2.0 IDENTIFYING WATER QUALITY PROBLEMS AND CAUSES

As part of the watershed planning process, an inventory and assessment of the watershed and existing water quality studies relevant to the watershed must be conducted. Examination of previous work may show that data already gathered is sufficient for determining the magnitude and extent of water quality conditions, or it may indicate that additional studies are needed to characterize the water quality problems. In either case, assessing water quality information that has already been completed is part of the initial process of building a WMP and will help to guide the identification of water quality problems and links to pollution sources in the watershed. The following section provides a summary of past and current assessments of the Upper Wabash River Basin.

2.1 STAKEHOLDER CONCERNS

The individuals living, working, and playing in a watershed can prove themselves valuable by providing both current and historical insight to the issues of the area. These issues revolve around water quality, water quantity, and other associated natural resource concerns in the watershed. Concerns listed by the Steering Committee in the original grant application are identified below.

1) Failing manure management; poultry farm manure
2) Livestock access to open streams
3) Grain farming tilled to edge of streambank & nutrients/chemical application
4) Ohio-Mercer County (southern part) most concentrated livestock area in US
5) Urban lawns: fertilizer & chemicals
6) Parking Lot & Pavement Runoff
7) Increased water quantity and velocity; streams dredged w/o BMPs to keep sediment from re-entering streambank; erosion
8) Open streams: no filter strips or riparian corridor & livestock trample streams
9) Rural homes: failing septic, severely limiting soils
10) Wetlands, forest being cleared

The aforementioned concerns were consolidated by the Steering Committee to create 5 categories of concern regarding the Upper Wabash River Basin. These topics have further been addressed in public meetings and workshop settings with invited presenters.

1) Stakeholder education
2) Water quantity in regards to flooding control, streambank restoration, and log jam removal
3) Agricultural production in regards to crop production, livestock, and manure management
4) *E. coli* loadings to waterways in the watershed
5) Urban development and associated water quality and quantity issues

2.2 WATER QUALITY BASELINE STUDIES

The following section provides a summary of baseline water quality conditions present in the Upper Wabash River Basin as found in other plans, studies, and investigations.

Wabash River Nutrient and Pathogen TMDL Development

The severity ranking for the Wabash River is high and data has recently been collected as part of a TMDL development. The TMDL addresses *E. coli*, nitrate, and phosphorus in the Wabash

River from the Indiana – Ohio state line to the Indiana – Illinois state line. Loads of pH and dissolved oxygen were not calculated but it is anticipated that the nutrient TMDLs will result in attainment of the water quality standards for these two parameters. The Indiana portion of the *E. coli* and nutrient TMDLs were based on assumptions that Ohio's standard would be met at the state line. This theoretically ensures that each state is responsible for reducing loads that are generated within their boundaries. The targets utilized for the nutrient and *E. coli* TMDLs are provided in **Table 2-1** below.

Table 2-1: TMDL Targets

TMDL	IN targets	OH targets
Nutrients		
Nitrate + Nitrite	10 mg/L	1.5 mg/L
Phosphorus	0.30 mg/L	0.17 mg/L
E. coli	125 cfu/100 mL	126 cfu/100 mL

(Wabash River TMDL, 2006)

Water quality standards were assessed for several representative locations to facilitate the allocation process and the presentation of the results. For the area being studied as a part of this planning process, information obtained within the reach of the Wabash River at the inflow to J. Edward Roush Lake will be utilized. On average, the findings for *E. coli* were that between the months of April and October, approximately 95% of the *E. coli* loadings from non-point source pollution needs to be reduced. Total Phosphorus non-point source reductions range from 12% - 23%, and Nitrate reductions from non-point sources are not warranted per this study.

A public review draft of the Wabash River Nutrient and Pathogen TMDL Development was released in July of 2006. A final draft of the document was approved on September 22, 2006.

2006 Indiana Integrated Water Quality Report

The IDEM is the primary agency involved in surface water quality monitoring and assessment in the State of Indiana. In conjunction with the requirements of the CWA and the State's goals for protecting its natural and recreational resources, the IDEM operates several monitoring programs designed to monitor and assess the chemical, physical, and biological conditions of Indiana's rivers, streams, and lakes.

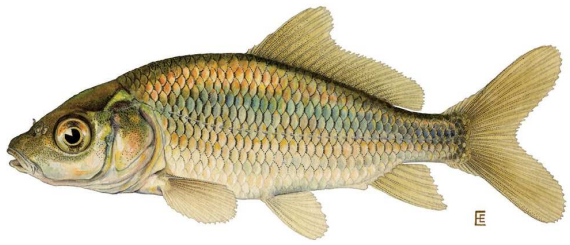
The IDEM's Office of Water Quality's surface water quality basin strategy is designed to describe the overall environmental quality of each major river basin in the state and to identify monitored water bodies that do not fully support designated uses. The IDEM's surface water monitoring was revised in 2001 to meet the goals of assessing all waters of the state within five years.

The 305(b) report provides a compilation and summary of all of the IDEM's water quality monitoring and assessment data (compiled from AIMS database and other datasets/reports within the IDEM). Each subwatershed is given a water quality rating relative to its streams status in meeting Indiana's Water Quality Standards (WQS). WQS are set at levels necessary for protecting a waterway's designated use(s), such as swimmable, fishable, or drinkable. Each subwatershed is given a rating of fully, partially, or not supportive of its designated uses.

Chapter 303(d) of the CWA requires states to identify waters that do not or are not expected to meet applicable water quality standards with technology based standards alone. States are also required to develop a priority ranking for these waters, taking into account the severity of the pollution and the designated use of the waters. Once this listing and ranking of waters is completed, States are required to develop TMDLs for these waters in order to achieve water quality standards. The Wabash River and tributaries were listed on both the 2002 and 2004 303(d) List of Impaired Waters due to *E. coli*, Nutrients, and Impaired Biotic Communities. In an attempt to ensure greater consistencies between the 305(b) report and 303d list, the two reports are now submitted together as an integrated report to U.S. EPA every two years. **Appendix 3** identifies the Upper Wabash River Basin's impairments as identified by the 2006 Integrated Water Quality report.

Fish Consumption Advisory (FCA)

Each year since 1972, three agencies have collaborated to create the Indiana FCA. These agencies include the IDEM, the IDNR, and the Indiana State Department of Health (ISDH). Each year, members from these agencies meet to discuss the findings of recent fish monitoring data and to develop the new statewide fish consumption advisory.



The 2004 FCA is based on levels of PCBs and mercury found in fish tissue. In each area, samples were taken of bottom-feeding fish, top-feeding fish, and fish feeding in between. Fish tissue samples were analyzed for PCBs, pesticides, and heavy metals. Of those samples, the majority contained some level of mercury. However, not all fish tissue samples had mercury at the levels considered harmful to human health. If the samples resulted in higher than normal levels of mercury, those waterbody segments were listed in the fish consumption advisory.

While there are seemingly few FCAs noted within the Upper Wabash River Basin, it should be realized that there is a statewide Fish Consumption Advisory for carp in all Indiana streams, the Indiana portion of Lake Michigan, and inland lakes due to the bioaccumulation tendencies of PCBs. More detailed information related to specific stream segments and the FCAs identified for those streams can be found in Appendix 3.

An Assessment of Pesticides in the Upper Wabash River Basin

In 1998, surface water samples from the Upper Wabash Basin were analyzed for 142 pesticides, pesticide degradation products, and urban chemicals. Atrazine, metolachlor, and acetochlor were the most represented pesticides during the study. Average concentrations for the three respective pesticides were 3.31ug/L, 2.17ug/L, and 1.04ug/L. The drinking water Maximum Contaminant Level (MCL) for atrazine is 3.0ug/L, 2.0ug/L for acetochlor, and there is no MCL for metolachlor. The study also utilized flow data and mathematical calculations to determine estimated loadings of each pesticide. Table 2-13 identifies the average concentration, Drinking Water MCL, and the percent runoff for each pesticide. Utilizing sampling results obtained at the USGS gaging station located on the Wabash River at Linn Grove, the pesticides Acetochlor and Atrazine were in exceedence of the MCL in 4 of the 11 samples taken between April 20, 1998 and July 29, 1998. The pesticide Metolachlor was not contained in the samples obtained from the Linn Grove sampling station.

Table 2-2: Pesticide Concentrations and MCLs in the Upper Wabash Basin

Pesticide	Average Concentration	Drinking Water MCL
Atrazine	3.31 ug/L	3.0 ug/L
Metolachlor	2.17 ug/L	N/A
Acetochlor	1.04 ug/L	2.0 ug/L

(IDEM, 2001)

The study also evaluated which tributary watersheds to the Upper Wabash River contribute the largest pesticide loadings. In general, it was determined that pesticide loadings were correlated with a watershed's contributing land use. Large watersheds tended to contribute larger pesticide loadings while smaller watershed tend to contribute smaller pesticide loadings. However, the correlation was not absolute, as factors such as soil composition, rainfall totals, the timing of sampling events, and land use all influence the pollutant loadings of a watershed.

The report concluded that identification of tributaries contributing the greatest pesticide loads was important and that priority should be given to federally funded Clean Water Act Section 319 grant projects within these basins to help alleviate pesticide runoff potential. Currently EPA requires a 66' setback for atrazine use; numerous county landowners are utilizing federal cost share dollars to implement filter strips in order to abide by this regulation.

Chemical Water Quality Assessment

In an effort to establish an expanded baseline of water quality conditions in the Upper Wabash River watershed, CBBEL partnered with JRM Environmental, Inc. to develop a chemical water quality monitoring program. Two water quality sampling events were conducted, one during a wet weather period and another event completed during a dry weather period. The first event (dry weather sampling) took place August 29 and 30, 2005, while the second sampling event (wet weather sampling) occurred on October 25 and 26, 2005. Twenty (20) sampling stations were established in the Upper Wabash River watershed, with sampling parameters including total phosphorus, nitrogen/nitrates/nitrites, total coliform, and *E. coli*. **Table 2-3** describes the water quality sampling sites located within the Upper Wabash River watershed. Duplicate field samples were also collected at sites 1 and 20 for validation purposes. **Appendix 4** provides the raw chemical and biological sampling data completed by JRM Environmental, Inc. for the purpose of this planning process.

Table 2-3: Narrative Description of Chemical Monitoring Sites

Site ID #	Waterbody	County	Location
1	Simison Creek	Jay	State Line Rd Bridge
2	Wabash River	Jay	State Line Rd Bridge
3	Wabash River	Jay	County Road 700E Bridge
4	Limberlost Creek	Jay	County Road 450E Bridge
5	Limberlost Creek	Jay/Adams	County Line Road Bridge
6	Loblolly Ditch	Jay	County Road 375W Bridge
7	Loblolly Ditch	Adams/Jay	County Road 300 W/50W Bridge
8	Wabash River	Adams	County Road 125 E Bridge
9	Loblolly Creek	Adams	County Road 1050 South west bank
10	Wabash River	Adams	Covered Bridge Road Bridge

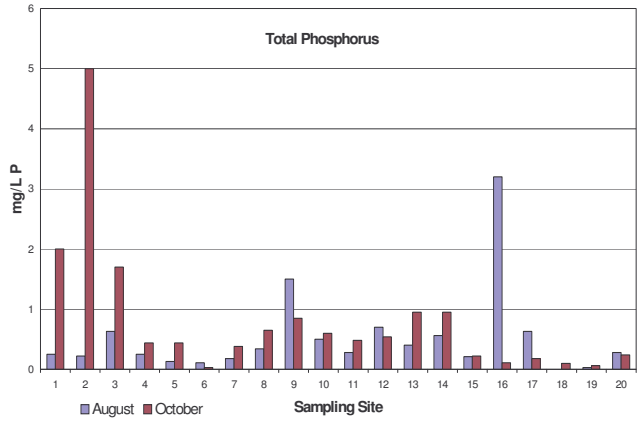
11	Wabash River	Adams	US Highway 27 S Bridge
12	Wabash River	Adams	County Road 400W Bridge
13	Wabash River	Adams	SR 218 West St Rt Bridges
14	Wabash River	Adams	CR 300S NE streambank
15	Wabash River	Wells	State Road 316 Bridge
16	Un-named Tributary	Wells	Elm Grove Road Bridge
17	Un-named Tributary	Wells	State Road 116 Bridge
18	Markley Ditch	Wells	State Road 116 Bridge
19	Six Mile Creek	Wells	State Road 116 Bridge at Six Mile Cemetery
20	Wabash River	Wells	County Road 450E Bridge

Nutrients

The term "nutrients" primarily refers to the two major plant macronutrients, phosphorus and nitrogen. These nutrients are common components of fertilizers, animal and human wastes, vegetation, and some industrial processes. Nutrients up to certain levels are both necessary and beneficial to water bodies. However, an overabundance of nutrients can stimulate the occurrence of algal blooms and excessive plant growth, which can result in the reduction of dissolved oxygen concentrations in surface water through respiration and the decomposition of dead algae.

Total Phosphorus

Nonpoint discharges are the major source of phosphorus in most watersheds. Phosphorus can be present as organic matter and can be either dissolved or suspended in the water column. Phosphorus may also occur in inorganic compounds released from various minerals, fertilizers, and detergents, which may also be either dissolved or suspended in the water column. Phosphorus is the primary nutrient associated with the production of algae and aquatic plants, as it is often a limiting nutrient in aquatic environments.



When referring to the chemical water quality sampling completed in 2005, guidelines were provided by DRAFT TMDL that total phosphorus levels equal to or above 0.3 milligrams per liter (mg/L) were an indication of poor water quality at the sampling sites. As shown from the sampling data, phosphorus loadings to the waterways within the Upper Wabash River watershed are an issue of concern and should be addressed. Of 20 samples, 10 samples, or 45%, resulted in levels of phosphorus higher than 0.3mg/L during the August collection event. Two of those ten samples had levels that exceeded 1.0 mg/L of total phosphorus.

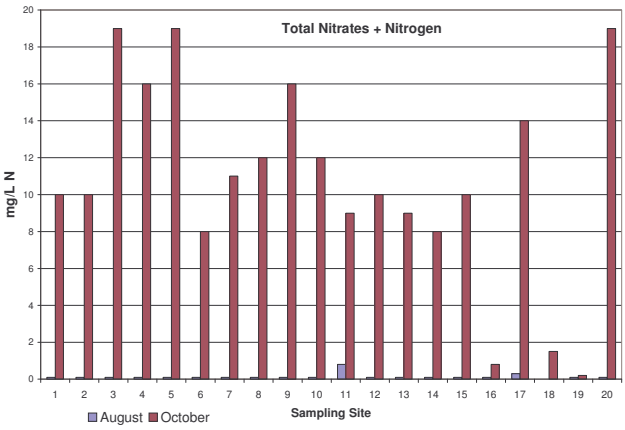
During the October collection event, 14 samples, 64%, indicated levels above 0.3mg/L, including 3 sites that resulted in levels above 1.0 mg/L. Seven sites (#3, 8, 9, 10, 12, 13 and 14) sampled had levels of total phosphorus that exceeded 0.3 mg/L during both the dry (August)

and the wet (October) collection events. This would seem to indicate a more continual phosphorus loading situation than had the exceedance occurred only during one event.

With approximately 92% of the land use in the Upper Wabash River watershed involved in agricultural production, it would seem highly likely that the main source of the phosphorus loadings to the sampled waterways are originating from associated agricultural practices. Situations such as conventional tillage, applied fertilizers and/or manure, failing septic systems usually located in more rural areas, and feedlot runoff should all be considered potential contributors of phosphorus.

Total Nitrogen/Nitrates/Nitrites

Point source discharges, such as Wastewater Treatment Plants (WWTP) can be a significant source of ammonia in surface waters; however, nonpoint discharges such as untreated effluent from septic systems, decaying organisms, and bacterial decomposition of organic waste from improper disposal or over-application of fertilizers in stormwater runoff can also contribute to the level of nitrogen in a waterbody.



Nitrogen is a significant factor in the water quality degradation of the Upper Wabash River, as shown by the 2005 sampling events. The guideline given by the DRAFT TMDL for total nitrogen was such that a value equal to or greater than 10 mg/L indicates poor water quality. Following this, in August, all samples collected were below 1.0 mg/L total nitrogen. However, 67% of the samples collected in October, or 14 of 20 samples resulted in levels above 10.0 mg/L of total nitrogen. Above those 14 samples, an additional 4 samples were valued at levels between 8.0 mg/L and 10 mg/L, indicating nearly 86% of the sampled sites have issues regarding nitrogen loadings.

As with phosphorus, all indications seem to focus on agricultural production activities as the main contributor to the water quality issues in the area. However, other potential sources, such as WWTPs, Combined Sewer Overflows (CSOs), and the application of residential or recreational fertilizers should not be overlooked. With the majority of the exceedences occurring during high flow events, it would seem to indicate that septic systems are not the main contributor of the usual rural nonpoint sources of pollution. More so, manure management practices such as storage and application, and agricultural fertilizer application should be further investigated, along with livestock access to tributary streams and feedlot management practices.

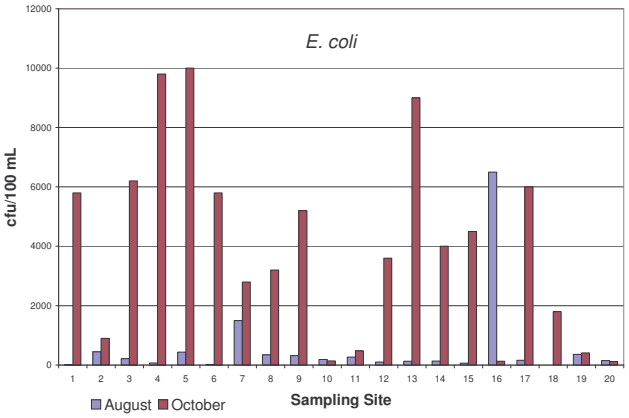
As the Wabash River Basin includes a significant drainage area within Ohio, it is important to become aware of the contributions regarding water quality, as well as water quantity. One of the chemical monitoring stations was located along the Ohio-Indiana State line. Site #1 captures water quality data as the Wabash River exits Ohio and enters Indiana. It can also be noted that while neither Ohio or Indiana have promulgated ambient water quality nutrient standards, targets utilized during the development of the Wabash River Nutrient and Pathogen TMDL Development are significantly varied. If the Ohio values were utilized, merely 6 of 40

samples or 15% are below the 0.17 mg/L target. With the same considerations regarding Nitrates + Nitrogen, approximately 50% of the samples collected are at or below the 1.5 mg/L target. Nearly all of the samples at or below the Nitrate + Nitrogen Ohio target were obtained during the August sampling event.

E. coli Bacteria

E. coli bacteria are associated with the intestinal tract of warm blooded animals and are widely used as an indicator of fecal pollution in water bodies. *E. coli* can enter surface waterbodies from nonpoint sources such as runoff from malfunctioning septic systems, straight pipe discharges from septic tanks, livestock, domestic pets, and wildlife. In addition, *E. coli* can also come from improperly treated or untreated discharges of domestic wastewater. Detection of *E. coli* in water bodies may indicate the presence of other microbes harmful to humans. Certain *E. coli* bacteria themselves may cause disease in humans and animals.

E. coli is also used as an indicator because it is easier and less costly to monitor for and detect than the actual pathogenic organisms such as *Giardia, Cryptosporidium,* and *Shigella*, which require special sampling protocols and sophisticated laboratory techniques in order to evaluate. The presence of waterborne disease causing organisms can cause outbreaks of diseases such as Typhoid Fever, dysentery, Cholera, and Chryptosporidosis.



Indiana WQS for *E. coli* have been established in order to ensure safe use of surface waters for recreation and drinking water. The state WQS for *E. coli* states that the E. coli bacteria, using membrane filter count, shall not exceed 125 colony forming units per 100 milliliters (cfu/100mL) as a geometric mean based on not less than 5 samples equally spaced over a 30 day period, nor exceed 235 cfu/100mL in any one sample in a 30 day period.

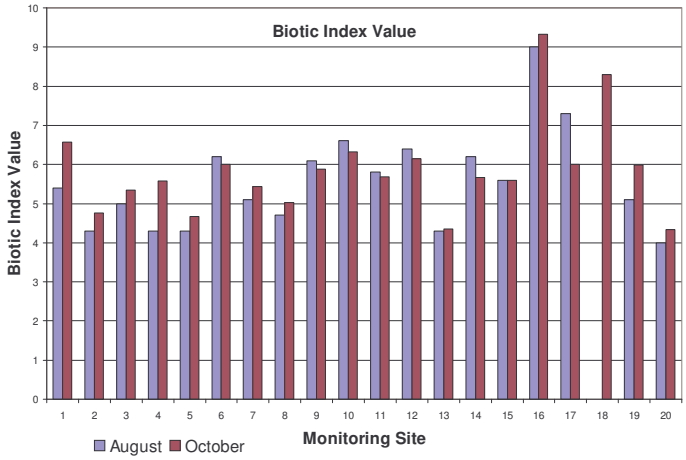
In all, for the first sampling event (August) there were 2 instances out of 20 where the levels were greater than 1,000 cfu/100mL mark, representing 10% of the samples taken. For August, when referencing the Indiana state WQS for *E. coli* (235 cfu/100mL) 8 of 20 samples or 40% were in violation. During the October sampling event, 80%, or 16 of 20 samples taken were in violation of the Indiana State WQS for *E. coli* (235cfu/100mL). Further 14 samples of 20 taken in October were indicative of excessive *E. coli* levels over 1,000 cfu/100mL.

Biological Water Quality Assessment

In addition to chemical water quality monitoring, CBBEL partnered with Commonwealth Bio-monitoring, Inc. to conduct habitat evaluations and macro-invertebrate monitoring at all sites utilizing both the Qualitative Habitat Evaluation Index (QHEI), and the biotic index. The purpose of these indices is to provide a measure of the stream habitat and riparian health which correspond to the physical factors affecting fish and other aquatic life. The QHEI values range from 100, or extremely good, to 0, or extremely poor while the Biotic Index Values range from 1 to 10, or extremely good to extremely poor, respectively.

The overall Biotic Index scores in the Upper Wabash River watershed ranged from 4.0 to 9.0, while the QHEI values were similar with respect to a range of 21 to 66. Taking the two indices

into consideration, an assessment was made regarding the overall water quality with only one site scoring in the "Very Good" range, 7 sites scoring in the "Good" range, 3 sites with a "Fair" rating, 5 sites with a "Fairly Poor" rating, 2 sites rated as "Poor" and 2 sites rated as "Very Poor". One of the assessed sites (site 18) was observed dry so no biological assessment could occur.



Priority sites were suggested and divided into two categories by those completing the assessment. Priority sites with relatively good habitat but with a relatively poor biotic index are Sites 10, 11 and 12. The priority site selected based on the biotic index value indicating obvious sewage-related pollution is Site 16.

IDEM Total Suspended Solids (TSS) Data

Sediment monitoring was completed throughout the Upper Wabash River Basin at 30 IDEM monitoring locations. The number of samples per site varied with some locations such as the Wabash River at the Ohio-Indiana State Line, Wabash River at US 27, and the Wabash River at Adams County Road 400 W with the longest sampling record (1991-2006) and the most number of individual samples. Two of these locations were sampled through USGS stream gages utilized in loading and reduction calculations later in this WMP; the Ohio-Indiana State Line and Linn Grove.

While a State WQS for TSS had not been established, a guideline target concentration of 80 mg/L TSS was set for this watershed in based on guidelines provided by Waters, 1995. For the three sampling sites with the greatest number of samples and the longest sampling period, the summary information is shown below in **Table 2-4**.

Table 2-4: IDEM TSS Data

Site Location	Length of Record	# Samples	Avg. TSS (mg/L)
Wabash River @ OH-IN State Line	2005-2006	32	95.9
Wabash River @ US 27	1991-2002	135	85.6
Wabash River @ Adams CR 400W	2003-2006	40	117.2

Water Quality Prioritization

In an effort to prioritize sampling sites based on data collected throughout the entire watershed, a water quality matrix was developed to rank and prioritize the overall aquatic ecological situation at each site. In **Table 2-5,** the average concentration of each parameter discussed above and its corresponding ranking is compared for each site within an 11-digit HUC and overall priority rankings are identified. While the data presented in the tables are averages, the raw data tables can be found in Appendix 4.

It can be shown by the sampling data that site 9, Loblolly Creek at State Road 116 near County Road 1100S, in the 0512010-040 watershed has the lowest overall water quality. This is further

described by looking at the individual parameters and the ranking of site 9: 4 of 5 for *E. coli*, Total Nitrogen and Total Phosphorus, and the lowest scores for the Biotic Index and the QHEI.

Regarding subwatershed 0512010-050, site 5, Limberlost Creek at the Jay/Adams County Line Road Bridge, resulted in the poorest water quality for the chemical components. However, this site scored the highest for this subwatershed for the Biotic Index and second highest for the QHEI. Total Nitrogen and *E. coli* samplings for this segment of Limberlost Creek were the poorest of this section. Similarly, the other site sampled on the Limberlost Creek, site 4, at the County Road 450E Bridge, was proven to have poor water quality as well, seemingly indicating an overall trend in the Limberlost Creek drainage area.

Sites 16 & 17, both unnamed tributaries to the Wabash River, West of Vera Cruz, tied for the poorest water quality observed in the 0512010-060 subwatershed of the Upper Wabash River watershed. These sites both were consistent in placing the lowest two or three rankings for all parameters. The exception to this being site 16's ranking as the second best result for Total Nitrogen in the subwatershed.

If the focus of watershed planning efforts is to be targeted on a broader level, the subwatershed 0512010-060 should be the primary focus of implementation efforts, education & outreach and other restoration activities. Ten sampling sites were located in this subwatershed, with 80% of those sites resulting in higher priority rankings than other sites in other subwatersheds.

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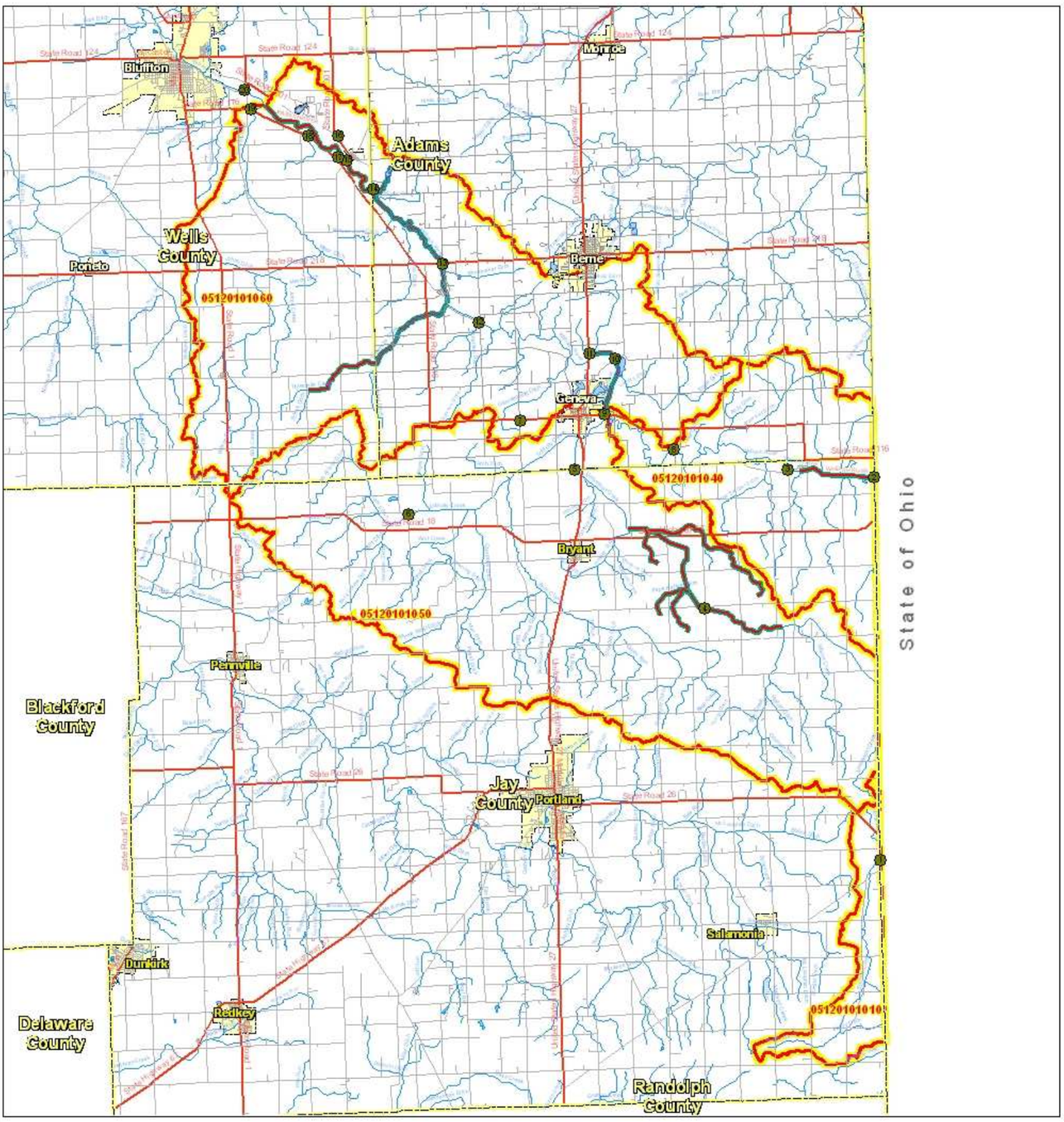


Monitoring Locations

Upper Wabash River Basin

Monitoring Locations
HUC 11 Boundary
County Boundary
Municipalities

0 1 2 3 Miles

Base Map Source: US Bureau of the Census, TIGER files, 2000

Table 2-5: Water Quality RankingUpper Wabash River watershed

11-digit HUC	Site #	Location	Total Phosphorus mg/L		Total N Nitrates + Nitrites mg/L		*E. coli* cfu/100mL		Biotic Index Value		QHEI Score		Final Rank	
			Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Sum	Rank
05120101-040	1	Simison Creek – State Line Rd Bridge	1.13	**2**	5.05	**1**	1409	**2**	5.4	**4**	51	**3**	**12**	**2**
	2	Wabash River – State Line Rd Bridge	2.61	**5**	5.55	**2**	675	**1**	4.3	**1**	61	**1**	**10**	**1**
	3	Wabash River – CR 700E Bridge	1.17	**3**	9.5	**5**	3208	**5**	5.0	**3**	58	**2**	**18**	**3**
	8	Wabash River – CR 125E Bridge	0.50	**1**	6.0	**3**	1773	**3**	4.7	**2**	61	**1**	**10**	**1**
	9	Loblolly Creek – CR 1050 S (west bank)	1.18	**4**	8.0	**4**	2760	**4**	6.1	**5**	36	**4**	**21**	**4**
05120101-050	4	Limberlost Creek – CR450E Bridge	0.34	**4**	8.05	**3**	4937	**3**	4.3	**1**	52	**1**	**12**	**3**
	5	Limberlost Creek – County Line Rd bridge	0.29	**3**	9.5	**4**	5220	**4**	4.3	**1**	44	**2**	**14**	**4**
	6	Loblolly Ditch – CR 375W Bridge	0.07	**1**	4.0	**1**	2911	**2**	6.2	**3**	26	**3**	**10**	**1**
	7	Loblolly Ditch – CR300 W/50W Bridge	0.28	**2**	5.5	**2**	2150	**1**	5.1	**2**	24	**4**	**11**	**2**
05120101-060	10	Wabash River – Covered Bridge Rd Bdg	0.06	**2**	6.0	**8**	163	**2**	6.6	**8**	51	**4**	**26**	**4**
	11	Wabash River – US27 Bridge	0.38	**5**	4.9	**6**	374	**3**	5.8	**5**	51	**4**	**23**	**3**
	12	Wabash River – CR400W	0.62	**7**	5.0	**7**	1850	**6**	6.4	**7**	58	**3**	**30**	**6**
	13	Wabash River – SR218 Bridge	0.68	**8**	4.5	**5**	4564	**11**	4.3	**2**	66	**1**	**27**	**5**
	14	Wabash River – CR300S NE bank	0.76	**9**	4.0	**4**	2069	**7**	6.2	**6**	44	**6**	**32**	**7**
	15	Wabash River – SR316 Bridge	0.22	**3**	5.0	**7**	2282	**8**	5.6	**4**	50	**5**	**27**	**5**
	16	UNT – Elm Grove Rd Bridge	1.66	**10**	0.40	**2**	3314	**10**	9.0	**10**	21	**9**	**41**	**8**
	17	UNT – SR 116 Bridge	0.41	**6**	7.15	**9**	3083	**9**	7.3	**9**	38	**8**	**41**	**8**
	18	Markley Ditch – SR 116 Bridge	0.05	**1**	0.75	**3**	900	**5**	*		*			
	19	Six Mile Creek – SR 116 Bridge	0.05	**1**	0.10	**1**	386	**4**	5.1	**3**	43	**7**	**16**	**1**
	20	Wabash River – CR 450E Bridge	0.26	**4**	9.50	**10**	135	**1**	4.0	**1**	65	**2**	**18**	**2**

(5 = Higher Restoration Priority)

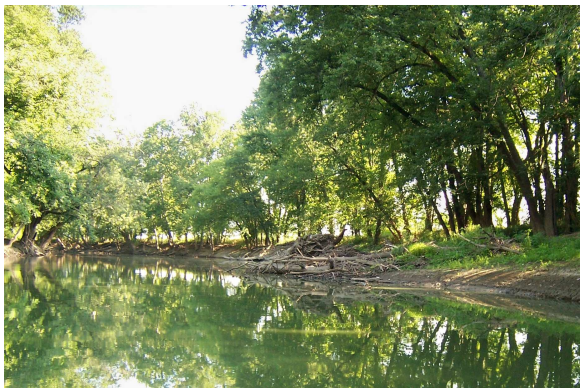
2.3 BASELINE WATER QUALITY: CONCERNS, PROBLEMS, AND CAUSES

Linking stakeholder concerns with known and discovered water quality issues in the watershed helps to validate initial observations and provides evidence to dismiss others. Thus, a review of historic water quality studies can help to guide the planning process toward management actions that are most appropriate and efficient for improving water quality conditions. The following descriptions detail water quality baseline conditions that have been established by prior studies as they relate to stakeholder concerns. These descriptions are organized by listed stakeholder concerns as shown in Section 2.1, and provide the foundations for the watershed management strategies identified in the WMP.

Stakeholder Education – Public, local decision makers, organizations

The studies listed in Section 2.2 indicate that there are certainly water quality problems associated with the Upper Wabash River and its tributary streams. Those problems stem from elevated levels of nutrients and bacteria in the water system. These levels can directly be impacted by raising stakeholder awareness and modifying day-to-day behavior within the watershed. The results of the water quality studies support the idea that education and outreach will positively impact the water quality in this watershed.

Flooding – Flood control, streambank restoration, log jam removal



Stakeholders in the Upper Wabash River watershed have expressed great concern over the issue of water quantity. Interest is high in regard to flood control measures, streambank restoration, and log jam removal practices. Historic climate and disaster data does indicate a strong prevalence of high water events, carrying with them the ability to wash out valuable in-stream habitat, destruct streambanks, increase pollutant loadings to receiving waterbodies, and associated destruction of aquatic communities. Debris from infrastructure and buildings damaged by flood events, oils, grease, and toxins from submerged vehicles and septic systems, and common chemicals and solvents that are present in nearly every home and can all become mobile when flooding occurs.

Agricultural Impacts – Crop production, livestock & manure management,

The studies listed do indicate a potential impact on water quality by agricultural practices within the boundaries of the watershed. Pollutant loadings from agricultural sources can include pathogens, nutrients, and sediments. Elevated levels of phosphorus, nitrates, sediment, and pesticides have been observed during sampling sessions at locations in the Upper Wabash River watershed surrounded by agricultural land uses. *E. coli* impairments could likely be linked to land applied manure, livestock with direct access to waterways, and improper handling of manure and nutrients. Prior studies do indicate that the concerns raised regarding agricultural practices and the associated impact to water quality are supported by the data.

E. coli Loadings – Failing septic systems, land applied manure, wildlife

Referencing the 305(b) and 303(d) listings provided by IDEM and the chemical sampling completed in the fall of 2005, it can be witnessed that the levels of *E. coli* exceed the limits set for good water quality. The Steering Committee has expressed concern regarding this parameter specifically questioning the effects from failing septic systems. Another potential

source, wastewater treatment plant facilities within the watershed, should be further investigated to determine if these facilities are impacting the Upper Wabash River watershed. Import should be placed on this issue as it is a direct impairment not only to water quality, but also to human health.

Urban Development – Land use change, increased imperviousness

Point source and non-point source pollution has the potential to greatly increase proportionally to urban development. Increases in leaking underground storage tanks, impervious surfaces, household and yard waste, and even pet waste all contribute to the degradation of water quality. While there are no major urban areas in the Upper Wabash River watershed, the potential for growth is always accounted for. Planning needs to occur so that new construction and areas of development are required to implement measures to limit soil erosion and control stormwater runoff to reduce further degradation of the river and tributaries.