca-Big Raccoon	051201081504	23.6	31.9%	520.4	100%

Understanding Table 9: Land area helps IDEM to define the pollutant load reductions needed for each AU in each 12-digit HUC subwatershed that comprises the Big Raccoon-Wabash 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 percentage of land area of each subwatershed, providing a relative understanding of the portions of each subwatershed compared to the overall Big Raccoon-Wabash River watershed.
- Column 5: Drainage Area. Quantifies the area the specific subwatershed drains in square miles.
- 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 2023 Figure 10 displays the spatial distribution of the land uses and the data are summarized in Table 10. Additionally, Table 11 displays the breakdown of land uses within each of the four subwatersheds.

Land use in the Big Raccoon-Wabash River watershed is primarily agriculture, comprising 42 percent of the Big Raccoon-Wabash River watershed. Corn and soybean crops are not typically associated with high *E. coli* loads unless they have been fertilized with manure. Approximately

41 percent of the land is forest. Pasture/hay represents 8 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 represent less than 10 percent of the total land area.

The Big Raccoon-Wabash River watershed has a diverse network of streams. Tributaries include Big Raccoon Creek, Cat Creek, Leatherwood Creek, Rocky Run, and Rock Run, among others. The watershed is influenced by its drainage into the Wabash River. Forested areas are primarily found in the southern portion of the watershed, encompassing Big Raccoon Creek as well as both Rocky Run and Rock Run. Much of this watershed is undeveloped with urban areas limited to the eastern and western cities of Montezuma and Rockville, respectively. Water drains west toward the Wabash River where they eventually leave the Big Raccoon-Wabash River watershed into the Wabash River. Many threatened and endangered species call this watershed home. Various species of darters such as Western Sand Darter (*Ammocrypta clara*), Tippecanoe Darter (*Etheostoma tippecanoe*), and freshwater mussels (*Echyridella menziesi*) can be found in the watershed and surrounding counties and are dependent upon the health of the aquatic system (IDNR, 2023. Additional information on state endangered, threatened and rare species can be found on the DNR website (https://www.in.gov/dnr/nature-preserves/heritage-data-center/endangered-plant-and-animal-species/county/).

Table 10: Land Use of the Big Raccoon-Wabash River Watershed

Land Use	Watershed		
	Area		Percent
	Acres	Square Miles	
Agricultural Land	19,903.45	31.1	42%
Developed Land	2,949.85	4.6	6%
Forested Land	19,430.19	30.4	41%
Hay/Pasture	3,891.47	6.08	8%
Open Water	116.31	0.2	0.25%
Shrub/Scrub	6.89	0.01	<1%
Wetlands	995.22	1.6	2%
Total	47,293.38	73.90	100.00%

Understanding Table 10: The predominant land use types in the Big Raccoon-Wabash River watershed can indicate potential sources of E. coli, TSS, and nutrient 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, and nutrients 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, and nutrient load reductions.

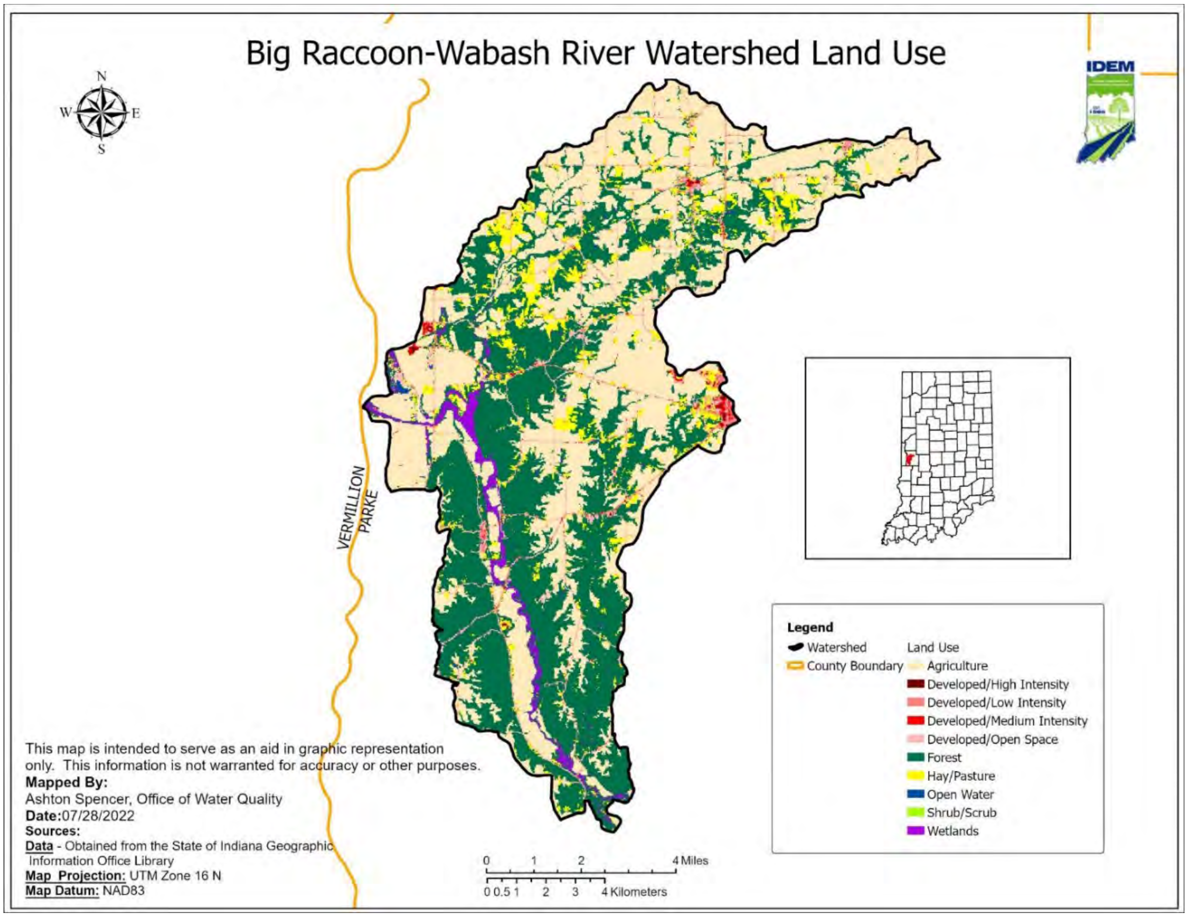

Figure 10: Land use in the Big Raccoon-Wabash River Watershed

Table 11: Land Use in the Big Raccoon-Wabash River Subwatersheds

Subwatershed	Area	Land Use							Total
		Agriculture	Developed	Forest	Hay/ Pasture	Open Water	Shrub/ Scrub	Wetlands	
Cat Creek-Leatherwood	Acres	6,453	672	2,391	972	14.9	1.56	21.4	10,525
	Sq. Mi.	10.08	1.05	3.74	1.52	0.02	0.00	0.03	16.44
	Percent	61%	6%	23%	9%	<1%	<1%	<1%	100%
Rocky Run-Leatherwood	Acres	3,794	555	4,367	1,222	7.56	2	127	10,075
	Sq. Mi.	5.93	0.87	6.82	1.91	0.01	<1	0.20	15.74
	Percent	37.7%	5.5%	43%	12%	<1%	<1%	1.3%	100%
Rock Run-Big Raccoon	Acres	4,523	788	5,354	842	13.8	0.89	123	11,644
	Sq. Mi.	7.07	1.23	8.37	1.31	0.02	0.0014	0.19	18.19
	Percent	39%	6.8%	46%	7%	<1%	<1%	1.1%	100%
Town of Mecca-Big Raccoon	Acres	5,526	883	7,359	568	80	2.45	692	15,110
	Sq. Mi.	8.63	1.38	11.5	0.89	0.12	<1	1.08	23.61
	Percent	37%	6%	49%	4%	0.5%	<1%	5%	100%

2.1.1 Cropland

Croplands can be a source of *E. coli*, sediments, and nutrients. Accumulation of nutrients and *E. coli* on cropland occurs from decomposition of residual crop material, 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 2023 NASS statistics were used in the analysis as shown in Table 12 and displayed in Figure 11 (USDA, 2017).

Table 12: Major Cash Crop Acreage in the Big Raccoon-Wabash River Watershed

Subwatershed	Crop	Total Acreage	% of Subwatershed Cash Crop Acreage
Cat Creek-Leatherwood	Corn	3,510	54%
	Soybean	2,677	41%
	Winter Wheat	32.47	<1%
	Winter Wheat/Soybeans	229.3	3%
	Total	6,451	100%
Rocky Run-Leatherwood	Corn	1,460	39%
	Soybean	2,280	60%
	Winter Wheat	44.92	1%
	Total	3,792	100%
Rock Run-Big Raccoon	Corn	2,134	47%
	Soybean	2,351	52%
	Winter Wheat	18.24	<1%
	Total	4,522	100%
Town of Mecca-Big Raccoon	Corn	2,434	44%
	Soybean	3,073	56%
	Winter Wheat	10	<1%
	Total	5,522	100%

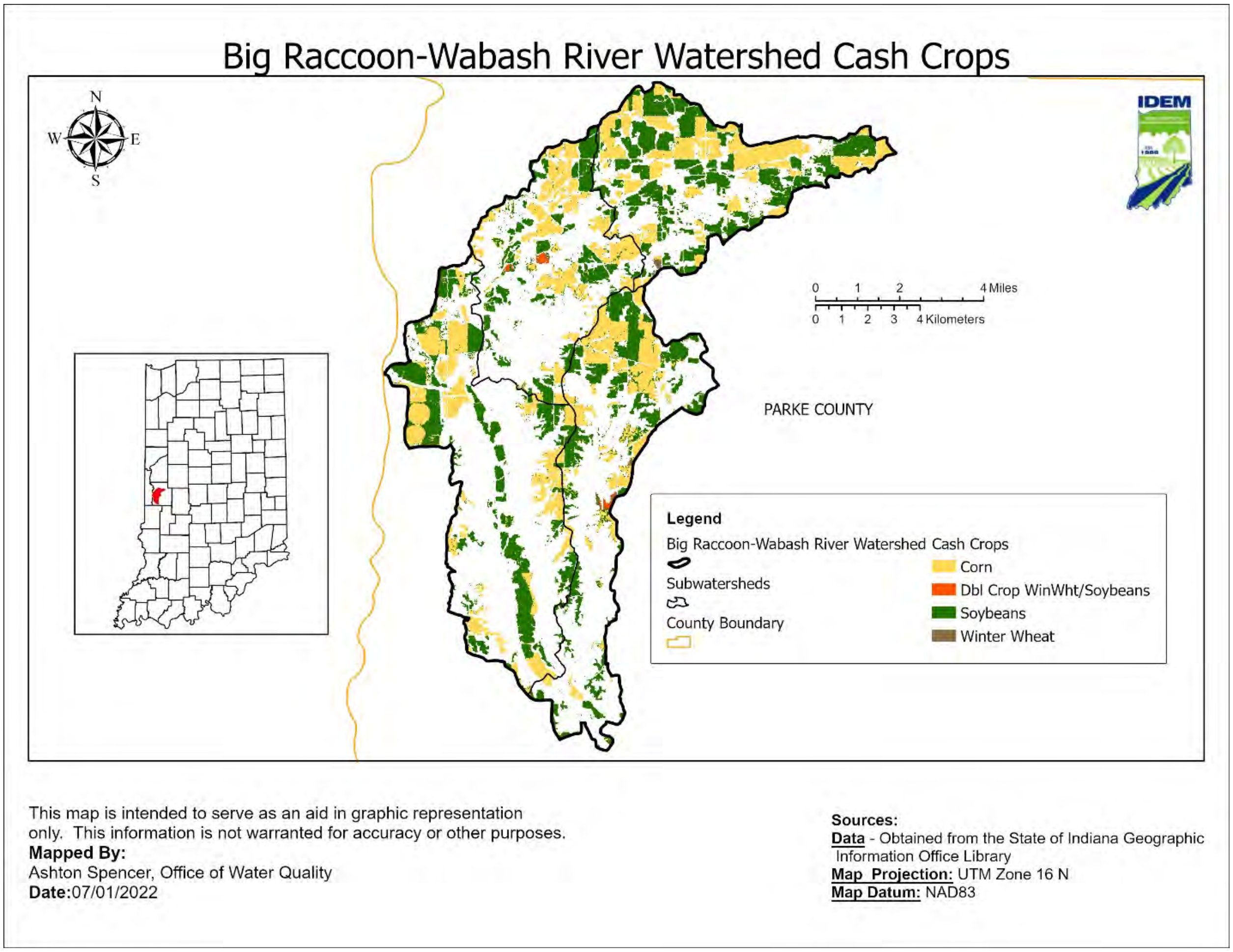

Figure 11: Cash Crop Acreage in the Big Raccoon-Wabash River Watershed

2.1.2 Hay/Pastureland

Run-off from pastures and livestock operations can be potential agricultural sources of *E. coli*, nutrients, and TSS. For example, animals grazing in pasturelands deposit manure directly upon the land surface and, 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 are potential sources of *E. coli*, nutrients, and TSS to streams, particularly when direct access is unrestricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. The amount of hay/pastureland across the landscape can be used as an indicator for potential areas of higher densities from livestock. Information on permitted livestock facilities within the Big Raccoon-Wabash River watershed are presented in Figure 12.

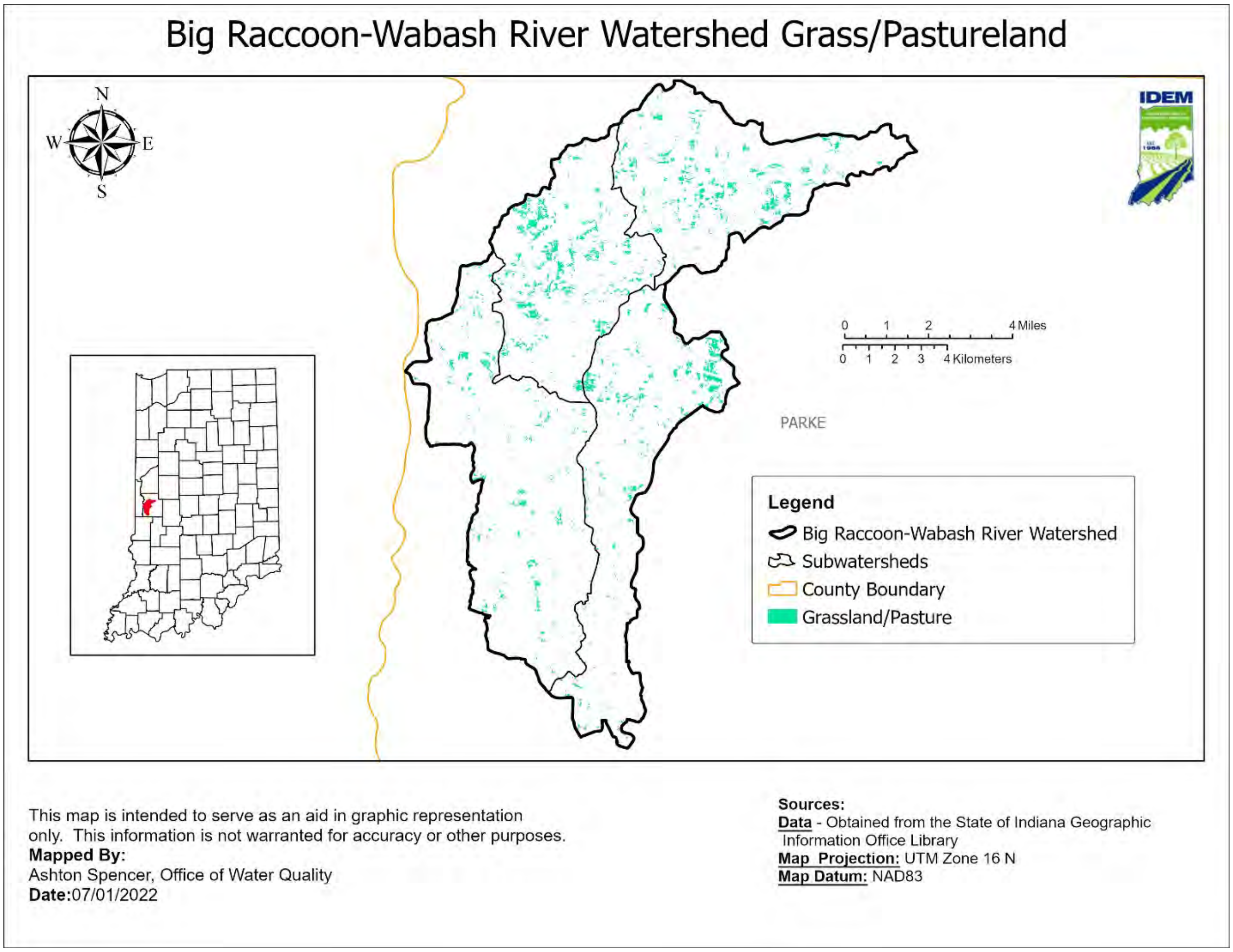

Figure 12: Grassland and Pastureland in the Big Raccoon-Wabash River Watershed

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

A CFO is an agricultural operation where animals are kept and raised in confined situations. It is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period.
- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over 50 percent of the lot or facility.
- The number of animals present meets the requirements for the state permitting action.

Feeding operations that are not classified as concentrated animal feeding operations (CAFOs) are known as CFOs in Indiana. There are currently no CAFOs in the Big Raccoon-Wabash River watershed. Non-CAFO animal feeding operations identified as CFOs by IDEM 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 water 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 confined feeding operations under IC 13-18-10, the Confined Feeding Control Law. The rules at 327 IAC 19, which implement the statute regulating confined feeding operations, 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. It should be noted that there are currently no facilities in Indiana that have an NPDES permit under 15-16.

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* due to the following:

- Improper application of manure can contaminate surface or groundwater.
- Manure over application or improper application can adversely impact soil productivity.

There are currently no AFOs in the Big Raccoon-Wabash River watershed and no permitted CFOs in the watershed, as shown above in Figure 12. Manure used for land application in the Big Raccoon-Wabash River watershed may also originate from AFOs and CFOs in adjacent watersheds.

2.2 Topography and Geology

Topographic and geologic features of a watershed play a role in defining a watershed's drainage pattern. Figure 13 below displays the topography of the watershed. Information concerning the topography and geology within the Big Raccoon-Wabash River watershed is available from the Indiana Geological and Water Survey (IGWS). The Big Raccoon-Wabash River watershed originates in southwest corner of Parke County and travels northwest through the municipalities of Montezuma, Rockville, and Mecca, eventually discharging into the Wabash River. The Big Raccoon-Wabash River Watershed is located in the Glaciated Wabash Lowlands and High Lime Till Plains physiographic region which is characterized by the presence of glacial tills and outwash plains with lime till plains in the north. Like much of Indiana, this watershed is affected by glacial tills.

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/GroundWater).

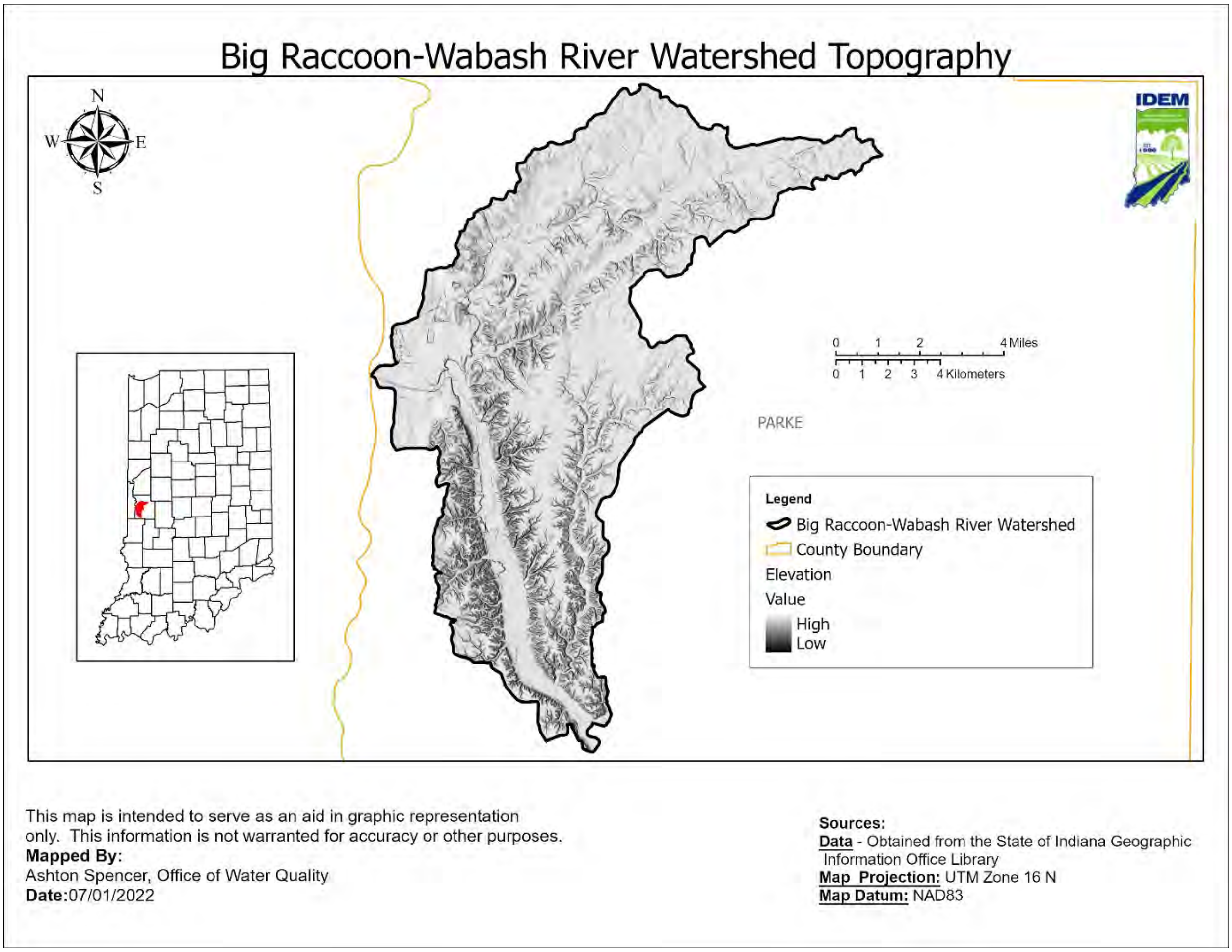

Figure 13: Topography of the Big Raccoon-Wabash River Watershed. Digital Elevation Data (DEM) was taken from the state of Indiana's Geographic Information Office (GIO).

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 14 (USDA, 2009). Data for the Big Raccoon-Wabash River watershed was 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 14 and Table 14.

The majority of the watershed is covered by category B soils (59 percent) followed by category D soils (30 percent), category C soils (7 percent), and category C/D soils (6 percent). The remaining 3 percent of soil in this watershed are category A soils. Category B soil is moderately deep and well drained, while Category C soil is finer and allows for slower infiltration. This means that regular flooding is likely not typical in much of this watershed but could potentially occur on occasion and transport pollutants across the landscape.

Of the soils identified as category D, 75 percent are specified as dual hydrologic group B/D, and 20 percent are specified as dual hydrologic group C/D and the remaining 5 percent are categorized as A/D soils. 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 13: 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 13: 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 14: Hydrologic Soil Groups in the Big Raccoon-Wabash River Subwatersheds

Subwatershed	Hydrologic Soil Group			
	A	B	C	D
Cat Creek-Leatherwood	0.2%	54.7%	3.7%	41.5%

Rocky Run-Leatherwood	4.4%	65.3%	8.6%	21.7%
Rock Run-Big Raccoon	4.6%	71%	6.2%	17.6%
Town of Mecca-Big Raccoon	0.3%	44.9%	12.9%	42.8%

Big Raccoon-Wabash River Watershed Hydrologic Soils Groups

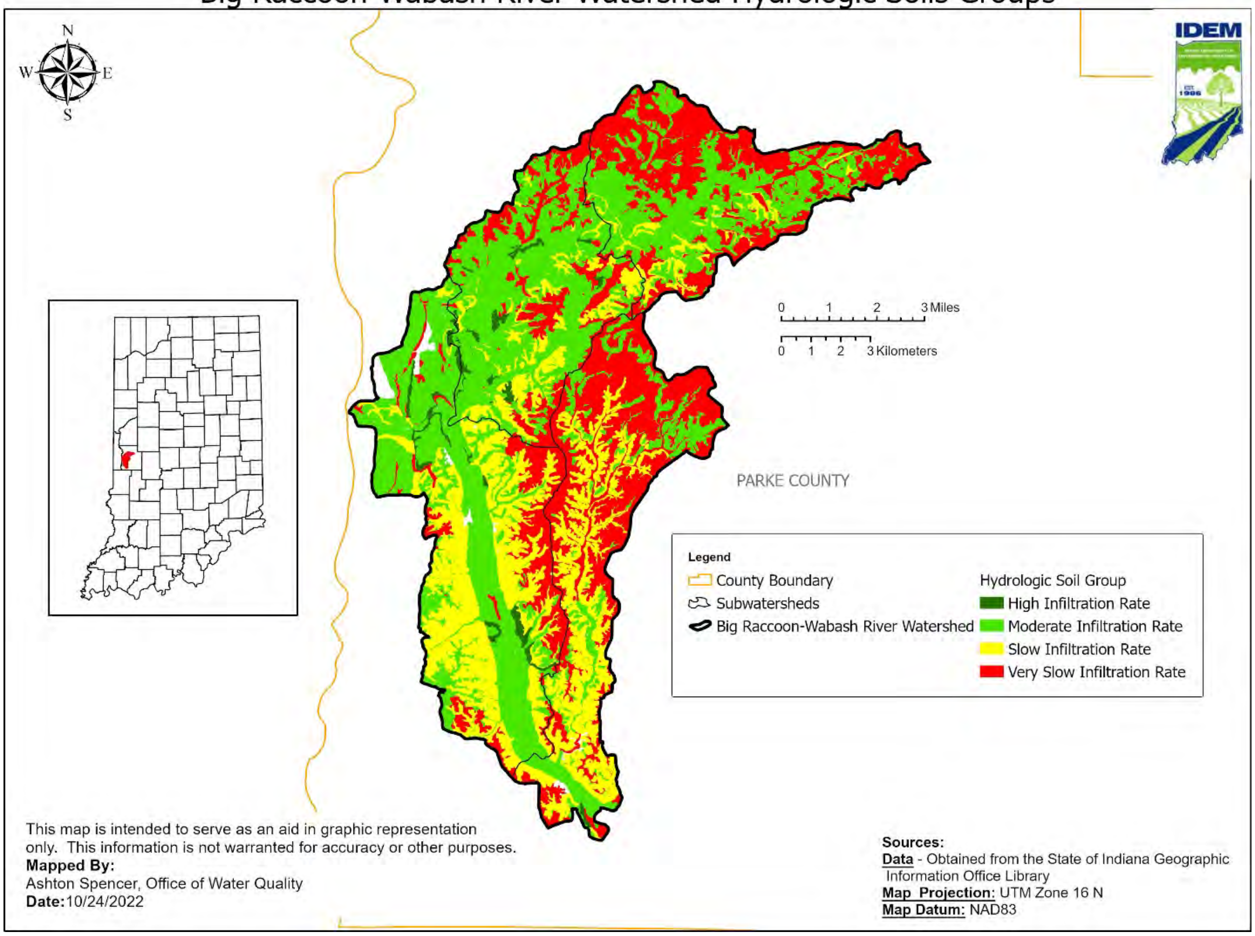

Figure 14: Hydrological Soil Groups in the Big Raccoon-Wabash River Watershed

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 14 illustrates the hydrologic soil groups for the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed.

Figure 15 shows ratings that indicate the extent to which the soils are suitable for septic systems within the Big Raccoon-Wabash 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 46 percent of the Big Raccoon-Wabash 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 6 percent of the soils within the Big Raccoon-Wabash 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 48 percent of the soils in the Big Raccoon-Wabash River watershed are designated “somewhat limited,” meaning that the soil type is suitable for septic systems.

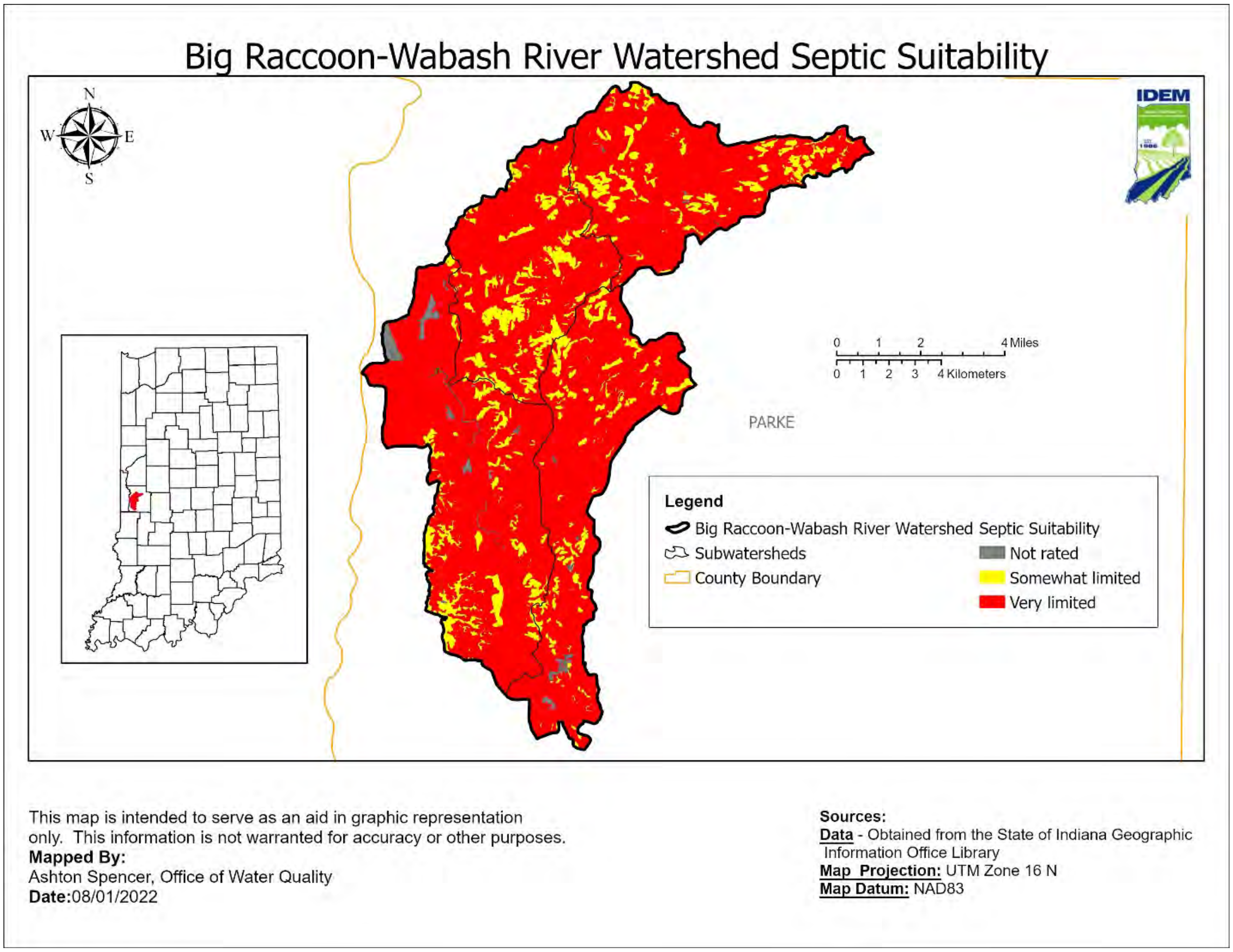

Figure 145: Suitability of Soils for Septic Systems in the Big Raccoon-Wabash River watershed

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 Big Raccoon-Wabash River watershed and are important in consideration of wetland restoration activities. Approximately 18,619 acres or 39 percent of the Big Raccoon-Wabash River watershed area contains soils that are considered hydric or have hydric inclusions. Table 15 includes a list of each map unit within the Big Raccoon-Wabash 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 soil, and map units with a hydric rating of 95 or more have more significant coverage of hydric soils. Figure 16 displays the hydric ratings for each map unit within the Big Raccoon-Wabash River watershed. The Town of Mecca-Big Raccoon Creek subwatershed appears to have the most significant hydric soil coverage in the watershed. However, a large majority of this soil has been drained for either agricultural production or urban development and 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 15: Hydric Ratings for Map Units with Hydric Soils in the Big Raccoon-Wabash River Watershed

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
Cat Creek-Leatherwood	Ea	Eel loam	3	12
	El	Eel silt loam, 0 to 2 percent slopes	5	466
	FcB	Fincastle silt loam, Tipton Till Plain, 2 to 4 percent slopes	3	7
	Ra	Ragsdale silt loam, 0 to 2 percent slopes	85	870
	Rc	Ragsdale silty clay loam, 0 to 2 percent slopes	90	13
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	1,310
	ReB	Reesville silt loam, 2 to 5 percent slopes	3	2,225
	RtB2	Russell silt loam, 2 to 6 percent slopes, eroded	2	150
	Sb	Shoals silt loam, 0 to 2 percent slopes	85	5
	SmA	Sleeth silt loam, loamy substratum, 0 to 2 percent slopes	3	102
	Wd	Westland loam, loamy substratum	100	45
	Wr	Westland silty clay loam, loamy substratum	100	14
			Total Acreage:	**6,178**
Rocky Run-Leatherwood	Al	Allison silty clay loam	3	83
	Ar	Armiesburg silty clay loam	3	9
	En	Eel silty clay loam	3	120
	El	Eel silt loam, 0 to 2 percent slopes, frequently flooded	5	81
	FmA	Fox loam, 0 to 2 percent slopes	4	402
	Gh	Genesee loam	3	364
	Ra	Ragsdale silt loam, 0 to 2 percent slopes	85	62
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	1,390
	ReB	Reesville silt loam, 2 to 5 percent slopes	3	304
	RtB2	Russell silt loam, 2 to 6 percent slopes	2	63
	ShA	Sleeth loam, loamy substratum, 0 to 2 percent slopes	3	6

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
	SmA	Sleeth silt loam, loamy substratum, 0 to 2 percent slopes	3	2
	Wd	Westland loam, loamy substratum	100	28
	Wo	Westland silt loam	100	119
	Wr	Westland silty clay loam, loamy substratum	100	27
	Ww	Whitson silt loam	100	12
			Total Acreage:	**3,073**
Rock Run-Big Raccoon	As	Ayrshire fine sandy loam	3	9
	Ea	Eel loam	3	63
	El	Eel silt loam, 0 to 2 percent slopes, frequently flooded	5	201
	FcA	Fincastle silt loam, Tipton Till Plain, 0 to 2 percent slopes	15	7
	FcB	Fincastle silt loam, Tipton Till Plain, 2 to 5 percent slopes	3	29
	Gh	Genesee loam	3	275
	Ra	Ragsdale silt loam, 0 to 2 percent slopes	85	155
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	293
	ReB	Reesville silt loam, 2 to 5 percent slopes	3	1,225
	RtB2	Russell silt loam, 2 to 6 percent slopes, eroded	2	170
	ShA	Sleeth loam, loamy substratum, 0 to 2 percent slopes	3	7
	SmA	Sleeth silt loam, loamy substratum, 0 to 2 percent slopes	3	24
	Wd	Westland loam, loamy substratum	100	166
	Wo	Westland silt loam	100	1
	Ww	Whitson silt loam	100	2
			Total Acreage:	**2,630**
Town of Mecca-Big Raccoon	El	Eel silt loam, 0 to 2 percent slopes, frequently flooded	5	668
	Gh	Genesee loam	3	552
	MaoA	Mahalaland silty clay loam, 0 to 1 percent slopes	94	36
	Ra	Ragsdale silt loam, 0 to 2 percent slopes	85	658
	Rc	Ragsdale silty clay loam, 0 to 2 percent slopes	90	6
	ReA	Reesville silt loam, 0 to 2 percent slopes	5	3,771
	ReB	Reesville silt loam, 2 to 5 percent slopes	3	968
	RtB2	Russell silt loam, 2 to 6 percent slopes	2	26

Subwatershed	Map Symbol	Map Unit Name	Hydric Rating	Map Unit Acreage
	Sb	Shoals silt loam, 0 to 2 percent slopes	4	23
	SmA	Sleeth silt loam, loamy substratum, 0 to 2 percent slopes	3	2
	Ww	Whitson silt loam	100	31
			Total Acreage:	**6,738**

Understanding Table 15: 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.

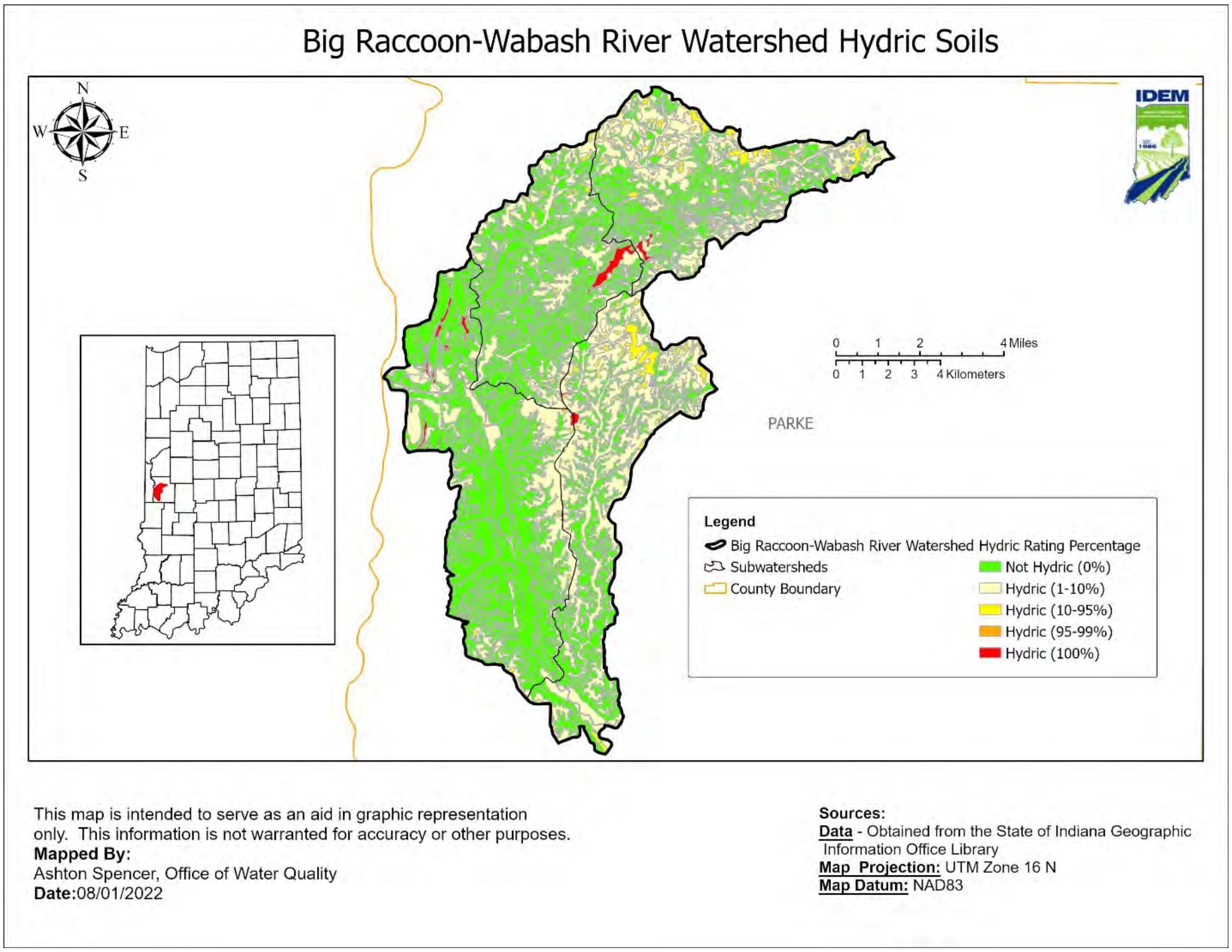

Figure 156: Hydric Soils in the Big Raccoon-Wabash River Watershed (https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/)

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, approximating over 80 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, dunes and swales, cypress swamps, marshes, and swamps. Wetlands now cover less than 4 percent of Indiana. (http://www.in.gov/idem/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 help 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 Big Raccoon-Wabash River watershed contains approximately 918 acres of wetlands or 2 percent of the total surface area. Additional information on wetlands can be found on the IDEM website http://www.in.gov/idem/wetlands/.

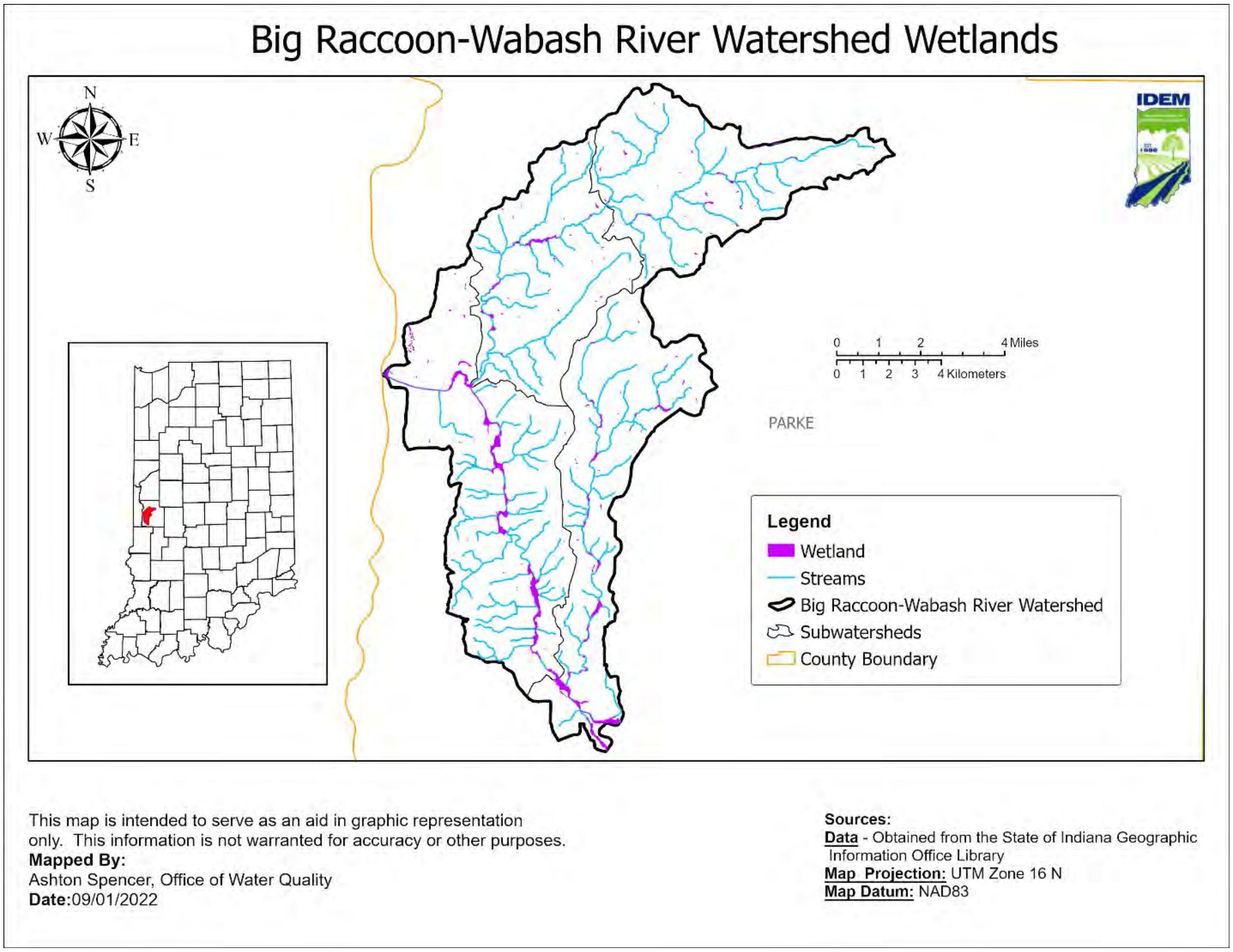

Figure 167: Location of Wetlands in the Big Raccoon-Wabash River Watershed

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 17 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 Big Raccoon-Wabash 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 (http://indianacountysurveyors.org/directory.html).

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 Big Raccoon-Wabash River watershed are listed in Table 16. HELs and potential HELs in the Big Raccoon-Wabash River watershed are mapped in Figure 18.

A total of 24,035 acres or 81 percent of the Big Raccoon-Wabash River watershed is considered highly erodible or potentially highly erodible. Rainfall surrounding the Big Raccoon-Wabash River watershed is moderately heavy with an annual average of 48 inches. This 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.

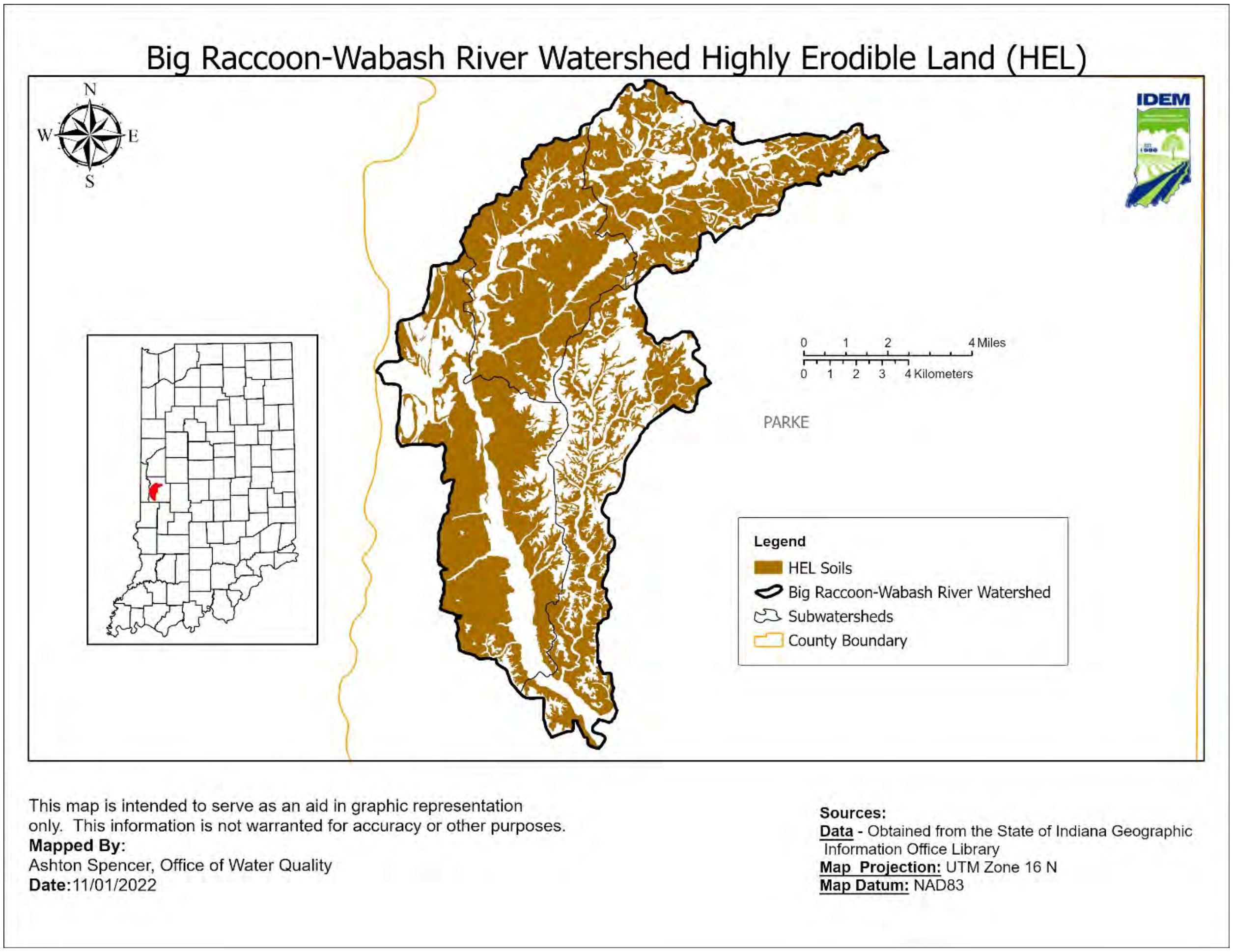

Figure 178: Location of Highly Erodible Lands (HEL) in the Big Raccoon-Wabash River Watershed

Table 16: HEL/Potential HEL Total Acres in the Big Raccoon-Wabash River Watershed

Map Symbol	HEL/Potential HEL Soil Types	Acres
AfB2	Alford silt loam, 2 to 5 percent slopes, moderately eroded	26,723
AfC2	Alford silt loam, 6 to 12 percent slopes, eroded	1,509
AhC3	Alford soils, 5 to 8 percent slopes, severely eroded	138
CaB	Camden loam, 2 to 5 percent slopes	115
CdB	Camden silt loam, 2 to 6 percent slopes	62
CdC2	Camden silt loam, 5 to 8 percent slopes, moderately eroded	27
ChC	Chelsea loamy fine sand, 5 to 8 percent slopes	73
ChD	Chelsea loamy fine sand, 8 to 15 percent slopes	25
ChF	Chelsea loamy fine sand, 15 to 40 percent slopes	38
CnD2	Cincinnati-Hickory complex, 8 to 15 percent slopes, moderately eroded	271
CnD3	Cincinnati-Hickory complex, 8 to 15 percent slopes, severely eroded	43
Cp	Clay pits	29
FmB	Fox loam, 2 to 6 percent slopes	303
FmC2	Fox loam, 5 to 8 percent slopes, moderately eroded	104
FsC	Fox sandy loam, 5 to 8 percent slopes	2
FtD2	Fox silt loam, 8 to 15 percent slopes, moderately eroded	336
FtB	Fox silt loam, 2 to 5 percent slopes	67
Gr	Gravel Pits	300
HnF	Hennepin association, 30 to 60 percent slopes	2,889
HrE2	Hennepin-Russell complex, 15 to 30 percent slopes, moderately eroded	1,607
HsE	Hickory complex, 15 to 30 percent slopes	1,198
HsF	Hickory complex, 30 to 70 percent slopes	4,203
Mp	Mine pits and dumps	23
NsE	Negley soils, 15 to 60 percent slopes	36
OaB	Ockley loam, 2 to 5 percent slopes	67
OcB	Ockley silt loam, 2 to 6 percent slopes	1,658
OcC2	Ockley silt loam, 5 to 8 percent slopes, moderately eroded	541
PaC2	Parke silt loam, 5 to 8 percent slopes, moderately eroded	16
PrB	Princeton fine sandy loam, 2 to 5 percent slopes	291
PrC2	Princeton fine sandy loam, 5 to 8 percent slopes, moderately eroded	514
PrD2	Princeton fine sandy loam, 8 to 15 percent slopes, moderately eroded	70
PrE	Princeton fine sandy loam, 15 to 30 percent slopes	86
ReB	Reesville silt loam, 2 to 5 percent slopes	4,777
RoE	Rodman gravelly soils, 15 to 30 percent slopes	394
RoF	Rodman gravelly soils, 30 to 70 percent slopes	51
RsB	Russell loam, 2 to 6 percent slopes	37
RtB2	Russell silt loam, 2 to 6 percent slopes, eroded	414
RtC2	Russell silt loam, 5 to 8 percent slopes, moderately eroded	2,878
RtD2	Russell silt loam, 8 to 15 percent slopes, moderately eroded	1,185

Map Symbol	HEL/Potential HEL Soil Types	Acres
RuB3	Russell soils, 2 to 5 percent slopes, severely eroded	16
RuC3	Russell soils, 5 to 8 percent slopes, severely eroded	281
RuD3	Russell soils, 8 to 15 percent slopes, severely eroded	184
St	Steep stony and rocky land	115
WbB	Warsaw loam, 2 to 5 percent slopes	338
WbC2	Warsaw loam, 5 to 8 percent slopes, moderately eroded	9

Understanding Table 16 and Figure 18: 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 tillage transects. Data collected through the tillage transect county (https://secure.in.gov/isda/divisions/soil-conservation/cofver-crop-and-tillage-transect-data/) can help determine adoption of conservation practices and estimate the average annual soil loss from Indiana's agricultural lands. The latest figures for the counties in the Big Raccoon-Wabash River watershed are shown in Table 17. Tillage practices captured in ISDA's tillage transect include living cover and no-till practices. According to ISDA, living cover includes living cover crops and cereal grains planted into cash crops using direct seeding or broadcast methods, and no-till is any direct seeding system including site preparation, with minimal soil disturbance (ISDA, 2023).

Table 17: Tillage Transect Data for 2022 by County in the Big Raccoon-Wabash River Watershed

County	Tillage Practice 2022			
	Living Cover		No Till	
	Corn	Soybean	Corn	Soybean
Parke	4,319 acres 7%	5,686 acres 9%	15,922 acres 84%	40,497 acres 92%

Understanding Table 17: According to the table, in Parke County no till is predominant for both corn and soybeans, while living cover is the least utilized method.

2.3.5 Streambank Erosion

Streambank erosion is potentially a significant source of pollutants in the Big Raccoon-Wabash 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 crops 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. Higher concentrations of wildlife in the habitats described in Table 18 could contribute *E. coli* and nutrients to the watershed, particularly during high flow conditions or flooding events.

Table 18: 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 19 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 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 an 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 19 and Figure 19 show the managed lands within the Big Raccoon-Wabash River watershed. Table 20 and Figure 19 show the classified lands within Big Raccoon-Wabash River watershed.

Table 19: Managed Lands within the Big Raccoon-Wabash River Watershed

Unit Name	Manager	Area (acres)
Rosedale NRDS Settlement	DNR Fish and Wildlife	75.2
Raccoon Creek Public Fishing Area	DNR Fish and Wildlife	24.4
HRI Wabash River	DNR Fish and Wildlife	37.9
Hajji Hollow	Central Indiana Land Trust Inc.	69.3
Total		206.8

Table 20: Classified Lands within the Big Raccoon-Wabash River Watershed

Classified Lands	
Subwatershed	Area (acres)
Cat Creek-Leatherwood Creek	<1
Rocky Run-Leatherwood Creek	561.9
Rock Run-Big Raccoon Creek	973.2
Town of Mecca-Big Raccoon Creek	1,958
Total	3,494

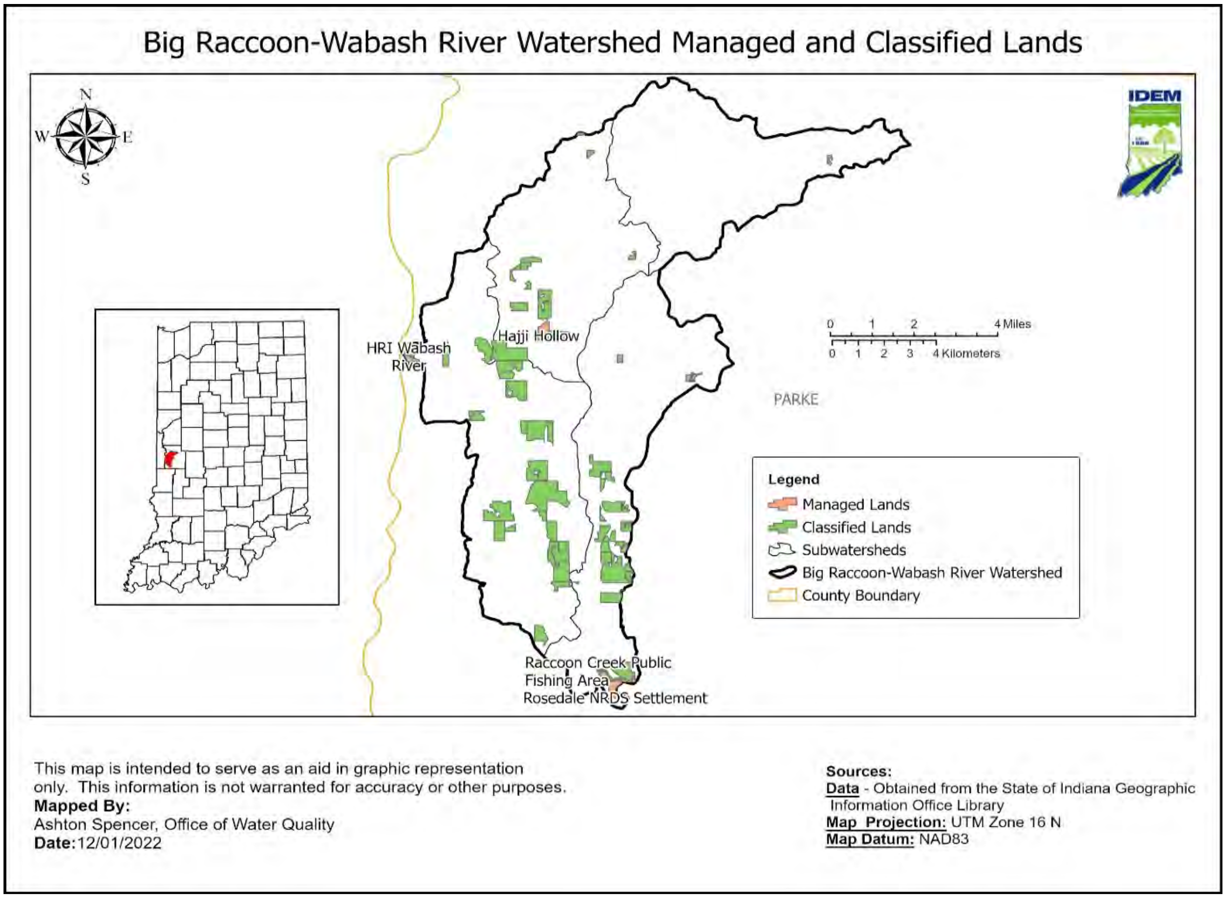

Figure 19: Managed and Classified Lands within the Big Raccoon-Wabash River Watershed

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 USC00127522 located in Rockville, IN were used for climate analysis of the Big Raccoon-Wabash River watershed. Monthly data from 1993-2023 was available at the time of analysis. In general, the climate of the region is continental with hot, humid summers and cold winters. From 2014 to 2023, the average winter temperature in Rockville was 30.5°F and the average summer temperature was 72.8°F. The average growing season (consecutive days with low temperatures greater than or equal to 32 degrees) is 165 days.

Examination of precipitation patterns is also a key component of watershed characterization because of the impact of run-off on water quality. From 2014 to 2024, the annual average precipitation in Rockville at Station USC00127522 was approximately 48 inches, including approximately 9.75 inches on average of total annual Big Raccoon-Wabash River snowfall.

Rainfall intensity and timing affect watershed response to precipitation. This information is important in evaluating the effects of stormwater on the Big Raccoon-Wabash River watershed. Using data from USC00127522 during 2014 to 2023, 83 percent of the measurable precipitation events were low intensity (i.e., less than 0.2 inches), while less than 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 Big Raccoon-Wabash River watershed currently occurs between the months of March and May.

2.6 Human Population

Counties with land located in the Big Raccoon-Wabash River watershed include Parke. Major government units with jurisdiction at least partially within the Big Raccoon-Wabash River watershed include Mecca, Rockville, Montezuma, Bloomingdale, and Marshall Town. U.S. Census data for each county during the past three decades are provided in Table 21 (U.S. Census Bureau, 2012).

Table 21: Population Data for Counties in Big Raccoon-Wabash River Watershed

County	2000	2010	2022
Parke	17,241	17,339	16,369
Total	17,241	17,339	16,369

Understanding Table 21 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 Big Raccoon-Wabash River watershed over time. In addition, understanding population *trends can help watershed stakeholders to anticipate where pressures might increase or decrease in the future and where action in the Big Raccoon-Wabash River could help prevent further water quality degradation.*

Estimates of population within Big Raccoon-Wabash River watershed are based on US Census data 2020 and the percentage of census blocks in urban and rural areas (Table 22). Based on this analysis, the estimated population of the watershed is 4,079 with approximately 100 percent of the population classified as rural residents and 0 percent classified as urban residents. Figure 20 below indicates population density within the Big Raccoon-Wabash River watershed.

Table 22: Estimated Population in the Big Raccoon-Wabash River Watershed

County	2020 Population	Total Estimated Watershed Urban Population	Total Estimated Watershed Rural Population	Total Estimated Watershed Population	Percent of Total Watershed Population
Parke	16,369	0	4,079	4,079	100%
Total	16,369	0	4,079	4,079	100%

Understanding Table 22: Understanding where the greatest population is concentrated within the Big Raccoon-Wabash 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 22 with the information in Table 22 can provide an understanding of how population might change in the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed might signify communities with under-utilized infrastructure and indicate opportunities to "rightsized" existing infrastructure and promote changes to land use that would benefit water quality (e.g., green infrastructure).

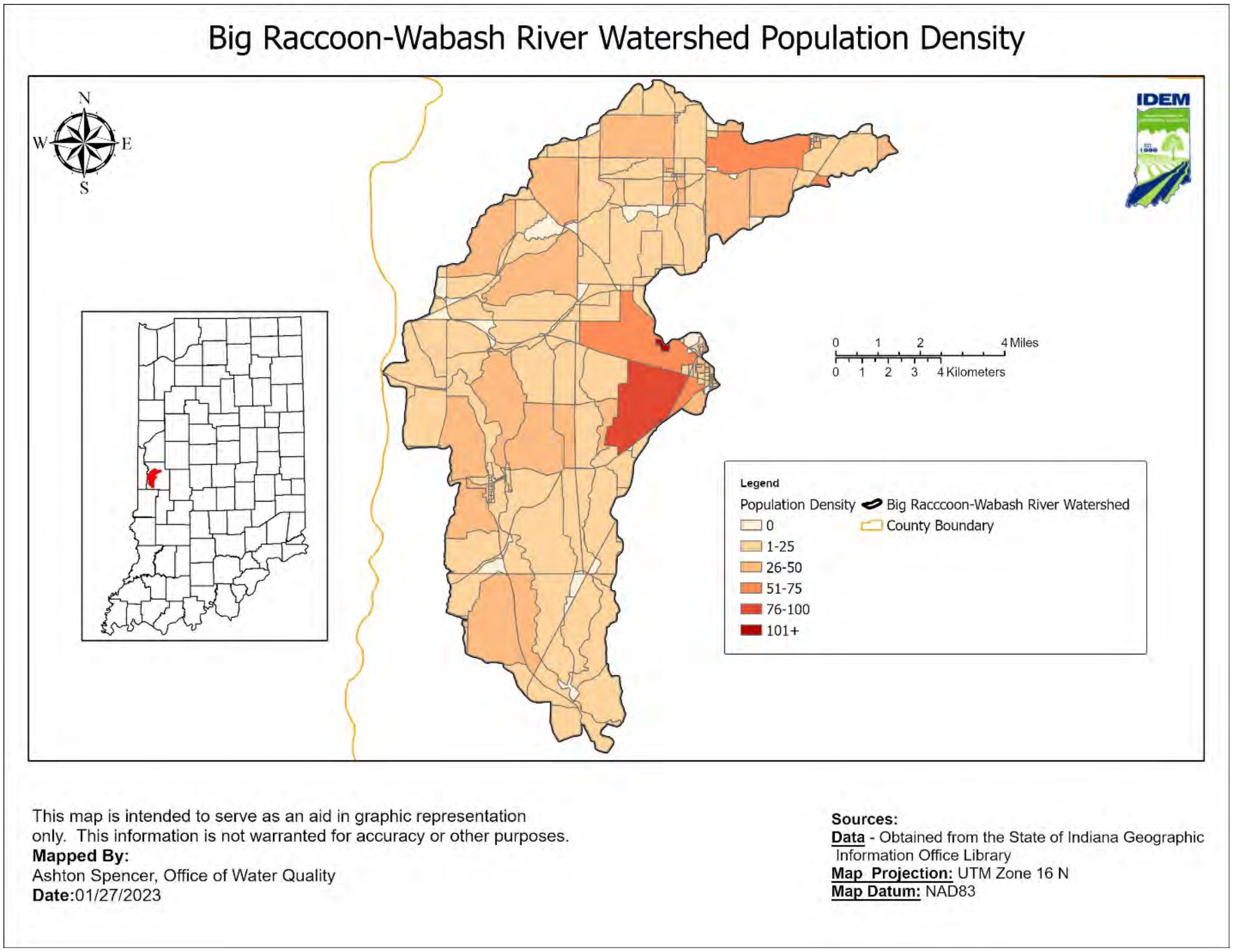

Figure 20: Population Density in the Big Raccoon-Wabash River Watershed

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 drain field. 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 drain field 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River subwatersheds are shown in Table 23, 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 Big Raccoon-Wabash River watershed (U.S. Census Bureau, 2012).

Table 23: Rural and Urban Household Density in the Big Raccoon-Wabash 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)
Cat Creek Leatherwood	Parke	16.43	375	0	375	22.8	0
	Total	16.43	375	0	375		
Rock Run Leatherwood	Parke	15.69	141	0	141	8.9	0
	Total	15.69	141	0	141		
Rocky Run Big Raccoon	Parke	18.19	544	0	544	29.9	0
	Total	18.19	544	0	544		
Town of Mecca Big Raccoon	Parke	23.64	320	0	320	13.5	0
	Total	23.64	320	0	320		

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 24 reports unsewered communities by county relevant to the Big Raccoon-Wabash River watershed.

Table 24: Unsewered residences/businesses reported by county in 2016-2017.

County	Unsewered Communities	Residences	Businesses
Parke	1	No Report	7

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 post construction 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 percentage and distribution of developed land in the Big Raccoon-Wabash 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 nutrients, TSS, and *E. coli* in the Big Raccoon-Wabash River watershed.

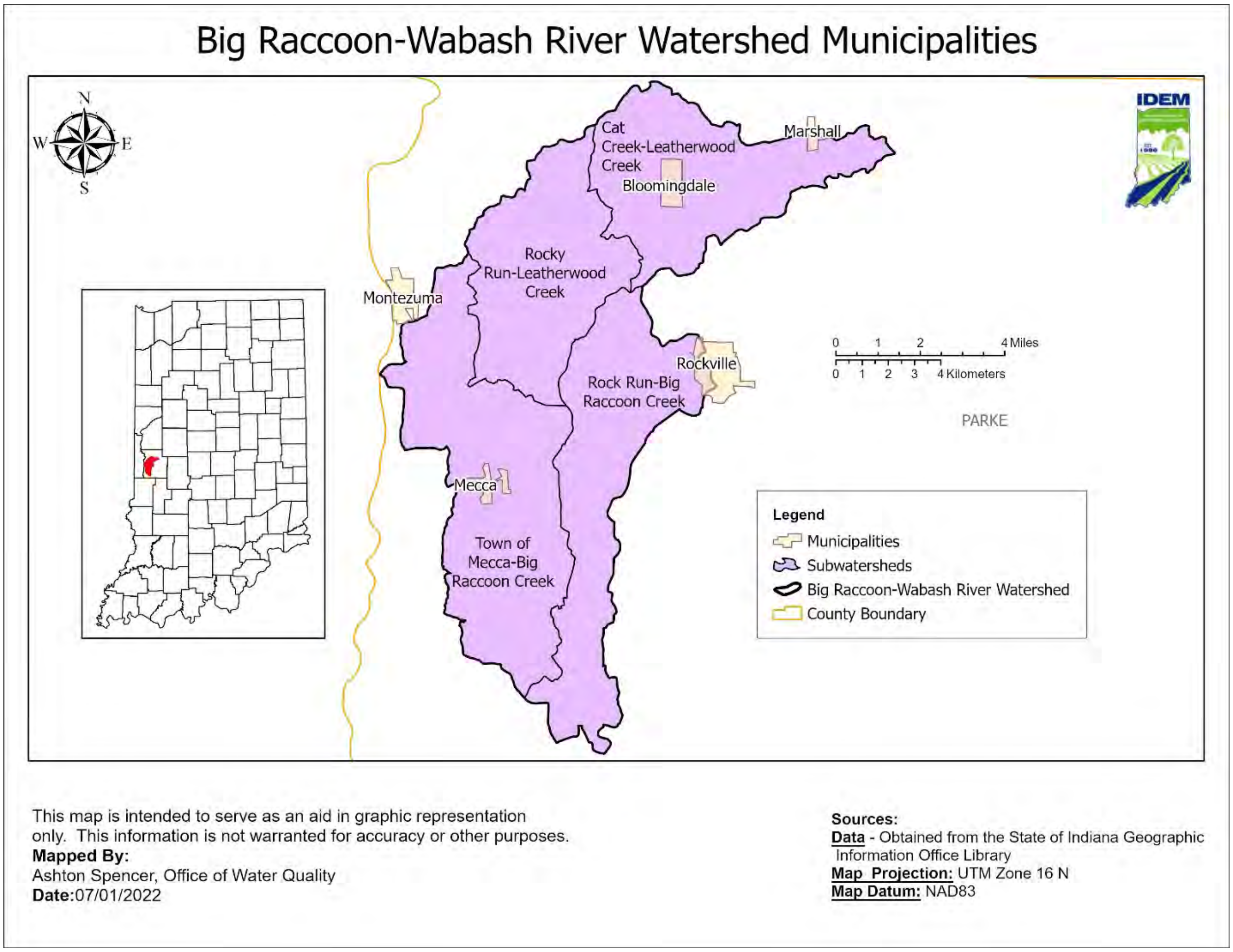

Figure 21: Municipalities in the Big Raccoon-Wabash River Watershed

2.7 Point Sources

This section summarizes the potential point sources of *E. coli*, TSS, and TP in the Big Raccoon-Wabash River watershed, as regulated through the 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 Big Raccoon-Wabash River watershed includes municipal WWTPs, a PWS, and construction sites. A summary of the potential point sources of *E. coli*, TSS, and TP in the Big Raccoon-Wabash River watershed, including an overview of the facilities and WLAs, is provided in Appendix G.

2.7.1 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 WWTP include sewage treatment and industrial waste treatment. WWTPs are critical for maintaining public sanitation and a healthy environment. However, WWTPs may discharge wastewater with elevated concentrations of pollutants into streams. Industrial

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 one active WWTPs that discharge wastewater within the Big Raccoon-Wabash River watershed (Table 25 and Figure 22).

The Riverton Parke JR SR HS operates a minor municipal WWTP (IN0045861). The WWTP is a Class I, 0.01 MGD bio-mechanical aeration treatment facility consisting of surge tank, grinder pumps, an aeration tank, a secondary clarifier, chlorination/dichlorination facilities, a three-day polishing tank, aerobic digestion, and a flow meter. Additional sludge is taken to a larger WWTP for final disposal. The system is comprised of 100 percent separate sanitary sewers by design with no overflow or bypass points. The facility has one outfall (Outfall 001) that discharges to Big Raccoon Creek. The facility remediation process is conducted through IDEM to address violation issues. Some improvements to the process include changing filters, cleaning pumps, and adding additional drains to prevent violations during heavy rain events.

Effluent from this facility are potential point sources of *E. coli*, TSS, and TP. 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 TMDL target value for total phosphorus is 0.3 mg/L or interpreted from current permit limits. These target values 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 data monitoring reports (DMR) or design flows from the facility permits when actual flow data is not available. Pollutant concentrations used to calculate wasteloads from each treatment plant are based on known technological limitations of the facilities.

The facilities' permit effluent limits for *E. coli*, TSS, and TP are used to determine WLAs for each treatment plant. The effluent limit for TSS is set at the NPDES permit limit of 30 mg/L monthly average. The effluent limit for *E. coli* is set at 235 counts/100 mL single sample maximum component of the water quality standard. Average design flow was determined from information reported by the facility during the permitting process. Compliance with the NPDES permit is believed to be consistent with the TMDL in protecting water quality.

Table 25: Municipal WWTP Facilities Discharging within the Big Raccoon-Wabash River Watershed

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Average Design Flow (MGD)
Town of Mecca-Big Raccoon	Riverton Parke JR SR HS WWTP	IN0045861	INB08F4_T1005	Big Raccoon Creek	0.01

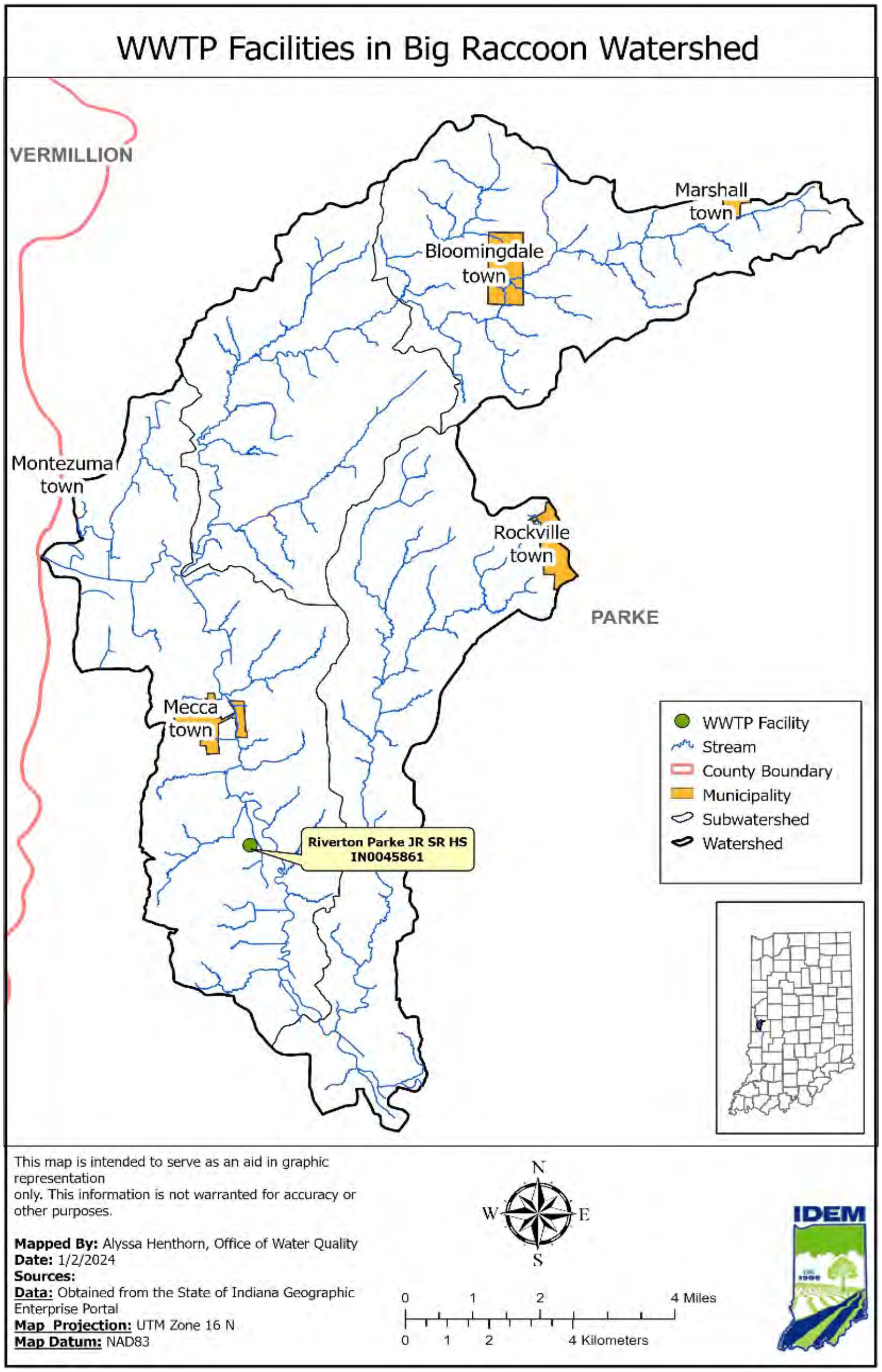

Figure 22: Municipal WWTP in the Big Raccoon-Wabash River Watershed

Permit Compliance

Table 26: Summary of Municipal WWTP Permit Compliance in the Big Raccoon-Wabash River Watershed for the Five-Year Period of 2018-2023.

Subwatershed	**Facility Name**	**NPDES Permit Number**	**Stream**	**Inspections for the Last Five Years**	**Water Quality Violations for the Last Five Years**					
					Outfall	**Month**	**Year**	**Parameter**	**Type**	**Exceedance**
Town of Mecca	Riverton Parke JR SR HS WWTP	IN0045861	Wabash River & Big Raccoon Creek	Inspected by IDEM:						
				10/6/2021: Violations Observed	001	Oct.	2021	DO	Monthly Avg.	300%
				11/3/2021: Violations Observed	001	Nov	2021	DO	Monthly Avg	1060%
				11/3/2021: Violations Observed	001	Nov	2021	DO	Monthly Avg.	43%
				11/8/2021: Violations Observed	001	Nov	2021	DO	Monthly Avg.	669%
				2/2/2022: Violations Observed	001	Feb	2022	DO	Weekly Max.	15%
				10/6/2021: Violations Observed	001	Oct	2021	Clorine	Daily Max	67%
				6/6/2019: Violations Observed	001	June	2019	*E. coli*	Daily Max	75%
				5/8/2020: Violations Observed	001	May	2020	*E. coli*	Daily Max	47%
				10/8/2020: Violations Observed	001	Oct	2020	*E. coli*	Daily Max	27%
				11/7/2020: Violations Observed	001	Nov	2020	*E. coli*	Daily Max.	930%
				11/3/2021: Violations Observed	001	Nov	2021	*E. coli*	Daily Max.	16%
				7/5/2022: Violations Observed	001	July	2022	*E. coli*	Daily Max.	192%
				8/3/2022: Violations Observed	001	Aug	2022	*E. coli*	Daily Max.	930%
				9/7/2022: Violations Observed	001	Sept	2022	*E. coli*	Daily Max.	930%
				10/7/2022: Violations Observed	001	Oct	2022	*E. coli*	Daily Max.	930%
				8/3/2022: Violations Observed	001	Nov	2022	*E. coli*	Daily Max.	930%
				2/6/2020: Violations Observed	001	Feb	2020	Nitrogen	Weekly Max	50%
				2/6/2020: Violations Observed	001	Feb	2020	Nitrogen	Monthly Avg	16%
				3/4/2020: Violations Observed	001	March	2020	Nitrogen	Monthly Avg	133%
				4/10/2020: Violations Observed	001	April	2020	Nitrogen	Monthly Avg	205%
				5/8/2020: Violations Observed	001	May	2020	Nitrogen	Monthly Avg	103%
				11/3/2021 Violations Observed	001	Nov	2021	Nitrogen	Monthly Avg	123%
				12/8/2021: Violations Observed	001	Dec	2021	Nitrogen	Monthly Avg	239%
				11/2/2022: Violations Observed	001	Nov	2022	Nitrogen	Monthly Avg	144%
				12/7/2022: Violations Observed	001	Dec	2022	Nitrogen	Monthly Avg	97%
				9/7/2023: Violations Observed	001	Sept	2023	Nitrogen	Weekly Avg	68%
				10/5/2023: Violations Observed	001	Nov	2023	Nitrogen	Monthly Avg	236%
				3/4/2020: Violations Observed	001	March	2020	TSS	Monthly Avg	19%
				5/8/2020: Violations Observed	001	May	2020	TSS	Weekly Max	9%
				10/6/2021: Violations Observed	001	Oct	2021	TSS	Weekly Max	24%

2.7.2 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 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. There is currently one industrial facility with an industrial wastewater permit within the Big Raccoon-Wabash River Watershed.

Wastewater discharges from Superior Forest Products (IN0064335) are regulated by an individual industrial wastewater permit (Table 27 and Figure 23). Superior Forest Products has one outfall (Outfalls 005) which discharges into an unnamed tributary of the Wabash River. The wastewater discharged at Outfall 005 consists of non-processed wastewater from boiler blowdown and kiln condensate. The facility has an average discharge of approximately 0.0014 MGD.

Effluent from this facility is a point source of TSS. As discussed in Section 2.1, 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 sediment loads from this facility are estimated based on current flow data from data monitoring reports (DMR) or design flow from the facility permit when actual flow data is not available.

The facility's permit effluent limit for TSS is set at the NPDES permit limit of 20 mg/L monthly average design flow was determined from information reported by the facility during the permitting process. Compliance with the NPDES permit is believed to be consistent with the TMDL in protecting water quality.

Table 27: Industrial Facilities Discharging within the Big Raccoon-Wabash River Watershed

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Average Design Flow (MGD)
Town of Mecca	Superior Forest Products	IN0064335	INB08G5_05	Unnamed Tributary of Wabash River	0.0014

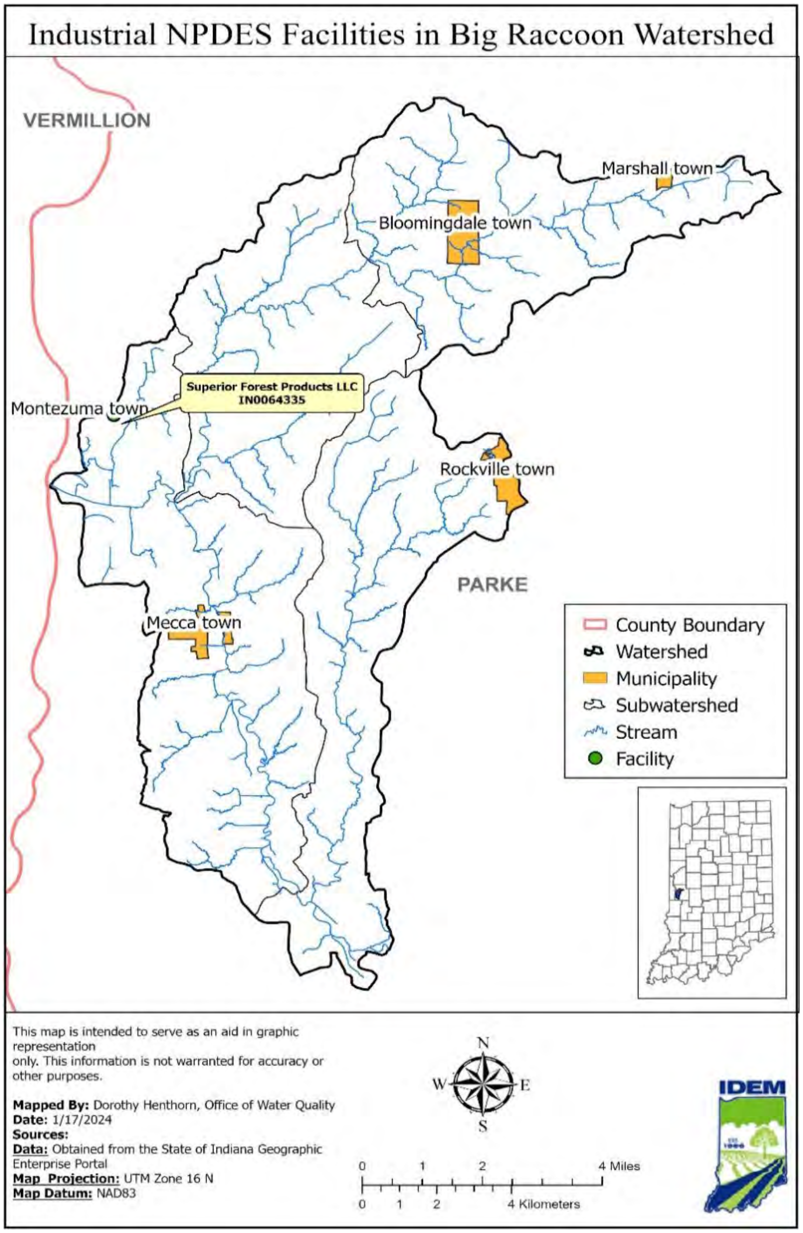

Figure 23: Industrial Facilities Discharging within the Big Raccoon-Wabash River Watershed

Permit Compliance

Table 28: Summary of Industrial Wastewater Permit Compliance in the Big Raccoon-Wabash River Watersheds for the Five-Year Period of 2018-2023.

Subwatershed	Facility Name	NPDES Permit Number	Stream	Inspections for the Last Five Years	Water Quality Violations for the Last Five Years					
					Outfall	Month	Year	Parameter	Type	Exceedance
Town of Mecca	Superior Forest Products LLC	IN0064335	Wabash River	Inspected by IDEM: 1/21/2023: Violation Observed	005	Dec.	2020	TSS	Monthly Avg.	38%

2.7.3 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 administrative construction general permit (CGP). The CGP is a performance-based regulation designed to reduce pollutants that are associated with construction and/or land disturbing activities. In Indiana, most construction projects are administered through the general permit. The requirements of the permit apply 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 is still subject to stormwater permitting.

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 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 29. The estimated land disturbance was calculated for each subwatershed using data from permitted construction sites for the past five years.

Table 29: Average Annual Land Disturbance from Permitted Construction Activity in the Big Raccoon-Wabash River Subwatersheds from 2022-2028.

Subwatershed	Estimated Annual Land Disturbance (Acres)
Cat Creek Leatherwood	0
Rocky Run Leatherwood	0
Rock Run Big Raccoon	62.59
Town of Mecca Big Raccoon	7.5

Industrial Stormwater

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. Compliance with the industrial stormwater general permit is required for facilities where activities of the industrial operation are exposed to stormwater and run-off is discharged though a point source to a water of the state. The general permit applies to specific categories of industrial activities that must obtain permit coverage. Determination of applicable industrial activities is based on a facility’s Standard Industrial Classification (SIC) Code(s) or facility activities included in the listed narrative descriptions within 327 IAC 15-6.

The industrial stormwater general permit requires 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, and the frequency of practices and maintenance requirements of measures requirements must be included in the SWP3. The SWP3 should also clearly identify the responsibilities of each stormwater pollution prevention team member. In addition, it is required that quarterly visual inspections of outdoor operations, measures, and outfalls are conducted as well as annual sampling of stormwater from applicable outfalls in order to determine if modifications of the SWP3 are necessary to prevent pollutants from discharging into a water of the state.

Under certain circumstances, IDEM may require a facility to obtain an individual stormwater permit. An individual stormwater permit is required if a facility conducts an activity that falls under a regulated industrial activity category in which established effluent limitations have been set by the EPA. In addition, IDEM may determine that the general permit is not sufficient to protect water quality and an individual stormwater permit is required. If an individual stormwater permit is required, notice will be given to the industrial facility representative. An individual stormwater permit is a written document developed specifically for the facility.

There are a total of four industrial facilities with industrial stormwater general permits within the Big Raccoon-Wabash River watershed.

Table 30: Industrial Stormwater Facilities within the Big Raccoon-Wabash River Subwatersheds

Subwatershed	Facility Name	Permit Number	Receiving Stream	Parcel Size (Acres)
Cat Creek	Futurex Inc	INRM00709	Leatherwood	10
Town of Mecca-Big Raccoon	Mecca Auto Salvage	INRM01353	Big Raccoon Creek	9
Town of Mecca-Big Raccoon	Superior Forest Products	INRM02306	Wabash River	3.11
Rock Run-Big Raccoon	Mecca Auto Salvage & Recycling Inc	INRM02501	Rock Run	12.8

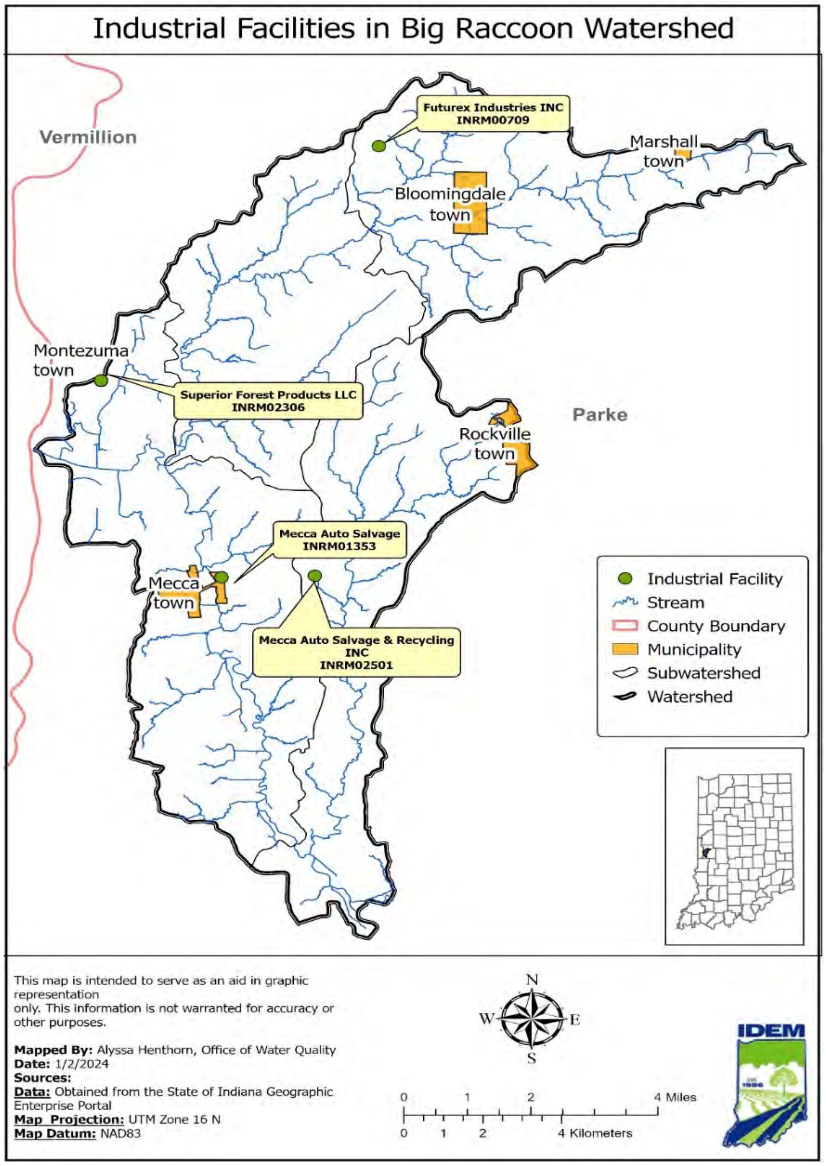

Figure 24: Industrial Stormwater Facilities Discharging within the Big Raccoon-Wabash River Watershed

Municipal Separate Storm Sewer Systems (MS4)

Stormwater run-off from certain types of urbanized areas is 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 Big Raccoon-Wabash River watershed.

Stormwater run-off from certain types of urbanized areas is 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. There is currently no MS4 entity in the Big Raccoon-Wabash River watershed.

The CWA requires stormwater discharges from certain types of urbanized areas to be permitted under the NPDES program. In 1990, Phase I of these requirements became effective, and municipalities with a population served by a MS4 of 100,000, or more were regulated. Under Phase I federal stormwater regulations, regulated MS4 entities were required to obtain individual permits. In 1999, Phase II became effective and any entity responsible for an MS4 conveyance, regardless of population size, could potentially be regulated. An individual NPDES permit is required when water quality standards are not being met under the general permit, a technology or regulatory change has occurred that causes the implementation of specific controls or limitations not expressed in the general permit, or a general permit is no longer appropriate based on permittee changes. If any of these situations occur, MS4 entities covered under this general permit rule may be required to terminate coverage and apply for an individual MS4 permit.

MS4 conveyances within urbanized areas have one of the greatest potentials for polluted stormwater run-off. The Federal Register Final Rule explains the reason as: “urbanization alters the natural infiltration capacity of the land and generates...pollutants...causing an increase in stormwater run-off volumes and pollutant loadings.” Based on increased population and proportionally higher pollutant sources, urbanization results, “in a greater concentration of pollutants that can be mobilized by, or disposed into, stormwater discharges.” MS4s can be significant sources of *E. coli*, nutrients, and sediment because they transport urban run-off that can be affected by pet waste, illicit sewer connections, failing septic systems, fertilizer, construction, and streambank erosion from hydrologic modifications.

Municipal boundaries and MS4 boundaries are not always the same but are often used to delineate the regulated MS4 area if a system map is not readily available. The MS4 WLAs are developed at High and Moist flow regimes; it is not expected that the MS4 will have non stormwater discharges. The MS4 operator shall develop a stormwater quality management plan (SWQMP) that includes a commitment to develop and implement a strategy to detect and eliminate illicit discharges to the MS4 conveyance.

2.8 Summary

The information presented in Section 1.0 helps to provide a better comprehensive understanding of the conditions and characteristics in the Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed. Human population in the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed. These features interact with land use activities and human population to create pressures on both water quality and quantity in the Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed and summarized the applicable water quality standards, water quality data, and identified the potential sources of *E. coli*, TSS, and TP 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, and TP in each subwatershed. This section focuses on describing the methodology and is helpful in understanding subsequent sections of the TMDL report.

3.0 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)
- Total Phosphorus and TSS: 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 31 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 WWTPs are usually 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 are most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur.

Table 31: 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)

3.1 Stream Flow Estimates

Daily stream flows are necessary to implement the load duration curve approach. Load duration assessment locations in the Big Raccoon-Wabash 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 operates one stream flow gaging station in the Big Raccoon-Wabash River watershed. The flow data was estimated for the Big Raccoon-Wabash River watershed using flow data from the USGS gage named Big Raccoon-Coxville. This gage receives a flow from three neighboring watersheds the Little Raccoon Creek (HUC10: 0512010813), Flow Run-Big Raccoon Creek (HUC 10: 0512010814), and Cecil M Harden Lake-Big Raccoon (HUC 10: 0512010812). This is standard procedure to find the flow gage for watersheds that have a gage within the watershed.

The USGS gage for the Big Raccoon-Coxville at Coxville, IN (03341300) located just downstream of the confluence of the Big Raccoon-Wabash River and the Wabash River was used for the development of the *E. coli*, TSS, and TP load duration curve analysis for the Big Raccoon-Wabash River watershed TMDL. USGS gage 03341300 is located in Parke County. Gage 03341300 drains approximately 448 sq. miles in the Big Raccoon-Wabash River (HUC 8: 05120108) watershed as shown in Figure 25.

Table 32: USGS Site Assignment for Development of Load Duration Curve

Gage Location	Gage ID	Period of Record Used in Analysis
Big Raccoon-Coxville at Coxville, IN	03341300	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 gage 03341300 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 Big Raccoon-Wabash 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 ungaged location
Q_{gaged}: Flow at surrogate USGS gage station
$A_{ungaged}$: Drainage area of the ungaged location
A_{gaged}: Drainage area of the gaged location

In this procedure, the drainage area of each of the load duration stations was divided by the drainage area of the USGS gage. 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 WWTPs that discharge upstream and are not directly reflected in the load duration curve method.

Table 33: 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%)
Town of Mecca	537.19	1814	827	387	147	77
Rock Run-Big Raccoon	447.76	1511	689	322	122	63
Rocky Run-Leatherwood	32.13	108	49	23	9	5
Cat Creek	16.43	55	25	12	4	2

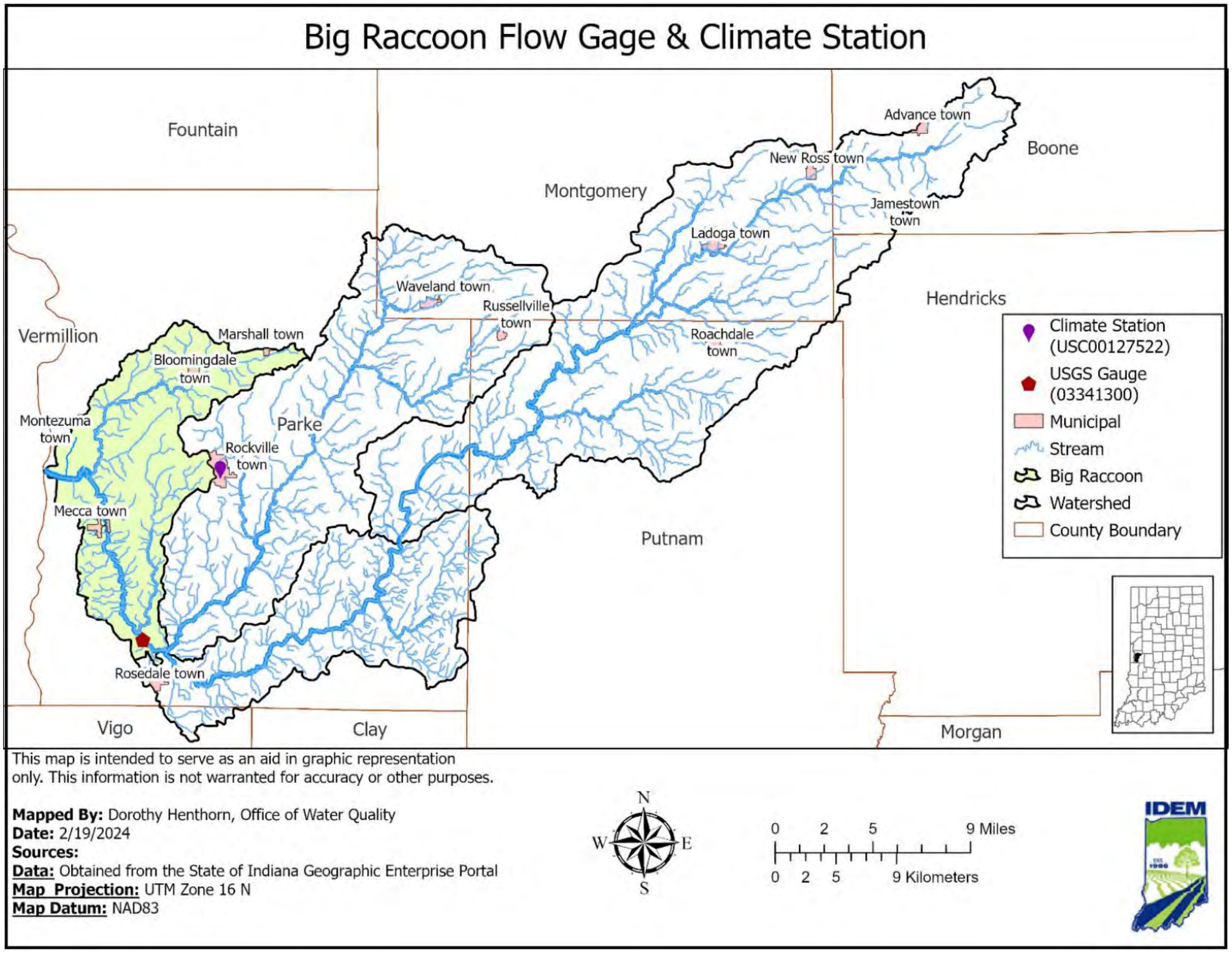

Figure 25: Location of Flow Gage & Climate Station in Coxville, IN

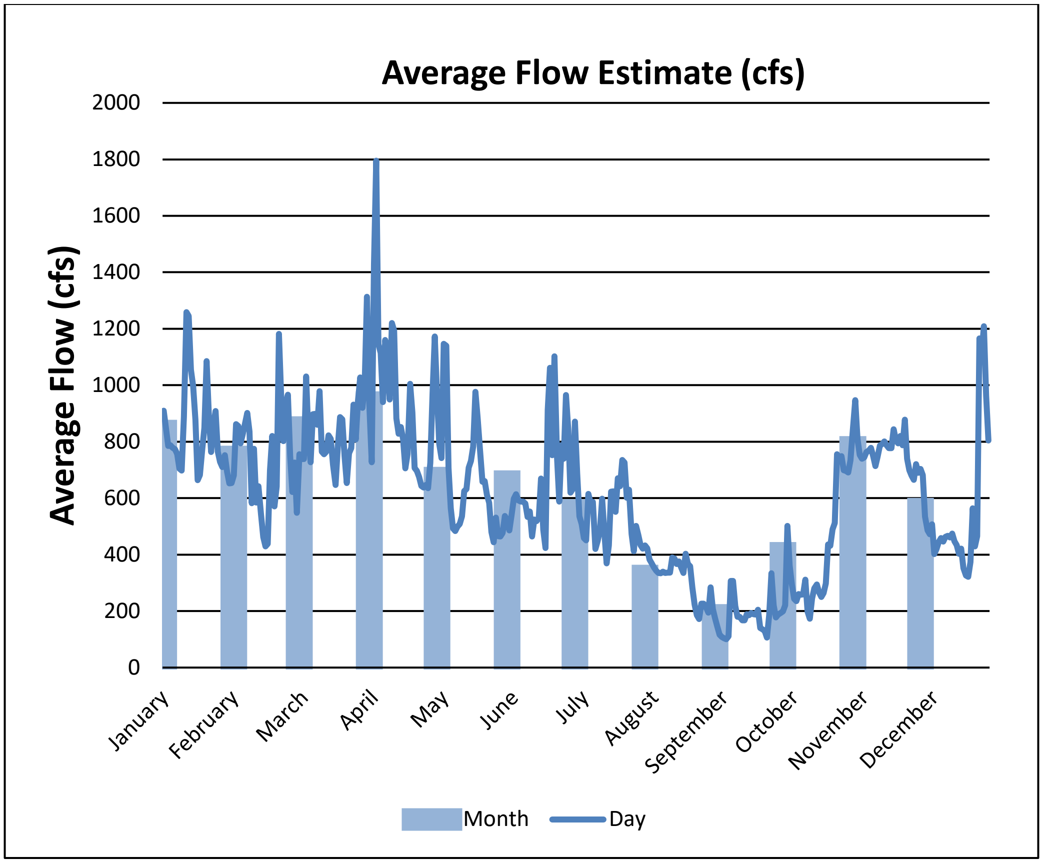

Figure 26: Average Daily Flow Estimate for the Big Raccoon-Wabash River Watershed for data from 2014-2024

3.2 Margin of Safety (MOS)

Section 303(d) of the CWA 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 by applying a couple of conservative assumptions. 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.

3.3 Future Growth Calculations

Population trends are indicating that this watershed was increasing (Table 21) over the past two decades but has decreased over the past 5 years; uncertainty in future populations in the Big Raccoon-Wabash River watershed has led IDEM to choose to allocate 5 percent of the loading capacity toward future growth as a conservative assumption that the population might increase again in the future. 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, sediment, and nutrient loads from those future contributors.

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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed that were sampled by IDEM in 2022 and 2023. 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 3.0 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 Rockville, 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, CSO communities, and soil characteristics. A summary table of each subwatershed is also provided that includes the LAs, WLAs, and 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 Big Raccoon-Wabash River watershed identified by sampling data include *E. coli*, total phosphorus, and TSS.

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 WWTPs or animals with direct access to streams.

4.1.2 Total Phosphorus

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 Big Raccoon-Wabash River watershed. Additional information is outlined in Sections 1.1.2 and 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.

The load duration curves indicate that nonpoint sources as well as point sources may be contributing to the impairment; however, there are no permitted dischargers for phosphorus. Nonpoint sources might include sediment-bound phosphorus that enters the river during erosional processes, as well as the run-off of storms over fertilized fields and residential areas. Septic systems might also be a potential source of phosphorus if the systems are failing and located adjacent to the streams.

4.1.3 Total Suspended Solids

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 1.1.3.

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.

Since monitoring began, TSS in the Big Raccoon-Wabash River watershed has sporadically exceeded the target value. TSS tends to exceed target values in the spring and summer months, although data is incomplete or lacking for the winter months. High loads in the spring may be related to the plowing and planting of agricultural fields occurring during these months, increasing the opportunity for sheet and rill erosion. Further analysis pairing the TSS concentrations with flow conditions reveals elevated TSS concentrations during slightly lower concentrations during moist, dry, and low flow conditions. Elevated TSS concentrations during moist, dry, and low flows are consistent with significant loads coming from stream bank and gully erosion.

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 EPA (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 Big Raccoon-Wabash 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 macroinvertebrate community mIBI scores. Additional information regarding IBI and mIBI scores is available in Section 1.1.2.

Substrate and bank erosion/riparian zone metric scores were totaled and plotted against both fish community IBI scores and macroinvertebrate community mIBI scores (Figure 27 and Figure 28). Lower values for the substrate and bank erosion/riparian zone metrics indicate greater observed siltation within the stream and/or lower riparian and flood-plain quality. Lower IBI and mIBI scores indicate fewer individuals and/or low species diversity was observed within a stream. The R2 value for the macroinvertebrate community was approximately 0.98. These values indicate a negative correlation between excessive siltation and low mIBI scores for the macroinvertebrates. The fish community scores are reflective of a good community. However, it has been determined that the excessive sand and silt observed in the field has caused poor habitat for macroinvertebrate communities. This analysis provides additional evidence that excessive siltation within a stream is linked to IBCs throughout the Big Raccoon-Wabash River watershed in addition to elevated TSS monitoring data.

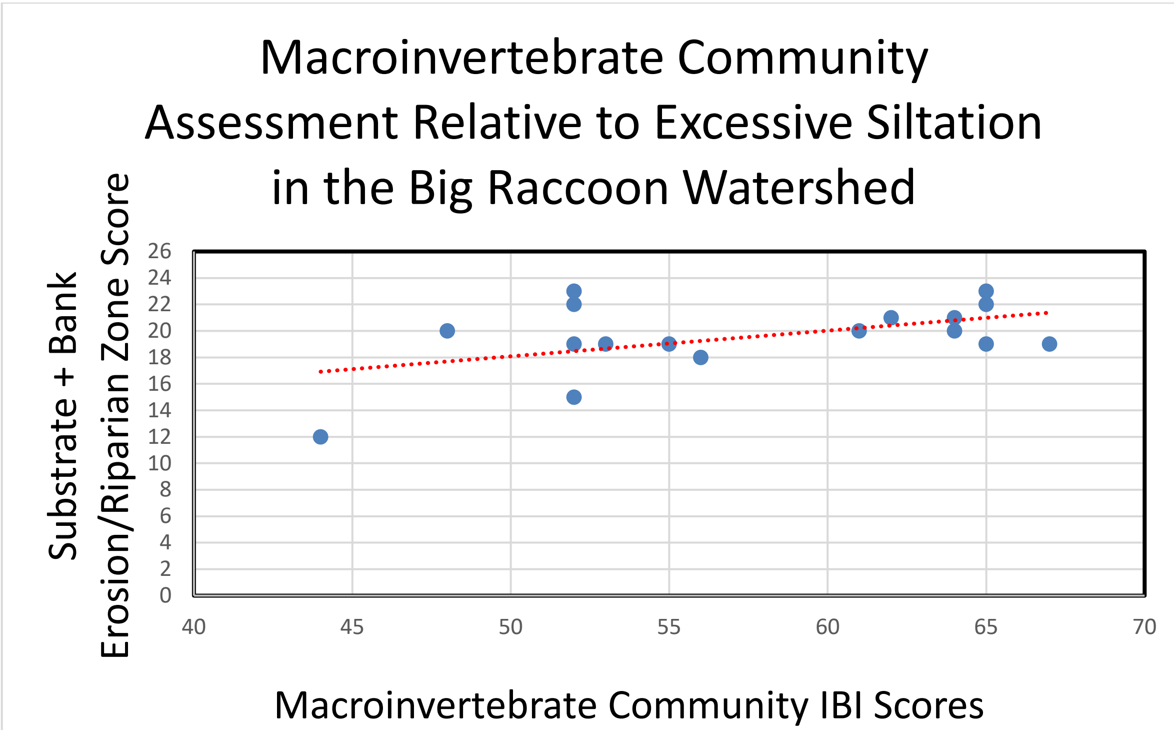

Figure 27: Substrate + Bank Erosion/Riparian Zone Score in Relation to Macroinvertebrate Community mIBI Scores in the Big Raccoon Watershed

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 Town of Mecca

The Town of Mecca subwatershed has an area of approximately 24 square miles and drains around 520 square miles from the three neighboring watersheds the Little Raccoon Creek (HUC10: 0512010813), Flow Run-Big Raccoon Creek (HUC 10: 0512010814), and Cecil M Harden Lake-Big Raccoon (HUC 10: 0512010812). The subwatershed drains into the main stem of the Wabash River just east of Montezuma, IN. The land use is primarily forest land (49 percent) followed by agriculture (37 percent) and hay and developed land (10 percent). There is one WWTP permit held by Riverton Parks JR, SR, HS (IN0045861), one PWS permit held by Superior Forest Products (IN0064335), two industrial permits Superior Products (INRM02306) and Mecca Auto Salvage (INRM01353), as well as one construction permit for Indiana American Water Main project (INRA09186). 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 has some elevation changes and holds some agricultural production and use. In some areas of the subwatershed, there are few remaining riparian buffers left along its banks despite agricultural practices. In addition to the changes in elevation, the subwatershed also contains 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 almost 40 percent of land used as pastureland a heavy presence of pasture animals is expected.

There are four monitoring sites located in this subwatershed. Sites T01, T03, and T05 are located on Big Raccoon Creek and site T02 is located on a tributary of Big Raccoon Creek (Figure 28). In 2022 and 2023 this watershed was sampled 38 times between the four sites. Sites T01 and T03 exceeded the single sample max for *E. coli* 5/10 samples taken. Site T02 continuously ran dry around sampling events preventing a sufficient number of samples to confidently determine an *E. coli* impairment. Site T01 received a geomean of 376.2 cfu/100ml. Site T03 received a geomean of 318.4 cfu/100ml. Site T05 exceeded the single sample max for *E.* coli 7/10 samples taken and received a geomean of 396.5 cfu/100ml. The *E. coli* water quality samples from all sites were used to calculate the geomean and were taken on the same day approximately one hour apart for five consecutive weeks. There is one WWPT permit and one PWS permit the discharges into the subwatershed. Riverton Parks JR, SR, HS (IN0045861) is permitted to discharge into the Big Raccoon Creek. This facility has experienced numerous permit violations over the past five years for *E. coli*. However, the permitted limits currently set should not require updates to the permit at this time. Therefore, both point source and non-point sources may be contributing to the elevated levels of *E. coli* experienced during sampling events. High levels of non-point sources of *E.* coli are reflective of wildlife populations, agricultural runoff, possible leaking and failing septic systems.

The fish community IBI score for site T01 was 52 (good) and the QHEI was 67 (excellent). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 55 (excellent). The fish community IBI score for site T02 was 46 (good) and the QHEI was 60 (good). The macroinvertebrate community mIBI score was 38 (fair) and the QHEI was 52 (good). The fish community IBI score for site T03 was 52 (good) and the QHEI was 62 (excellent). The macroinvertebrate community mIBI score was 44 (fair) and the QHEI was 52 (good). The fish community IBI score for site T05 was 50 (good) and the QHEI was 64 (excellent). The macroinvertebrate community mIBI score was 38 (fair) and the QHEI was 56 (excellent). Based on assessments of this data, stream T05 will be delisted for IBC on the 2026 303(d) listing.

There are two permits within the subwatershed Riverton Parks JR, SR, HS (IN0045861) and Superior Forest Products (IN0064335). Superior Forest Products only experienced violations in 2020 which did not cause issues during sampling events. Riverton Parks JR, SR, HS has experienced some violations that were recorded by IDEM. These violations went through a remediation process which included the replacement of filters, cleaning pumps, and adding additional drainage areas to prevent future violations during large rainstorm events.

There are approximately 27 miles of streams in the subwatershed. Based on IDEM data collected in 2022 and 2023, there will be roughly 5 stream miles impaired for DO (site T2) and 22 stream miles impaired for *E. coli* (T1, T3, and T5). These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, a TMDL has been developed to address *E. coli* impairments in this subwatershed. Site 2 consistently ran dry during sampling events preventing a conclusive linkage for low DO levels. The load duration curve for the Town of Mecca subwatershed is shown in Figure 29. Table 34 provides a summary of the Town of Mecca 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*.

A precipitation graph (Figure 30) and a water quality duration graph (Appendix D) were created to further analyze potential sources. Elevated levels of pollutants during rain events indicate streams are susceptible to high loads of from run-off for *E. coli*. However, the precipitation graph illustrates that streams are also consistently in violation of water quality standards even during drier conditions for *E. coli*. This indicates point sources may also be contributing in addition to nonpoint sources. The water quality duration graph, as well as limited permitted sources, indicate the majority of sources of *E. coli* in this watershed are nonpoint sources. Nonpoint sources may include wildlife, pasture animals with direct access to streams, agriculture practices, land application of animal waste, straight pipes, and leaking and failing septic systems. If animals have direct access to streams, this could contribute to *E. coli* violations in dry and wet conditions as indicated by the precipitation graph. Drought events can also cause a decrease in flow causing a concentration of pollutants in streams.

To achieve necessary load reductions for *E. coli* implementation in the Town of Mecca subwatershed should primarily focus on best management practices (BMPs) that have an impact throughout moist, mid-range, low, and dry flow regimes. See Section 6.1 and Table 41 for information pertaining to potentially suitable BMP selection for the Big Raccoon-Wabash River watershed.

Table 34: Summary of Town of Mecca Subwatershed Characteristics

Town of Mecca (051201081504)					
Drainage Area	537.19 square miles				
Surface Area	23.64 square miles				
Site # [IDEM Station ID]	T01 [WLV-190-0010], T02 [WLV-15-004], T03 [WLV-190-0012], T05 [WLV-15-0017]				
Listed Segments	INB08F4_04; INB08F4_T1008; INB08F4_03; INB08F4_05				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*]				
Land Use	Agricultural Land: 37% Forested Land: 49% Developed Land: 6% Open Water: <1% Pasture/Hay: 4% Grassland/Shrubs: 0% Wetland: 5%				
NPDES Facilities	Riverton Parks JR, SR, HS (IN0045861) & Superior Forest Products (IN0064335)				
CAFOs	NA				
CFOs	NA				
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	9.84E+11	4.62E+11	2.27E+11	9.13E+10	4.64E+10
WLA (Total)	4.73E+07	4.73E+07	4.73E+07	4.73E+07	4.73E+07
MOS (10%)	1.16E+11	5.43E+10	2.67E+10	1.07E+10	5.46E+09
Future Growth (5%)	5.79E+10	2.72E+10	1.33E+10	5.37E+09	2.73E+09
Upstream Drainage Input	9.27E+12	4.32E+12	2.10E+12	8.14E+11	3.89E+11
TMDL = LA+WLA+MOS	1.04E+13	4.86E+12	2.36E+12	9.21E+11	4.44E+11
WLA					
Riverton Parke JR SR HS (IN0045861)	4.73E+07	4.73E+07	4.73E+07	4.73E+07	4.73E+07

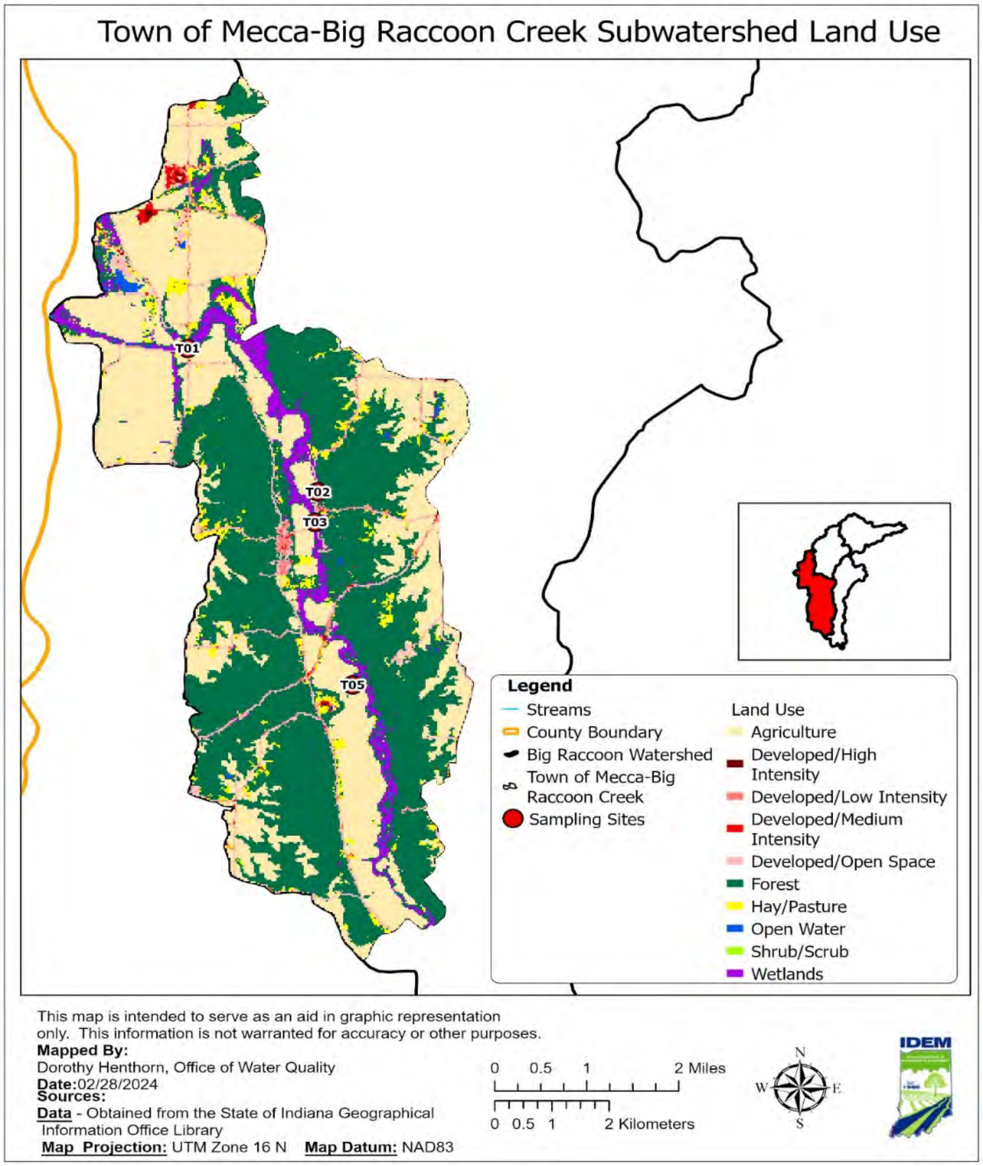

Figure 28: Sampling Stations in Town of Mecca Subwatershed

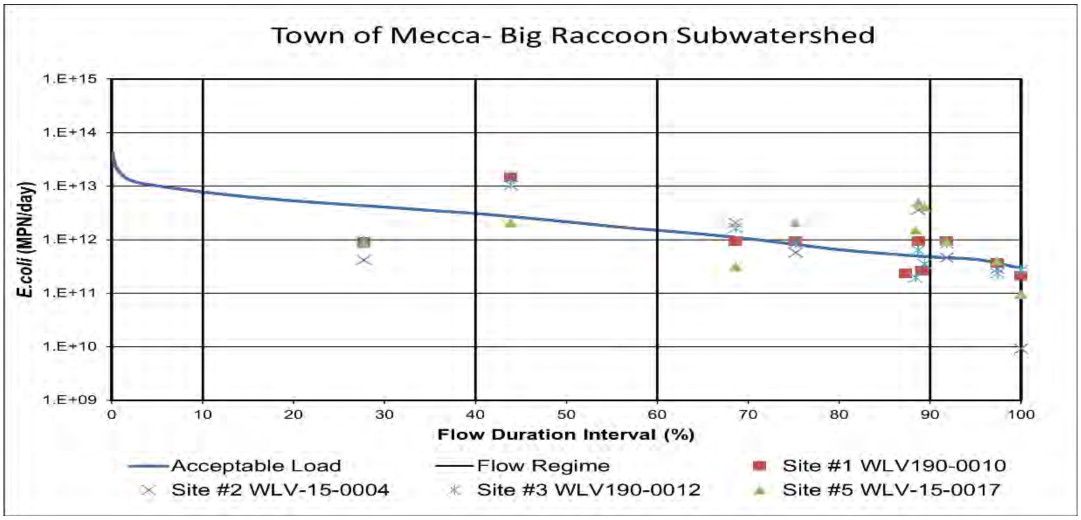

Figure 29: *E. coli* Load Duration Curve for Town of Mecca Subwatershed.

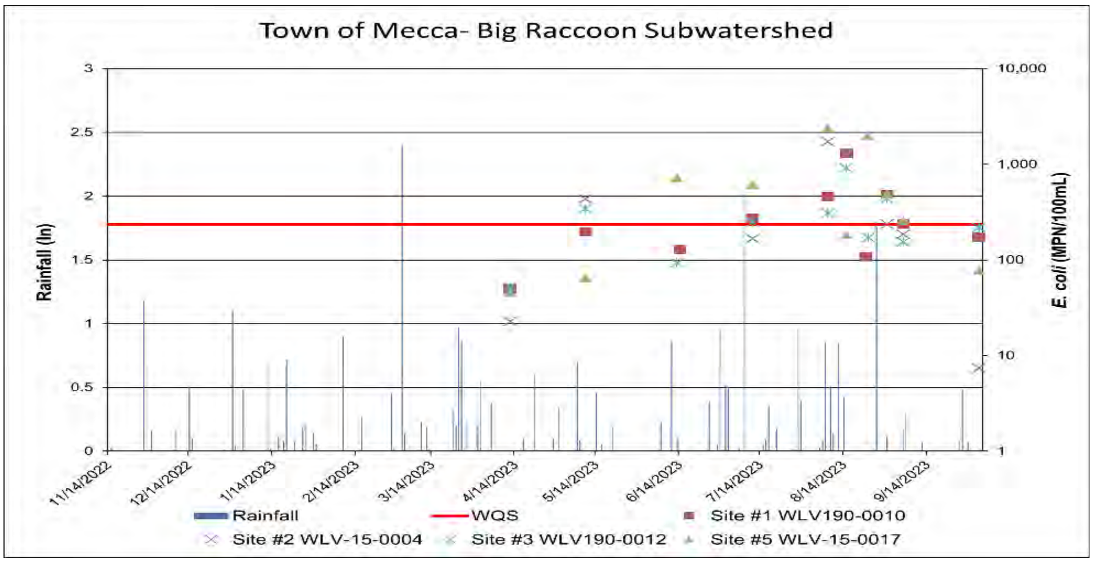

Figure 30: Graph of Precipitation and *E. coli* Data Town of Mecca Subwatershed

4.2.2 Rock Run-Big Raccoon

The Rock Run-Big Raccoon subwatershed drains approximately 465 square miles with a majority being received from three neighboring watersheds the Little Raccoon Creek (HUC10: 0512010813), Flow Run-Big Raccoon Creek (HUC 10: 0512010814), and Cecil M Harden Lake-Big Raccoon (HUC 10: 0512010812) an actual land area of approximately 18 square miles. Water drains east to west, through the Town of Mecca subwatershed and into the Wabash River. The land use is primarily forest land (46 percent), followed by agriculture (39 percent) and developed land and hay and pastureland (roughly 14 percent). There is one Industrial permit, Mecca Salvage & Recycling (INRM20501) and three construction permits, Parke Heritage Tennis Courts (INRA09538), O'Reilly (INRA05244), and Street Reconstruction (INRA10314) within the subwatershed.

The majority of the subwatershed is rural indicating homes pump to on-site septic systems. The soil in Rock Run-Big Raccoon subwatershed's septic suitability 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 with some elevation in the northern parts of the subwatershed, leading to its conversion to agricultural crop production and use. In many areas of the subwatershed there are little remaining riparian buffers along the streambanks due to agricultural practices. Despite its limited elevation the subwatershed does contain significant amounts of highly erodible soil types in the northeastern and southwestern areas. 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.

Some parts of the waterways within this subwatershed, mainly in the northern portion, 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 a land use of seven percent pastureland, a heavy presence of pasture animals is not expected.

There are four monitoring sites located in this subwatershed. Site T06 is located on Big Raccoon Creek, T07, and T10 are located on Run Rock, and T09 is located on a Tributary of Rock Run. These sampling locations were used to characterize inflowing pollutants in the subwatershed (Figure 31).

In 2022 and 2023, sites T06 and T07 were sampled 16 times, and sites T09 and T10 were sampled 11 times. Site T06 exceeded the single sample max for *E. coli* 6/10 samples taken and received a geomean of 224.5 cfu/100ml. T07 exceeded the single sample max for *E*. *coli* 4/10 samples taken and received a geomean of 351.6 cfu/100ml. Site T09 exceeded the single sample max for *E*. *coli* 6/10 samples taken and received a geomean of 646 cfu/ml. Site T10 exceeded the single sample max for *E*. *coli* 9/10 samples taken and received a geomean of 1382.2 cfu/100ml. The *E. coli* water quality samples from all sites were used to calculate the geomean were taken on the same day approximately one hour apart for five consecutive weeks. High levels of *E*. coli are reflective of high gradient slopes along the banks causing runoff and erosion, possible leaking or failing septic systems, and agricultural runoff.

The fish community IBI score for site T06 was 54 (excellent) and the QHEI was 64 (excellent). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 52 (good). The fish community IBI score for site T07 was 40 (fair) and the QHEI was 52 (good). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 52 (good). The fish community IBI score for site T010 was 42 (fair) and the QHEI was 59 (excellent). The macroinvertebrate community mIBI score was 24 (poor) and the QHEI was 64 (good). The fish community IBI score for site T09 was 54 (excellent) and the QHEI was 64 (excellent). The macroinvertebrate community mIBI score was 30 (poor) and the QHEI was 65 (excellent). Sites T9 and T10 will be listed as impaired for biotic communities despite fair fish community QHIE scores. The QHEI scores indicate that the habitat within this subwatershed is supporting for fish communities but high levels of sand and silt hinder the macroinvertebrate habitat requirements. Therefore, two stream segments were determined to be impaired for biological communities (IBC) with Rock Run-Big Raccoon subwatershed.

Evaluation of total phosphorus monitoring data and QHEI substrate and bank erosion/riparian zone metrices scores indicate a linkage between IBC impairments, nutrient loads, and DO impairments in the subwatershed. TP concentrations ranged from 0.05 mg/L to 0.34 mg/L across 38 sampling events within the subwatershed and exceeded the target value twice. The load duration curve indicates that TP levels increase in moist conditions. Two stream segments were determined to be impaired for DO, one stream segment to be impaired for nutrients, and two stream segments to be impaired for IBC with a TP sampling event being over the target values. Moderate siltation was observed at most sites with the substrate being primarily sand with observations of silt and a very narrow riparian width causing bank erosion. Reports indicate little to no buffer zones in between the streams and development areas which limit the amount of runoff that can be intercepted. The flood-plain quality was documented as open pasture/row crop at 66% of sampling sites. Non-point source run-off with concentrations of fertilizer could be contributing to the nutrient levels considering site T10’s proximity to a few homes and crop fields with a limited forested buffer in between. Therefore, a TMDL for TP was developed to address IBC, nutrients and, DO impairment for this subwatershed.

There are four construction sites permitted within the subwatershed. Moving soil during construction events can cause additional runoff into streams, causing rises in TP levels. These measurements have been outlined within the table below. However, due to their locations and limited projected soil movements, it is most likely nonpoint source pollutants that have caused these impairments. It is possible that nonpoint source pollutants could be from field runoff or fertilizer from residential homes in the area and causing an increase of phosphorus loads, resulting in a decrease in oxygen levels. Additional factors such as failing septic systems and impeded flow could also be contributing factors.

There are approximately 30 miles of streams in the subwatershed. Based on IDEM data collected in 2022 and 2023, there will be 4 stream miles impaired for biotic communities, DO, and nutrients (T9 and T10) and approximately 30 stream miles impaired for *E. coli* (all sites). These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, a TP TMDL was developed to address IBC, DO, and nutrients, and an *E. coli* TMDL was developed to address *E. coli* in this subwatershed. Load duration curves for the Rock Run-Big Raccoon subwatershed are listed in Figures 32- 34. Table 35 provides a summary of the Rock Run-Big Raccoon subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, as well as LA, WLAs, and MOS values for *E. coli* and TP.

A precipitation graph (Figures 35-37) and a water quality duration graph (Appendix D) were created to further analyze potential sources. Elevated levels of pollutants during rain events indicate streams are susceptible to high loads of *E. coli* and TP from run-off. However, precipitation graphs illustrate that streams are also consistently in violation of water quality standards even during drier conditions for *E. coli*. This indicates point sources may be contributing along with nonpoint sources. The water quality duration graph indicates the majority of sources of *E. coli* and TP in this watershed are nonpoint sources. Drought events can also cause a decrease in flow causing a concentration of pollutants in streams. Nonpoint sources may include agricultural practices, streambank erosion, and transportation site run-off.

To achieve necessary load reductions for *E. coli* and TP implementation in the Rock Run-Big Raccoon subwatershed should primarily focus on best management practices (BMPs) that have an impact throughout moist, mid-range, low, and dry flow regimes. See Section 6.1 and Table 41 for information pertaining to potentially suitable BMP selection for the Big Raccoon-Wabash River watershed.

Table 35: Summary of Rock Run-Big Raccoon Subwatershed Characteristics

Rock Run-Big Raccoon (051201081503)	
Drainage Area	447.76 square miles
Surface Area	18.19 square miles
Site # [IDEM Station ID]	T06 [WLV190-0003], T07 [WLV-15-0006], T09 [WLV190-0017], T10 [WLV190-0016
Listed Segments	INB08F3_01, INB08F3_T1004, INB08F3_T10002, INB08F3_T1003
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*], Impaired Biotic Communities [TP], Nutrients [TP], DO [TP]
Land Use	Agricultural Land: 39% Forested Land: 46% Developed Land: 6.7% Open Water: 0% Pasture/Hay: 7% Grassland/Shrubs: 0% Wetland: 1%
NPDES Facilities	Mecca Auto Salvage & Recycling (INRM02501), Parke Heritage Tennis Courts (INRA09538), O'Reilly (INRA05244), Street Reconstruction (INRA10314)
CAFOs	NA
CFOs	NA

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	3.10E+11	1.44E+11	7.00E+10	2.72E+10	1.30E+10
WLA (Total)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MOS (10%)	3.64E+10	1.70E+10	8.24E+09	3.20E+09	1.53E+09
Future Growth (5%)	1.82E+10	8.49E+09	4.12E+09	1.60E+09	7.64E+08
Upstream Drainage Input	8.94E+12	4.16E+12	2.02E+12	7.85E+11	3.75E+11
TMDL = LA+WLA+MOS	9.30E+12	4.33E+12	2.10E+12	8.17E+11	3.90E+11

TMDL TP Allocations (lbs/day)

Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
LA	87.11	40.60	19.71	7.65	3.66
WLA (Total)	0.00	0.00	0.00	0.00	0.00
MOS (10%)	10.25	4.78	2.32	0.90	0.43
Future Growth (5%)	5.12	2.39	1.16	0.45	0.22
Upstream Drainage Input	2,515.09	1,172.10	569.12	220.88	105.54
TMDL = LA+WLA+MOS	2,617.58	1,219.86	592.31	229.88	109.84

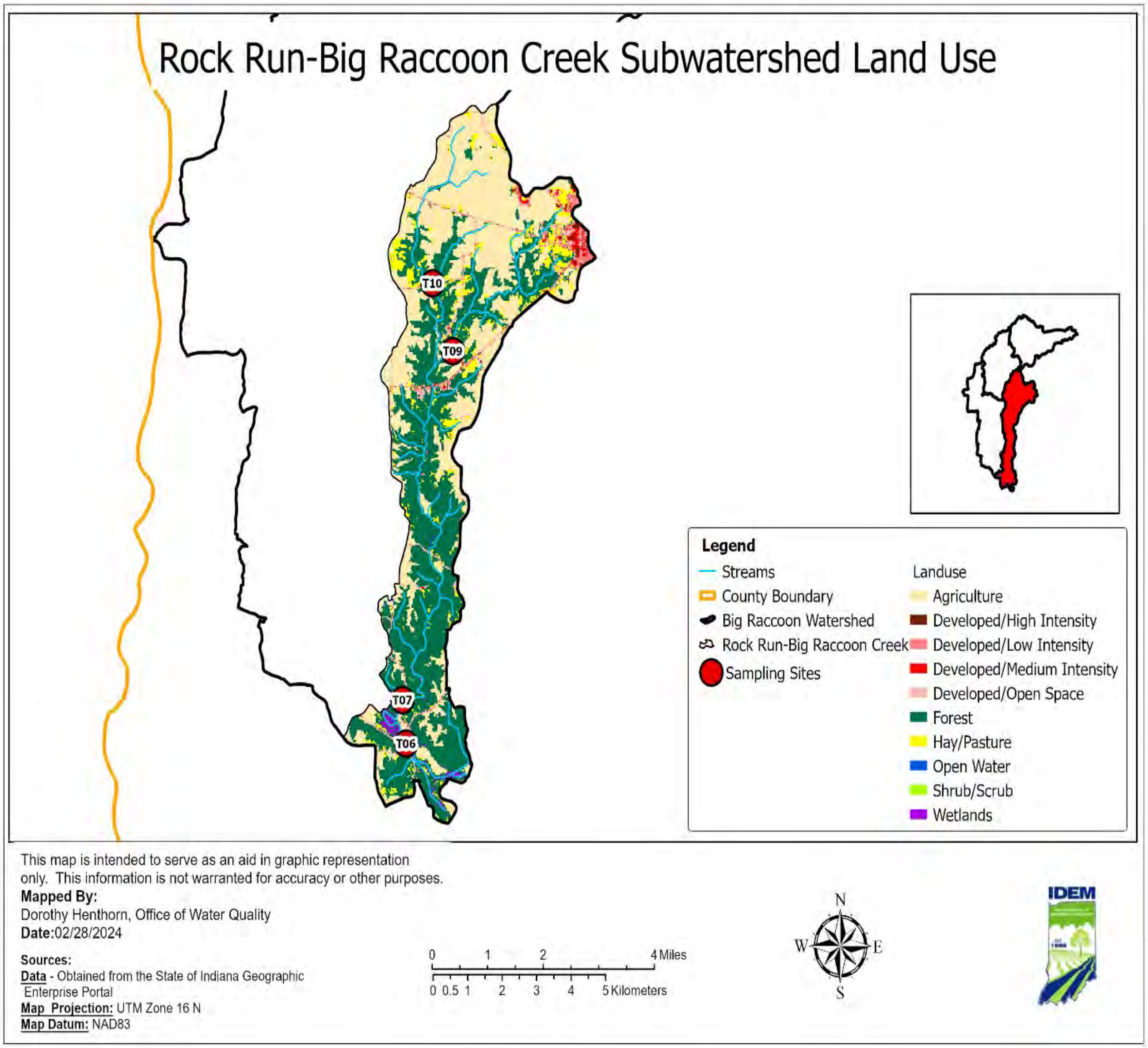

Figure 31: Sampling Stations in Rock Run–Big Raccoon Subwatershed

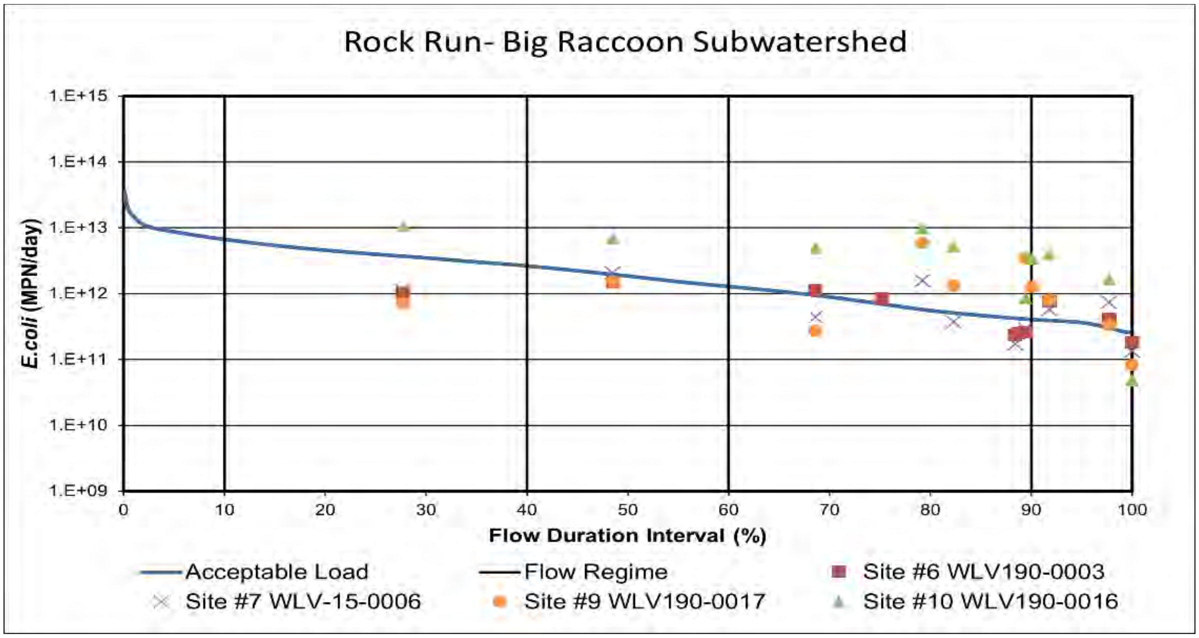

Figure 182: *E. coli* Load Duration Curve for Rock Run-Big Raccoon Subwatershed

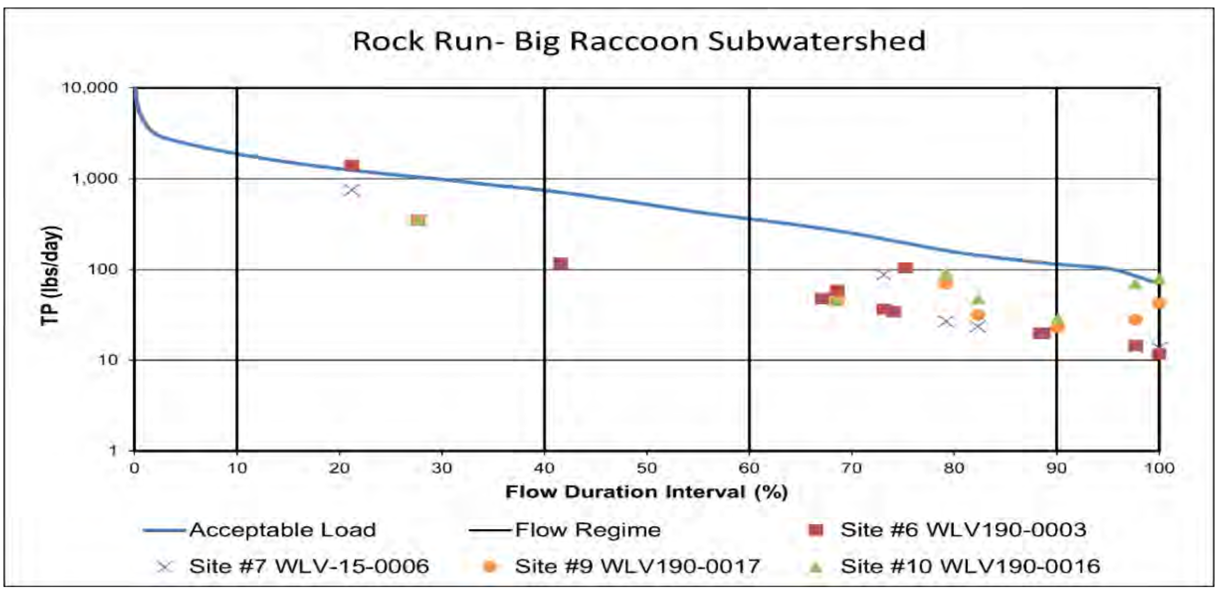

Figure 193: TP Load Duration Curve for Rock Run-Big Raccoon Subwatershed

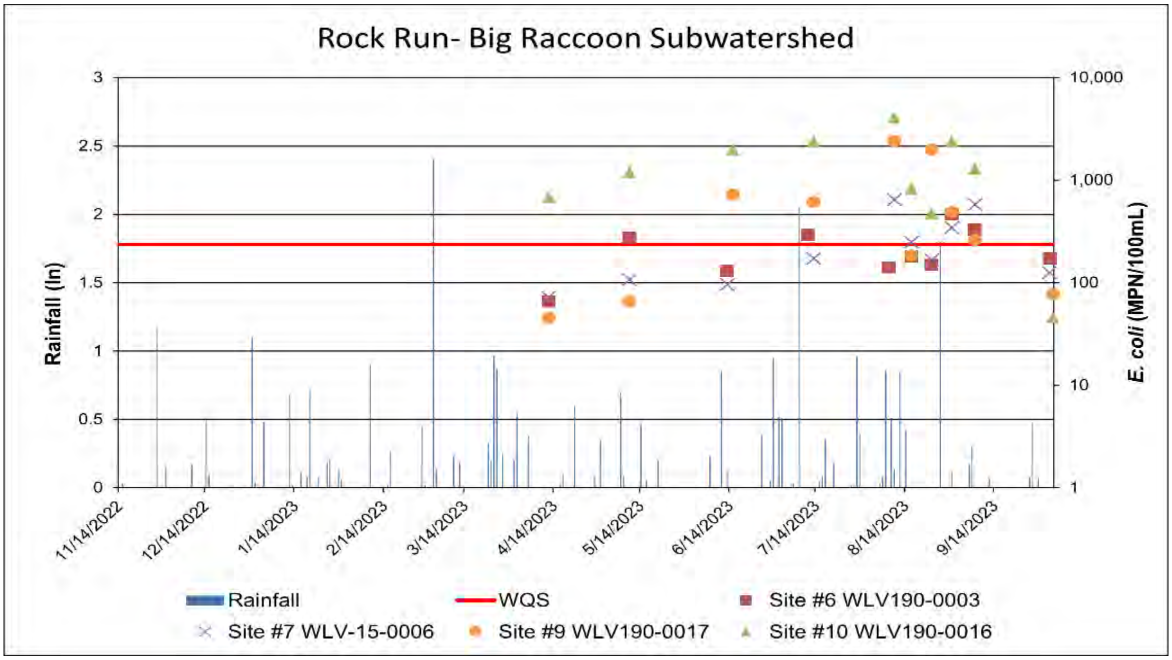

Figure 204: Graph of Precipitation and E. *coli* Data in Rock Run-Big Raccoon Subwatershed

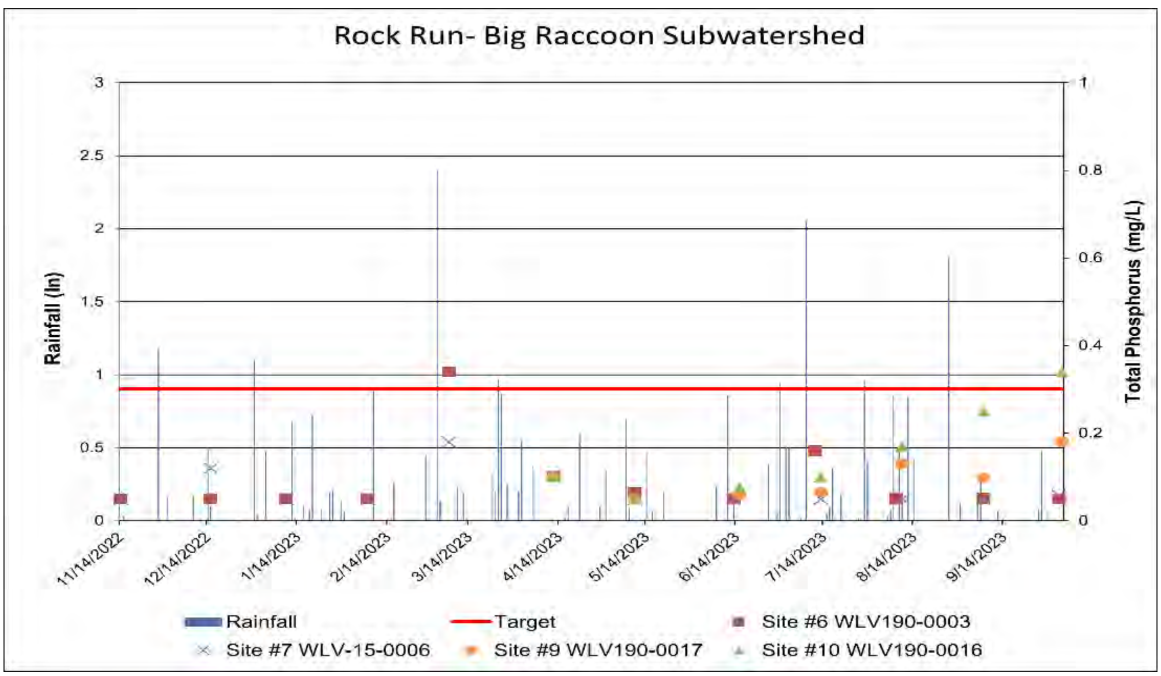

Figure 35: Graph of Precipitation and TP Data in Rock Run-Big Raccoon Subwatershed

4.2.3 Rocky Run-Leatherwood

The Rocky Run-Leatherwood subwatershed drains approximately 16 square miles that receives flow from Cat Creek which drains into the mainstem of the watershed and into the Wabash River just north of Montezuma, IN. The land use is primarily forested land (43 percent), followed by agricultural land (roughly 38 percent) and hay and pastureland (12 percent). There are no NPDES permitted facilities in the subwatershed. 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 inspection of septic systems in the area is important to ensure proper function and capacity. The landscape in the area is relatively flat with some elevation in the western and northern parts of the subwatershed, 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 streambanks due to agricultural practices. Despite its limited elevation 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.

Some parts of the waterways primarily in the northern and eastern part of 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 a land use of twelve percent pastureland, a heavy presence of pasture animals is not expected.

There are five monitoring sites located in this subwatershed. Sites T12, T13 and T15 are located on Leatherwood Creek, site T11 is located on Rocky Run, and site T14 is located on Little Leatherwood Creek. (Figure 38). In 2022 and 2023, sites T11 and T12 were sampled 16 times and sites T13, T14, and T15 were sampled 11 times. Sites T11 and T12 both exceeded the single sample max for *E.* coli 6/10 samples taken. The E. coli geomean for site T11 was 460.5 cfu/100ml and site T12 was 553 cfu/100ml. Site T13 exceeded the single sample max for E. coli 6/10 samples taken and received a geomean of 870.9 cfu/100ml. Site T14 exceeded the single sample max for *E.* coli for all 10 samples taken and received a geomean of 5,399 cfu/100ml. Site T15 exceeded the single sample max for *E*. coli 9/10 samples taken and received a geomean of 1,202.5 cfu/100ml. The *E. coli* water quality samples used to calculate the geomean were taken on the same day approximately one hour apart for five consecutive weeks. High levels of *E*. coli are reflective of runoff, possible leaking or failing septic systems, high concentrations of pasture animals, and wildlife.

The fish community IBI score for site T11 was 50 (good) and the QHEI was 71 (excellent). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 52 (good). The fish community IBI score for site T12 was 48 (good) and the QHEI was 67 (excellent). The macroinvertebrate community mIBI score was 42 (fair) and the QHEI was 67 (excellent). The fish community IBI score for site T13 was 46 (good) and the QHEI was 77 (excellent). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 64 (excellent). The fish community IBI score for site T14 was 44 (fair) and the QHEI was 48 (good). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 48 (good). The fish community IBI score for site T15 was 42 (fair) and the QHEI was 68 (excellent). The macroinvertebrate community mIBI score was 38 (fair) and the QHEI was 65 (excellent). The QHEI scores indicate that the habitat within this subwatershed is supporting for fish communities but high levels of sand and silt hinder the macroinvertebrate habitat requirements. Therefore, one stream segment was determined to be impaired for biological communities (IBC) within Rocky Run-Leatherwood subwatershed.

Evaluation of TSS monitoring data and QHEI substrate and bank erosion/riparian zone metric scores indicate a linkage between siltation and biological communities impairments in the Rocky Run-Leatherwood subwatershed. TSS concentrations ranged from 2.5 mg/L to 64.1 mg/L across 45 sampling events within the subwatershed and exceeded the target value twice within sites T13 and T14. Siltation was observed at most sampling sites, but silt is not the predominant substrate and observed moderate and narrow riparian width. Moderate erosion was noted at most sampling sites. The flood-plain quality was documented as open pasture/row crop at 80% of sampling sites. Given that the target value for TSS was sporadically violated and indicators of siltation was documented throughout the subwatershed, high TSS is believed to be a linkage to the biotic communities impairments. Therefore, a TMDL for TSS was developed for this subwatershed to address IBC.

There are approximately 27.5 miles of streams in the subwatershed. Based on IDEM data collected in 2022 and 2023, there will be 27.5 stream miles impaired for *E. coli* (all sites), 5 miles impaired for biological communities (site T14). These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, an E. *coli* TMDL was developed to address all *E. coli* impairments and a TSS TMDL was developed to address IBC. The load duration curves for the Rocky Run-Leatherwood subwatershed are shown in Figure 39 and Figure 40. Table 36 provides a summary of the Rocky Run-Leatherwood subwatershed, including listed stream reaches by AUID, drainage area, sampling sites, land use, as well as LA, WLAs, and MOS values for *E. coli* and TSS.

Precipitation graphs (Figure 41 and Figure 42) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Elevated levels of pollutants during rainy events in warmer months of the year indicate streams are susceptible to high loads of *E. coli* and TSS from run-off. However, the precipitation graphs illustrate that streams are also consistently in violation of water quality standards/targets even during drier conditions for *E. coli*. Because there are no permitted discharges within the subwatershed, illegal discharges may be contributing in addition to nonpoint sources. Nonpoint sources may include small animal operations, wildlife, pasture animals with direct access to streams, land application of animal waste, straight pipes, streambank erosion, leaking and failing septic systems, and transportation runoff. Drought events can also cause a decrease in flow causing a concentration of pollutants in streams.

To achieve necessary load reductions for *E. coli* and TSS implementation in the Rocky Run-Leatherwood subwatershed should primarily focus on best management practices (BMPs) that have an impact throughout moist, mid-range, low, and dry flow regimes. See Section 6.1 and

Table 41 for information pertaining to potentially suitable BMP selection for the Big Raccoon-Wabash River watershed.

Table 36: Summary of Rocky Run-Leatherwood Subwatershed Characteristics

Rocky Run-Leatherwood (051201081502)					
Drainage Area	32.13 square miles				
Surface Area	15.7 square miles				
Site # [IDEM Station ID]	T11 [WLV-15-0007], T12 [WLV-15-0008], T13 [WLV-15-0009], T14 [WLV-15-0010], T15 [WLV-15-0011]				
Listed Segments	INB08F2_1004; INB08F2_03; INB08F2_02; INB08F2_T1001; INB08F2_01				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*], Impaired Biotic Communities [TSS]				
Land Use	Forested Land: 43% Agricultural Land: 37.7% Developed Land: 5.5% Open Water: <1% Pasture/Hay: 12% Grassland/Shrubs: 0% Wetland: 1.3%				
NPDES Facilities	NA				
CAFOs	NA				
CFOs	NA				
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	2.67E+11	1.25E+11	6.05E+10	2.36E+10	1.12E+10
WLA	0.00E+00	0.00E+00	0.0E+00	0.00E+00	0.00E+00
MOS (10%)	3.14E+10	1.47E+10	7.113E+09	2.7E+09	1.32E+09
Future Growth (5%)	1.57E+10	7.3E+09	3.56E+09	1.380E+09	6.60E+08
Upstream Drainage Input	3.29E+11	1.533E+11	7.44E+10	2.89E+10	1.38E+10
TMDL = LA+WLA+MOS	6.43E+11	3.00E+11	1.46E+11	5.65E+10	2.70E+10
TMDL TSS Allocations (lbs/day)					
Allocation Category Duration Interval (%)	**High Flows 5%**	**Moist Conditions 25%**	**Mid-Range Flows 50%**	**Dry Conditions 75%**	**Low Flows 95%**
LA	7,518.79	3,503.95	1,701.37	660.30	315.50
WLA	0.00	0.00	0.00	0.00	0.00
MOS (10%)	884.56	412.23	200.16	77.68	37.12
Future Growth (5%)	442.28	206.11	100.08	38.84	18.56
Upstream Drainage Input	9,256.93	4,313.97	2,094.68	812.95	388.44
TMDL = LA+WLA+MOS	18,102.57	8,436.26	4,096.29	1,589.78	759.61

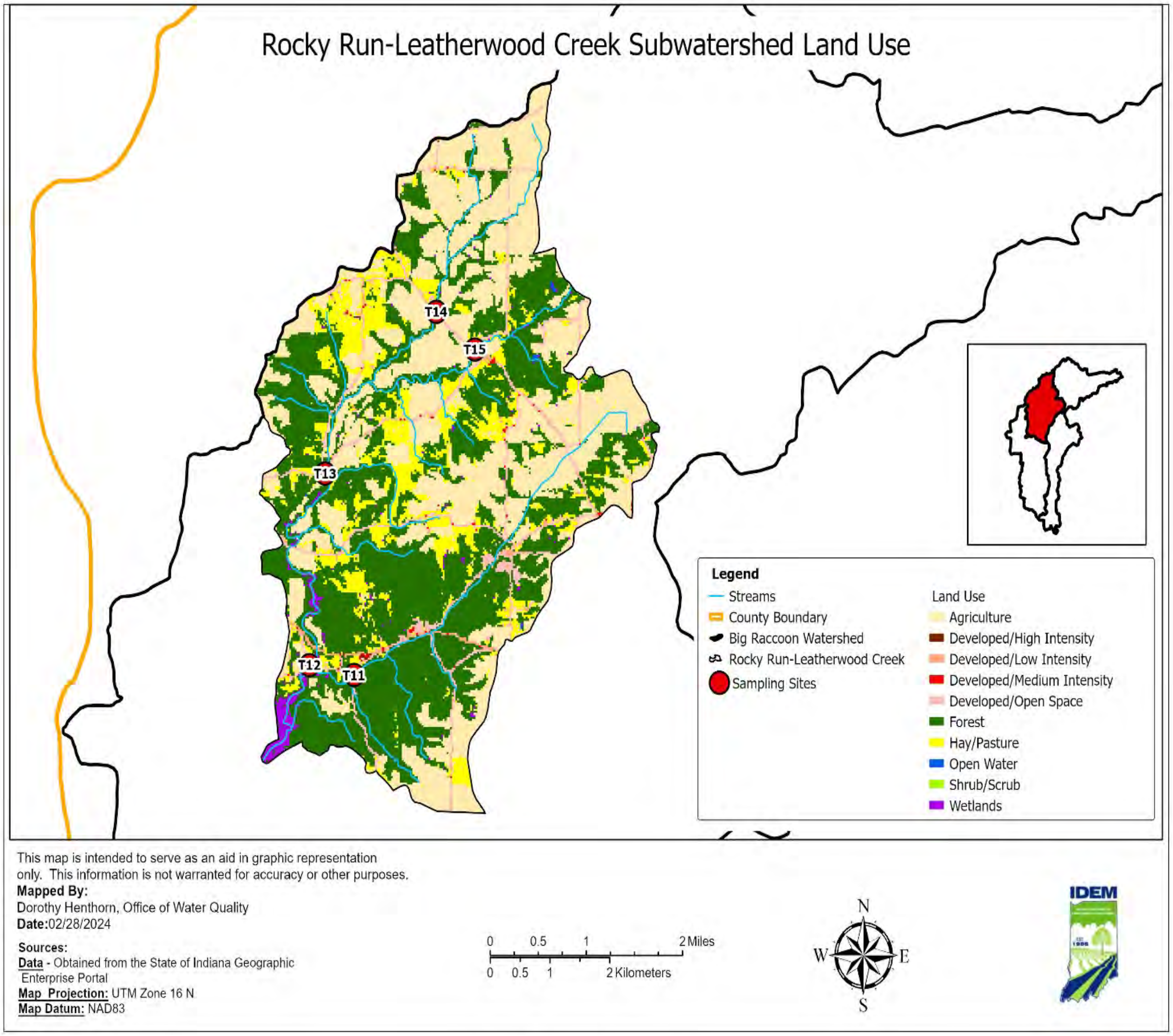

Figure 216: Sampling Stations in Rocky Run-Leatherwood Creek Subwatershed

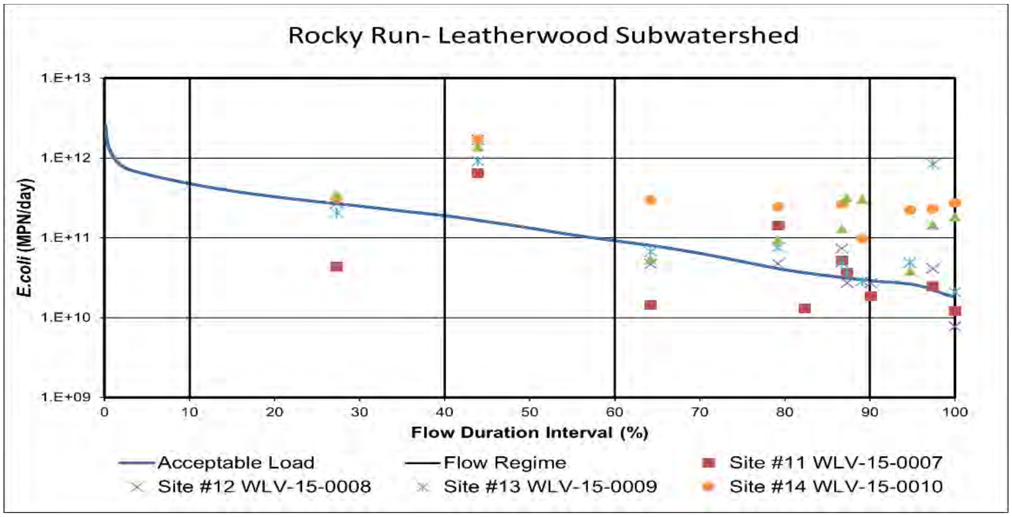

Figure 227: *E. coli* Load Duration Curve for Rocky Run-Leatherwood Subwatershed

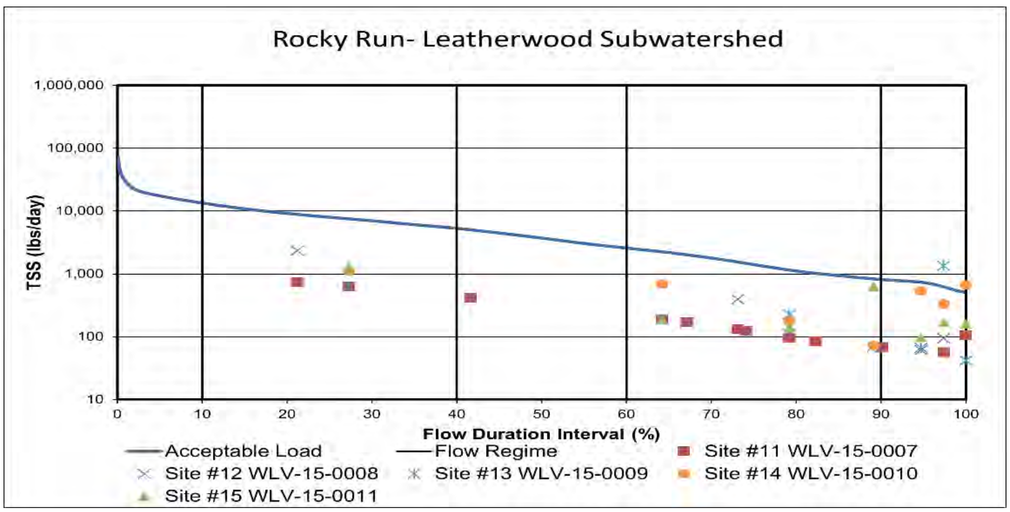

Figure 38: TSS Load Duration Curve for Rocky Run-Leatherwood Subwatershed

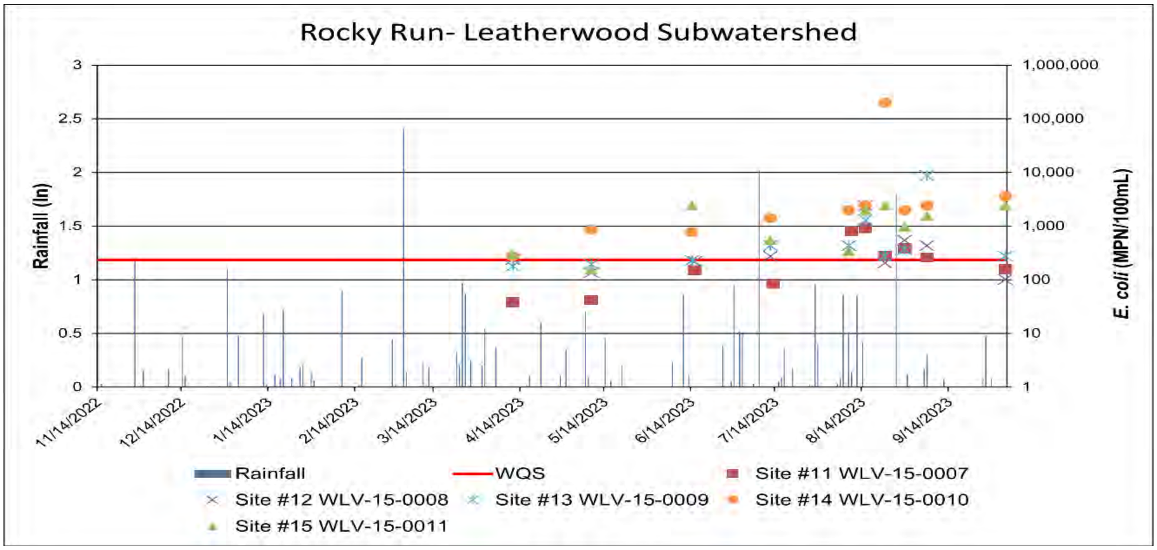

Figure 39: Graph of Precipitation and *E. coli* Data at Rocky Run-Leatherwood Subwatershed

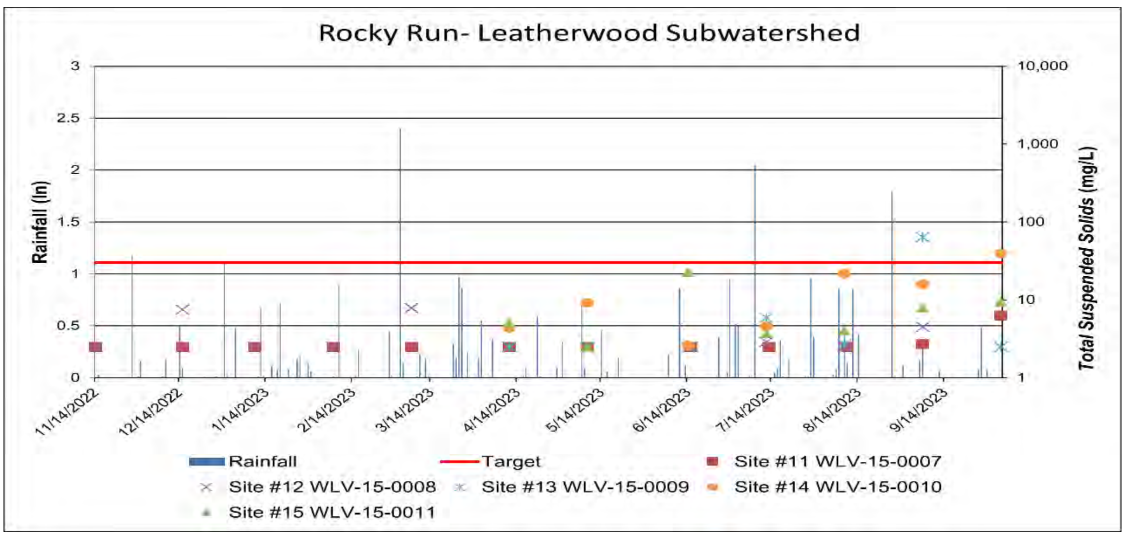

Figure 40: Graph of Precipitation and TSS Data at Rocky Run-Leatherwood Subwatershed

4.2.4 Cat Creek

The Cat Creek subwatershed drains approximately 16.5 square miles into Rocky Run-Leatherwood subwatershed and into the Wabash River. The land use is primarily agriculture (61 percent), followed by forested land (23 percent) and hay/pasture and developed land (15 percent). There is one industrial stormwater permit, Futurex Industries (INRM00709), within Cat Creek subwatershed and there are no MS4 permits in this subwatershed or the entire Big Raccoon-Wabash River watershed. The subwatershed is rural, indicating many homes pump to on-site septic systems. Based on the septic suitability of the soil, the majority of Cat Creek subwatershed is very limited. Maintenance and inspections of septic systems in the area are important to ensure proper function and capacity. While the landscape in the area is flat, 61% of the subwatershed has been converted to agricultural production and use. In parts of the subwatershed there are little to no remaining riparian buffers left along the banks, due to agricultural practices. The subwatershed does contain significant amounts of highly erodible soil types, which can be susceptible to sheet, rill, and isolated gully erosion, and can contribute to sediment loss from agricultural lands.

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 fifteen percent of land used as pastureland, a heavy presence of pasture animals is not expected. There are no permitted CFOs in the watershed.

There are five monitoring sites located in this subwatershed. Site T17 is located on Cat Creek, sites T16, T18, T19, and T20 are located on Leatherwood Creek (Figure 43). In 2022 and 2023 site T16 was sampled 16 times and sites T17, T18, T19, and T20 were each sampled 11 times. Site T16 did not meet the water quality standard to *E*. coli 8/9 samples taken exceeded the single sample max and has an *E*. coli geomean of 855.3 cfu/100ml. Site T17 exceeded the single sample for *E*. coli 6/10 samples taken and received an E. *coli* geomean of 1207.8 cfu/ml. Sites T18 and T19 failed the water quality standard for *E*. coli during each of the 10-sampling events. Site T18 received a geomean of 5015 cfu/100ml, site T19 received a geomean of 960 cfu/100ml. Site T20 did not meet the water quality standard for *E*. *coli* 9/9 samples taken and received a geomean of 1393 cfu/100ml. The *E. coli* water quality samples from all sites used to calculate the geomean were taken on the same day approximately one hour apart for five consecutive weeks. High levels of *E*. *coli* are reflective of high animal concentrations, land application of waste, wildlife, leaking or failing septic systems.

The fish community IBI score for site T16 was 46 (good) and the QHEI was 61 (excellent). The macroinvertebrate community mIBI score was 30 (poor) and the QHEI was 62 (excellent). This will impair site T05 for IBC. The fish community IBI score for site T17 was 44 (fair) and the QHEI was 69 (excellent). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 62 (excellent). The fish community IBI score for site T18 was 42 (fair) and the QHEI was 61 (excellent). The macroinvertebrate community mIBI score was 34 (poor) and the QHEI was 44 (fair). The fish community IBI score for site T19 was 46 (good) and the QHEI was 53 (excellent). The macroinvertebrate community mIBI score was 36 (fair) and the QHEI was 53 (excellent). The fish community IBI score for site T20 was 46 (good) and the QHEI was 63 (excellent). The macroinvertebrate community mIBI score was 28 (poor) and the QHEI was 61 (excellent). IBC impairments were determined to be caused by heavy sediment and low flow or stagnant stream systems for macroinvertebrate communities. Therefore, four of the five stream segments (Sites T16, T17, T18, and T20) were determined to be impaired for biological communities (IBC) with Cat Creek subwatershed. However, a clear pollutant linkage could not be determined at this time for TMDL development.

There are approximately 21 miles of streams in the subwatershed. Based on IDEM data collected in 2022 and 2023, there will be roughly 21 stream miles impaired for *E. coli* and 4.5 stream miles for biological communities. These stream reaches will be listed on the 2026 303(d) List of Impaired Waters. Therefore, TMDLs have been developed to address all *E. coli* impairments (all sites) in the subwatershed. The load duration curves for the Cat Creek subwatershed are shown in Figure 44. Table 37 provides a summary of the Cat 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*.

Precipitation graphs (Figure 45) and water quality duration graphs (Appendix D) were created to further analyze potential sources. Elevated levels of pollutants during rain events indicate streams are susceptible to high loads of *E. coli* from run-off in warmer months. However, the precipitation graphs illustrate that streams are also consistently in violation of water quality standards/targets even during dry and low conditions for E. *coli*. This indicates point sources may also be contributing in addition to nonpoint sources. The water quality duration graphs, as well as limited permitted sources, indicate the majority of sources of pollutants in this watershed are nonpoint sources with some potential inputs from point sources. Nonpoint sources may include wildlife, pasture animals with direct access to streams, streambank erosion, agricultural practices, land application of animal waste, straight pipes, and leaking and failing septic systems. Drought events can also cause a decrease in flow causing a concentration of pollutants in streams.

To achieve necessary load reductions for *E. coli* implementation in the Cat Creek subwatershed should primarily focus on best management practices (BMPs) that have an impact throughout moist, mid-range, low, and dry flow regimes. See Section 6.1 and Table 41 for information pertaining to potentially suitable BMP selection for the Big Raccoon-Wabash River watershed.

Table 37: Summary of Cat Creek Subwatershed Characteristics

Cat Creek (051201081501)					
Drainage Area	16.43 square miles				
Surface Area	16.43 square miles				
Site # [IDEM Station ID]	T16 [WLV-15-0012], T17 [WLV-15-0013], T18 [WLV-15-0014], T19 [WLV-15-0015], T20 [WLV-15-0016]				
Listed Segments	INB08F1_03, INB08F1_T1006, INB08F1_03, INB08F1_02, INB08F1_02				
Listed Impairments [TMDL(s)]	*E. coli* [*E. coli*]				
Land Use	Agricultural Land: 61% Forested Land: 23% Developed Land: 6% Open Water: 0% Pasture/Hay: 9% Grassland/Shrubs: 0% Wetland: <1%				
NPDES Facilities	Futurex Industries (INRM00709)				
CAFOs	NA				
CFOs	NA				
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	2.80E+11	1.30E+11	6.33E+10	2.46E+10	1.1E+10
WLA (Total)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000E+00
MOS (10%)	3.29E+10	1.53E+10	7.44E+09	2.9E+09	1.38E+09
Future Growth (5%)	1.65E+10	7.67E+09	3.72E+09	1.444E+09	6.90E+08
TMDL = LA+WLA+MOS	3.29E+11	1.53E+11	7.44E+10	2.89E+10	1.38E+10

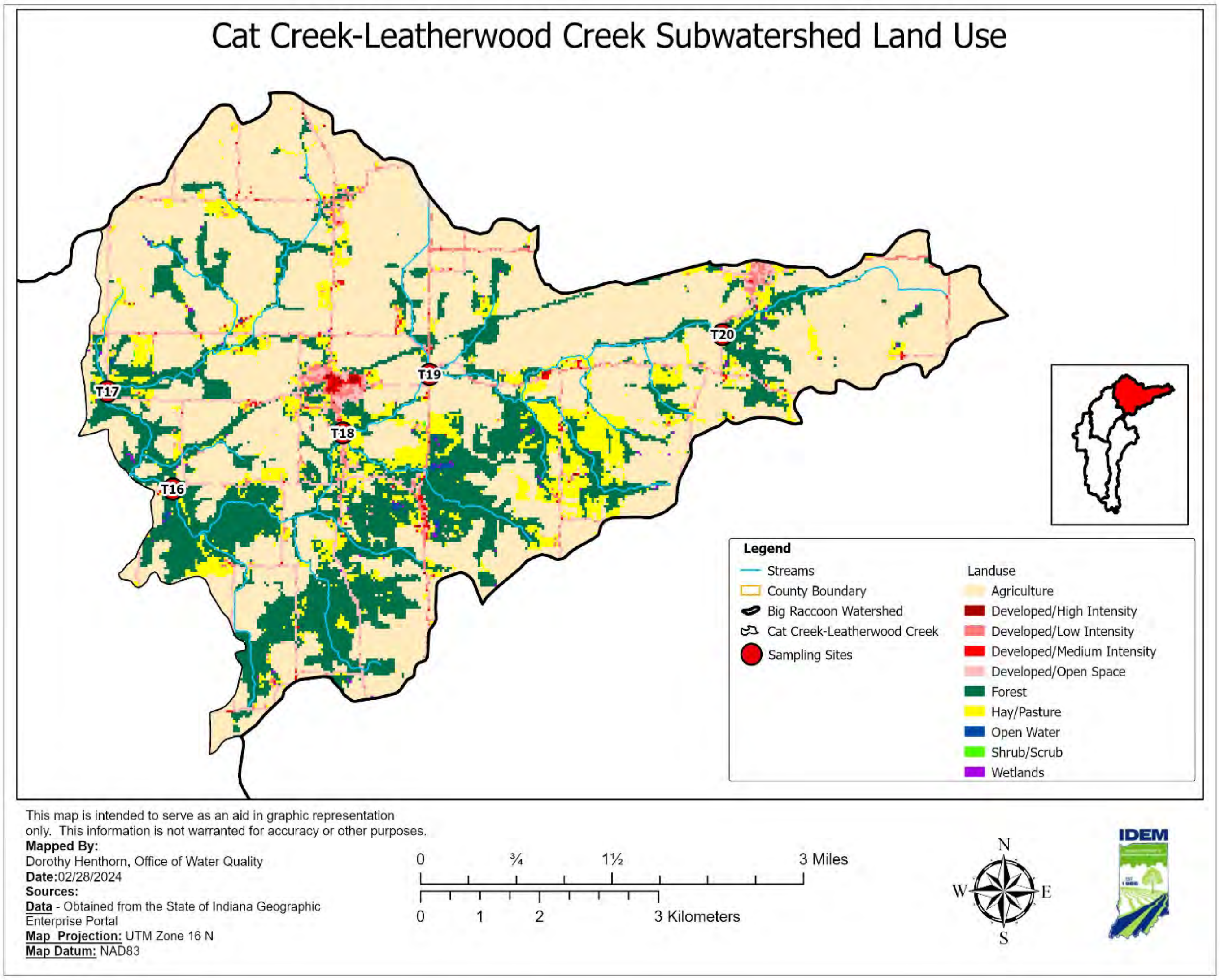

Figure 231: Sampling Stations in Cat Creek Subwatershed

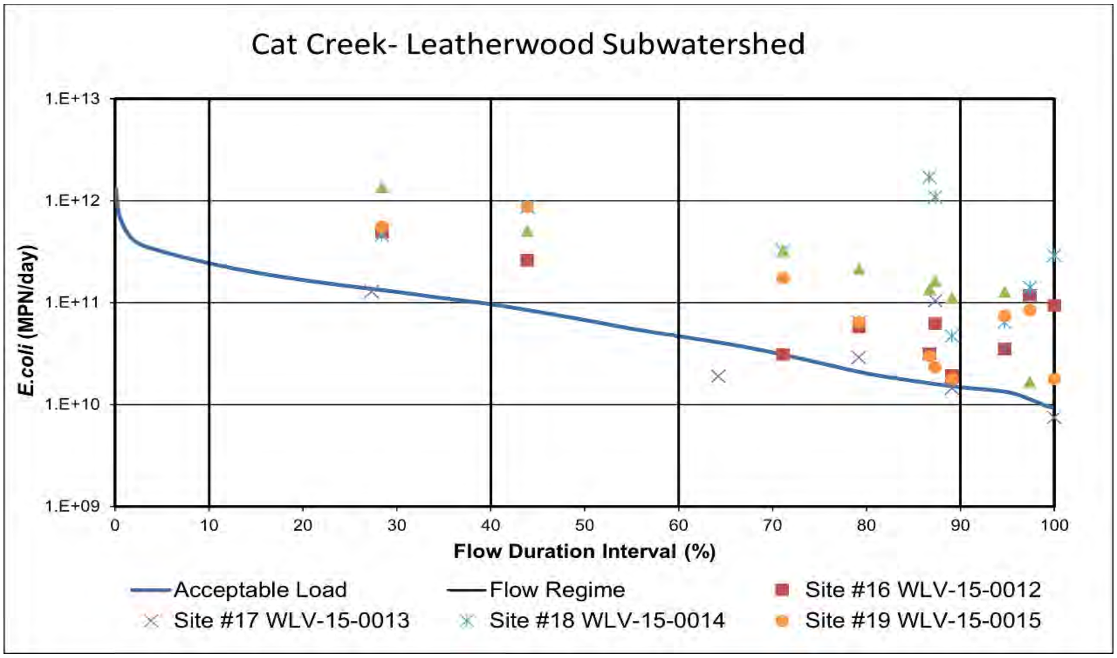

Figure 242: *E. coli* Load Duration Curve for Cat Creek Subwatershed

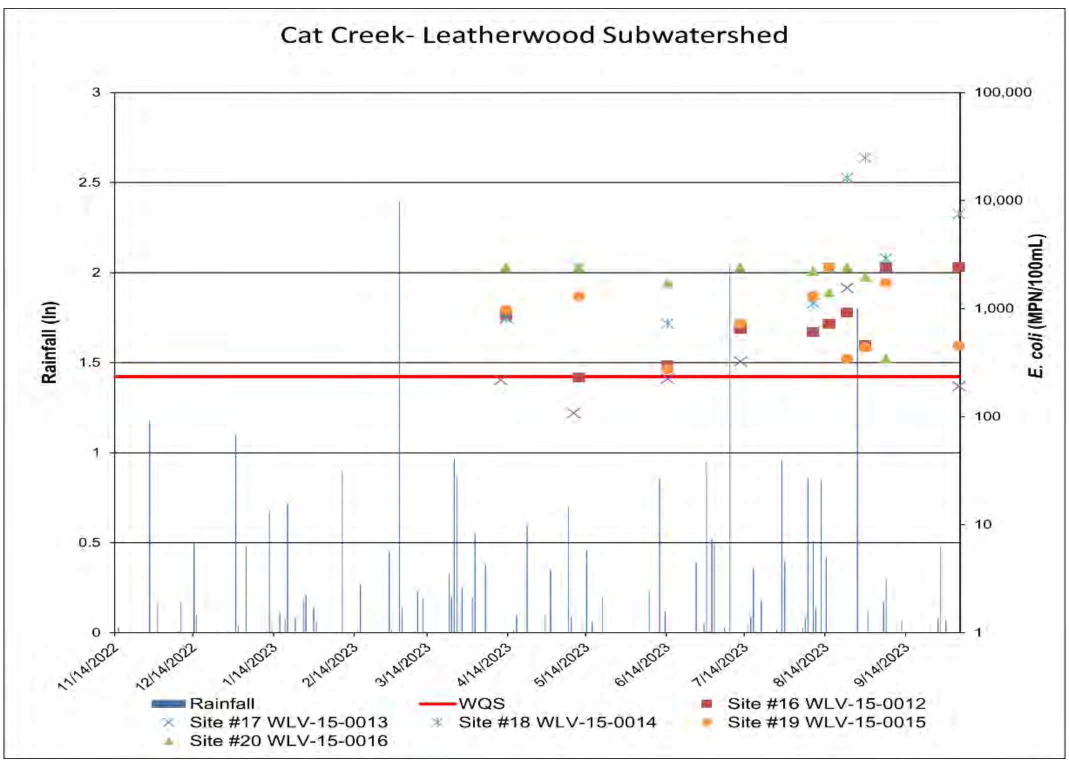

Figure 253: Graph of Precipitation and *E. coli* Data at Cat Creek Subwatershed

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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed by subwatershed.

Table 38: Individual WLAs for NPDES Individual Permit Municipal and Industrial Facilities in the Big Raccoon-Wabash River Watershed

Subwatershed	Facility Name	Permit Number	AUID	Receiving Stream	Flow Regime	Estimated Design Flow (MGD)	*E. coli* WLA (MPN/day)	NPDES Permit *E. coli* Limit
Town of Mecca	Riverton Parke JR SR HS WWTP	IN0045861	INB08F4_T1005	Big Raccoon Creek	All	0.01	4.73E+07	235 MPN/100 mL Daily Max.
	Superior Forest Products PWS	IN0064335	INB08G5_05	Unnamed Tributary of Wabash River	All	0.7	NA	NA

Understanding 38: The WLA for each NPDES permitted facility will be achieved through compliance with the facility's NPDES individual permit.

5.1.1 Approach for Calculating General Permit Waste Load Allocations

A number of permittees in the Big Raccoon-Wabash 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.

Stormwater run-off associated with construction activity is currently regulated under 327 IAC 15-5, which is commonly referred to as "Rule 5" or the construction stormwater general permit. The WLA for sites regulated under the construction stormwater general permit 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 39 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, in 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, 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 40. After existing loading and percentage 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 for most locations occur during the moist to low regimes, and, therefore, implementation of controls should be targeted for these conditions.

Table 39: 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 40: Critical Conditions for TMDL Parameters

Parameter	Subwatershed (HUC)	Critical Condition				
		High	**Moist**	**Mid-Range**	**Dry**	**Low**
E. coli (counts/mL)	Cat Creek-Leatherwood (051201081501)	--	93%	95%	95%	95%
	Rocky Run-Leatherwood (051201081502)	--	57%	95%	92%	95%
	Rock Run-Big Raccoon (051201081503)	--	67%	77%	95%	93%
	Town of Mecca-Big Raccoon (051201081504)	--	NA	90%	62%	74%
Total Suspended Solids (mg/L)	Rocky Run-Leatherwood (051201081502)	--	NA	NA	NA	NA
	Rock Run-Big Raccoon (051201081503)	--	76%	NA	NA	NA
Total Phosphorus (mg/L)	Rock Run-Big Raccoon (051201081503)	--	NA	NA	NA	NA

Note: -- = No Data Collected in Flow Regime; NA = No reduction needed (note: overall reductions still may be needed as critical condition reductions are based on 90th percentile concentrations. Some samples for TP and TSS surpassed the water quality target but not high enough to require reductions at the 90th percentile.)

Table 39 and Table 40 provide the foundation necessary to identify subwatersheds that are in need of the most significant pollutant reductions to achieve water quality standards in the Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 WMP 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 Big Raccoon-Wabash 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, and TP loads from sources throughout the Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed.

Point Sources

- Wastewater treatment facilities
- Industrial facilities
- Illicitly connected straight pipe systems

Nonpoint Sources

- Cropland
- Pastures and livestock operations
- TSS Failing septic systems
- Streambank erosion
- Wildlife
- Urban nonpoint source run-off

6.1 Implementation Activity Options for Sources in the Big Raccoon-Wabash River Watershed

Keeping the list of significant sources in the Big Raccoon-Wabash 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 41 provides a list of implementation activities that are potentially suitable for the Big Raccoon-Wabash 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 41 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 19: List of Potentially Suitable BMPs for the Big Raccoon-Wabash 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**
Inspection and maintenance	X	X	X	X	X						X		
Outreach and education and training	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										
Rain garden		X	X										
Porous pavement		X	X										
Stormwater planning and management	X	X	X	X						X	X	X	
Comprehensive Nutrient Management Plan	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
Constructed Wetland	X	X	X	X		X	X					X	
Critical Area Planting			X					X		X			
Drainage Water Management		X					X						
Nutrient Management Plan		X					X			X			
Land Reconstruction of Mined Land			X							X			
Sediment Basin		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			

The information provided in Section 5.2 assisted in the development of Table 41, 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 41 for each critical flow condition and select activities that are most feasible in the Big Raccoon-Wabash 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 Big Raccoon-Wabash 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 WMP.

***E. coli* Goal Statement:** The waterbodies (or streams) in the Big Raccoon-Wabash 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 (TP) Goal Statement: The waterbodies (or streams) in the Big Raccoon-Wabash River watershed should meet the 0.30 mg/L TMDL TP target value.

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

Total Suspended Solids (TSS) Goal Statement: The waterbodies (or streams) in the Big Raccoon-Wabash River watershed should meet the 30 mg/L TMDL TSS target value.

Total Suspended Solids (TSS) Indicator: Water quality monitoring by IDEM will serve as the environmental indicator to determine progress toward the TSS target value.

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 Big Raccoon-Wabash 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 Big Raccoon-Wabash River watershed.

6.3.1 Federal Programs

CWA Section 319(h) Grants

Section 319 of the federal CWA 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 CWA 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 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. For-profit entities, non-profit organizations, private associations, universities, and individuals are not eligible for funding through Section 205(j). The CWA states that the grants are to be used for water quality management and planning, including, but not limited to:

- Identifying the 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 WMPs.

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 CWA. 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 CWA 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. EPA. 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 IDEM must also issue a Section 401 Water Quality Certification. 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 WWTPs 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 CWA, 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 WMPs, 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 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.

IDEM Hoosier Riverwatch Program

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.

ISDA Division of Soil Conservation

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 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 in. 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.

6.3.3 Local Programs

Programs taking place at the local level are key to successful TMDL implementation. Partners such as Parke & Vermillion SWCDs are instrumental in bringing grant funding into the Big Raccoon-Wabash River watershed to support local protection and restoration projects. This section provides a brief summary of the local programs taking place in the Big Raccoon-Wabash River watershed that will help to reduce pollutant loads, as well as provide ancillary benefits to the Big Raccoon-Wabash River watershed.

Additional monitoring will likely take place in the Big Raccoon Wabash River watershed as a result of the BRC Watershed Project. Local groups frequently conduct monitoring in watersheds with WMPs 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 Section 303(d) List of Impaired Waters.

Parke county is active in obtaining funding and implementing projects in their respective watersheds to improve water quality. The county has a contribution agreement with NRCS to provide technical and administration assistance as a technical advisor. In addition, there are also active and upcoming 319 grants in nearby watersheds located in both counties that will be beneficial for cross-promotion and public awareness with the BRC Watershed Project.

Parke County

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

- Local Parke County SWCD: $22,000
- Vermillion County SWCD: $40,000
- ISDA: $24,000
- Purdue Extension Parke County: $10,000
- The Nature Conservancy: $10,000
- Partnership Parke County: $8,000
- Parke County Community Foundation: $4,000
- Purple Ribbon Seed: $4,500
- Ceres Solutions: $10,000
- Ouabache Land Conservancy: $2,500
- Parke County Sentinel: $6,000 estimate
- Farm Bureau: $2,000 estimate
- Parke trails Alliance: $1,000 estimate
- CCSI: $2,500 estimate

Total: $146,500 estimate

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 Big Raccoon-Wabash River watershed. Table 42 and the following sections identify which programs are relevant to the various sources in the Big Raccoon-Wabash River watershed.

Table 20: Summary of Programs Relevant to Sources in the Big Raccoon-Wabash 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
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																	

6.4.1 Point Source Programs

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. 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 currently regulated under 327 IAC 15-5, which is commonly referred to as "Rule 5" or the construction stormwater general permit. The construction stormwater general permit 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 IBC in the Town of Mecca, Rock Run-Big Raccoon, and Rocky Run-Leatherwood 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 construction stormwater general permit 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.

Industrial Stormwater

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 are a total of four industrial facilities with industrial stormwater general permits and no industrial facilities with an individual stormwater permit within the Big Raccoon-Wabash 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 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 is required to obtain permit coverage under the MS4 general permit. There are currently no MS4s in the Big Raccoon-Wabash 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 Big Raccoon-Wabash 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:

- CWA Section 319(h) Grants
- CWA 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:

- CWA Section 319(h) Grants
- CWA 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:

- CWA Section 319(h) Grants
- CWA 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:

- CWA 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 43 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 http://www.in.gov/idem/nps/3439.htm.

Table 21: Potential Implementation Partners in the Big Raccoon-Wabash 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	Local Funds

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 Big Raccoon-Wabash River watershed in order to optimize BMP selection. These tools include L-THIA LID, STEPL, the Region 5 Model, PLET, 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 https://engineering.purdue.edu/mapserve/LTHIA7/lthianew/lidIntro.php.

The Pollutant Load Estimation Tool (PLET) 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. PLET 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 PLET package can be downloaded at https://www.epa.gov/nps/plet. Purdue University has also developed a web-based version of STEPL available at https://engineering.purdue.edu/mapserve/ldc/STEPL/?.

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 https://www.in.gov/idem/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 Rockville, IN on October 17, 2022 to introduce the project and solicit public input. IDEM explained the TMDL process during these meetings, presented initial information regarding the Big Raccoon-Wabash River watershed, and answered questions from the public. Questions were answered from the public, and information was solicited from stakeholders in the area.
- On April 2, 2024, a notice was posted to the Indiana Register to inform stakeholders of new impairments discovered during the 2022-2023 watershed characterization study in the Big Raccoon-Wabash 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 May 16, 2024. IDEM received no comments regarding the notice.
- A draft TMDL public meeting was held in the watershed at Parke County Extension Office, 1472 N US Highway 41, Rockville, IN 47872 on June 26, 2024 at 6:00 PM. The draft findings of the TMDL were presented at the meeting and the public had the opportunity ask questions and provide information to be included in the final TMDL report. A representative from the Parke County SWCD was in attendance and presented information on the progress of the WMP. The public comment period was from July 2, 2024 to August 2, 2024.

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APPENDIX A. WATER QUALITY DATA FOR THE BIG RACCOON-WABASH RIVER WATERSHED TMDL

APPENDIX B. FISH AND MACROINVERTEBRATE COMMUNITY ASSESSMENT REPORTS FOR THE BIG RACCOON-WABASH RIVER WATERSHED TMDL

APPENDIX C. FISH AND MACROINVERTEBRATE COMMUNITY QUALITATIVE HABITAT EVALUATION INDEX FOR THE BIG RACCOON-WABASH RIVER WATERSHED TMDL

APPENDIX D. REASSESSMENT NOTES FOR THE BIG RACCOON-WABASH RIVER WATERSHED

APPENDIX E. SAMPLING AND ANALYSIS WORK PLAN FOR THE BIG RACCOON-WABASH RIVER WATERSHED

APPENDIX F. WATER QUALITY DURATION GRAPHS FOR THE BIG RACCOON-WABASH RIVER WATERSHED

APPENDIX G. NPDES EXECUTIVE SUMMARY

FOR BIG RACCOON-WABASH RIVER WATERSHED