Upper Wabash River
Watershed Management Plan
Phase III

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With Guidance from the Upper Wabash River Watershed Steering Committee
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Prepared for:
Huntington County Soil and Water Conservation District
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Upper Wabash River
WATERSHED MANAGEMENT PLAN

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List of Acronyms

Aquatic Invasive Species	AIS
Best Management Practice	BMP
Clean Water Act	CWA
Combined Sewer Overflow	CSO
Department of Community Development	DCD
Department of Natural Resources	DNR
Dissolved Oxygen	D.O.
Highly Erodible Land	HEL
Hoosier Riverwatch	HRW
Hydrologic Unit Code	HUC
Indiana Department of Environmental Management	IDEM
Impaired Biotic Communities	IBC
Indiana Department of Natural Resources	IDNR
Indiana State Department of Agriculture	ISDA
Lake and River Enhancement	LARE
Leadership in Energy and Environmental Design	LEED
Leaking Underground Storage Tank	LUST
Minimum Control Measures	MCM
Municipal Separate Storm Sewer System	MS4
National Land Cover Database	NLCD
National Pollution Discharge Elimination System	NPDES
National Technical Committee for Hydric Soils	NTCHS
Natural Resource Conservation Service	NRCS
Nonpoint Source	NPS
Ohio Environmental Protection Agency	OEPA
Potentially Highly Erodible Land	PHEL
Potential Pollution Sources	PPS
Purdue Cooperative Extension Service	PCES
Soil and Water Conservation District	SWCD
State Soil Geographic Database	STATSGO
Storm Water Quality Management Plan	SWQMP
The Nature Conservancy	TNC
Total Maximum Daily Load	TMDL
Total Suspended Solids	TSS
U.S Army Corps of Engineers	USACE
U.S. Department of Agriculture	USDA
Upper Wabash River Basin Commission	UWRBC
Upper Wabash River Watershed	UWRW

Indiana Water Quality Monitoring Strategy	WQMS
Wastewater Treatment Plant	WWTP
Watershed Management Plan	WMP
White-nose Syndrome	WNS

1 Watershed Community Initiative

1.1 Project History

The Wabash River is a prominent tributary of the Mississippi River system, the primary contributor of nonpoint source (NPS) pollution driving the Gulf of Mexico hypoxic zone. The Wabash River originates in west-central Ohio, near the Indiana border, and flows southwest for 503 miles before reaching its confluence with the Ohio River. The major source of pollutants in the Wabash River and its tributaries is NPS pollution. It is carried over fields, lawns, and streets by rainwater, wind, or snow. It is this runoff that deposits sediment, fertilizer, pesticides, road salt, motor oil, and animal waste from the surrounding landscape into resident streams and rivers. Additionally, point source pollution from outdated or failing septic systems contributes to the nutrient and bacteria loads in our local waterways.

In 2006, a Total Maximum Daily Load (TMDL) was developed for the Wabash River. The Wabash River TMDL Final Report identified the mainstem Wabash River as impaired and listed *Escherichia coli* (*E. coli)* and nutrients as primary pollutants. Other water quality issues such as impaired Biotic Communities (IBC), dissolved oxygen (D.O.), and pH were also documented. Pollution sources in the watershed were identified as NPS pollution from agriculture, land application of manure, urban and rural run-off, as well as point sources from straight pipe discharges, home sewage treatment system disposal, and combined sewer overflow (CSO) outlets.

The rationale to develop a watershed management plan (WMP) for the Upper Wabash River Watershed (UWRW) stemmed from known water quality impairments occurring throughout the Wabash River system. The UWRW is an 8-digit hydrologic unit code (HUC 05120101) watershed covering portions of western Ohio and northeastern Indiana. The Indiana portion of the watershed flows through parts of eleven counties and covers approximately 1,045,000 acres (Figure 1-1). In Indiana, the watershed is comprised of fourteen 10-digit HUC's.

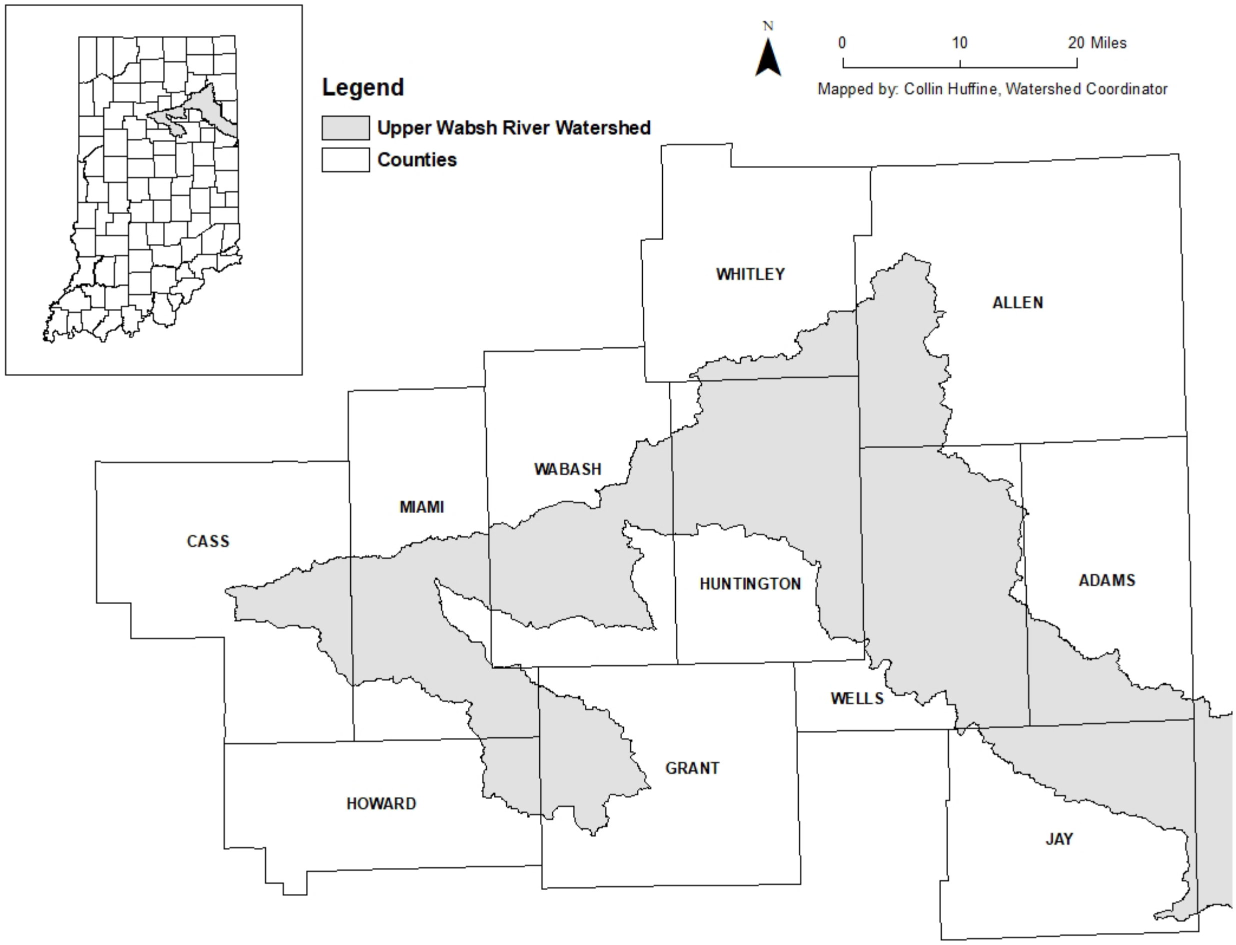

Figure 1-1. Indiana portion of the Upper Wabash River Watershed (HUC 05120101)

In 2007, watershed planning efforts in the UWRW were initiated by the Upper Wabash River Basin Commission (UWRBC) with the completion of a watershed management plan (WMP) for the "Phase I" project area (Figure 1-2). The Phase I WMP covered four 10-digit HUC's (Headwaters Wabash River, HUC 0512010101; Loblolly Creek, HUC 0512010104; Brewster Ditch-Wabash River, HUC 0512010105; and Sixmile Creek-Wabash River, HUC 0512010106) encompassing 244,427 acres. Following development of the Phase I WMP, the UWRBC conducted a three-year implementation project from 2009-2013 focused on the implementation of agricultural best management practices (BMP's) throughout priority sub-watersheds. In 2016, the UWRBC continued to advance conservation planning efforts in the UWRW by completing "Phase II" of the WMP. Phase II covered 176,123 acres and included three 10-digit HUCs (Rock Creek, HUC 0512010107; Griffen Ditch-Wabash River, HUC 0512010108; and Eightmile Creek, HUC 0512010109; Figure 1-2).

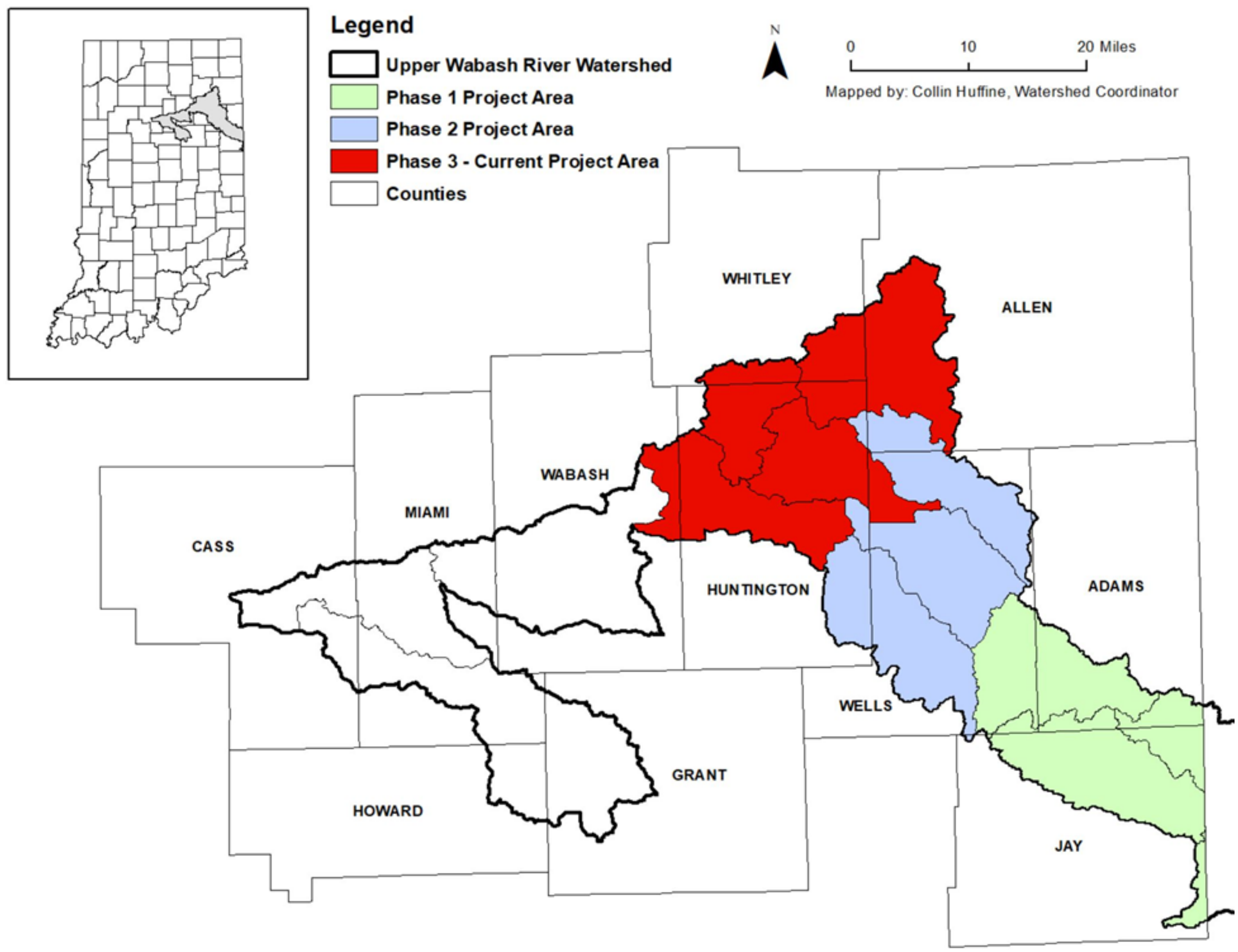

Figure 1-2. Upper Wabash River Watershed- Phases 1, 2, and 3 watershed management plan project areas.

The current project, focused on the development of a WMP for the "Phase III" portion of the UWRW (Figure 1-2), is a continuation of past efforts led by the UWRBC. The Phase III project area falls outside of UWRBC jurisdiction. To progress conservation efforts in downstream sections of the UWRW, the Huntington County Soil and Water Conservation District (SWCD) has taken responsibility as the project sponsor. The Huntington County SWCD received funding through a Clean Water Act Section 205(j) Grant (#25874) from the Indiana Department of Environmental Management (IDEM) focused on three main components:

(1) Development of a watershed management plan for the Phase III project area to achieve reductions in pollutant loads called for in the Wabash River Watershed TMDL

(2) Water quality monitoring program to establish a water quality baseline and identify critical areas within the Phase III project area

(3) Education and outreach program to engage and inform local stakeholders and bring about behavioral changes that will lead to reduced NPS pollution in the watershed.

The need for a WMP specific to the Phase III project area has been made evident through previous studies, including several Lake and River Enhancement (LARE) diagnostic studies, conducted within the watershed boundaries of the current project area. A LARE project in the Little River watershed (HUC 05120101120) conducted by the Indiana Department of Natural Resources (DNR) in 2009, concluded that the physical and chemical characteristics of the watershed were degraded. The most prominent issues within the watershed were excess nutrient inputs from surrounding agricultural practices and degraded aquatic habitat. The DNR recommended the use of several BMP's to improve water quality and restore biological communities such as grassed waterways, filter strips, and riparian buffers, as well as more extensive stream restoration projects.

In 2002, a LARE study was conducted in Flat Creek, Griffen Ditch, Fleming Ditch, and Somers Creek watersheds. The results of the study indicated impaired water quality resulting primarily from highly agricultural land use occurring over erodible soils. Very few BMP's were documented throughout the watersheds and conventional tillage was abundant. Poor habitat and impaired macroinvertebrate communities were observed throughout the watershed. Nitrogen, phosphorus, ammonia, *E. coli*, and suspended sediment concentrations exceeded state standards or targets, primarily during storm flows. Recommended actions to improve watershed conditions and water quality included alternative technology for waste treatment systems, exclusion of cattle from streams, education and outreach, maintenance of previously installed practices, and the development of a watershed management plan.

In 2018, a LARE study was completed for Silver Creek-Hanging Rock Watershed in Wabash and Huntington counties. The study documented elevated concentrations of soluble and total phosphorus during base and storm flow conditions, as well as high concentrations of total suspended solids (TSS) and *E. coli* during storm flows. Habitat was generally adequate for maintaining good quality fish communities and only moderately impaired macroinvertebrate communities. The study revealed a need for implementation of BMP's focused on the reduction of soil erosion, highlighted by approximately fourteen miles of streambank erosion observed throughout the study area.

This comprehensive watershed management plan will fulfill the need for a detailed course of action focused on the improvement of soil health and water quality in the Phase III project area through the identification of priority sub-watersheds and the development of an action register. The development of the watershed management plan will be guided by collaborative efforts among local stakeholders who have a vested interest in the quality of our local soil and water resources. This watershed management plan will adhere to the requirements and specifications set forth by the Indiana Department of Environmental Management (IDEM) and U.S. Environmental Protection Agency (US EPA) and will act as a guiding document to protect and enhance the quality of our natural resources within the Phase III project area and the UWRW.

1.2 Steering Committee

Specific stakeholders were invited to join the steering committee and encouraged to become involved in the planning process. To generate local stakeholder involvement on the UWRW steering committee, an initial news release advertising the project and calling for individuals to participate on the steering committee was published in local newspapers and posted on other social media outlets. A total of 13 individuals attended the first steering committee meeting held on July 19, 2018. News releases were published prior to each steering committee meeting and included an open invitation for the general public to attend and provide input on the development of the watershed management plan. Additional stakeholders were invited to become involved through education and outreach events.

The UWRW steering committee is a community-based watershed group comprised of a diverse assembly of natural resource professionals, local government employees, and residents from surrounding communities, all of which share the collective vision of improving soil health and water quality through the reduction of NPS pollution in the UWRW (Table 1-1). Organizations involved in the steering committee included partnering SWCD's of Allen, Whitley, Wells, and Wabash counties, as well as representatives from The Nature Conservancy (TNC), Purdue Cooperative Extension Service (PCES), U.S. Army Corps of Engineers (USACE), Department of Natural Resources (DNR), Indiana State Department of Agriculture (ISDA), Natural Resource Conservation Service (NRCS), and Indiana Department of Environmental Management (IDEM).

The steering committee met regularly at least once a quarter, or more frequently when deemed necessary. Meetings were focused on project updates and planning for the WMP, water quality monitoring program, and education and outreach efforts. The steering committee meetings were facilitated primarily by the Watershed Coordinator from Huntington County SWCD. The steering committee did not include any formal subcommittees, or bylaws, and decisions related to the development of the WMP were determined by general consensus of UWRW steering committee members.

Table 1-1. Upper Wabash River Watershed Steering Committee Members

Upper Wabash River Watershed Steering Committee	
Member	**Affiliation**
Nadean Lamle	Whitley County SWCD
Katie Peden	ISDA
Lynne Huffman	Wells County SWCD
Seth Harden	The Nature Conservancy
Herb Manifold	Ecosystems Connections Institute (ECI), LLC
Andy Ambriole	Huntington County SWCD/farmer
Kyle Lund	Huntington County SWCD/farmer
Tashina Lahr-Manifold	Wabash County SWCD
Amy Lybarger	NRCS - Whitley County
Collin Huffine	Watershed Coordinator, ECI
Cheryl Jarrett	Huntington County SWCD
Cassandra Vondran	NRCS - Huntington County
Ed Farris	Huntington County Purdue Extension
Adam Couch	Huntington County SWCD/farmer
Dave Lefforge	ISDA
Ryan Martin	USACE
Mariah Underwood	USACE
Heath Hurst	ISDA
Kristi Todd	IDEM

1.3 Stakeholder Concerns List

An important component of any well-developed WMP is the inclusion and consideration of input from local stakeholders and community members. To collect information on stakeholder concerns related to land use and water quality within the Phase III project area, an initial list of stakeholder concerns was developed during the first UWRW Phase 3 steering committee meeting on July 19th, 2018. Members of the general public were invited and encouraged to attend steering committee meetings to ask questions, provide input, and express concerns. Additionally, stakeholders were given the opportunity to write down resource concerns on comment cards at public meetings and other education and outreach events, such as river clean-ups, field days, and workshops throughout the planning process. A summarized list of stakeholder concerns was maintained by the Watershed Coordinator (Table 1-2). These concerns guided the UWRW steering committee in the development of the WMP. All stakeholder concerns were considered and addressed to the degree possible through this process.

Table 1-2. Stakeholder Concerns

Stakeholder Concerns
High Nitrogen Concentration/Loading
High Phosphorus Concentration/Loading
High Sediment Concentration/Loading
High *E.coli* Concentration
Lack of agricultural BMP's
Streambank erosion
Failing on-site waste systems in rural and urban communities
Manure in the watershed
Livestock access to streams
Flooding
Trash/debris throughout the watershed
Rural and urban interface opportunities
Urban development and urbanization
Low farmer involvement in watershed planning process
Lack of community engagement, understanding of NPS pollution, and knowledge of local water quality issues
Lack of recreational opportunities on the river
Protection of endangered fish, wildlife, and plant species
Invasive species

2 Watershed Inventory – Part I

2.1 Geology and Topography

The underlying geology of the Phase III project area was deposited during the Paleozoic Era. The bedrock geology of the southwest portion of the watershed, including the Littler River (HUC 0512010111) and Loon Creek-Wabash River (HUC 0512010113) watersheds, was formed during the Silurian period and consists primarily of limestone, dolomite, and argillaceous dolomite. The northeast areas of the watershed including the northern section of the Clear Creek watershed (HUC 0512010112) and the majority of the Aboite Creek-Little River watershed (HUC 0512010110) have bedrock geology indicative of the Devonian Period including both dolomite and limestone. A noteworthy geological feature located within the project watershed is the Hanging Rock National Natural Landmark, a 5-acre Acres Land Trust preserve located in Wabash County near the town of Lagro, Indiana. Hanging Rock, located on the southern bank of the Wabash River, is a natural exposure of fossilized coral reef from the Silurian Period and stands 65 feet above the Wabash Valley (Acres Land Trust, 2018).

The Phase III Upper Wabash River Watershed Management Plan project areas lies predominately within the Bluffton Till Plain. The Bluffton Till Plain is a relatively level till plain characterized by poorly drained, clay-rich soils. A small northeast portion of the Aboite Creek-Little River watershed (HUC 0512010111) in Allen County is located within the Auburn Moraine Complex of the Northern Moraine and Lake physiographic region. These areas were one of the last in Indiana to be occupied by glacial ice. In Northern Indiana, where the glaciers melted relatively rapidly, glacial till ridges, called moraines were left. While the topography of the project watershed is relatively uniform throughout with low local relief, the receding glaciers also left areas of small hills and ridges with gentle slopes and areas of steep slopes with soils vulnerable to erosion. No karst topography is present within the watershed.

2.2 Hydrology

The Phase III project area drains approximately 228,303 acres and contains over 540 miles of rivers and streams, including 25 miles of the mainstem Wabash River flowing from west of Markel, Indiana to just east of Lagro, Indiana through the Loon Creek-Wabash River watershed (Table 2-1 & Figure 2-1). The project area also includes 23 miles of the Little River flowing southwest through the Aboite-Creek Watershed from west of Ft. Wayne, Indiana to its confluence with the Wabash River in Huntington, Indiana. Other waterways within the watershed are primarily small headwater streams or drainage ditches (Table 2-2). Open water accounts for roughly 1% (2,390 acres) of land cover and includes 416 lakes and ponds covering an estimated 1,429 acres within the watershed. Many of the streams have been artificially straightened and are classified as legal drains. The watershed contains 64 miles of ditches and 509 miles of legal drains. Legal drains are under the authority of the County Surveyors who are mandated to maintain channels to promote drainage. The watershed also contains approximately 4,407 acres of wetland habitats. The Little River Wetlands Project (LRWP) protects more than 1,200 acres of wetlands including Eagle Marsh, Arrowhead Marsh, Arrowhead Prairie, Little River Landing, and Buttonbush Bottoms Preserves (LRWP (a and b), 2019). At more than 750 acres, Eagle Marsh is the third largest wetland restoration in the state.

Table 2-1. Hydrologic features of the UWRW Phase 3 WMP project area

Watershed (10-digit HUC)	Streams (miles)	Ditches (miles)	Legal Drains (miles)	Lakes & ponds (#)	Lakes & ponds (acres)	Wetlands (acres)
Aboite Creek-Little River	179.69	39.08	221.19	212	338.29	2,452.55
Clear Creek	54.14	14.28	74.42	40	38.55	503.30
Little River	83.86	10.92	123.47	83	128.99	554.50
Loon Creek-Wabash River	161.76	0.00	90.31	81	923.68	897.37
Total	**479.44**	**64.28**	**509.39**	**416**	**1,429.50**	**4407.72**

Table 2-2. Waterways of the UWRW Phase 3 WMP project area

Aboite Creek	Fahl Ditch	Nieman Creek
Beal Taylor Ditch	Flat Creek	North Beck Ditch
Beck Ditch	Flaugh Ditch	Rabbit Run
Big Indian Creek	Graham McCulloch Ditch	Robinson Creek
Brindle Ditch	Graham McCulloch Ditch Number Four	Rock Creek
Brown Ditch	Graham McCulloch Ditch Number One	Seegar Ditch
Bull Creek	Lee Ditch	Silver Creek
Calf Creek	Lehman Ditch	Smith Limer Ditch
Clear Creek	Little Indian Creek	Squaw Creek
Cow Creek	Little River	Tah Kun Wah Creek
Deemer Ditch	Loon Creek	Verdrick Ditch
Durnell Ditch	McPherren Ditch	Wabash River
Eightmile Creek	Mud Creek	West Branch Clear Creek

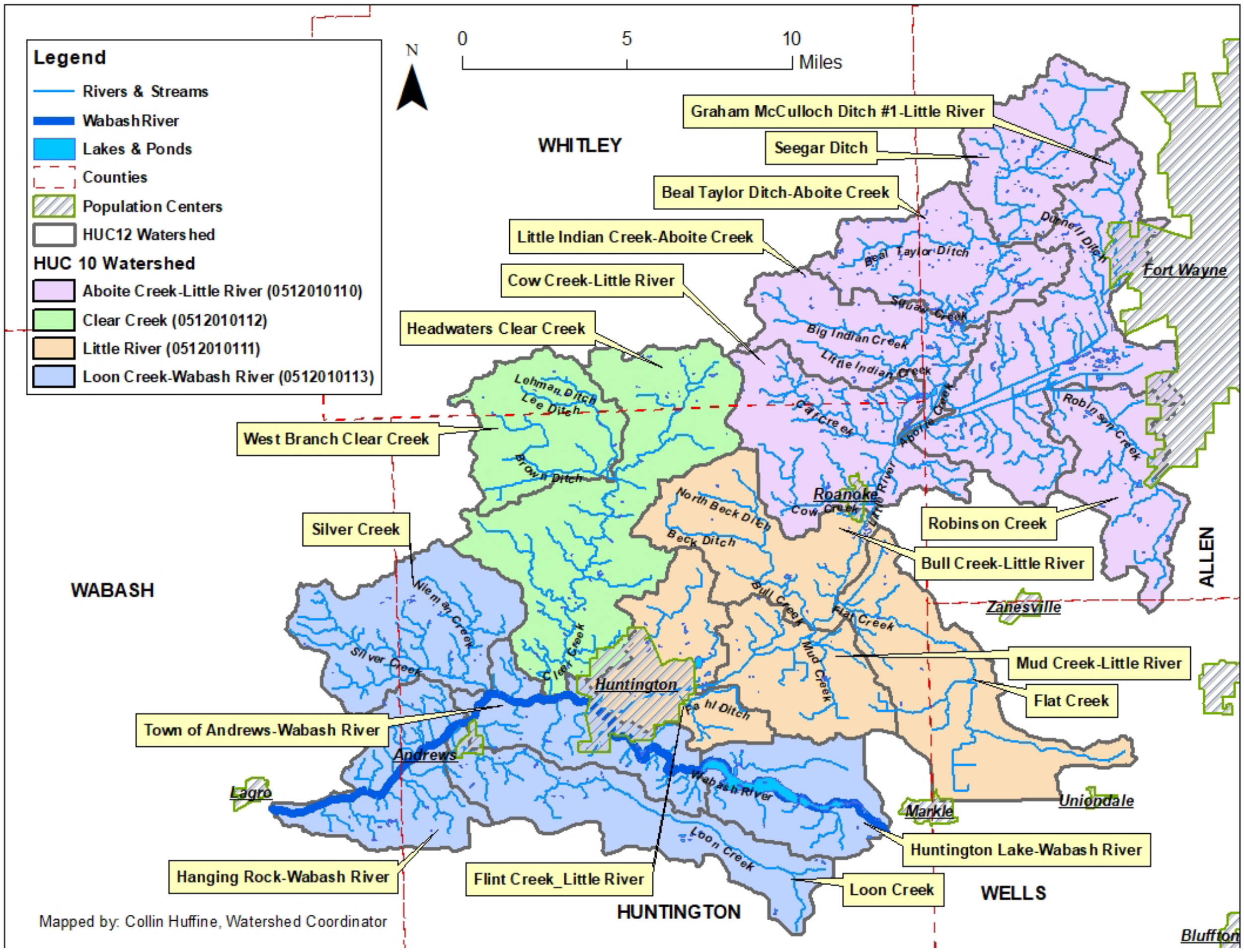

Figure 2-1 . Hydrology of the UWRW Phase 3 WMP project area

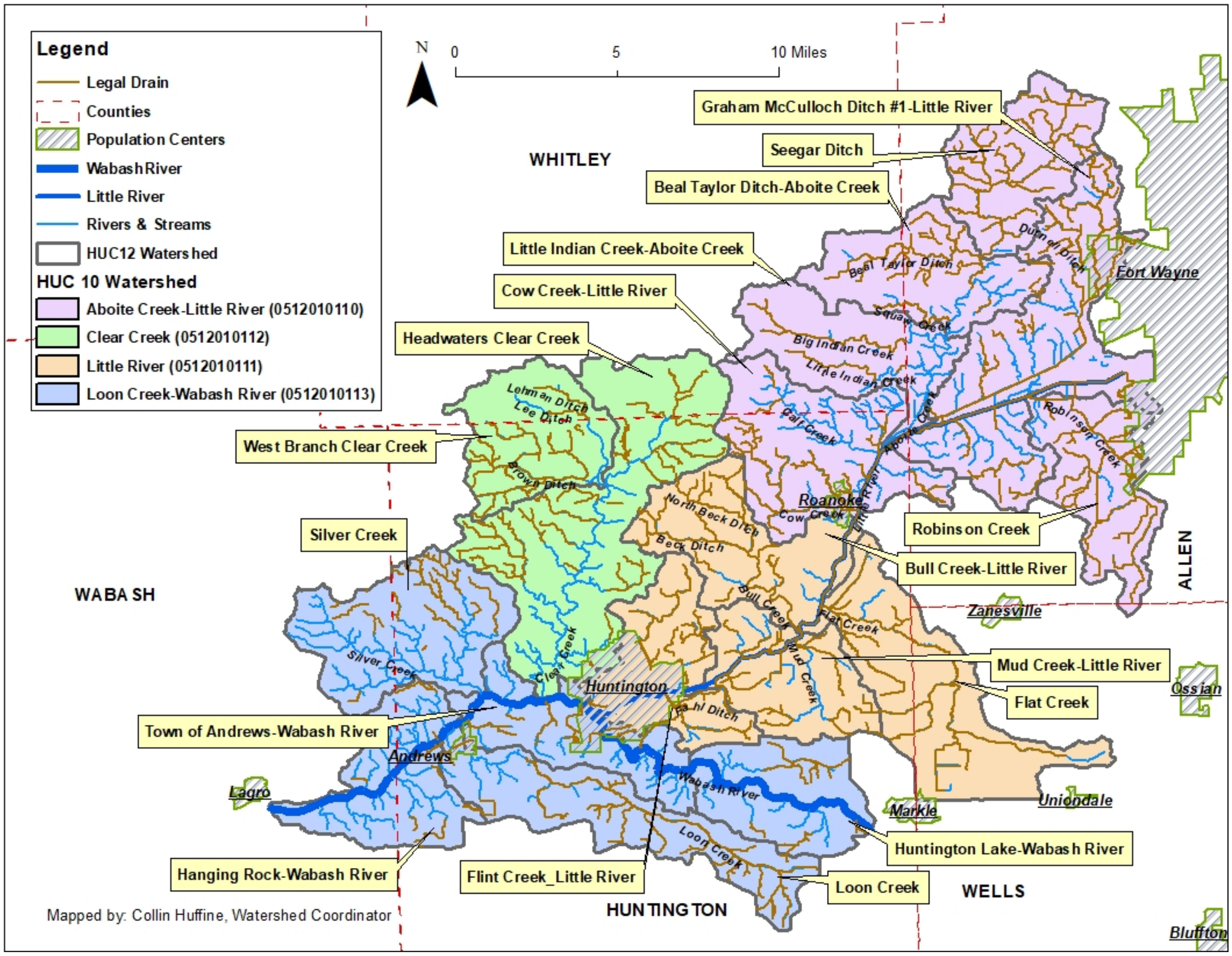

Figure 2-2. Legal drains/county regulated drains of the UWRW Phase 3 WMP project area.

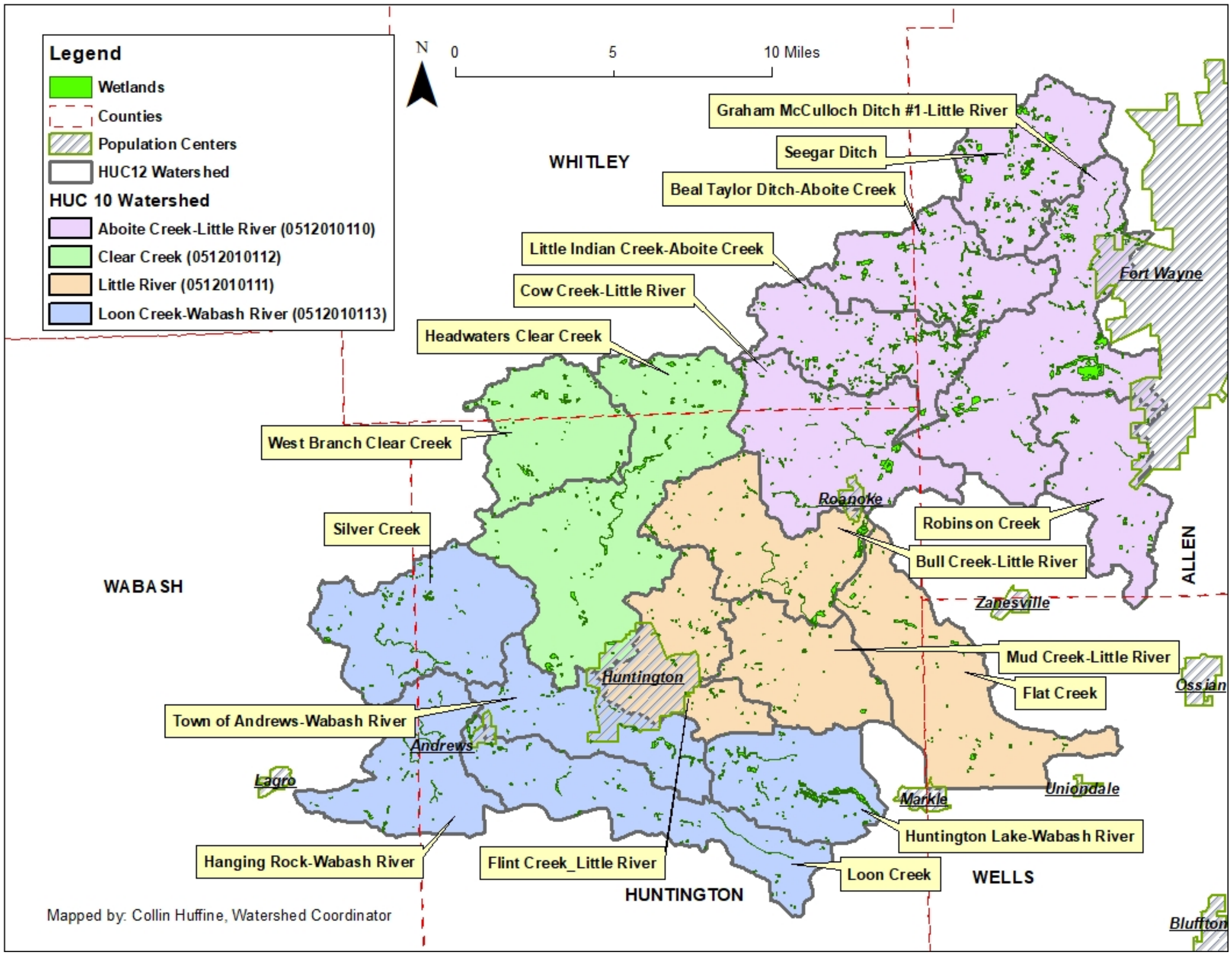

Figure 2-3. Wetlands of the UWRW Phase 3 WMP project area

Hydrologic modifications

Characteristic of many Midwestern watersheds, the hydrology of the Upper Wabash River Watershed has been substantially altered by humans. Streams and ditches in the watershed are primarily used for drainage. County legal drains are routinely maintained for this purpose. The open streams and drains are regularly sprayed to reduce and control the growth of woody vegetation. Clearing, dredging, and reconstruction are also used as methods to reduce and remove obstructions. These modifications can result in the destruction of aquatic habitats, loss of riparian areas, and increased potential for erosion and sedimentation. Subsurface tile is also used extensively throughout the watershed project area to improve drainage. Subsurface tile increases the rate at which water reaches the streams and ditches. This can lead to increased flow within the stream and increased potential for erosion occurring within the stream channel. Tile inlets can also provide a direct conduit for nutrients, sediments and pathogens to travel to the open stream or river and result in a decrease in water quality; all concerns identified by local stakeholders.

A prominent hydrologic modification within the watershed is the J. Edward Roush Dam which forms J. Edward Roush Lake, formerly "Huntington Lake". The dam, located south of Huntington, Indiana on State Road 5, was constructed in 1967 to control flood waters of the Wabash River Basin. The USACE manages the dam and some recreational facilities immediately around the dam and is responsible for monitoring and controlling lake water levels. The J.E. Roush Dam is a part of the Upper Wabash River Reservoirs which includes nearby Salamonie and Mississinewa lakes. Several smaller dams are also located within the watershed including the Covington Lake Dam, Coventry Dry Dam, and Kekionga Lake Dam in the Aboite-Creek Watershed (Allen County), as well as the Little River Dam in the Littler River Watershed and the Wahl-Shin-Cah Lake Dam of the Loon Creek-Wabash River watershed (Huntington County) (Figure 2-4).

<u>Recreational opportunities</u>

The Wabash River and Little River, as well as the numerous lakes and ponds within the watershed, provide ample opportunity for recreation such as swimming, canoeing, kayaking, fishing, and wildlife viewing. The J.E. Roush Lake Fish and Wildlife Area, which covers 7,347 acres of land along 15 miles of the Wabash River, supports fishing and hunting activities. The property boasts over 900 acres of lake and 350 acres of impoundments, 200 acres of which are open to fishing. Anglers can catch several species of fish including channel catfish, crappie, white bass, largemouth bass, smallmouth bass, walleye, bluegill, redear sunfish, and rough fish. J.E. Roush Lake Fish and Wildlife Areas also includes the Little Turtle, Kil-So-Quah, and Markle State Recreation Areas. Additionally, the DNR Division of Fish & Wildlife's Public Access Program encourages the public to recreate on our rivers, streams, and lakes by providing free access to Indiana water for anglers and boaters. The Public Access Program maintains 416 public access sites, ten of which are located within the project watershed (IDNR, 2019; Figure 2-4).

Many trails throughout the project area provide fantastic recreational opportunities such as hiking, birding, nature photography, and wildlife viewing. The LRWP preserve, Eagle Marsh, is a 756-acre wetland nature preserve located southwest of Ft. Wayne, Indiana. The preserve provides hikers access to over ten miles of trails meandering through a variety of habitats and is home to a diverse wildlife community. Adjacent to the preserve is Fox Island County Park which covers 605 acres. Two hundred and seventy (270) acres of the park are dedicated as State Nature Preserve which provides protection to a variety of unique plants, animals, and geographic features. The park includes seven miles of marked trails as well as the Bowman Lake swimming beach. The LRWP's Arrowhead Preserves include Arrowhead Marsh (97 acres) and Arrowhead Prairie (158 acres) near Roanoke, Indiana. Together they comprise 255 acres of wetland, prairie, and mature woods where visitors are welcome to hike several miles of trails. Buttonbush Bottoms is a 25-acre restored wetland situated between LRWP's Arrowhead Marsh and Prairie Preserves in Roanoke, Indiana and provides an additional one and half miles of trails.

The city of Huntington has established a system of trails including the Etna Rail Trail, Erie Rail Trail, Evergreen Trail, Lime City Trail, Little River Trail, and Old U.S. 24 Trail that allow the community to enjoy scenic walks along the Little River and Wabash River (HARTA, 2019). Furthermore, the city of Huntington's, River Greenway, is located along the Little River and contains approximately 5 acres offering picnic areas, bike paths, and walkways, as well as some fishing and boating activities. The city also maintains a system of bike trails. While public use of natural resources for recreation should be viewed in a positive context, local stakeholders have expressed concern related to an increase in litter at public trails, preserves, and habitats. Furthermore, stakeholders are concerned about the possible health risks associated with *E. coli* levels exceeding those prescribed for safe bodily contact and as a result the potential for health issues as well as limited recreational opportunities such as swimming, kayaking, canoeing, and fishing.

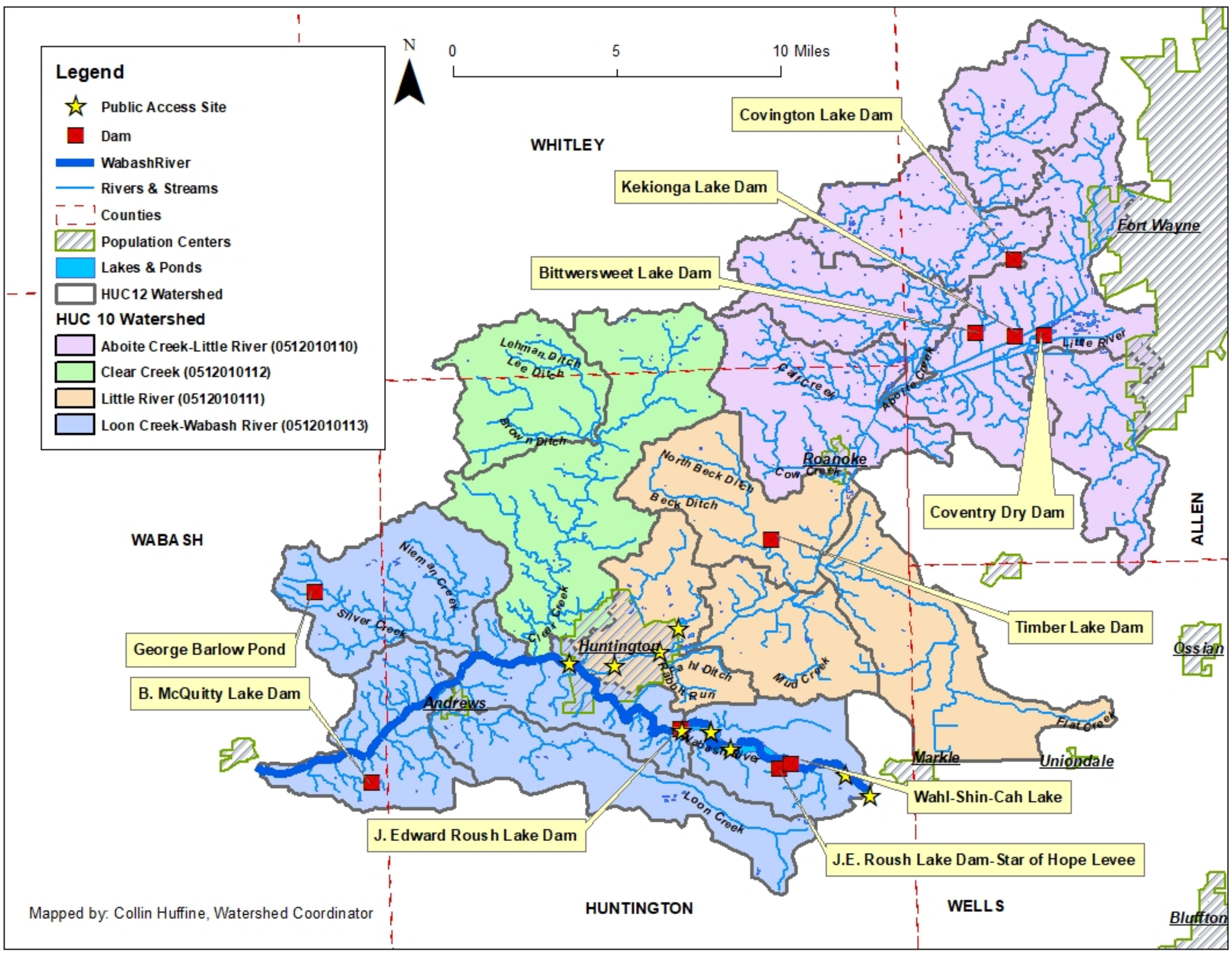

Figure 2-4. Dams and publics access sties of the UWRW Phase 3 WMP project area.

2.3 Soil Characteristics

The project area is comprised of 11 soil associations as classified by the State Soil Geographic Database (STATSGO) maintained by the United States Department of Agriculture (USDA) – Natural Resources Conservation Services (NRCS). Table 2-3 is a list of the soil associations present in the project area and presents information relative to their acreage and percent of project area coverage. The most abundant soils within the UWRW Phase III Project Area are Blount-Pewamo-Glynwood (46%) and Blount-Glynwood Morley (37%). Other soil associations present within the watershed include Millsdale-Newglarus-Randolph (5%), Rensselaer-Darroch-Whitaker (3%), Fox-Ockley-Westland (2%), Montgomery-Strole-Lenawee (2%), Houghton-Adrian-Carlisle (1%), Martinsville-Whitaker-Rensselaer (1%), Milford-Martinton-Del Rey (1%), and Sebewa-Gilford-Homer (<1%). The soils associations found throughout the Upper Wabash River Watershed are exceptionally productive soils, when properly drained and managed, which accounts for the heavy agriculture production within the watershed.

Soil series descriptions (USDA-NRCS (b), 2019):

The Blount series consist of deep, somewhat poorly drained, slowly permeable soils on till plains. These soils formed in calcareous glacial till. Slope ranges from 1 to 4 percent. Almost all areas of Blount soils are cultivated crops. Corn, soybeans, small grain, and meadow are principal crops. Native vegetation is hardwood forest.

The Pewamo series consists of deep, very poorly drained soils on till plains and moraines. These soils formed in calcareous glacial till. Permeability is moderately slow. Slope ranges from 0 to 2 percent. Most areas are used to grow corn, soybeans, small grains, and hay. A small part, especially areas that lack adequate drainage, is in permanent pasture or forest. Native vegetation is forest of red maple, American elm, white ash, and American basswood.

The Glynwood series consists of deep, moderately well drained, slowly permeable soils on till plains and moraines. These soils formed in calcareous glacial till. Slope ranges 3 to 7 percent. A large proportion of Glynwood soils is under cultivation, primarily corn, grass-legume hay, oats, soybeans and wheat. A relatively small proportion is in permanent bluegrass pasture or in woodland. Native vegetation is deciduous forest, principally ash, beech, elm, hickory, oak, and maple.

The Morley series consists of deep, well drained, slowly permeable soils on till plains and moraines. These soils formed in calcareous glacial till. Slope ranges from 6 to 30 percent. Most areas are used to grow corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few areas are used for woodland. Native vegetation is mixed deciduous hardwood forest.

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Table 2-3. Soil associations of the UWRW Phase 3 project area

Soil Association	Aboite Creek-Little River		Clear Creek		Little River		Loon Creek Wabash River		Total	
	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres
BLOUNT-PEWAMO-GLYNWOOD (IN005)	47.41	38,975.51	59.17	21,358.80	47.61	23,986.51	43.15	25,719.41	**46.56**	**106,301.30**
BLOUNT-GLYNWOOD-MORLEY (IN004)	38.98	32,047.14	31.42	11,340.71	30.05	15,139.00	36.87	21,980.49	**36.90**	**84,246.25**
MILLSDALE-NEWGLARUS-RANDOLPH (IN047)	-	-	-	-	9.91	4,994.87	11.51	6,862.45	**5.19**	**11,857.32**
RENSSELAER-DARROCH-WHITAKER (IN003)	2.72	2,239.61	-	-	9.42	4,743.43	-	-	**3.06**	**6,983.04**
FOX-OCKLEY-WESTLAND (IN026)	-	-	0.55	197.46	0.19	97.04	8.34	4,970.98	**2.31**	**5,265.48**
SAWMILL-LAWSON-GENESEE (IN029)	2.33	1,915.85	8.86	3,199.78	-	-	0.13	77.96	**2.27**	**5,193.59**
MONTGOMERY-STROLE-LENAWEE (IN033)	4.49	3,689.97	-	-	-	-	-	-	**1.62**	**3,689.97**
HOUGHTON-ADRIAN-CARLISLE (IN019)	2.05	1,681.49	-	-	-	-	-	-	**0.74**	**1,681.49**
MARTINSVILLE-WHITAKER-RENSSELAER (IN028)	2.03	1,665.80	-	-	-	-	-	-	**0.73**	**1,665.80**
MILFORD-MARTINTON-DEL REY (IN053)	-	-	-	-	2.55	1,286.26	-	-	**0.56**	**1,286.26**
SEBEWA-GILFORD-HOMER (IN025)	-	-	-	-	0.26	132.87	-	-	**0.06**	**132.87**

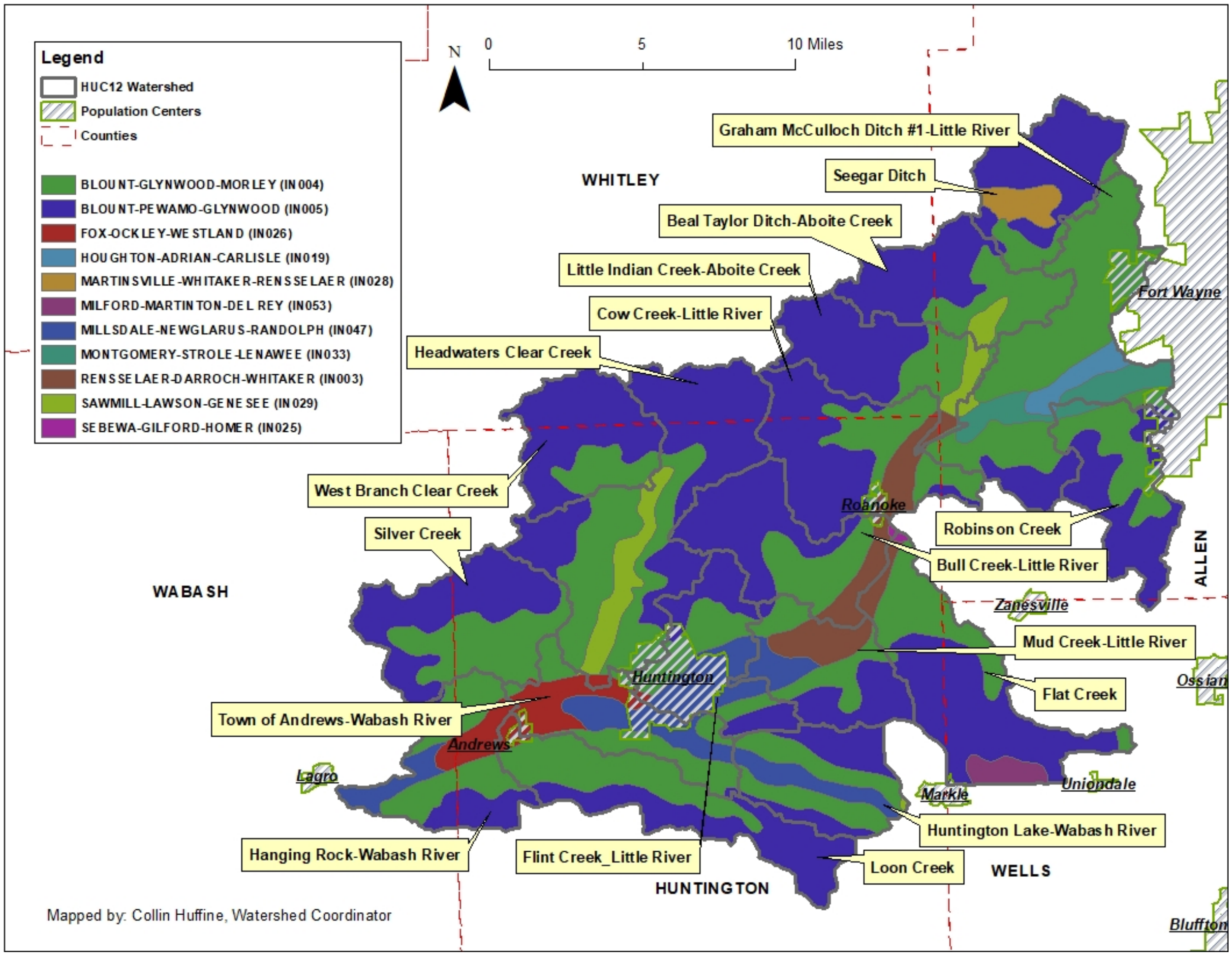


Figure 2-5. Soil associations of the UWRW Phase 3 project area (STATSGO)

Highly Erodible Land

The UWRW Phase III steering committee and stakeholders expressed concern about soil erosion and sedimentation of streams and rivers. The erosion issues present in the watershed may be due in part to unsustainable farming practices on land that is highly or potentially highly erodible. The Natural Resource Conservation Service (NRCS) maintains a database of highly erodible land (HEL) and potentially highly erodible land (PHEL) for each county.

The Food Security Act of 1985 required that soil survey map units be separated into three categories based on potential erodibility due to wind erosion and sheet and rill erosion. A Highly Erodible Soil Map Unit list designates the category assigned to each map unit. It has been determined that no map units are highly erodible because of only wind erosion in Indiana. The equation for determining potential erodibility from sheet and rill erosion is (USDA-NRCS (a), 2019):

$$A = \frac{RK(LS)}{T}$$

Where, A is the amount of soil loss in tons per acre, R is the rainfall factor, K is the soil erodibility factor, L and S are slope length and steepness factors, respectively, and T is the tolerable soil loss in tons per acre.

A map unit is designated highly erodible if the value (A) obtained from the equation is equal to or greater than 8 when the minimum slope length and minimum slope percent are used. A map unit is designated potentially highly erodible if the value obtained from the equation is less than 8 when the minimum slope length and minimum slope percent are used but equal to or greater than 8 when the maximum slope length and maximum slope percent are used. A map unit is designated not highly erodible (NHEL) if the value obtained from the equation is less than 8 when the maximum slope length and maximum slope percent are used. The minimum and maximum slope percent are obtained from the map unit name and were determined by district conservationists and soil scientists.

The presence of HEL and PHEL in farmland can contribute significantly to nonpoint source pollution (NPS) by increasing the amount of sediment carrying other pollutants, such as nutrients and pesticides, to open water. HEL is more vulnerable to erosion which may result in an increase of total suspended solids (TSS) in rivers, creeks, and ditches, negatively affecting the biological community through the presence of excess total phosphorus in water, resulting in excessive algal growth and low dissolved oxygen. Approximately 3% of the soils in the watershed are considered HEL and 39% are considered PHEL (Table 2-4). A map of HEL within the UWRW Phase 3 project area is shown in Figure 2-6.

Table 2-4. Highly erodible land of the UWRW Phase 3 project area

HUC10 Watershed	**HEL Class**					
	NHEL		**PHEL**		**HEL**	
	%	Acres	%	Acres	%	Acres
Aboite Creek-Little River	67.03	55,107.80	27.98	22,999.95	5	4,107.60
Clear Creek	52.29	18,875.27	45.52	16,429.85	2.19	791.63
Little River	58.79	29,616.39	39.7	20,000.25	1.52	763.33
Loon Creek-Wabash River	47.42	28,268.38	50.35	30,016.15	2.23	1,326.76
Total	**57.76**	**131,867.83**	**39.18**	**89,446.20**	**3.06**	**6,989.32**

*NHEL = not highly erodible land; PHEL = potentially highly erodible land; and HEL = highly erodible land

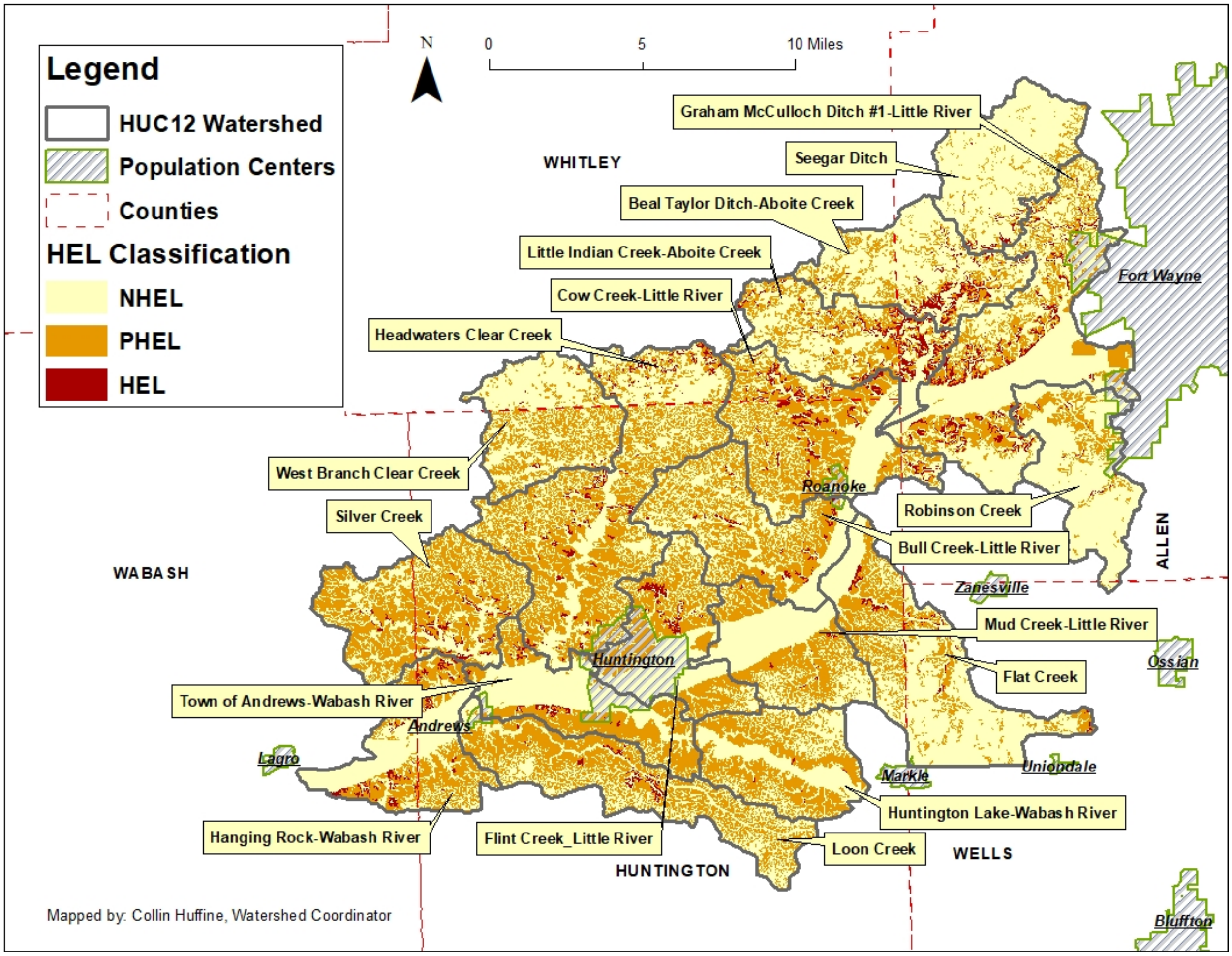


Figure 2-6. Highly Erodible Land of the UWRW Phase 3 project area

<u>Tillage Transect Data</u>

With 42% of the watershed area being HEL and PHEL, conservation practices such as conservation tillage and cover crops are essential for protection against soil erosion and soil loss. Tillage transects, windshield surveys designed to collect data on current and past crop use and tillage practices, provide valuable information on trends in cropland use. Based on the fall 2018 tillage transect survey, conducted by the USDA-NRCS, ISDA, and local SWCD staff; corn and soybeans were planted by conservation tillage methods on 690,900 acres (89.94%) over the five-county area. Of the total planted acres in the five-county area 1.18% of the corn and 15% of the bean crop were planted using conventional tillage. The data indicate that producers are more widely adopting conservation tillage practices such as no-till, mulch-till, and reduced-till for corn production while conventional tillage is more frequent for bean production. While the fall 2018 transect surveys indicate that adoption rates of conservation tillage practices are high, the data are most likely influenced by (1) unusually wet field conditions delaying or preventing tillage; and (2) collection of data prior to the occurrence of tillage. Therefore, conventional tillage is most likely much more widespread than demonstrated by the current data. Tillage to the edge of stream banks and low adoption rates of conservation tillage have been identified as concerns for contributing sediment and nutrients to streams. Table 2-5 through Table 2-9 display the fall 2018 tillage transect data for Allen, Huntington, Wabash, Wells, and Whitley counties individually. Table 2-10 shows the fall 2018 tillage transect data for all five counties combined.

Table 2-5. Fall 2018 tillage data for Allen County, IN. Indiana State Department of Agriculture 2018.

Tillage Practice	**Corn**		**Soybeans**	
	%	Acres	%	Acres
No-Till	80	62,400	65	74,800
Mulch-Till	17	13,300	7	8,100
Reduced-Till	1	800	11	12,700
Conventional-Till	2	1,600	17	19,600

Table 2-6. Fall 2018 tillage data for Huntington County, IN. Indiana State Department of Agriculture 2018.

Tillage Practice	**Corn**		**Soybeans**	
	%	Acres	%	Acres
No-Till	83	51,700	84	81,700
Mulch-Till	17	10,600	3	2,900
Reduced-Till	0	0	0	0
Conventional-Till	0	0	12	11,700

Table 2-7. Fall 2018 tillage data for Wabash County, IN. Indiana State Department of Agriculture 2018.

Tillage Practice	**Corn**		**Soybeans**	
	%	Acres	%	Acres
No-Till	88	4,500	81	80,100
Mulch-Till	9	6,600	6	5,900
Reduced-Till	1	700	1	1,000
Conventional-Till	2	1,500	12	11,900

Table 2-8. Fall 2018 tillage data for Wells County, IN. Indiana State Department of Agriculture 2018.

Tillage Practice	Corn		Soybeans	
	%	Acres	%	Acres
No-Till	75	57,600	61	65,300
Mulch-Till	17	13,000	1	1,100
Reduced-Till	1	800	16	17,100
Conventional-Till	2	1,500	18	19,300

Table 2-9. Fall 2018 tillage data for Whitley County, IN. Indiana State Department of Agriculture 2018.

Tillage Practice	Corn		Soybeans	
	%	Acres	%	Acres
No-Till	78	47,400	74	50,500
Mulch-Till	19	11,600	5	3,400
Reduced-Till	2	1,200	6	4,100
Conventional-Till	1	600	14	9,600

Table 2-10. Fall 2018 tillage data for all counties combined (Allen, Huntington, Wabash, Wells, Whitley). Indiana State Department of Agriculture 2018.

Tillage Practice	Corn		Soybeans	
	%	Acres	%	Acres
No-Till	77.80	223,600	73.29	352,400
Mulch-Till	19.17	55,100	4.45	21,400
Reduced-Till	1.22	3,500	7.26	34,900
Conventional-Till	1.81	5,200	15.00	72,100

Hydric Soils

Several soils present within the watershed are classified by the local Natural Resource Conservation Service (NRCS) as hydric as can be seen in Figure 2-7. Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

Hydric soils can pose threats to surface water when farmed due to excessive runoff of fertilizers, pesticides, and manure. Farmland located on hydric soils often requires the installation of field tiles to keep the fields from flooding or ponding. Hydric soils are not suitable soils for septic usage as they do not allow for proper filtration of the septic waste and may result in surface and/or groundwater contamination. Soils that are considered hydric are so classified for several reasons. The following explanation of hydric soils was taken from the NRCS, Field Office Technical Guide.

1. All Histols except for Folistels, and Histosols except for Folists
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that
    a. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season; or
    b. are poorly drained or very poorly drained and have either:
        i. Water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
        ii. Water table at a depth of 0.5 feet or less during the growing season if permeability is equal to or greater than 6.0 in/hr. in all layers within a depth of 20 inches; or
        iii. Water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr. in any layer within a depth of 20 inches.
    c. are frequently ponded for long/very long duration at the growing season; or
    d. are frequently flooded for long/very long duration at the growing season.

Hydric soils, while posing a significant problem when farmed, also are quite beneficial as they are prime locations to create or restore wetlands. Wetlands are great resources as they provide many ecological benefits and could help prevent polluted runoff from reaching open water. Hydric soils account for over 30% (69,128 acres) of the watershed areas (Table 2-11). Figure 2-7 shows the extent of hydric soils within the UWRW Phase 3 project area.

Table 2-11. Hydric soils of the UWRW Phase 3 project area

HUC10 Watershed	Hydric Class			
	Not Hydric		Hydric	
	%	Acres	%	Acres
Aboite Creek-Little River	69.81	57,398.09	30.19	24,817.26
Clear Creek	67.13	24,233.44	32.87	11,863.31
Little River	62.27	31,369.84	37.73	19,010.13
Loon Creek-Wabash River	77.46	46,173.85	22.54	13,437.44
Total	**69.72**	**159,175.22**	**30.28**	**69,128.14**

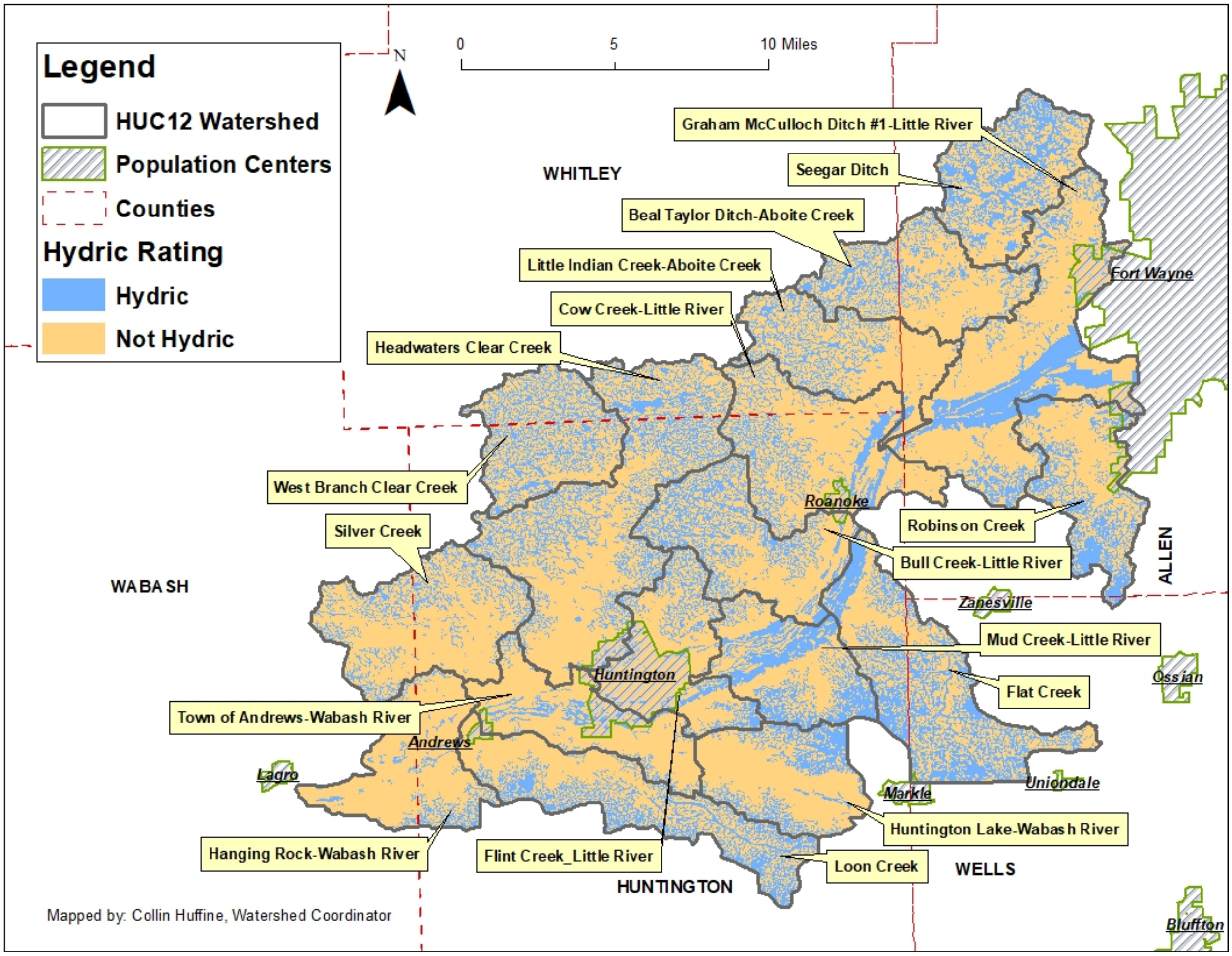


Figure 2-7. Hydric Soils of the UWRW Phase 3 project area

Septic System Suitability

Soil type is important to consider when installing a septic tank as traditional septic tanks utilize the soil to absorb effluent discharged from the tank into absorption fields. Often, septic tank absorption fields are subsurface systems of French drains that distribute septic liquid waste evenly throughout the designated area and into the natural soil. Soil properties and landscape features that affect the ability of the soil to properly absorb and filter the effluent should be considered when designing a septic system. Most of the rural population within the UWRW Phase III project area is unsewered and uses septic systems to process their wastewater. All incorporated population centers utilize a centralized sewer system to handle household effluent (Figure 2-8).

The UWRW Phase III steering committee and stakeholders expressed concern regarding failing on-site waste disposal systems and since the majority of the watershed is rural and using on-site waste disposal, it is important to note that nearly all (97.53%) soils located within the project area are rated as "very limited" for septic usage according to the NRCS (Table 2-12). A designation of "very limited" indicates that the soil has one or more features that are unfavorable for use in septic systems. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected. Less than 1% of the soils located throughout the project area are classified as "somewhat limited" for the installation of an on-site sewage system. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Furthermore, a small portion of the watershed (2.27%) has not been rated for septic suitability. Figure 2-9 shows the extent of septic suitability in the UWRW Phase III Project Area.

Table 2-12. Septic suitability of the UWRW Phase 3 project area

HUC10 Watershed	Septic Suitability Class					
	Not Rated		Somewhat Limited		Very Limited	
	%	Acres	%	Acres	%	Acres
Aboite Creek-Little River	2.91	2,390.97	0.55	449.7	96.54	79,374.68
Clear Creek	0.22	78.74	-	-	99.78	36,018.01
Little River	1.42	716.78	-	-	98.58	49,663.19
Loon Creek-Wabash River	3.35	1,998.12	-	-	96.65	57,613.17
Total	**2.27**	**5,184.61**	**0.2**	**449.7**	**97.53**	**222,669.05**

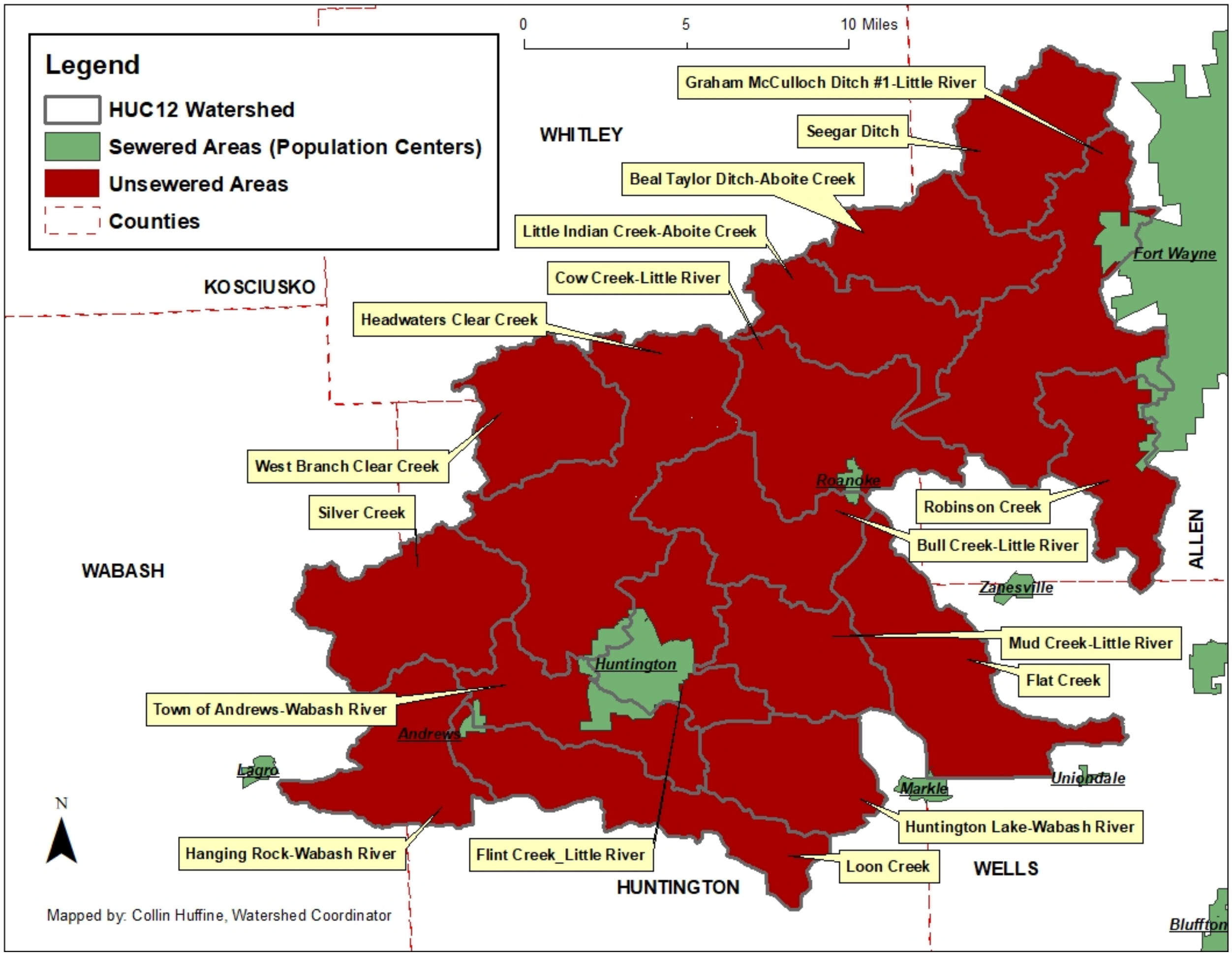


Figure 2-8. Unsewered Areas of the UWRW Phase 3 project area

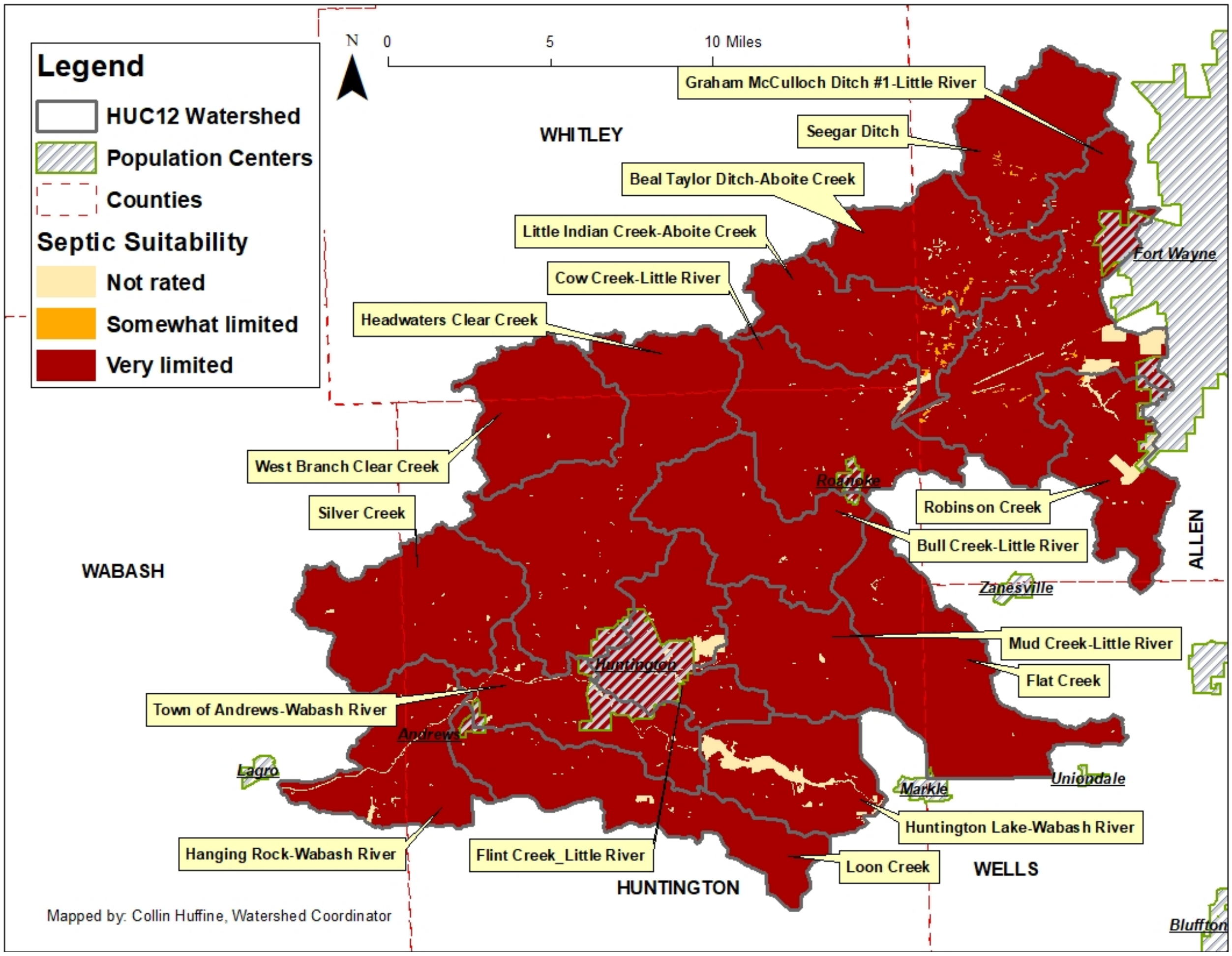


Figure 2-9. Septic Suitability of the UWRW Phase 3 project area

2.4 Land Use

Land use within the UWRW Phase III project area is nearly 70% agriculture (158,397acres) as can be seen in Table 2-13 and Table 2-14, as well as Figure 2-10. Cultivated crops dominate land use of the watershed covering over 152,394 acres (66.75%; Table 2-13, Table 2-14). The Little River Watershed includes the highest proportion of agriculture at 79% (28,694 acres). The UWRW Phase III steering committee and stakeholders have expressed concerns related to NPS pollution resulting from high levels of agriculture in the project area. NPS pollution resulting from agricultural production can lead to high levels of nutrients such as nitrogen and phosphorous, as well as increased sediment loads in rivers and streams.

Industrial, urban, and suburban areas can contribute significantly to poor water quality due to extensive amounts of impervious surfaces. Impervious surfaces, such as roads, parking lots, and rooftops, do not allow rain or snowmelt to soak, or infiltrate, into the ground leading to increased runoff. Additionally, most developed areas utilize storm drains to carry large amounts of stormwater runoff to nearby waterways. The stormwater runoff carries pollutants such as oil, dirt, chemicals, and lawn fertilizers directly to streams and rivers. The National Land Cover Database (NLCD) includes four classes of developed land based on the amount of impervious surfaces present: (1) developed open space (imperviousness <20%); (2) low-intensity developed (imperviousness 20 to 49%); medium-intensity developed (imperviousness 50 to 79%); and high-intensity developed (imperviousness >79%). Developed area is the second highest land use classification in the project area accounting for nearly 16% (36,294 acres) of the watershed. The developed land is concentrated around the industrial, urban, and suburban areas near the cities of Fort Wayne and Huntington, as well as the towns of Andrews and Roanoke. The proportion of developed land is highest in the Aboite Creek-Little River Watershed, which includes portions of Fort Wayne, where it encompasses over 24% (19,839 acres) of the watershed area. The Aboite township area in Allen County near U.S. 24 continues to rapidly urbanize. Additionally, land use near I-69 and the Fort Wayne International Airport have experienced increased commercial and industrial construction. Developed land also exceeds 15% (7,761 acres) of land use in the Little River Watershed. Stakeholders have expressed concerns about the rural-urban interface present in the UWRW Phase III project area and its implications for water quality. Concerns related to urban development and urbanization and how they influence water quality were also expressed.

Nearly 13% (29,375 acres) of land use within the project area is forest or woodland. The Loon Creek-Wabash River Watershed, which includes the J.E. Roush Fish & Wildlife Area, has the greatest proportion of forest/woodland covering nearly 20% (11,599 acres) of its watershed area.

This section provides a general description of land use in the project area. Section 3-Watershed Inventory –Part II, will provide a more detailed description of land use at the HUC 12 sub-watershed level.

Table 2-13.UWRW Phase 3 project area land use by groups

Land use	Aboite Creek-Little River		Clear Creek		Little River		Loon Creek Wabash River		Total	
	%	Acres	%	Acres	%	Acres	%	Acres	**%**	**Acres**
Open Water	0.79	652	0.18	65	0.39	195	2.58	1,535	**1.07**	**2,447**
All Developed Areas	24.13	19,839	8.65	3,121	15.40	7,761	9.35	5,574	**15.90**	**36,294**
All Forest/Woodland Types	11.79	9,693	11.43	4,124	7.86	3,958	19.46	11,599	**12.87**	**29,375**
Agricultural Uses (Crops, Pasture/Hay, etc.)	61.86	50,858	79.49	28,694	75.76	38,170	68.23	40,675	**69.38**	**158,397**
Wetlands	0.80	661	0.26	93	0.49	249	0.38	226	**0.54**	**1,229**
Barren Land	0.62	512	0.00	0	0.10	48	0.00	2	**0.25**	**562**

Table 2-14. Land use data of the UWRW Phase 3 project area

Land use	Aboite Creek-Little River		Clear Creek		Little River		Loon Creek Wabash River		Total	
	%	Acres	%	Acres	%	Acres	%	Acres	**%**	**Acres**
Barren Land	0.62	512	0.00	0	0.10	48	0.00	2	**0.25**	**562**
Cultivated Crops	59.80	49,166	76.37	27,568	74.08	37,320	64.32	38,339	**66.75**	**152,394**
Deciduous Forest	10.47	8,608	9.45	3,411	6.59	3,319	17.20	10,250	**11.21**	**25,588**
Developed, High Intensity	0.89	735	0.16	58	0.63	318	0.15	87	**0.52**	**1,198**
Developed, Low Intensity	8.38	6,890	1.12	404	4.56	2,300	1.42	847	**4.57**	**10,441**
Developed, Medium Intensity	2.53	2,079	0.35	125	1.49	749	0.53	318	**1.43**	**3,272**
Developed, Open Space	12.33	10,135	7.02	2,533	8.72	4,393	7.25	4,322	**9.37**	**21,383**
Emergent Herbaceous Wetlands	0.32	260	0.10	36	0.14	71	0.28	168	**0.23**	**534**
Evergreen Forest	0.13	108	0.03	11	0.03	15	0.06	33	**0.07**	**167**
Hay/Pasture	2.06	1,692	3.12	1,126	1.69	850	3.92	2,336	**2.63**	**6,003**
Herbaceous	1.02	841	1.46	528	0.87	441	1.40	832	**1.16**	**2,641**
Open Water	0.79	652	0.18	65	0.39	195	2.58	1,535	**1.07**	**2,447**
Shrub/Scrub	0.16	136	0.49	175	0.36	184	0.81	484	**0.43**	**979**
Woody Wetlands	0.49	401	0.16	57	0.35	178	0.10	58	**0.30**	**695**

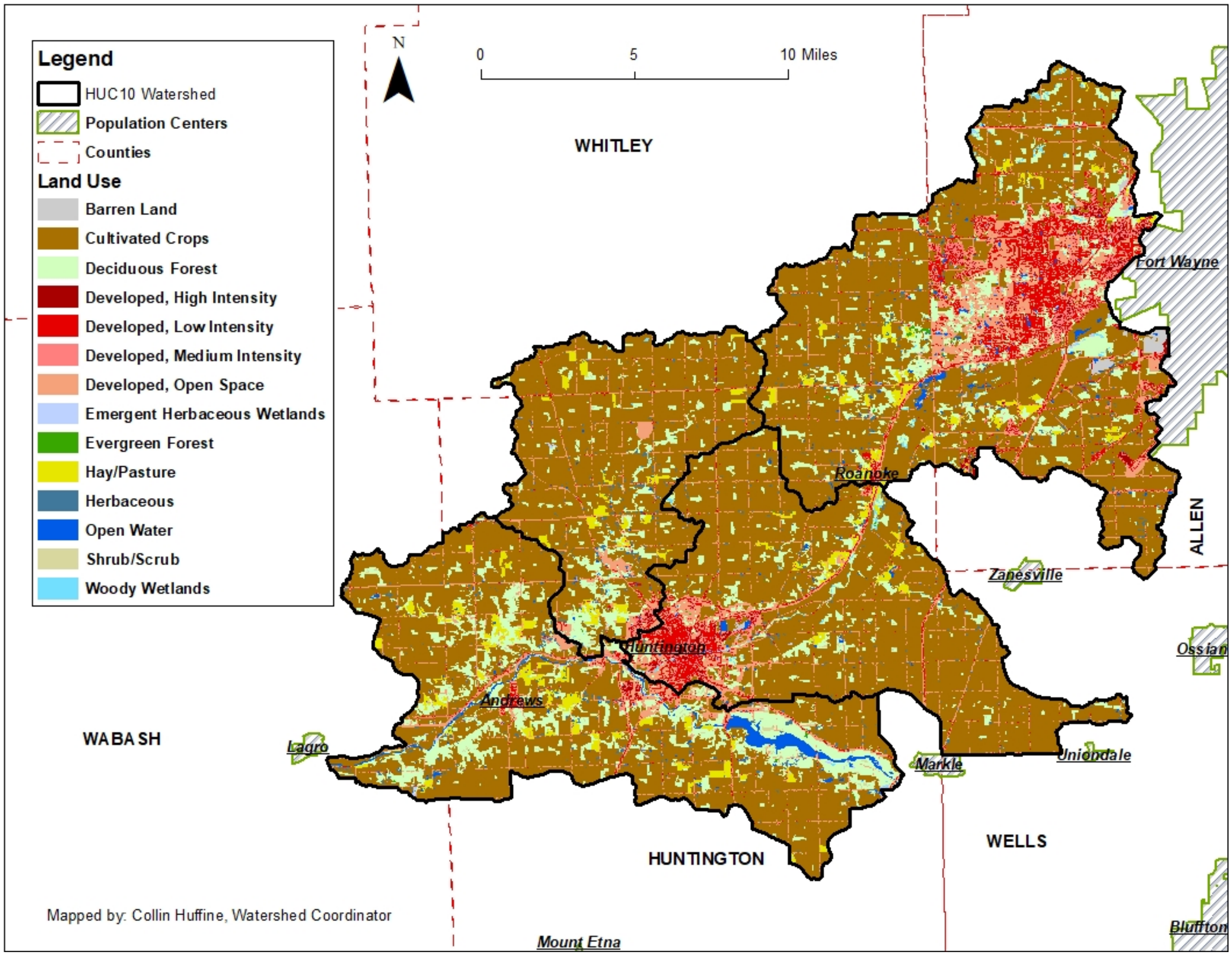


Figure 2-10. Land use of the UWRW Phase 3 project area

Potential Pollution Sources

Brownfields

Brownfields are defined by IDEM as "a parcel of real estate that is abandoned or inactive or may not be operated at its appropriate use. The expansion, redevelopment, or reuse of the property is complicated because the presence or potential presence of a hazardous substance, a contaminant, petroleum, or a petroleum product poses a risk to human health and the environment (per Indiana Code 13-11-2-19.3)". Contaminated brownfield sites with hazardous substances may impact surface or ground water quality. Examining these sites in closer detail to determine potential future uses for the sites by cleaning up any environmental hazards present, will help to protect the environment, can improve the local economy, and reduces pressure on currently undeveloped lands for future development. The US EPA, states, and local municipalities often offer assistance in the form of grants and low interest rate loans for the cleanup and redevelopment of identified and potential brownfield sites. There are nine brownfield sites located within the UWRW Phase 3 project area (Figure 2-11 & Table 2-16).

NPDES Permits

IDEM administers the National Pollution Discharge Elimination System (NPDES) permit program required by the Clean Water Act (CWA). IDEM addresses activities that cause or may cause discharge of pollutants into the waters of the State. According to IDEM, the purpose of NPDES permits is to control point source pollution of the state's waters. The NPDES permit requirements must ensure that, at a minimum, any new or existing point source discharger must comply with technology-based treatment requirements and water quality based effluent requirements that are contained in 327 IAC 5-5-2. According to 327 IAC 5-2-2, "Any discharge of pollutants into waters of the State as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to discharge." This is the most basic principle of the NPDES permit program. (IDEM Office of Water Quality, 2009). There are 147 NPDES permitted facilities in the watershed (Figure 2-11 & Table 2-16). Concentrated Animal Feeding Operations also require NPDES permits and are addressed in the next section.

Animal Feeding Operations (AFO)

The U.S. EPA describes Animal Feeding Operations (AFO) as:

agricultural operations where animals are kept and raised in confined situations. An AFO 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, and

- crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

AFOs that meet the regulatory definition of a concentrated animal feeding operation (CAFO) are regulated under the NPDES permitting program. The NPDES program regulates the discharge of pollutants from point sources to waters of the United States. CAFOs are point sources, as defined by the CWA. To be considered a CAFO, a facility must first be defined as an AFO, and meet the criteria established in the CAFO regulation.

AFOs must not exceed the quantity threshold of either confined feeding operation (CFO) or concentrated animal feeding operation (CAFO).

Confined Feeding Operations (CFO)

Confined feeding is the raising of animals in any confined area for at least 45 days during any year where there is no ground cover or vegetation over half of the confined area. CFOs are defined by Indiana law as any feeding operation engaged in the confined feeding of at least:

- 300 cattle or
- 600 swine or sheep
- 30,000 fowl (chickens, turkey or other poultry)
- 500 horses in confinement

IDEM regulates the CFOs through the Office of Land Quality which is responsible for permitting, compliance monitoring and enforcement activities as outlined in the Confined Feeding Control Law. The following criteria must be met in order to be a permitted CFO:

- Must have at least 180 days storage for manure and wastewater
- Be designed according to the design standards outlined in the CFO Guidance Manual
- Have sufficient acreage available for application of manure generated
- Provide adequate seperation distances of the manure storage structures and confinement lots from roads, wells, and surface waters
- Include a manure management plan detailing soil testing, manure testing and manure application areas
- Provide record keeping at the CFO which includes:
    - Manure type
    - Amount of manure generated
    - Amount of manure applied to land
    - Manure storage methods
    - Type of application equipment used
    - Application rates based on laboratory analysis

Concentrated Animal Feed Operations (CAFOs)

The CAFO permit process and operational requirements are slightly different from CFOs. CAFOs in Indiana are required to obtain an NPDES permit through IDEM according to the USEPA Clean Water Act regulations for CAFOs finalized in 2003. CAFOs are considered to be point sources for pollution by the USEPA. IDEM developed a general permit for CAFOs (327 IAC 15-15) effective in February 2004. Two types of NPDES permits are available for CAFOs:

1. The general permit establishes uniform criteria to be followed by those with a general permit.

2. An individual permit provides an opportunity for IDEM to require additional protective measures, or for the farm to construct or operate in a manner different from that prescribed by the general permit regulation.

The main determining factor for requirement of an NPDES permit is the number and species of animals. The threshold for each species is shown in Table 2-15.

Table 2-15. Threshold number and species that requires CAFO NPDES permit

Threshold Number Requiring NPDES Permit	Species
700	Mature Dairy Cows
1,000	Veal Calves
1,000	Cattle - other than mature dairy cows
2,500	Swine - above 55 pounds
10,000	Swine - less than 55 pounds
500	Horses
10,000	Sheep or Lambs
55,000	Turkeys
30,000	Laying Hens/Broilers with liquid manure handling system
125,000	Broilers with solid manure handling system
82,000	Laying Hens with solid manure handling system
30,000	Ducks with solid manure handling system
5,000	Ducks with a liquid manure handling system

Any CAFO seeking an NPDES permit must provide to IDEM the following information:

- A completed NPDES permit application form;
- A completed CFO approval application form;
- Confirmation that any necessary public notice requirements were conducted;
- Plans and specifications for the design and construction of the animal confinement structure and manure treatment and control facilities;
- At least two soil borings within the area of any liquid waste storage structures;
- A manure management plan outlining procedures for soil testing and manure testing;
- Soil Survey and Topographic Maps of manure application areas which outline field borders, identify the owner, and acres available;
- Farmstead plan showing the location of the buildings and waste storage structures in relation to the following features within 500 feet:
    - water wells
    - drainage patterns
    - property lines
    - roads
    - streams, ditches and tile inlets

The following conditions must be satisfied for IDEM to issue an NPDES permit:

- The submitted application forms must be complete with no missing applicable information;
- Confirmation that public notice requirements were satisfied;
- Provides at least 6 months of manure and wastewater storage capacity;
- Has sufficient acreage available for application of the manure and wastewater;
- Provides adequate separation distances of the manure storage structures and confinement lots from property lines, roads, wells, and surface waters;
- If a construction application is submitted that the structures are designed to be built according to the design standards outlined in the CFO rule and CFO Guidance Manual.

There are nine CFO's and three CAFO's located within the UWRW Phase 3 project area with six located in HUC 0512010112 (Clear Creek), one located within HUC 0512010111 (Little River), and five located in HUC 0512010113 (Loon Creek-Wabash River) (Figure 2-11 & Table 2-16). Manure waste from animals can be transported directly to adjacent waterbodies by means of spills, overflows, stormwater and other paths, negatively impacting water quality and contributing to *E. coli* contamination.

Combined Sewer Overflow (CSO)

A combined sewer overflow (CSO) is a piped outfall that is part of a combined sewer system, which carries both sanitary waste and storm water runoff through the same pipe to the wastewater treatment plant (WWTP). However, during rainfall events, the system is designed to discharge flows directly into a receiving waterbody once the WWTP storage capacity is exceeded. CSO's discharge untreated or partially treated human and industrial waste, toxic materials, and debris directly to rivers and streams. Each population center that contains CSO's is required to comply with the CWA and manage the discharges of combined sewers. A review of EPAs Guidance for long-term control plan states that many CSO communities enter into a consent decree or an Agreed Order (AO), which is a federally or state administered enforcement mechanism that compels the community to implement a plan to improve water quality. The consent decree or AO may include a Long Term Control Plan (LTCP) for construction of sewer system improvements as well as documented plans for the operation, maintenance and rehabilitation of the sewer system to minimize or eliminate CSO discharges to receiving waters.

There are fifteen CSO's located within the UWRW Phase 3 project area (Figure 2-11 & Table 2-16). All CSO's in the project area are located within the limits of the City of Huntington. Fourteen of the CSO's are within the Little River watershed (HUC 0512010111) and one CSO's is located within the Loon Creek-Wabash River watershed (HUC 0512010113)

Leaking Underground Storage Tanks (LUST's)

An underground storage tank (UST) system is a tank and any underground piping connected to the tank that has at least 10 percent of its combined volume underground. The IDEM Office of Land Quality (OLQ) does not regulate every type of storage tank. The OLQ regulations apply only to UST systems that store petroleum or certain hazardous substances. The OLQ helps UST owners and operators understand the regulations in order to encourage and promote compliance. For safety, tanks containing petroleum products and other hazardous substances are placed underground to lessen the risk of explosion. Leaking Underground Storage Tanks (LUSTs) and their associated piping can release dangerous vapors or chemicals into buildings or contaminate soil, surface water, and ground water. There are 82 LUST in the UWRW Phase 3 project areas (Figure 2-10 & Table 2-16).

Agricultural Tile Drainage

Tile drainage in Indiana is intimately tied to row crop agriculture. No agency tracks the placement or number of tile drains in Indiana fields or watersheds. Subsurface tile drains are common across the watershed and can be found by the discharge pipes seen in ditches and streams. It is well known that nitrate binds and moves with water. As water drains off the land through the tile drains it may carry excess nitrogen from the fields and cause an increase in the nitrogen concentrations in rivers and streams.

Urban and Suburban Fertilizer Use & Pet/Wildlife Waste

Fertilizer use and pet waste in urban and suburban areas can contribute to increased levels of pollutants in water. The contribution of nitrogen and phosphorus from urban fertilization and *E.*

coli from pet waste to receiving waterbodies is likely greatest in the areas near the cities of Fort Wayne and Huntington. Waste from wildlife populations, such as Canada Geese (*Branta canadensis*), can also significantly affect water quality. In addition to being a nuisance on lawns, excess goose populations degrade water quality when their wastes which is high in organic matter and nutrients enters lakes, rivers, and streams. Geese defecate both on land and directly in waterbodies contributing to nutrient and *E. coli* contamination.

Land Use & Stakeholder Concerns

Many of the concerns expressed by the stakeholders directly relate to how the land uses are utilized in the watershed. With the conversion of the landscape from forest and prairie prior to European settlement to the current row-crop agricultural landscape, many natural processes have been altered. Row crop agriculture requires nutrient inputs from fertilizers or manure to sustain high yields yearly. These nutrient inputs have the potential to enter adjacent waterbodies through both overland runoff and subsurface tile. With the conversion of forest to row crop agriculture the watersheds lack a nutrient sink to provide treatment before the water enters a waterbody. Additionally, much of the riparian buffers around the streams have been modified or removed to increase the land in row crop production. The removal of these buffers reduces the potential nutrients to be absorbed before they enter the waterway. Additionally, with a lack of riparian buffers the stability of the streambank is reduced and the potential for streambank erosion increases.

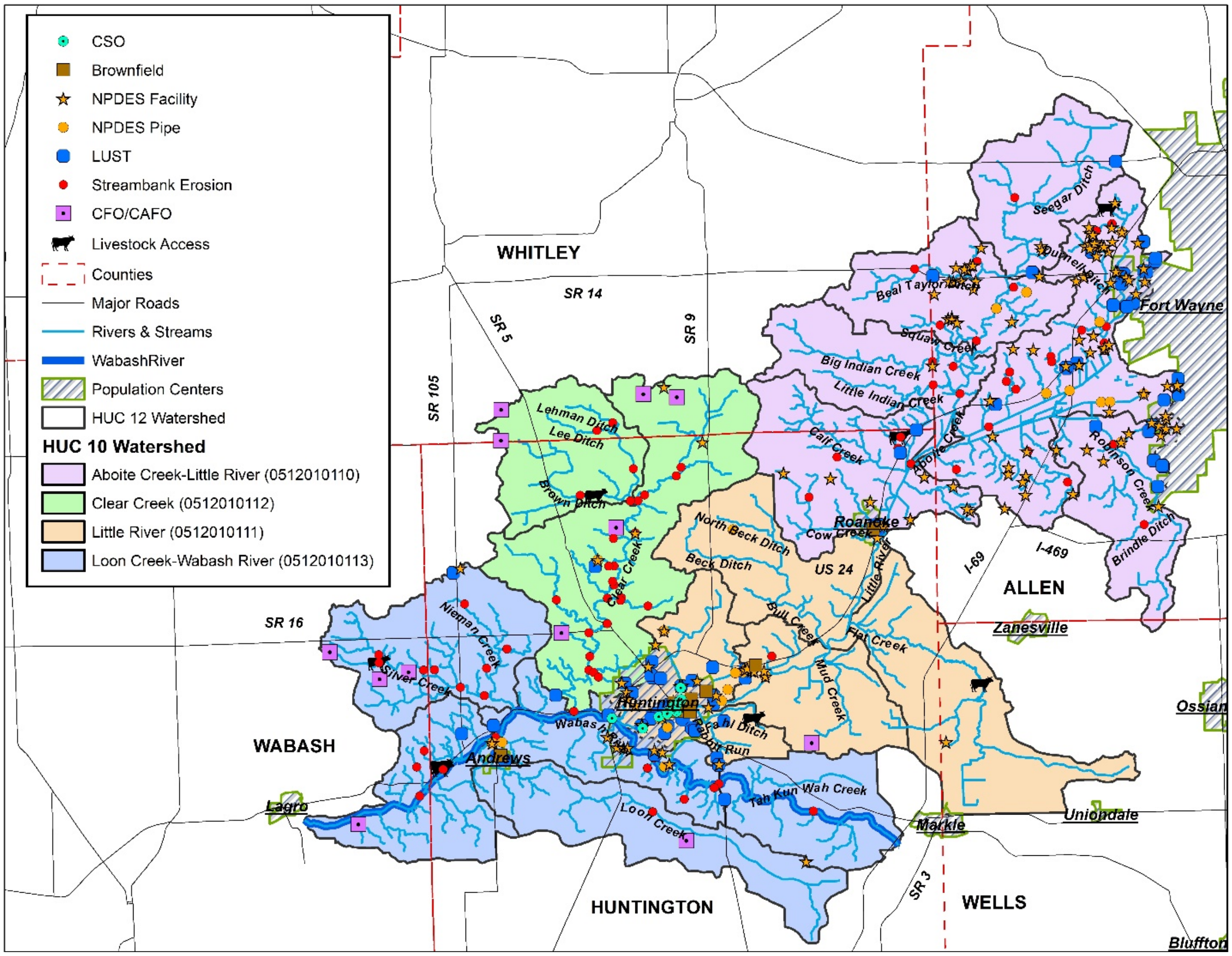


Figure 2-11. Potential pollution sources within the UWRW Phase 3 project area.

Table 2-16. Potential pollution sources (PPS) in the UWRW Phase 3 project area.

Potential Pollution Source (PPS)	#
Brownfield	9
CSO	15
NPDES Facility	147
NPDES Pipe	55
LUST	82
CFO	9
CAFO	3
Livestock access	8
Streambank erosion	81

2.5 Previous Watershed Planning Efforts

<u>City and County Master/Comprehensive Plans</u>

Plan-it Allen

Plan-It Allen is a Comprehensive Plan that was developed under the guidance of the planning commission of Fort Wayne and Allen County and encompasses all of Allen County, Fort Wayne, and the surrounding smaller communities. There are two chapters in the Plan that are of particular interest to this project; Chapter 1: Land Use and Chapter 5: Environmental Stewardship. Each chapter outlines particular goals and objectives to meet to minimize the impact of development on our natural areas and to protect the natural resources we currently have available. Below is a list of the goals outlined in the Plan.

Chapter 1 – Land Use:

1) Encourage the adoption of the Conceptual Development Map (page 25 of Plan-It Allen) to utilize existing infrastructure for new development.
2) Encourage revitalization, remodels, and new development along existing infrastructure.
3) Discourage development in growth not currently served by a sanitary sewer.
4) Encourage a ‘fix-it" first approach to existing facilities prior to new development within Fort Wayne.
5) Encourage sustainable growth and coordinated development with mixed land uses.
6) Encourage development proposals that are sensitive to preserve or reserve areas.
7) Encourage Sustainable growth by conserving natural features and environmentally sensitive land with significant value.
8) Identify and implement additional floodplain and watershed management tools.
9) Inform and educate the public and appropriate community stakeholders about sustainable development alternatives that conserve natural features and preserve environmentally sensitive land.
10) Collaborate with NGOs to acquire and/or protect significant and environmentally sensitive land.
11) Continue to coordinate with existing adopted river-oriented plans and strategies.
12) Enhance the use and presence of the three rivers.

Chapter 5 – Environmental Stewardship:

1) Ensure the conservation of significant land resources, including but not limited to agricultural land, woodlands, and wetlands.
2) Pursue wetland restoration initiatives.
3) Protect wildlife habitats and limit invasive species.
4) Preserve and improve the quality of groundwater and surface water resources.
5) Support and collaborate in the establishment of watershed management plans that recommend actions to major sources of surface water contamination.
6) Encourage the expansion of riparian buffers and enhance public access to waterfronts.

7) Protect the natural and built environment through comprehensive floodplain management initiatives.
8) Encourage utilization of green building technologies to promote sustainable development.
9) Encourage brownfield redevelopment.

Huntington County Comprehensive Plan 2040

The *Huntington County Comprehensive Plan 2040* was adopted by the Board of Commissioners of Huntington County in December 2018. The plan was developed by Huntington Countywide Department of Community Development (DCD) and Region3A Development & Regional Planning Commission. The plan is focused on future community growth in the unincorporated areas of Huntington County. There are three chapters in the Plan that are relevant to this project in which the impacts of community growth and development are considered with respect to the environment: Chapter 2: Environment; Chapter 3: Parks & Recreation; and Chapter 8: Land Use. Each chapter begins with a current analysis of the section topic and ends with a future proposal containing overarching goals and objectives along with specific strategies to accomplish those goals and objectives. Below is a list of the goals, objectives, and strategies outlined in the Plan.

Chapter 2 – Environment:

- **Goal**: Promote an ecologically sound community through the protection and enhancement of environmental resources, balancing the value of human, plant, and animal life forms and their need to coexist together, while continuing to recognize, protect, and enhance those natural systems and the intricacies of their interrelationships.
- **Objectives**:
    1) Protect the local groundwater supply.
    2) Protect the quality and quantity of water in Huntington County's streams, rivers, and reservoirs.
    3) Conserve natural areas such as forestland, wetlands, and prairies.
    4) Protect and enhance the character of the natural environment present in Huntington County.
    5) Protect and enhance the streams and riverbanks throughout the county.
    6) Minimize conflicts between growth and the natural environment.
    7) Protect and preserve natural drainage areas and the Special Flood Hazard Area (SFHA).
    8) Reserve open space for future development of parks and recreation amenities and to provide habitats for plants and animals.
    9) Reduce damage to life and property from flood and other natural hazards by discouraging development in the SFHA and 500-year flood zone.
- **Environmental Strategies:**
    1) Establish development buffers around waterways that run throughout Huntington County.

2) Establish a Huntington County land trust program to protect forestlands, wetlands, prairies and valuable farm ground.
3) Limit development and uses near wellhead sites.
4) Use cluster development techniques for new developments to create pockets of open space.
5) Limit development and uses within the Special Flood Hazard Area.
6) Limit development and uses within the 500-year flood zone.
7) Expand DNR's involvement throughout the county.
8) Create education experiences (K-12) with respect to environmental issues.
9) Develop green areas (planned open space).
10) Establish educational opportunities dealing with environmental issues for nontraditional students and adults.
11) Research and establish alternative green energy solutions.

Chapter 3 – Parks & Recreation

- **Goal**: To develop, maintain, and promote recreational opportunities and/or facilities to meet the current and future needs of Huntington County; and to preserve greenspaces between towns by development of preserves throughout the County
- **Objectives**:
    1) Develop the park system in a coordinated manner such that expenditures are effective and match the community's growth
    2) Protect parklands and recreational areas from undesirable, conflicting, and potentially hazardous land uses and developments.
    3) Maintain the parks and recreational amenities at a level that attracts frequent and returning users from communities within and around Huntington County.
    4) Establish and maintain a variety of size and locations of public parks and open spaces that provide opportunities for passive and active recreation.
    5) Interconnect the parks, recreation land, public natural areas and public facilities with a network of trails suitable for pedestrians and bicyclists.
    6) Utilize abandoned railways and roads for a countywide trail system.
    7) Develop historic tour using existing county roads connecting each community.
    8) Keep the community informed of recreational opportunities available.
    9) Weave pedestrian greenways into town fabric to connect residential areas with local commercial areas, schools, etc.
- **Parks & Recreation Strategies:**
    1) Develop trails connecting all communities in Huntington County.
    2) Connect Huntington County's trail network to neighboring counties.
    3) Create a countywide parks and recreation board.
    4) Expand reservoir programs.
    5) Expand hunting and fishing opportunities.
    6) Establish joint programs through the YMCA, PAL Club, and Huntington University.

7) Hold joint meetings with all community park boards.
8) Designate potential areas for future sports fields.
9) Major housing developments should provide open space for recreation purposes.
10) Re-establish a “Historic Tour” for the county.
11) Create links between various destinations.
12) Build upon existing youth programs.
13) Provide recreational opportunities that allow for handicap accessibility.
14) Expand fine art festivals.
15) Promote camping opportunities.

Chapter 8 – Land Use

- **Goal**: Encourage orderly and responsible development of land in order to promote the health, safety and welfare of residents within Huntington County, while simultaneously promoting opportunities for community growth and development that result in enhanced quality of life, resulting in diverse housing, economic vitality, enhanced recreation, and nurtured environmental integrity.
- **Objectives**:
  1) Provide for a compatible coexistence between land use categories.
  2) Meet future growth needs of the community.
  3) Preserve and protect the agricultural character and function of the county.
- **Land Use Strategies:**
  1) Provide adequate housing for all levels of income within the community.
  2) Ensure that residential land uses are designed to be safe, accessible, sanitary, decent and aesthetically appealing.
  3) Allow residential, commercial, industrial, farming, parks, and open space to occur in areas planned for such uses, while restricting the same uses from occurring where they are not planned.
  4) Protect prime agricultural land from unrelated development.
  5) Require that uses of land are sensitive to adjacent environmental features.
  6) Strongly discourage incompatible and conflicting land uses from being adjacent or in close proximity to one another.

Wabash County Comprehensive Plan

The Wabash County Comprehensive Plan Initiative was started in 2009. The evolving goals of Wabash County’s future were developed through public meetings, public questionnaires, interviews, and from extensive research of data for Wabash County. Furthermore, the goals and objects laid out in the Plan are based on several planning documents, studies, and processes conducted by Wabash County and its incorporated and unincorporated towns. Four chapters in the Plan address agriculture and environmental/natural resource topics: Ag Land Use and Consumption, Ag Livestock, Land Use Introduction, and Environmental Introduction. The Ag Land Use and Consumption and Ag Livestock chapters do not describe specific goals and objectives related to agriculture, but rather provide a summary of data relevant to area of land dedicated to farming, number of farms, farm operators, beef production, dairy production, poultry production, and swine production within Wabash County. The chapters dedicated to Land Use and Environment provide specific objectives and goals. They are outlined below.

Land Use Introduction:

- **Objective 1: Preservation of Ag Land and Ag Industry**
    - **Goal 1:** Provide opportunities for county growth and development while preserving valuable Ag land, promoting community culture, and ensuring the environmental stability that will result in a diversely enhanced and healthier quality of life for the citizens of Wabash County**.**
    - **Goal 2:** Enact a strong farmland preservation program. The adoption and enforcement of a "Right to Exercise Agriculture Practices" or "Right to Farm Statue" policy along with the incorporation of "Multi-tier Ag Zoning" is necessary to preserve farmland, support farming and to alert potential development sites of the activities associated with farming.
- **Objective 2: Focused Development**
    - **Goal 1:** Promote revitalization of community housing through incentive programs to raze dilapidated structures and rebuild within the existing communities.
    - **Goal 2:** Develop housing units to be located within existing communities where necessary infrastructure services are readily available.
    - **Goal 3:** Promote construction of various housing styles with the purpose of providing citizens the opportunity to reside in homes that fulfill the home owners' needs and are economically scaled for various income levels.
- **Objective 3: Diversity and Placement of All Business and Industry**
    - **Goal 1:** Strategically grow the county with a diverse industrial, commercial and business foundation that is of modest size. Diversity is essential for stability of the community.
    - **Goal 2:** Prevent commercial development from stringing along transportation corridors and occurring at random in rural areas. Focus key commercial growth on key transportation intersections in the county and where infrastructures already exist.
    - **Goal 3:** Study short- and long-term impacts of commercial development on adjacent land to guarantee "best practice" planning for Wabash County.

Environment Introduction:

- **Objective: Balance needs of community growth, human health, and other life forms while enhancing and protecting the county's environment to the maximum possible level**

- **Goal 1:** Protect today's environment and natural resources for our benefit and the benefit of future generations through strategic development practices.
- **Goal 2:** Work with Federal, State, and local environmental groups to meet regulations for sewage processing in all rural communities. Focus development where sanitary sewer and infrastructure exists.
- **Goal 3:** Protect underground aquifers from contamination that can result from inappropriate or improper development and/or use of land.
- **Goal 4:** Maintain the community floodways, floodplains and spillways as natural spaces primarily for flood and erosion control, water quality management, and groundwater recharge. Development must be managed carefully and well-buffered in these sensitive areas.
- **Goal 5:** Provide incentives for the agriculture community to incorporate best practices in all Ag and Ag related operations.
- **Goal 6:** Use zoning and ordinances to preserve natural wooded areas and wetlands to help minimize discord between growth and natural environment.
- **Goal 7**: Initiate program in which community members are provided the opportunity to earn their solid waste fee back through obedient recycling practices.
- **Goal 8:** Develop positive relationships with Wabash County's industrial interest and work together to protect the environmental surroundings of Wabash County. The growth of employment within Wabash County cannot come at the expense of the county's natural environment.
- **Goal 9:** Hold environmental impacts on recreational areas in check. This is essential in implementing a high quality of life, good health, and a favorable community spirit.

Wells County Comprehensive Plan 2014-2024

The *Wells County Comprehensive Plan 2014-2024* is a 10-year comprehensive plan for Wells County developed by the Wells County Area Plan Commission and Wells County Comprehensive Plan Steering Committee. The purpose of the plan is to promote public health, safety, morals, convenience, order, and the general welfare, and for the sake of efficiency and economy in the process of development within the jurisdiction of the plan. Chapters relevant to this WMP include Chapter11 subsections 2, 8, and 13 which focus on CAFO's, Discouraged Land Uses, and Floodplains, respectively, as well as Chapter 13 subsection 2 which describes zoning principles for land use development in Wells County. The relevant sections and subsections are outlined below.

Chapter 11 - Statement of Objectives for the Future Development of the Jurisdiction:

- **Section 2 - Concentrated Animal Feeding Operations (CAFO):**
    - **Subsection D -** outlines action points that need to be considered to help the County reach its goal and aspirations regarding CAFO's:

1) Remember when reviewing the CAFO section of the zoning ordinance, do not stray away too far from the current rules
2) Continually review new technologies to promote using proven odor reduction techniques within the plan
3) Continually stay up-to-date on the Indiana Department of Environmental Management, Indiana State Chemists, and the United States Environmental Protection Agency's rules regarding ground water protection, surface water protection, and manure application
4) Review the need for minimal acreage requirements regarding CAFOs while keeping action point 1 in mind
5) Continually stay up-to-date on the Indiana Code rules regarding water rights
6) Review the need for strengthening the benefit for developing near the operator's place of residence requirement while keeping action point 1 in mind
7) Continually review information from all sides of the CAFO issue while making any decision regarding its requirements
8) Review increasing the residential setback regarding CAFOs while keeping action point 1 in mind
9) Review the need for requirements regarding wear and tear on community roads while keeping action point 1 in mind

- **Section 8 - Wells County's Discouraged Land Uses:**
  - **Subsection D -** outlines action points that need to be considered to help the County reach its goal and aspirations regarding discouraged land uses:
    1) Review the requirements for landfills to verify adequacy
    2) Review the requirements for commercial scale wind development to verify adequacy
    3) Review the requirements for all electric production facilities to verify adequacy
    4) Determine what types of land uses may have objectionable attributes and verify whether or not the ordinance should prohibit such uses, or whether the ordinance requirements governing such uses are adequate, or should be amended
    5) Add language into the ordinances stating that items not specifically defined in the ordinance are not permitted uses
    6) Review the County's setbacks to verify that they successfully alleviate the objectionable attributes of these uses
    7) Review possible non-setback related solutions that have been proven successful in alleviating the objectionable attributes
    8) Review what types of approval processes are adequate for these uses (i.e. development plans, special exceptions, overlay zones...)

- **Section 13 – Floodplain:**
  - **Subsection D -** outlines action points that need to be considered to help the County reach its goal and aspirations regarding floodplains:
    1) Protect the County's residences from the effects of flood damages
    2) Find a balance between private land rights and necessary flood plain regulations
    3) Utilize flood prone areas for recreational uses that are not negatively impacted by flooding
    4) Start with the state and federal government's regulations to participate in the national flood insurance program
    5) Upgrade floodplain maps to make determinations easier at a local level and encourage more accurate mapping when feasible
    6) Strongly discourage development in the mapped floodplain
    7) Promote conservation and open spaces' uses such as parks and trails in flood prone areas
    8) Review regulations and zoning maps to verify that these policies are being promoted

Chapter 12 – A Statement of Policy for the Land Use Development of the Jurisdiction:

- **Section 2 – Overview of Zoning Principles:**

  A. The following zoning principles should be taken into account when the County is making land use decisions
    1) The same zoning classification should cover an entire parcel
    2) Zoning classifications should be clear on what primary and secondary uses are permitted
    3) Items listed in the permitted use table are promoted by the ordinance unless the use requires a special exception or overlay zone to be permitted
    4) The County should pay special attention when adding and removing uses from a zoning district's permitted uses. These use changes can alter the character of the zoning district causing unintended consequences
    5) The County should review the lot size, setbacks, and land uses for each district to verify that they are meeting their intended goals
    6) Areas that need to be preserved should be zoned Conservation (C-1), therefore not providing developers with a false sense of development opportunity
    7) Urban residential should only be used in areas that have immediate access to a public sanitary sewer system
    8) Rural residential should only be used in areas that have a reasonable potential for obtaining access to a public sanitary system
    9) Heavy Industrial (I-2) and Landfill (L-1) require substantial land use and visual buffering from residential uses
    10) Light Industrial (I-1) and Business district may require land use or visual buffering depending on the site from residential uses

Whitley County Comprehensive Plan

The *Whitley County Comprehensive Plan* was adopted in 2010 and replaced the previous plan completed in 1993. The plan applies to the Whitley County planning jurisdiction excluding the incorporated communities of Churubusco, Columbia City, and South Whitley, as well as the extra-territorial planning jurisdictions of those communities. The overall theme of the plan is improving health, safety, and welfare of residents and analyzes physical characteristics of the county including land use, transportation systems, community facilities, developed areas, and natural land features, while utilizing public involvement as the foundation of the plan. Chapters with relevance to the WMP Include Part 2: Planning Principles and Part 3: Land Classification Plan.

Part 2 – Planning Principles**:**

- **Subsection – Nurture Environmental Integrity:**
    - The principle of nurturing environmental integrity strives to:
        1. **1)** Protect environmental resources
        2. **2)** Minimize energy consumption
        3. **3)** Promote public health and safety
        4. **4)** Move toward sustainability
    - **Objective 1:** Prohibit development in the floodplain
    - **Objective 2:** Develop and implement a county-wide storm water management and erosion control ordinance
    - **Objective 3:** Include incentives for conservation and preservation of environmentally sensitive areas in Whitley County Zoning Ordinance and Whitley County Subdivision Control Ordinance
    - **Objective 4:** Modify Whitley County Zoning Ordinance to regulate the use of alternative energy devise in a way that mitigates negative effects to neighboring properties
    - **Objective 5:** Prohibit septic systems where soils are not suitable for such systems. Allow other on-site systems when consistent with Land Classification Plan
    - **Objective 6:** Monitor Indiana's list of impaired waterbodies for Whitley County lakes and stream segments
    - **Objective 7:** Continue the county-wide recycling program and enhance the program by investigating local companies that can make use of the recycled materials
    - **Objective 8:** Inventory environmental features that are unique, large in size, irreplaceable, or contain a rich diversity of species.
    - **Objective 9:** Target new environmentally sensitive areas for conservation and/or preservation
    - **Objective 10:** Encourage and educate the development community about the benefits of buildings that are Leadership in Energy and Environmental Design (LEED) certified

  - **Objective 11:** Create and publish an environmental toolbox that includes information about programs to conserve, sustain, and restore natural areas and a directory of environmental organizations and existing lake associations

Part 3 – Land Classification Plan:

- **Subsection – Conservation and Open Space:**
  - **Purpose:** To protect existing conservation areas; to establish open space; to serve as a transition between incompatible uses; and to preserve land for private and public park and recitation facilities
- **Subsection – Agriculture:**
  - **Purpose:** To maintain large, undeveloped areas for productive agricultural uses and intense agricultural-relates uses
- **Subsection – Transitional Agriculture:**
  - **Purpose:** To allow farmland and residential uses to coincide in appropriate rural areas

<u>Watershed Management Studies</u>

The Flat Creek, Griffen Ditch, Fleming Ditch, and Somners Creek Watershed Diagnostic Study, Wells County, Indiana (2002).

In 2002, a LARE study was conducted in Flat Creek, Griffin Ditch, Fleming Ditch, and Somers Creek watersheds. The results of the study indicated impaired water quality resulting primarily from highly agricultural land use occurring over erodible soils. Very few BMPs were documented throughout the watersheds and conventional tillage was abundant. Poor habitat and impaired macroinvertebrate communities were observed throughout the watershed. Nitrogen, phosphorus, ammonia, *E. coli*, and suspended sediment concentrations exceeded state water quality assessment benchmarks, primarily during storm flows. Recommended actions to improve watershed conditions and water quality included alternative technology for waste treatment systems, exclusion of cattle from streams, education and outreach, maintenance of previously installed practices, and the development of a watershed management plan.

Little River Watershed Diagnostic Study (2009).

In 2009, A LARE project focused on the Little River watershed (HUC 05120101120) conducted by the Indiana Department of Natural Resources (IDNR) concluded that the physical and chemical characteristics of the watershed were degraded. The most prominent issues within the watershed were excess nutrient inputs from surrounding agricultural practices and degraded aquatic habitat. The DNR recommended the use of several BMPs to improve water quality and restore biological communities such as grassed waterways, filter strips, and riparian buffers, as well as more extensive stream restoration projects.

Silver Creek-Hanging Rock Watershed Diagnostic Study, Wabash and Huntington Counties, Indiana (2018).

In 2018, a LARE study was completed for Silver Creek-Hanging Rock Watershed in Wabash and Huntington Counties. The study documented elevated concentrations of soluble and total phosphorus during base and storm flow conditions, as well as high concentrations of total suspended solids (TSS) and *E. coli* during storm flows. Habitat was generally adequate for maintaining good quality fish communities and only moderately impaired macroinvertebrate communities. The study revealed a need for implementation of BMPs focused on the reduction of soil erosion, highlighted by approximately 14 miles of streambank erosion observed throughout the study area

Rapid Watershed Assessment – Upper Wabash River Watershed (2009).

The Rapid Watershed Assessment-Upper Wabash Watershed (2009) report cites excessive amounts of sediments, nutrients, and bacteria as resource concerns in the entire Upper Wabash 8-digit HUC (05120101) watershed that begins in northeast Ohio and continues west into 10 northeastern Indiana counties, which includes the UWRW Phase 3 project area

Watershed Restoration Action Strategy for the Upper Wabash River Watershed (2002)

The Watershed Restoration Action Strategy for the Upper Wabash Watershed (2002) identifies and discusses concerns similar to other reports approached at the 8-digit HUC watershed scale, including sediment, nutrients, and *E. coli.* While projects at this scale make it difficult to inform local decisions, many of the concerns listed in this report have also been identified by the UWRW Phase III steering committee members and stakeholders.

Total Maximum Daily Load (TMDL) Documents

Wabash River Nutrient and Pathogen TMDL Development (2006).

In 2006, a Total Maximum Daily Load (TMDL) report was developed for the entire 475 miles of the Wabash River in Indiana to the confluence with the Ohio River. The Wabash River TMDL Final Report identifies the main stem of the Wabash River as impaired and lists *E. coli* and nutrients as the primary pollutants. Other water quality issues such as impaired Biotic Communities (IBC), dissolved oxygen (D.O.), and pH are also documented. Pollution sources in the watershed were identified as NPS pollution from agriculture and pastures, land application of manure, and urban and rural run-off, as well as from straight pipe discharges, home sewage treatment system disposal and combined sewer overflow outlets.

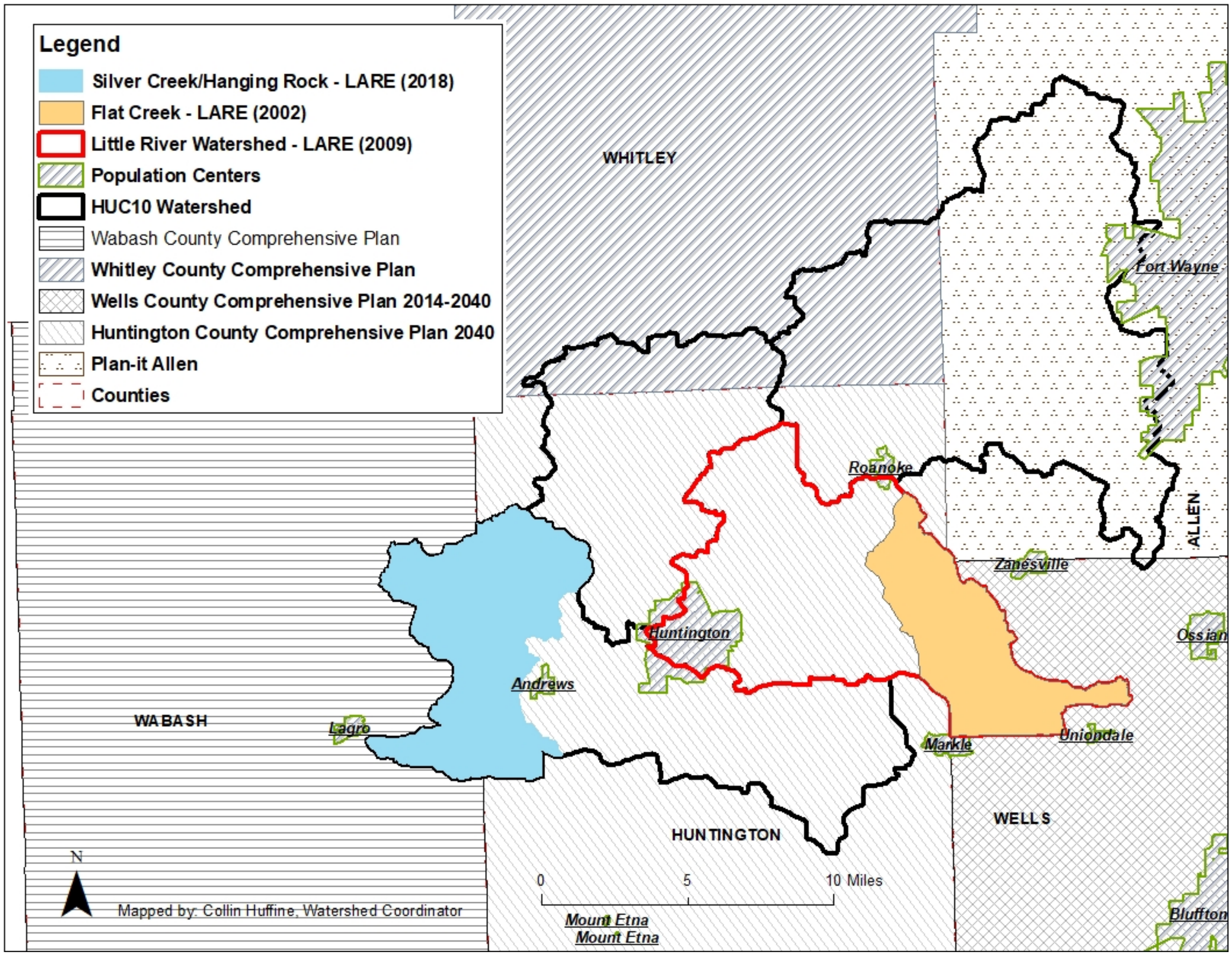


Figure 2-12.Previous watershed planning efforts in the UWRW Phase 3 project area.

Previous Watershed Management Plans (WMPs)

Upper Wabash River Watershed Management Plan – Phase 1 (2007)

Phase 1 of the Upper Wabash River Watershed Management Plan was developed by the Upper Wabash River Basin Commission (UWRBC) and Christopher B. Burke Engineering, Ltd (CBBEL). The Phase 1 WMP project area covered 244,427 acres and included four 10-digit HUCs (Headwaters Wabash River, HUC 0512010101; Loblolly Creek, HUC 0512010104; Brewster Ditch-Wabash River, HUC 0512010105; and Six-mile Creek-Wabash River, HUC 0512010106) through portions of Jay, Adams, and Wells counties. After competition of the Phase 1 WMP, the UWRBC conducted a three-year implementation project of BMP's from 2009-2013. Figure 1-2 (section 1.1) is map depicting the Phase 1 WMP project area.

Upper Wabash River Watershed Management Plan – Phase 2 (2016)

As a continuation of previous efforts to improve water quality in the Upper Wabash River Watershed, Phase 2 of the Upper Wabash River Watershed Management Plan was completed by the UWRBC in 2016. The Phase 2 WMP project area covered 176,123 acres and included three 10-digit HUCs (Rock Creek, HUC 0512010107; Griffin Ditch-Wabash River, HUC 0512010108; and Eight-mile Creek, HUC 0512010109) through portions of Jay, Adams, Wells, Allen, and Huntington counties. The UWRBC plans to administer a program to install BMP's in the Phase 2 WMP project area. Figure 1-2 (section 1.1) is map depicting the Phase 2 WMP project area.

MS4 Areas and Rule 5

The Federal Clean Water Act (CWA) requires storm water discharges from larger urbanized areas to be permitted under the National Pollutant Discharge Elimination System (NPDES) program. A map of NPDES facilities and pipes is displayed in Section 2.4 – Figure 2-11. These communities are referred to as Municipal Separate Storm Sewer System (MS4) communities. MS4 communities are a necessity because urban storm water runoff has one of the highest potentials for carrying pollutants to our waterways. IDEM describes a MS4 as "a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water." MS4 Communities and are required to develop a Storm Water Quality Management Plan (SWQMP), which must include six management techniques, referred to as "minimum control measures" (MCM's) including; 1) Public education and outreach; 2) Public participation and involvement; 3) Illicit discharge, detection and elimination; 4) Construction site runoff control; 5) Post-construction site runoff control; and 6) Pollution prevention and good housekeeping. Essentially, the MCM's list several management practices to limit the amount of storm water entering the sewers on a regular basis. Several areas in the watershed are designated as MS4 communities including the cities of Fort Wayne (Permit # INR040029) and Huntington (Permit # INR040011) as well as the entirety of Allen County (Permit # INR040131).

The Wells and Huntington County Soil and Water Conservation Districts (SWCDs) have plan review authority for 327 IAC 15-5, commonly referred to as Rule 5 (storm water run-off associated with construction activity), which is a regulation designed to reduce pollutants, principally sediment, that are a result of soil erosion and other activities associated with construction and/or land disturbing activities on projects of one acre or more. The SWCDs actively review the storm water pollution prevention plans, make site visits, and suggest best management practices to reduce the threat that runoff could pose to local water quality throughout the counties. The Allen County Erosion Control Ordinance is used to regulate property in Allen County, similar to Rule 5.

Regional Water and Sewer Districts Plans

Regional Sewer and Water Districts are a form of local government that provide management of drinking water and wastewater infrastructure needs. Several Regional Water and Sewer Districts are established within the limits of the UWRW Phase III project area. The Allen County Regional Water and Sewer District (ACRWSD) and Wells County Regional Sewer District (RSD) are county-wide districts. Several regional districts exist in Huntington County including Arlington RSD, Bippus RSD, Dawn Lakes RSD, Norwood RWSD, and Rural Huntington RWSD. No RWSD's established in the counties of Wabash or Whitley are relevant to the project watershed.

Wellhead Protection Plans

The majority of rural community and smaller incorporated areas acquire their drinking water from groundwater wells. Those communities are commonly known as community public water supply systems (CPWSS). A CPWSS is designated as such if it has 15 service connections or supplies drinking water to at least 25 people, according to the federal Safe Drinking Water Act. The entity controlling the system is required to develop a Wellhead Protection Plan (WHPP). A WHPP must contain five elements according to the IDEM; 1) Establishment of a local planning team, 2) Wellhead Protection Area Delineation of where ground water is being drawn from, 3) Inventory of existing and potential sources of contamination to identify known and potential areas of contamination within the wellhead protection area, 4) Wellhead Protection Area Management to provide ways to reduce the risks found in step three, and 5) Contingency Plan in case of a water supply emergency. It is also important to identify areas for new wells to meet existing and future water supply needs.

There are two phases of wellhead protection. Phase I is the development of the WHPP which involves delineating the protection area and determining sources of potential contamination. Phase II is the implementation of the WHPP. Table 2-17 identifies WHPPs located within the project area and which phase they are currently in. A map of WHPP area in Indiana is not available since the delineation of such areas is not made public.

Table 2-17.Wellhead Protection Plans (WHPP) located in the UWRW Phase 3 Project Area

County	System Name	Population Served	Phase
Allen	Honeysuckle (Fort Wayne Utilities)	100	Phase2
	Fort Wayne City Utilities	24,890	Phase2
Huntington	Andrews Water Department	1,149	5 Year Update
	Norwood Regional Water & Sewage	635	5 Year Update
	Huntington Water Department	17,300	5 Year Update
	Markle Water Utility	1,095	5 Year Update
	Roanoke Water Works	1,722	5 Year Update
	Heritage Pointe	470	5 Year Update
	Warren Municipal Water Works	1,237	Phase2
	Valley View Estates	200	Phase2
Wabash	Indiana American Water - Wabash	11,185	5 Year Update
	Lagro Municipal Water Department	438	5 Year Update

2.6 Endangered, Threatened, and Rare Species

The Indiana Department of Natural Resources (IDNR) maintains lists of threatened and endangered species for each county in Indiana, however, specific locations of the species present are not available. Since specific locations are not available, it is assumed that any species present in the five-county area could potentially occur within the UWRW Phase III project area. There are several Federally and State endangered, threatened, and rare species that inhabit Allen, Huntington, Wabash, Wells, and Whitley counties. Appendix-A provides a compiled list of threatened, endangered, and rare species for the five-county area.

The UWRW Phase III steering committee and stakeholders have raised concerns about the protection of endangered, threatened, and rare species within the watershed. The five-county area includes six species of federally endangered freshwater mussel. North America has the highest diversity of freshwater mussels in the word, historically the Midwest had some of the highest numbers of mussel species richness; however; according the U.S. Fish & Wildlife Services (USFWS (a), 2019), more than half of the 78 species are classified as Federally endangered, threatened, or State species of special concern. The Nature Conservancy (TNC) reports that nearly 70% of mussel species in North America are extinct or imperiled.

The Federally endangered Indiana Bat (*Myotis sodalist*) occurs within Huntington, Wabash, and Wells counties. The Indiana Bat was listed as endangered in 1967. Threats to the Indiana Bat are extensive and include disturbance during hibernation, commercialization of caves, loss of summer habitat, pesticides, and other contaminants, and most recently, White-nose syndrome (WNS). According to the USFWS, White-nose Syndrome, a fungal disease, is responsible for over a million bat deaths since 2006 (USFWS (b), 2019).

2.7 Watershed Inventory – Part I Summary

All of the elements described above, when combined, can provide a more detailed depiction how the watershed functions and what activities may pose a greater threat to our water resources. This section will summarize the characteristics of the project area and describe how they relate to each other. This will be examined more closely in subsequent sections.

Agriculture is a primary driver of water quality within the UWRW Phase 3 project area. Given the relatively flat topography and productive soils, row crop agriculture dominates the landscape. Artificial drainage speeds up the delivery of storm water to receiving streams and provides a direct conduit for fertilizer and chemical runoff, as well as sediment. Regular management of open ditches and conversion of idle lands to row crop result in losses of environmentally valuable land which would normally provide benefits such as water quality improvement, flood protection, and wildlife habitat. Over 42% of soils within the watershed are considered potentially highly erodible or highly erodible with a large runoff potential. When combined with a lack of riparian buffers (42% of stream miles) and increases in water velocities in the stream channels, these soils have a much higher potential for runoff or stream bank erosion. Sedimentation can have a major effect on water quality and biota. Tillage data collected by each county in the watershed indicates a relatively high adoption of conservation tillage practices. Conservation tillage requires a minimum of 30% residue cover on the land. This limits the potential for soil erosion, decreases soil compaction, and can save the producer time and money by minimizing the number of passes made on each field while preparing for the next planting season.

Rural communities are spread throughout the watershed. Generally, these communities do not carry services such as centralized wastewater treatment which are normally seen in today's populated areas. This creates potential for significant impacts from wastewater discharges to waterways. Over 93% of soil within the UWRW Phase 3 project area was documented as being very limited in the suitability for septic systems. Many older or unmaintained systems fail resulting in additional wastewater discharges to our streams and creeks. With failing septic systems and a lack of natural areas to treat nutrients from wastewater these areas provide a conduit for nutrients to nearby waterways. Additionally, these rural settings make it difficult to provide intensive education and outreach programs to much of the watershed due to a lack of a centralized location where increased interaction can occur.

Industrial, urban, and suburban land use within the UWRW Phase 3 project area is high compared to many watersheds throughout the state. The developed land is concentrated near the cities of Fort Wayne and Huntington, as well as the towns of Andrews and Roanoke. The proportion of developed land is highest in the Aboite Creek-Little River Watershed, which includes portions of Fort Wayne, where it encompasses over 24% (19,839 acres) of the watershed area. The impact of these developed lands on water quality could be extensive. During large precipitation events, combined sewer overflows open and directly release untreated wastewater into the streams. These events can lead to increases in nutrients and cause a biological oxygen demand bubble downstream of the CSO. To address water quality issues in the UWRW Phase 3 project area, both agricultural and urban influences must be considered.

Overall, the landscape within the UWRW Phase 3 project area has been drastically altered by humans. These alterations come in many forms from floodplain modifications to urban development, to extensive agriculture. These modifications greatly influence water quality conditions throughout the UWRW Phase 3 project area. In the following section, Section 3.0 Watershed Inventory-Part II, the conditions within the project area will be examined in more detail at the 12-digit HUC watershed scale.

3 Watershed Inventory – Part II

3.1 Water Quality

Water Quality Parameters

Dissolved Oxygen - Dissolved oxygen (D.O.) is the measure of oxygen in the water available for uptake by aquatic life. Typically, streams with a D.O. level greater than 8 mg/L are considered very healthy and streams with D.O. levels less than 2 mg/L are very unhealthy as there is not enough oxygen to sustain aquatic life. D.O. is affected by many factors including; temperature - the warmer the water the harder it is for oxygen to dissolve, flow – more oxygen can enter a stream where the water is moving faster and turning more, and aquatic plants – an influx of plant growth will use more oxygen than normal which does not leave enough available D.O. for other aquatic life, however photosynthesis will add oxygen to the water during the day. Thus, D.O. levels may change frequently when there is excessive aquatic plant growth. Excessive amounts of suspended or dissolved solids will decrease the amount of D.O. in the water. The state of Indiana has set a standard of at least an average of 5 mg/L per calendar day, but not less than 4 mg/L of D.O. for warm water streams. The U.S. EPA recommends that D.O. not exceed 12 mg/L as to avoid super-saturation of D.O. in the water system (Table 3-1).

Temperature – Water temperature impacts the overall aquatic ecosystem. Temperature can influence water chemistry, as exemplified in the impact on D.O. mentioned above. Additionally, water temperature is a controlling factor for aquatic organisms. If there are too many fluctuations in water temperature, metabolic activities of aquatic organisms may slow, speed up, or even stop. Many things can affect water temperature including stream canopy, dams, and industrial discharges. The state of Indiana has set a standard for water temperature (which may be found in 327 IAC 2-1-6) depending on if the waterbody is a cold or warm water system. The UWRW Phase 3 project area should range between 4.44°C and 29.44°C to meet the targeted value (Table 3-1).

Escherichia coli - *E. coli* is a bacteria found in all animal and human waste. *E. coli* testing is used as an indicator of fecal contamination in the water. While not all *E. coli* is harmful, there are certain strains that can cause serious illness in humans. *E. coli* may be present in the water system due to faulty septic systems, CSO overflows, wildlife, particularly geese, pet waste, and from contaminated stormwater runoff from animal feeding operations. Due to the serious health risks from certain forms of *E. coli*, and other bacteria that may be present in water, the state of Indiana has developed the full body contact standard of less than 235 CFU/100 ml of *E. coli* in any one water sample and less than 125 CFU/100 ml for the geometric mean of five (5) equally spaced samples over a 30 day period (Table 3-1).

Turbidity -Turbidity is the measure of the cloudiness of the water that may be caused by sediment or an overgrowth of aquatic plants or animals. High levels of turbidity can block out essential sunlight for submerged plants and animals and may raise water temperatures, which can decrease D.O. Extensive sediment in the water can clog fish gills and smother nests when it settles, thus affecting the overall health of the aquatic biota. Turbid water may be caused from farm field erosion, feedlot or urban stormwater runoff, eroding stream banks, and excessive aquatic plant growth. The U.S. EPA recommends that the turbidity in the water measure less than 10.4 NTUs (Table 3-1).

Total Suspended Solids - Total suspended solids (TSS) is a measure of particulate matter in a water sample. TSS is measured by passing a water sample through a series of sieves of differing sizes, drying the particulate, and weighing the dried matter. The amount of TSS in the water system will have the same type of deleterious effects on water quality as mentioned above under turbidity. These include debilitating aquatic habitat and life and carrying other pollutants to the water such as fertilizers and pathogens. A state standard for TSS has not been developed. However, it is recommended that reference levels should be equal to or less than 30 mg/L (Table 3-1).

Phosphorus - Phosphorus is an essential nutrient for aquatic plants; however, too much phosphorus can create an overgrowth of plants which can lower D.O. in a water system and decrease the amount of light that penetrates the surface, thus killing other aquatic life that depends on these for survival. Some types of aquatic plants that thrive when phosphorus levels are high, such as blue-green algae, are toxic when consumed by humans and wildlife. Excessive amounts of phosphorus have also been found in groundwater, thus increasing the bacteria growth in underground water systems. Phosphorus can reach surface and groundwater through contaminated runoff from row crop fields, urban lawns where fertilizer has been applied, animal feeding operations, faulty septic tanks, and the disposal of cleaning supplies containing phosphorus in landfills or down the drain. Total phosphorus (TP) defines the sum of all phosphorus compounds that occur in various forms such as soluble, sediment tied, and organic bound. The state of Indiana has set a target value of 0.076 mg/L of total phosphorus (under certain conditions) in a water sample to list a waterbody as impaired on the state's impaired water list as required by the CWA § 303(d), often referred to as the 303(d) list (Table 3-1).

Nitrate + Nitrite – Nitrate and nitrite can have the same effect on the water system as phosphorus, only to a much lesser degree. Nitrate+Nitrite can be found at levels up to 30 mg/L in some waters before detrimental effects on aquatic life occur. However, because infants who consume water with nitrate+nitrite levels exceeding the U.S. EPA MCL of 10 mg/L can become ill, nitrates in drinking water should be of particular concern to people who use wells as their drinking water source. The most common sources of nitrate+nitrite are from fertilizer runoff from row crop fields, faulty septic systems, and sewage. Baseline nitrate + nitrite levels vary greatly across the country; thus, an overall standard has not been developed. However, it is recommended that reference levels should be below 2.2 mg/L according to the U.S. EPA 2002 (Table 3-1).

Habitat- Habitat scores are based on the Citizen's Qualitative Habitat Evaluation Index (CQHEI). The CQHEI, a standard method for habitat evaluation in IDEM's Hoosier Riverwatch Program is a "citizen science" version of the Ohio EPA (OEPA) QHEI, an assessment tool used widely by stream biologists to quantify the physical parameters that provide habitat for fish and benthic macroinvertebrates. Research has clearly shown positive correlations between QHEI scores and biological-base indices like the Index of Biotic Integrity (IBI). The QHEI is a tool that connects land use to habitat availability or degradation. QHEI (and CQHEI) scores greater than 60 suggest the stream reach is suitable for warm water habitat (Table 3-1).

Pollution Tolerance Index Rating (PTIR) - Certain taxa or groups of benthic macroinvertebrates are known to be more or less tolerant of polluted conditions of a stream. The presence or absence of these organisms can be used to evaluate the level of pollution or human disturbance of a stream. The PTIR analysis breaks stream invertebrates into 4 groups (Intolerant of Pollution, Moderately Intolerant, Fairly Intolerant, and Very Tolerant), and the presence or absence of these organisms is used to calculate a "Pollution Tolerance Index" for a stream. Target scores should be greater than or equal to 17 (Table 3-1).

Index of Biotic Integrity (IBI) - IBI scores are based on matrices developed to examine both benthic macroinvertebrate and fish community structures and overall abundance of species/individuals. The IBI provides an assessment tool used widely by stream biologists to compare different sites relative to their ability to support aquatic life. Research has clearly shown positive correlations between QHEI scores and the Index of Biotic Integrity (IBI). IBI scores greater than or equal to 35 suggest the stream reach is suitable for supporting aquatic life (Table 3-1).

Water Quality Targets

Water quality targets were set to coincide with IDEM, USEPA, and OEPA targets for water quality parameters (Table 3-1). These target values were selected due to resulting declines in water quality documented outside of these parameter ranges.

Table 3-1.Water Quality Targets

Parameter	Target	Source
D.O.	> 4 and <12 mg/L	IDEM
E. coli	≤ 235 CFU/100mL (single sample) ≤ 125 CFU/100mL (geometric mean)	IDEM
Nitrate+Nitrite	≤ 2.2 mg/L	USEPA
Total Phosphorus	≤ 0.076 mg/L	IDEM
Turbidity	≤ 10.4 NTU	USEPA
Total Suspended Solids	≤ 30 mg/L	IDEM
Water Temperature	4.44°C – 29.44°C	IDEM
PTIR	≥ 17	HRW
mIBI	≥ 35	IDEM
QHEI/CQHEI	≥ 60	OEPA/HRW

Water Chemistry Data and Sampling Efforts

Upper Wabash River Watershed Management Plan Phase 3 Sampling

The design of this project's water quality monitoring program was synoptic. Sampling sites were determined by an assessment of accessibility by road and bridge, and the ability to represent catchments (hydrology and land area) and in general to provide an equitable and representative distribution of the sampling sites across the project area. This sampling design provided valuable chemical, biological, and physical data for the assessment of the UWRW Phase 3 project area, which aided in the development of the watershed management plan and baseline water quality dataset.

Water quality monitoring was conducted at nineteen (19) sites. Sampling sites were located at the outlets of each of the four 10-digit HUC watersheds and near the outlets of most of the12-digit HUC watersheds in an attempt to collect finer-scale data representative of the contributions of non-point source pollution from smaller catchments within the project area. Site selection was limited by safety and access.

Water sampling occured monthly over the course of nine months from Janurary 2020 to September 2020 for a total of nine (9) sampling events. The parameters to be monitored shall include: pH, dissolved oxygen (D.O.), turbidity, conductivity, temperature, nitrate+nitrite, total phosphorus, total suspended solids, *E. coli*, and flow. Macroinvertebrate sampling and habitat assessments were conducted at each site at least once over the course of the sampling year between July and October. The macroinvertebrate community was sampled using the Multi-Habitat (MHAB) Macroinvertebrate Collection Procedure and evaluated by calculating the IDEM macroinvertebrate Index of Biotic Integrity (mIBI). Habitat assessments followed the IDEM OWQ Qualitative Habitat Evaluation Index (QHEI).

IDEM Sampling

Indiana is required to perform water quality analysis of its surface waters and report their findings to EPA in a report called the "Integrated Report" (IR) on a biannual basis, as mandated by the CWA§305(b). Prior to compiling the IR, a list of water bodies that do not meet state standards is developed as mandated by the Clean Water Act section 303(d). This has become commonly known as the 303(d) list. Many stream segments located within the UWRW Phase 3 project area are listed on the IDEM 2018 303(d) List of Impaired Waters (Table 3-2). As part of the IDEM monitoring process, water samples are analyzed for numerous parameters. Those relative to this WMP include: nitrate-nitrogen, total phosphorus, pH, TSS, D.O., turbidity, temperature, and *E. coli*. There are eight (8) IDEM sampling site located with the UWRW Phase 3 project area. Data at these sites were collected monthly during time periods ranging from 2009-2019. The data from these sites were analyzed and sorted for the purpose of this project. All data was downloaded from the IDEM AIMS Database.

IDEM 303(d) List of Impaired Waters

IDEM is required to perform water monitoring as part of the Clean Water Act (CWA) Section 303(d) to identify waters that do not meet the state's water quality standards for designated uses. IDEM has divided the state into nine major water basins and the water quality monitoring strategy calls for rotating through each of the nine basins once every nine years. According to IDEM's Surface Water Quality Monitoring Strategy, the following data is collected to determine if the state water quality standards are being met:

- Physical or chemical water monitoring
- Fish Community Assessment
- *E. coli* monitoring
- Benthic aquatic macroinvertebrate community assessment
- Fish Tissue and superficial aquatic sediment contaminants monitoring
- Habitat evaluation

Water quality standards for the state of Indiana are designed to ensure that all waters of the state, unless specifically exempt, are safe for full body contact recreation and are protective of aquatic life, wildlife, and human health. The UWRW Phase 3 project area and its tributaries are required to be fishable, swimmable, and able to support warm water aquatic life. Each waterbody listed on the 303(d) list is placed into one or more of five (5) categories depending on the degree to which it supports its designated uses as determined by IDEM's assessment process. The following is a summary of the five (5) categories:

Category 1: All designated uses are supported and no use is threatened.

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported.

Category 3: There is insufficient available data and/or information to make a use support determination.

Category 4: Available data and/or information indicate that at least one designated use is impaired or is threatened, but a TMDL is not needed.

A. A TMDL has been completed that is expected to result in attainment of all applicable WQS and has been approved by U.S. EPA.

B. Other pollution control requirements are reasonably expected to result in the attainment of the WQS in a reasonable period of time

C. A pollutant does not cause impairment.

Category 5: Available data and/or information indicate that at least one designated use is not supported impaired or is threatened, and a TMDL is needed.

A. The waterbody AU is impaired or threatened for one or more designated uses by a pollutant(s) and require a TMDL.

B. The waterbody AU is impaired due to the presence of mercury and/or PCBs in the edible tissue of fish collected from them at levels exceeding Indiana's human health criteria for these contaminants.

Over 136 stream miles within the UWRW Phase 3 project area are identified as impaired on the IDEM 2018 Draft 303(d) List of Impaired Waters (Table 3-2). Dissolved oxygen (D.O.), *E. coli*, impaired biotic communities, PCBs in fish tissue, and nutrients are listed as causes of impairment. Impaired water bodies include Aboite Creek, Big Indian Creek, Calf Creek, Eightmile Creek, Fal Creek, Huntington Lake, Little River, Mud Creek, Nieman Creek, Rock Creek, Seegar Ditch, West Branch Clear Creek, and the mainstem Wabash River (Table 3-2).

Table 3-2. IDEM 2018 303(d) List of Impaired Waters in the UWRW Phase 3 project area

HUC 12	Assessment Unit ID	Assessment Unit Name	Cause of Impairment
Cow Creek (051201011006)	INB01A5_05	ABOITE CREEK	*E. coli*
	INB01A6_02	LITTLE RIVER	*E. coli,* IBC
	INB01A6_T1002	CALF CREEK	*E. coli,* IBC
Flat Creek (051201011101)	INB01B1_02	FLAT CREEK	*E. coli*
Hanging Rock-Wabash River (051201011305)	INB01D3_03	WABASH RIVER	*E. coli*, Nutrients, PCBs (Fish tissue)
	INB01D5_01	WABASH RIVER	*E. coli*, Nutrients, PCBs (Fish tissue)
Huntington Lake-Wabash River (051201011301)	INB0174_02	ROCK CREEK	PCBs (Fish tissue)
	INB01D3_01	WABASH RIVER	*E. coli*, IBC, Nutrients, PCBs (Fish tissue)
	INB01P1008_00	HUNTINGTON LAKE	PCBs (Fish tissue)
Little Indian Creek-Aboite Creek (051201011005)	INB01A5_04	ABOITE CREEK	*E. coli*
	INB01A5_05	ABOITE CREEK	*E. coli*
	INB01A5_T1007	BIG INDIAN CREEK	*E. coli,* IBC
Mud Creek-Little River (051201011103)	INB01B3_01	LITTLE RIVER	*E. coli*, Nutrients
	INB01B3_T1001	MUD CREEK	*E. coli*, IBC
Seegar Ditch (051201011001)	INB01A1_01	SEEGAR DITCH	*E. coli,* D.O.
	INB01A1_T1001	SEEGAR DITCH - UNNAMED TRIBUTARY	*E. coli*
	INB01A1_T1002	SEEGAR DITCH - UNNAMED TRIBUTARY	*E. coli*
Silver Creek (051201011302)	INB01D2_T1008	NIEMAN CREEK	*E. coli*
Town of Andrews-Wabash River (051201011303)	INB01D3_01	WABASH RIVER	*E. coli,* IBC, Nutrients, PCBs (Fish tissue)
	INB01D3_02	WABASH RIVER	*E. coli,* Nutrients, PCBs (Fish tissue)
	INB01D3_03	WABASH RIVER	*E. coli,* Nutrients, PCBs (Fish tissue)
West Branch Clear Creek (051201011201)	INB01C1_01	WEST BRANCH CLEAR CREEK	*E. coli*, Nutrients

Hoosier Riverwatch Sampling

IDEM's Hoosier Riverwatch (HRW) is a program designed to engage Indiana citizens in becoming active stewards of Indiana's valuable water resources through its hands-on water quality education and volunteer stream monitoring program. The statewide Hoosier Riverwatch volunteer network includes over 3,000 trained stream monitors and over 31 certified instructors. The data that volunteers collect is added to the Hoosier Riverwatch online database and can be used to monitor the health of streams and evaluate changes over time (IDEM, 2019). HRW data is available for eleven (11) sites within the UWRW Phase 3 project area. For the majority of the site, samples were taken once a quarter beginning in 2000-2018. However, due the voluntary nature of the sampling efforts, sampling frequency is more sporadic and inconsistent at several sites. Parameters analyzed at the HRW sites include: D.O., water temperature, nitrate, ortho-phosphate, turbidity, PTIR, and CQHEI.

3.2 Water Quality Data per 12 Digit HUC Watershed

This section discusses historic and current water quality data that has been collected within each HUC 12 watershed in the UWRW Phase 3 project area to help provide a depiction of the overall health of each of the sub-watersheds and possible water quality stressors.

Sub-watersheds of the Aboite Creek-Little River Watershed

Robinson Creek (HUC 051201011003)

Water quality data in the Robinson Creek watershed (HUC 051201011003) were analyzed as part of this project. Nine (9) Samples were collected at one site (Site 4) on Robinson Creek west of Fort Wayne and just south of Fox Island County Park (Table 3-3). Sampling efforts followed the UWRW Phase 3 WMP Quality Assurance Project Plan (QAPP) (Section 3.1). The location of the sample site is shown in Figure 3-1.

Nine (9) samples were collected and analyzed at Site 4. Approximately 22% of E. coli samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 71.17 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Just over 22% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and the total phosphorus target value of ≤ 0.076 mg/L. Just over 33% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 11.11% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 17 met the target value of ≥ 17, though the CQHEI score of 50 was below the target value of ≥ 60.

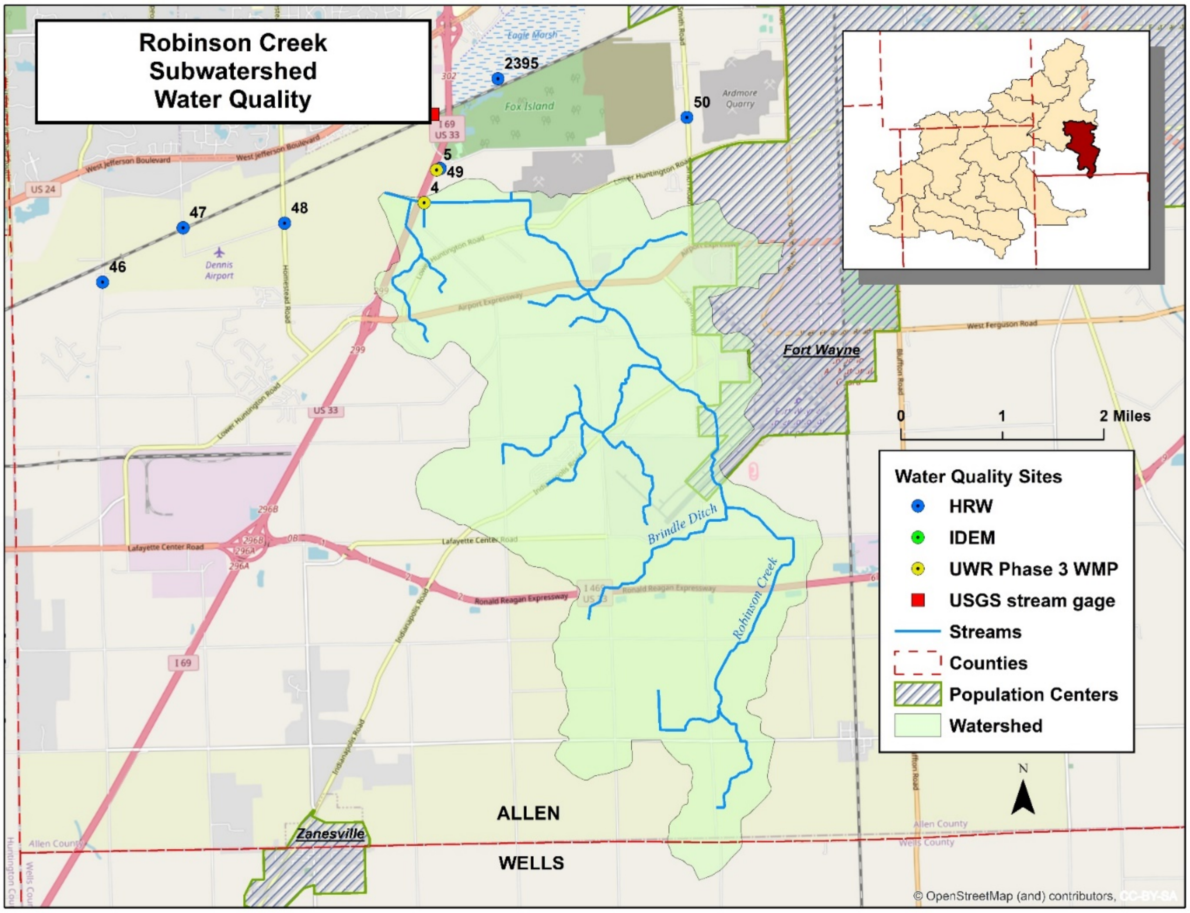


Figure 3-1. Robinson Creek (051201011003) water quality

Table 3-3. UWRW Phase 3-Site 4 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.78	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	124.06	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	2	22.22
	*71.17			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	1.31	mg/L	9	≤ 2.2 mg/L	2	22.22
Total Phosphorus	0.05	mg/L	9	≤ 0.076 mg/L	2	22.22
Turbidity	11.80	NTU	9	≤ 10.4 NTU	3	33.33
TSS	17.89	mg/L	9	≤ 30 mg/L	1	11.11
Water Temperature	13.57	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	17.00	Points	1	≥ 17	1	100
CQHEI	50.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Seegar Ditch (HUC 051201011001)

Water quality data in the Seegar Ditch watershed (HUC 051201011001) were analyzed as part of this project and by IDEM as part of regular state water quality monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 2) on Seegar Ditch west of Fort Wayne and just north of SR 14 at Sycamore Hills Golf Club (Table 3-5). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). IDEM collected data at one sample location (Site WUW-10-001) within watershed. The locations of sample sites are shown in Figure 3-2 and analysis of water quality data is presented Table 3-4. A total of 16.9 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli* and D.O.

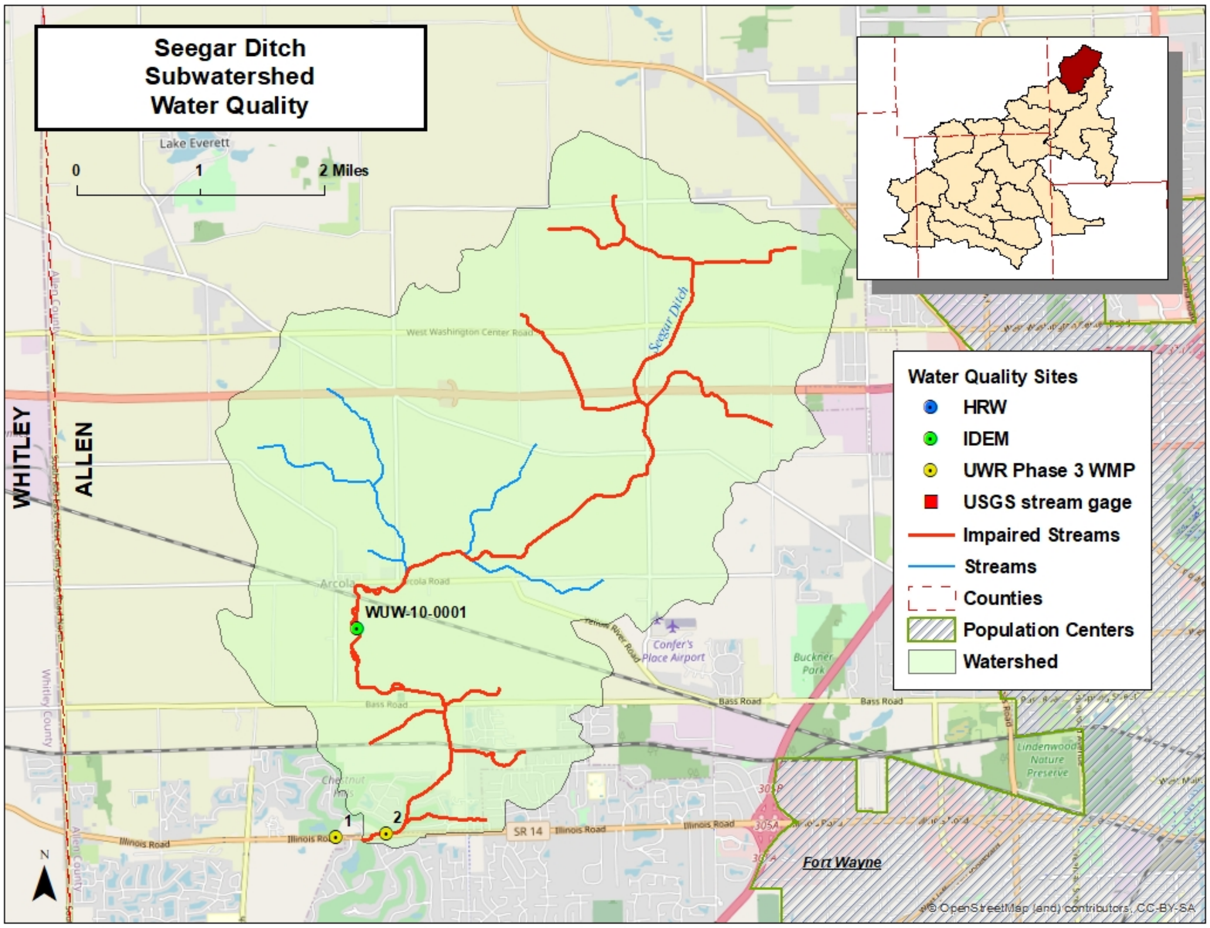


Figure 3-2. Seegar Ditch (HUC 051201011001) water quality

IDEM sampled water from site WUW-10-0001 within Seegar Ditch watershed ten times from April to September 2015. Analysis of water quality data show that D.O., *E. coli*, Nitrate+Nitrite, and Total Phosphorus exceeded target values on multiple occasions with Total Phosphorus exceeding the target value of 0.076 mg/L in 100% of samples.

Table 3-4. IDEM Site WUW-10-0001 (Seegar Ditch) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Yarget
D.O.	7.41	mg/L	10	> 4 and <12 mg/L	2	20.00
E. coli	1947.08	CFU/100mL	5	≤ 235 CFU/100mL (single sample)	3	60.00
Nitrate+Nitrite	1.93	mg/L	3	≤ 2.2 mg/L	2	66.67
Total Phosphorus	0.26	mg/L	3	≤ 0.076 mg/L	3	100.00
Turbidity	-	NTU	0	≤ 10.4 NTU	0	-
TSS	23.67	mg/L	3	≤ 30 mg/L	1	33.33
Water Temperature	14.86	°C	10	4.44°C – 29.44°C	0	0.00
mIBI (MacroInvert)	-	Points	0	≥ 17	0	-
QHEI (Habitat)	-	Points	0	≥ 60	0	-

Nine (9) samples were collected at analyzed at Site 2. Just over 44% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 31.20%. Just over 44% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and over 55% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Approximately 33% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 11% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 24 met the target range of ≥ 17 and CQHEI score of 49 was below the target value of ≥ 60.

Table 3-5 UWRW Phase 3-Site 2 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	9.66	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	236.96	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	4	44.44
	*164.00			≤ 125 CFU/100mL (geometric mean)	Yes	-
Nitrate+Nitrite	1.65	mg/L	9	≤ 2.2 mg/L	4	44.44
Total Phosphorus	0.11	mg/L	9	≤ 0.076 mg/L	5	55.56
Turbidity	17.27	NTU	9	≤ 10.4 NTU	3	33.33
TSS	11.72	mg/L	9	≤ 30 mg/L	1	11.11
Water Temperature	12.88	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	24.00	Points	1	≥ 17	1	100
CQHEI	49.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Graham McCulloch Ditch #1-Little River (HUC 051201011004)

Water quality data in the Graham McCulloch Ditch #1 watershed (HUC 051201011004) were analyzed as part of this project and by the Little River Wetlands Project, Inc as part of IDEM's Hoosier Riverwatch monitoring program. Samples analyzed by the UWR WMP Phase 3 group were collected at two sites on the Little River between Fort Wayne and Roanoke (Table 3-14; Table 3-15. Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). The Little River Wetlands Project, Inc. sampled eight locations within watershed. The locations of sample sites are shown in Figure 3-3 and analysis of water quality data is presented in Table 3-6 through Table 3-13.

The Little River Wetlands Project, Inc. sampled water from HRW Site 46 on the Little River within Graham McCulloch Ditch #1 watershed 54 times from 2000 to 2016. Analysis of water quality data show that nutrients (Nitrate and Orthophosphate) and turbidity exceeded target values in a vast majority of samples, while D.O., *E. coli*, and water temperature exceeded target values in only 3.7%, 21.43%, and 26.42% of samples, respectively. Habitat (CQHEI) and biological (PTIR) data did not meet target values in 100% and 89% of evaluations, respectively.

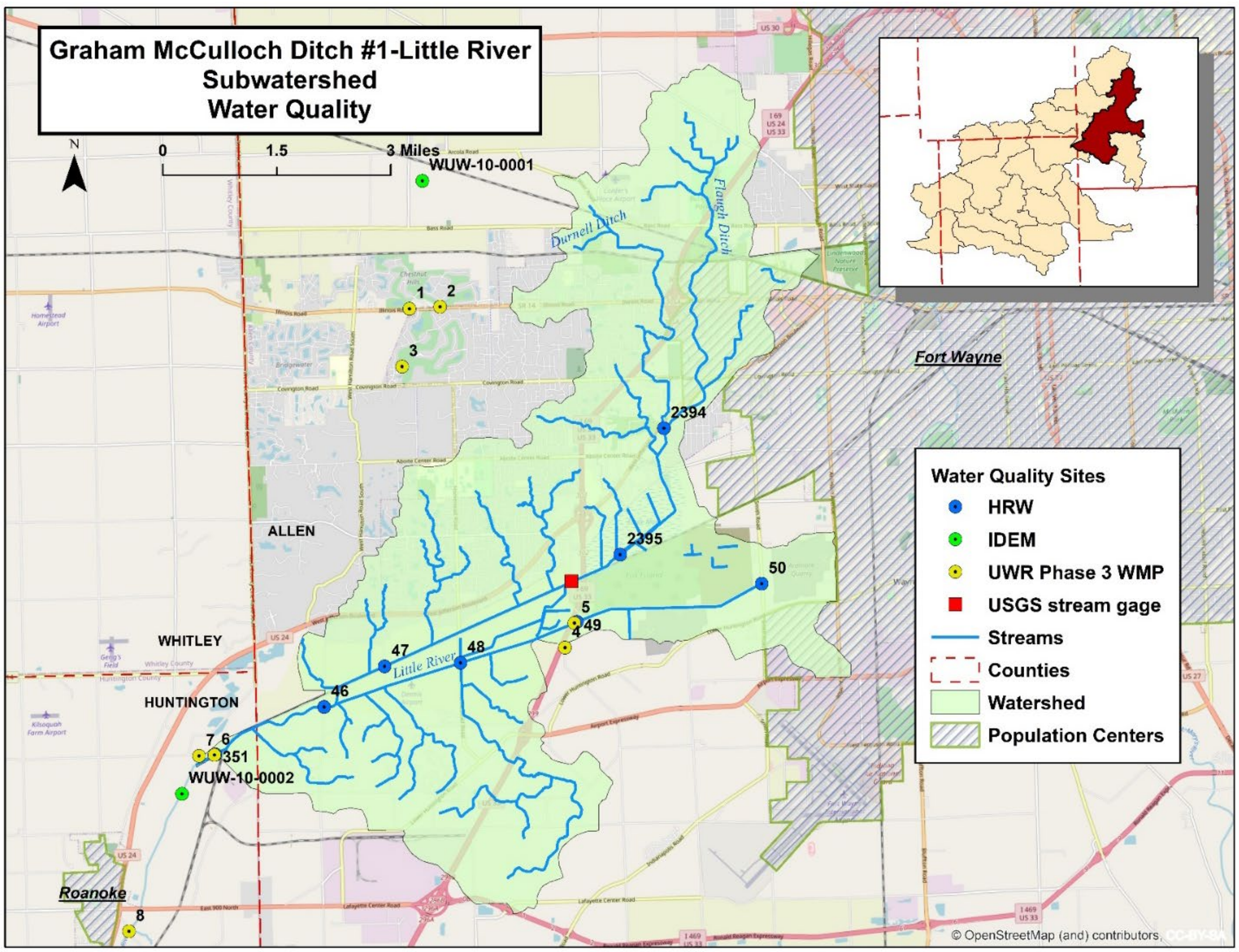


Figure 3-3. Graham McCulloch Ditch #1-Little River (HUC 051201011004) Water Quality

Table 3-6. Hoosier Riverwatch Site 46 (Little River) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	7.58	mg/L	54	>4 and <12 mg/L	2	3.70
E. coli	594.63	CFU/100mL	28	≤235 CFU/100mL (single sample)	6	21.43
Nitrate	13.88	mg/L	54	≤1 mg/L	46	85.19
Ortho-Phosphate	1.61	mg/L	28	≤0.076 mg/L	23	82.14
Turbidity	46.13	NTU	55	≤10.4 NTU	55	100.00
Water Temperature	12.22	°C	53	4.44°C – 29.44°C	14	26.42
PTIR (MacroInvert)	7.49	Points	45	≥17-22	40	88.89
CQHEI (Habitat)	29.90	Points	24	≥60	24	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 47 on Graham McCulloch Ditch #1 within Graham McCulloch Ditch #1 watershed 20 times from 2000 to 2012. Analysis of water quality data show that Nitrate and Turbidity exceeded target values in 73.68% and 100% of samples, respectively, while Orthophosphate exceeded target values in over 33% of samples. D.O., *E. coli*, and water temperature exceeded target values in only 10.53%, 20%, and 29.41% of samples, respectively. Habitat (CQHEI) and biological (PTIR) data failed to meet target values in 100% of evaluations.

Table 3-7. Hoosier Riverwatch Site 47 (Graham McCulloch Ditch #1) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	8.26	mg/L	19	>4 and <12 mg/L	2	10.53
E. coli	776.25	CFU/100mL	20	≤235 CFU/100mL (single sample)	4	20.00
Nitrate	13.80	mg/L	19	≤1 mg/L	14	73.68
Ortho-Phosphate	0.60	mg/L	3	≤0.076 mg/L	1	33.33
Turbidity	48.26	NTU	19	≤10.4 NTU	19	100.00
Water Temperature	9.97	°C	17	4.44°C – 29.44°C	5	29.41
PTIR (MacroInvert)	6.42	Points	12	≥17-22	12	100.00
CQHEI (Habitat)	23.17	Points	3	≥60	3	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 48 on Little River within Graham McCulloch Ditch #1 watershed 28 times from 2000 to 2012. Analysis of water quality data show that Nitrate, Orthophosphate, and turbidity exceeded target values in 77.78%, 50%, and 96.43% of samples, respectively. D.O., *E. coli*, and water temperature exceeded target values in only 10.71%, 14.29%, and 33.33% of samples, respectively. Habitat (CQHEI) and biological (PTIR) data failed to meet target values in 100% of evaluations.

Table 3-8. Hoosier Riverwatch Site 48 (Little River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	8.69	mg/L	28	>4 and <12 mg/L	3	10.71
E. coli	419.05	CFU/100mL	21	≤235 CFU/100mL (single sample)	3	14.29
Nitrate	7.08	mg/L	27	≤1 mg/L	21	77.78
Ortho-Phosphate	0.42	mg/L	12	≤0.076 mg/L	6	50.00
Turbidity	43.14	NTU	28	≤10.4 NTU	27	96.43
Water Temperature	11.00	°C	27	4.44°C – 29.44°C	9	33.33
PTIR (MacroInvert)	6.89	Points	18	≥17-22	18	100.00
CQHEI (Habitat)	19.25	Points	10	≥60	10	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 49 on Little River within Graham McCulloch Ditch #1 watershed 30 times from 2000 to 2008. Analysis of water quality data show that Nitrate and turbidity exceeded target values in 76.67% and 96.55% of samples, respectively. D.O., *E. coli*, Orthophosphate, and water temperature exceeded target values in only 6.67%, 16%, 8.33%, and 35.71% of samples, respectively. Habitat (CQHEI) and biological (PTIR) data failed to meet target values in 100% and 93.33% of evaluations, respectively.

Table 3-9. Hoosier Riverwatch Site 49 (Little River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	8.68	mg/L	30	>4 and <12 mg/L	2	6.67
E. coli	330.68	CFU/100mL	25	≤235 CFU/100mL (single sample)	4	16.00
Nitrate	3.82	mg/L	30	≤1 mg/L	23	76.67
Ortho-Phosphate	0.02	mg/L	12	≤0.076 mg/L	1	8.33
Turbidity	30.41	NTU	29	≤10.4 NTU	28	96.55
Water Temperature	11.16	°C	28	4.44°C – 29.44°C	10	35.71
PTIR (MacroInvert)	8.93	Points	15	≥17-22	14	93.33
CQHEI (Habitat)	21.39	Points	9	≥60	9	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 50 on Little River within Graham McCulloch Ditch #1 watershed 50 times from 2000 to 2018. Analysis of water quality data show that Nitrate and turbidity exceeded target values in 70% and 97.78% of samples, respectively. D.O., *E. coli*, Orthophosphate, and water temperature exceeded target values in only 4%, 6.25%, 37%, and 8.51% of samples, respectively. Habitat (CQHEI) and biological (PTIR) data failed to meet target values in 100% and 97.30% of evaluations, respectively.

Table 3-10. Hoosier Riverwatch Site 50 (Little River) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	9.45	mg/L	50	>4 and <12 mg/L	2	4.00
E. coli	473.94	CFU/100mL	16	≤235 CFU/100mL (single sample)	1	6.25
Nitrate	5.44	mg/L	50	≤1 mg/L	35	70.00
Ortho-Phosphate	0.08	mg/L	27	≤0.076 mg/L	10	37.04
Turbidity	36.86	NTU	45	≤10.4 NTU	44	97.78
Water Temperature	15.10	°C	47	4.44°C – 29.44°C	4	8.51
PTIR (MacroInvert)	5.43	Points	37	≥17-22	36	97.30
CQHEI (Habitat)	31.22	Points	25	≥60	25	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 351 on the Little River within Graham McCulloch Ditch #1 watershed nine times from 2000 to 2004. Analysis of water quality data show that Nitrate and turbidity exceeded target values in 44.44% and 100% of samples, respectively. Water temperature exceeded target values in 75% of samples D.O. and *E. coli* exceeded target values in only 11.11% and 22.22% of samples, respectively, while Orthophosphate did not exceed target values. Habitat (CQHEI) data failed to meet target values.

Table 3-11. Hoosier Riverwatch Site 351 (Little River) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	9.22	mg/L	9	>4 and <12 mg/L	1	11.11
E. coli	211.11	CFU/100mL	9	≤235 CFU/100mL (single sample)	2	22.22
Nitrate	7.29	mg/L	9	≤1 mg/L	4	44.44
Ortho-Phosphate	0.10	mg/L	1	≤0.076 mg/L	0	0.00
Turbidity	41.89	NTU	9	≤10.4 NTU	9	100.00
Water Temperature	4.06	°C	8	4.44°C – 29.44°C	6	75.00
PTIR (MacroInvert)	-	Points	0	≥17-22	-	-
CQHEI (Habitat)	13.00	Points	1	≥60	1	100.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 2394 on Graham McCulloch Ditch within Graham McCulloch Ditch #1 watershed nine times from 2015 to 2018. Analysis of water quality data show that Nitrate and turbidity exceeded target values in 44.44% and 100% of samples, respectively. D.O. and water temperature did not exceed target values, while Nitrate exceed target values in only 11.11% of samples. Orthophosphate and turbidity exceed target values in 88.89% and 100% of samples, respectively. Biological (PTIR) data exceeded target values in 87.50% of evaluations.

Table 3-12. Hoosier Riverwatch Site 2394 (Graham McCulloch Ditch) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	8.19	mg/L	54	>4 and <12 mg/L	0	0.00
E. coli	-	CFU/100mL	0	≤235 CFU/100mL (single sample)	-	-
Nitrate	0.39	mg/L	9	≤1 mg/L	1	11.11
Ortho-Phosphate	0.27	mg/L	9	≤0.076 mg/L	8	88.89
Turbidity	48.93	NTU	9	≤10.4 NTU	9	100.00
Water Temperature	18.21	°C	8	4.44°C – 29.44°C	0	0.00
PTIR (MacroInvert)	12.25	Points	8	≥17-22	7	87.50
CQHEI (Habitat)	65.00	Points	2	≥60	0	0.00

The Little River Wetlands Project, Inc. sampled water from HRW Site 2395 on Graham McCulloch Ditch within Graham McCulloch Ditch #1 watershed ten (10) times from 2015 to 2018. Analysis of water quality data show that Nitrate and turbidity exceeded target values in 44.44% and 100% of samples, respectively. D.O. and water temperature did not exceed target values, while Nitrate exceed target values in 55.56% of samples. Orthophosphate and turbidity exceed target values in 100% of samples, respectively. Biological (PTIR) data exceeded target values in 100% of evaluations.

Table 3-13. Hoosier Riverwatch Site 2395 (Graham McCulloch Ditch) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	8.07	mg/L	10	>4 and <12 mg/L	0	0.00
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate	3.29	mg/L	9	≤1 mg/L	5	55.56
Ortho-Phosphate	1.58	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	27.57	NTU	10	≤ 10.4 NTU	10	100.00
Water Temperature	18.34	°C	9	4.44°C – 29.44°C	0	0.00
PTIR (MacroInvert)	8.60	Points	10	≥17-22	10	100.00
CQHEI (Habitat)	-	Points	0	≥60	-	-

Of the nine (9) samples collected and analyzed at Site 5, 22% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 39.32 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Just over 33% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and over 44% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 55% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 22.22% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 21 met the target value of ≥ 17, though the CQHEI score of 13 was below the target value of ≥ 60.

Table 3-14. UWRW Phase 3-Site 5 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.72	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	82.84	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	1	11.11
	*39.32			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	2.18	mg/L	9	≤ 2.2 mg/L	3	33.33
Total Phosphorus	0.07	mg/L	9	≤ 0.076 mg/L	4	44.44
Turbidity	19.51	NTU	9	≤ 10.4 NTU	5	55.56
TSS	27.00	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	13.77	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	21.00	Points	1	≥ 17	0	0
CQHEI	13.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Of the nine (9) samples collected and analyzed at Site 6, nearly 89% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 497%. Over 55% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and nearly 78% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 78% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 22.22% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 17 met the target value of ≥ 17, though the CQHEI score of 13 was below the target value of ≥ 60.

Table 3-15. UWRW Phase 3-Site 6 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	8.19	mg/L	9	> 4 and <12 mg/L	0	0.00
E. coli	1,122.71	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	8	88.89
	*746.26			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	2.94	mg/L	9	≤ 2.2 mg/L	5	55.56
Total Phosphorus	0.27	mg/L	9	≤ 0.076 mg/L	7	77.78
Turbidity	21.04	NTU	9	≤ 10.4 NTU	7	77.78
TSS	23.17	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	14.39	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	17.00	Points	1	≥ 17	0	0
CQHEI	13.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Beal Taylor Ditch-Aboite Creek (HUC 051201011002)

Water quality data in the Beal Taylor Ditch-Aboite Creek watershed (HUC 051201011002) were analyzed as part of this project. Nine (9) samples were analyzed by the UWR WMP Phase 3 group at two sites within the watershed. Site 1 is located on Beal Taylor Ditch on IN 14 just south of Chestnut Hills Golf Club (Table 3-16) and Site 3 is located on Aboite Creek on the Sycamore Hills Golf Club (Table 3-17). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). The locations of sample sites are shown in Figure 3-4.

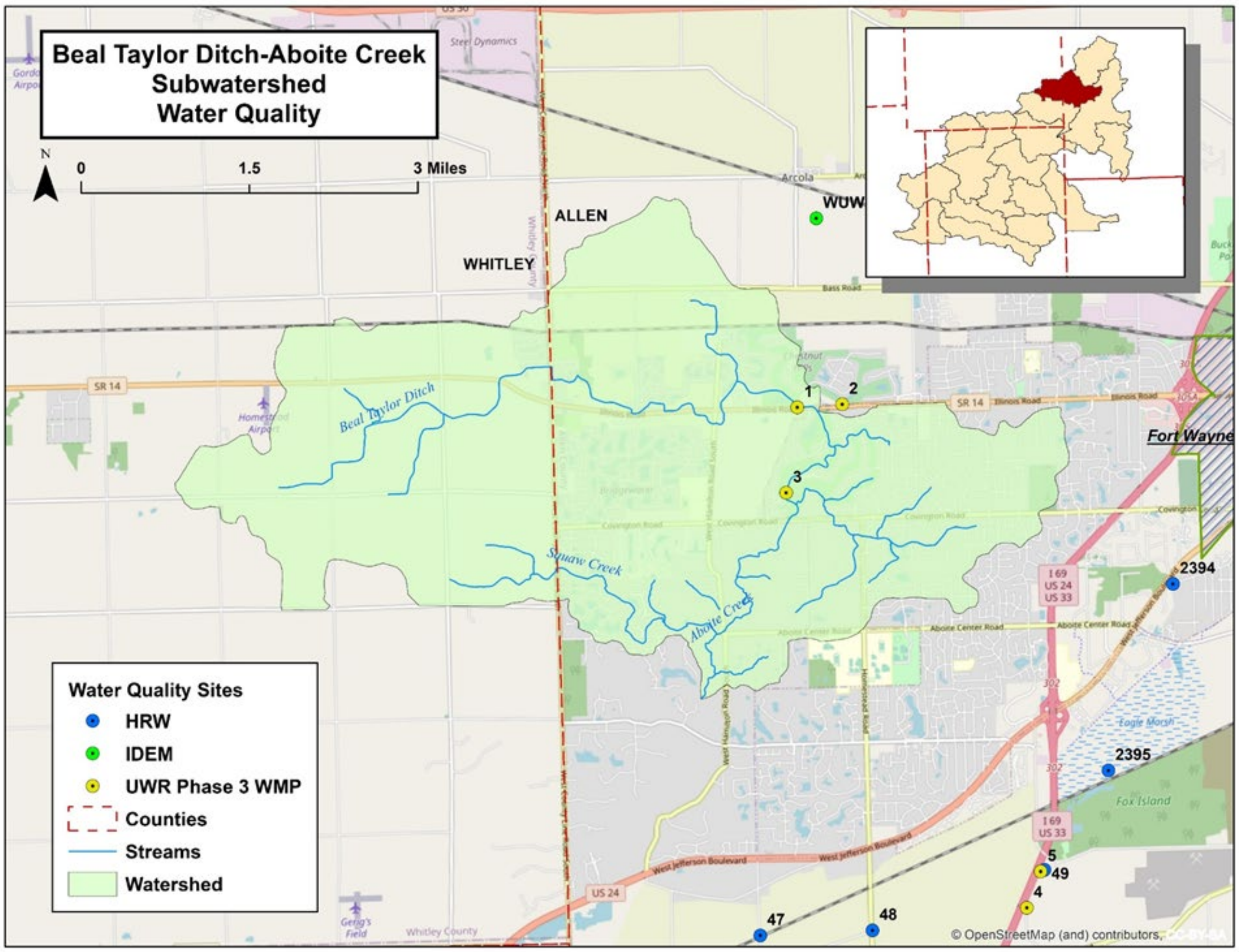


Figure 3-4. Beal Taylor Ditch-Aboite Creek (HUC 051201011002) water qualit

Of the nine (9) samples collected and analyzed at Site 1, nearly 89% of E. coli samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 212%. Just over 11% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and over 44% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 78% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 22.22% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively

Table 3-16. UWRW Phase 3-Site 1 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	9.41	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	589.73	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	8	88.89
	*389.97			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	1.12	mg/L	9	≤ 2.2 mg/L	1	11.11
Total Phosphorus	0.17	mg/L	9	≤ 0.076 mg/L	4	44.44
Turbidity	22.07	NTU	9	≤ 10.4 NTU	7	77.78
TSS	20.33	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	12.39	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	12.00	Points	1	≥ 17	1	100
CQHEI	52.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Of the nine (9) samples collected and analyzed at Site 3, just over 44% of E. coli samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 9.8%. Just over 22% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and over 66% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 55% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 11% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 26 met the target value of ≥17, though the CQHEI score of 48 was below the target value of ≥ 60.

Table 3-17. UWRW Phase 3-Site 3 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of target
D.O.	9.34	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	232.24	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	4	44.44
	*137.25			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	1.41	mg/L	9	≤ 2.2 mg/L	2	22.22
Total Phosphorus	0.09	mg/L	9	≤ 0.076 mg/L	6	66.67
Turbidity	13.48	NTU	9	≤ 10.4 NTU	5	55.56
TSS	11.28	mg/L	9	≤ 30 mg/L	1	11.11
Water Temperature	13.77	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	26.00	Points	1	≥ 17	0	0
CQHEI	48.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Little Indian Creek-Aboite Creek (HUC 051201011005)

Water quality data in the Little Indian Creek-Aboite Creek watershed (HUC 051201011005) were analyzed as part of this project. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 7) on Aboite Creek at CR 1100 N just east of Welker Rd (Table 3-18). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1) The locations of sample sites are shown in Figure 3-5. A total of 8.6 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli* and impaired biotic communities.

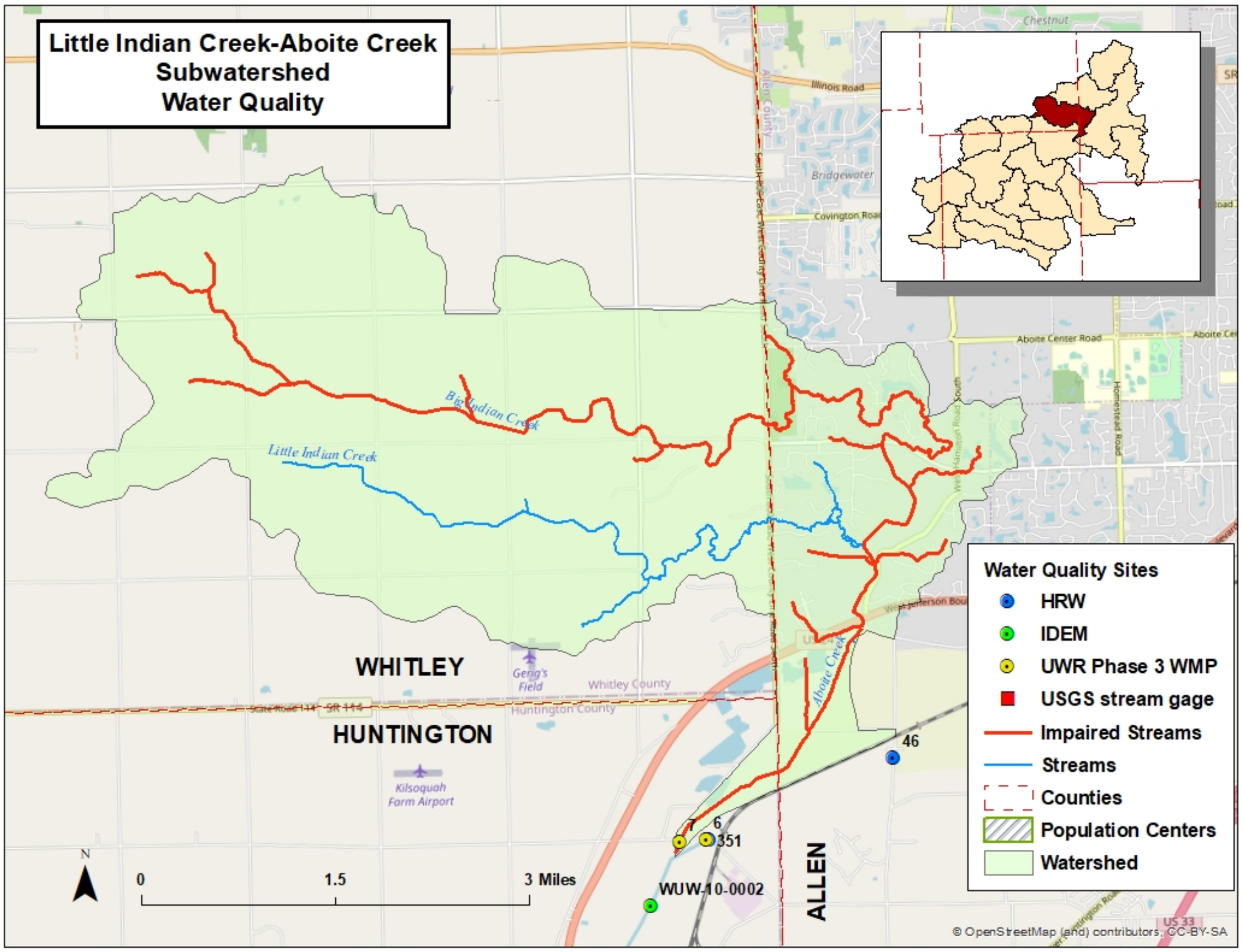


Figure 3-5. Little Indian Creek-Aboite Creek (HUC 051201011005) water quality

Of the nine (9) samples collected and analyzed at Site 7, 11% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 82.83 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Just over 11% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and over 66% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 55% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 22.22% of samples exceed the TSS target value of ≤ 30 mg/L.

Table 3-18. UWRW Phase 3-Site 7 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.39	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	104.31	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	1	11.11
	*82.83			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	0.97	mg/L	9	≤ 2.2 mg/L	1	11.11
Total Phosphorus	0.16	mg/L	9	≤ 0.076 mg/L	6	66.67
Turbidity	15.85	NTU	9	≤ 10.4 NTU	5	55.56
TSS	19.67	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	14.43	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	17.00	Points	1	≥ 17	0	0
CQHEI	44.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Cow Creek-Little River (HUC 051201011006)

Water quality data in the Cow Creek-Little River watershed (HUC 051201011006) were analyzed as part of this project and by IDEM as part of regular state water quality monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at one site on the Little River just east of Roanoke and US 24 (Table 3-20). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). IDEM collected data at one sample location (Site WUW-10-0002) within watershed. The locations of sample sites are shown in Figure 3-6 and analysis of water quality data is presented Table 3-19. A total of 22.8 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli* and impaired biotic communities.

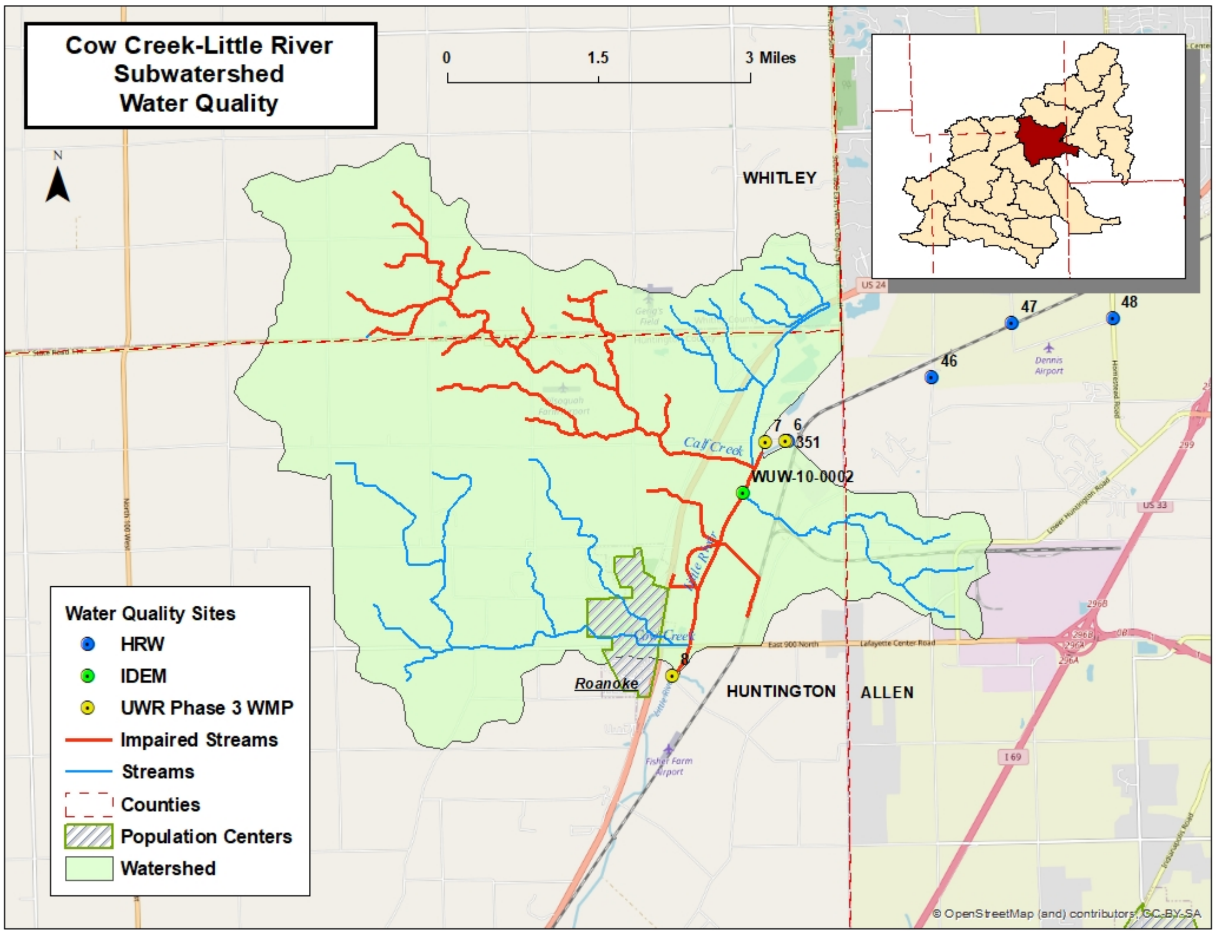


Figure 3-6. Cow Creek-Little River (HUC 051201011006) water quality

IDEM sampled water from site WUW-10-0002 within Cow Creek-Little River watershed ten times from April to September 2015. Analysis of water quality data show that D.O. did not exceed target values, while *E. coli* and Nitrate+Nitrite exceeded target values in 40% and 66.67% of samples, respectively. TSS and Total Phosphorus exceeded the target values in 100% of samples.

Table 3-19. IDEM Site WUW-10-0002 (Little River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	7.74	mg/L	10	>4 and <12 mg/L	0	0.00
E. coli	402.04	CFU/100mL	5	≤ 235 CFU/100mL (single sample)	2	40.00
Nitrate+Nitrite	2.33	mg/L	3	≤ 2.2 mg/L	2	66.67
Total Phosphorus	0.39	mg/L	3	≤ 0.076 mg/L	3	100.00
Turbidity	-	NTU	0	≤10.4 NTU	-	-
TSS	61.00	mg/L	3	≤ 30 mg/L	3	100.00
Water Temperature	16.59	°C	10	4.44°C – 29.44°C	0	0.00
PTIR (MacroInvert)	-	Points	0	≥ 17-22	-	-
CQHEI (Habitat)	-	Points	0	≥ 60	-	-

Of the nine (9) samples collected and analyzed at Site 8, nearly 78% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 328%. Over 55% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 100% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 78% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 33% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were above the target values ≥ 17 and ≥ 60, respectively

Table 3-20. UWRW Phase 3-Site 8 Water Quality Analysis

Parameter	Mean	Unit	# of samples	Target	# Outside of Target	% Outside of Target
D.O.	8.77	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	941.37	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	7	77.78
	*535.40			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	2.50	mg/L	9	≤ 2.2 mg/L	5	55.56
Total Phosphorus	0.42	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	22.52	NTU	9	≤ 10.4 NTU	7	77.78
TSS	31.90	mg/L	9	≤ 30 mg/L	3	33.33
Water Temperature	14.53	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	24.00	Points	1	≥ 17	0	0
CQHEI	91.00	Points	1	≥ 60	0	0

**E. coli* geometric mean

West Branch Clear Creek (HUC 051201011201)

Water quality data in the West Branch Clear Creek watershed (HUC 051201011201) were analyzed as part of this project. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 19) on West Branch Clear Creek at CR 1000 N between CR 300 and CR 400 (Table 3-21). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). The locations of sample sites are shown in Figure 3-7. A total of 5.4 stream miles are listed on the IDEM 303(d) List of Impaired Streams. Impairments include *E. coli* and nutrients.

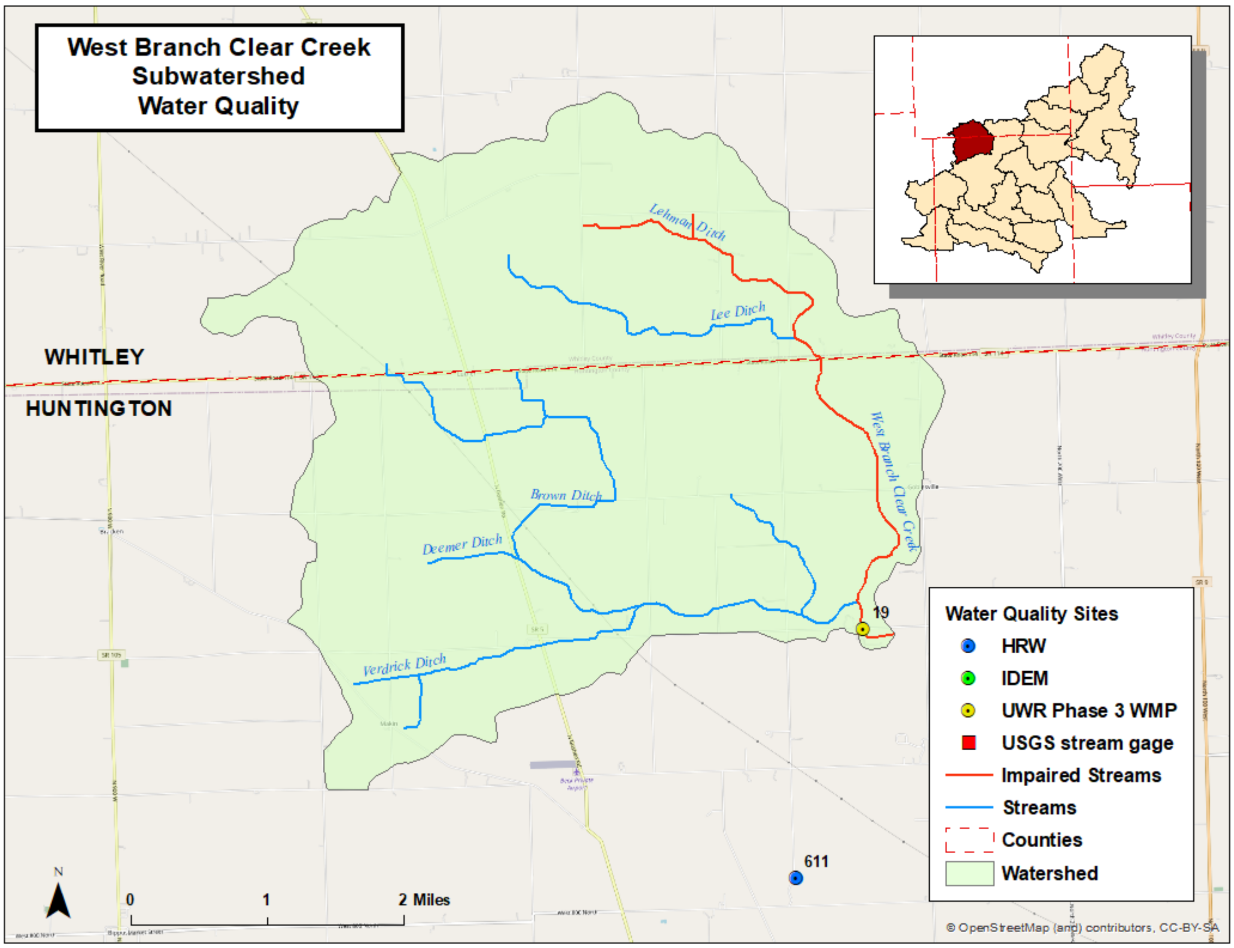


Figure 3-7. West Branch Clear Creek (HUC 051201011201) water quality

Of the nine (9) samples collected and analyzed at Site 19, over 55% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean of 156.54 CFU/100mL exceeded the target value of ≤ 125 CFU/100mL by 25.23%. Over 44% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and nearly 67% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. 33% of samples exceeded the turbidity target value of ≤ 10.4 NTU and 11% TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively.

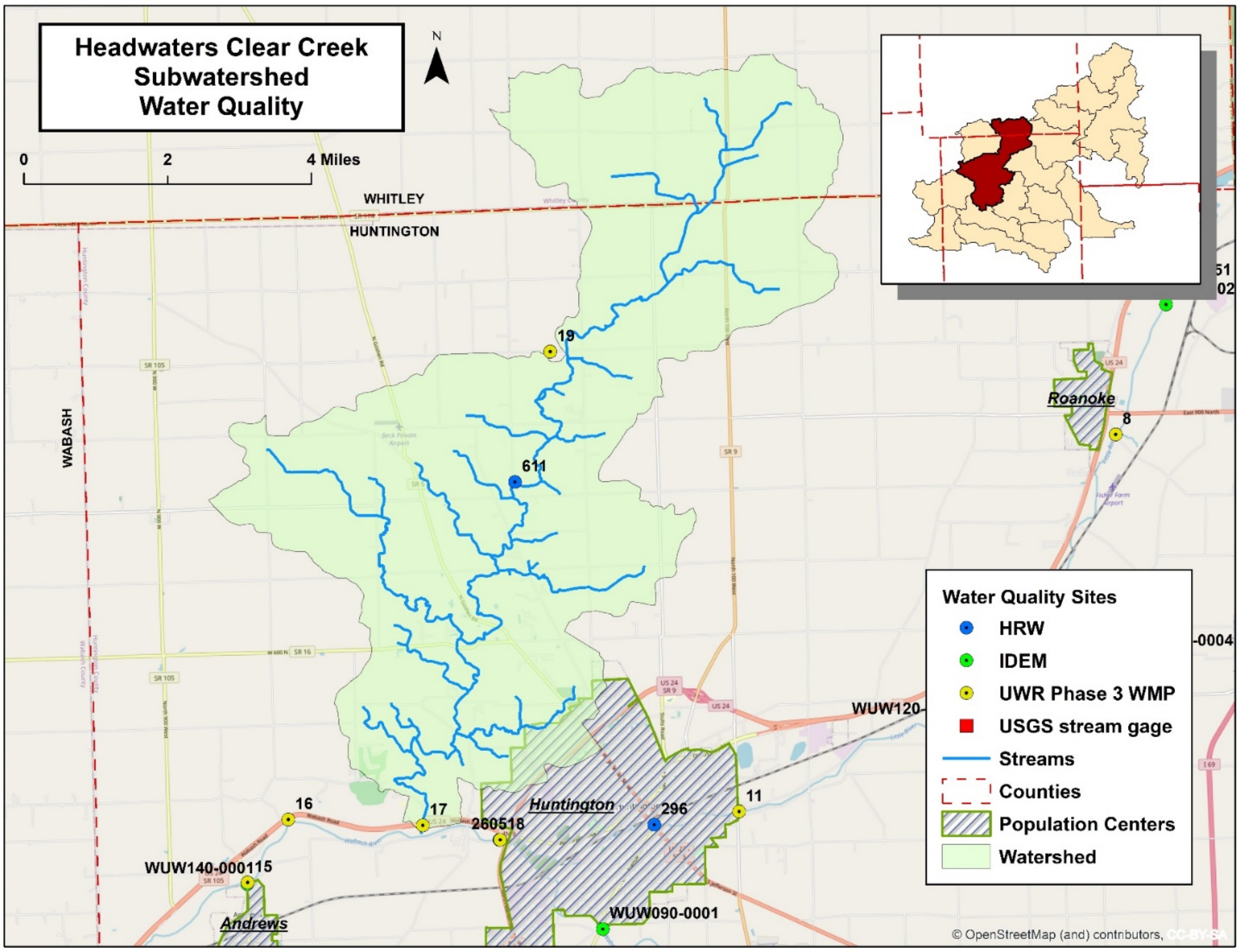
Table 3-21. UWRW Phase 3-Site 19 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.35	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	207.88	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	5	55.56
	*156.54			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	1.88	mg/L	9	≤ 2.2 mg/L	4	44.44
Total Phosphorus	0.19	mg/L	9	≤ 0.076 mg/L	6	66.67
Turbidity	12.59	NTU	9	≤ 10.4 NTU	3	33.33
TSS	15.46	mg/L	9	≤ 30 mg/L	1	11.11
Water Temperature	14.34	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	11.00	Points	1	≥ 17	1	100
CQHEI	52.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Headwaters Clear Creek (HUC 051201011202)

Water quality data in the Headwaters Clear Creek (HUC 051201011202) were analyzed as part of this project and by Northwest Elementary as part of IDEM's Hoosier Riverwatch monitoring program. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 17) on Clear Creek west of Huntington on US 24 east of Norwood Rd (Table 3-23). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Sections 3.1). Northwest Elementary sampled one location (Site 611) within the watershed. The locations of sample sites are shown in Figure 3-8 and analysis of water quality data is presented in Table 3-22.



Northwest Elementary evaluated habitat and biological data once at HRW site 611 on Clear Creek in January of 2003. Habitat data (CQHEI) met target values while biological (PTIR) data did not meet target values.

Table 3-22. Hoosier Riverwatch Site 611 (Clear Creek) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	-	mg/L	0	>4 and <12 mg/L	-	-
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate	-	mg/L	0	≤ 1 mg/L	-	-
Ortho-Phosphate	-	mg/L	0	≤ 0.076 mg/L	-	-
Turbidity	-	NTU	0	≤ 10.4 NTU	-	-
Water Temperature	-	°C	0	4.44°C – 29.44°C	-	-
PTIR (MacroInvert)	14.00	Points	1	≥ 17	1	100.00
CQHEI (Habitat)	80.00	Points	1	≥ 60	0	0.00

Only five samples were collected at Site 17. Sample collection was limited by bridge construction on US-24 beginning in May 2020 resulting in potentially hazardous collection conditions due to congested traffic. Of the five (5) samples collected and analyzed at Site 17, zero (0) *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean of 38.77 CFU/100mL was below the target value of ≤ 125 CFU/100mL. 20% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 40% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. 40% of samples exceeded the turbidity target value of ≤ 10.4 NTU and 20% exceeded the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores met the target values ≥ 17 and ≥ 60, respectively

Table 3-23. UWRW Phase 3-Site 17 Water Quality Analysis

<table>
<tr><th>Parameter</th><th>Mean</th><th>Unit</th><th># of Samples</th><th>Target</th><th># of Outside of Target</th><th>% Outside of Target</th></tr>
<tr><td>D.O.</td><td>11.99</td><td>mg/L</td><td>5</td><td>> 4 and <12 mg/L</td><td>3</td><td>60.00</td></tr>
<tr><td rowspan="2">E. coli</td><td>59.84</td><td rowspan="2">CFU/100mL</td><td rowspan="2">5</td><td>≤ 235 CFU/100mL (single sample)</td><td>0</td><td>0.00</td></tr>
<tr><td>*38.77</td><td>≤ 125 CFU/100mL (geometric mean)</td><td>0</td><td>0.00</td></tr>
<tr><td>Nitrate+Nitrite</td><td>2.12</td><td>mg/L</td><td>5</td><td>≤ 2.2 mg/L</td><td>1</td><td>20.00</td></tr>
<tr><td>Total Phosphorus</td><td>0.06</td><td>mg/L</td><td>5</td><td>≤ 0.076 mg/L</td><td>2</td><td>40.00</td></tr>
<tr><td>Turbidity</td><td>21.16</td><td>NTU</td><td>5</td><td>≤ 10.4 NTU</td><td>2</td><td>40.00</td></tr>
<tr><td>TSS</td><td>13.80</td><td>mg/L</td><td>5</td><td>≤ 30 mg/L</td><td>1</td><td>20.00</td></tr>
<tr><td>Water Temperature</td><td>9.69</td><td>°C</td><td>5</td><td>4.44°C – 29.44°C</td><td>1</td><td>20.00</td></tr>
<tr><td>PTIR</td><td>26.00</td><td>Points</td><td>1</td><td>≥ 17</td><td>0</td><td>0.00</td></tr>
<tr><td>CQHEI</td><td>93.00</td><td>Points</td><td>1</td><td>≥ 60</td><td>0</td><td>0.00</td></tr>
</table>

**E. coli* geometric mean

Bull Creek-Little River (HUC 051201011102)

No water quality data representative of the Bull Creek-Little River watershed (HUC 051201011102) were collected or analyzed as part of this project. Samples analyzed by the UWR WMP Phase 3 group at Site 8, located in the Bull Creek-Little River watershed on the Little River just south of Roanoke, are representative of the outflow of the Cow Creek-Little River Watershed (HUC 051201011006) and thus presented in the above section. A map of the Bull Creek-Little River watershed is presented in Figure 3-9.

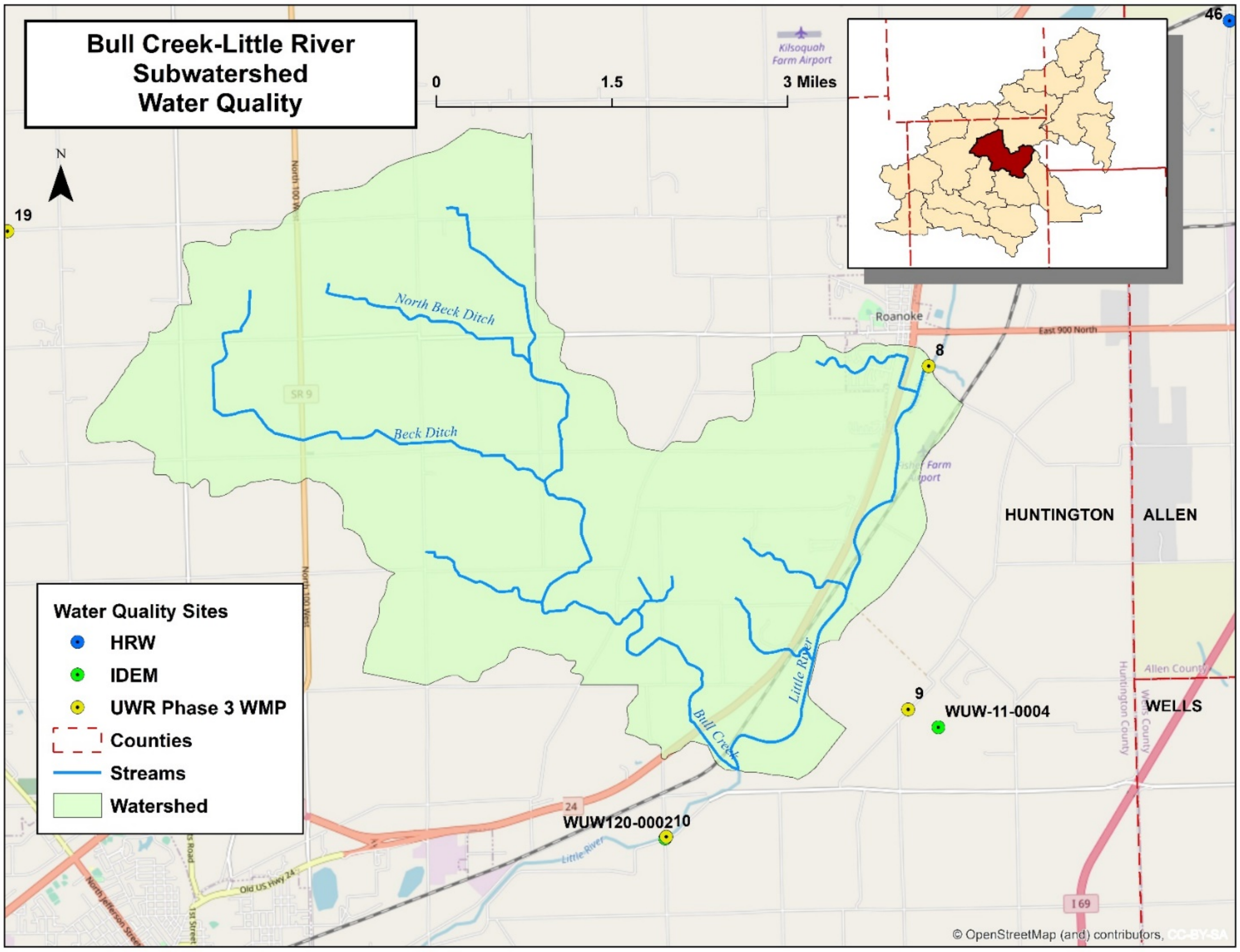


Figure 3-9. Bull Creek-Little River (HUC 051201011102) water quality

Flint Creek-Little River (HUC 051201011104)

No water quality data representative of the Flint Creek-Little River (HUC 051201011104) watershed were analyzed as part of this project, though samples within the watershed were previously analyzed by Riverview Middle School as part of IDEM's Hoosier Riverwatch monitoring program at one site (Site 296). The locations of sample sites are shown in Figure 3-10 and analysis of water quality data is presented Table 3-24.

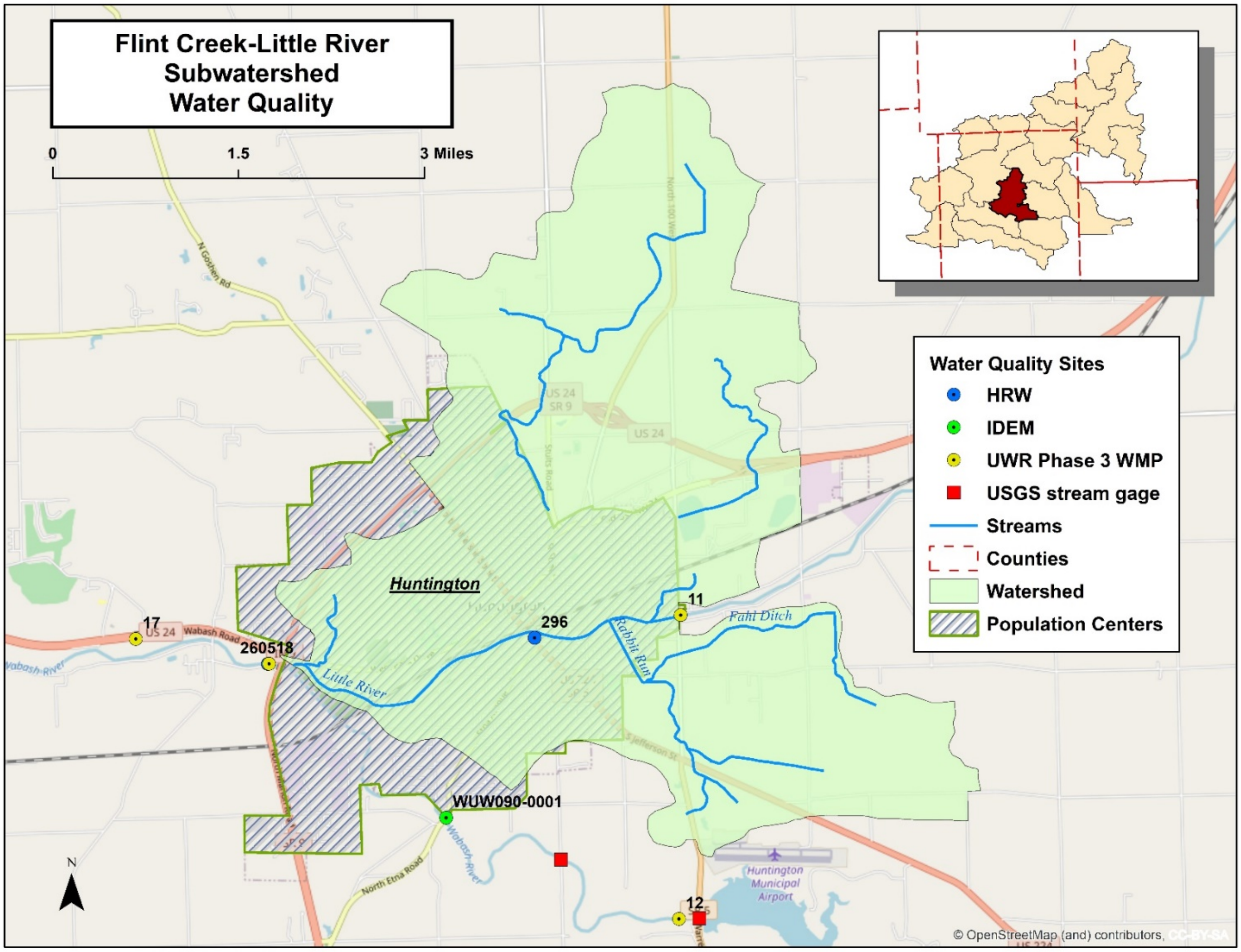


Figure 3-10. Flint Creek-Little River (HUC 051201011104) water quality

Riverview Middle School sampled water from HRW Site 296 on the Little River within the Flint Creek-Little River watershed on 5/7/2001 and 8/15/2011. Analysis of water quality data show that D.O., *E. coli,* Nitrate, and water temperature did not exceed target values. Turbidity exceeded the target value of 10.4 NTU in both samples. Biological data (PTIR) met target values while habitat data (CQHEI) did not meet target values in both evaluations.

Table 3-24. Hoosier Riverwatch Site 296 (Little River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	8.50	mg/L	2	>4 and <12 mg/L	0	0.00
E. coli	233.34	CFU/100mL	2	≤ 235 CFU/100mL (single sample)	0	0.00
Nitrate	11.42	mg/L	2	≤ 1 mg/L	0	0.00
Ortho-Phosphate	-	mg/L	-	≤ 0.076 mg/L	-	-
Turbidity	31.34	NTU	2	≤ 10.4 NTU	2	100.00
Water Temperature	19.50	°C	2	4.44°C – 29.44°C	0	0.00
PTIR (MacroInvert)	19.00	Points	1	≥ 17	0	0.00
CQHEI (Habitat)	46.00	Points	2	≥ 60	2	100.00

Flat Creek (HUC 051201011101)

Water quality data in the Flat Creek watershed (HUC 051201011101) were analyzed as part of this project and by IDEM as part of regular state water quality monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 9) on Flat Creek at N. Mayne Rd. northeast of CR 400 (Table 3-26). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1) IDEM collected data at one sample location (Site WUW-11-0004) within the watershed. The locations of sample sites are shown in Figure 3-11 and analysis of water quality data is presented Table 3-25. A total of seven (7) stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli*.

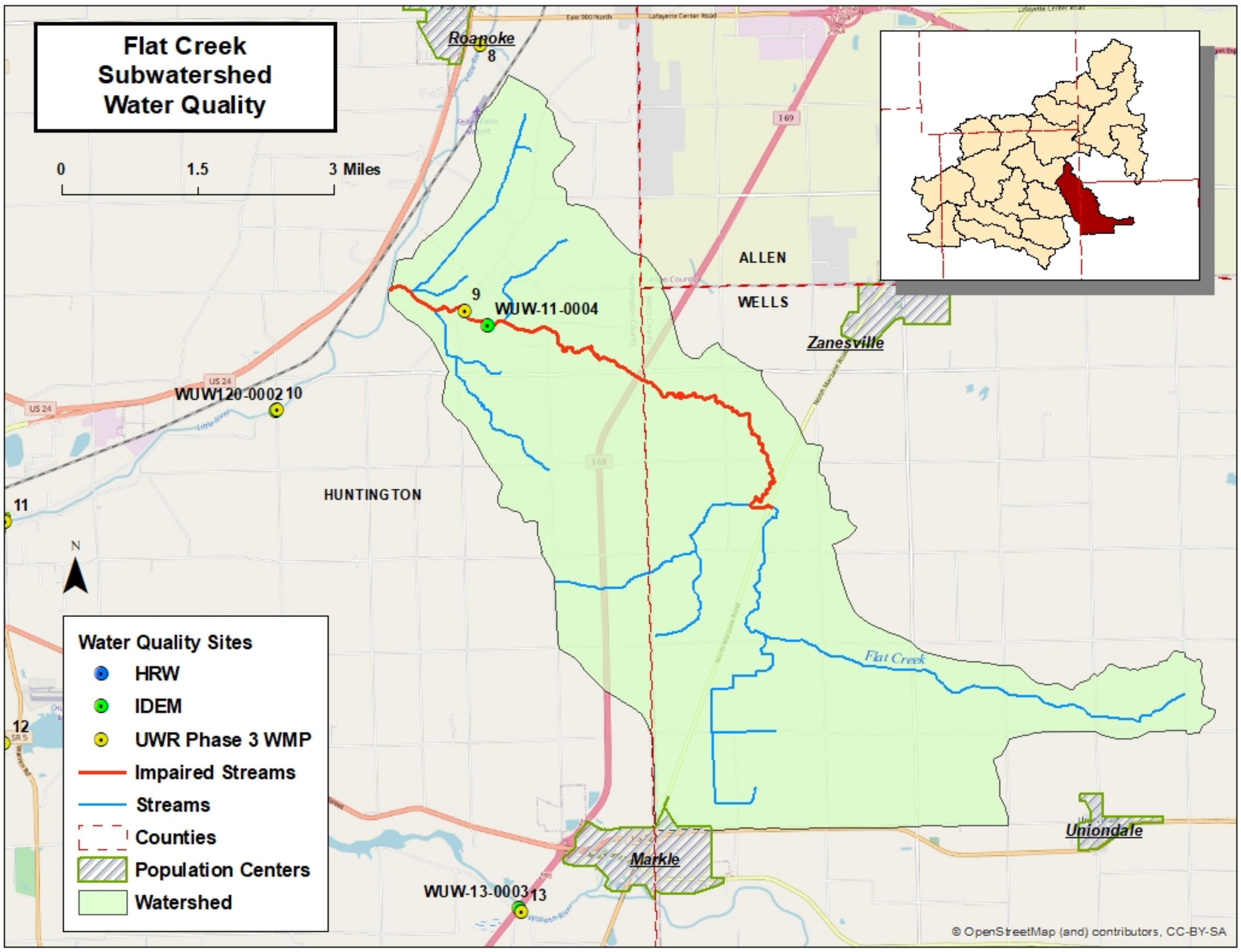


Figure 3-11. Flat Creek (HUC 051201011101) water quality

IDEM sampled water from site WUW-11-0004 within Flat Creek watershed eleven times from April to September 2015. Analysis of water quality data show that D.O., *E. coli*, and Nitrate+Nitrite exceeded target values in 27.27%, 40%, and 33.33% of samples, respectively. Both Total Phosphorus and TSS exceeded target values in 66.67% of samples.

Table 3-25. IDEM Site WUW-11-0004 (Flat Creek) Water Quality Analysis

Parameter	**Mean**	**Unit**	**# of Samples**	**Target**	**# Outside of Target**	**% Outside of Target**
D.O.	10.13	mg/L	11	>4 and <12 mg/L	3	27.27
E. coli	187.86	CFU/100mL	5	≤ 235 CFU/100mL (single sample)	2	40.00
Nitrate+Nitrite	1.81	mg/L	3	≤ 2.2 mg/L	1	33.33
Total Phosphorus	0.20	mg/L	3	≤ 0.076 mg/L	2	66.67
Turbidity	-	NTU	0	≤ 10.4 NTU	-	-
TSS	72.33	mg/L	3	≤ 30 mg/L	2	66.67
Water Temperature	17.07	°C	11	4.44°C – 29.44°C	0	0.00
PTIR (MacroInvert)	-	Points	0	≥ 17	-	-
CQHEI (Habitat)	-	Points	0	≥ 60	-	-

Of the nine (9) samples collected and analyzed at Site 9, 11% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 52.74 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Over 55% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and just over 22% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Approximately 44% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas only 22.22% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 20 met the target value of ≥ 17, though the CQHEI score of 31 was below the target value of ≥ 60.

Table 3-26. UWRW Phase 3-Site 9 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	10.09	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	122.00	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	1	11.11
	*52.74			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	2.19	mg/L	9	≤ 2.2 mg/L	5	55.56
Total Phosphorus	0.10	mg/L	9	≤ 0.076 mg/L	2	22.22
Turbidity	22.75	NTU	9	≤ 10.4 NTU	4	44.44
TSS	16.88	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	14.39	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	20.00	Points	1	≥ 17	0	0
CQHEI	31.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Mud Creek-Little River (HUC 051201011103)

Water quality data in the Mud Creek-Little River watershed (HUC 051201011103) were analyzed as part of this project and by IDEM as part of regular state water quality monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at two sites (Sites 10 and 11) on the Little River east of Huntington (Table 3-28; Table 3-29). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). IDEM collected samples at one sample location (WUW-12-0002) within the watershed. The locations of sample sites are shown in Figure 3-12 and analysis of water quality data is presented Table 3-27. A total of 12 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli*, impaired biotic communities, and nutrients. Precipitation, discharge, and gage height data are all available for the Little River in the Mud Creek-Little River watershed from USGS stream gage 03324000.

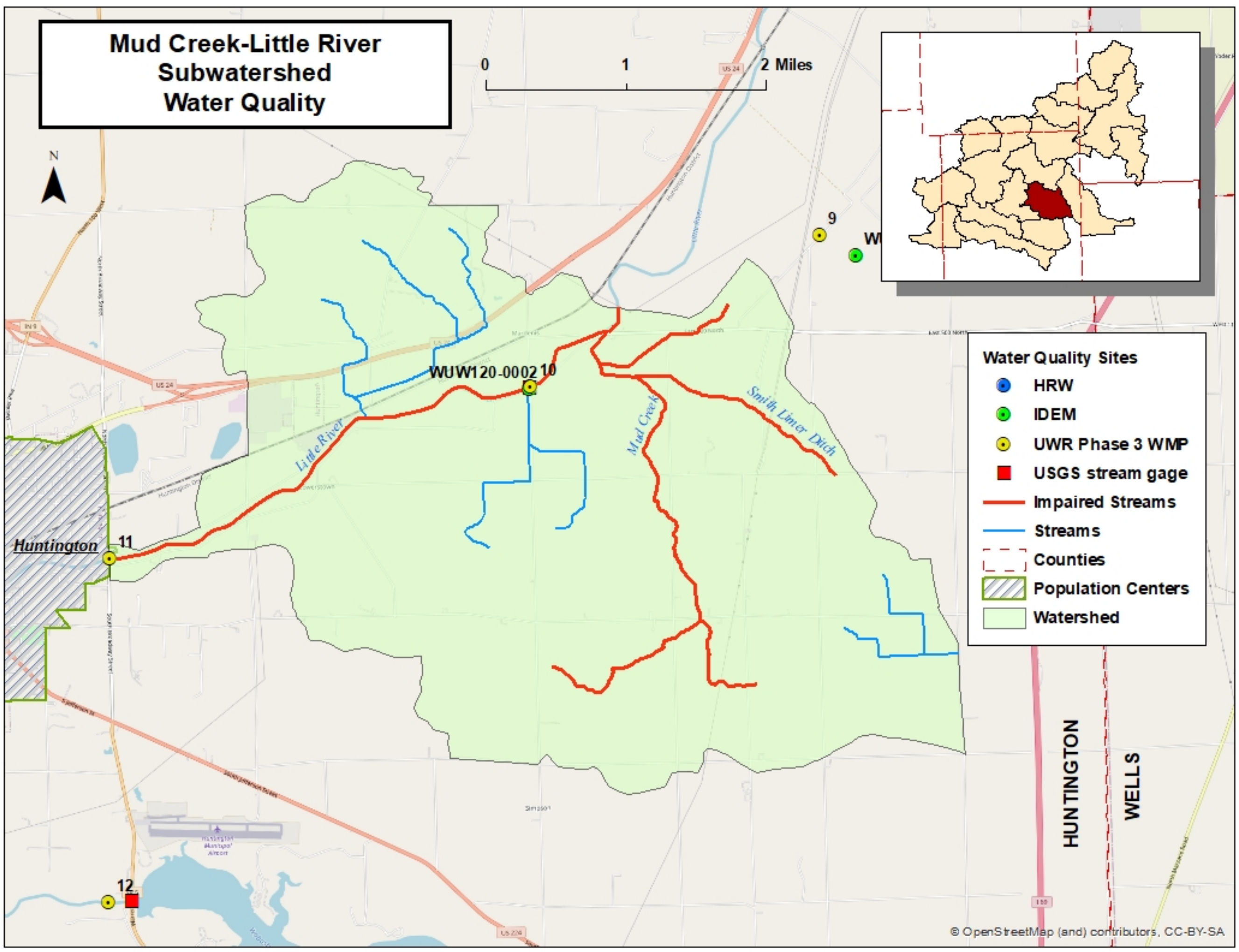


Figure 3-12. Mud Creek-Little River (HUC 051201011103) water quality

IDEM sampled water at site WUW-12-0002 within the Mud Creek-Little River watershed eleven times from April to September 2015. Analysis of water quality data show that D.O., Turbidity, TSS, and water temperature exceeded target values in 22.69%, 33.33%, 30%, and 22.69% of samples, respectively. Nitrate+Nitrite and Total Phosphorus exceeded target values in 60.27% and 99.32% of samples, respectively.

Table 3-27. IDEM Site WUW-12-0002 (Little River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.62	mg/L	119	>4 and <12 mg/L	27	22.69
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate+Nitrite	2.80	mg/L	146	≤ 2.2 mg/L	88	60.27
Total Phosphorus	0.25	mg/L	146	≤ 0.076 mg/L	145	99.32
Turbidity	14.20	NTU	3	≤ 10.4 NTU	1	33.33
TSS	57.38	mg/L	140	≤ 30 mg/L	42	30.00
Water Temperature	13.03	°C	119	4.44°C – 29.44°C	27	22.69
PTIR (MacroInvert)	-	Points	0	≥ 17	-	-
CQHEI (Habitat)	-	Points	0	≥ 60	-	-

Of the nine (9) samples collected and analyzed at Site 10, nearly 67% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 94%. Over 44% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and nearly 78% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 66% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas 33% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively

Table 3-28. UWRW Phase 3-Site 10 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	9.23	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	410.89	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	6	66.67
	*242.67			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	2.10	mg/L	9	≤ 2.2 mg/L	4	44.44
Total Phosphorus	0.31	mg/L	9	≤ 0.076 mg/L	7	77.78
Turbidity	18.18	NTU	9	≤ 10.4 NTU	6	66.67
TSS	21.50	mg/L	9	≤ 30 mg/L	3	33.33
Water Temperature	15.40	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	11.00	Points	1	≥ 17	1	100
CQHEI	24.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Of the nine (9) samples collected and analyzed at Site 11, 33% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 112.64 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Over 44% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 100% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 55% of samples exceeded the turbidity target value of ≤ 10.4 NTU whereas 22% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were above the target values ≥ 17 and ≥ 60, respectively

Table 3-29. UWRW Phase 3-Site 11 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	9.92	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	196.98	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	3	33.33
	*112.64			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	2.89	mg/L	9	≤ 2.2 mg/L	4	44.44
Total Phosphorus	0.20	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	14.97	NTU	9	≤ 10.4 NTU	5	55.56
TSS	15.50	mg/L	9	≤ 30 mg/L	2	22.22
Water Temperature	15.51	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	23.00	Points	1	≥ 17	0	0
CQHEI	61.00	Points	1	≥ 60	0	0

**E. coli* geometric mean

Sub-watersheds of the Loon Creek-Wabash River Watershed

Huntington Lake-Wabash River (HUC 051201011301)

Water quality data in the Huntington Lake-Wabash River watershed (HUC 051201011301) were analyzed as part of this project and by IDEM as part of regular state water quality monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at two sites (Sites 12 and 13). Site 13 is located on the Wabash River near the 1-69 bridge at J.E. Roush Fish & Wildlife Area and is representative of water quality conditions exiting the Phase 2 project area (Table 3-32). Site 12 is positioned just outside of the watershed area but represents water quality flowing out of the Huntington Lake-Wabash River (HUC 051201011301) subwatershed (Table 3-31). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1) IDEM collected data at one sample location (WUW-13-0003) within the watershed. The locations of sample sites are shown in Figure 3-13 and analysis of water quality data from IDEM is presented Table 3-30. A total of 16.4 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli*, impaired biotic communities, nutrients, and PCBs in fish tissue. Reservoir water surface elevation data are available from USGS stream gage 03323450.

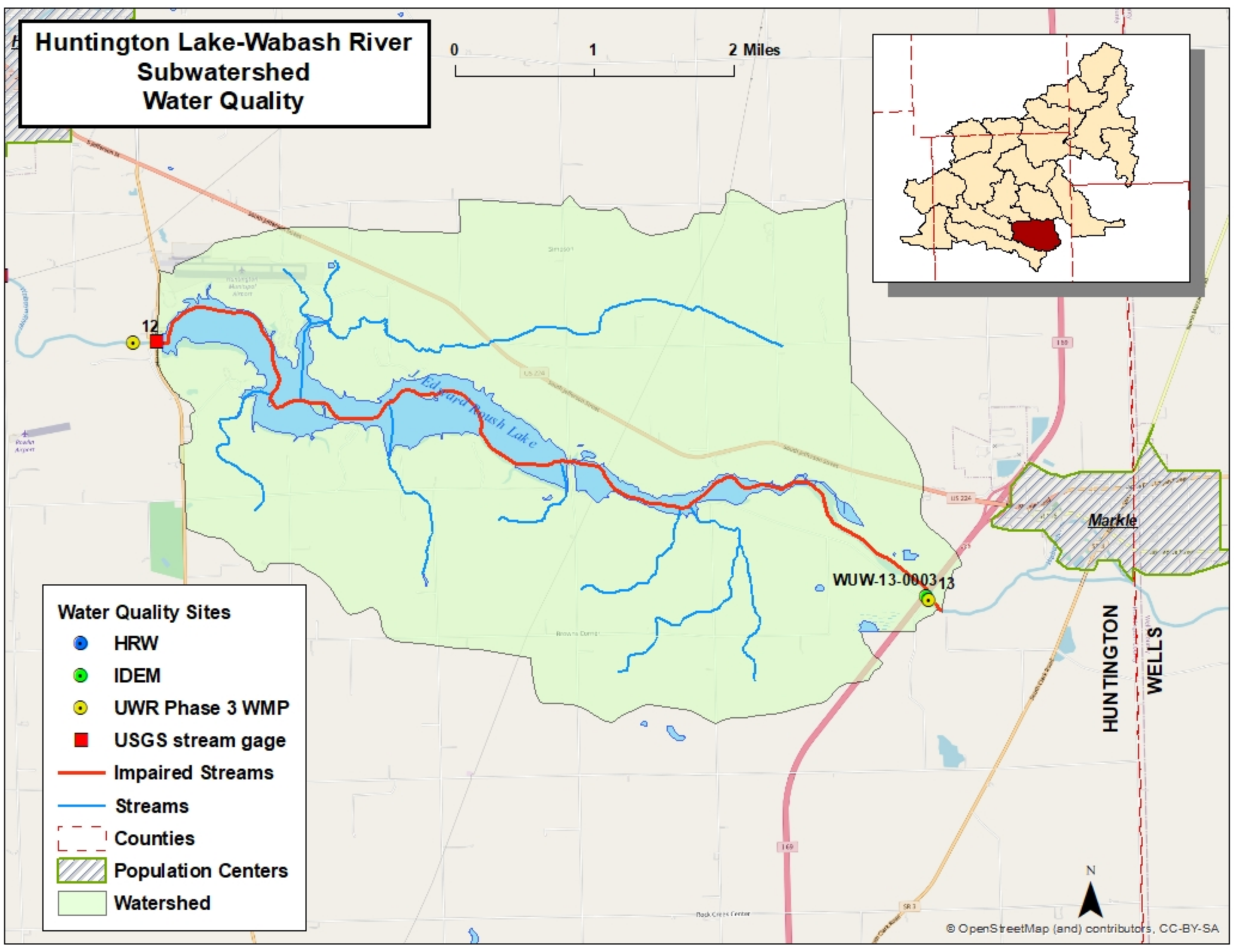


Figure 3-13. Huntington Lake-Wabash River (HUC 051201011301) water quality

IDEM sampled water at site WUW-13-0003 within the Huntington Lake-Wabash River watershed seventeen times from September 2013 to July 2016. Analysis of water quality data show that D.O. and water temperature exceeded target values in 16.67% and 11.76% of samples, respectively. Total Phosphorus and Turbidity exceeded target values in 90.91% and 100% of samples, respectively.

Table 3-30. IDEM Site WUW-13-0003 (Wabash River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	10.75	mg/L	6	>4 and <12 mg/L	1	16.67
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate+Nitrite	-	mg/L	0	≤ 2.2 mg/L	-	-
Total Phosphorus	0.27	mg/L	11	≤ 0.076 mg/L	10	90.91
Turbidity	96.52	NTU	6	≤ 10.4 NTU	6	100.00
TSS	-	mg/L	0	≤ 30 mg/L	-	-
Water Temperature	17.69	°C	17	4.44°C – 29.44°C	2	11.76
PTIR (MacroInvert)	-	Points	0	≥ 17	-	-
CQHEI (Habitat)	82.00	Points	2	≥ 60	0	0.00

Of the nine (9) samples collected and analyzed at Site 12, 33% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 113.93 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Nearly 78% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 100% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 89% of samples exceeded the turbidity target value of ≤ 10.4 NTU and 66.67% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were above the target values ≥ 17 and ≥ 60, respectively

Table 3-31. UWRW Phase 3-Site 12 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.63	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	243.84	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	4	44.44
	*113.93			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	3.91	mg/L	9	≤ 2.2 mg/L	7	77.78
Total Phosphorus	0.34	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	70.16	NTU	9	≤ 10.4 NTU	8	88.89
TSS	68.18	mg/L	9	≤ 30 mg/L	6	66.67
Water Temperature	14.83	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	26.00	Points	1	≥ 17	0	0
CQHEI	72.00	Points	1	≥ 60	0	0

**E. coli* geometric mean

Of the nine (9) samples collected and analyzed at Site 13, 33% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 130.91 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Over 66% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 100% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 89% of samples exceeded the turbidity target value of ≤ 10.4 NTU and 66.67% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively

Table 3-32. UWRW Phase 3-Site 13 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.23	mg/L	9	> 4 and <12 mg/L	1	11.11
E. coli	267.38	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	3	33.33
	*130.91			≤ 125 CFU/100mL (geometric mean)	1	100.00
Nitrate+Nitrite	3.42	mg/L	9	≤ 2.2 mg/L	6	66.67
Total Phosphorus	0.49	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	78.35	NTU	9	≤ 10.4 NTU	8	88.89
TSS	71.14	mg/L	9	≤ 30 mg/L	6	66.67
Water Temperature	15.55	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	14.00	Points	1	≥ 17	1	100.00
CQHEI	51.00	Points	1	≥ 60	1	100.00

**E. coli* geometric mean

Loon Creek (HUC 051201011304) water quality

No water sampling sites are located within the Loon Creek watershed (HUC 051201011304). Water temperature and gage height data are available for the Wabash River in Loon Creek from USGS stream gage 03323500.

Hanging Rock-Wabash River (HUC 051201011305)

Water quality data in the Hanging Rock-Wabash River watershed (HUC 051201011305) were analyzed as part of this project. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 14) on the Wabash River southeast of Lagro and just upstream of the confluence with the Salamonie River (Table 3-33). Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). The locations of sample sites are shown in Figure 3-14. A total of ten (10) stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli*, nutrients, and PCBs in fish tissue.

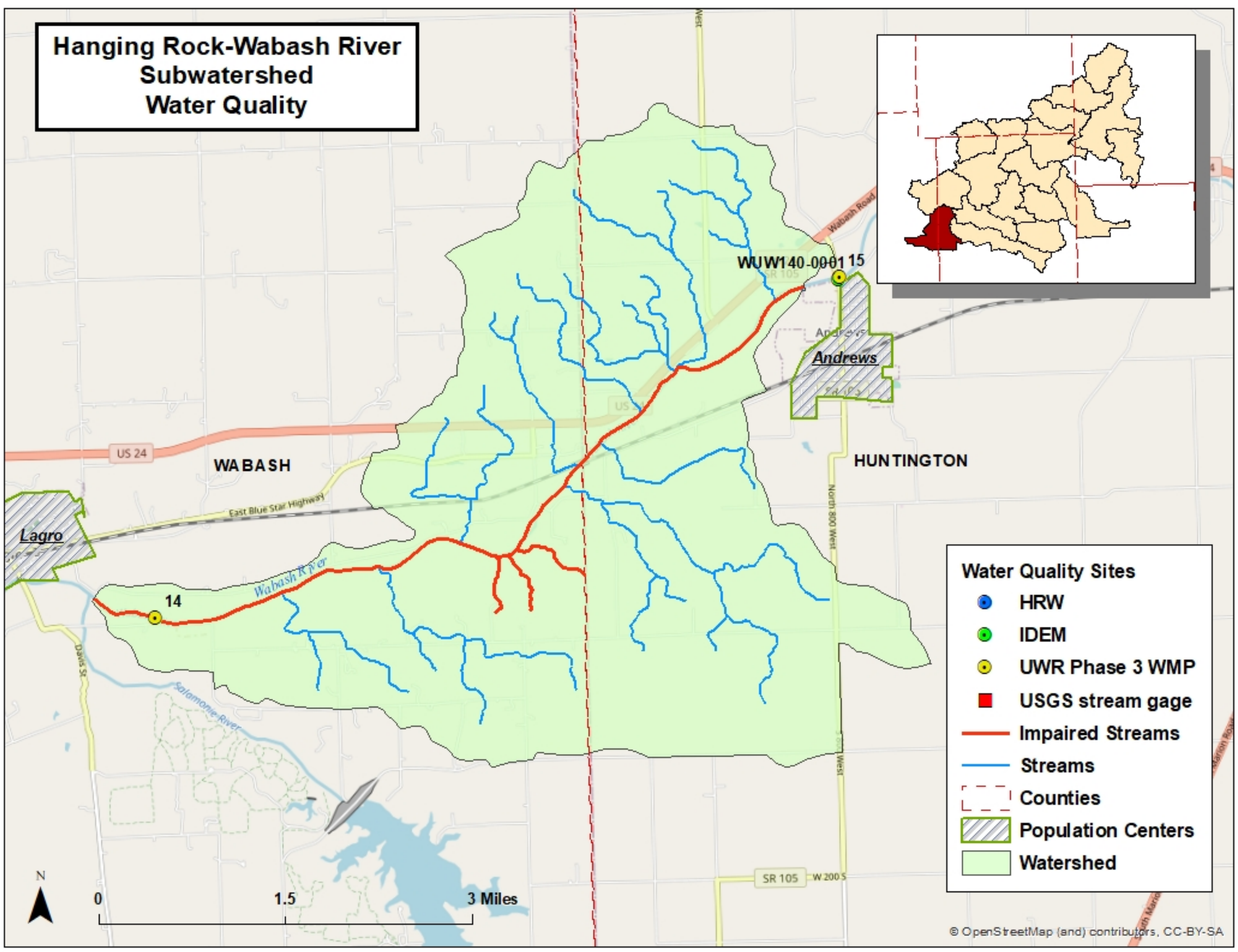


Figure 3-14. Hanging Rock-Wabash River (HUC 051201011305) water quality

Of the nine (9) samples collected and analyzed at Site 14, over 55% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, though the geometric mean of 111.64 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Over 66% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and nearly 89% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 89% of samples exceeded the turbidity target value of ≤ 10.4 NTU and over 55% of samples exceed the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively

Table 3-33. UWRW Phase 3-Site 14 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	10.08	mg/L	9	> 4 and <12 mg/L	1	11.11
E. coli	228.64	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	5	55.56
	*111.64			≤ 125 CFU/100mL (geometric mean)	0	0
Nitrate+Nitrite	3.68	mg/L	9	≤ 2.2 mg/L	6	66.67
Total Phosphorus	0.23	mg/L	9	≤ 0.076 mg/L	8	88.89
Turbidity	56.37	NTU	9	≤ 10.4 NTU	8	88.89
TSS	76.72	mg/L	9	≤ 30 mg/L	5	55.56
Water Temperature	15.98	°C	9	4.44°C – 29.44°C	1	11.11
PTIR	12.00	Points	1	≥ 17	1	100
CQHEI	43.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Silver Creek (HUC 051201011303)

Water quality data in the Silver Creek watershed (HUC 051201011302) were analyzed as part of this project. Samples analyzed by the UWR WMP Phase 3 group were collected at one site (Site 16) on Silver Creek northeast of Andrews on US 24 east of CR 750 (Table 3-34). Sampling efforts followed the UWRW Phase 3 Watershed Management Plan Quality Assurance Project Plan (Section 3.1). The locations of sample sites are shown in Figure 3-15. A total of 4.9 stream miles are listed on the IDEM 303(d) List of Impaired Streams for *E. coli.*

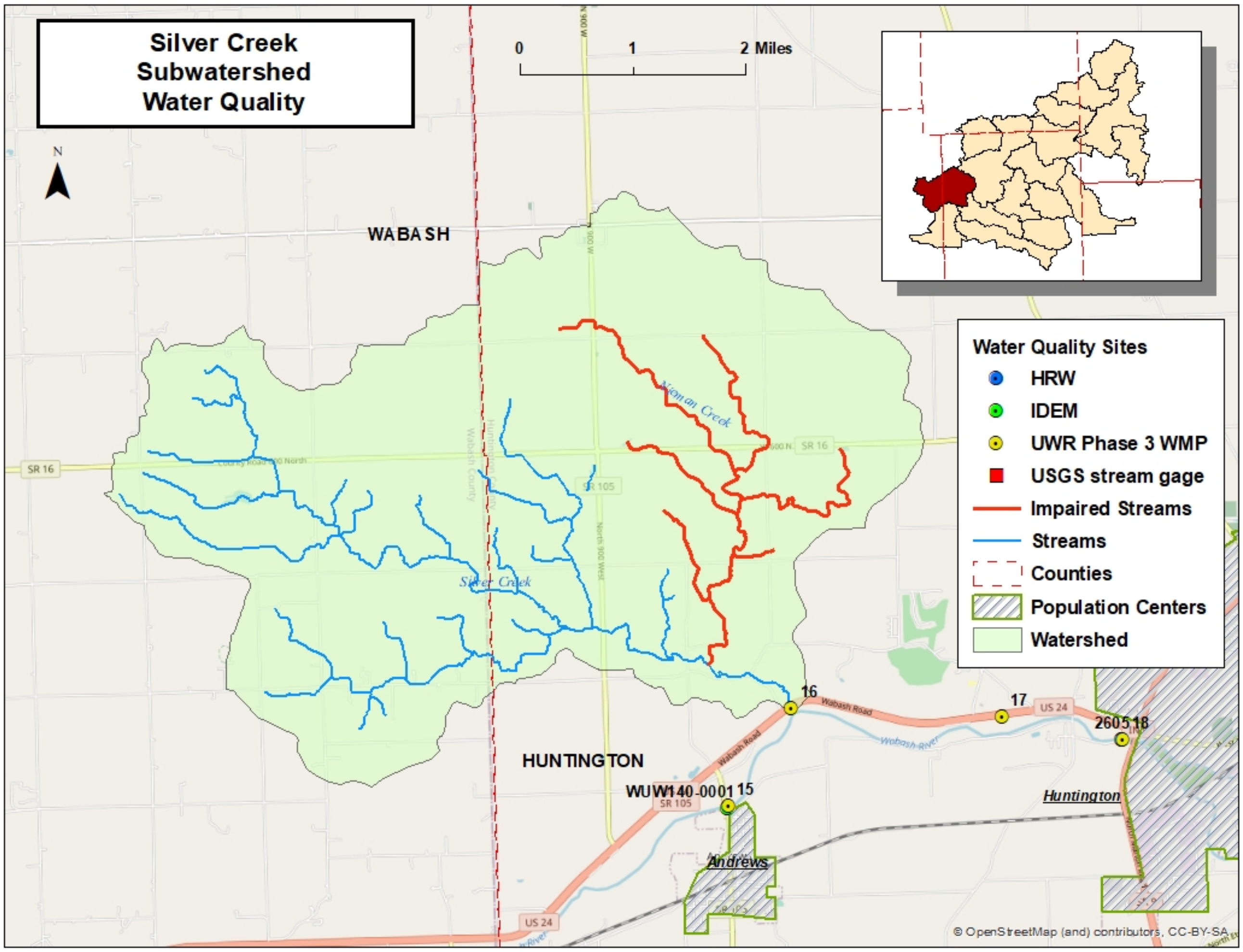


Figure 3-15. Silver Creek (HUC 051201011302) water quality

Of the nine (9) samples collected and analyzed at Site 16, over 22% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean of 108.27 CFU/100mL was below the target value of ≤ 125 CFU/100mL. Just over 11% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 22% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. 11.11% of samples exceeded the turbidity target value of ≤ 10.4 NTU and the TSS target value of ≤ 30 mg/L. The PTIR score of 16 was below the target value of ≥ 17, though the CQHEI score of 68 met the target value of ≥ 60.

Table 3-34. UWRW Phase 3-Site 16 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	10.37	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	176.06	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	2	22.22
	*108.27			0	No	0
Nitrate+Nitrite	0.90	mg/L	9	≤ 2.2 mg/L	1	11.11
Total Phosphorus	0.05	mg/L	9	≤ 0.076 mg/L	2	22.22
Turbidity	7.72	NTU	9	≤ 10.4 NTU	1	11.11
TSS	9.78	mg/L	9	≤ 30 mg/L	1	11.11
Water Temperature	15.22	°C	9	4.44°C – 29.44°C	1	11.11
PTIR	16.00	Points	1	≥ 17	1	100
CQHEI	61.00	Points	1	≥ 60	0	0

**E. coli* geometric mean

Town of Andrews-Wabash River (HUC 051201011303)

Water quality data in the Town of Andrews-Wabash River watershed (HUC 051201011303) were analyzed as part of this project, as well as by IDEM as part of regular state water quality monitoring and Hoosier Riverwatch monitoring. Samples analyzed by the UWR WMP Phase 3 group were collected at two sites (Sites 15 and 18) on the Wabash River (Table 3-38; Table 3-39) . Sampling efforts followed the UWRW Phase 3 WMP QAPP (Section 3.1). IDEM collected data at two sample locations (WUW090-0001 and WIW140-0001) within watershed (Table 3-35; Table 3-36). Data from one sampling event on the Wabash River (Site 2605) are present in IDEM's Hoosier Riverwatch database (Table 3-37). The locations of sample sites are shown in Figure 3-16 and analysis of water quality data is presented in Table 3-35 though Table 3-39. A total of 19.6 stream miles located within the watershed are listed on the IDEM 303(d) list of impaired waters. Impairments include *E. coli*, impaired biotic communities, and nutrients.

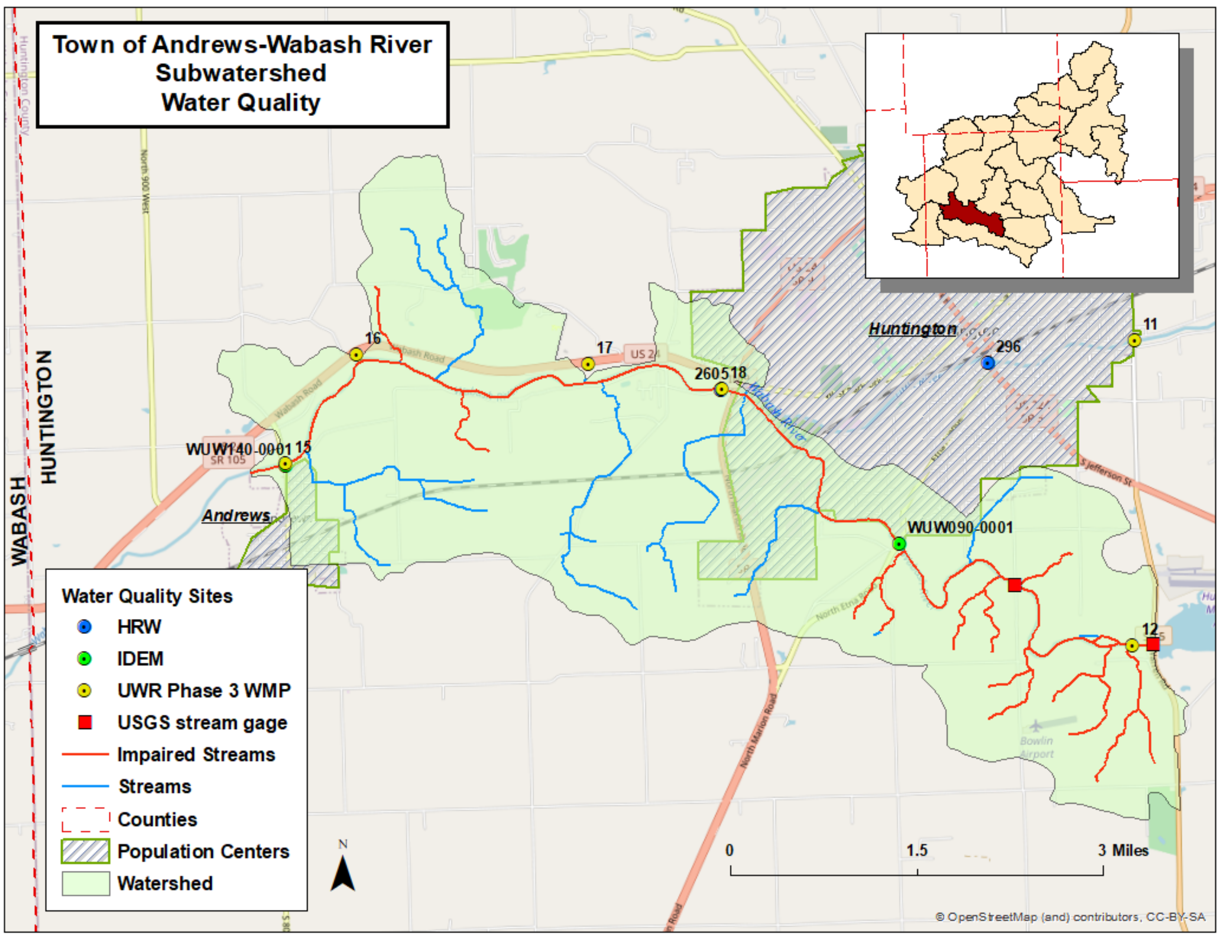


Figure 3-16. Town of Andrews-Wabash River (HUC 051201011303) water quality

IDEM sampled water at site WUW090-0001 within the Town of Andrews-Wabash River watershed 128 times from January 2009 to April 2019. Analysis of water quality data show that D.O. and water temperature exceeded target values in 27.87% and 23.77% of samples, respectively. Nitrate+Nitrite and TSS exceeded target values in 71.43% and 53.03% of samples, respectively. Total phosphorus and turbidity exceeded target values in 96.88% and 100% of samples, respectively.

Table 3-35. IDEM Site WUW090-0001(Wabash River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	10.05	mg/L	122	>4 and <12 mg/L	34	27.87
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate+Nitrite	4.26	mg/L	126	≤ 2.2 mg/L	90	71.43
Total Phosphorus	0.27	mg/L	128	≤ 0.076 mg/L	124	96.88
Turbidity	20.60	NTU	3	≤ 10.4 NTU	3	100.00
TSS	51.91	mg/L	66	≤ 30 mg/L	35	53.03
Water Temperature	13.11	°C	122	4.44°C – 29.44°C	29	23.77
PTIR (MacroInvert)	-	Points	0	≥ 17	-	-
CQHEI (Habitat)	-	Points	0	≥ 60	-	-

IDEM sampled water at site WUW140-0001 within the Town of Andrews-Wabash River watershed 129 times from January 2009 to April 2019. Analysis of water quality data show that D.O., nitrate+nitrite, total phosphorus, turbidity, TSS, and water temperature exceeded target values. Total phosphorus exceeded target values in 97.67% of samples.

Table 3-36. IDEM Site WUW140-0001 (Wabash River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	10.13	mg/L	122	>4 and <12 mg/L	33	27.05
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	0	-
Nitrate+Nitrite	4.07	mg/L	128	≤ 2.2 mg/L	95	74.22
Total Phosphorus	0.29	mg/L	129	≤ 0.076 mg/L	126	97.67
Turbidity	15.83	NTU	9.3	≤ 10.4 NTU	27.9	10.30
TSS	64.35	mg/L	127	≤ 30 mg/L	61	48.03
Water Temperature	13.02	°C	122	4.44°C – 29.44°C	30	24.59
PTIR (MacroInvert)	-	Points	0	≥ 17	-	-
CQHEI (Habitat)	-	Points	0	≥ 60	-	-

One sample was recorded at HRW Site 2605 on the Wabash River within the Town of Andrews-Wabash River watershed on 7/23/2018. Analysis of water quality data show that D.O., nitrate, orthophosphate, turbidity, and water temperature exceeded target values. Additionally, evaluations of habitat (CQHEI) and biological (PTIR) data did not meet target values.

Table 3-37. Hoosier Riverwatch Site 2605 (Wabash River) Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# Outside of Target	% Outside of Target
D.O.	9.00	mg/L	1	>4 and <12 mg/L	Upper Wabash	0.00
E. coli	-	CFU/100mL	0	≤ 235 CFU/100mL (single sample)	-	-
Nitrate	2.00	mg/L	1	≤ 1 mg/L	1	100.00
Ortho-Phosphate	2.00	mg/L	1	≤ 0.076 mg/L	1	100.00
Turbidity	53.00	NTU	1	≤ 10.4 NTU	1	100.00
Water Temperature	36.00	°C	1	4.44°C – 29.44°C	1	100.00
PTIR (MacroInvert)	10.00	Points	1	≥ 17	1	100.00
CQHEI (Habitat)	55.50	Points	1	≥ 60	1	100.00

Of the nine (9) samples collected and analyzed at Site 15, over 55% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 24.41%. Over 66% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and 100% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Nearly 89% of samples exceeded the turbidity target value of ≤ 10.4 NTU and over 55% of samples exceed the TSS target value of ≤ 30 mg/L. The PTIR score of 20 met the target value of ≥ 17, though the CQHEI score of 68 was below the target value of ≥ 60

Table 3-38. UWRW Phase 3-Site 15 Water Quality Analysis

Parameter	Mean	Unit	# of Samples	Target	# of Outside of Target	% Outside of Target
D.O.	9.83	mg/L	9	> 4 and <12 mg/L	2	22.22
E. coli	303.80	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	5	55.56
	*155.51			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	3.78	mg/L	9	≤ 2.2 mg/L	6	66.67
Total Phosphorus	0.26	mg/L	9	≤ 0.076 mg/L	9	100.00
Turbidity	60.54	NTU	9	≤ 10.4 NTU	8	88.89
TSS	57.72	mg/L	9	≤ 30 mg/L	5	55.56
Water Temperature	15.36	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	20.00	Points	1	≥ 17	0	0
CQHEI	58.00	Points	1	≥ 60	1	100

**E. coli* geometric mean

Of the nine (9) samples collected and analyzed at Site 18, 33% of *E. coli* samples exceeded the single sample target value of ≤ 235 CFU/100mL, and the geometric mean target value of ≤ 125 CFU/100mL was exceeded by 7.44%. Over 66% of samples exceeded the nitrate+nitrite target value of ≤ 2.2 mg/L and nearly 89% of samples exceeded the total phosphorus target value of ≤ 0.076 mg/L. Over 55% of samples exceeded the turbidity target value of ≤ 10.4 NTU and the TSS target value of ≤ 30 mg/L. Both the PTIR and CQHEI scores were below the target values ≥ 17 and ≥ 60, respectively

Table 3-39. UWRW Phase 3-Site 18 Water Quality Analysis

Parameter	Mean	Unit	# of samples	Target	# Outside of Target	% Outside of Target
D.O.	9.80	mg/L	9	> 4 and <12 mg/L	3	33.33
E. coli	252.49	CFU/100mL	9	≤ 235 CFU/100mL (single sample)	3	33.33
	*134.30			≤ 125 CFU/100mL (geometric mean)	1	100
Nitrate+Nitrite	3.88	mg/L	9	≤ 2.2 mg/L	6	66.67
Total Phosphorus	0.27	mg/L	9	≤ 0.076 mg/L	8	88.89
Turbidity	60.58	NTU	9	≤ 10.4 NTU	5	55.56
TSS	66.39	mg/L	9	≤ 30 mg/L	5	55.56
Water Temperature	15.73	°C	9	4.44°C – 29.44°C	2	22.22
PTIR	18.00	Points	1	≥ 17	0	0
CQHEI	63.00	Points	1	≥ 60	0	0

**E. coli* geometric mean

3.3 Land Use by Sub-watershed

Survey Methods

Initial data and surveys were conducted using desktop applications. ESRI ArcGIS was used to determine areas within the watershed that are in a degraded condition. This determination was conducted using GIS data from indianamap.org. Data was analyzed for slope, current stream buffers, proximity of potential water pollution sources, etc. Upon completion of the desktop survey, a windshield survey was conducted throughout the watershed to identify areas where nonpoint source pollution may be an issue. The methodology for the windshield survey was adapted from Michigan DEQ Stream Crossing Watershed Procedure (Michigan DEQ, 2007). Data from a total of 299 stream crossings were collected from November through December 2018. Data were collected relative to channel modification, stream bank erosion, buffer presence, adjacent land use, livestock access, drainage tile, trash, tillage practices, and cover crops. Data from the windshield survey will be discussed in further detail at the sub-watershed level.

Land Use Overview

This section will provide land use information pertaining to each 12-digit HUC watershed located in the UWRW Phase 3 project area. Data was collected using a desktop analysis within ArcGIS and windshield surveys. While there are differences between sub-watersheds, it is important to note that there are many trends that are similar between all the watersheds. Overall, the project watershed is predominantly agriculture with 69% of land use in agriculture production. Much of the watershed is considered prime farmland and has consistently been in cropland since the mid-1900's.

Fertilizer use within the watershed is very common due to extensive agriculture production. Fertilizers in the form of nitrogen and phosphorus are applied on a yearly basis throughout the watershed. Many producers will apply a slightly greater amount of fertilizer than necessary to insure optimal growth. With increased fertilizer application, atmospheric, and soil mineralization there is a pool of nutrients present in the soil. Inevitably, this excess nutrient pool will be extracted from the watershed by either harvestable grain or through the waterbodies.

Hobby farms and small animal feeding operations (AFOs) are minimal throughout the watershed and were not quantified in this study. While inevitably these farms impact the watershed, their contribution to ecological degradation is considered minimal compared to other agriculture practices such CFO's/CAFO's.

Riparian Buffers

Riparian (along the waters' edge) buffers are extremely important to water quality. Conservation riparian buffers are small areas or strips of land in permanent vegetation, designed to intercept pollutants and manage other environmental concerns. Buffers include: riparian buffers, filter strips, grassed waterways, shelterbelts, windbreaks, living snow fences, contour grass strips, crosswind trap strips, and shallow water areas for wildlife, field borders, alley cropping, herbaceous wind barriers, and vegetative barriers.

Strategically placed buffer strips in the agricultural landscape can effectively mitigate the movement of sediment, nutrients, and pesticides within farm fields and from farm fields. When coupled with appropriate upland treatments, including crop residue management, nutrient management, and integrated pest management, winter cover crops, and similar management practices and technologies, buffer strips should allow farmers to achieve a measure of economic and environmental sustainability in their operations. Buffer strips can also enhance wildlife habitat and protect biodiversity. Literature shows that a 30-meter buffer strip is the most effective, "The most effective buffers are at least 30-meters, or 100 feet wide, composed of native forest, and are applied to all streams, including very small ones." (Wenger and Fowler 2000).

Streams segments with inadequate riparian buffers (< 30-meters) were determined using ArcGIS by placing a 30-meter buffer around all rivers and streams and analyzing land use within the applied buffer. Total streams lacking suitable riparian buffers were highlighted and analyzed.

Stream Bank Stabilization

Streambank erosion is a major concern of the stakeholders. Many stream banks are significantly eroded. It is nearly impossible to quantify streambank erosion via desktop analysis. Thus, a windshield survey documented the extent of streambank erosion at each stream crossing within the UWRW Phase 3 project area. Stream bank erosion was recorded as none, slight, moderate, or severe.

Leaking Underground Storage Tanks (LUST)

The USEPA describes LUST as:

> A typical leaking underground storage tank (LUST) scenario involves the release of a fuel product from an underground storage tank (UST) that can contaminate surrounding soil, groundwater, or surface waters, or affect indoor air spaces. Early detection of an UST release is important, as is determining the source of the release, the type of fuel released, the occurrence of imminently threatened

receptors, and the appropriate initial response. The primary objective of the initial response is to determine the nature and extent of a release as soon as possible.

Warning signs of a release can be identified through inspection and monitoring, inventory control, and leak-detection technology. Once the release is confirmed, notification to the appropriate government agency must follow particular state or tribal requirements.

In some cases, emergency response actions must be taken immediately without waiting for government approval or oversight. Initial actions are all focused on protecting public health, safety, and the environment. Under most state regulations, the operator or owner has specific time frames to conduct initial response actions, submit reports, complete an initial site characterization, and conduct free product removal. It is important that LUST personnel reinforce these required targets in the event that an enforcement action becomes necessary.

Brownfields

The USEPA describes Brownfields as a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. It is estimated that there are more than 450,000 brownfields in the U.S. Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures off of undeveloped, open land, and both improves and protects the environment.

Combined Sewer Overflows

A combined sewer overflow (CSO) is a piped outfall that is part of a combined sewer system, which carries both sanitary waste and storm water runoff through the same pipe to the wastewater treatment plant (WWTP). However, during rainfall events, the system is designed to discharge flows directly into a receiving waterbody once the WWTP storage capacity is exceeded. Each population center that contains CSO's is required to comply with the CWA and manage the discharges of combined sewers. EPA Guidance for long-term control plan states that many CSO communities enter into a consent decree or an Agreed Order (AO), which is a federally or state administered enforcement mechanism that compels the community to implement a plan to improve water quality. The consent decree or AO may include a Long Term Control Plan (LTCP) for construction of sewer system improvements as well as documented plans for the operation, maintenance, and rehabilitation of the sewer system to minimize or eliminate CSO discharges to receiving waters.

Sanitary Sewers and Sanitary Sewer Overflows

Sanitary sewer systems collect and transport wastewater and limited amounts of stormwater to treatment facilities for appropriate treatment. A sanitary sewer is an underground pipe or tunnel system for transporting sewage from domestics, commercial, and industrial sources, as well as limited amounts of stormwater and infiltrated ground water, to treatment facilities or disposal. Occasionally, sanitary sewers will release raw sewage. These types of releases are called sanitary sewer overflows (SSOs). SSOs can contaminate water, causing serious water quality problems, and back-up into homes, causing property damage and threatening public health

USEPA identified possible causes of SSOs include:

- blockages,
- line breaks,
- sewer defects that allow stormwater and groundwater to overload the system,
- power failures,
- improper sewer design, and
- vandalism.

EPA estimates there are at least 23,000 - 75,000 SSOs per year (not including sewage backups into buildings) in the U.S.

SSOs that reach waters of the U.S. are point source discharges. Like other point source discharges from municipal sanitary sewer systems, SSOs are prohibited unless authorized by a NPDES permit. Moreover, SSOs, including those that do not reach waters of the U.S., may be indicative of improper operation and maintenance of the sewer systems, and may violate NPDES permit conditions

.

Confided Feeding Operations

A description of CFO is documented in Section 2.4 – Land Use.

The UWRW Phase 3 project area contains a low density of confined feeding operations. However, animal waste produced by these facilities is commonly used as a supplement to commercial fertilizer. Animal waste contains a large amount of nitrogen and phosphorus. Unlike commercial fertilizer which can be applied by side dressing, animal waste is broadcast applied or injected into the soil column. This application occurs generally in the fall or spring when agriculture fields are barren. Without a current crop stand, nutrients are stored in the soil waiting for assimilation by vegetative material. However, with the changing climate, it is common to receive late fall/winter or early spring rainfall events. These rainfall events can cause transport of nutrients from the soil into a receiving waterbody. Animal waste use is a primary concern within the watershed.

3.4 Land Use Data per 12 Digit HUC Watershed Sub-watershed

Sub-watersheds of the Aboite Creek-Little River Watershed

Robinson Creek (HUC 051201011003) Land Use

The primary land use in the Robinson Creek watershed (HUC 051201011003) is agriculture. Over 77% of land is maintained for agricultural purposes. Table 3-40 shows the quantity and percentage of each land use within the Robinson Creek watershed (HUC 051201011003) and Table 3-41 shows information on land use in more broad classifications. Figure 3-17 displays the distribution land use throughout the watershed. Of the 77% agriculture land use, over 76% is cultivated crops. Furthermore, over 6% of land use is forest/woodland while just over 15% of the watershed is developed land.

The windshield survey for the Robinson Creek watershed (HUC 051201011003) was conducted from 11/6/2018 to 11/9/2018. Data was collected at eight stream crossings. During the survey, four fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on three fields within the watershed with one of those fields having an active fall cover crop. Remaining fields in the watershed were in other tillage practices, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at two of the stream crossings analyzed. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the eight stream crossings analyzed, two (25%) were classified as having moderate stream bank erosion. No sites were characterized as having severe streambank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at three of the eight stream crossing. Though few drainage tile were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 23.18 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 17.13 stream miles or 73.92% of the total stream miles (Table 3-44). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are eight LUST's present within the Robinson Creek watershed (HUC 051201011003) (Table 3-42). Additionally, there are eleven NPDES permitted facilities located in the watershed (Table 3-43). There are no brownfields, SSO's, CSO's, or CFO's/CAFO's located within the watershed.

Table 3-40. Land use within HUC 051201011003 (Robinson Creek)

Land Use	%	Acres
Barren Land	0.13	14.18
Cultivated Crops	76.52	8,088.92
Deciduous Forest	5.01	529.15
Developed, High Intensity	1.01	107.04
Developed, Low Intensity	3.78	399.50
Developed, Medium Intensity	1.83	193.87
Developed, Open Space	8.66	915.54
Emergent Herbaceous Wetlands	0.02	2.33
Evergreen Forest	0.01	1.44
Hay/Pasture	1.03	108.41
Herbaceous	1.53	161.48
Open Water	0.37	38.93
Shrub/Scrub	0.06	6.43
Woody Wetlands	0.04	3.77

Table 3-41. Land use by group within HUC 051201011003 (Robinson Creek)

Land use	%	Acres
Open Water	0.37	38.93
All Developed Areas	15.29	1,615.96
All Forest/Woodland Types	6.61	698.50
Agricultural Uses (Crops, Pasture/Hay, etc.)	77.55	8,197.33
Wetlands	0.06	6.10
Barren Land	0.13	14.18

Table 3-42. Leaking underground storage tanks within HUC 051201011003 (Robinson Creek)

UST Facility ID	Facility Name	Address
9165	National Weather Service	-
3472	-	-
11839	HVSA/SX	Dalman Rd & Smith Rd
1953	-	-
12059	Central Soya Aviation	11501 W Perimeter Rd
5193	Lincoln National Corporation	11021 W Perimeter Rd
22808	Statewide Trucking	7432 Lower Huntington Rd
1281	Ft Wayne Allen County Airport	11102 W Perimeter Rd

Table 3-43. NPDES facilities within HUC 051201011003 (Robinson Creek)

Permit #	Facility Name	County	Expiration Date
INR10H098	DALMAN ROAD SUBSTATION	Allen	8/20/2018
INR10K481	AMERICAN SEALANTS	Allen	7/22/2020
INR10N856	AEP TOWPATH TRAIL MITIGATION AREA (AVIATION-WAYNEDALE, LINCOLN-DECATUR)	Allen	5/10/2022
INR10J035	BRANSTRATOR ROAD AND ELLISON ROAD WATER MAIN EXTENSION	Allen	9/12/2019
INR10J322	FWA ARM/DEARM APRON EXPANSION	Allen	11/3/2019
ING250105	FRANKLIN ELECTRIC	Allen	10/31/2020
INR10M405	HAGERMAN SPEC BUILDING GRADING	Allen	7/27/2021
INR10M801	HAGERMAN SPEC BUILDING	Allen	10/3/2021
INR10P389	OLD DOMINION EXPANSION	Allen	7/28/2022
INR10I099	LOWER HUNTINGTON LAYDOWN AREA	Allen	4/7/2019
INR10I676	WEST FERGUSON ROAD IMPROVEMENTS	Allen	7/14/2019

Table 3-44. Streams lacking buffer within HUC 051201011003 (Robinson Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
17.13	23.18	73.92

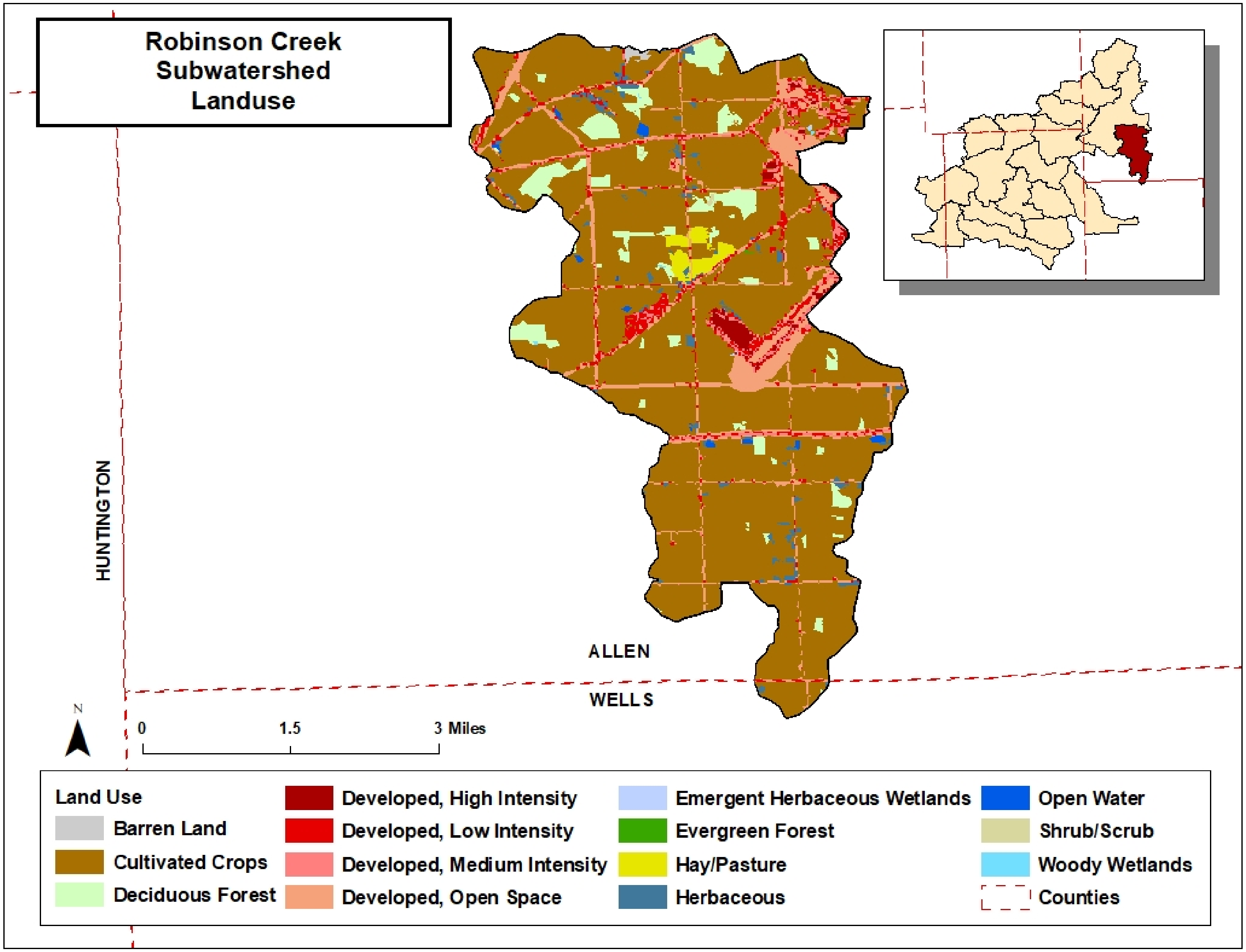


Figure 3-17. Robinson Creek (HUC 051201011003) Land Use

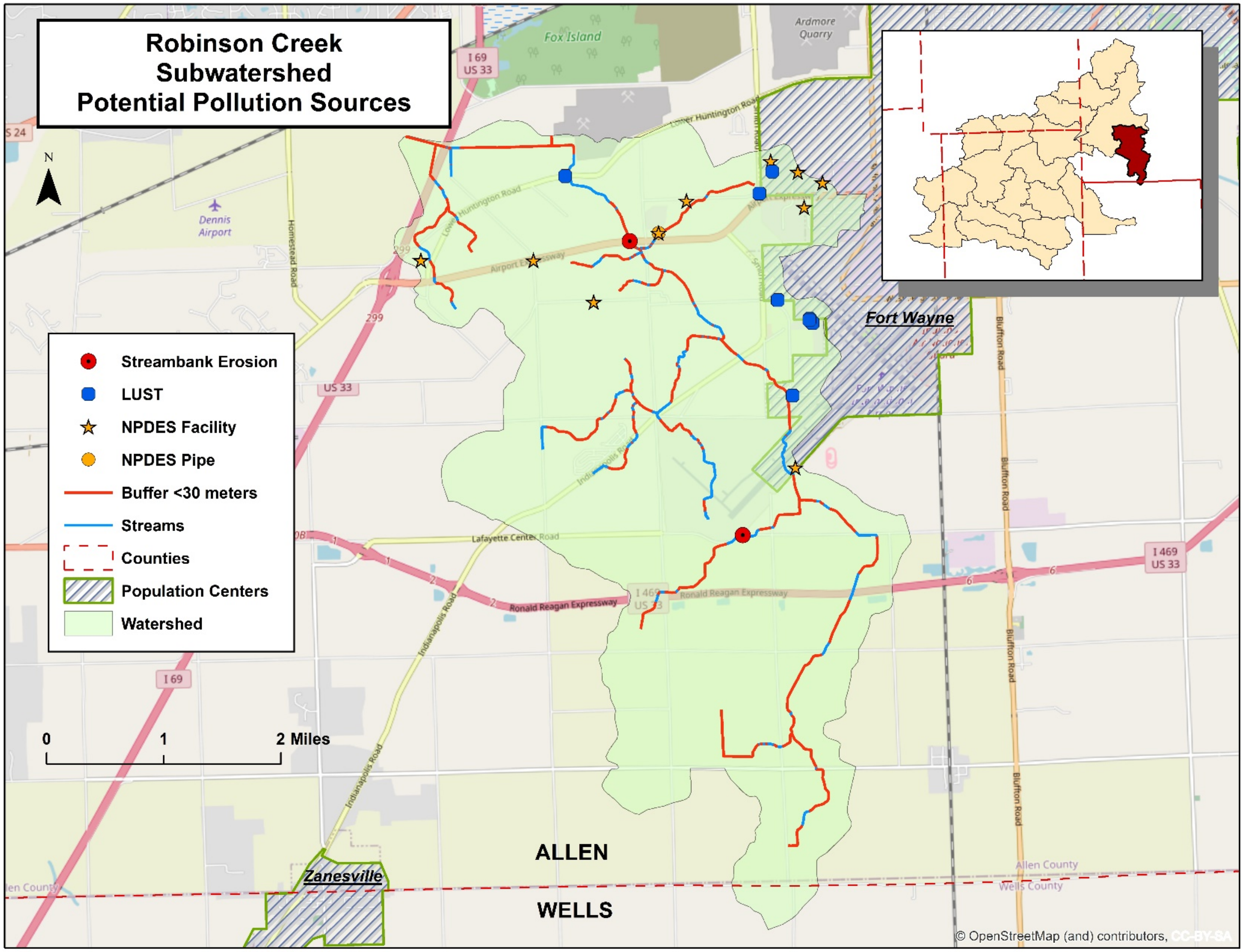


Figure 3-18. Robinson Creek (HUC 051201011003) Potential Pollution Sources

Seegar Ditch (HUC 051201011001) Land Use

The primary land use in the Seegar Ditch watershed (HUC 051201011001) is agriculture. Nearly 75% of land is maintained for agricultural purposes. Table 3-45 shows the quantity and percentage of each land use within the watershed and Table 3-46 shows information on land use in more broad classifications. Figure 3-19 displays the distribution land use throughout the watershed. Of the 75% agriculture land use, approximately 73% is cultivated crops. Furthermore, over 10% of land use is forest/woodland while nearly 13% of the watershed is developed land.

The windshield survey for the Seegar Ditch watershed (HUC 051201011001) was conducted on 12/23/2018. Data were collected at eight stream crossings. During the survey, two fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on six fields within the watershed with two of those fields having an active fall cover crop. Remaining fields in the watershed were in other tillage practices, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented at any of the stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the eight stream crossings analyzed, one (12.5%) was classified as having severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at two of the eight stream crossings. Though few drainage tile were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 22.61 total stream miles within the watershed. Streams that lack at least a 30 meter buffer make up 15.31 stream miles or 67.69% of the total stream miles (Table 3-49). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are two LUST's are present within the Seegar Ditch watershed (HUC 051201011001) (Table 3-47). Additionally, there are two NPDES permitted facilities located in the watershed (Table 3-48). There are no brownfields, SSO's, CSO's, or CFO's/CAFO's located within the watershed.

Table 3-45. Land use within HUC 051201011001 (Seegar Ditch)

Land Use	%	Acres
Cultivated Crops	73.35	8,144.43
Deciduous Forest	10.05	1,116.18
Developed, High Intensity	0.12	12.93
Developed, Low Intensity	4.35	483.01
Developed, Medium Intensity	0.95	105.56
Developed, Open Space	7.48	830.13
Emergent Herbaceous Wetlands	0.26	28.47
Evergreen Forest	0.06	6.11
Hay/Pasture	1.52	168.53
Herbaceous	0.13	14.83
Open Water	0.07	7.35
Shrub/Scrub	0.06	6.75
Woody Wetlands	1.62	179.71

Table 3-46. Land use by group within HUC 051201011001 (Seegar Ditch)

Land use	%	Acres
Open Water	0.07	7.35
All Developed Areas	12.89	1,431.64
All Forest/Woodland Types	10.30	1,143.87
Agricultural Uses (Crops, Pasture/Hay, etc.)	74.86	8,312.96
Wetlands	1.87	208.18
Barren Land	0.00	0.00

Table 3-47. Leaking underground storage tanks within HUC 051201011001 (Seegar Ditch)

UST Facility ID	Facility Name	Address
218	Swifty Service Station #4	7535 Lincoln Hwy E
25144	Kroger/Scotts J 424	10230 Chestnut Plaza

Table 3-48. NPDES facilities within HUC 051201011001 (Seegar Ditch)

Permit #	Facility Name	County	Expiration Date
INR10H569	SYCAMORE LAKES SECTION 3	Allen	11/12/2018
INR10L138	SYCAMORE LAKES SECTION 4	Allen	11/9/2020

Table 3-49. Streams lacking buffer within HUC 051201011001 (Seegar Ditch)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
15.31	22.61	67.69

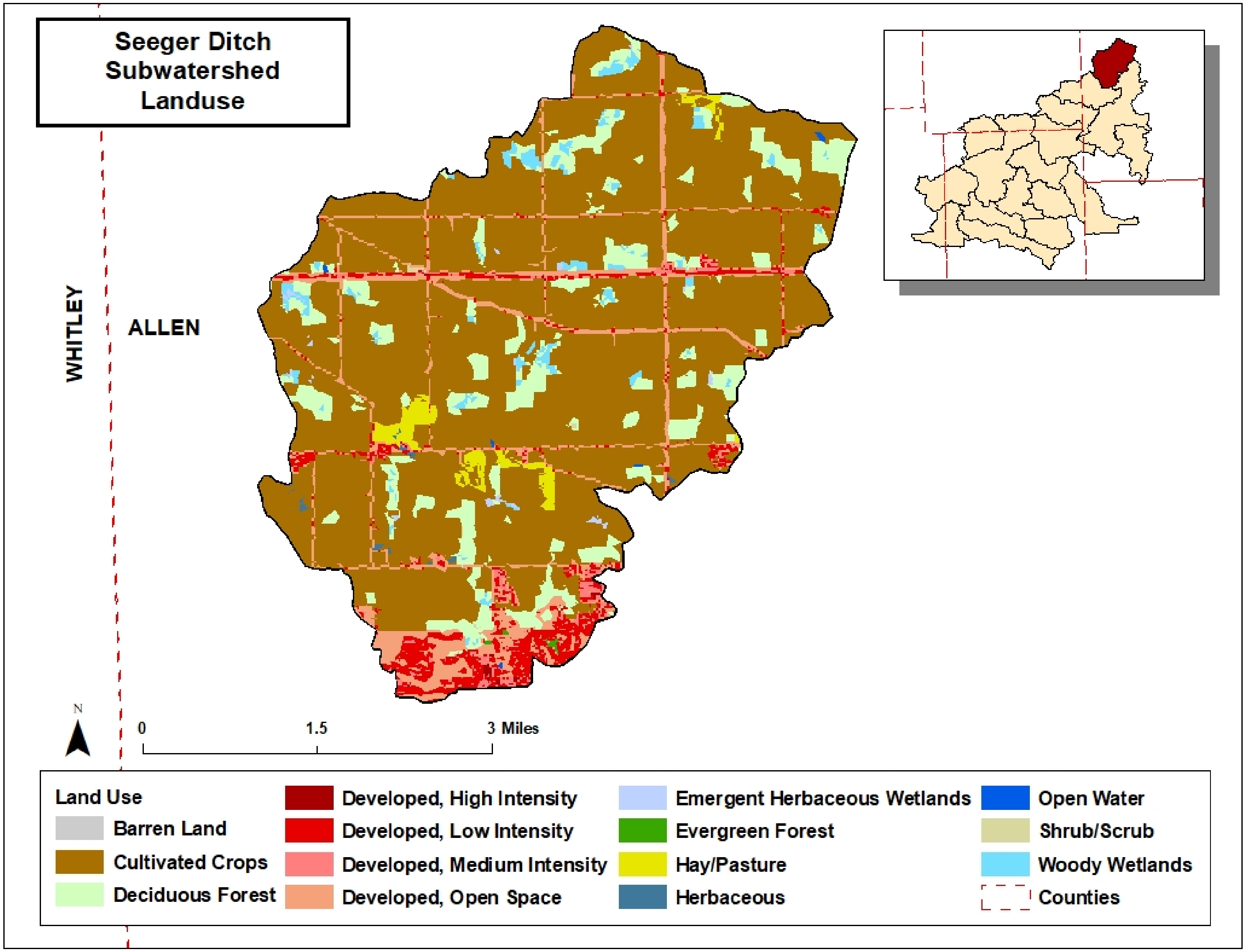


Figure 3-19. Seegar Ditch (HUC 051201011001) Land Use

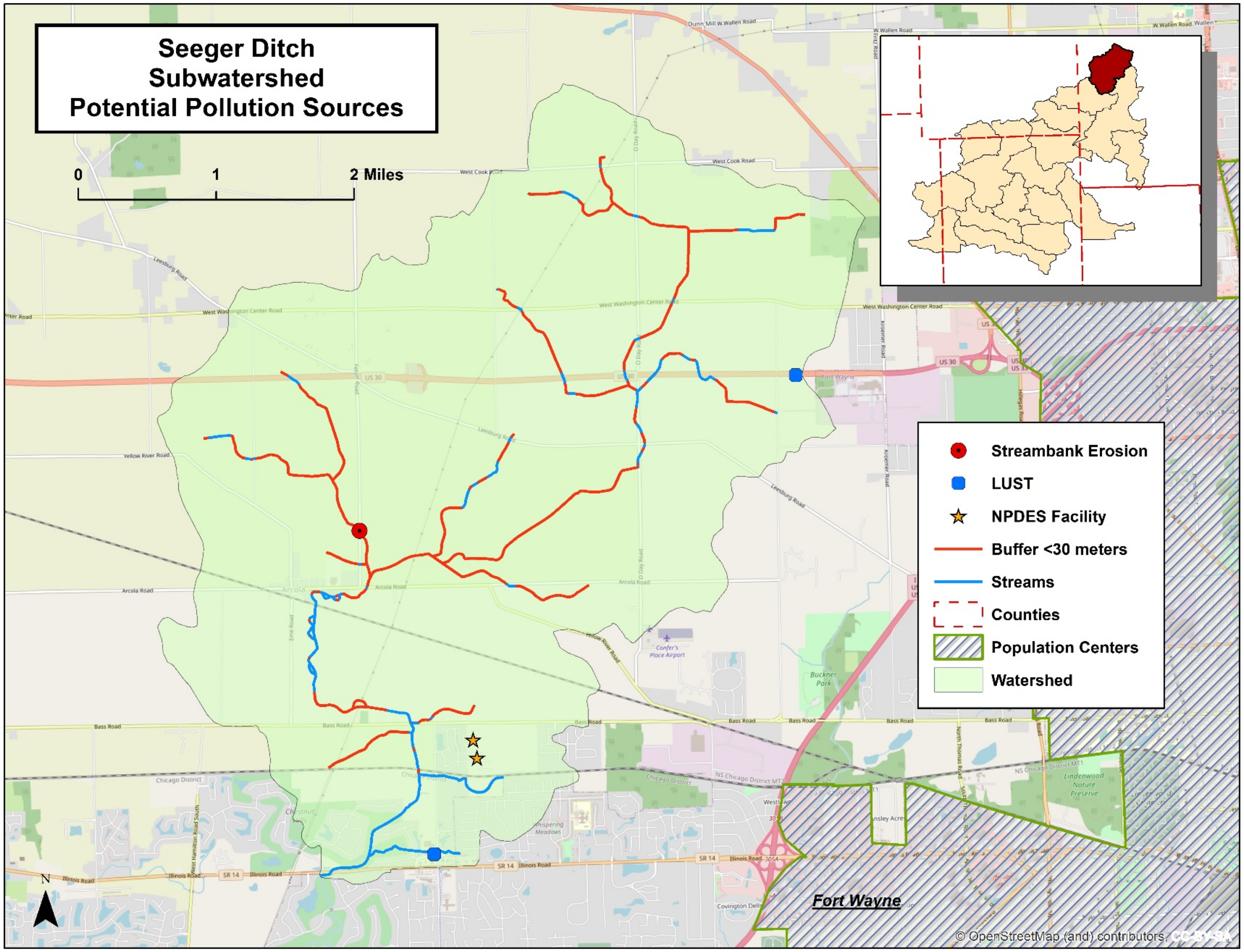


Figure 3-20. Seegar Ditch (HUC 051201011001) Potential Pollution Sources

Graham McCulloch Ditch #1-Little River (HUC 051201011004) Land Use

The primary land uses in the Graham McCulloch Ditch #1-Little River watershed (HUC 51201011004) are agriculture and developed land. Agriculture uses and developed land each account for over 40% of land use within the watershed. This relationship between agricultural and developed land uses highlight the rural-urban interface present in the UWRW Phase 3 project area. Table 3-50 shows the quantity and percentage of each land use within the watershed and Table 3-51 shows information on land use in more broad classifications. Figure 3-21 displays the distribution land use throughout the watershed. Of the 40.89% agricultural land use, approximately 39% is cultivated crops. Furthermore, approximately 14% of land use is forest/woodland.

The windshield survey for the Graham McCulloch Ditch #1-Little River watershed (HUC 51201011004) was conducted from 11/5/2018 to 12/23/2018. Data were collected at 38 stream crossings. During the survey, five fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on seven fields within the watershed with one of those fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was at five stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the thirty-eight stream crossings analyzed, fourteen (37%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at two of the eight stream crossings. Though few drainage tile were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 72.07 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 31.65 stream miles or 43.91% of the total stream miles (Table 3-54). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are 21 LUST's located within the Graham McCulloch Ditch #1-Little River watershed (HUC 51201011004) (Table 3-52). Additionally, there are 59 NPDES permitted facilities located in the watershed (Table 3-53). There are no brownfields, SSO's, CSO's, or CFO's/CAFO's located within the watershed.

Table 3-50. Land use within HUC 051201011004 (Graham McCulloch Ditch #1-Little River)

Land Use	**%**	**Acres**
Barren Land	2.22	497.86
Cultivated Crops	39.02	8,756.16
Deciduous Forest	13.27	2,976.57
Developed, High Intensity	2.17	485.95
Developed, Low Intensity	16.61	3,726.64
Developed, Medium Intensity	5.50	1,234.94
Developed, Open Space	16.51	3,705.41
Emergent Herbaceous Wetlands	0.63	142.04
Evergreen Forest	0.06	14.10
Hay/Pasture	1.83	411.10
Herbaceous	0.52	116.64
Open Water	1.09	244.39
Shrub/Scrub	0.13	28.90
Woody Wetlands	0.43	97.29

Table 3-51. Land use by group within HUC 051201011004 (Graham McCulloch Ditch #1-Little River)

Land use	**%**	**Acres**
Open Water	1.09	244.39
All Developed Areas	40.79	9,152.94
All Forest/Woodland Types	13.98	3,136.22
Agricultural Uses (Crops, Pasture/Hay, etc.)	40.86	9,167.26
Wetlands	1.07	239.33
Barren Land	2.22	497.86

Table 3-52. Leaking underground storage tanks within HUC 051201011004 (Graham McCulloch Ditch #1-Little River)

UST Facility ID	Facility Name	Address
14255	Lincoln National Corp	1700 Magnavox Way
7737	Lassus Bros Oil Handy Dandy #32	12010 Us 24 W
8702	Graves Trucking Inc	-
124	Times Corner	-
2080	VERIZON Ft. Wayne ADM/GAR	8001 W Jefferson
12340	Indiana State Police Dist 22	5811 Ellison Rd
5400	Marathon Unit #2025	8717 Us 24 W
17247	S E Johnson Companies Inc	325 S Thomas Rd
146	Herdrich Petroleum Cummings Ill	6310 Illinois Rd
12984	Bob Rohrman Acura	5000 Illinois Rd
5528	Eric Haven, Inc. P-1 Ardmore	6300 Ardmore Ave
12713	Greenlawn Memorial Park Inc	6600 Covington Road
14501	Orchard Ridge Country Club	4531 Lower Huntington Road
1558	Dehaven Chevrolet Inc	5200 Illinois Rd
10545	Doc Rickers	-
309	Six S Corp Dba Pure Sealed Dairy	5031 Bass Rd
640	Speedway/Sm #5161	6205 Illinois Rd
20159	S E Johnson	-
24861	Michel Tire Plus	-
7739	Jp Foodservice Fort Wayne	7235 Vicksburg Pike
648	Speedway Unit 5174	6033 W Jefferson

Table 3-53. NPDES facilities within HUC 051201011004 (Graham McCulloch Ditch #1-Little River)

Permit #	Facility Name	County	Expiration Date
INR10M284	AVIATION TRANSMISSION LINE	Allen	7/5/2021
IN0035378	AQUA INDIANA MAIN ABOITE WWTP	Allen	10/31/2021
INR10K146	AQUA INDIANA MIDWEST WATER RESOURCE FACILITY (WRRF) EXPANSION PROJECT 2015	Allen	5/26/2020
IN0042391	AQUA INDIANA, INC. (UTILITY CENTER) MIDWEST WWTP	Allen	7/31/2022
INR10L609	BELLE TIRE SERVICE CENTER - 6320 ILLINOIS RD	Allen	3/15/2021
INR10L405	AZBURY PARK SECTION II	Allen	2/1/2021
INR10L684	AZBURY WOODS SECTION IV	Allen	3/28/2021
INR10K177	BASS ROAD RECONSTRUCTION PHASE IA	Allen	5/29/2020
INR10K178	BASS ROAD RECONSTRUCTION PHASE IIB	Allen	5/29/2020
INR10H143	84 BED SKILLED NURSING FACILITY	Allen	8/25/2018
INR10M914	2016 PARKING IMPROVEMENTS FOR BRUNSWICK 1111 NORTH HADLEY ROAD	Allen	11/3/2021
INR10I836	1ST SOURCE BANK - "INVERNESS CENTRE" BRANCH FORT WAYNE IN	Allen	8/11/2019
INR10N807	DENNIS #2 REGULATED DRAIN RECONSTRUCTION PROJECT	Allen	5/5/2022
INR10J199	EAGLE MARSH AQUATIC NUISANCE SPECIES CONTROL BERM PROJECT	Allen	10/7/2019
INRM01773	D & W FINE PACK	Allen	7/22/2019
INR10M795	DIRECT CARE SW	Allen	9/30/2021
INR10P524	CALERA COVES, SECTION III	Allen	8/21/2022
INR10M477	CALERA, SECTION II	Allen	8/8/2021
INR10K773	CANAL FLATS	Allen	9/4/2020
INR10H231	BRUNSWICK PROPERTY	Allen	9/13/2018
INR10I344	BUCKNER'S CROSSING SECTION II	Allen	5/15/2019
INRM01613	BRUNSWICK LEISURE BOAT COMPANY		8/11/2018
IN0064441	BUCKNER PARK SPLASHPAD	Allen	4/30/2021
INRM01596	BROOKS CONSTRUCTION CO INC	Allen	8/29/2018
INR10K228	ERNST ROAD RECONSTRUCTION	Allen	6/8/2020
INR10K108	GENERAL MOTORS PT/ED FACILTIY	Allen	5/19/2020
INRM00147	FORT WAYNE POOLS INC	Allen	10/6/2020

Table 3-53. continued.

Permit #	Facility Name	County	Expiration Date
INR10H392	EMMANUEL COMMUNITY CHURCH-CHILDREN'S CLASSROOM & NURSERY ADDITIONS & RENOVATION	Allen	10/11/2018
INR10K909	LASSUS BROS OIL (1.01 ACRE)	Allen	9/28/2020
INR10L458	JUNK DITCH SEWER FORCE MAIN	Allen	2/10/2021
INR10I101	HOMESTEAD HIGH SCHOOL FOOTBALL AND BAND RENOVATION	Allen	4/7/2019
INRM02255	IRVING MATERIALS INC.		8/15/2022
INR10L710	LAWRENCE DRAIN FLOOD CONTROL PROJECT	Allen	3/31/2021
ING490058	HANSON AGGREGATES MIDWEST INC ARDMORE QUARRY	Allen	9/30/2020
ING490081	HANSON AGGREGATES MIDWEST LOWER HUNTINGTON ROAD QUARRY	Allen	9/30/2020
INR10M388	INDIANA MICHIGAN POWER CO - ARDMORE SERVICE CENTER & AVIATION STATION PROJECT	Allen	7/25/2021
INR10I073	PROPOSED FACILITY FOR BAE SYSTEMS	Allen	4/4/2019
ING490120	PRIMCO SMITH ROAD LLC	Allen	9/30/2020
INRM00592	OMNISOURCE VICKSBURG PIKE	Allen	3/26/2021
INR10L127	OMSA NEW FACILITY	Allen	11/6/2020
INR10I984	NEW PARKING LOT FOR 1700 REINSURANCE PLACE	Allen	9/5/2019
INR10L806	MEIJER STORE NO. 125	Allen	4/18/2021
INR10H927	NORTH WOODS VILLAGE AT IVERNESS LAKES	Allen	3/6/2019
INR10J146	SUMMIT CITY CHEVROLET CAR WASH	Allen	9/30/2019
INR10N509	WINTERS ROAD EXTENSION AT GENERAL MOTORS	Allen	3/20/2022
INR10N603	SUMPTER DEVELOPMENT - STORAGE FACILITY	Allen	4/3/2022
INR10P225	THE TUBE ON ILLINOIS	Allen	7/7/2022
INR10L016	THE POINTE CHURCH 2015 SITE IMPROVEMENTS	Allen	10/19/2020
INR10L132	STRATFORD FOREST SECTION VII	Allen	11/6/2020
INR10P239	STRATFORD FOREST, SECTION VIII	Allen	7/10/2022
INR10K149	RECKEWEG SENIOR COMMUNITY	Allen	5/26/2020
INR10H559	SHAMROCK HOTELS LLC SITE DEVELOPMENT	Allen	11/6/2018

Table 3-53. continued.

Permit #	Facility Name	County	Expiration Date
INRM00668	SARATOGA POTATO CHIPS	Allen	9/23/2022
INR10P049	SARATOGA POTATO CHIPS 2017 SITE IMPROVEMENTS	Allen	6/12/2022
INR10H196	STRATFORD FOREST SECTION V	Allen	9/9/2018
INR10I458	STRATFORD FOREST SECTION VI	Allen	6/6/2019
INR10M199	SORENSON 765 KV AND ROBISON PARK STATION WETLAND MITIGATION	Huntington	6/20/2021
INR10L187	WOMEN'S HEALTH ADVANTAGE	Allen	11/23/2020
INR10L739	WINTERS ROAD	Allen	4/4/2021

Table 3-54. Streams lacking buffer within HUC 051201011004 (Graham McCulloch Ditch #1-Little River)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
31.65	72.07	43.91

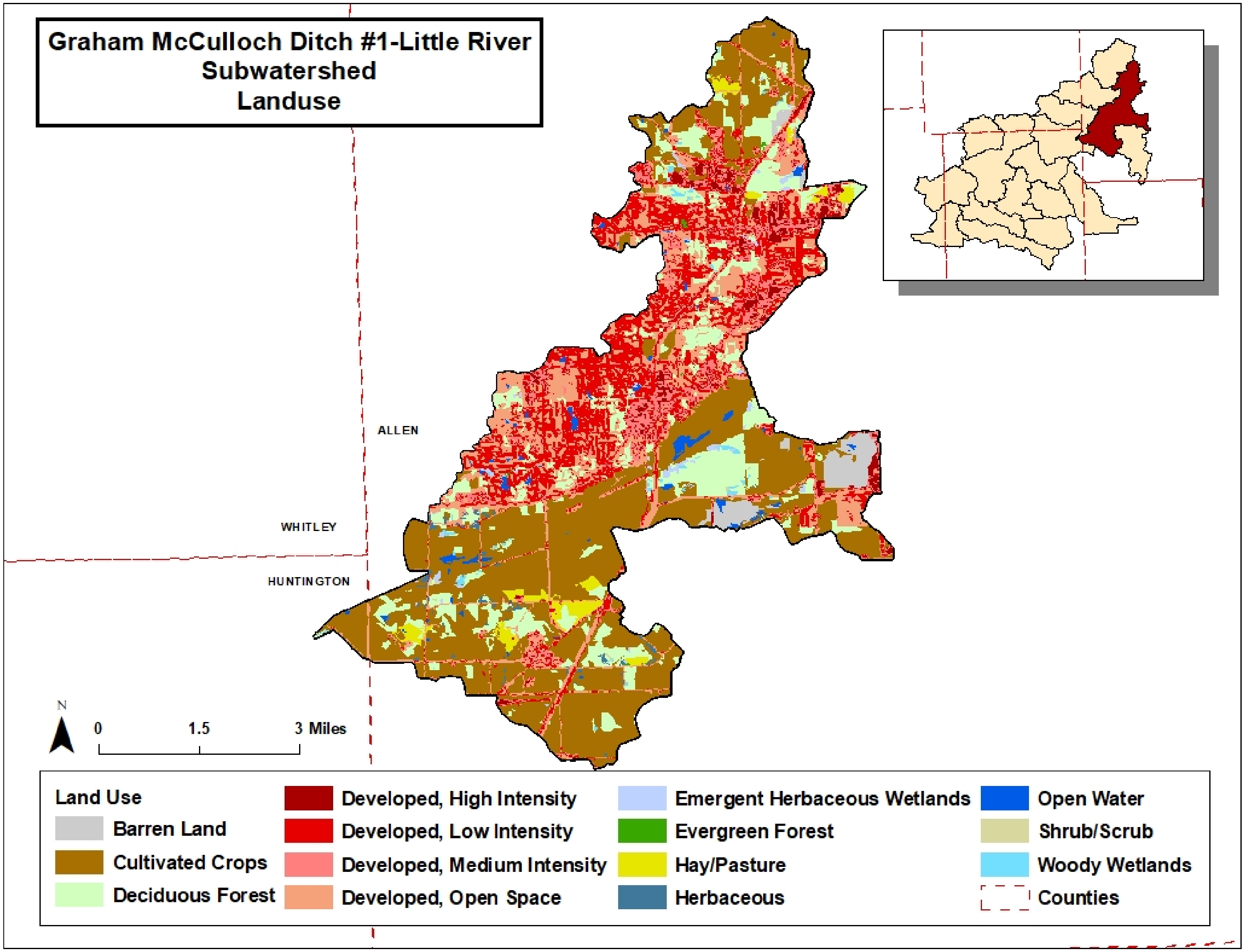


Figure 3-21. Graham McCulloch Ditch #1-Little River (HUC 051201011004) Land Use

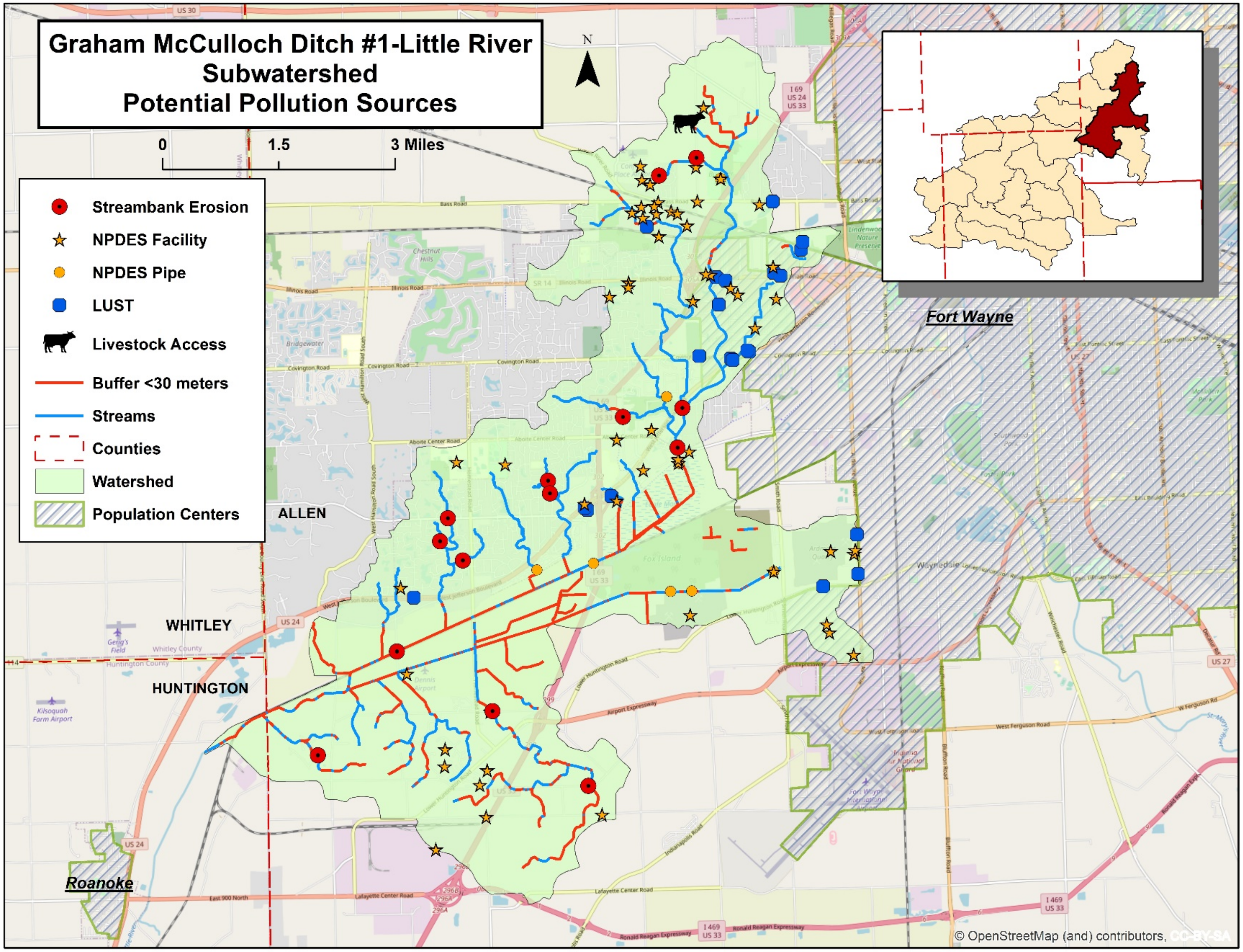


Figure 3-22. Graham McCulloch Ditch #1-Little River (HUC 051201011004) Potential Pollution Sources

Beal Taylor Ditch-Aboite Creek (HUC 051201011002) Land Use

The primary land uses in the Beal Taylor Ditch-Aboite Creek watershed (HUC 051201011002) are agriculture and developed land. Agriculture uses and developed land each account for 49.74% and 39.46% of land use within the watershed, respectively. This relationship between agricultural and developed land uses highlights the rural-urban interface present in the UWRW Phase 3 project area. Table 3-55 shows the quantity and percentage of each land use within the watershed and Table 3-56 shows information on land use in more broad classifications. Figure 3-23 displays the distribution land use throughout the watershed. Of the 49.74% agricultural land use, 100% is cultivated crops. Furthermore, approximately 10% of land use is forest/woodland.

The windshield survey for the Beal Taylor Ditch-Aboite Creek watershed (HUC 051201011002) was conducted on 12/23/2018. Data were collected at twelve stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on three fields within the watershed with no fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was document at three stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area, and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the eight stream crossings analyzed, five (63%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at one of the twelve stream crossings. Though few drainage tile were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 24.67 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 7.9 stream miles or 32.02% of the total stream miles (Table 3-59). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one LUST present within the Beal Taylor Ditch-Aboite Creek watershed (HUC 051201011002) (Table 3-57). Additionally, there are twenty NPDES permitted facilities located in the watershed (Table 3-58). There are no brownfields, SSO's, CSO's, CFO's/CAFO's located within the watershed.

Table 3-55. Land use within HUC 051201011002 (Beal Taylor Ditch-Aboite Creek)

Land Use	%	Acres
Cultivated Crops	49.74	5,758.08
Deciduous Forest	8.30	960.35
Developed, High Intensity	0.59	68.45
Developed, Low Intensity	14.51	1,679.20
Developed, Medium Intensity	3.77	436.33
Developed, Open Space	20.59	2,384.01
Emergent Herbaceous Wetlands	0.20	22.67
Evergreen Forest	0.06	7.30
Herbaceous	1.28	147.79
Open Water	0.61	70.57
Shrub/Scrub	0.17	20.00
Woody Wetlands	0.18	21.24

Table 3-56. Land use by group within HUC 051201011002 (Beal Taylor Ditch-Aboite Creek)

Land use	%	Acres
Open Water	0.61	70.57
All Developed Areas	39.46	4,568.00
All Forest/Woodland Types	9.81	1,135.44
Agricultural Uses (Crops, Pasture/Hay, etc.)	49.74	5,758.08
Wetlands	0.38	43.91
Barren Land	0.00	0.00

Table 3-57. Leaking underground storage tanks within HUC 051201011002 (Beal Taylor Ditch-Aboite Creek)

UST Facility ID	Facility Name	Address
13264	Glidewell County Line Service	15316 Illinois Rd 46804

Table 3-58. NPDES facilities within HUC 051201011002 (Beal Taylor Ditch-Aboite Creek)

Permit #	Facility Name	County	Expiration Date
INR10L201	AQUA INDIANA OFFICE	Allen	11/30/2020
INR10I943	BRIDGEWATER STORAMERICA	Allen	8/27/2019
INR10L487	ALLEN COUNTY BRIDGE #221 OVER BEAL TAYLOR DITCH; BRIDGE REPLACEMENT & TRAIL CON	Allen	2/19/2021
INR10H596	EAGLE POINT	Allen	11/18/2018
INR10I929	BRISTOE	Allen	8/25/2019
INR10N884	GREYHAWK SECTION II	Allen	5/19/2022
INR10I023	GLEN HOLLOW SECTIONS I & II	Allen	3/24/2019
INR10H238	MEDITERRA SECTION II	Allen	9/12/2018
coINR10J740	GREY OAKS VILLAS SECTION III	Allen	3/13/2020
INR10J754	HARRISON LAKES SECTION I & II	Allen	3/16/2020
INR10I356	GREY OAKS SECTION III AND IV	Allen	5/19/2019
INR10K569	GREY OAKS SECTION IV	Allen	8/3/2020
INR10N857	PALMIRA LAKES SECTION 1	Allen	5/10/2022
INR10L898	MAGNOLIA MEADOWS SECTION II	Allen	5/2/2021
INR10N663	MAGNOLIA MEADOWS SECTION III	Allen	4/13/2022
INR10N665	THE VILLAS AT SIENNA RESERVE SECTION I	Allen	4/13/2022
INR10J459	THE COTTAGES AT BRIDGEWATER- PHASE 1	Allen	12/8/2019
INR10K470	SIENNA RESERVE SECTION I AND MAGNOLIA MEADOWS SECTION I	Allen	7/23/2020
INR10J228	WILLIAMSBURG VILLAGE	Allen	10/14/2019
INR10L272	THE ESTATES ON HOMESTEAD, SECTIONS I, II & III (MINOR PLATS)	Allen	12/17/2020

Table 3-59. Streams lacking buffer within HUC 051201011002 (Beal Taylor Ditch-Aboite Creek)

Streams with <30 meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
7.90	24.67	32.02

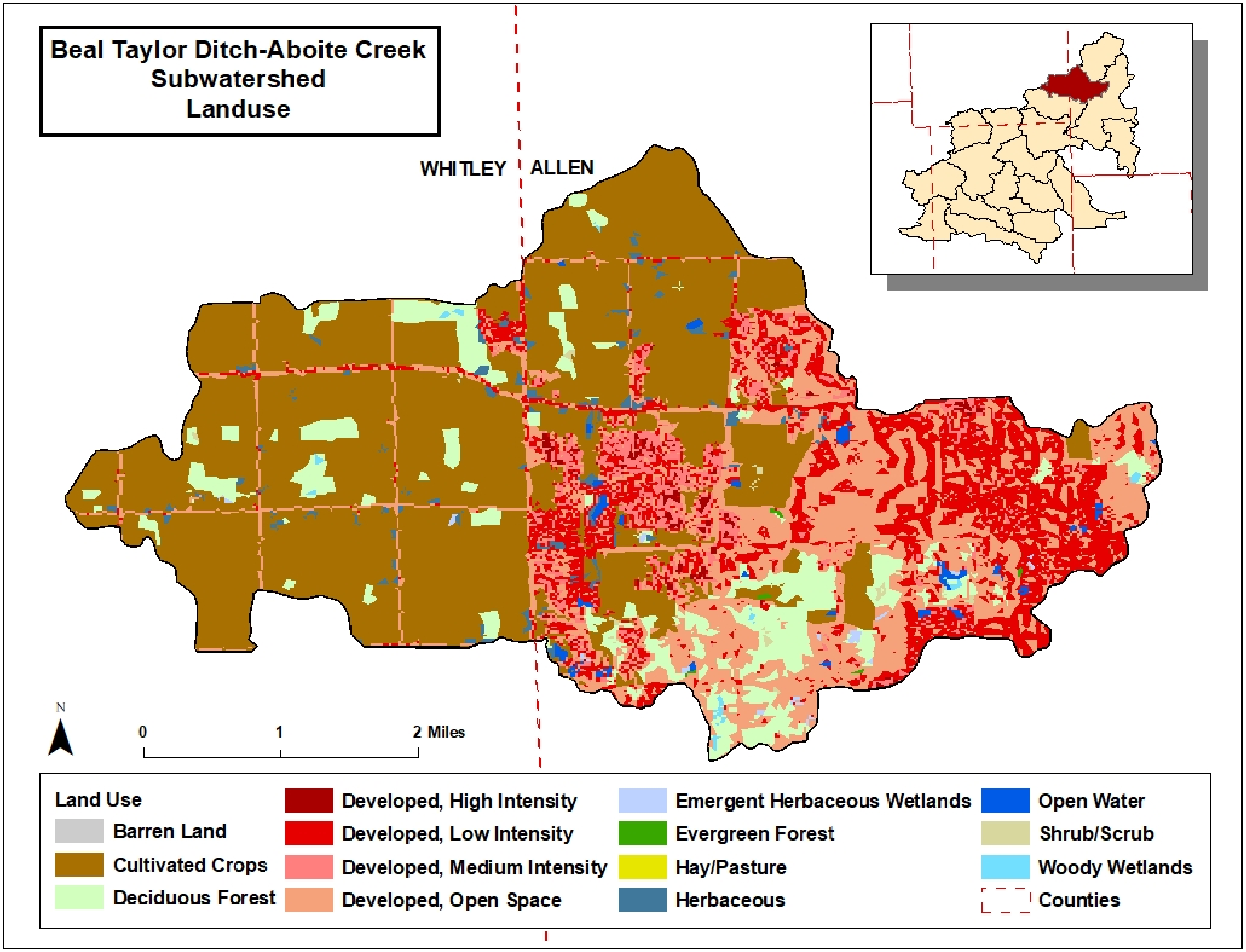


Figure 3-23. Beal Taylor Ditch-Aboite Creek (051201011002) Land Use

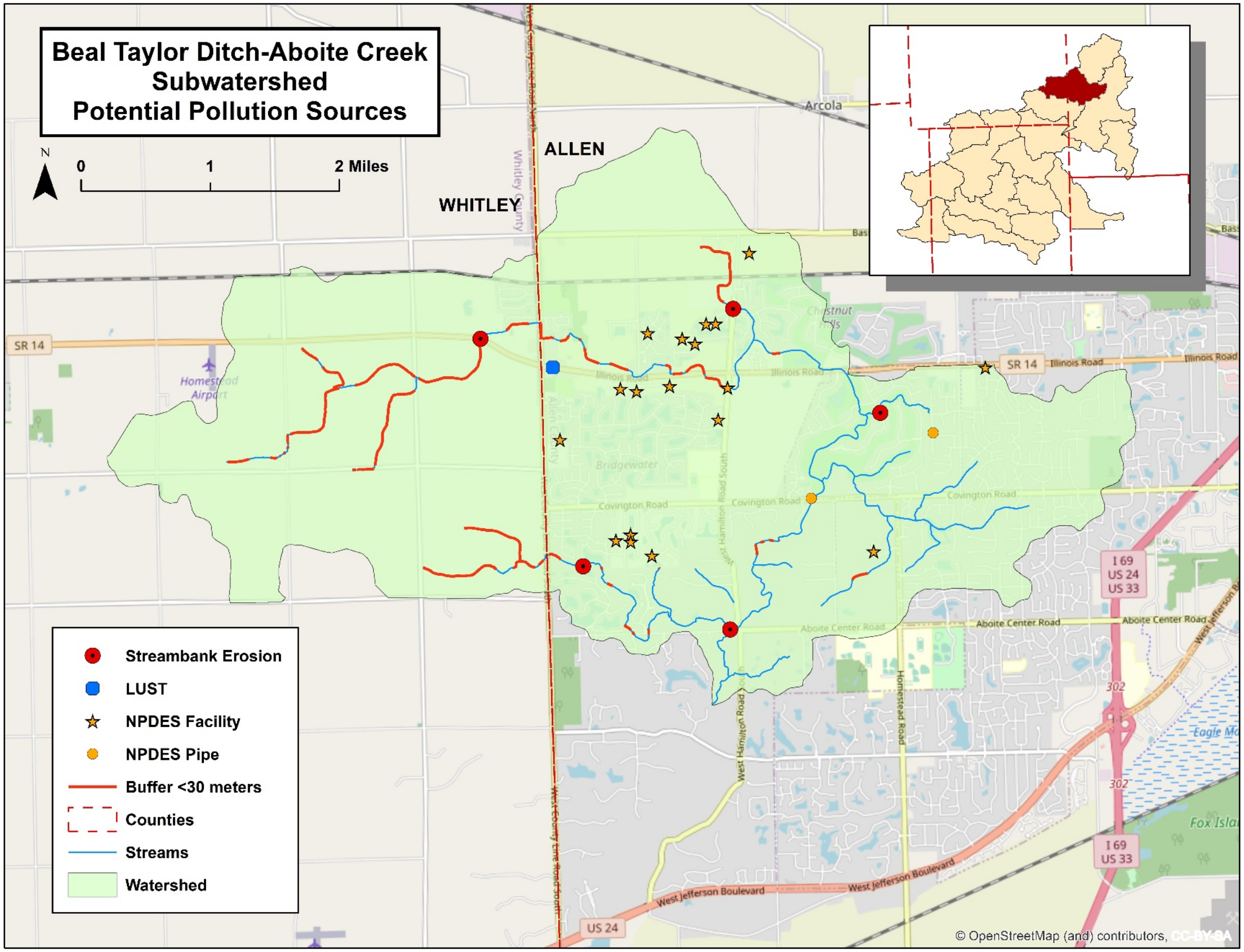


Figure 3-24. Beal Taylor Ditch-Aboite Creek (HUC 051201011002) Potential Pollution Sources

Little Indian Creek-Aboite Creek (HUC 051201011005) Land Use

The primary land use in the Little Indian Creek-Aboite Creek watershed (HUC 051201011005) is agriculture. Agricultural uses account for 68.10% of land use within the watershed. Of the 68% agricultural land use, 66.17% is cultivated crops. Furthermore, approximately 14% of land use is forest/woodland and 16% is developed area. Table 3-60 shows the quantity and percentage of each land use within the watershed and Table 3-61 shows information on land use in more broad classifications. Figure 3-25 displays the distribution of land use throughout the watershed.

The windshield survey for the Little Indian Creek-Aboite Creek watershed (HUC 051201011005) was conducted on 12/23/2018. Data were collected at nine stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on two fields within the watershed with no fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was document at two stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area, and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the nine stream crossings analyzed, five (55.56%) were classified as having severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at two of the nine stream crossings. Though few drainage tile were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 28.85 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 12.7 stream miles or 44% of the total stream miles (Table 3-63). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one NPDES permitted facility present within the Little Indian Creek-Aboite Creek watershed (HUC 051201011005) (Table 3-62). There are no brownfields, LUST’s, SSO’s, CSO’s, or CFO’s/CAFO’s located within the watershed.

Table 3-60. Land use within HUC 051201011005 (Little Indian Creek-Aboite Creek)

Land Use	%	Acres
Cultivated Crops	66.17	7,319.58
Deciduous Forest	11.96	1,322.94
Developed, High Intensity	0.02	1.78
Developed, Low Intensity	2.55	282.63
Developed, Medium Intensity	0.22	24.80
Developed, Open Space	13.28	1,468.77
Emergent Herbaceous Wetlands	0.18	19.60
Evergreen Forest	0.64	71.30
Hay/Pasture	1.93	213.13
Herbaceous	1.34	147.78
Open Water	1.10	121.52
Shrub/Scrub	0.33	36.06
Woody Wetlands	0.29	32.11

Table 3-61. Land use by group within HUC 051201011005 (Little Indian Creek-Aboite Creek)

Land use	%	Acres
Open Water	1.10	121.52
All Developed Areas	16.07	1,777.98
All Forest/Woodland Types	14.27	1,578.08
Agricultural Uses (Crops, Pasture/Hay, etc.)	68.10	7,532.71
Wetlands	0.47	51.71
Barren Land	0.00	0.00

Table 3-62. NPDES facilities within HUC 051201011005 (Little Indian Creek-Aboite Creek)

Permit #	Facility Name	County	Expiration Date
INR10N544	LIBERTY MILLS ROAD, W. COUNTY LINE RD, & CR 900 S INTERSECTION IMPROVEMENTS	Allen	3/27/2022

Table 3-63. Streams lacking buffer within HUC 051201011005 (Little Indian Creek-Aboite Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
12.70	28.85	44.02

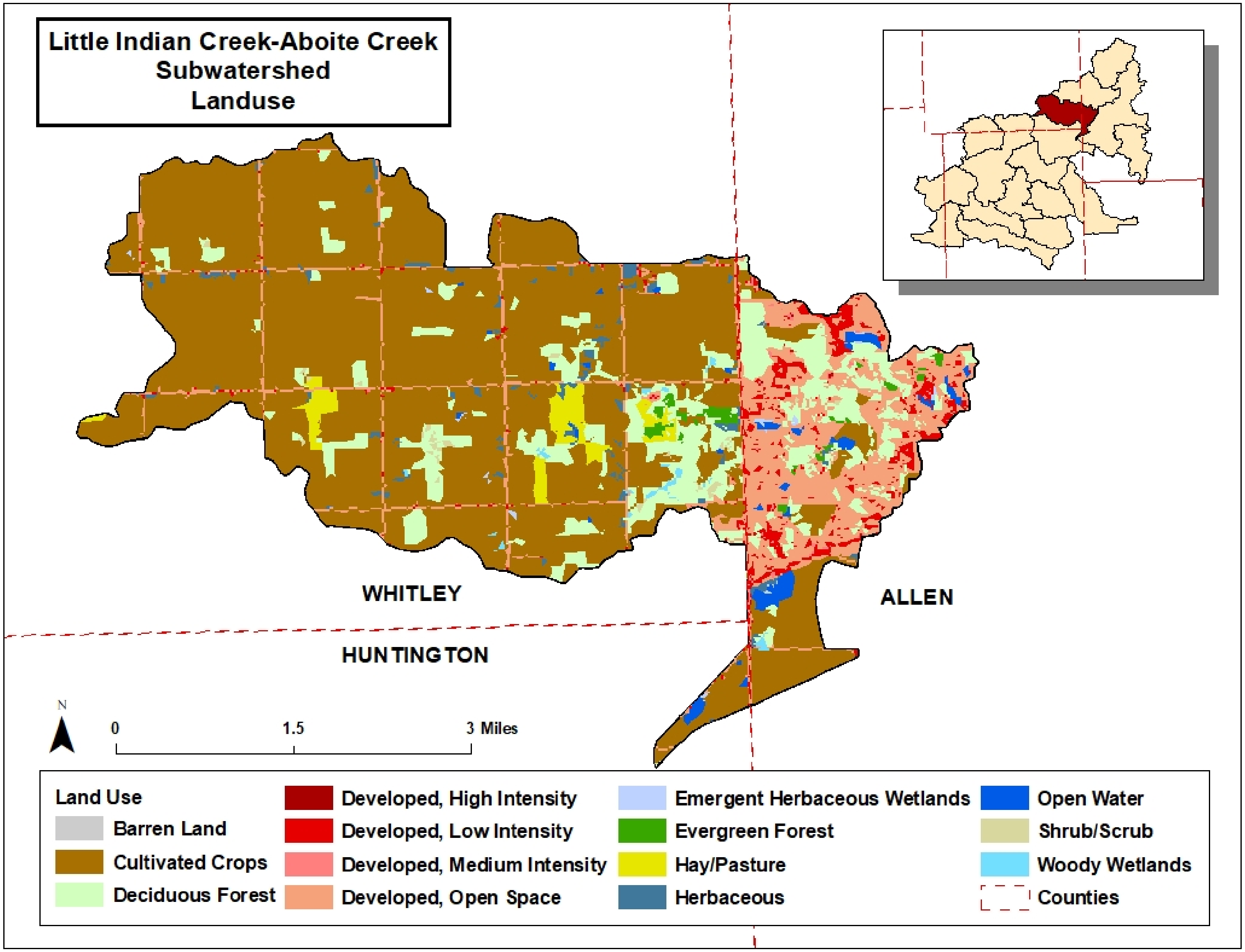


Figure 3-25. Little Indian Creek-Aboite Creek (HUC 051201011005) Land Use

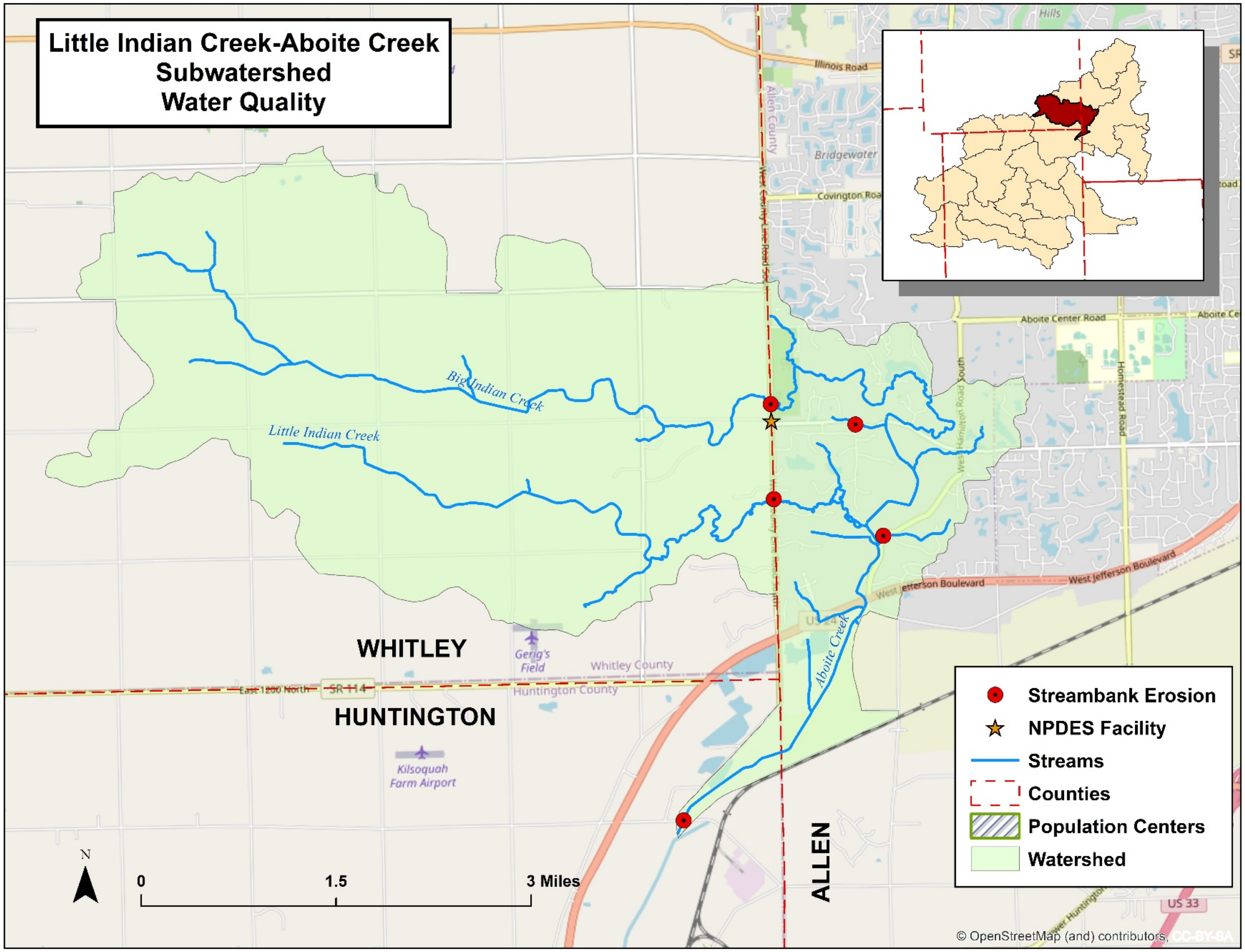


Figure 3-26. Little Indian Creek-Aboite Creek (HUC 051201011005) Potential Pollution Source

Cow Creek-Little River (HUC 051201011006) Land Use

The primary land use in the Cow Creek-Little River watershed (HUC 051201011006) is agriculture. Agricultural uses account for 76.86% of land use within the watershed. Of the 77% agricultural land use, 71.75% is cultivated crops. Furthermore, approximately 13% of land use is forest/woodland and 8% is developed area. Table 3-64 shows the quantity and percentage of each land use within the watershed and Table 3-65 shows information on land use in more broad classifications. Figure 3-27 displays the distribution land use throughout the watershed.

The windshield survey for the Cow Creek-Little River watershed (HUC 051201011006) was conducted on 11/9/2018. Data were collected at fifteen stream crossings. During the survey, one field was documented to have recently practiced conventional fall tillage. No-till farming practices were documented on three fields within the watershed with no fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was document at one stream crossing. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of stream crossings analyzed, four (26.7%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at two of the 15 stream crossings. Though few drainage tiles were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 47.44 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 25.84 stream miles or 54.50% of the total stream miles (Table 3-69). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are eight LUST's (Table 3-67), ten NPDES permitted facilities (Table 3-68), and one brownfield (Table 3-66) present within the Cow Creek-Little River watershed (HUC 051201011006). There are no SSO's, CSO's, or CFO's/CAFO's located within the watershed.

Table 3-64. Land use within HUC 051201011006 (Cow Creek-Little River)

Land Use	%	Acres
Cultivated Crops	71.75	11,112.55
Deciduous Forest	11.01	1,705.00
Developed, High Intensity	0.38	59.10
Developed, Low Intensity	2.07	321.21
Developed, Medium Intensity	0.54	84.30
Developed, Open Space	5.38	833.52
Emergent Herbaceous Wetlands	0.29	45.21
Evergreen Forest	0.05	8.00
Hay/Pasture	5.11	790.92
Herbaceous	1.63	253.15
Open Water	1.09	169.38
Shrub/Scrub	0.24	37.43
Woody Wetlands	0.43	67.23

Table 3-65. Land use by group within HUC 051201011006 (Cow Creek-Little River)

Land use	%	Acres
Open Water	1.09	169.38
All Developed Areas	8.38	1,298.13
All Forest/Woodland Types	12.94	2,003.58
Agricultural Uses (Crops, Pasture/Hay, etc.)	76.86	11,903.47
Wetlands	0.73	112.43
Barren Land	0.00	0.00

Table 3-66. Brownfields within HUC 051201011006 (Cow Creek-Little River)

Site Name	ID	Status	Address	City	County
C&M GAS STATION (F) 4000012	29590	Active	208 S MAIN ST	Roanoke	Huntington

Table 3-67. Leaking underground storage tanks within HUC 051201011006 (Cow Creek-Little River)

UST Facility ID	Facility Name	Address
9609	Johnson Junction #7	-
14814	Roanoke Customer Ag Serv Inc	-
25068	Roanoke Sparky Mart	8980 N US 24 E Roanoke, IN 46783
18866	Wayne Guy	Us 24 & Us 114 Roanoke, IN 46783
17675	Johnsons 66	8977 N 24e Roanoke IN, 46783
17506	-	-
8354	Hartley Garage Inc	171 E 2nd St
16790	Lassus Bros Oil Handy Dandy 34	-

Table 3-68. NPDES facilities within HUC 051201011006 (Cow Creek-Little River)

Permit #	Facility Name	County	Expiration Date
INRM01741	ANDROID INDUSTRIES	Allen	6/3/2019
INR10N214	CLAYBROOKE SUBDIVISION	Huntington	1/11/2022
INRM02208	JACK COOPER TRANSPORT COMPANY INC.	Huntington	5/2/2022
INR10H194	NEAHLONGQUAH FARM LLC POND	Allen	9/9/2018
INR10M661	MCCLEAD SITE	Huntington	9/8/2021
INR10H808	STEPHAN TRUCKING (PARKING LOT EXPANSION)	Huntington	1/30/2019
IN0021440	ROANOKE WWTP	Huntington	3/31/2020
INR10I288	SORENSON - ROBINSON PARK 138/345 KV TRANSMISSION LINE PROJECT	Huntington	5/8/2019
INR10I487	SORENSON 765 KV WEST TRANSMISSION LINE PROJECT	Huntington	6/10/2019
INR10H891	SORENSON SUBSTATION EXPANSION PROJECT	Huntington	2/20/2019

Table 3-69. Streams lacking buffer within HUC 051201011006 (Cow Creek-Little River)

Streams with <30 meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
25.84	47.44	54.47

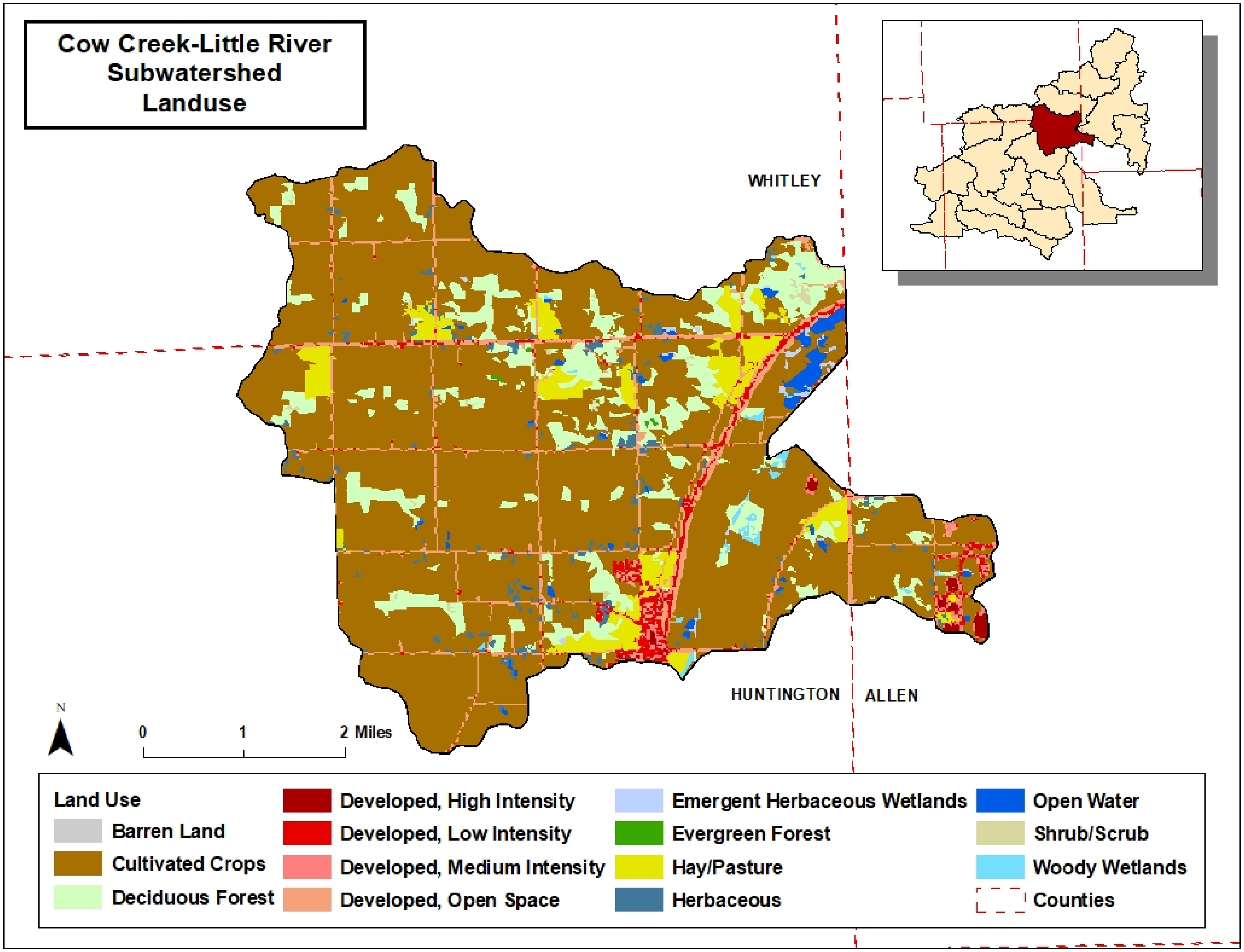


Figure 3-27. Cow Creek-Little River (HUC 051201011006) Land Use

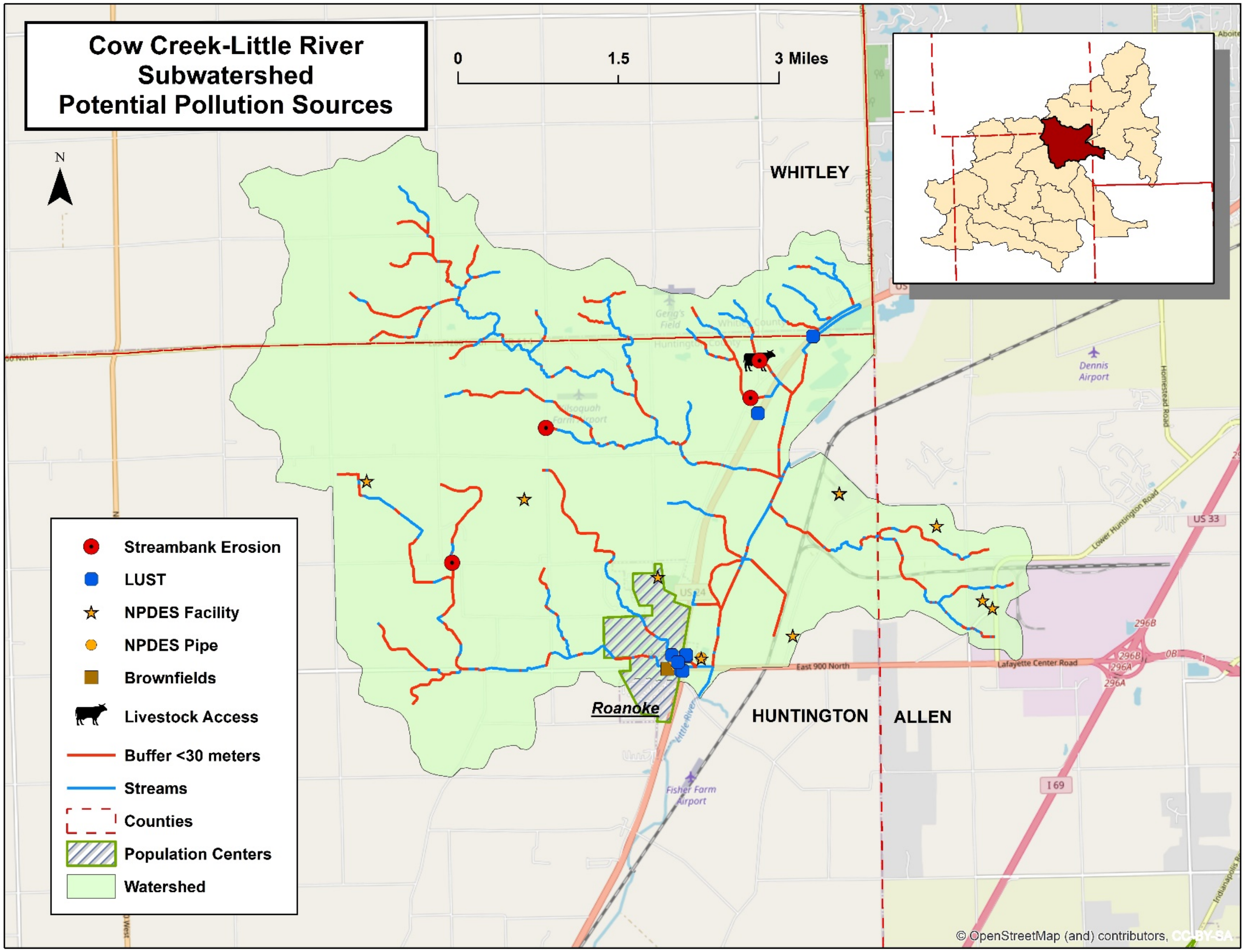


Figure 3-28. Cow Creek-Little River (HUC 051201011006) Potential Pollution Sources

Sub-watersheds of the Clear Creek Watershed

West Branch Clear Creek (HUC 051201011201) Land Use

The primary land use in the West Branch Clear Creek watershed (HUC 051201011201) is agriculture. Agricultural uses account for 86.69% of land use within the watershed. Of the 87% agricultural land use, 84.51% is cultivated crops. Furthermore, approximately 6% of land use is forest/woodland and 7% is developed area. Table 3-70 shows the quantity and percentage of each land use within the watershed and Table 3-71 shows information on land use in more broad classifications. Figure 3-29 displays the distribution land use throughout the watershed.

The windshield survey for the West Branch Clear Creek watershed (HUC 051201011201) was conducted on 12/17/2018. Data were collected at nineteen stream crossings. During the survey, four fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on fourteen fields within the watershed with five fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not document at any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of stream crossings analyzed, five (26.31%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at nine of the stream crossings. Though few drainage tiles were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The windshield survey verified the lack of riparian buffers within the watershed. There are 19.66 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 15.85 stream miles or 80.6% of the total stream miles (Table 3-73). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are two confined feeding operations located within the West Branch Clear Creek watershed (HUC 051201011201) (Table 3-72). There is potential for spills and/or leaks from the manure holding facilities or while being transferred to other farms as fertilizer. There are no NPDES permitted facilities, LUST's, brownfields, SSO's, CSO's, or CAFO's located within the watershed.

Table 3-70. Land use within HUC 051201011201 (West Branch Clear Creek)

Land Use	%	Acres
Cultivated Crops	84.51	8,941.49
Deciduous Forest	4.60	486.37
Developed, High Intensity	0.00	0.15
Developed, Low Intensity	0.60	63.18
Developed, Medium Intensity	0.03	3.23
Developed, Open Space	6.44	680.87
Emergent Herbaceous Wetlands	0.16	17.23
Hay/Pasture	2.17	230.02
Herbaceous	0.82	87.11
Open Water	0.10	10.05
Shrub/Scrub	0.55	57.69
Woody Wetlands	0.02	2.62

Table 3-71. Land use by group within HUC 051201011201 (West Branch Clear Creek)

Land use	%	Acres
Open Water	0.10	10.05
All Developed Areas	7.06	747.43
All Forest/Woodland Types	5.97	631.16
Agricultural Uses (Crops, Pasture/Hay, etc.)	86.69	9,171.51
Wetlands	0.19	19.85
Barren Land	0.00	0.00

Table 3-72. Confined feeding operations within HUC 051201011201 (West Branch Clear Creek)

CFO ID	Name	Farm Size	Effective Date
56748	CJ Farms	CFO	4/12/1994
56718	Cory & Jeff Sickafoose	CFO	3/9/2006

Table 3-73. Streams lacking buffer within HUC 051201011201 (West Branch Clear Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
15.85	19.66	80.60

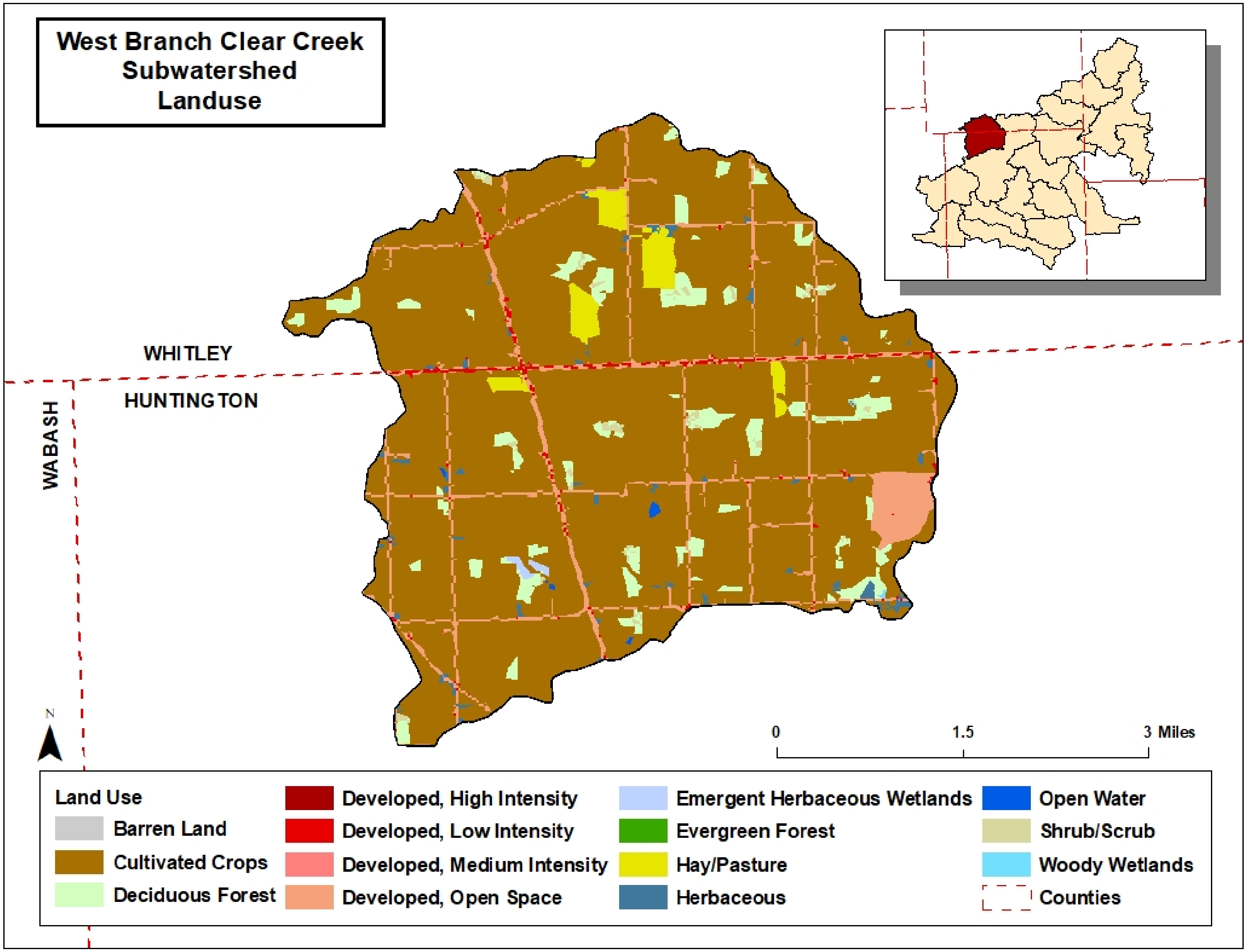


Figure 3-29. West Branch Clear Creek (HUC 051201011201) Land Use

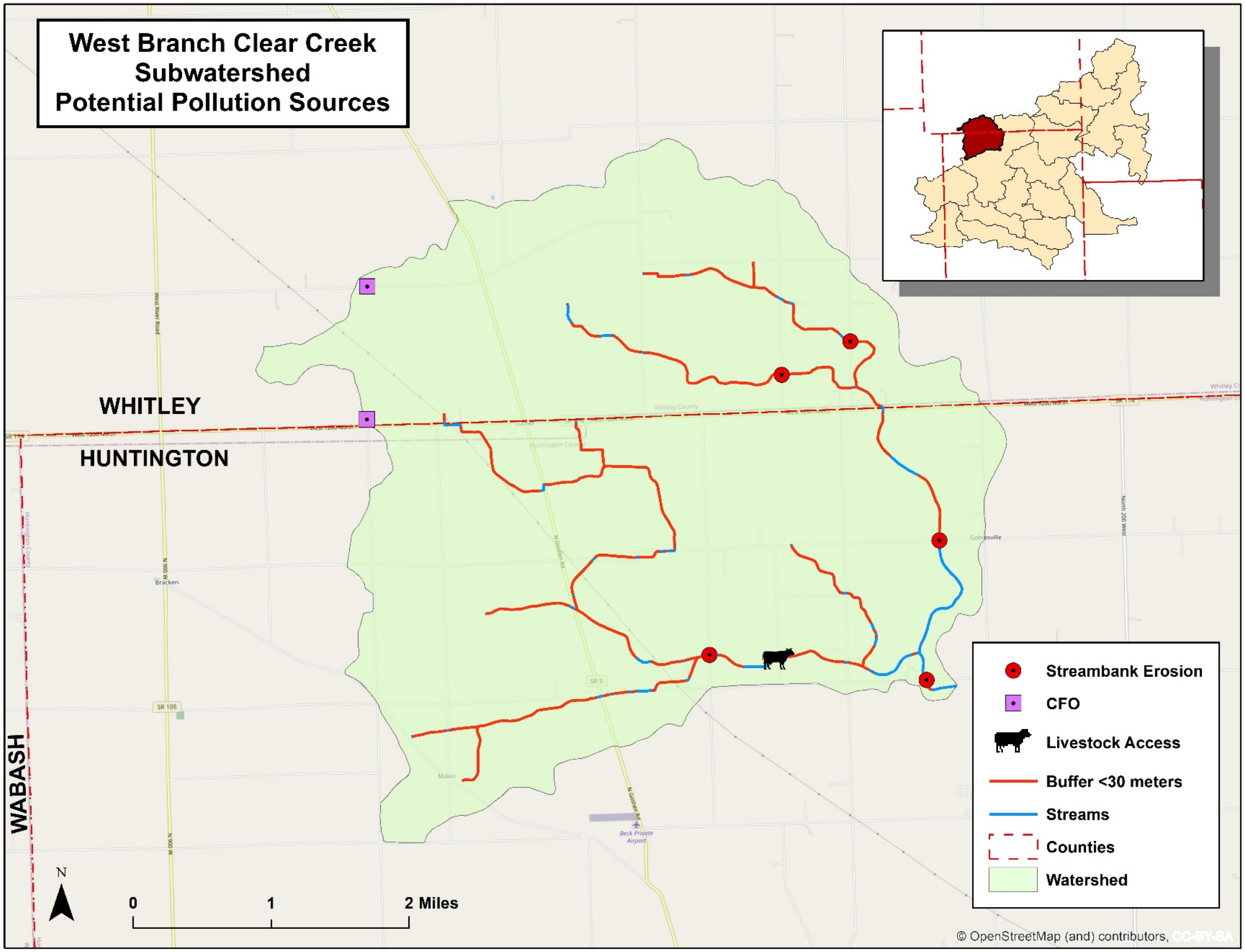


Figure 3-30. West Branch Clear Creek (HUC 051201011201) Potential Pollution Sources

Headwaters Clear Creek (HUC 051201011202) Land Use

The primary land use in the Headwaters Clear Creek watershed (HUC 051201011202) is agriculture. Agricultural uses account for 76.51% of land use within the watershed. Of the agricultural land use, 73% is cultivated crops. Furthermore, approximately 14% of land use is forest/woodland and 9% is developed area. Table 3-74 shows the quantity and percentage of each land use within the watershed and Table 3-75 shows information on land use in more broad classifications. Figure 3-31 displays the distribution land use throughout the watershed.

The windshield survey for the Headwaters Clear Creek watershed (HUC 051201011202) was conducted on 12/17/2018. Data were collected at 41 stream crossings. During the survey, eight fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on fifteen fields within the watershed with two fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at two stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of stream crossings analyzed, 22 (53.66%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at six of the stream crossings. Though few drainage tiles were documented, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The windshield survey verified the lack of riparian buffers within the watershed. There are 48.78 total stream miles within the watershed. Streams that lack at least a 30 meter buffer make up 18.59 stream miles or 38.12% of the total stream miles (Table 3-79). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are three confined feeding operations (Table 3-76), one concentrated animal feeding operation (Table 3-76), five LUST’s (Table 3-77) and six NPDES permitted facilities (Table 3-78) located within the Headwaters Clear Creek watershed (HUC 051201011202). There are no brownfields, SSO’s, or CSO’s located within the watershed.

Table 3-74. Land use within HUC 051201011202 (Headwaters Clear Creek)

Land Use	%	Acres
Cultivated Crops	73.00	18,637.53
Deciduous Forest	11.46	2,925.72
Developed, High Intensity	0.23	57.67
Developed, Low Intensity	1.34	341.38
Developed, Medium Intensity	0.48	121.97
Developed, Open Space	7.26	1,853.49
Emergent Herbaceous Wetlands	0.07	18.39
Evergreen Forest	0.04	10.97
Hay/Pasture	3.51	896.27
Herbaceous	1.73	440.74
Open Water	0.21	54.55
Shrub/Scrub	0.46	117.55
Woody Wetlands	0.21	54.78

Table 3-75. Land use by group within HUC 051201011202 (Headwaters Clear Creek)

Land use	%	Acres
Open Water	0.21	54.55
All Developed Areas	9.30	2,374.51
All Forest/Woodland Types	13.69	3,494.97
Agricultural Uses (Crops, Pasture/Hay, etc.)	76.51	19,533.80
Wetlands	0.29	73.17
Barren Land	0.00	0.00

Table 3-76. Confined feeding operations and concentrated animal feeding operations within HUC 051201011202 (Headwaters Clear Creek)

CFO ID	Name	Farm Size	Effective Date
37296	Manchester Veal LLC Bearcat Veal 2	CFO	7/15/1996
56716	Larry Ashbaugh-Ashbaugh Family Farms	CFO	5/23/2006
106611	Six Star Farms LLC	CAFO	9/4/2013
118392	Pine Wind Farms LLC	CFO	12/4/2017

Table 3-77. Leaking underground storage tanks within HUC 051201011202 (Headwaters Clear Creek)

UST Facility ID	Facility Name	Address
3156	PAK A SAK	2090 N Jefferson St
16744	Bernie Nelson Chevrolet Olds Dealer	2201 N Jefferson
15602	C & C Oil Office/Warehouse	20 Commercial Rd
18774	Norwood Golf Club	5961 West Maple Grove
4436	Huntington Co Schools Northwest Elem	4524 W 800 N

Table 3-78. NPDES facilities within HUC 051201011202 (Headwaters Clear Creek)

Permit #	Facility Name	County	Expiration Date
IN0051187	DAWN LAKES REGIONAL SEWER DISTRICT	Huntington	8/31/2020
INR10M057	CROWN EQUIPMENT CORPORATION - NEW BUILDING	Allen	5/31/2021
INR10P480	CASEY'S GENERAL STORE - HUNTINGTON, IN	Huntington	8/14/2022
INRM02230	GERDAU HUNTINGTON	Huntington	7/13/2022
IN0031739	NORTHWEST ELEMENTARY SCHOOL	Huntington	6/30/2020
INR10H213	SIX STAR FARMS LLC	Whitley	9/9/2018

Table 3-79. Streams lacking buffer within HUC 051201011202 (Headwaters Clear Creek)

Streams with <30 meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
18.59	48.78	38.12

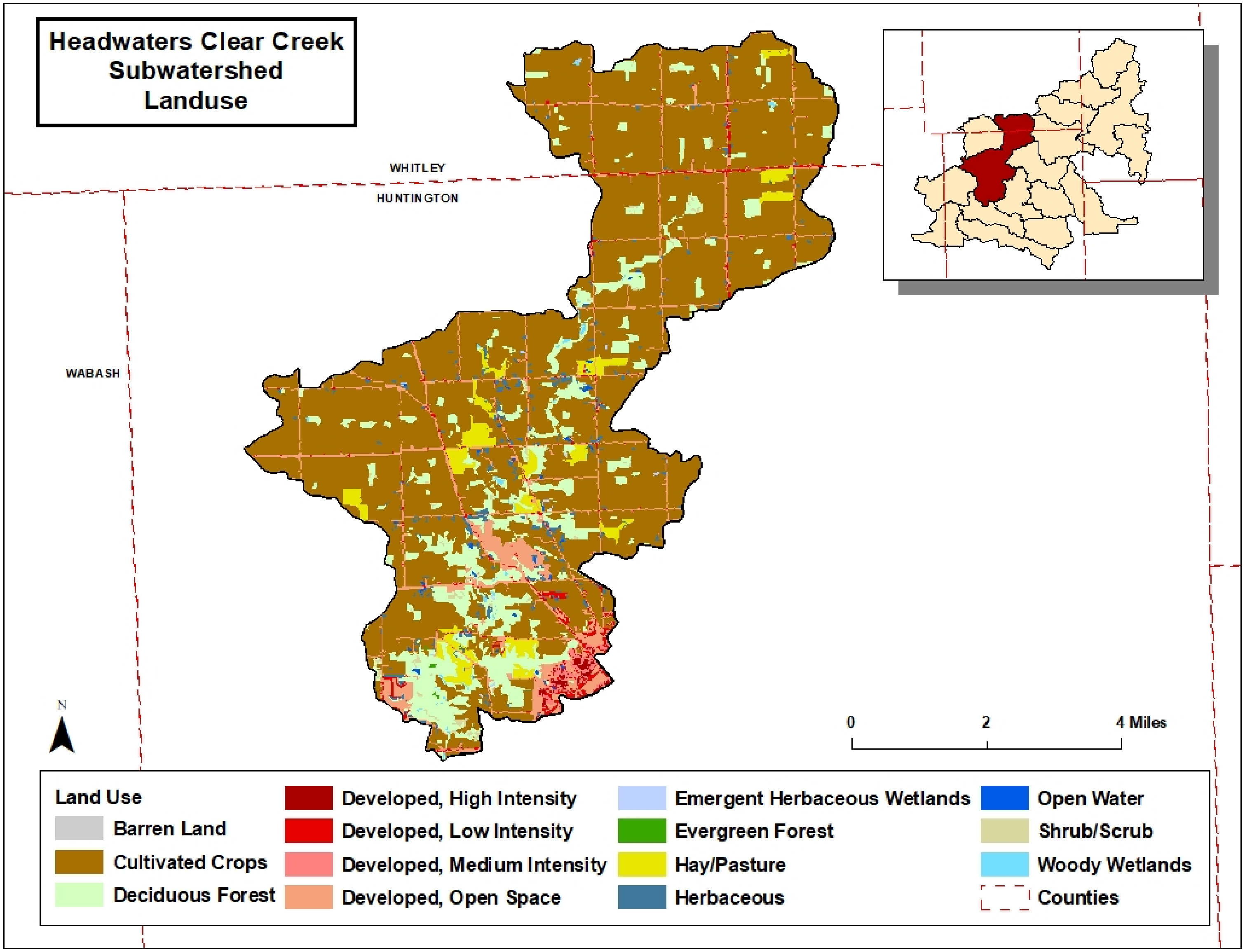


Figure 3-31. Headwaters Clear Creek (HUC 051201011202) Land Use

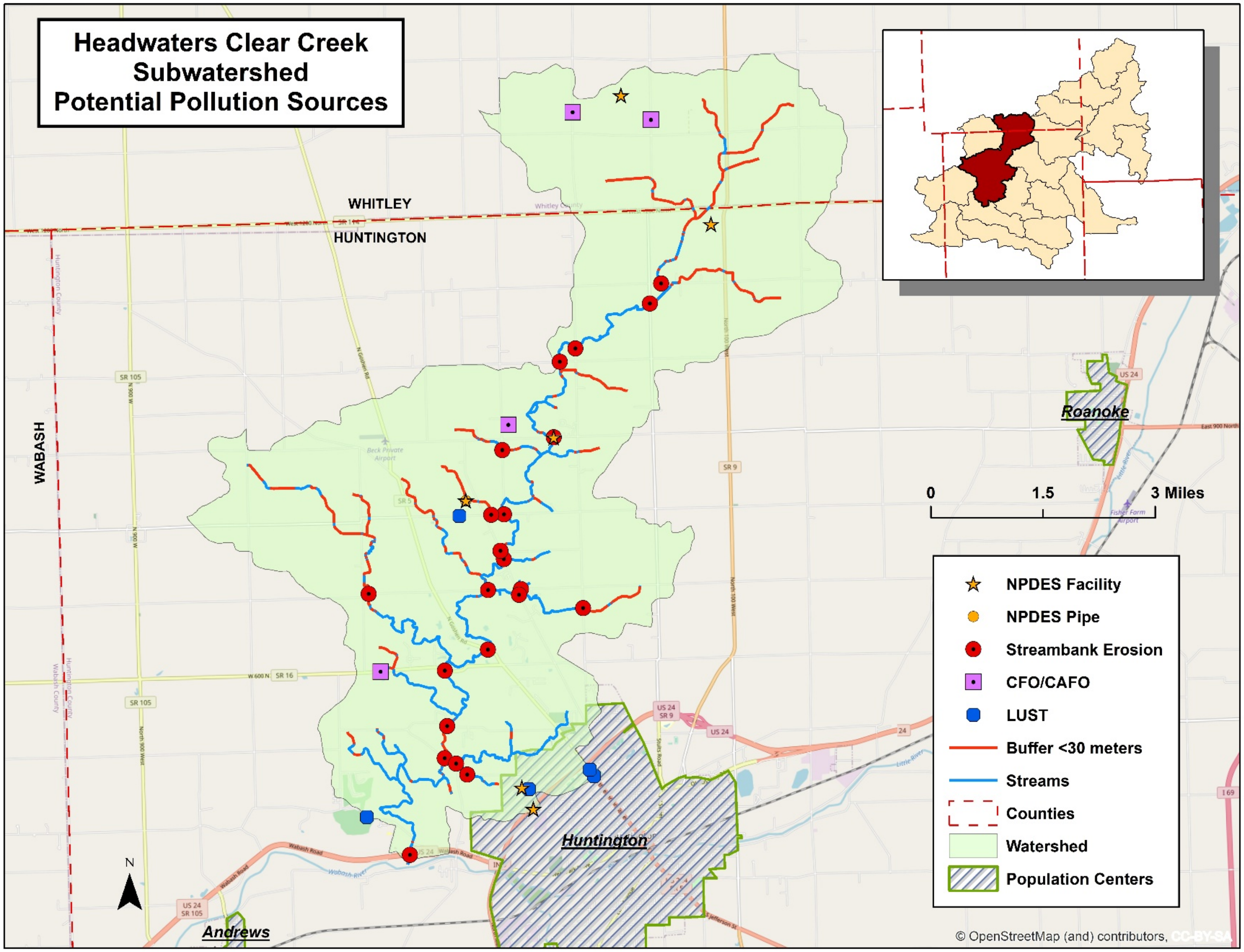


Figure 3-32. Headwaters Clear Creek (HUC 051201011202) Potential Pollution Sources

<u>Sub-watersheds of the Little River Watershed</u>

Bull Creek-Little River (HUC 051201011102) Land Use

The primary land use in the Bull Creek-Little River watershed (HUC 051201011102) is agriculture. Agricultural uses account for 82.27% of land use within the watershed. Of the agricultural land use, 78.31% is cultivated crops. Furthermore, approximately 9.67% of land use is forest/woodland and 7% is developed area. Table 3-80 shows the quantity and percentage of each land use within the watershed and Table 3-81 shows information on land use in more broad classifications. Figure 3-33 displays the distribution land use throughout the watershed.

The windshield survey for the Bull Creek-Little River watershed (HUC 051201011102) was conducted on 12/17/2018. Data were collected at twelve stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on eight fields within the watershed with no fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices; however, of the stream crossings analyzed none were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at nine of the stream crossings. It is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 24.67 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 14.73 stream miles or 59.72% of the total stream miles (Table 3-82). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one NPDES permitted facility located within the watershed (Table 3-83) There are no CFO's, LUST's, brownfields, SSO's, CSO's, or CFO's/CAFO's located within the Bull Creek-Little River watershed (051201011102).

Table 3-80. Land use within HUC 051201011102 (Bull Creek-Little River)

Land Use	%	Acres
Cultivated Crops	78.31	9,936.47
Deciduous Forest	8.16	1,035.07
Developed, High Intensity	0.02	2.89
Developed, Low Intensity	1.43	181.03
Developed, Medium Intensity	0.26	33.22
Developed, Open Space	5.31	673.48
Emergent Herbaceous Wetlands	0.12	15.56
Evergreen Forest	0.06	7.45
Hay/Pasture	3.97	503.22
Herbaceous	1.19	150.69
Open Water	0.20	25.74
Shrub/Scrub	0.27	33.99
Woody Wetlands	0.71	90.20

Table 3-81. Land use by group within HUC 051201011102 (Bull Creek-Little River)

Land use	%	Acres
Open Water	0.20	25.74
All Developed Areas	7.02	890.63
All Forest/Woodland Types	9.67	1,227.19
Agricultural Uses (Crops, Pasture/Hay, etc.)	82.27	10,439.68
Wetlands	0.83	105.76
Barren Land	0.00	0.00

Table 3-82. Streams lacking buffer within HUC 051201011102 (Bull Creek-Little River)

Streams with <30 meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
14.73	24.67	59.72

Table 3-83. NPDES facilities within HUC 051201011102 (Bull Creek-Little River)

Permit #	Facility Name	County	Expiration Date
INR10N624	ROANOKE DOLLAR GENERAL	Huntington	4/7/2022

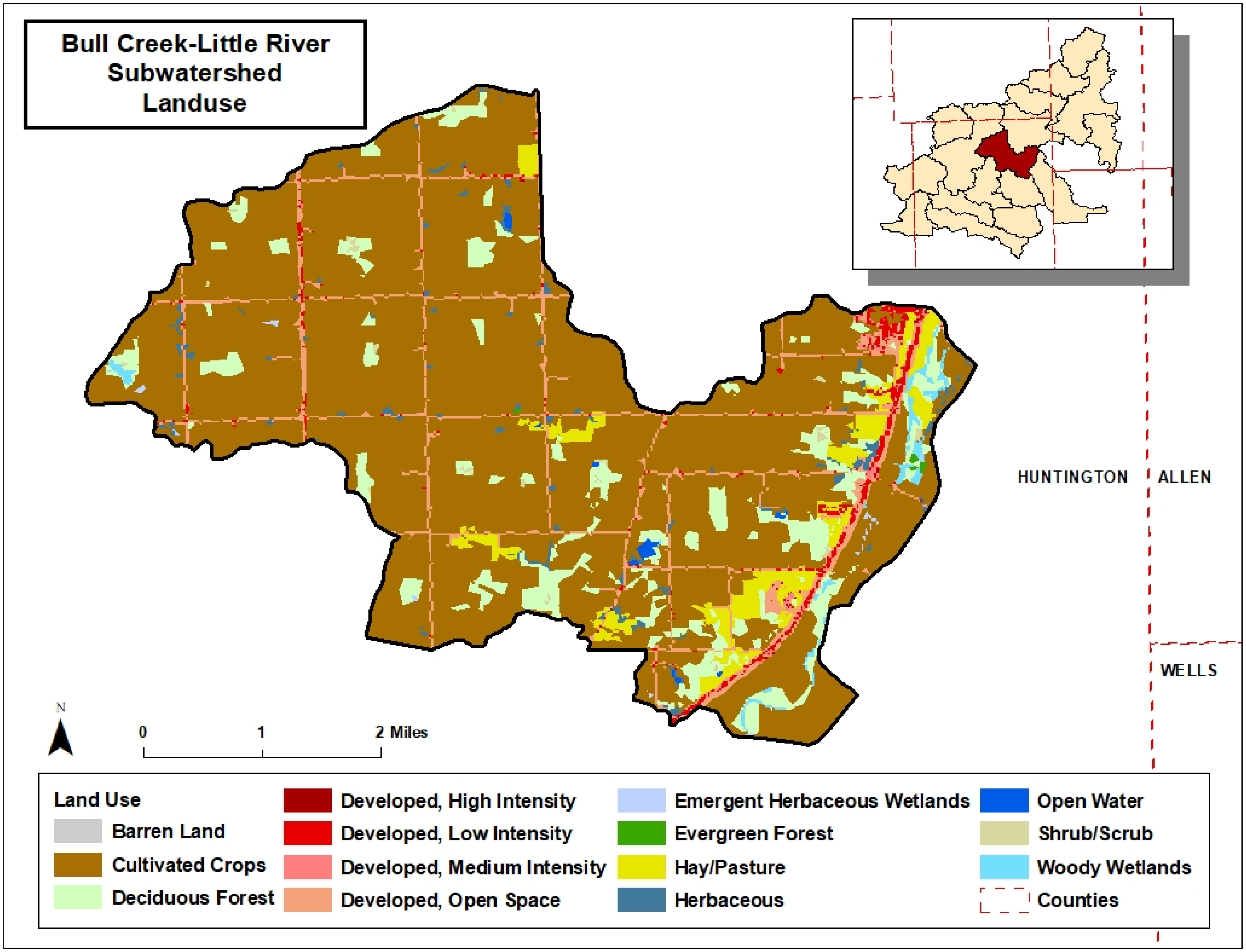


Figure 3-33. Bull Creek-Little River (HUC 051201011102) Land Use

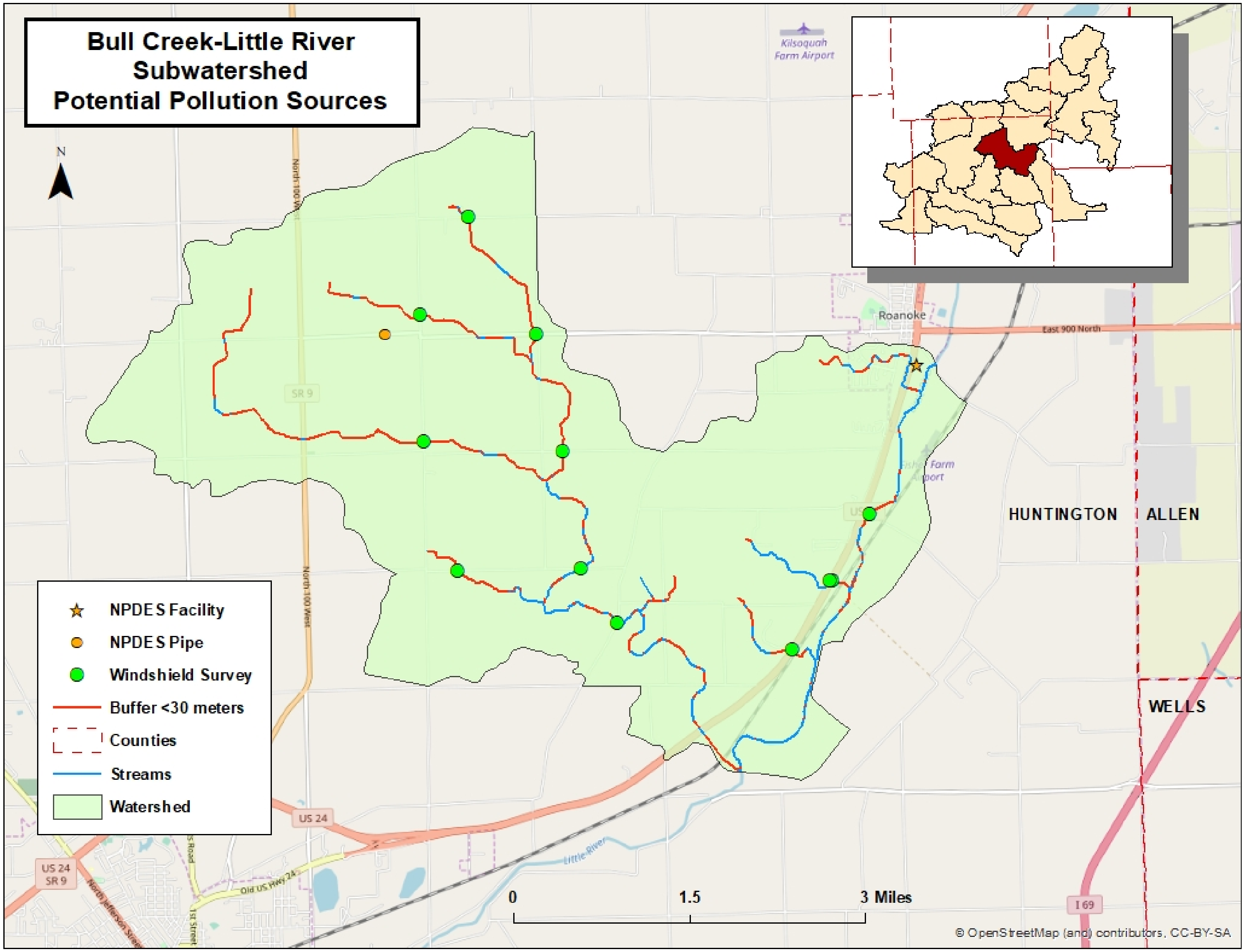


Figure 3-34. Bull Creek-Little River (HUC 051201011102) Potential Pollution Source

Flint Creek-Little River (HUC 051201011104) Land Use

The primary land uses in the Flint Creek-Little River watershed (HUC 051201011104) are agriculture and developed land. Agriculture uses and developed land account for 43.87% and 45.03% of land use within the watershed, respectively. This relationship between agricultural and developed land uses highlights the rural-urban interface present in the UWRW Phase 3 project area. Furthermore, approximately 9% of land use is forest/woodland and 7% is developed area. Table 3-84 shows the quantity and percentage of each land use within the watershed and Table 3-85 shows information on land use in more broad classifications. Figure 3-35 displays the distribution land use throughout the watershed.

The windshield survey for the Flint Creek-Little River watershed (HUC 051201011104) was conducted on 11/5/2018. Data were collected at sixteen stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on three fields within the watershed with no fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices; however, of the stream crossings analyzed none were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at three of the stream crossings. It is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 18.74 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 5.82 stream miles or 31.05% of the total stream miles (Table 3-90). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are 28 LUST's (Table 3-88), nineteen NPDES permitted facilities (Table 3-89), fourteen CSO's (Table 3-87) and six brownfields (Table 3-86) located within Flint Creek-Little River watershed (HUC 051201011104). There are no SSO's, CFO's/CAFO's in the watershed.

Table 3-84. Land use within HUC 051201011104 (Flint Creek)

Class	%	Acres
Barren Land	0.43	46.36
Cultivated Crops	43.87	4,760.34
Deciduous Forest	8.01	868.60
Developed, High Intensity	2.72	294.98
Developed, Low Intensity	16.68	1,809.79
Developed, Medium Intensity	5.75	624.05
Developed, Open Space	19.88	2,157.40
Emergent Herbaceous Wetlands	0.26	27.74
Evergreen Forest	0.02	1.86
Herbaceous	0.50	53.84
Open Water	1.06	114.98
Shrub/Scrub	0.48	52.33
Woody Wetlands	0.35	37.73

Table 3-85. Land use by group within HUC 051201011104 (Flint Creek)

Land use	%	Acres
Open Water	1.06	114.98
All Developed Areas	45.03	4,886.22
All Forest/Woodland Types	9.00	976.63
Agricultural Uses (Crops, Pasture/Hay, etc.)	43.87	4,760.34
Wetlands	0.60	65.48
Barren Land	0.43	46.36

Table 3-86. Brownfields within HUC 051201011104 (Flint Creek)

Site Name	ID	Status	Address	City	County
Heyde Gas Station 4161112	116608	Active	35 S Jefferson St	Huntington	Huntington
Pearson Welding & Fabrication 4160203	111324	Active	102 N Briant St	Huntington	Huntington
UB-Oddfellows Building 4160405	113091	Active	48 E Franklin St	Huntington	Huntington
THE GRILL CARE COMPANY 4090519	10854	Active	1000 E Market St	Huntington	Huntington
Huntington Family YMCA 4130703	49538	Active	607 Warren St 41 E Park Dr	Huntington	Huntington
Friction Material Company Inc 4150904	29740	Active	1849 E Sabine St	Huntington	Huntington

Table 3-87. Combined sewer overflows within HUC 051201011104 (Flint Creek)

Interest ID	City	NPDES Number	CSO Number	Receiving stream	Status	Wastewater Type
29840	City of Huntington	IN0023132	003C -- CSO - Lafontaine Bridge North	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	004C -- CSO - Rabbit Run	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	005C -- CSO - Clark St and Frederick St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	006C -- CSO - Lafontaine Bridge South	Little River	Inactive	Untreated CSO
29840	City of Huntington	IN0023132	007C -- CSO - Jefferson St Bridge	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	008C -- CSO - State St / E of Jefferson St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	009C -- CSO - State St and City Building	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	010C -- CSO - Market St and Jefferson St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	011C -- CSO - Warren St - S of Market St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	012C -- CSO - Warren St - N or Market St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	013C -- CSO - Market St and Guilford St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	014C -- CSO - Market St and Byron St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	015C -- CSO - Market St and First St	Little River	Active	Untreated CSO
29840	City of Huntington	IN0023132	016C -- CSO - Division St West of First St	Little River	Active	Untreated CSO

Table 3-88. Leaking underground storage tanks within HUC 051201011104 (Flint Creek)

UST Facility ID	Facility Name	Address
8897	Huntington Ready Mix	1217 W Park Dr P O Box 428
6175	Schroeders Sales & Service Inc	1001 W Park Dr
17175	Mill Run Proje Inc	201 S Jefferson
11191	Huggy Bear Trading Post	904 Etna Ave
14257	Huntington Memorial Hospital	1215 Etna Ave
20094	Huntington Commercial Building	416 Warren St
3152	Savemore #9	1215 S Jefferson St
15789	Convenience Corner Inc	-
18052	Huntington Administration Bldg	1360 N Warren Rd
2945	Clark Jefferson	735 S Jefferson St
8262	Richard Ness Excav & Trkg Co Inc	1 Hitzfield St
7984	Johnson Junction #9	2008 N Guilford St
697	Marathon Oil Southside	602 S Jefferson St
2416	Speedway/Sm #1304	221 W Park Dr
19195	Former Yellow Truck Terminal	2115 E Taylor
7982	Economart Convenience	1970 E State St
10387	Public Service Indiana	217 W State St
20328	Irwin Bank Trust	1403 E Tipton
6927	Us Mineral Products	701 N Broadway
336	Schenkel All Star Dairy	1019 Flaxmill Rd
3410	Huntington Terminal	4393 N Meridian Rd
4737	Johnson Junction #1	-
4632	Huntington Street & Sanitation Dept	384 N Briant St
6176	Johnson Junction #4	-
4634	Huntington Water Pollution Control	-
4645	Hiner Transport Inc	-
16787	Jonhson Junction #5	2840 Guilford St
14039	Huntington Municipal Airport	1365 Warren Rd

Table 3-89. NPDES facilities within HUC 051201011104 (Flint Creek)

Permit #	Facility Name	County	Expiration Date
INR10M609	ARCHBISHOP NOLL PARKWAY	Huntington	8/26/2021
INR10K724	APRON EXPANSION	Huntington	8/27/2020
INR10M416	CROWN HILL FARMS SECTION 4	Huntington	7/28/2021
INRM01765	ECOLAB INCORPORATED	Huntington	12/22/2018
INR10N097	ERIE RAIL TRAIL PHASE 3	Huntington	12/5/2021
INRM01075	ISOLATEK INTERNATIONAL	Huntington	6/6/2019
IN0063827	HUNTINGTON WATER DEPT. - NORTH WATER	Huntington	7/31/2021
IN0023132	HUNTINGTON WWTP	Huntington	5/31/2018
INL023132	HUNTINGTON WWTP	Huntington	12/31/2020
INR10K313	HUNTINGTON 138KV SUBSTATION TO HUNTINGTON STATE STREET 69143 RECONDUCTOR	Huntington	6/16/2020
INR10L520	HUNTINGTON CITY SERVICES	Huntington	2/25/2021
INR10K863	HUNTINGTON LITTLE RIVER TRAIL	Huntington	9/21/2020
INR10H735	RABBIT RUN CSO PROJECT PHASE I	Huntington	1/3/2019
INR10I644	PARKS LOFTS AT HUNTINGTON	Huntington	7/9/2019
INRM00859	ONWARD MANUFACTURING COMPANY	Huntington	11/15/2019
INR10J860	MEMORIAL PARK IMPROVEMENTS PHASE 1	Huntington	4/6/2020
ING340061	MARATHON PETROLEUM HUNTINGTON TERMINAL	Huntington	10/31/2020
INR10K767	SCHENKEL DAIRY PARKING LOT EXPANSION	Huntington	9/3/2020
INR10N575	VICTORY NOLL, NORTH DRIVE EXTENSION TO HITZFIELD ROAD	Huntington	3/29/2022

Table 3-90. Streams lacking buffer within HUC 051201011104 (Flint Creek)

Streams with <30 meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
5.82	18.74	31.05

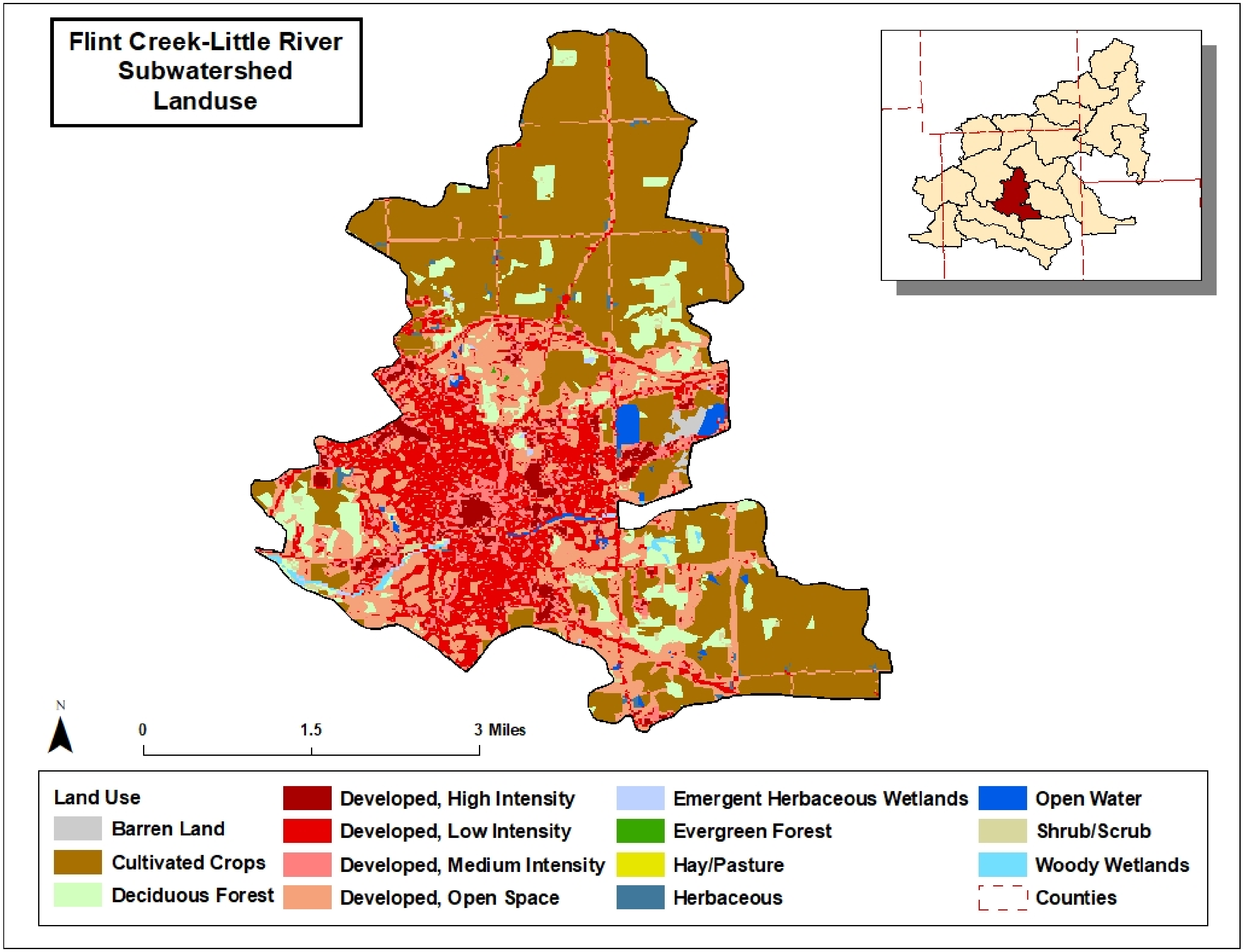


Figure 3-35. Flint Creek-Little River (HUC 051201011104) Land Use

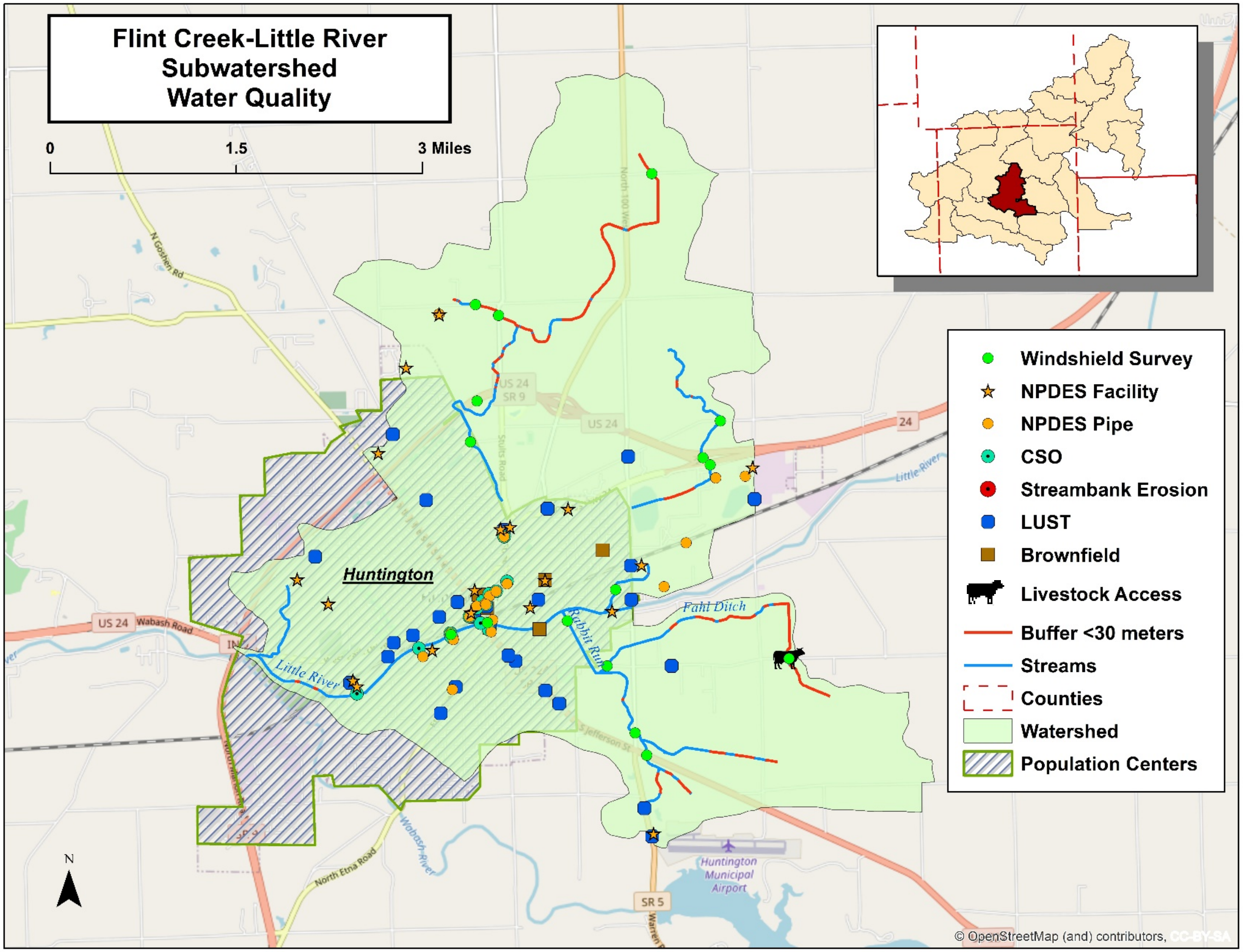


Figure 3-36. Flint Creek-Little River (HUC 051201011104) Potential Pollution Sources

Flat Creek (HUC 051201011101) Land Use

The primary land use in the Flat Creek watershed (HUC 051201011101) is agriculture. Agricultural uses account for 88.65% of land use within the watershed. Of the agricultural land use, 86.97% is cultivated crops. Furthermore, approximately 5% of land use is forest/woodland and 6% is developed area. Table 3-91 shows the quantity and percentage of each land use within the watershed and Table 3-92 shows information on land use in more broad classifications. Figure 3-37 displays the distribution land use throughout the watershed.

The windshield survey for the Flat Creek watershed (HUC 051201011101) was conducted on 11/5/2018. Data were collected at sixteen stream crossings. During the survey, three fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on twelve fields within the watershed with two fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented at any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices; however, of the stream crossings analyzed, none were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at thirteen of the stream crossings. It is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 29.76 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 23.78 stream miles or 79.90% of the total stream miles (Table 3-94). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one NPDES permitted facility (Table 3-93) located within the Flat Creek watershed (HUC 051201011101). There are no brownfields, CFO's/CAFO's, LUST's, SSO's, or CSO's within the watershed.

Table 3-91. Land use within HUC 051201011101 (Flat Creek)

Land Use	%	Acres
Cultivated Crops	86.97	14,624.35
Deciduous Forest	3.75	631.21
Developed, High Intensity	0.00	0.73
Developed, Low Intensity	1.03	172.41
Developed, Medium Intensity	0.14	23.72
Developed, Open Space	5.10	858.20
Emergent Herbaceous Wetlands	0.01	1.75
Hay/Pasture	1.67	281.52
Herbaceous	0.78	130.70
Open Water	0.19	32.59
Shrub/Scrub	0.28	47.13
Woody Wetlands	0.06	10.67

Table 3-92. Land use by group within HUC 051201011101 (Flat Creek)

Land use	%	Acres
Open Water	0.19	32.59
All Developed Areas	6.27	1,055.07
All Forest/Woodland Types	4.81	809.04
Agricultural Uses (Crops, Pasture/Hay, etc.)	88.65	14,905.88
Wetlands	0.07	12.43
Barren Land	0.00	0.00

Table 3-93. NPDES facilities within HUC 051201011101 (Flat Creek)

Permit #	Facility Name	County	Expiration Date
INRM01197	GLADIEUX TRADING & MARKETING COMPANY LLP	Huntington	6/6/2019

Table 3-94. Streams lacking buffer within HUC 051201011101 (Flat Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
23.78	29.76	79.90

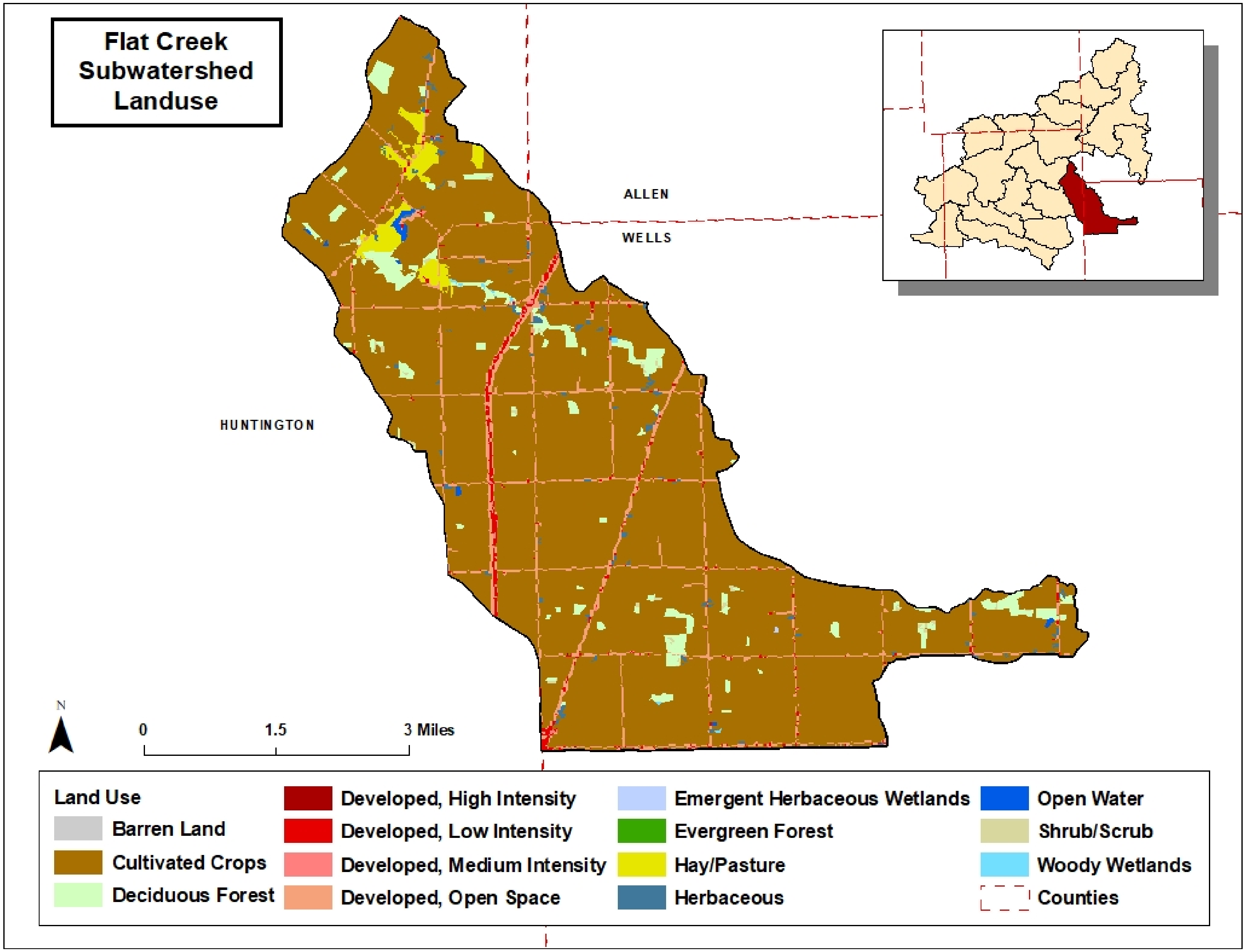


Figure 3-37. Flat Creek (HUC 051201011101) Land Use

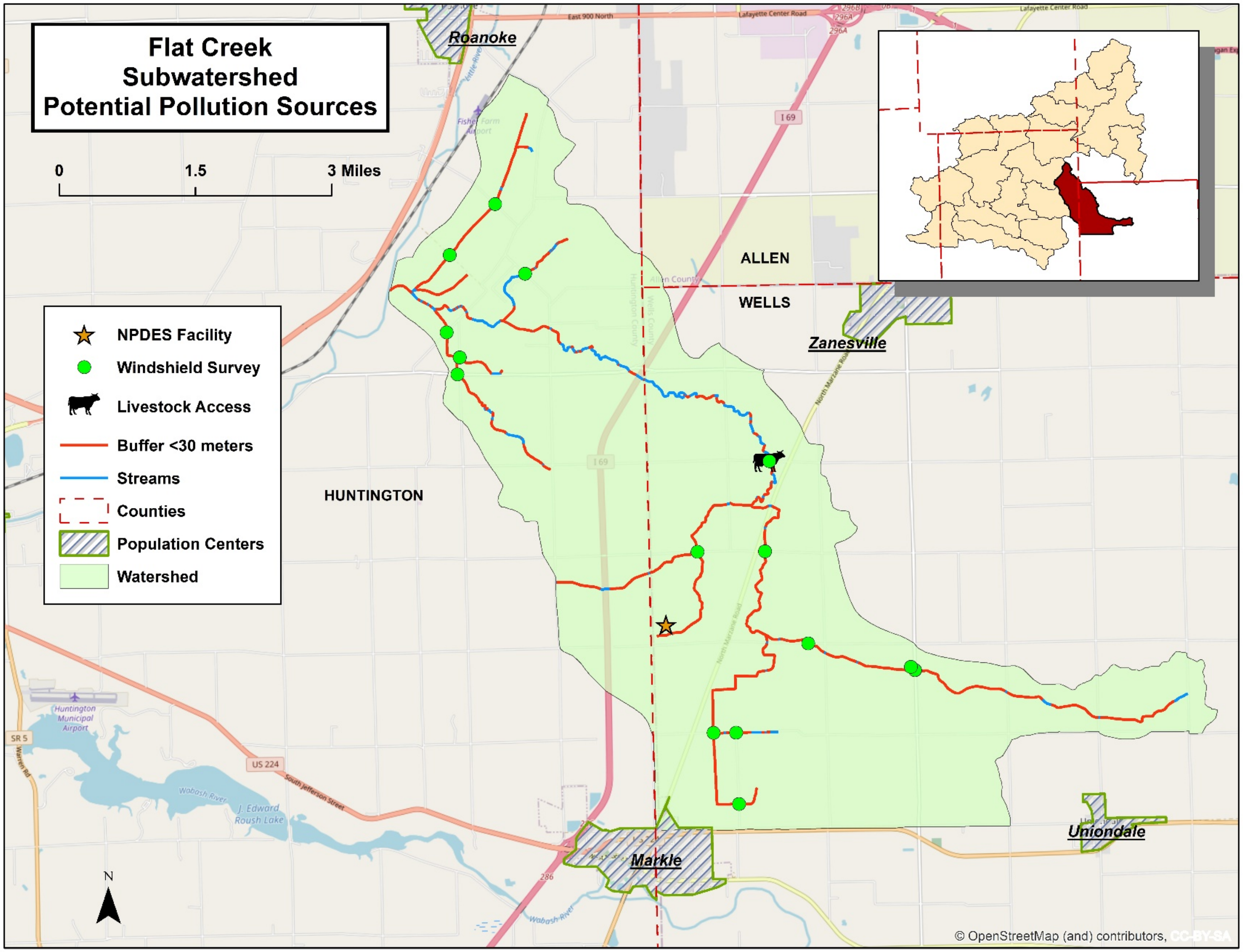


Figure 3-38. Flat Creek (HUC 051201011101) Potential Pollution Sources

Mud Creek-Little River (HUC 051201011103) Land Use

The primary land use in the Mud Creek-Little River watershed (HUC 051201011103) is agriculture. Agricultural uses account for 80.42% of land use within the watershed. Of the agricultural land use, 79.77% is cultivated crops. Furthermore, approximately 9% of land use is forest/woodland and 9% is developed area. Table 3-95 shows the quantity and percentage of each land use within the watershed and Table 3-96 shows information on land use in more broad classifications. Figure 3-39 displays the distribution land use throughout the watershed.

The windshield survey for the Mud Creek-Little River watershed (HUC 051201011103) was conducted on 11/7/2018. Data were collected at fourteen stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on ten fields within the watershed with one field having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented at any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, one (7.14%) was classified as having severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at eight of the stream crossings. It is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 20.92 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 12.55 stream miles or 60% of the total stream miles (Table 3-100). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one brownfield (Table 3-97), one confined feeding operation (Table 3-98), and six NPDES permitted facilities (Table 3-99) located within the Mud Creek-Little River watershed (HUC 051201011103). There are no LUST's, SSO's, CSO's, or CAFO's within the watershed.

Table 3-95. Land use within HUC 051201011103 (Mud Creek-Little River)

Land Use	%	Acres
Barren Land	0.02	1.86
Cultivated Crops	79.77	8,011.43
Deciduous Forest	7.82	785.00
Developed, High Intensity	0.20	19.96
Developed, Low Intensity	1.37	137.43
Developed, Medium Intensity	0.68	68.73
Developed, Open Space	7.03	705.55
Emergent Herbaceous Wetlands	0.26	25.82
Evergreen Forest	0.05	5.48
Hay/Pasture	0.65	65.16
Herbaceous	1.05	105.68
Open Water	0.21	21.37
Shrub/Scrub	0.50	50.17

Table 3-96. Land use by group within HUC 051201011103 (Mud Creek-Little River)

Land use	%	Acres
Open Water	0.21	21.37
All Developed Areas	9.28	931.67
All Forest/Woodland Types	9.42	946.34
Agricultural Uses (Crops, Pasture/Hay, etc.)	80.42	8,076.59
Wetlands	0.65	65.16
Barren Land	0.02	1.86

Table 3-97. Brownfields within HUC 051201011103 (Mud Creek-Little River)

Site Name	ID	Status	Address	City	County
U.S. HIGHWAY 24 PROPERTY 4990074	35119	Active	US HWY 24 E HUNTINGTON OIL	Huntington	Huntington

Table 3-98. Confined feeding operations within HUC 051201011103 (Mud Creek-Little River)

CFO ID	Name	Farm Size	Effective Date
35723	Stephan & Sons Incorporated	CFO	1/13/1995

Table 3-99. NPDES facilities within HUC 051201011103 (Mud Creek-Little River)

Permit #	Facility Name	County	Expiration Date
IN0063908	CF INDUSTRIES SALES LLC - HUNTINGTON TERMINAL	Huntington	1/31/2022
INRM00021	GLADIEUX PROCESSING LLC	Huntington	4/27/2020
ING340069	GLADIEUX TRADING & MARKETING LLC	Huntington	10/31/2020
INRM00604	HELENA CHEMICAL HUNTINGTON TERMINAL	Huntington	4/1/2022
INR10L581	THURMAN POE WAY PARKING IMPROVEMENTS	Huntington	3/10/2021
ING340040	SUNOCO PARTNERS MARKETING & TERMINALS	Huntington	10/31/2020

Table 3-100. Streams lacking buffer within HUC 051201011103 (Mud Creek-Little River)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
12.55	20.92	60.00

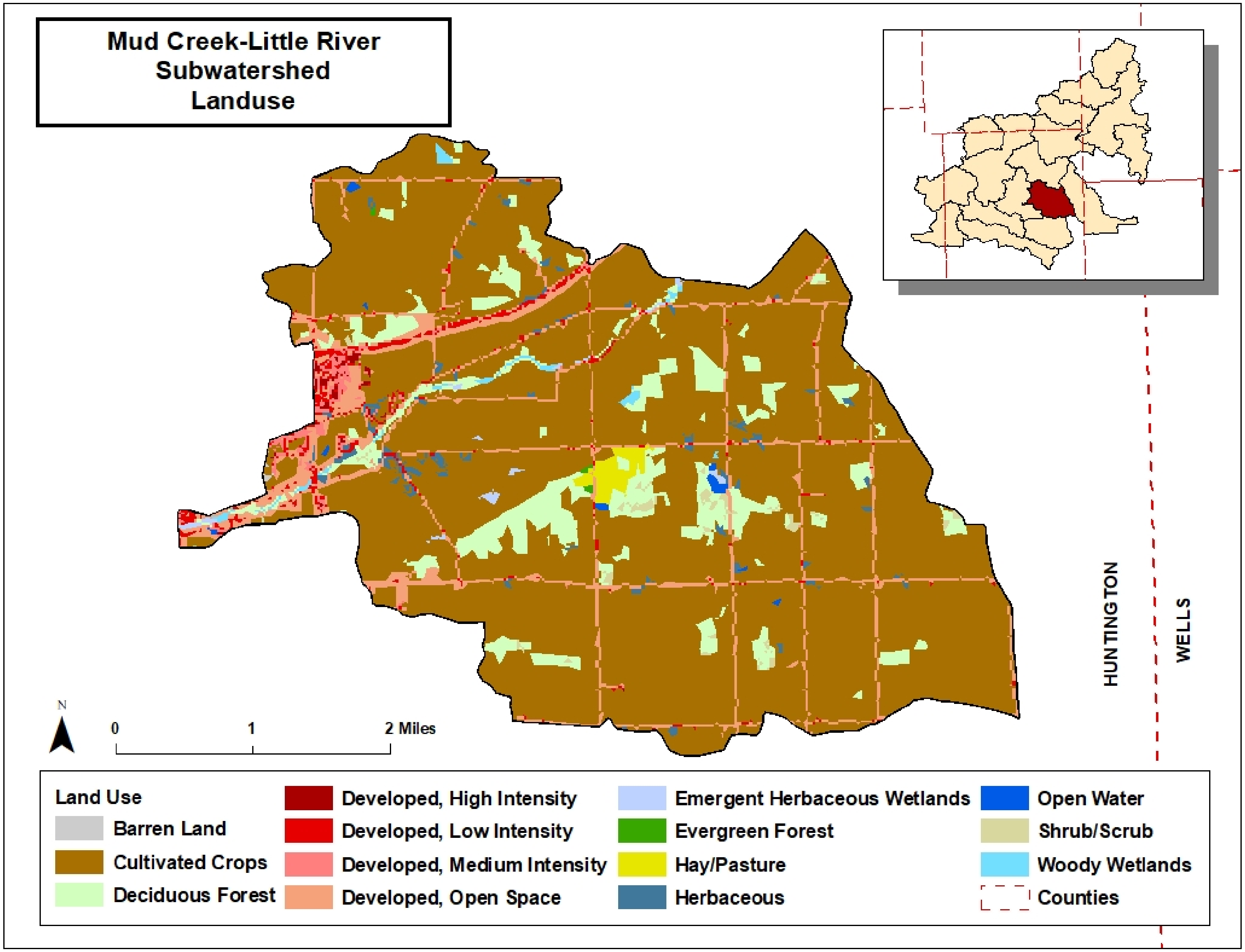


Figure 3-39. Mud Creek-Little River (HUC 051201011103) Land Use

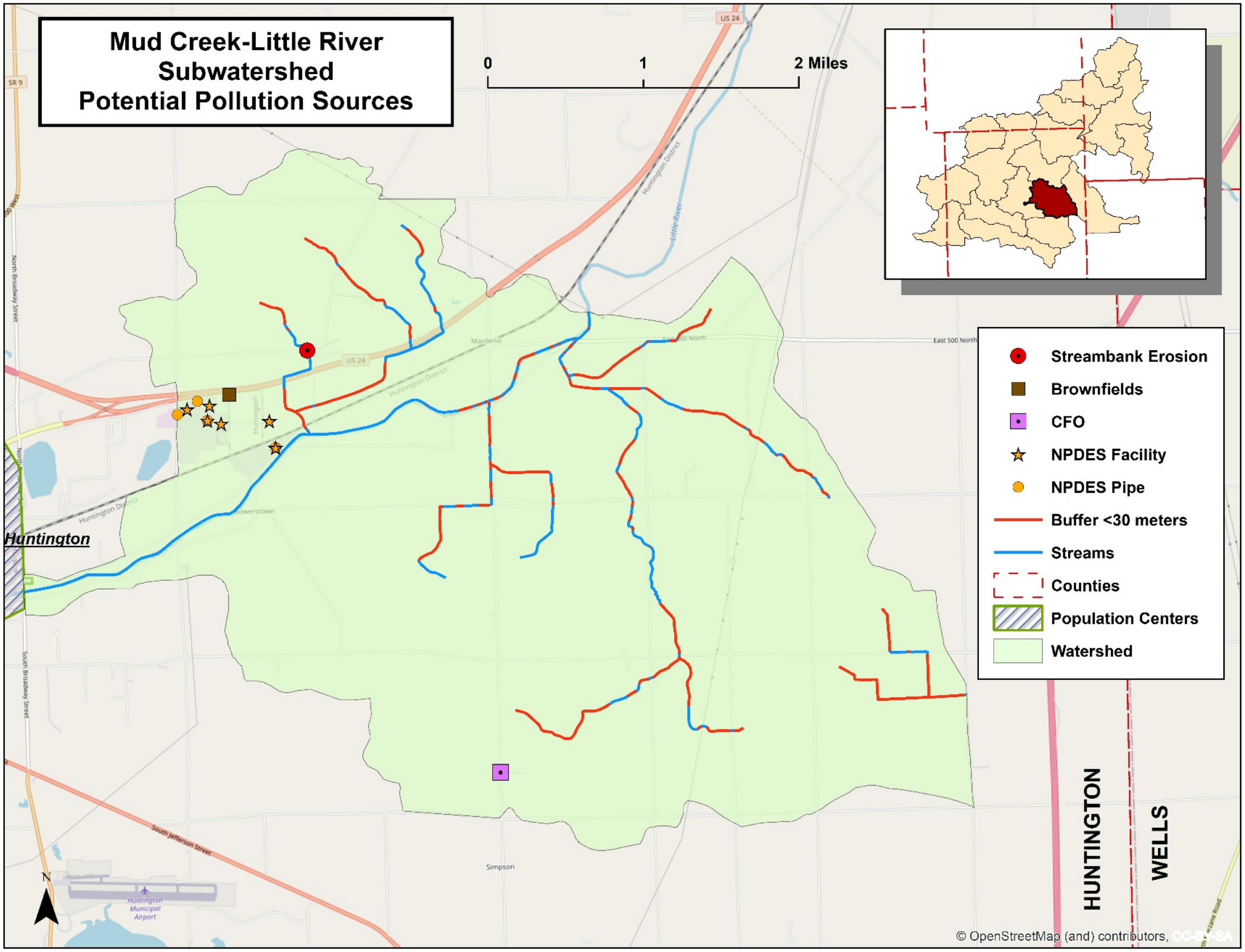


Figure 3-40. Mud Creek-Little River (HUC 051201011103) Potential Pollution Sources

<u>Sub-watersheds of the Loon Creek-Wabash River Watershed</u>

Huntington Lake-Wabash River (HUC 051201011301) Land Use

The primary land use in the Huntington Lake-Wabash River watershed (HUC 051201011301) is agriculture. Agricultural uses account for 49.81% of land use within the watershed. Furthermore, the greatest proportion of forested/woodland land use is found in this watershed, covering approximately 31% of the watershed area. The abundant forest/woodland in this watershed is attributed to the J.E. Roush Fish & Wildlife Area. Table 3-101 shows the quantity and percentage of each land use within the watershed and Table 3-102 shows information on land use in more broad classifications. Figure 3-41 displays the distribution land use throughout the watershed.

The windshield survey for the Huntington Lake-Wabash River watershed (HUC 051201011301) was conducted on 11/5/2018. Data were collected at seven stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on five fields within the watershed with all five fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was not documented at any stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, one (14%) was classified as having severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was not documented at any of the stream crossings; however, it is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey indicated that the amount of streams lacking riparian buffer is lowest in the Huntington Lake-Wabash River watershed (HUC 051201011301) as compared to other sub-watersheds within the project area. There are 21.27 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 2.61 stream miles or 12.28% of the total stream miles (Table 3-104). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one NPDES permitted facility (Table 3-103) located within the Huntington Lake-Wabash River watershed (HUC 051201011301). There are no LUST's, SSO's, CSO's, or CFO's/CAFO's within the watershed.

Table 3-101. Land use within HUC 051201011301 (Huntington Lake-Wabash River)

Land Use	%	Acres
Barren Land	0.01	1.52
Cultivated Crops	49.12	5,025.03
Deciduous Forest	27.48	2,811.56
Developed, High Intensity	0.02	2.34
Developed, Low Intensity	1.13	115.93
Developed, Medium Intensity	0.21	21.46
Developed, Open Space	6.97	713.08
Emergent Herbaceous Wetlands	0.66	67.15
Evergreen Forest	0.26	26.80
Hay/Pasture	0.70	71.33
Herbaceous	1.76	180.36
Open Water	9.81	1,003.73
Shrub/Scrub	1.69	172.74
Woody Wetlands	0.18	17.98

Table 3-102. Land use by group within HUC 051201011301 (Huntington Lake-Wabash River)

Land use	%	Acres
Open Water	9.81	1,003.73
All Developed Areas	8.34	852.80
All Forest/Woodland Types	31.19	3,191.47
Agricultural Uses (Crops, Pasture/Hay, etc.)	49.81	5,096.35
Wetlands	0.83	85.13
Barren Land	0.01	1.52

Table 3-103. NPDES facilities within HUC 051201011301 (Huntington Lake-Wabash River)

Permit #	Facility Name	County	Expiration Date
INR10K378	INDIANA MICHIGAN POWER COMPANY-ROCK CREEK STATION EXPANSION	Huntington	7/1/2020

Table 3-104. Streams lacking buffer within HUC 051201011301 (Huntington Lake-Wabash River)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
2.61	21.27	12.28

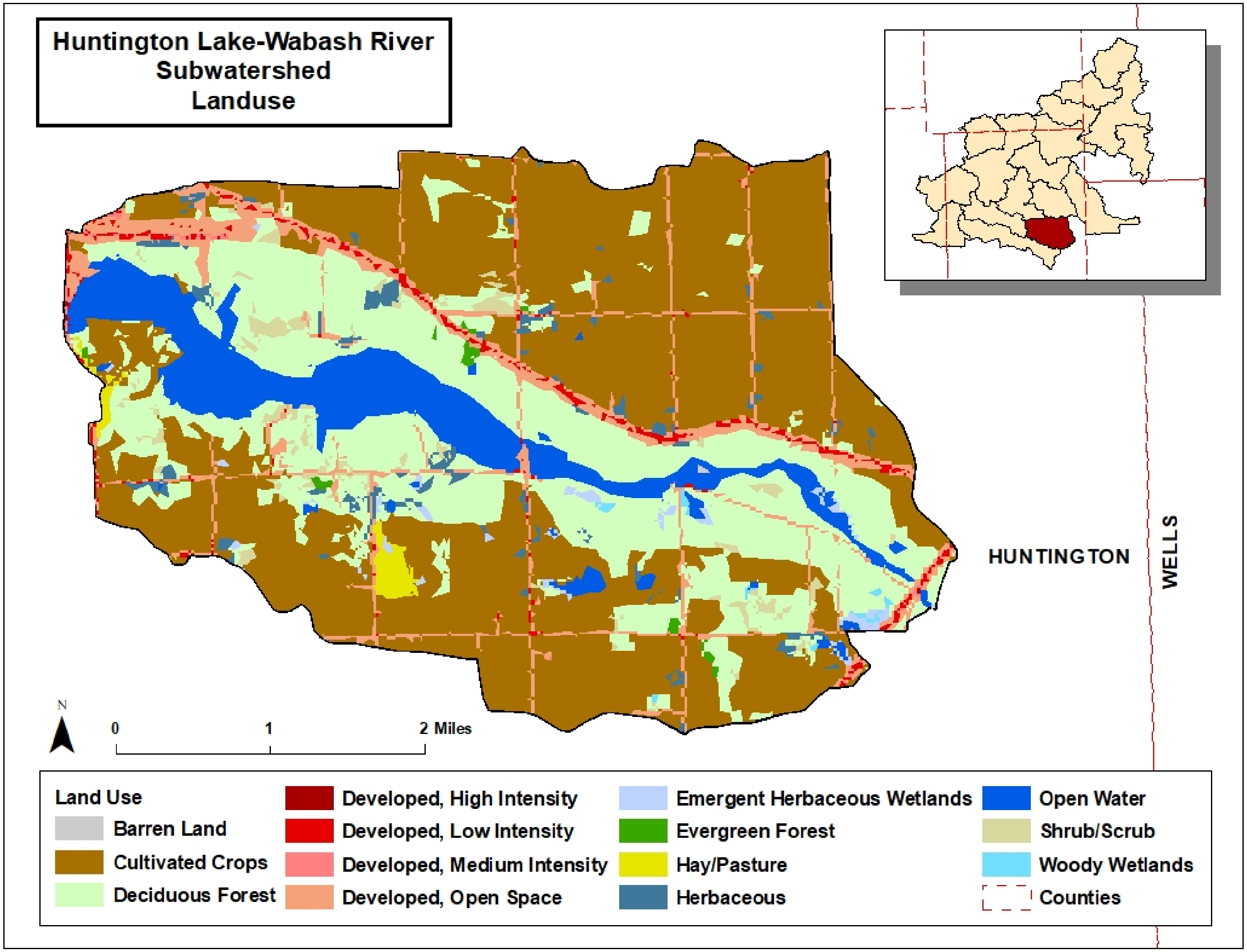


Figure 3-41. Huntington Lake-Wabash River (HUC 051201011301) Land Use

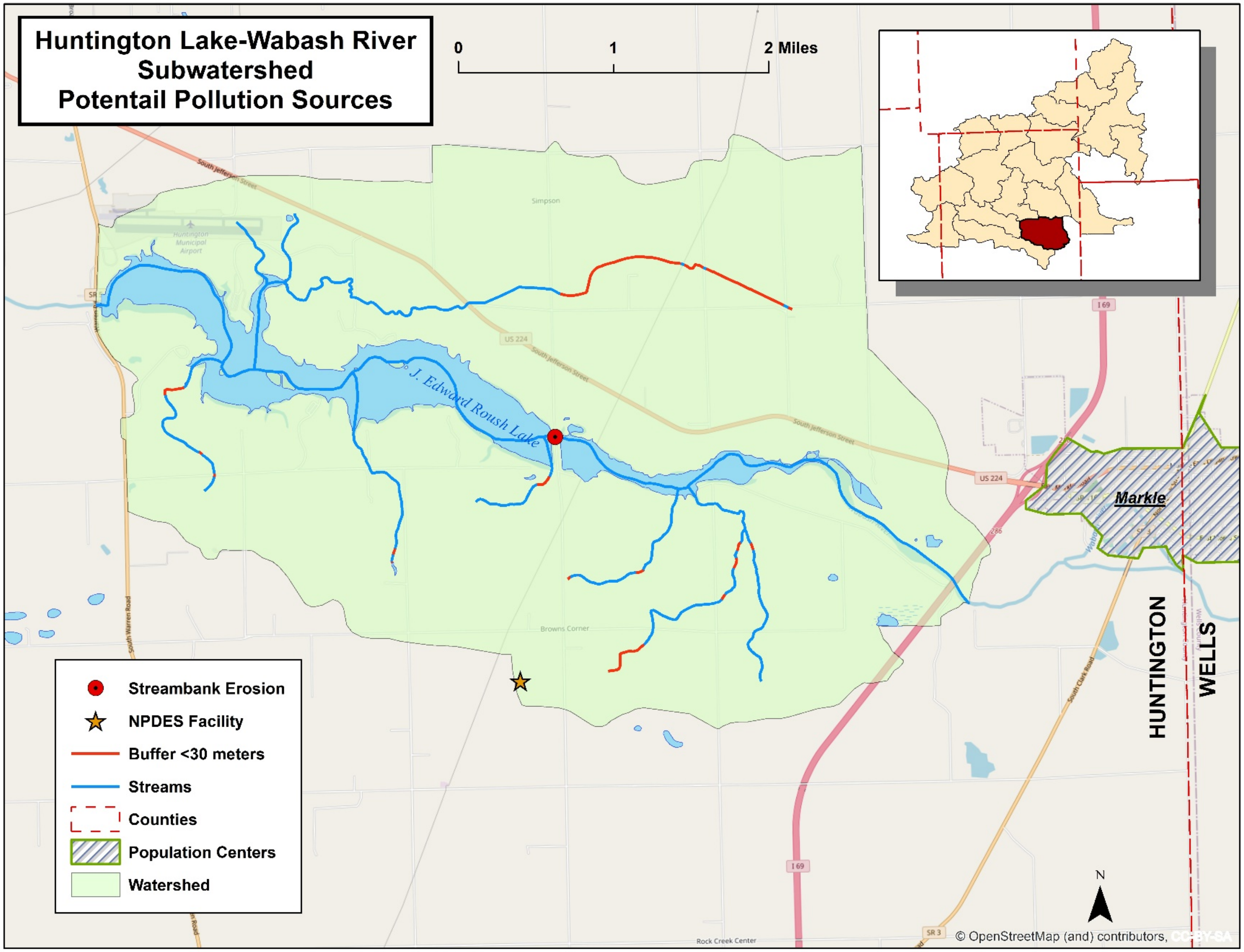


Figure 3-42. Huntington Lake-Wabash River (HUC 051201011301) Potential Pollution Sources

Loon Creek (HUC 051201011304) Land Use

The primary land use in the Loon Creek watershed (HUC 051201011304) is agriculture. Agricultural uses account for 80.87% of land use within the watershed. Of the agricultural land use, 76.02% is cultivated crops. Furthermore, approximately 12% of land use is forest/woodland and 6.57% is developed area. Table 3-105 shows the quantity and percentage of each land use within the watershed and Table 3-106 shows information on land use in more broad classifications. Figure 3-43 displays the distribution land use throughout the watershed.

The windshield survey for the Loon Creek watershed (HUC 051201011304) was conducted on 11/9/2018. Data were collected at sixteen stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on twelve fields within the watershed with one field having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at three stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, one (6.25%) was classified as having severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at three of the stream crossings. It is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey verified the lack of riparian buffers within the watershed. There are 24.91 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 13.05 stream miles or 52.38% of the total stream miles (Table 3-109). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one CAFO (Table 3-107) and one NPDES permitted facility (Table 3-108) located within Loon Creek watershed (HUC 051201011304). There are no brownfields, LUST's, SSO's, CSO's, or CFO's within the watershed.

Table 3-105. Land use within HUC 051201011304 (Loon Creek)

Land Use	%	Acres
Cultivated Crops	76.02	10,439.03
Deciduous Forest	10.61	1,456.53
Developed, High Intensity	0.01	1.05
Developed, Low Intensity	1.14	156.15
Developed, Medium Intensity	0.14	19.83
Developed, Open Space	5.28	725.36
Emergent Herbaceous Wetlands	0.16	21.52
Evergreen Forest	0.01	1.75
Hay/Pasture	4.85	665.35
Herbaceous	1.10	151.12
Open Water	0.30	41.10
Shrub/Scrub	0.35	48.54
Woody Wetlands	0.03	4.66

Table 3-106. Land use by group within HUC 051201011304 (Loon Creek)

Land use	%	Acres
Open Water	0.30	41.10
All Developed Areas	6.57	902.39
All Forest/Woodland Types	12.07	1,657.94
Agricultural Uses (Crops, Pasture/Hay, etc.)	80.87	11,104.38
Wetlands	0.19	26.18
Barren Land	0.00	0.00

Table 3-107. Concentrated animal feeding operations within HUC 051201011304 (Loon Creek)

CFO ID	Name	Farm Size	Effective Date
36946	Carl Swine Enterprises Incorporated	CAFO	1/13/1995

Table 3-108. NPDES facilities within HUC 051201011304 (Loon Creek)

Permit #	Facility Name	County	Expiration Date
IN0022268	ANDREWS WWTP, TOWN OF	Huntington	8/31/2021

Table 3-109. Streams lacking buffer within HUC 051201011304 (Loon Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
13.05	24.91	52.38

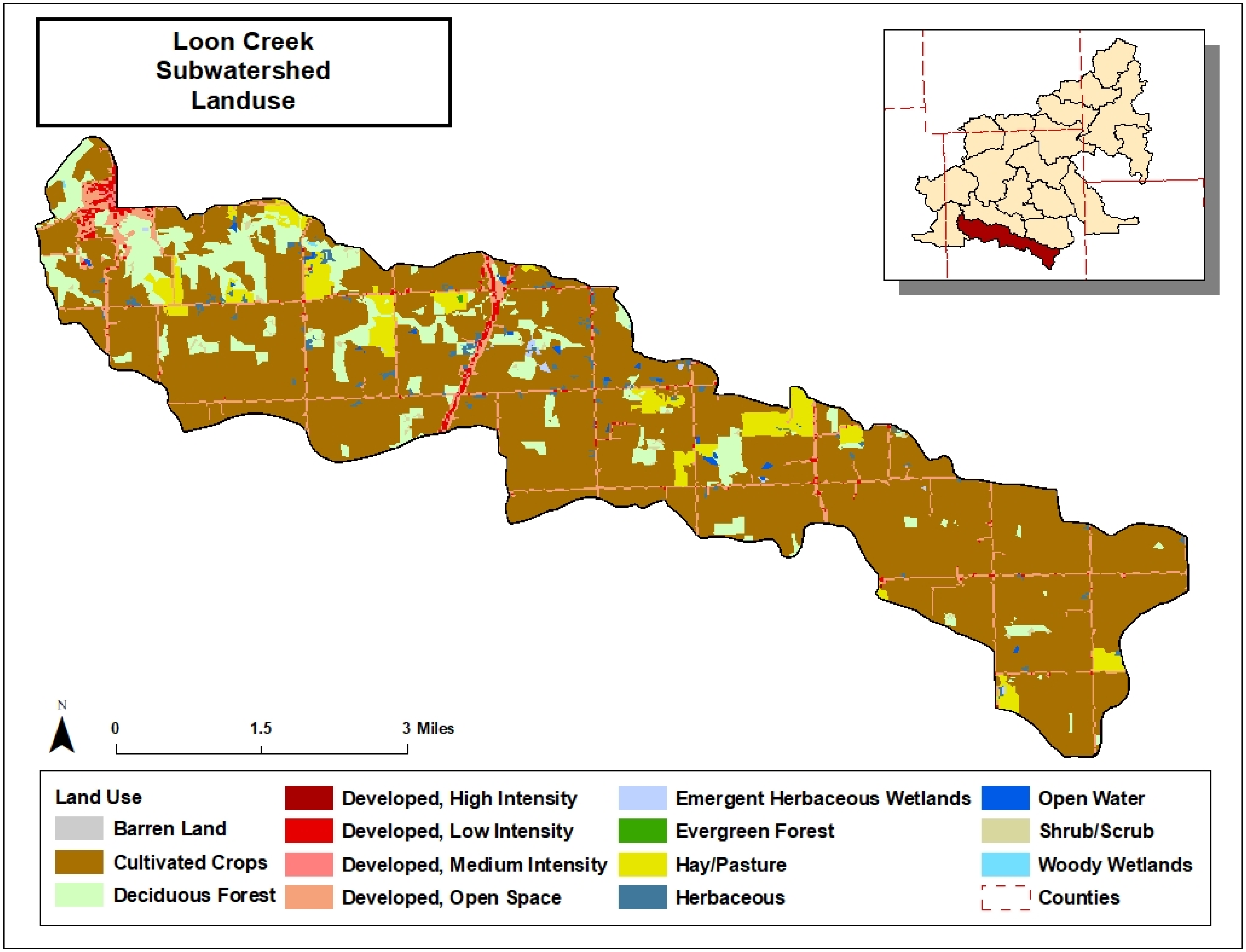


Figure 3-43. Loon Creek (HUC 051201011304) Land Use

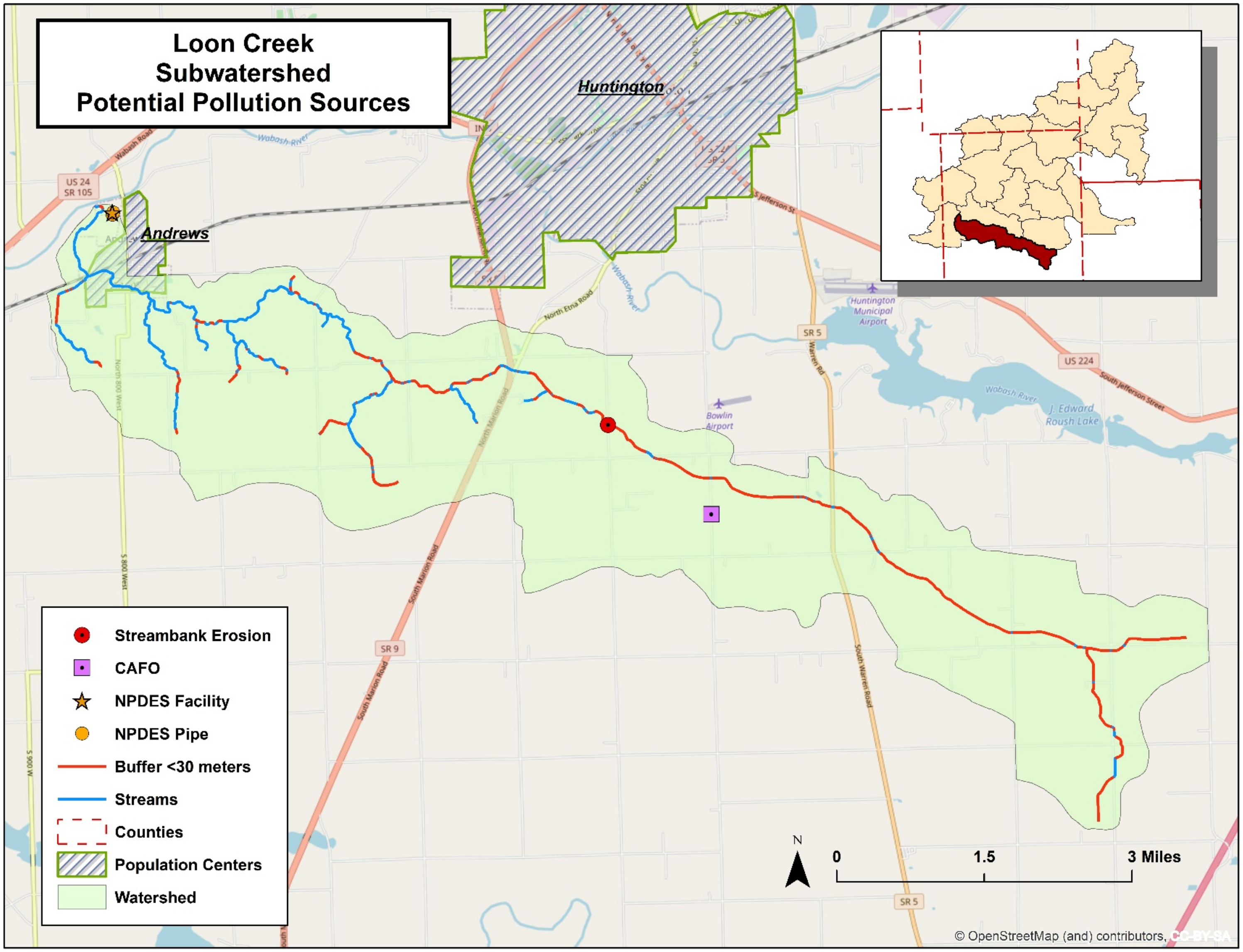


Figure 3-44. Loon Creek (HUC 051201011304) Potential Pollution Sources

Hanging Rock-Wabash River (HUC 051201011305) Land Use

The primary land use in the Hanging Rock-Wabash River watershed (HUC 051201011305) is agriculture. Agricultural uses account for 68.25% of land use within the watershed. Furthermore, approximately 22.54% of land use is forest/woodland and 6.74% is developed area. Table 3-110 shows the quantity and percentage of each land use within the watershed and Table 3-111 shows information on land use in more broad classifications. Figure 3-45 displays the distribution land use throughout the watershed.

The windshield survey for the Hanging Rock-Wabash River watershed (HUC 051201011305) was conducted on 11/9/2018. Data were collected at 25 stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on four fields within the watershed with one field having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at two stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, four (16%) were classified as having moderate stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at one of the stream crossings though is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The windshield survey verified the lack of riparian buffers within the watershed. There are 39.05 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 11.44 stream miles or 29.30% of the total stream miles (Table 3-114). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one CFO (Table 3-112) and one LUST (Table 3-113) located within Hanging Rock-Wabash River watershed (HUC 051201011305). There are no brownfields, NPDES permitted facilities, SSO's, CSO's, or CAFO's within the watershed.

Table 3-110. Land use within HUC 051201011305 (Hanging Rock-Wabash River)

Land Use	%	Acres
Cultivated Crops	65.64	7,207.98
Deciduous Forest	20.16	2,214.01
Developed, High Intensity	0.02	1.92
Developed, Low Intensity	0.51	55.51
Developed, Medium Intensity	0.54	59.69
Developed, Open Space	5.67	622.58
Emergent Herbaceous Wetlands	0.40	44.35
Evergreen Forest	0.03	3.41
Hay/Pasture	2.61	286.10
Herbaceous	1.68	184.04
Open Water	1.96	215.17
Shrub/Scrub	0.68	74.14
Woody Wetlands	0.11	12.09

Table 3-111. Land use by group within HUC 051201011305 (Hanging Rock-Wabash River)

Land use	%	Acres
Open Water	1.96	215.17
All Developed Areas	6.74	739.70
All Forest/Woodland Types	22.54	2,475.60
Agricultural Uses (Crops, Pasture/Hay, etc.)	68.25	7,494.08
Wetlands	0.51	56.45
Barren Land	0.00	0.00

Table 3-112. Confined feeding operations within HUC 051201011305 (Hanging Rock-Wabash River)

CFO ID	Name	Farm Size	Effective Date
56707	Hegel Farm	CFO	10/19/1998

Table 3-113. Leaking underground storage tanks within HUC 051201011305 (Hanging Rock-Wabash River)

UST Facility ID	Facility Name	Address
6143	Tripple 'd' Store	2996 S 900 W (SR 105)

Table 3-114. Streams lacking buffer within HUC 051201011305 (Hanging Rock-Wabash River)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
11.44	39.05	29.30

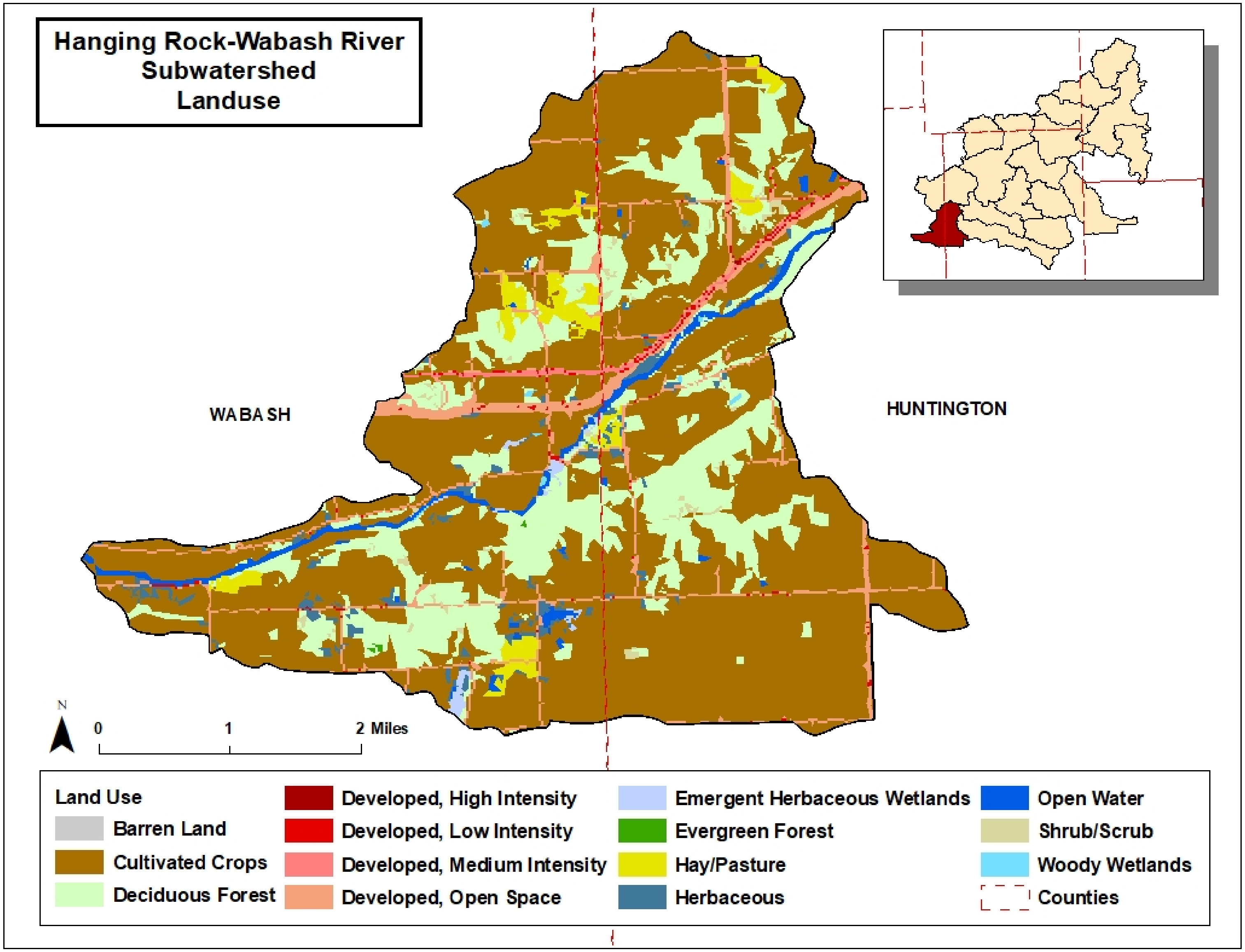


Figure 3-45. Hanging Rock-Wabash River (HUC 051201011305) Land Use

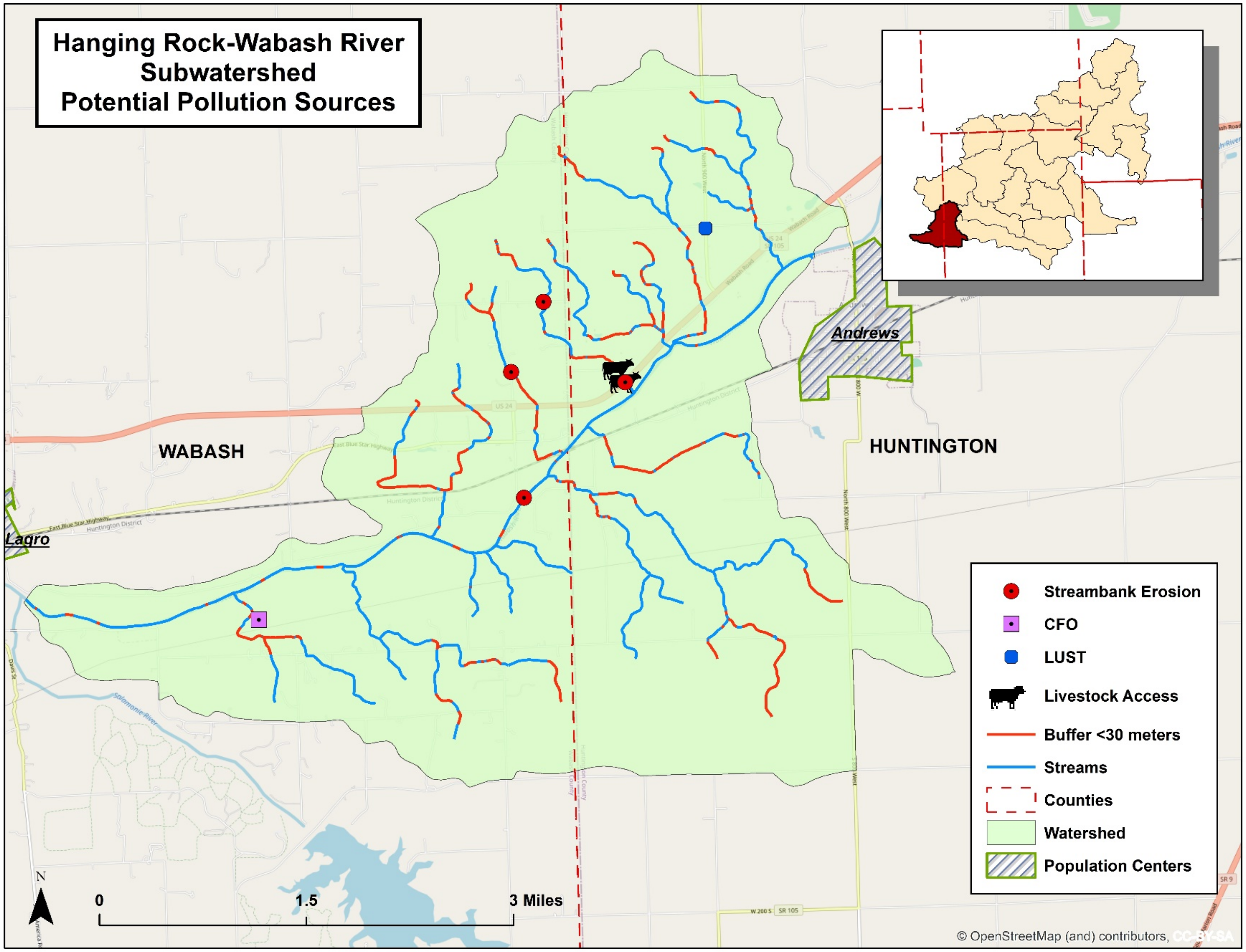


Figure 3-46. Hanging Rock-Wabash River (HUC 051201011305) Potential Pollution Sources

Silver Creek (HUC 051201011302) Land Use

The primary land use in the Silver Creek watershed (HUC 051201011302) is agriculture. Agricultural uses account for 80.17% of land use within the watershed. Furthermore, approximately 14% of land use is forest/woodland and 5.7% is developed area. Table 3-115 shows the quantity and percentage of each land use within the watershed and Table 3-116 shows information on land use in more broad classifications. Figure 3-47 displays the distribution land use throughout the watershed.

The windshield survey for the Silver Creek watershed (HUC 051201011302) was conducted on 11/9/2018. Data were collected at 22 stream crossings. During the survey, one field was documented to have recently practiced conventional fall tillage. No-till farming practices were documented on seven fields within the watershed with four fields having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at one stream crossing. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, nine (42.86%) were classified as having moderate or severe stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at six of the stream crossings though is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area

The windshield survey verified the lack of riparian buffers within the watershed. There are 40.43 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 17.83 stream miles or 44.10% of the total stream miles (Table 3-120). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There are two confined feeding operations (Table 3-117), one concentrated animal feeding operation (Table 3-117), one LUST (Table 3-118), and one NPDES permitted facility (Table 3-119) located within the Silver Creek watershed (HUC 051201011302). There are no brownfields, SSO's, or CSO's within the watershed.

Table 3-115. Land use within HUC 051201011302 (Silver Creek)

Land Use	%	Acres
Cultivated Crops	75.58	10,972.35
Deciduous Forest	12.59	1,828.11
Developed, High Intensity	0.03	3.75
Developed, Low Intensity	0.50	72.61
Developed, Medium Intensity	0.09	13.22
Developed, Open Space	5.08	737.84
Emergent Herbaceous Wetlands	0.02	3.50
Hay/Pasture	4.60	667.24
Herbaceous	0.75	108.48
Open Water	0.24	34.28
Shrub/Scrub	0.50	72.23
Woody Wetlands	0.03	4.38

Table 3-116. Land use by group within HUC 051201011302 (Silver Creek)

Land use	%	Acres
Open Water	0.24	34.28
All Developed Areas	5.70	827.42
All Forest/Woodland Types	13.84	2,008.82
Agricultural Uses (Crops, Pasture/Hay, etc.)	80.17	11,639.59
Wetlands	0.05	7.88
Barren Land	0.00	0.00

Table 3-117. Confined feeding operations and concentrated animal feeding operations within HUC 051201011302 (Silver Creek)

CFO ID	Name	Farm Size	Effective Date
57399	Midwest Veal LLC Eco Veal	CFO	6/1/1987
56740	Rosen Farms Incorporated	CFO	12/4/1985
119863	KR Swine LLC	CAFO	3/1/2018

Table 3-118. Leaking underground storage tanks within HUC 051201011302 (Silver Creek)

UST Facility ID	Facility Name	Address
4941	Knecht Excavating	7981 N 911 W

Table 3-119. NPDES facilities within HUC 051201011302 (Silver Creek)

Permit #	Facility Name	County	Expiration Date
IN0061310	BIPPUS REGIONAL SEWER DISTRICT	Huntington	6/30/2021

Table 3-120. Streams lacking buffer within HUC 051201011302 (Silver Creek)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
17.83	40.43	44.10

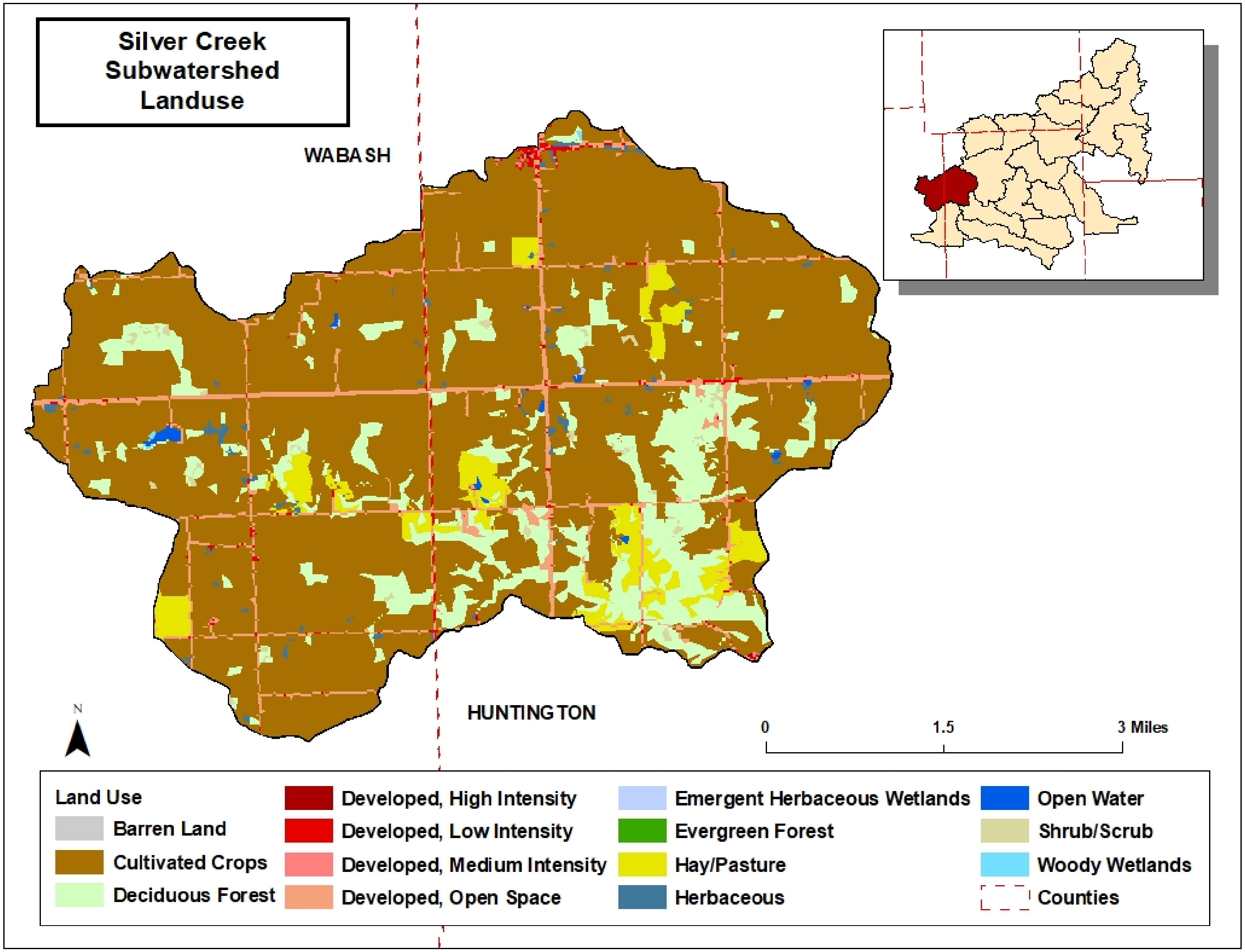


Figure 3-47. Silver Creek (HUC 051201011302) Land Use

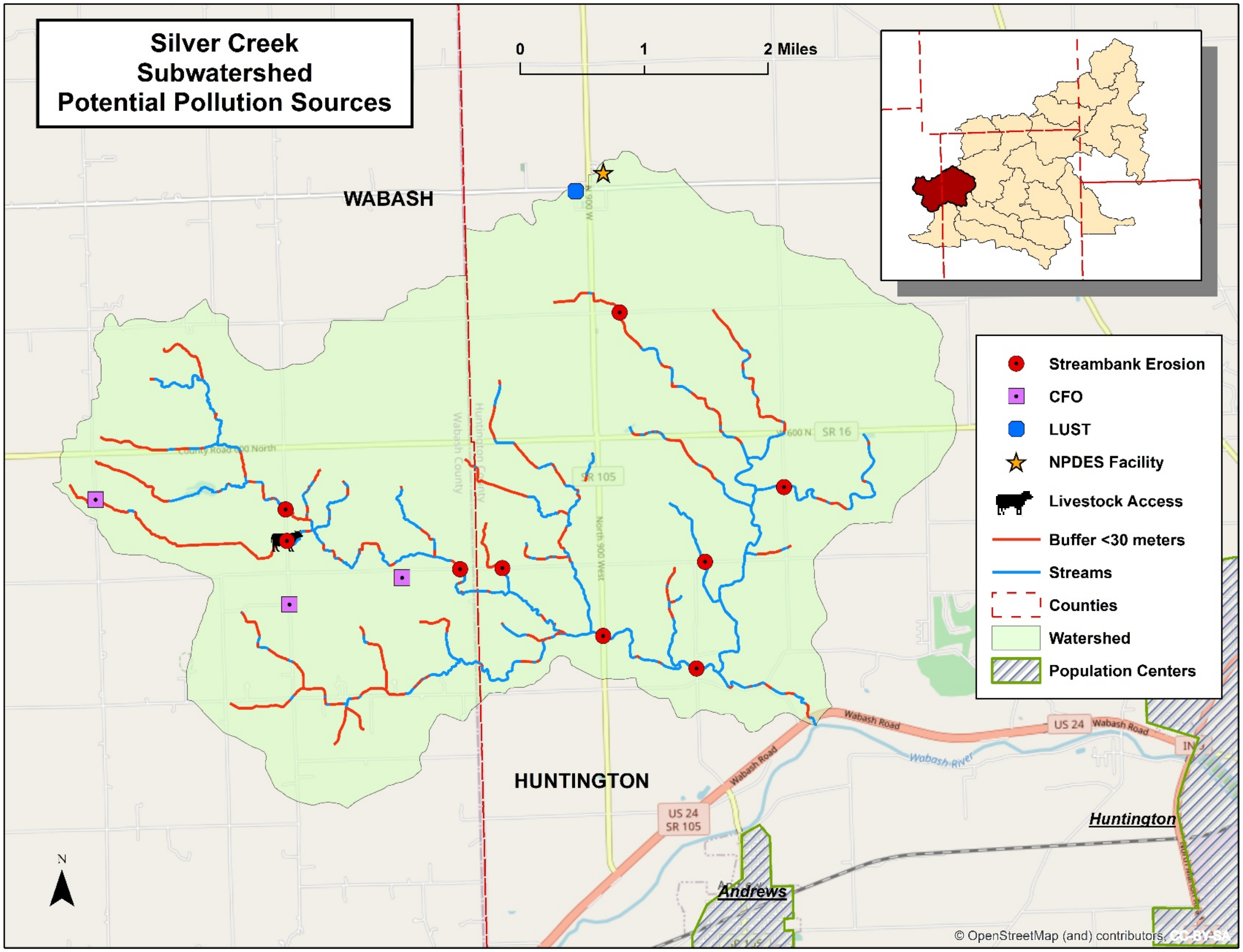


Figure 3-48. Silver Creek (HUC 051201011302) Potential Pollution Sources

Town of Andrews-Wabash River (HUC 051201011303) Land Use

Land use in the Town of Andrews-Wabash River watershed (HUC 051201011303) is diverse. The primary land use is agriculture. Agricultural uses account for 52.66% of land use within the watershed. Furthermore, approximately 22.31% of land use is forest/woodland and 22.15% is developed area. Table 3-121 shows the quantity and percentage of each land use within the watershed and Table 3-122 shows information on land use in more broad classifications. Figure 3-49 displays the distribution land use throughout the watershed.

The windshield survey for the Town of Andrews-Wabash River watershed (HUC 051201011303) was conducted on 11/9/2018. Data were collected at 21 stream crossings. During the survey, no fields were documented to have recently practiced conventional fall tillage. No-till farming practices were documented on four fields within the watershed with one field having an active fall cover crop. Remaining fields in the watershed were in other land uses, current production, or it was undetermined what fall practices were being represented. Trash presence within the stream was documented at six stream crossings. Stream bank erosion is a major issue within the UWRW Phase 3 project area and the amount of sediment being eroded in the streambank may overshadow any upland sediment targeted by conservation practices. Of the stream crossings analyzed, seven (36.84%) were classified as having moderate stream bank erosion. Many of these locations were coupled with extensive stream modifications, such as channelization, riparian buffer removal, etc. Visible drainage tile was documented at only two of the stream crossings though is likely that nearly all fields within the watershed possess drainage tile due to the relatively low landscape gradient within the UWRW Phase 3 project area.

The desktop survey revealed a lack of the riparian buffers within the watershed. There are 33.83 total stream miles within the watershed. Streams that lack at least a 30-meter buffer make up 7.54 stream miles or 22.28% of the total stream miles (Table 3-127). Verification by the windshield survey was successful. Farming practices consistently were documented to be directly adjacent to the stream with little to no buffer zones.

There is one brownfield (Table 3-123), one CSO (Table 1-124), six LUST's (Table 3-125), and eight NPDES permitted facilities (Table 3-126) located within the Town of Andrews-Wabash River watershed (HUC 051201011303). There are no SSO's or CFO's/CAFO's within the watershed.

Table 3-121. Land use within HUC 051201011303 (Town of Andrews-Wabash River)

Land Use	%	Acres
Cultivated Crops	46.30	4,710.95
Deciduous Forest	19.11	1,944.28
Developed, High Intensity	0.76	77.76
Developed, Low Intensity	4.39	446.92
Developed, Medium Intensity	2.01	204.02
Developed, Open Space	14.99	1,524.94
Emergent Herbaceous Wetlands	0.31	31.25
Evergreen Forest	0.01	1.03
Hay/Pasture	6.36	647.15
Herbaceous	2.04	207.95
Open Water	2.38	241.72
Shrub/Scrub	1.15	116.93
Woody Wetlands	0.19	19.10

Table 3-122. Land use by group within HUC 051201011303 (Town of Andrews-Wabash River)

Land use	%	Acres
Open Water	2.38	241.72
All Developed Areas	22.15	2,253.64
All Forest/Woodland Types	22.31	2,270.18
Agricultural Uses (Crops, Pasture/Hay, etc.)	52.66	5,358.11
Wetlands	0.49	50.36
Barren Land	0.00	0.00

Table 3-123. Brownfields within HUC 051201011303 (Town of Andrews-Wabash River)

Site Name	ID	Status	Address	City	County
Revis Island LLC-United Technologies Corp 4180412	37605	Active	303 N Jackson St	Andrews	Huntington

Table 3-124. Combined sewer overflows within HUC 051201011303 (Town of Andrews-Wabash River)

Interest ID	City	NPDES Number	CSO Number	Receiving stream	Status	County	Wastewater Type
29840	City of Huntington	IN0023132	002C -- CSO - before headworks	Little River	Active	Huntington	Untreated CSO

Table 3-125. Leaking underground storage tanks within HUC 051201011303 (Town of Andrews-Wabash River)

UST Facility ID	Facility Name	Address
4435	Huntington Andrews Elementary	400 E Jefferson Street
4033	Huntington Reservoir	517 N Warren Rd
24238	M & B DAIRY STORE	7961 W WABASH RD
25195	Texaco	1901 Etna Ave
2616	Stop and Shop	3030 W Park Dr
1267	Andrews Diary Store	-

Table 3-126. NPDES facilities within HUC 051201011303 (Town of Andrews-Wabash River)

Permit #	Facility Name	County	Expiration Date
INRM00017	CONTINENTAL STRUCTURAL PLASTICS	Huntington	8/16/2020
INR10L639	ETNA AVENUE ROAD RECONSTRUCTION	Huntington	3/18/2021
INR10I194	HUNTINGTON RIVERFORKS STORMWATER DRAINAGE IMPROVEMENTS AND TRAIL	Huntington	4/24/2019
IN0062260	HUNTINGTON WATER TREATMENT PLANT	Huntington	8/31/2020
INRM01826	HUNTINGTON ALUMINUM INCORPORATED	Huntington	11/24/2019
INR10L564	STONEY BROOK SECTION 7	Huntington	3/7/2021
INR10J564	SR 9 BRIDGE REHABILITATION OVER NS RAILWAY DES #1006182 & 1006183	Huntington	1/26/2020
IN0062651	UNITED TECHNOLOGIES CORPORATION	Huntington	10/31/2021

Table 3-127. Streams lacking buffer within HUC 051201011303 (Town of Andrews-Wabash River)

Streams with <30-meter buffer (mi)	Total Streams (mi)	% stream miles lacking buffer
7.54	33.83	22.28

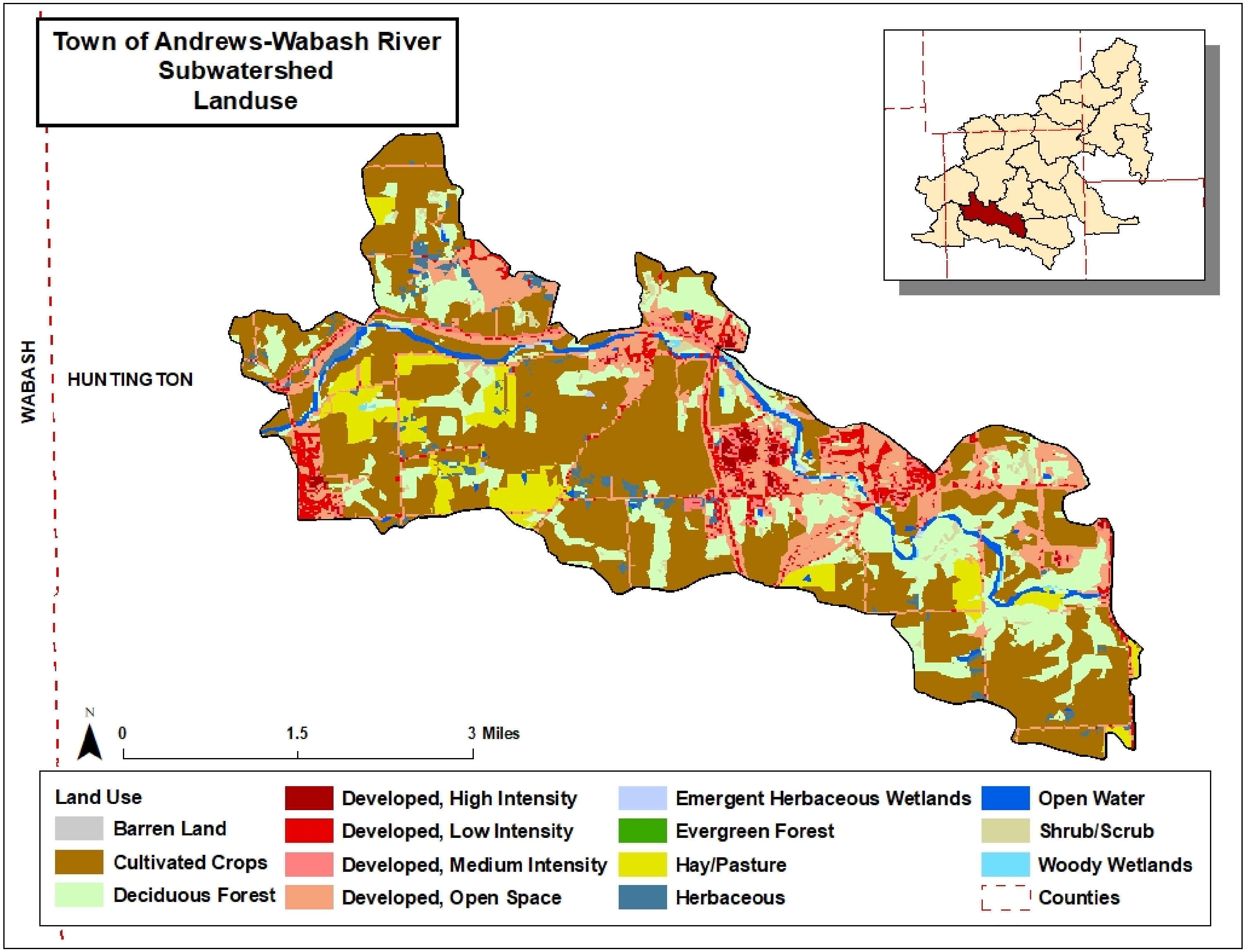


Figure 3-49. Town of Andrews-Wabash River (HUC 051201011303) Land Use

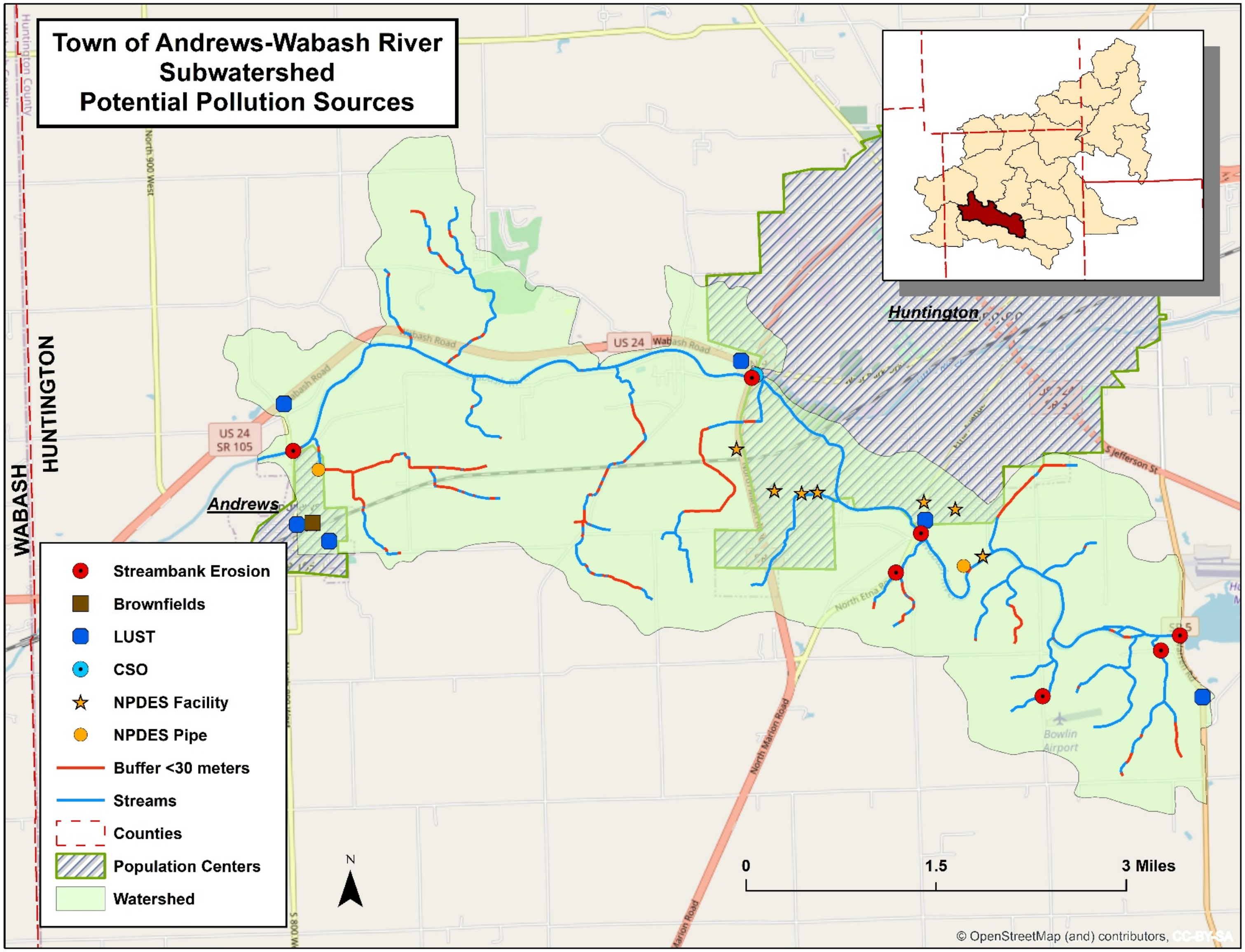


Figure 3-50. Town of Andrews-Wabash River (HUC 051201011303) Potential Pollution Sources

3.5 Watershed Inventory – Part II Summary

To better understand the water quality problems and land use features present in the UWRW Phase 3 Project Area and what influences may be contributing to those problems, a map was developed outlining the water quality issues in each subwatershed (Figure 3-51). Figure 3-51 also displays findings from windshield and desktop surveys and other points of interest that may contribute to water quality impairment. Table 3-128 provides a summary of the windshield survey data collected for the entire project area and Table 3-129 summarizes HUC 12 subwatershed nutrient, sediment, and *E.coli* data. *E. coli* and turbidity were elevated in nearly all watersheds and nutrients were elevated at nearly all sites. Several water quality impairments are listed in the IDEM 2018 Draft 303(d) List of Impaired waters for the UWRW Phase 3 area including *E. coli,* nutrients, impaired biotic communities, and PCB's in fish tissue (see Table 3-2). Table 3-130 summarizes the findings of the windshield and desktop surveys at the HUC 12 subwatershed level.

Examination of land use patterns within the UWRW Phase 3 project area indicated that the features contributing to water quality vary throughout the watershed. For instance, while the majority of land use in the project watershed is row crop agriculture (70%), particularly corn and soybean production, industrial, urban, and suburban land uses are also prevalent within the project area accounting for 16% of land use, concentrated primarily around the cities of Fort Wayne, IN and Huntington, IN in the Graham McCulloch Ditch #1-Little River (HUC 051201011004) and Flint Creek-Little River (HUC 051201011104) subwatersheds. Approximately 13% of the watershed area is classified as forest and woodland including the J.E. Roush Fish & Wildlife Area in the Huntington Lake-Wabash River (HUC 051201011301) subwatershed. These areas, as well as the 4,407 acres of wetland habitats throughout the watershed, should be protected and preserved for their flood control, pollution sink capabilities, and other ecosystem services.

The soils in the UWRW Phase 3 project area are ideal for row crop agriculture as they are nutrient rich; however, conventional tillage still occurs throughout the watershed and may be a contributor of high nutrient and sediment levels. Furthermore, 3% of soils within the watershed are considered highly erodible and 39% are classified as potentially highly erodible. This land requires special consideration when being worked, though many landowners are unaware of those precautions. Lack of BMP's on soils susceptible to erosion is likely a leading cause of elevated nutrient and sediment levels throughout the watershed.

The majority of the project area is rural, and centralized sewer systems are only present in the incorporated areas. Therefore, it can be assumed that on-site sewage treatment is prevalent throughout the project area. This poses a significant threat to water quality being that 97.53% of the soils are classified as "Very Limited" for septic suitability indicating that septic systems may be contributing to bacteria, nutrient, and sediment contamination in the UWRW Phase 3 project area.

There is a significant lack of riparian buffer throughout the UWRW Phase 3 project area with 47% (245.30 miles) of the 541 total stream miles having a riparian buffer of less than 100 feet (<30-meters). Riparian buffers are essential to water quality as they slow the movement of surface flow to streams and ditches, decrease the erosion potential power of stormflow on streambanks, and increase water infiltration which reduces the potential for flooding and allows for pollutants to be absorbed by plants before they reach adjacent waterbodies. Moderate and severe streambank erosion (81 sites) was also widespread in the watershed.

A variety of potential pollution sources (PPS) are distributed throughout the project area. The most frequent PPS within the project area is NPDES permitted facilities (147). The density of NPDES facilities is greatest in densely populated and urban areas such as those near Fort Wayne, Roanoke, Huntington, and Andrews. This observation is also true for the 81 LUST's within the watershed. The presence of fifteen (15) CSO's in Huntington is likely a prominent contributor to nutrient and bacteria inputs during overflow events. Fourteen (14) of the CSO's are located within the Flint Creek-Little River (HUC 051201011104) subwatershed. Six (6) of the nine (9) brownfields within the project area are also found in the Flint Creek-Little River (HUC 051201011104) subwatershed. The density of CFO's (9) and CAFO's (3) as well as sites where livestock have direct access to streams and rivers (8) in the UWRW Phase 3 project area is relatively low compared to other watersheds within the Wabash River Basin and is likely not a significant cause of water quality impairments.

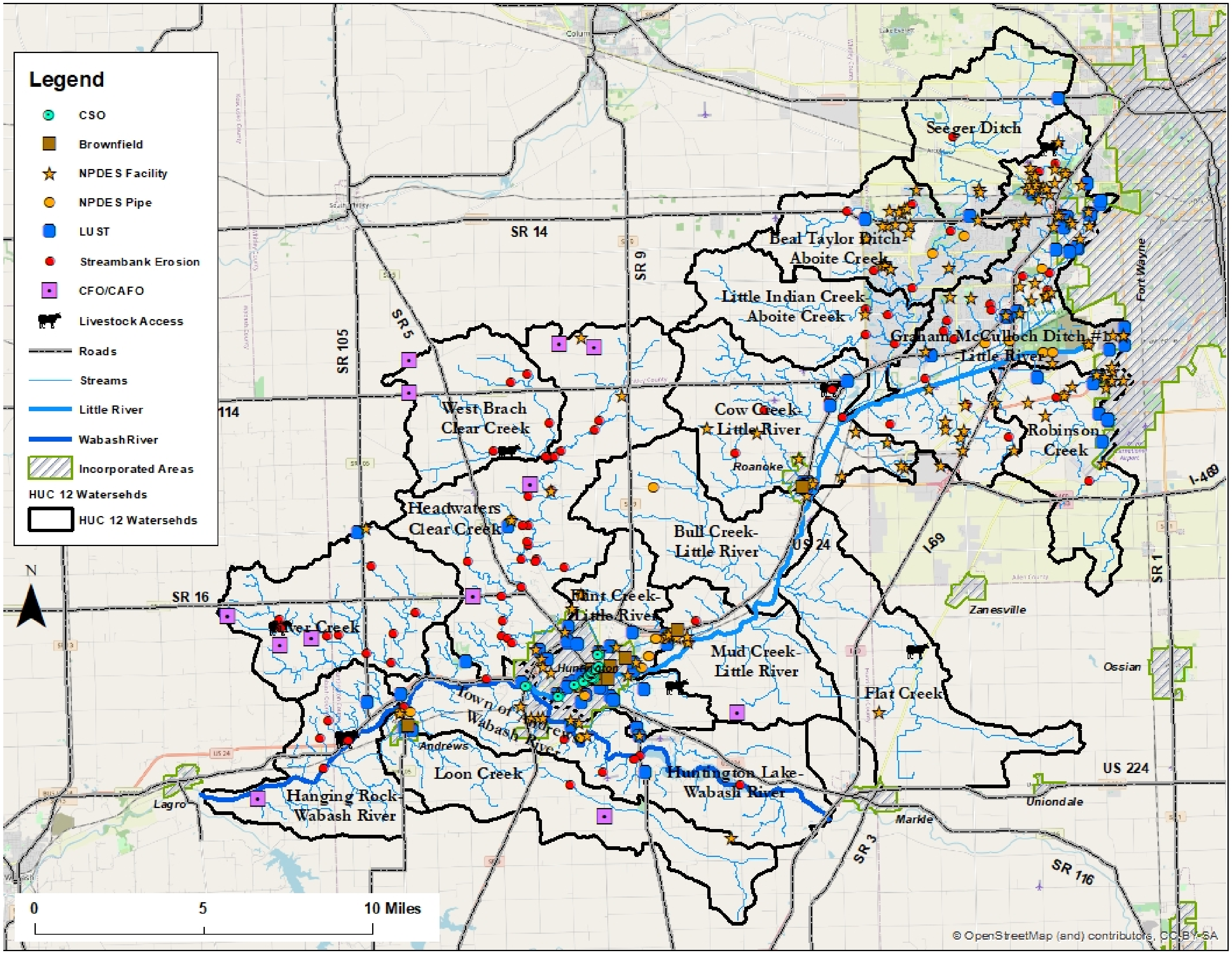


Figure 3-51. Watershed inventory summary map of potential pollution sources (PPS) of the UWRW Phase 3 project area

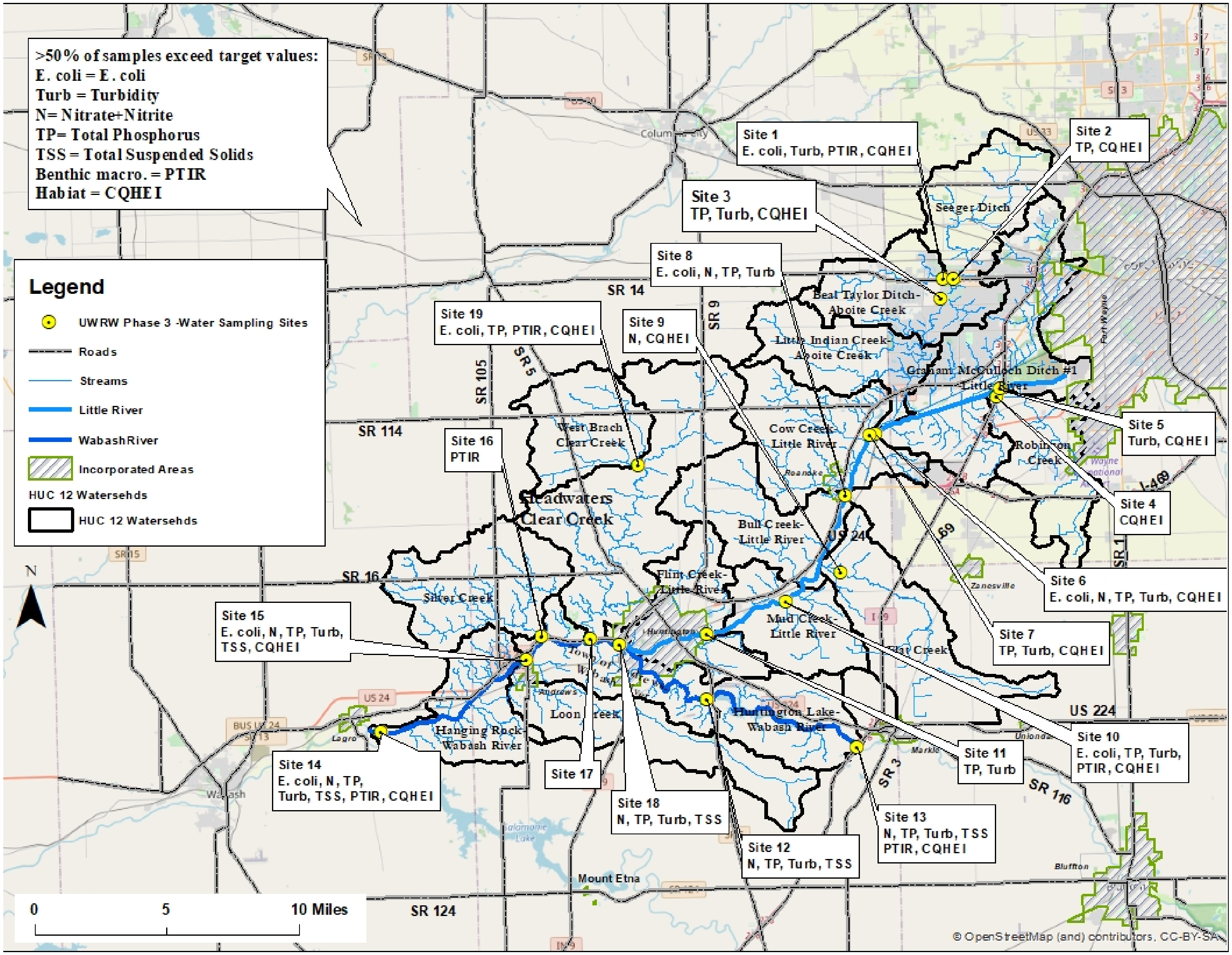


Figure 3-52. Watershed Inventory Summary map of water quality data of the UWRW Phase 3 project area.

Table 3-128. Summary of UWRW Phase 3 Project Area Watershed Inventory Results

Potential Pollution Source (PPS)	# Present
Brownfields	9
CSO	15
NPDES Facility	147
NPDES Pipe	55
LUST	82
CFO	9
CAFO	3
Livestock access	8
Inadequate stream buffer (miles)	254.30
Moderate/Severe streambank erosion (# of sites)	81

Table 3-129. Summary of HUC 12 subwatershed nutrient, sediment, and *E. coli* data for the UWRW Phase 3 Project Area

HUC 12 Subwatershed	Site	Water Body	Average Concentration (% of samples outside of target)				
			Nitrate-Nitrite (mg/L)	Total Phosphorus (mg/L)	TSS (mg/L)	Turbidity (NTU)	*E. coli* (CFU/100mL)
Beal Taylor Ditch-Aboite Creek (051201011002)	1	Beal Taylor Ditch	1.12 (11.11)	0.17 (44.44)	20.33 (22.22)	22.07 (77.78)	589.73 (88.89)
	3	Aboite Creek	1.41 (22.22)	0.09 (66.67)	11.28 (11.11)	13.48 (55.56)	232.24 (44.44)
Cow Creek-Little River (051201011006)	8	Little River	2.50 (55.56)	0.42 (100)	31.90 (33.33)	22.52 (77.78)	941.37 (77.78)
Flat Creek (051201011101)	9	Flat Creek	2.19 (55.56)	0.10 (22.22)	16.88 (22.22)	22.75 (44.44)	122.00 (11.11)
Graham McCulloch Ditch #1-Little River (051201011004)	5	Little River	2.18 (33.33)	0.07 (44.44)	27.00 (22.22)	19.51 (55.56)	82.84 (11.11)
	6	Little River	2.94 (55.56)	0.27 (77.78)	23.17 (22.22)	21.04 (77.78)	1,122.71 (88.89)
Hanging Rock-Wabash River (051201011305)	14	Wabash River	3.68 (66.67)	0.23 (88.89)	76.72 (55.56)	56.37 (88.89)	228.64 (55.56)
Headwaters Clear Creek (051201011202)	17	Clear Creek	2.12 (20.00)	0.06 (40.00)	13.80 (20.00)	21.16 (40.00)	59.84 (0)
Huntington Lake-Wabash River (051201011301)	13	Wabash River	3.42 (66.67)	0.49 (100)	71.14 (66.67)	78.35 (88.89)	267.28 (33.33)
	12	Wabash River	3.91 (77.78)	0.34 (100)	68.18 (66.67)	70.16 (88.89)	243.84 (44.44)
Little Indian Creek-Aboite Creek (051201011005)	7	Aboite Creek	0.97 (11.11)	0.16 (66.67)	19.67 (22.22)	15.85 (55.56)	104.31 (11.11)
Mud Creek-Little River (051201011103)	10	Little River	2.10 (44.44)	0.31 (77.78)	21.50 (33.33)	18.18 (66.67)	410.89 (66.67)
	11	Little River	2.89 (44.44)	0.20 (100)	15.50 (22.22)	14.97 (55.56)	196.98 (33.33)
Robinson Creek (051201011003)	4	Robinson Creek	1.31 (22.22)	0.05 (22.22)	17.89 (11.11)	11.80 (33.33)	124.06 (22.22)
Seegar Ditch (051201011002)	2	Seegar Ditch	1.65 (44.44)	0.11 (55.56)	11.72 (11.11)	17.27 (33.33)	236.96 (44.44)
Silver Creek (051201011302)	16	Silver Creek	0.90 (11.11)	0.05 (22.22)	9.78 (11.11)	7.72 (11.11)	176.06 (22.22)
Town of Andrews-Wabash River (051201011303)	15	Wabash River	3.78 (66.67)	0.26 (100)	57.72 (55.56)	60.54 (88.89)	303.80 (55.56)
	18	Wabash River	3.88 (66.67)	0.27 (88.89)	66.39 (55.56)	60.58 (55.56)	252.49 (33.33)
West Branch Clear Creek (051201011201)	19	West Branch Clear Creek	1.88 (44.44)	0.19 (66.67)	15.46 (11.11)	12.59 (33.33)	207.88 (55.56)
UWRW Phase 3 Project Area	-	-	2.36 (43.71)	0.17 (68.26)	31.79 (30.54)	30.04 (59.88)	316.75 (43.11)

Table 3-130. Watershed Inventory Summary by HUC 12 subwatershed for the UWRW Phase 3 Project Area.

HUC 12 subwatershed	Land use %			Potential Pollution Source (PPS)									
	Agriculture	Developed	Forested	Brownfield	CSO	NPDES Facility	NPDES Pipe	LUST	CFO	CAFO	Livestock access	% Streambank erosion (#)	% Inadequate stream buffer (miles)
Graham McCulloch Ditch #1-Little River	40.86	40.79	13.98	0	0	59	15	21	0	0	1	37 (14)	43.91 (31.65)
Cow Creek-Little River	76.86	8.38	12.94	1	0	10	3	8	0	0	1	30.76 (4)	54.5 (25.84)
Seeger Ditch	74.86	12.89	10.3	0	0	2	0	2	0	0	0	12.5 (1)	67.69 (15.31)
Robinson Creek	77.55	15.29	6.61	0	0	11	1	8	0	0	0	25 (2)	73.92 (17.13)
Little Indian Creek-Aboite Creek	68.1	16.07	14.27	0	0	1	0	0	0	0	0	55.6 (5)	44.00 (12.7)
Beal Taylor Ditch-Aboite Creek	49.74	39.46	9.81	0	0	20	2	1	0	0	0	41 (5)	32.02 (7.9)
Headwaters Clear Creek	76.51	9.3	13.69	0	0	6	1	5	3	1	0	53.66 (22)	38.12 (18.59)
West Branch Clear Creek	86.69	7.06	5.97	0	0	0	0	0	2	0	1	26.31 (5)	80.6 (15.85)
Flat Creek	88.65	6.27	4.81	0	0	1	0	0	0	0	1	0 (0)	79.9 (23.78)
Bull Creek-Little River	82.27	7.02	9.67	0	0	1	1	0	0	0	0	0 (0)	59.71 (14.73)
Mud Creek-Little River	80.42	9.28	9.42	1	0	6	4	0	1	0	0	7.14 (1)	60 (12.55)
Flint Creek-Little River	43.87	45.03	9	6	14	19	21	28	0	0	1	0 (0)	31.05 (5.82)
Silver Creek	80.17	5.7	13.84	0	0	1	0	1	2	1	1	42.86 (9)	44.1 (17.83)
Loon Creek	80.87	6.57	12.07	0	0	1	2	0	0	1	0	8.33 (1)	52.38 (13.05)
Hanging Rock-Wabash River	68.25	6.74	22.54	0	0	0	0	1	1	0	2	16 (4)	29.3 (11.44)
Town of Andrews-Wabash River	52.66	22.15	22.31	1	1	8	5	6	0	0	0	36.84 (7)	22.28 (7.54)
Huntington Lake-Wabash River	49.81	8.34	31.19	0	0	1	0	0	0	0	0	20 (1)	12.28 (2.61)

4 Review of Watershed Problems and Causes

4.1 Analysis of Stakeholder Concerns

A list of watershed concerns was generated by stakeholders and the UWRW Phase 3 steering committee members. The list was reviewed by the UWRW Phase 3 steering committee members and compared to the watershed inventory information to determine which concerns were supported by data. The list of concerns was evaluated to determine whether each was quantifiable, within the scope of the WMP, and whether or not the group would focus on the concern. Additional concerns, problems, causes and sources may be added upon additional analysis of monitoring data or as additional watershed information is obtained.

Table 4-1. Analysis of Stakeholder Concerns

Concern	Supported by Data?	Evidence	Able to Quantify?	Outside of Scope?	Group wants to focus on?
High nitrogen concentration/loading	Yes	43.71% of samples collected exceeded target value. Eight (8) stream segments have nutrient impairments in IDEM 303(d) List of Impaired Waters.	Yes	No	**Yes**
High phosphorus concentration/loading	Yes	68.26% of samples collected exceeded target value. Eight (8) stream segments have nutrient impairment in IDEM 303(d) List of Impaired Waters.	Yes	No	**Yes**
High sediment concentration/loading	Yes	59.88% of samples exceeded the target value for Turbidity. 30.54% of samples exceeded the target value for TSS	Yes	No	**Yes**
High *E. coli* concentration	Yes	43.11% of samples exceeded the target value of ≤ 235 CFU/100mL (single sample). The geometric mean of 138.26 CFU/100mL exceeded the target value of ≤ 125 CFU/100mL (geometric mean) by 10.61%. Twenty (20) stream segments have *E. coli* impairment in IDEM 303(d) List of Impaired Waters.	Yes	No	**Yes**
Lack of agricultural BMP's	Yes	Observed during windshield survey – 254 stream miles lacking buffer (47%), 19% of observations were no-till and 82% of observations had	Yes	No	**Yes**

		a cover crop. Fall 2018 tillage transect data for No-Till; Corn-77.80%; Soybeans-73.29%.			
Streambank erosion	Yes	Observed during windshield survey. 28% (81) of 287 observed sites categorized as 'moderate to severe' erosion. 3% of watershed soils are HEL and 39% are PHEL.	Yes	No	**Yes**
Failing on-site waste systems in rural communities	Yes	Much of the watershed is unsewered and requires on-site waste treatment. 97.53% of soils in the watershed are considered very limited for use of underground septic systems. *E. coli* - 43.11% of samples exceeded the target value of ≤ 235 CFU/100mL (single sample). The geometric mean of 138.26 CFU/100mL exceeded the target value of ≤ 125 CFU/100mL by 10.61%. Total phosphorus target exceeded target in 68.26% of samples. Twenty (20) stream segments have *E. coli* impairment in IDEM 303(d) List of Impaired Waters.	Yes	No	**Yes**
Manure in the watershed	Yes	*E. coli* - 43.11% of samples exceeded the target value of ≤ 235 CFU/100mL (single sample). The geometric mean of 138.26 CFU/100mL exceeded the target value of ≤ 125 CFU/100mL by 10.61%. Total phosphorus target exceeded target in 68.26% of samples. Seventeen (17) stream segments have *E. coli* impairment in IDEM 303(d) List of Impaired Waters. Pollutant concentrations may be partially a result of livestock waste in streams; however, there is a low density of CAFO's (3) and CFO's (9) in the watershed.	Yes	No	No
Livestock access to streams	No	Limited livestock access to streams was observed during the windshield survey (livestock access documented at eight (8) sites)	Yes	No	No
Flooding	No	0% of 103,078 gage height data points characterized as minor flood,	Yes	Yes*	No

		moderate flood, or major flood in the last 10 years (1/1/18 to 1/1/2021) at USGS stream gage 03323500 Wabash River at Huntington, IN.			
Trash and debris throughout the watershed	Yes	Observed during windshield survey and river clean-up events. Trash documented at 27 survey sites. River clean-ups have removed over one ton of debris from the river.	Yes	No	**Yes**
Rural and urban interface opportunities	Yes	While land-use throughout the watershed is primarily agricultural (≈70%), a substantial portion of the watershed is developed land (≈16%)	Yes	No	**No**
Urban development and urbanization	Yes	Approximately 16% of land-use is developed land. Developed land is concentrated around cities of Fort Wayne, IN and Huntington, IN	Yes	No	**Yes**
Low farmer involvement in watershed planning process	Yes	Low attendance of local farmers at steering committee meetings aside from partnering SWCD Supervisors.	Yes	No	**Yes**
Lack of community engagement, understanding of NPS pollution, and knowledge of local water quality issues	Yes	Low attendance at public meetings and field days/workshops.	Yes	No	**Yes**
Lack of recreational opportunities on the river	No	There is ample opportunity for recreation such as swimming, canoeing, kayaking, fishing, and wildlife viewing, as well as river clean-up/float events held by the City of Huntington. Ten (10) public access sites available to the public (see Figure 2-4).	Yes	No	No
Protection of endangered fish, wildlife, and plant species	Yes	Project area includes six (6) species of federally endangered freshwater mussel, as well as the federally endangered Indiana Bat (*Myotis sodalist),* and numerous other plant and animal species listed at the State level. Sedimentation can have major effects on the health of aquatic biota. 59.88% of samples exceeded the target value for Turbidity. 30.54%	Yes	No	**Yes**

		of samples exceeded the target value for TSS.			
Invasive species	Yes	The spread of aquatic invasive species (AIS) such as Asian carp (*Hypophthalmichthys spp.*) and Zebra Mussel (*Dreissena polymorpha*) are well documented in the Wabash River Basin.	Yes	Yes	No

After analysis of the stakeholder concerns list, the UWRW Phase 3 steering committee decided not to focus on several of the concerns. At this time, data relevant to the application of manure within the watershed is not readily available and its contribution to water quality impairments within the watershed cannot be accurately quantified. Additionally, while livestock access to streams was documented at eight sites during the windshield survey, the group does not believe there is enough evidence or occurrences to support livestock access as a significant contributor to water quality degradation within the project area. Flooding is listed as being outside the scope of the watershed management plan and will only be addressed in relation to the effect it has on water quality within the watershed or for BMP's that are intended to improve water quality but also reduce flooding impacts as a secondary benefit. The group also decided not to focus on rural and urban interface opportunities as it does not necessarily reflect a true concern; however, the group did choose to focus on urban development and urbanization and their effects on water quality. There is no evidence to support a lack of recreational opportunities on the rivers within the UWRW Phase 3 project area. In fact, the data indicate ample opportunity to recreate on the rivers such as swimming, canoeing, kayaking, fishing, and wildlife viewing, as well as river clean-up and float events held by the City of Huntington and the presence of 10 public access sites. While the spread of aquatic invasive species (AIS) such as Asian carp *(Hypophthalmichthys spp.)* and the Zebra mussel (*Dreissena polymorpha*) are well documented throughout the Wabash River Basin (USGS (a), IDNR (b)) the group believes the management of these invasive species and the magnitude of their spread is outside of the scope of this project.

4.2 Identified Problems

After review and evaluation of the stakeholder concerns and watershed inventory information, the UWRW Phase 3 steering committee identified problems associated with each concern. The problems were identified, and the concerns related to those problems were grouped together. Table 4-2 reflects the group of concerns that represent the problem(s) or the condition(s) that exists in the watershed.

Table 4-2. Problems identified for the Upper Wabash River Watershed Phase 3 Project Area based on stakeholder concerns

Concern	Problems
High nitrogen concentrations/loads	High nutrient levels Degraded habitat & biodiversity
High phosphorus concentrations/loads	High nutrient levels Degraded habitat & biodiversity
High sediment concentrations/loads	Sedimentation High nutrient levels Degraded habitat & biodiversity
High *E. coli* concentrations	High *E. coli* levels
Lack of agricultural BMP's	Sedimentation High nutrient levels High *E. coli* levels Degraded habitat & biodiversity
Streambank erosion	Sedimentation High nutrient levels Degraded habitat & biodiversity
Failing on-site waste systems	High *E. coli* levels High nutrient levels
Trash and debris	Degraded habitat & biodiversity
Urban development/urbanization	High nutrient levels High *E. coli* levels Degraded habitat & biodiversity
Low farmer involvement in watershed planning process	Sedimentation High nutrient levels High *E. coli* levels Degraded habitat & biodiversity
Lack of community engagement, understanding of NPS pollution, and knowledge of local water quality issues	Sedimentation High nutrient levels High *E. coli* levels Degraded habitat & biodiversity
Protection of endangered fish, wildlife, and plant species	Degraded habitat & biodiversity

4.3 Problems, Potential Causes, and Potential Sources for Water Quality Impairments

The UWRW Phase 3 steering committee evaluated the list of problems that had been identified and developed a list of the potential causes of impairment that keep the streams and rivers in the project area from meeting their designated uses (e.g. aquatic life use, recreational use, and fishable uses). From the list of problems and potential causes, a list of potential sources such as the location or activity that that the pollutant(s) come from, lack of awareness, or loss of a particular land use. The complete list of problems, causes, and potential sources is presented in Table 4-3.

Table 4-3. Problems, potential causes, and potentials sources for the UWRW Phase 3 Project Area.

Problems	Potential Causes	Potential Sources	Magnitude
High nutrient levels	Nutrient levels exceed target	Erosion	81 sites with moderate/severe streambank erosion. 59.88% of samples exceeded the target value for Turbidity. 30.54% of samples exceeded the target value for TSS
		Livestock access to streams	8 sites with livestock access
		Failing septic systems	97.53% of soils rated as “very limited” for septic usage; Failing septic systems listed as potential source in the TMDL
		Improper fertilizer/manure application	16% of watershed is developed – Excessive fertilizer use is a potential problem but no current data is available; Manure application data not currently available
		Lack of agricultural BMP's	Observed during windshield survey – 254 stream miles lacking buffer (47%), 19% of observations were no-till and 82% of observations had a cover crop. Fall 2018 tillage transect data for No-Till; Corn-77.80%; Soybeans-73.29%.
Sedimentation	Sedimentation	Erosion	81 sites with moderate/severe streambank erosion.

			59.88% of samples exceeded the target value for Turbidity. 30.54% of samples exceeded the target value for TSS
	Total Suspended Solids (TSS) and turbidity levels exceed target	Inadequate stream buffers	254 stream miles lacking adequate buffer
		Lack of agricultural BMP's	Observed during windshield survey – 254 stream miles lacking buffer (47%), 19% of observations were no-till and 82% of observations had a cover crop. Fall 2018 tillage transect data for No-Till; Corn-77.80%; Soybeans-73.29%.
High *E. coli* levels	*E. coli* levels exceed target	Livestock access to streams	8 sites with livestock access
		Failing septic systems	97.53% of soils rated as "very limited" for septic usage; Failing septic systems listed as potential source in the TMDL
		Improper fertilizer/ manure application	16% of watershed is developed – Excessive fertilizer use is a potential problem but no current data is available; Manure application data not currently available
		Pet/wildlife waste	No data currently available
Degraded habitat & biodiversity	Sedimentation	Erosion	81 sites with moderate/severe streambank erosion. 59.88% of samples exceeded the target value for Turbidity. 30.54% of samples exceeded the target value for TSS
	Nutrient levels exceed target	Livestock access to streams	8 sites with livestock access
		Failing septic systems	97.53% of soils rated as "very limited" for septic usage; Failing septic systems listed as potential source in the TMDL
		Improper fertilizer/manure application	16% of watershed is developed – Excessive fertilizer use is a potential problem but no current data is

			available; Manure application data not currently available
		Inadequate stream buffers	254 stream miles lacking adequate buffer
		Trash & debris	Trash documented at 27 survey sites

4.4 Current Loads and Reductions

Current pollutant loads, target loads, and load reductions were analyzed for nitrate+nitrite, total phosphorus, and sediment. Current load estimates for each monitoring site were calculated by multiplying the average pollutant concentration, average stream flow measurement, and a conversion factor to transform each concentration measurement into a "load" for that point in time. The estimated target loads were calculated by multiplying average stream flow by the water quality target for each pollutant of concern. Table 4-4 is a reminder of the target concentrations for each of the parameters of concern that were selected by the UWRW Phase 3 steering committee. An explanation of load calculations for each HUC-12 watershed is presented in Table 4-5. For example, the loads of nitrate-nitrite and sediment for the entire UWRW Phase 3 Project area were determined by subtracting the annual load at Site 13, which represents the contribution from the Phase 2 project, from the annual load at Site 14 which is positioned at the outflow of the Phase 3 project area. The total phosphorus load for the UWRW Phase 3 Project area was determined using a slightly modified calculation because the annual total phosphorus load at Site 13 was greater than the load calculated at site 14. This is potentially due to the phosphorous dynamics occurring within the J.E. Roush Lake. Therefore, the overall total phosphorus load for the UWRW Phase 3 project area was determined by subtracting the sum of all target loads from the sum of all current loads for the 13 HUC 12 subwatersheds for which loading data was available. Overall, load estimates were calculated for 13 of the 17 HUC-12 subwatersheds. Table 4-6 through Table 4-8 show the current loads, target loads, and load reductions for nitrate+nitrite, total phosphorus, and sediment at the HUC-12 subwatershed level. Average *E. coli* concentrations and reductions at each sampling location are presented in Table 4-9.

Table 4-4. Target concentrations for parameters of concern

Parameter	Target
Dissolved Oxygen	>4 mg/L and <12 mg/L
Temperature	4.44°C – 29.44°C
Turbidity	≤ 10.4 NTU
Total Suspended Solids	≤ 30 mg/L
E. Coli	≤ 235 CFU/100mL (single sample)
Total Phosphorus	≤ 0.076 mg/L
Nitrate+Nitrite	≤ 2.2 mg/L
QHEI/CQHEI	≥ 60
PTIR	≥ 17
IBI	≥ 35

Table 4-5. Load determination methods for HUC-12 subwatersheds

HUC 12	Load determination
Beal Taylor Ditch-Aboite Creek (051201011002)	= Site 3 – Site 2
Seegar Ditch (051201011002)	Site 2
Robinson Creek (051201011003)	Site 4
Graham McCulloch Ditch #1-Little River (051201011004)	= Site 6 – Site 4
Little Indian Creek-Aboite Creek (051201011005)	= Site 7 – Site 3
Cow Creek-Little River (51201011006)	= Site 8 – (Site 6 & Site 7)
Flat Creek (051201011101)	Site 9
Mud Creek-Little River (051201011103)	= Site 11 – Site 10
Huntington Lake-Wabash River (051201011301)	= Site 12 – Site 13
Silver Creek (051201011302)	Site 16
Headwaters Clear Creek (051201011202)	= Site 17 – Site 19
Flint Creek- Little River (051201011104)	= Site 18 – (Site 11 & Site 12)
West Branch Clear Creek (051201011201)	= Site 19
***UWRW Phase 3 Project Area**	= Site 14 – Site 13

*UWRW Phase 3 Area loads for nitrate-nitrite and sediment were determined by subtracting loads at Site 13 from loads at Site 14. Total Phosphorus load for the UWRW Phase 3 Project areas was calculated by subtracting the sum of all target loads from the sum of all current loads for the 13 HUC 12 subwatersheds for which loading data was available

Table 4-6. Current Nitrate-Nitrite Loads, Target loads, and Reduction to meet target load

HUC 12	Nitrate-Nitrite Loads (tons/year)		
	Current	Target	Reduction
Beal Taylor Ditch-Aboite Creek (051201011002)	36.54	29.97	**6.56**
Seegar Ditch (051201011002)	6.00	6.21	-
Robinson Creek (051201011003)	5.67	11.95	-
Graham McCulloch Ditch #1-Little River (051201011004)	87.91	64.28	**23.63**
Little Indian Creek-Aboite Creek (051201011005)	24.40	56.92	-
***Cow Creek-Little River (51201011006)**	25.03	163.60	-
Flat Creek (051201011101)	18.24	18.28	-
Mud Creek-Little River (051201011103)	172.35	72.98	**99.37**
Huntington Lake-Wabash River (051201011301)	2,798.19	1,046.19	**1,752.00**
Silver Creek (051201011302)	21.35	52.45	-
Headwaters Clear Creek (051201011202)	33.43	33.97	-
Flint Creek- Little River (051201011104)	475.49	582.75	-
West Branch Clear Creek (051201011201	7.16	8.23	-
UWRW Phase 3 Project Area	495.02	198.67	**296.35**

Table 4-7. Current Total Phosphorus Loads, Target loads, and Reduction to meet target load

HUC 12	Total Phosphorus Loads (tons/year)		
	Current	Target	Reduction
Beal Taylor Ditch-Aboite Creek (051201011002)	1.10	1.04	**0.07**
Seegar Ditch (051201011002)	0.22	0.21	**0.01**
Robinson Creek (051201011003)	0.32	0.41	-
Graham McCulloch Ditch #1-Little River (051201011004)	7.39	2.22	**5.17**
Little Indian Creek-Aboite Creek (051201011005)	10.00	1.97	**8.03**
Cow Creek-Little River (51201011006)	12.35	5.65	**6.69**
Flat Creek (051201011101)	0.87	0.63	**0.24**
Mud Creek-Little River (051201011103)	-11.99	2.52	-
Huntington Lake-Wabash River (051201011301)	54.46	36.14	**18.32**
Silver Creek (051201011302)	1.11	1.81	-
Headwaters Clear Creek (051201011202)	0.53	1.17	-
Flint Creek- Little River (051201011104)	26.97	20.13	**6.84**
West Branch Clear Creek (051201011201	0.70	0.28	**0.41**
***UWRW Phase 3 Project Area**	104.03	74.18	**29.85**

* Total Phosphorus load for the UWRW Phase 3 Project areas was calculated by subtracting the sum of all target loads from the sum of all current loads for the 13 HUC 12 subwatersheds for which loading data was available

Table 4-8. Current Sediment (TSS) Loads, Target loads, and Reduction to meet target load.

HUC 12	Sediment Loads (tons/year)		
	Current	Target	Reduction
Beal Taylor Ditch-Aboite Creek (051201011002)	149.06	408.70	-
Seegar Ditch (051201011002)	24.90	84.75	-
Robinson Creek (051201011003)	102.81	162.96	-
Graham McCulloch Ditch #1-Little River (051201011004)	712.93	876.51	-
Little Indian Creek-Aboite Creek (051201011005)	393.92	776.23	-
Cow Creek-Little River (51201011006)	988.65	2,230.97	-
Flat Creek (051201011101)	140.28	249.30	-
Mud Creek-Little River (051201011103)	663.75	995.22	-
Huntington Lake-Wabash River (051201011301)	42,435.07	14,266.17	**28,168.90**
Silver Creek (051201011302)	233.13	715.29	-
Headwaters Clear Creek (051201011202)	206.62	463.20	-
Flint Creek- Little River (051201011104)	9,522.95	7,946.56	**1,576.39**
West Branch Clear Creek (051201011201	58.09	112.25	-
UWRW Phase 3 Project Area	10,451.86	2,709.14	**7,742.72**

Table 4-9. Average *E. Coli* concentrations (CFU/100mL)

HUC 12 Subwatersehd	Site	Water Body	*E. coli* (CFU/100mL)		
			Average	% of samples exceeding 235 CFU/100mL	*Reduction (%)
Beal Taylor Ditch-Aboite Creek (051201011002)	1	Beal Taylor Ditch	589.73	88.89	**60.15**
	3	Aboite Creek	232.24	44.44	-
Cow Creek-Little River (051201011006)	8	Little River	941.37	77.78	**75.04**
Flat Creek (051201011101)	9	Flat Creek	122	11.11	-
Graham McCulloch Ditch #1-Little River (051201011004)	5	Little River	82.84	11.11	-
	6	Little River	1,122.71	88.89	**79.07**
Hanging Rock-Wabash River (051201011305)	14	Wabash River	228.64	55.56	-
Headwaters Clear Creek (051201011202)	17	Clear Creek	59.84	0	-
Huntington Lake-Wabash River (051201011301)	13	Wabash River	267.28	33.33	**12.08**
	12	Wabash River	243.84	44.44	**3.63**
Little Indian Creek-Aboite Creek (051201011005)	7	Aboite Creek	104.31	11.11	-
Mud Creek-Little River (051201011103)	10	Little River	410.89	66.67	**42.81**
	11	Little River	196.98	33.33	-
Robinson Creek (051201011003)	4	Robinson Creek	124.06	22.22	-
Seegar Ditch (051201011002)	2	Seegar Ditch	236.96	44.44	**0.83**
Silver Creek (051201011302)	16	Silver Creek	176.06	22.22	-
Town of Andrews-Wabash River (051201011303)	15	Wabash River	303.8	55.56	**22.65**
	18	Wabash River	252.49	33.33	**6.93**
West Branch Clear Creek (051201011201)	19	West Branch Clear Creek	207.88	55.56	-
UWRW Phase 3 Project Area	-	-	316.75	43.11	**25.81**

*Reduction (%) determined by calculating the percent reduction needed for the mean to meet the *E. coli* target value of ≤235 CFU/100mL

5 Water Quality Goals and Critical Areas

5.1 Water Quality Goals and Indicators

Nutrient, Sediment, and *E. coli* Goal Statement

Excess nutrients, sediment, and *E. coli* can severely impact the health of our rivers and streams Current loads and average concentrations of these parameters exceed target values and support the stakeholder concerns of excess nutrients, sediment, and *E.coli* in the UWRW Phase 3 project area.

- **Nitrate-Nitrite Long-term Goal:** Reduce nitrate+nitrite loading by 59.87% from 495.02 tons/year to 198.67 tons/year; a reduction of 296.35 tons/year; and reduce average annual concentrations by 6.80% from 2.36 mg/L to 2.2 mg/L in the UWRW Phase 3 project area by 2050 to meet water quality targets.

- **Nitrate-Nitrite Scaled Goals:**
  Reduce nitrate+nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030. Reduce nitrate+nitrite loading by an additional 19.96% (98.78 tons/year) from 396.24 tons/year to 297.45 tons/year by 2040. Reduce nitrate+nitrite loading by an additional 19.96% (98.78 tons/year) from 297.45 tons/year to the target load of 198.67 tons/year by 2050.

- **Total Phosphorus Long-term Goal:** Reduce total phosphorus loading by 28.69% from 104.03 tons/year to 74.18 tons/year; a reduction of 29.85 tons/year; and reduce average annual concentrations by 55.29% from 0.17 mg/L to 0.076 mg/L in the UWRW Phase 3 project area by 2050 to meet water quality targets.

- **Total Phosphorus Scaled Goals:**
  Reduce total phosphorus loading by 9.56%% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030. Reduce total phosphorus loading by an additional 9.56% (9.95 tons/year) from 94.08 tons/year to 84.13 tons/year by 2040. Reduce total phosphorus loading by an additional 9.56% (9.95 tons/year) from 84.13 tons/year to the target load of 74.18 tons/year by 2050.

- **Total Suspended Solids (TSS) Long-term Goal:**
  Reduce TSS loading by 74.08% from 10,451.86 tons/year to 2,709.14 tons/year; a reduction of 7,742.72 tons/year; and reduce average annual concentrations by 5.63% from 31.79 mg/L to 30 mg/L in the UWRW Phase 3 project area by 2050 to meet water quality targets.

- **Total Suspended Solids (TSS) Scaled Goals:**
  Reduce TSS loading by 24.69% (2,580.91 tons/year) from 10,451.86 tons/year to 7,870.95 tons/year by 2030. Reduce TSS loading by an additional 24.69% (2,580.91 tons/year) from 7,870.95 tons/year to 5,290.05 tons/year by 2040. Reduce TSS loading by an additional 24.69% (2,580.91 tons/year) from 5,290.05 tons/year to the target load of 2,709.14 tons/year by 2050.

- ***E. coli* Goal:** The goal of this project is to reduce average annual *E.coli* concentrations in water samples by 25.81% from 316.75 CFU/100mL to the target value of 235 CFU/100mL by 2050.

- ***E. coli* Scaled Goals:** Reduced average annual *E. coli* concentration by 8.60% from 316.75 CFU/100mL to 289.51 CFU/100mL by 2030. Reduce average annual *E. coli* concentration by an additional 8.60% from 289.51 CFU/100mL to 262.27 CFU/100mL by 2040. Reduce average annual *E. coli* concentration by an additional 8.60% from 262.27 CFU/100mL to meet the target value of 235 CFU/100mL by 2050.

<u>Goal Indicators</u>
Water quality monitoring data will be used as the primary indicator to track progress towards attaining these goals. Other indicators include tracking best management practices implemented in the project area and using models to estimate load reductions.

<u>Steam Habitat and Biology Goal Statement</u>
Biological and stream habitat assessments conducted during the development of this WMP indicated impaired benthic macroinvertebrate communities and habitat conditions at several locations throughout the UWRW Phase 3 project area. The UWRW Phase 3 steering committee strives to improve health and function of our river and stream ecosystems.

Stream Habitat and Biology Long-term Goal: Improve IBI and QHEI scores in all tributaries and mainstem sites to at least the target levels of 35 and 60, respectively, by 2050 to meet water quality targets.

Stream Habitat and Biology Scaled Goals: Improve IBI and QHEI scores to a minimum of 25 and 50, respectively, by 2030. Improve IBI and QHEI scores to a minimum of 30 and 55, respectively, by 2040. Improve IBI and QHEI scores to a minimum of 35 and 60, respectively, by 2050.

<u>Goal Indicators</u>
Annual biological and habitat monitoring will be conducted at the nineteen water quality monitoring sites established during the development of this WMP.

Education and Outreach Goal Statement

The steering committee expressed several concerns relevant to community awareness of NPS pollution. Of specific concern, was the lack of community involvement in environmental activities that benefit the health of the watershed. Awareness and education are needed with respect to common water quality issues and the variety of best management practices available to landowners.

Education and Outreach Long-term Goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality improvement by 3,000 people by 2050. Increase community awareness of water quality issues specifically related to nutrient, sediment and bacterial loading and the effects on aquatic habitats. Increase stakeholder participation in conservation programs that put best management practices on the ground.

Education and Outreach short-term Goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality by 1,000 people by 2030.

Goal Indicators

Participation in water quality program activities, river and stream clean-ups, and workshops and field days will be tracked. Participation in conservation cost-share programs will also be tracked. Social indicator data will be collected from stakeholder surveys to document changes in awareness, attitudes and behavior related to water quality improvements.

5.2 Critical Areas

One of the most crucial steps in watershed management planning is defining critical areas within the watershed so that implementation money and efforts can be focused on areas where water quality will benefit the most. The U.S. EPA has defined critical areas as those, "experiencing the most or worst problems and impairments" (U.S. EPA 2008) and "where management practices are needed" (U.S. EPA 2013b), and "producing disproportionately high pollutant loads" (U.S. EPA 2013a). The critical area ranking for all HUC 12 subwatersheds within the UWRW Phase 3 project area was based on a holistic scoring system which included an analysis of chemical, biological, and physical data collected through the water quality monitoring program, as well as data obtained from desktop and windshield surveys. A point system was developed to rank each HUC 12 subwatershed within the project area using the following criteria:

Nutrient & Sediment Analysis:
Highest reduction for parameter of concern – 5 Points
Second highest reduction – 4 Points
Third highest reduction – 3 Points

Bacteria Analysis:
Highest reduction of *E. coli* – 5 Points
Second highest reduction – 4 Points
Third highest reduction – 3 Points

Biological Analysis:
IBI (As opposed to the nutrient & sediment analysis, a high IBI score is good)
Lowest IBI – 5 Points
Second lowest IBI – 4 Points
Third lowest IBI – 3 Points

Habitat Analysis:
QHEI (As opposed to the nutrient & sediment analysis, a high QHEI score is good)
Lowest QHEI – 5 Points
Second lowest QHEI – 4 Points
Third lowest QHEI - 3 Points

Potential Pollution Source (PPS) Analysis:
Highest number of PPS – 5 Points
Second highest number of PPS – 4 Points
Third highest number of PPS – 3 Points

Inadequate Riparian Buffer Analysis:
Highest number of stream miles lacking buffer– 5 Points
Second highest number of stream miles lacking buffer – 4 Points
Third highest number of stream miles lacking buffer – 3 Points

IDEM 303(d) List of Impaired Waters:
Highest number of listed stream miles– 5 Points
Second highest number of listed stream miles– 4 Points
Third highest number of listed stream miles– 3 Points

Primary critical areas are subwatersheds with scores of ≥10 points and secondary critical areas have scores ranging from 5-9 points. Subwatersheds with 4 points or less are considered noncritical. This is a relative ranking process and only ranks the subwatersheds in comparison to each other and is not indicative of overall stream health. The critical area ranking results for each HUC 12 subwatershed are shown in Table 5-1 and Figure 5-1.

Table 5-1. Critical Area ranking scores for HUC 12 subwatersheds of the UWRW Phase 3 project area

HUC 12 Watershed	Nitrate+Nitrite	Total Phosphorus	TSS	*E. coli*	CQHEI	PTIR	PPS	Stream Buffer	Impaired Streams	Total Score
Graham McColloch Ditch#1-Little River (051201011004)	3			5	5		5	5		23
Huntington Lake-Wabash River (051201011301)	5	5	5			3				18
Flint Creek-Little River (051201011104)		3	4		3		4			14
Mud Creek-Little River (051201011103)	4				4	5				13
Cow Creek-Little River (051201011006)				4				4	5	13
Little Indian Creek-Aboite Creek (051201011005)		4							4	8
West Branch Clear Creek (051201011201)			3			5				8
Beal Taylor Ditch-Aboite Creek (051201011002)				3		4				7
Robinson Creek (051201011003)					5					5
Hanging Rock-Wabash River (051201011305)						4				4
Flat Creek (051201011101)								3		3
Head Waters Clear Creek (051201011202)							3			3
Town of Andrews-Wabash River (051201011303)									3	3
Seegar Ditch (051201011001)										0
Bull Creek-Little River (051201011102)										0
Silver Creek (051201011302)										0
Loon Creek (051201011304)										0

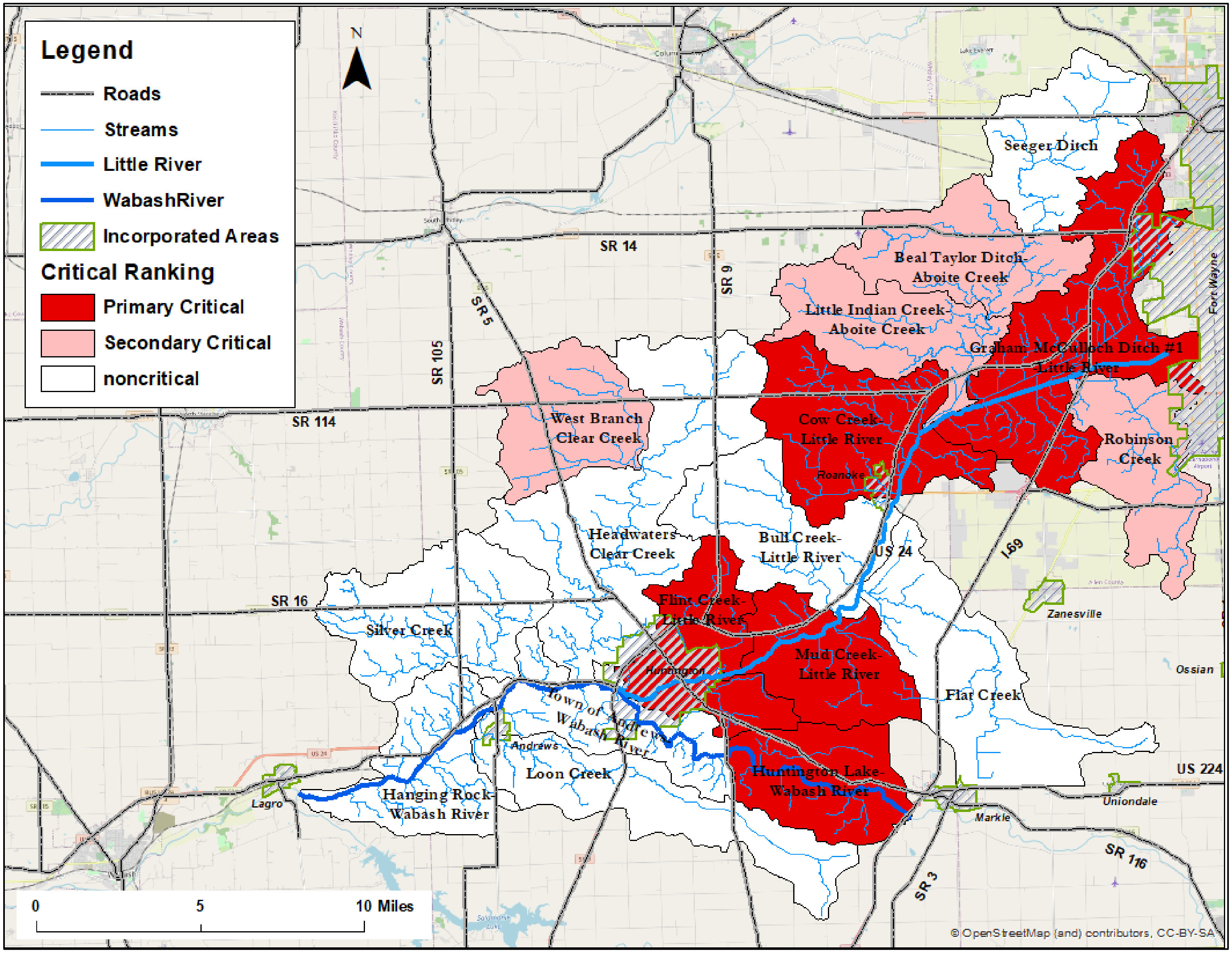


Figure 5-1. Primary and secondary critical areas of the UWRW Phase 3 WMP project area.

Five (5) subwatersheds were ranked as primary critical subwatersheds, including: Graham McColloch Ditch#1-Little River (051201011004), Huntington Lake-Wabash River (051201011301), Flint Creek-Little River (051201011104), Mud Creek-Little River (051201011103), Cow Creek-Little River (05120101100. Additionally, four (4) subwatersheds were ranked as secondary critical subwatersheds, including: Little Indian Creek-Aboite Creek (051201011005), West Branch Clear Creek (051201011201), Beal Taylor Ditch-Aboite Creek (051201011002), Robinson Creek (051201011003). The remaining eight (8) subwatersheds were categorized as noncritical. A description of the primary and secondary critical area rankings is presented in Table 5-2.

Table 5-2. Primary and secondary critical subwatersheds of the UWRW Phase 3 project area

HUC 12 Watershed	Critical/Secondary Critical	Parameter(s) of concern
Graham McColloch Ditch#1-Little River (051201011004)	**Critical**	**Nitrogen; *E. coli*; Habitat; PPS; Stream Buffers**
Huntington Lake-Wabash River (051201011301)	**Critical**	**Nitrogen; Phosphorus; TSS; Biological community**
Flint Creek-Little River (051201011104)	**Critical**	**Phosphorus; TSS; Habitat; PSS**
Mud Creek-Little River (051201011103)	**Critical**	**Nitrogen; Habitat; Biological community**
Cow Creek-Little River (051201011006)	**Critical**	***E coli*; Stream buffer; Impaired streams**
Little Indian Creek-Aboite Creek (051201011005)	**Secondary Critical**	**Phosphorus; Impaired streams**
West Branch Clear Creek (051201011201)	**Secondary Critical**	**TSS; Biological community**
Beal Taylor Ditch-Aboite Creek (051201011002)	**Secondary Critical**	***E coli*; Biological community**
Robinson Creek (051201011003)	**Secondary Critical**	**Habitat**

6 Implementation Strategies

Developing and implementing programs and practices in the UWRW Phase 3 project area is the primary objective to achieve the plan's goals; however, resources, manpower, and equipment are all limiting factors. For the watershed management plan to be successful, costs associated with meeting the objectives must be considered. Additionally, project partners will prove to be valuable during implementation efforts through leveraging of funds and technical support. Measurements of success are also necessary, as they provide a way to evaluate progress towards each goal. These items have been incorporated into the action register (Table 6-3 to 6-7) that provides the details of the tasks that need to be accomplished to meet the objectives and goals established in this watershed management plan.

6.1 Objectives to Reach Goals

The UWRW Phase 3 steering committee and stakeholders have identified the following objectives:

- Implement the UWRW Phase 3 WMP
- Develop and implement both agricultural-based and urban-based education outreach programs
- Develop and implement an agricultural and urban cost-share program for implementing BMPs.
- Develop and analyze a social indicator survey study for agricultural producers and urban landowners
- Develop and conduct a water quality sampling program

Indicators for water quality improvement such as water sampling data, habitat and biological assessments, and pollutant load modeling will be used to evaluate progress and aid in the review of the effectiveness of the selected objectives. Social data will also be used to help track progress towards the goals and objectives.

6.2 Best Management Practices and Estimated Load Reductions

A variety of best management practices (BMPs) are available for on-the-ground implementation. Many of these practices result in the reduction of nutrients, sediment, and *E. coli*, and can result in improvement of stream habitat and biology. A list of BMPs developed by the Steering Committee was reviewed and the practices were evaluated for their effectiveness in reducing pollutant loads.

The Steering Committee members, with technical assistance from NRCS and ISDA staff, identified a list of agricultural and urban BMPs which could be used to achieve the water quality goals described in Section 5.1. Consideration was given to practices that are easily adopted or expanded. This list does not include all practices that could be beneficial but is a starting point for developing future implementation programs. While the majority of land use within the project area is agricultural, there are significant areas of urban and suburban land use concentrated around the City of Huntington and west of the City of Fort Wayne where water quality impacts must be addressed. Additional practices or alternative technologies may be both possible and necessary to reach the water quality goals. The selected BMPs are listed below. Practice implementation costs are based on NRCS Conservation Activity Plan and Technical Service Provider payment rates (NRCS (b)).

<u>List of Agricultural & Urban BMP's</u>

- Residue and Tillage Management - No Till/ Reduced Till/Strip Till
- Cover Crops
- Critical Area Planting
- Riparian Herbaceous Cover
- Riparian Forested Buffer
- Filter Strip
- Grade Stabilization Structure
- Grassed Waterway (with Erosion Control Blanket)
- Pasture & Hay Planting
- Drainage Water Management
- Open Channel (2-Stage Ditch)
- Structure for Water Control
- Nutrient Management
- Waste & Sediment Control Basin
- Equipment Modification (Conservation Tillage, Cover Crops, and /or Precision Nutrient Application)
- Wetland Creation, Enhancement, and Restoration
- Rain Garden
- Rain Barrel
- Porous (pervious) Pavement
- Grass Swale
- Phosphorus-free Fertilizer

The list of BMPs was compared and assigned to the critical land use areas for each pollutant of concern based on the benefit provided by the practice. The Region 5 Model was used to estimate pollutant load reduction for nitrogen, phosphorus, and sediment based on the implementation of a single BMP or standard areal unit. In some instances, data is not available to estimate load reductions for the BMP or management measure. It is important to understand that these are only estimates for BMP effectiveness and that results will vary by location within the subwatersheds of the project area and does not account for potential synergistic effects resulting from the implementation of multiple BMPs at a single location. Table 6-3 displays the selected BMPs and their estimated pollutant load reductions.

Table 6-1. Selected BMPs for UWRW Phase 3 Critical Areas with Expected Pollutant Load Reductions

Critical Area	BMP	Estimated Load Reduction		
		Nitrogen (lbs/year)	**Phosphorus (lbs/year)**	**Sediment (tons/year)**
Critical Area for Nutrients (Nitrogen and/or Phosphorus) Primary Critical Areas Graham McCulloch Ditch #1 Huntington Lake-Wabash River Flint Creek-Little River Mud Creek-Little River Secondary Critical Areas Little Indian Creek-Aboite Creek	Cover Crops (1 acre)	4	2	2
	Drainage Water Management (1 acre)	0.5	1.4	7.9
	Equipment Modification	N/A	N/A	N/A
	Filter Strip (1 acre contributing area)	5	2	2
	Grassed Waterways (W: 10ft, D: 1ft; L: 500ft)	72.7	36.3	42.8
	Residue and Tillage Management - No Till/ Reduced Till (1 acre)	6	3	3
	Nutrient Management (1acre)	NA	N/A	NA
	Pasture & Hay Planting	5	2	2
	Riparian Forest Buffer (1 acre contributing/planted)	2	1	1
	Riparian Herbaceous Cover (1 acre contributing/planted)	5	1	2
	Two-Stage Ditch (L: 500 ft., H: 10 ft., LRR: 0.3)	114.8	57.4	57.4
	Waste and Sediment Control Basin (100 cu. ft.)	1.5	0.8	0.9
	Wetland Creation, Enhancement & Restoration (1-acre drainage area)	4	2	2
Critical Areas for Sediment Primary Critical Areas Huntington Lake-Wabash River Flint Creek-Little River Secondary Critical Areas West Branch Clear Creek	Critical Area Planting (1-acre)	5	2	2
	Cover Crops	4	2	2
	Equipment Modification	N/A	N/A	N/A
	Filter Strip (1 acre contributing area)	5	2	2
	Grade Stabilization Structure (W: 10ft, D: 1ft; L: 500ft)	72.7	36.3	42.8
	Grassed Waterways (W: 10ft, D: 1ft; L: 500ft)	72.7	36.3	42.8
	Residue and Tillage Management - No Till/ Reduced Till (1 acre)	6	3	3
	Pasture & Hay Planting	5	2	2
	Prescribed Grazing	4	2	2
	Riparian Forest Buffer (1-acre contributing/planted)	2	1	1
	Riparian Herbaceous Cover (1 acre contributing/planted)	5	2	2
	Two-Stage Ditch (L: 500 ft., H: 10 ft., LRR: 0.3)	114.8	57.4	57.4
	Water and Sediment Control Basin (100 cu. ft.)	1.5	0.8	0.9
	Wetland Creation, Enhancement & Restoration (1-acre drainage area)	4	2	2

Critical Areas for *E. coli* Primary Critical Areas Graham McCulloch Ditch #1 Cow Creek-Little River Secondary Critical Areas Beal Taylor Ditch-Aboite Creek	Equipment Modification	N/A	N/A	N/A
	Water and Sediment Control Basin (100 cu. ft.)	1.5	0.8	0.9
Critical Areas for Habitat and/or Biology Primary Critical Areas Graham McCulloch Ditch #1 Huntington Lake-Wabash River Flint Creek-Little River Mud Creek-Little River Secondary Critical Areas West Branch Clear Creek Beal Taylor Ditch-Aboite Creek Robinson Creek	Critical Area Planting (1 acre)	5	2	2
	Filter Strip (1 acre contributing area)	5	2	2
	Riparian Forest Buffer (1-acre contributing/planted)	2	1	1
	Riparian Herbaceous Cover (1 acre contributing/planted)	5	1	2
	Wetland Creation, Enhancement & Restoration (1-acre drainage area)	4	2	2
Critical Areas with urban/suburban land use Primary Critical Areas Graham McCulloch Ditch #1 Flint Creek-Little River Secondary Critical Areas Beal Taylor Ditch-Aboite Creek Little Indian Creek-Aboite Creek	Rain Garden	12.6	1.8	1.4
	Rain Barrel	0.8	0.2	0.2
	Porous (pervious) Pavement	N/A	N/A	N/A
	Grass Swale (1 acre)	14.9	3.3	1.4
	Phosphorus-free Fertilizer	0	2	0

6.3 Action Register and Schedule

The UWRW Phase 3 Steering Committee developed action registers (Table 6-3 to Table 6-7) to guide the implementation of the watershed management plan and aide in accomplishing the plan's goals. A series of objectives was developed (Section 6.1) and each objective was broken into smaller milestones to accomplish within a specific timeframe in order to track progress toward achieving the overarching project goals. A series of action registers are presented below outlining the specific management measures that will need to be executed in order achieve the goals outlined in this watershed management plan, as well as the estimated costs of the measures and potential partners for each objective. Project partners are those which provide financial assistance in the form of cash match or in-kind match and will be involved in the implementation and guidance of the WMP objectives such as partnering SWCD's, whereas technical assistants provide expertise in work such as the design and implementation of BMPs, for instance NRCS District Offices. Each action register is linked to specific objective(s) from Section 6.1 and the 10-year project goals presented in Section 5.1

Table 6-2. UWRW Phase 3 WMP Action Register

<table>
<tr><th colspan="6">UWRW Phase 3 WMP Action Register</th></tr>
<tr><td colspan="6">Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
Total Phosphorus 10-year goal: Reduce total phosphorus loading by 9.56% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030.
Total Suspended Solids (TSS) 10-year goal: Reduce TSS loading by 24.69% (2,580.91 tons/year) from 10,451.86 tons/year to 7,870.95 tons/year by 2030.
E. coli 10-year goal: Reduced average annual E. coli concentration by 8.60% from 316.75 CFU/100mL to 289.51 CFU/100mL by 2030.
Stream Habitat and Biology 10-year goal: Improve IBI and QHEI scores to a minimum of 25 and 50, respectively, by 2030
Education & Outreach 10-year goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality by 200 people by 2030.</td></tr>
<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Cost</th><th>Partners (P)/ Technical Assistance (TA)</th></tr>
<tr><td rowspan="4">Implement the UWRW Phase 3 WMP</td><td rowspan="4">UWRW Phase 3 Stakeholder and Public</td><td rowspan="4">Within 3 years of WMP approval then ongoing</td><td>Hire Watershed Coordinator to implement the WMP (6 months)</td><td>$45,000/year</td><td rowspan="4">Allen, Huntington, Wabash, Wells, Whitley County SWCD (P) and NRCS, IDEM, IDNR, USACE (TA)</td></tr>
<tr><td>Secure funding to implement WMP including any office overhead and salaries (6 months)</td><td>$3,000</td></tr>
<tr><td>Secure funding to promote education & outreach programs (6 months)</td><td>***</td></tr>
<tr><td>Secure funding to begin water quality sampling efforts (3 years)</td><td>***</td></tr>
</table>

***Cost included in salary

Table 6-3. Education & Outreach Action Register

Education & Outreach Action Register					
Education & Outreach 10-year goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality by 200 people by 2030.					
Objective	**Target Audience**	**Implementation Timeframe**	**Milestone**	**Cost**	**Partners (P)/ Technical Assistance (TA)**
Develop and Implement an Agriculture-based Education and Outreach program	UWRW Phase 3 Agricultural Producers	Within 2 years of WMP approval then ongoing	Develop outreach plan (6 months)	***	Allen, Huntington, Wabash, Wells, Whitley County SWCD and NRCS (P/TA), Purdue Extension (P), TNC (P), CCSI (P)
			Distribute agriculture-based brochure (1 year)	$1,000	
			Distribute agriculture-based newsletters (6 months)	$1,000	
			Hold annual workshops/field days focused on BMPs (12 months)	$1,000/year	
Develop and Implement an Urban-based Education & Outreach Program	UWRW Phase 3 Urban Landowners	Within 2 years of WMP approval then ongoing	Develop outreach plan (6 months)	***	Allen, Huntington, Wabash, Wells, Whitley County SWCD and NRCS (P/TA), Purdue Extension (P), TNC (P), CCSI (P), USACE (P), Cities of Fort Wayne & Huntington (P)
			Distribute urban-based brochure (1 year)	$1,000	
			Distribute urban -based newsletters (6 months)	$1,000	
			Distribute septic system brochure (1 year)	$1,000	
			Hold annual septic system workshop (1 year)	$1,000/year	
			Hold annual public river event (1 year)	$2,000/year	

***Cost included in salary

Table 6-4. Cost-Share Program Action Register

<table>
<tr><th colspan="6">Agricultural Cost-Share Program Action Register</th></tr>
<tr><td colspan="6">Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
Total Phosphorus 10-year goal: Reduce total phosphorus loading by 9.56% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030.
Total Suspended Solids (TSS) 10-year goal: Reduce TSS loading by 24.69% (2,580.91 tons/year) from 10,451.86 tons/year to 7,870.95 tons/year by 2030.
E. coli 10-year goal: Reduced average annual E. coli concentration by 8.60% from 316.75 CFU/100mL to 289.51 CFU/100mL by 2030.
Stream Habitat and Biology 10-year goal: Improve IBI and QHEI scores to a minimum of 25 and 50, respectively, by 2030
Education & Outreach 10-year goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality by 200 people by 2030.</td></tr>
<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Cost</th><th>Partners (P)/ Technical Assistance (TA)</th></tr>
<tr><td rowspan="3">Develop & Promote Agricultural & Urban Cost-Share Program</td><td rowspan="3">UWRW Phase 3 Agricultural Producers & Urban Landowners</td><td rowspan="3">Within 18 months of WMP approval</td><td>Secure funding to implement agricultural & urban cost-share program (12 months)</td><td>***</td><td rowspan="3">Allen, Huntington, Wabash, Wells, Whitley County SWCD and NRCS (P/TA), Purdue Extension (P), TNC (P), CCSI (P), IDEM (P/TA), IDNR (P/TA), USACE (P)</td></tr>
<tr><td>Develop agricultural & urban cost-share program (6 months)</td><td>***</td></tr>
<tr><td>Distribute agricultural & urban cost-share brochure (6 months)</td><td>$1,000/ year</td></tr>
</table>

***Cost included in salary

Table 6-5. Milestones for Indicators of Reaching WMP Goals Action Register

<table>
<tr><th colspan="6">Milestones for Indicators of Reaching WMP Goals</th></tr>
<tr><td colspan="6">Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
Total Phosphorus 10-year goal: Reduce total phosphorus loading by 9.56% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030.
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<tr><th>Objective</th><th>Target Audience</th><th>Implementation Timeframe</th><th>Milestone</th><th>Cost</th><th>Partners (P)/ Technical Assistance (TA)</th></tr>
<tr><td rowspan="3">Develop, Disseminate, and Analyze Social Indicator Survey for Agricultural Producers & Urban Landowners</td><td rowspan="3">UWRW Phase 3 agricultural producers & urban landowners</td><td rowspan="3">Within 6 years of WMP approval</td><td>Social indicator survey (5 years)</td><td rowspan="2">$1,000</td><td rowspan="3">Allen, Huntington, Wabash, Wells, Whitley County SWCD and NRCS (P/TA), Purdue Extension (P), TNC (P), CCSI (P), IDEM (P/TA), IDNR (P/TA), USACE (P), City of Fort Wayne, City of Huntington</td></tr>
<tr><td>Social indicator survey analyzed (6 years)</td></tr>
<tr><td>Present survey results at annual workshop/field day focused on BMPs (12 months)</td><td>$1,000</td></tr>
<tr><td>Water Quality Sampling</td><td>UWRW Phase 3 Stakeholders</td><td>Within 5 years of WMP approval</td><td>Water quality sampling at 19 sites for Nitrate+Nitrite, Total Phosphorus, TSS, Turbidity, E. coli, PTIR, and CQHEI at a minimum</td><td>$30,000/ year</td><td>Allen, Huntington, Wabash, Wells, Whitley County SWCD and NRCS, Ecosystems Connections Institute LLC, IDEM, IDNR (P/TA)</td></tr>
</table>

Table 6-6. Agricultural & Urban BMP Implementation Action Register

Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
Total Phosphorus 10-year goal: Reduce total phosphorus loading by 9.56% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030.
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Stream Habitat and Biology 10-year goal: Improve IBI and QHEI scores to a minimum of 25 and 50, respectively, by 2030
Education & Outreach 10-year goal: Increase individual and community participation in events such as water monitoring, river clean-up events, and other public outreach activities related to water quality by 200 people by 2030.

Objective	Target Audience	Implementation Timeframe	BMP/Measure	Milestone	Quantity		Load Reduction			Estimated Cost/Year ($)
					Annual	Total (30 years)	Nitrogen (lbs/year)	Phosphorus (lbs/year)	Sediment (tons/year)	
Implement Agricultural & Urban BMPs in UWRW Phase 3 Critical Areas to Reduce Pollutant Loading	UWRW Phase 3 Agricultural Producers	Within 30 years of WMP approval	Residue and Tillage Management - No Till/ Reduced Till/Strip Till	1,000 new acres/year	1,000 acres	30,000 acres	6000	3000	3000	15,880.00
			Cover Crops	1,000 new acres/year	1,000 acres	30,000 acres	4000	2000	2000	36,070.00
			Critical Area Planting	100 acres/year	100 acres	3,000 acres	15000	6000	6000	875,280.00
			Riparian Herbaceous Cover	5 acres/year	5 acres	150 acres	25	5	10	3,150.00
			Riparian Forested Buffer	5 acres/year	5 acres	150 acres	10	5	5	3,720.65
			Filter Strip	100 acres/year	100 acres	3,000 acres	500	200	200	55,920.00
			Grade Stabilization Structure	1 project every 3 years	1 project every 3 years	10 projects	SS	SS	SS	SS
			Grassed Waterway (with Erosion Control Blanket)	100 acres/year	100 acres	3,000 acres	7270	3630	4280	$279,066.00
			Drainage Water Management	1 project every 3 years	1 project every 3 years	10 projects	SS	SS	SS	SS

*SS = Site Specific

Table 6-8. continued.

Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
Total Phosphorus 10-year goal: Reduce total phosphorus loading by 9.56% (9.95 tons/year) from 104.03 tons/year to 94.08 tons/year by 2030.
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Objective	Target Audience	Implementation Timeframe	BMP/Measure	Milestone	Quantity		Load Reduction			Estimated Cost/Year ($)
					Annual	Total (30 years)	Nitrogen (lbs/year)	Phosphorus (lbs/year)	Sediment (tons/year)	
Implement Agricultural & Urban BMPs in UWRW Phase 3 Critical Areas to Reduce Pollutant Loading	UWRW Phase 3 Agricultural Producers	Within 30 years of WMP approval	Open Channel (2-Stage Ditch)	1 project every 3 years	1 project every 3 years	10 projects	SS	SS	SS	SS
			Structure for Water Control	1 project every 3 years	1 project every 3 years	10 projects	N/A	N/A	N/A	2,955.22
			Nutrient Management	1,000 new acres per year	1,000 acres	30,000 acres	N/A	N/A	N/A	97,000.00
			Waste & Sediment Control Basin	1 project every 3 years	1 project every 3 years	10 projects	SS	SS	SS	SS
			Equipment Modification (Conservation Tillage, Cover Crops, and /or Precision Nutrient Application)	5 projects/year	5 projects	150 projects	SS	SS	SS	SS
			Wetland Creation, Enhancement, and Restoration	5 acres/year	5 acres	150 acres	20	10	10	4,435.00

*SS = Site Specific

Table 6-8. continued.

Nitrate-Nitrite 10-year goal: Reduce nitrate-nitrite loading by 19.96% (98.78 tons/year) from 495.02 tons/year to 396.24 tons/year by 2030.
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Objective	Target Audience	Implementation Timeframe	BMP/Measure	Milestone	Quantity		Load Reduction			Estimated Cost/Year ($)
					Annual	Total (30 years)	Nitrogen (lbs/year)	Phosphorus (lbs/year)	Sediment (tons/year)	
Implement Agricultural & Urban BMPs in UWRW Phase 3 Critical Areas to Reduce Pollutant Loading	UWRW Phase 3 Urban/suburban landowners	Within 30 years of WMP approval	Rain Garden	10 rain gardens/year	10	300 rain gardens	126	18	14	$15,000.00
			Rain Barrel	10 rain barrels/year	10	300 rain barrels	8	2	2	$1,500.00
			Porous (pervious) Pavement	5 project/year	5 projects	150 projects	SS	SS	SS	$15,000
			Grass Swale	1 acre/year	1 acre/year	30 acres	14.9	3.3	1.4	$10,000
			Phosphorus-free Fertilizer	1 acre/year	1 acre/year	30 acres	0	2	0	$1,000

*SS = Site Specific

7 Project Tracking and Future Activities

7.1 Evaluating Effectiveness of Project

Indicators for measuring progress have been identified for each goal established by the Steering Committee. The Huntington County SWCD will assume leadership in the role of evaluating effectiveness of the WMP moving forward. While the overall WMP goals have been developed for 10-year increments, the Huntington County SWCD and UWRW Phase 3 Steering Committee will monitor progress at more frequent intervals. The steering committee will continue to meet quarterly after the approval of the WMP to track progress and will conduct a review of the WMP every five years to evaluate overall progress and to determine if any revisions to the plan are necessary. For example, significant land-use changes occurring within the project area should be evaluated and considered for their influence on water quality or social patterns. The Huntington County SWCD and UWRW Phase 3 Steering Committee will evaluate the outcomes of the WMP reviews to determine if adaptive management actions need to be taken to ensure that the WMP goals are achieved.

Water quality monitoring data, habitat, and biological surveys will continue to be collected throughout the WMP implementation and will be compared to the baseline data contained in this plan. Load reduction estimates based on monitoring data will be used for comparison to the baseline estimates to evaluate changes in water quality. More specific information on future water quality monitoring is provided in Section 7.2.

Best management practices installed throughout the implementation program will be mapped and modeled for their respective load reductions. BMP implementation will be tracked by the Huntington County SWCD and will be reviewed by the Steering Committee and partners to determine the success or failures of installed practices and used for evaluating the watershed management plan action items or when considering revisions and refinement to the implementation strategies.

Social data will be used to track stakeholder attitudes, awareness, behaviors, and participation in conservation programs and the implementation of best management practices that directly affect water quality improvement and protection. Surveys will be used to gather the social data and will be analyzed to the evaluate the effectiveness of our education and outreach efforts, as well as identify improvements for future implementation programs.

The overall project progress will be tracked using the action register (Section 6.3) as a guide for the schedule of activities to be completed throughout the implementation project. A tracking database will be developed by the Huntington County SWCD and UWRW Phase 3 Steering Committee to include measurable items such as workshops held, BMPs installed, meetings held, stakeholder and volunteer participation, etc., and will be updated quarterly with completed items. Individual landowner contacts and information will also be tracked for installed and future projects.

7.2 Future Watershed Activities

This watershed management plan contains a plethora of information about the UWRW Phase 3 project area. The variety of data and information in this watershed management plan covers topics such as land use, current agricultural practices, pollutant sources, and water quality. This information is not well documented or well known by stakeholders and the public; therefore, it is vital that the UWRW Phase 3 Steering Committee work to develop and implement the agricultural-based and urban-based education and outreach programs. Information about NPS pollution and water quality issues present in the UWRW Phase 3 project area will be presented to the public at events such as annual meetings, workshops and field days, and river clean-ups and floats to promote changes in behavior and environmental stewardship.

The first and most important priority of the UWRW Phase 3 steering committee is to locate and secure funding resources to implement the watershed management plan and begin working toward the objectives outlined in the action registers. Following the approval of this watershed management plan the UWRW Phase 3 steering committee will develop a cost-share program that will include at least the BMPs outlined in the action register (Section 6.3). Cost-share implementation will be prioritized in the primary critical subwatersheds. Only after all opportunity for implementation in the primary critical subwatersheds has been exhausted will cost-share be made available in the secondary critical areas. The cost share program will rely on the technical expertise of local NRCS, SWCD, and FSA offices to provide guidance on sound BMP implementation. It is encouraged that this watershed management plan be used by other organizations with the UWRW to help define and prioritize planning efforts so that a cohesive implementation approach can be utilized. The UWRW Phase 3 steering committee will work to distribute the approved watershed management plan to all stakeholder organizations and groups located in the UWRW. Hard copies will also be on file at local SWCD offices.

Future water quality monitoring efforts are vital to evaluating changes in water quality patterns and the effectiveness of WMP implementation. Currently, a clear path for future monitoring efforts is unclear due to limited funding opportunities. Moving forward, the ideal water quality monitoring program would continue with monthly sampling events at the 19 sites established during the development of this WMP. The Huntington County SWCD and UWRW Phase 3 Steering Committee will work to establish a group of volunteers to execute water quality sampling. Hoosier Riverwatch could be utilized to provide continued sampling within the project area in addition to IDEM’s sampling through the Indiana Water Quality Monitoring Strategy (WQMS) which includes a rotating basin monitoring program. The water quality data will be evaluated at quarterly steering committee meetings and the 5-year reviews of the WMP.

While this WMP is a good reference for the current conditions, watersheds are dynamic in nature and continually change due to a variety of influences such as changes in land use, community shift, and funding. It is vital that the watershed management plan and its goals, objectives, and action registers be reevaluated and revised as changes in the watershed are documented. It is recommended that the watershed management plan be reexamined by the Huntington County

SWCD and UWRW Phase 3 Steering Committee at least every 5 years to account for developments within the project area in order to achieve significant water quality improvements.

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