

ELKHART-MISHAWAKA- SOUTH BEND AQUATIC COMMUNITY MONITORING



**ANNUAL REPORT
2007**



City of Elkhart
Public Works and Utilities
Dick Moore, Mayor

**Cover Photo: Aquatic Biologist Len Kring receives assistance from the Ward sisters,
who live along Christiana Creek.**

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AQUATIC COMMUNITY MONITORING IN ELKHART AND ST. JOSEPH COUNTIES ON THE ST. JOSEPH RIVER AND SELECTED TRIBUTARIES 2007



Ryann with
a 10.5 lb
Northern
Pike

Prepared by
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Aquatic Biologist
May, 2008

INTRODUCTION

The St. Joseph River originates in Hillsdale, MI near Baw Beese Lake. As the mighty "Joe" surges on a 210 mile course through Southern Michigan and Northern Indiana, it drains nearly 4,685 square miles of land through an intricate capillary system of smaller tributary streams (SJRBC website). On its way to its confluence with Lake Michigan, near St. Joseph MI, the St. Joe encounters a myriad of different environments including: forests, wetlands, tilled agriculture fields, cities and towns, and many industrial facilities. All of these external factors can have an influence on the water quality and thus, an influence on the organisms that live in or near the water. Since 1998, the City of Elkhart has monitored the fish communities in area streams in order to better understand the impact the city has on these streams. It was at this time that the city decided to take a proactive approach in protecting local rivers and streams. In the event that biological monitoring becomes mandatory statewide, Elkhart will already have established themselves as a leader in this field.

Biological monitoring is an integral portion of an overall water quality program. The City of Elkhart continues to analyze the chemical and microbial contents of the St. Joseph River. However, these types of monitoring alone do not give a complete picture of the health of a river. By incorporating biological monitoring, local governments can get a true glimpse into what is really taking place in the body of water in question. Fish and other organisms that spend a significant portion of their lives in the water can tell us a story of what is happening in the stream. Based on the composition of the aquatic communities, estimations can be made on the overall health of our local rivers and streams.

During the period from 1998-2003, the aquatics program established core sampling sites on the St. Joseph River and many of its primary tributaries. For three consecutive years data was collected from these sites and a baseline of information was established for each stream. These baselines are now used to compare current and future data collected to determine if there are impairments taking place on local streams.

The program expanded in 2001, when the City of South Bend became the first partner to join Elkhart in its quest to help protect our aquatic resources. Similar to the Elkhart area, core sampling sites were established over a six year period. A similar baseline was established for the South Bend area. 2007 was the first year some of the original sites were sampled again after the initial three year period. This will allow the City of South Bend to see what their impacts have been on certain stream reaches.

In 2007, the City of Mishawaka joined the program. This helped the aquatics program fill a data gap that existed for the Mishawaka portion of the St. Joseph River. This also allows the monitoring team to access three additional tributaries. These new sites will be sampled for three years similar to how the other core sites were sampled. This additional data from the St. Joseph River will show a complete picture of the Indiana portion of the St. Joseph River from just downstream of Mottville, MI to just upstream of Niles, MI. Baugo Creek was also monitored more extensively starting in 2007. Two core sites were established and will be sampled for two more years to establish a baseline. Plans for the future include adding Goshen to the program and expanding efforts farther up the Elkhart River.

The aquatics program is not just about collecting fish data from area rivers and streams. The city's aquatic biologist is involved with local groups such as: The Elkhart River Alliance, St. Joseph River Basin Commission, Friends of the St. Joe, Michiana Walleye Association and the Indiana Bank Anglers Club. The biologist also stays connected with local schools by giving demonstrations and presentations to classrooms to increase awareness about what wonderful aquatic resources this area has.

The Index of Biotic Integrity (IBI), as modified by Simon (1997) for use in the St. Joseph River basin, has been utilized to assess the fish community information. This index was developed by Karr (1981), and is most useful in translating complex fish community information into a more understandable format for non-biologists. In simplest terms, the IBI acts as a biological indicator much like the DOW Industrial Average acts as an economic indicator (Karr 1996) and it provides a method to track the trends in fish community condition over time. It is comprised of three broad categories (species composition, trophic composition, and fish condition) which are broken down into 12 smaller categories known as metrics (Appendix A) to assess fish communities. These metrics are each given a score based on their similarity to least impacted (reference) sites; 1 (not similar), 3 (somewhat similar), or 5 (very similar). The total score for a site will range from 12 to 60. These scores can then be graphed and

Figure 1. MBI Personnel collecting macro-invertebrates with the use of a kick-net



placed into one of five classifications (very poor, poor, fair, good, or excellent) which describes the overall condition of the fish community being monitored.

Biologists recognize that fish community condition is a product of the water quality *and* the habitat that is available in any given area. Since 2003, Elkhart has been assessing available habitat at all sampling locations using the Qualitative Habitat Evaluation Index (QHEI) (Rankin 1989). This index is similar to the IBI in its structure. It has six broad categories which are broken down into 21 smaller categories or metrics (Appendix A). This index will have a final score of 0 to 100 and the scores will be classified as excellent, good, fair-good, poor, and very poor. This assessment will help determine to what extent the IBI scores are being affected by habitat and to begin cataloging the quality of available habitat in all the local rivers and streams.

There are other aquatic organisms that can be monitored to determine overall stream health. Through a sub-contract with the Midwest Biodiversity Institute (Figure 1) (MBI, Columbus, Ohio), the City of Elkhart completed its fourth year of benthic macroinvertebrate (bottom dwelling, visible animals without backbones) sampling. Fifteen sites were sampled in 2007 and results will be compared to baselines established from the past three years. The macroinvertebrate communities are assessed with the Invertebrate Community Index (ICI) developed by Ohio EPA (Ohio EPA 1987). This index is broken down into 10 metrics (Appendix A). Like the IBI metrics, the ICI metrics are given a score based on their similarity to relatively undisturbed sites; 6 (comparable to exceptional community), 4 (comparable to typical community), 2 (slightly dif-

Table 1: Fish consumption information taken from the 2007 Indiana Fish Consumption Advisory

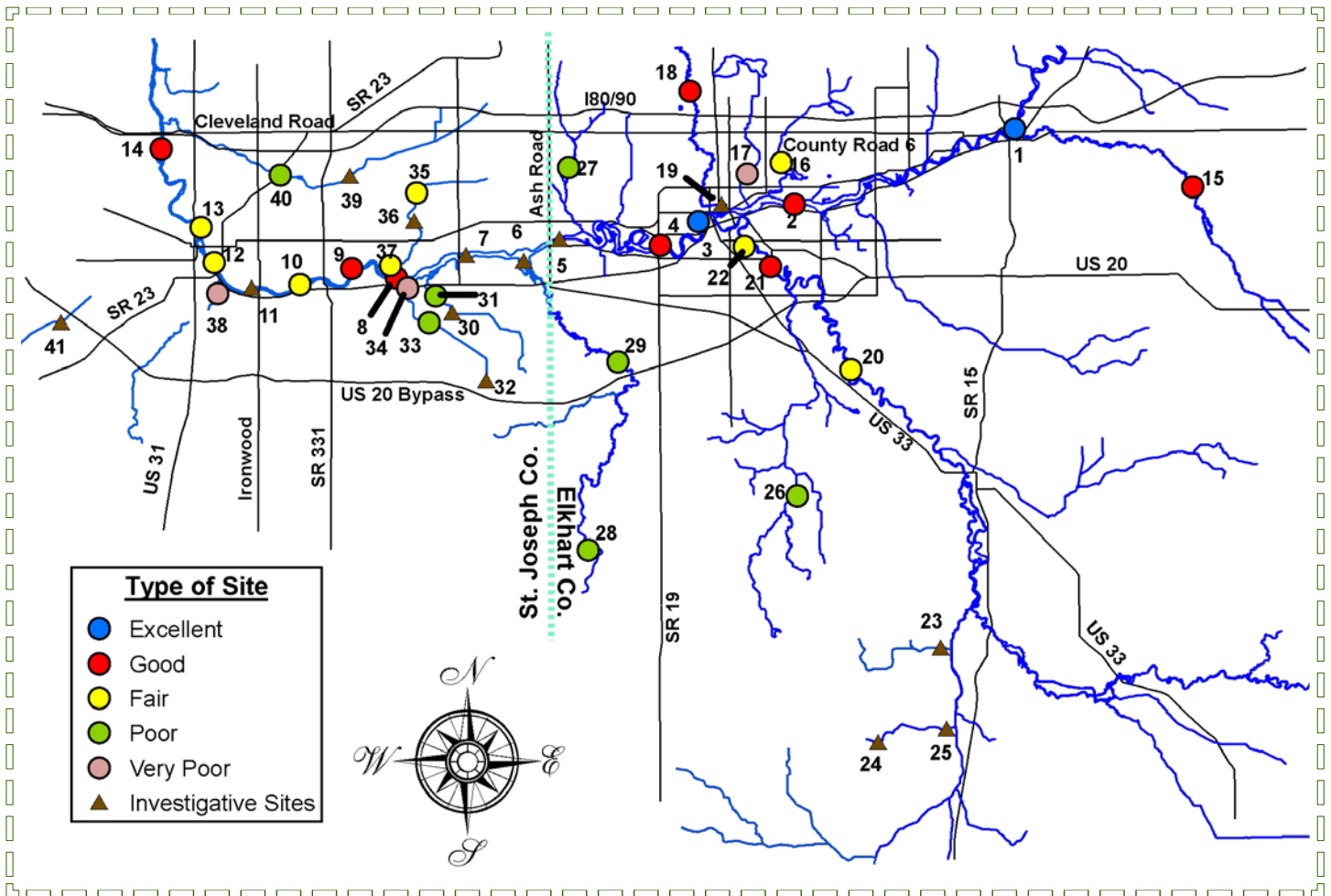
Location	Species	Fish Size (inches)	Contaminant	Group
Elkhart River <i>Elkhart River</i>	Rock Bass	9+	□	3
	Smallmouth Bass	17+	□	3
	White Sucker	16+	□	3
St. Joseph River <i>Elkhart County</i>	Bluegill	Up to 8		1
	Common Carp	25-28	□	3
		28+	□	4
	Channel Catfish	29+	□o	3
	Golden Redhorse	17+	□	3
	Northern Hogsucker	15+	□	3
	Rock Bass	Up to 7		1
	Shorthead Redhorse	15-17	□	3
		17+	□	4
	Walleye	16+	□	3
White Sucker	Up to 14		1	
St. Joseph River <i>St. Joseph County (Baugo Bay)</i>	Bluegill	Up to 8		1
	Channel Catfish	Up to 22	□	3
		22+	□	4
	Largemouth Bass	Up to 13		1
	Rock Bass	Up to 8		1
White Sucker	Up to 14		1	
St. Joseph River <i>St. Joseph County</i>	Black Redhorse	16-18	□	3
		18+	□	4
	Bluegill	Up to 7	□	3
		7+	□	4
	Common Carp	Up to 20	□	4
	Channel Catfish	All	□o	4
	Golden Redhorse	All	□	5
	Largemouth Bass	14+	□	3
	Quillback	18+	□	3
	Rainbow Trout (also known as Steelhead)	25-31	□	3
		31+	□	4
	Shorthead Redhorse	15-19	□	3
		19+	□	4
Smallmouth Bass	9+	□	3	
White Sucker	14-16	□	3	
Yellow Bullhead	Up to 10	□	2	
Juday Creek	White Sucker	17+	□	3

○ = Mercury
 □ = PCBs
 (Special restrictions apply to women and children. See advisory.)

Group 2 = 1 meal/week
 Group 3 = 1 meal/month
 Group 4 = 1 meal/2 months
 Group 5 = DO NOT EAT

ferent from the typical community), or 1 (very different from the typical community). The site scores range from 0 to 60 and are graphed and classified the same as the IBI scores. This combination of fish, habitat, and macroinvertebrate monitoring provides Elkhart, Mishawaka and South

Figure 2: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community condition for 2007



Bend with the most comprehensive view of our stream resources' health.

Besides water quality monitoring in the St. Joseph River basin, fish collections are conducted to determine the overall species diversity through out the area waterways. The aquatic biologist only tagged walleye (*Sander vitreus*) on sampling trips with the Indiana Department of Natural Resources (IDNR). Smallmouth bass (*Micropeterus dolomieu*) were not tagged in 2007. Tissue from 8 species was collected and analyzed for mercury and PCB content. This information was added to the existing tissue data from the basin, including new data from the Mishawaka area. The current Indiana Fish Consumption Advisory (FCA) (Table 1) shows many species from the St. Joseph River Watershed. The three cities involved in this program believe it is important to continually provide the public with the most updated information on fish consumption.

Methods

For ten years, the City of Elkhart has used two collection protocols to quickly classify the major fish species and to quantify water quality in the St. Joseph River basin. Investigative sites were normally sampled once and the fish collected at these sites were identified to species, the largest and smallest specimens measured to the nearest millimeter (mm), all fish were counted and then released. Conversely, index sites were sampled twice during the season, with a minimum five week "rest" period between sampling events. The length sampled is dependent on the wetted width of the stream. The length of sites was 15 times this width, with a minimum of 50 meters and a maximum of 500 meters. One investigative site was sampled during the day and five weeks later was sampled at night. This approach allows the aquatics staff to study shifts in fish assemblages in a 24 hour period. Differences in sampling and

Table 2: Fish sampling sites in Elkhart and St. Joseph Counties, 2007

Site Number	Site Description	Type of Site (Index/Investigative) County	Method	IBI Scores	ICI Scores	QHEI Scores
				2007	2007	2007
1	SR 15 (Bristol) St. Joseph River	Index Elkhart	Boat	55	42	66
2	Homan Avenue St. Joseph River	Index Elkhart	Boat	46		57
3	Sherman Street St. Joseph River	Index Elkhart	Boat	55		70
4	Nappanee Street St. Joseph River	Index Elkhart	Boat	51	24	60
5	Ash Road St. Joseph River	Investigative Elkhart	Boat			59
6	Baugo Bay St. Joseph River	Investigative St. Joseph	Boat			51
7	Bittersweet Road (A) St. Joseph River	Investigative St. Joseph	Boat			NA
8	Capital Avenue St. Joseph River	Index St. Joseph	Boat	47	36	56
9	Merrifield Park St. Joseph River	Index St. Joseph	Boat	48		56
10	Logan Street St. Joseph River	Index St. Joseph	Boat	45	48	61
11	Veteran's Park St. Joseph River	Investigative St. Joseph	Boat			58
12	Jefferson Blvd St. Joseph River	Index St. Joseph	Boat	41		53
13	Michigan Street St. Joseph River	Index St. Joseph	Boat	45		75
14	Pinhook Park (B) St. Joseph River	Index St. Joseph	Boat	46	50	69
15	County Road 10* Little Elkhart River	Index Elkhart	Tote Barge	46		75
16	County Road 8* Puterbaugh Creek	Index Elkhart	Tote Barge	42		60
17	Reckell Avenue Lily Creek	Index Elkhart	Back Pack	15		30
18	County Road 4 Christiana Creek	Index Elkhart	Tote Barge	49		73
19	High Dive Park (A) Christiana Creek	Investigative Elkhart	Tote Barge			74
20	Oxbow Park Elkhart River	Index Elkhart	Boat	45	36	77
21	Indiana Avenue Elkhart River	Index Elkhart	Boat	51	36	78
22	Middlebury Street Elkhart River	Index Elkhart	Boat	41		76
23	County Road 21 Swoveland Ditch	Investigative Elkhart	Tote Barge			34
24	County Road 17 Dausman Ditch	Investigative Elkhart	Tote Barge			41
25	County Road 21 Dausman Ditch	Investigative Elkhart	Back Pack			52
26	County Road 32 Yellow Creek	Index Elkhart	Tote Barge	31		59

* denotes a cool/cold water site

Table 2 (continued)

Site Number	Site Description	Type of Site (Index/Investigative) County	Method	IBI Scores	ICI Scores	QHEI Scores
				2007	2007	2007
27	County Road 8* Cobus creek	Index Elkhart	Tote Barge	28		64
28	County Road 1 (S) Baugo creek	Index Elkhart	Tote Barge	27	MG	61
29	County Road 3 (N) Baugo Creek	Index Elkhart	Tote Barge	36	18	73
30	Harrison Road* Woodward Ditch	Investigative St. Joseph	Back Pack			36
31	Oakside Avenue* Woodward Ditch	Index St. Joseph	Both	28	26	24
32	Dragoon Trail* Eller Ditch	Investigative St. Joseph	Back Pack			33
33	Bridgeton Drive* Eller Ditch	Index St. Joseph	Both	33	16	50
34	Lincolnway* Eller Ditch	Index St. Joseph	Both	17	26	55
35	Day Road* Willow Creek	Index St. Joseph	Back Pack	44	30	55
36	Early Road* Willow Creek	Investigative St. Joseph	Back Pack			35
37	Estates Blvd* Willow Creek	Index St. Joseph	Back Pack	37	40	55
38	Ravina Park Bowman Creek	Index St. Joseph	Back Pack	7		43
39	Merrifield Drive* Juday Creek	Investigative St. Joseph	Tote Barge			50
40	State Road 23* Juday Creek	Index St. Joseph	Tote Barge	36	46	52
41	Mayflower Road Dixon West Place Ditch	Investigative St. Joseph	Tote Barge			NA

* denotes a cool/cold water site

processing (Foy 2004) have allowed multiple investigative sites to be sampled in a day versus one or two index sites. Every species collected at each site is verified either by retaining a small specimen for the Office of Public Works voucher museum or photographing a large specimen. This practice allows for the verification of the field and lab identifications if needed.

In 2007, 13 index and 8 investigative sites were sampled in St. Joseph County and 15 index and 5 investigative sites were sampled in Elkhart County (Figure 2 and Table 2). Index sites were sampled twice and investigative sites were generally sampled once. IBI scores were calculated for each of the index sites and an average from the two visits was obtained to give the final score (Table 2).

Fish were collected from all sites using either boat mounted, tote barge, or backpack electrofishing equipment. The type of gear used was dependent on the size of the stream. The St. Joseph and Elkhart Rivers were sampled with the boat. Smaller, wadeable streams were sampled with the tote barge, unless the stream was extremely small and shallow, in which case, the backpack was used. Power output from the three devices differed. The boat output was 8-16 amperes, the tote barge was 4-6 amperes, and the backpack was 0.5-1.5 amperes.

At all sites sampled, stream habitat information was methodically obtained using the Qualitative Habitat Evaluation Index (QHEI) as developed by Ohio EPA (Rankin 1989). All field staff assessed the available habitat at all fish sampling sites each

Figure 3: Hester-Dendy samplers newly placed into the stream bed.

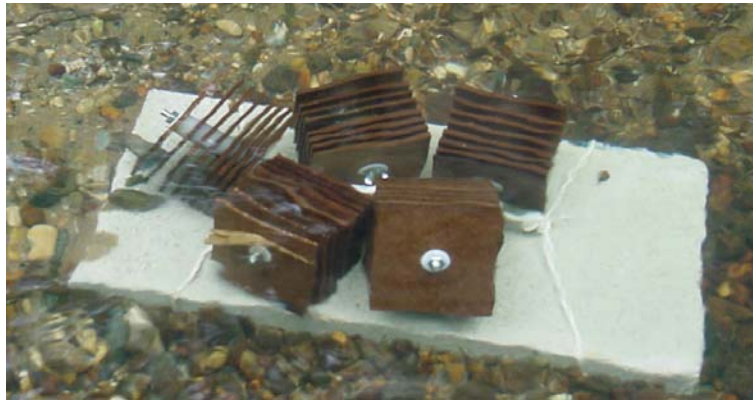


Table 3: Macroinvertebrate Sampling Sites, 2007

Site Number	Stream	Location	Site Number	Stream	Location
1	St. Joseph River	Bristol	8	Baugo Creek	County Road 1 (S)
2	St. Joseph River	Nappanee Street	9	Baugo Creek	County Road 3 (N)
3	St. Joseph River	Capital Avenue	10	Woodward Ditch	Oakside Avenue
4	St. Joseph River	Logan Street	11	Eller Ditch	Bridgeton Drive
5	St. Joseph River	Pinhook Park (B)	12	Eller Ditch	Lincolnway
6	Elkhart River	Oxbow Park	13	Willow Creek	Day Road
7	Elkhart River	Indiana Avenue	14	Willow Creek	Estates Blvd
			15	Juday Creek	SR 23

Figure 4: Location of macroinvertebrate sampling sites for 2007

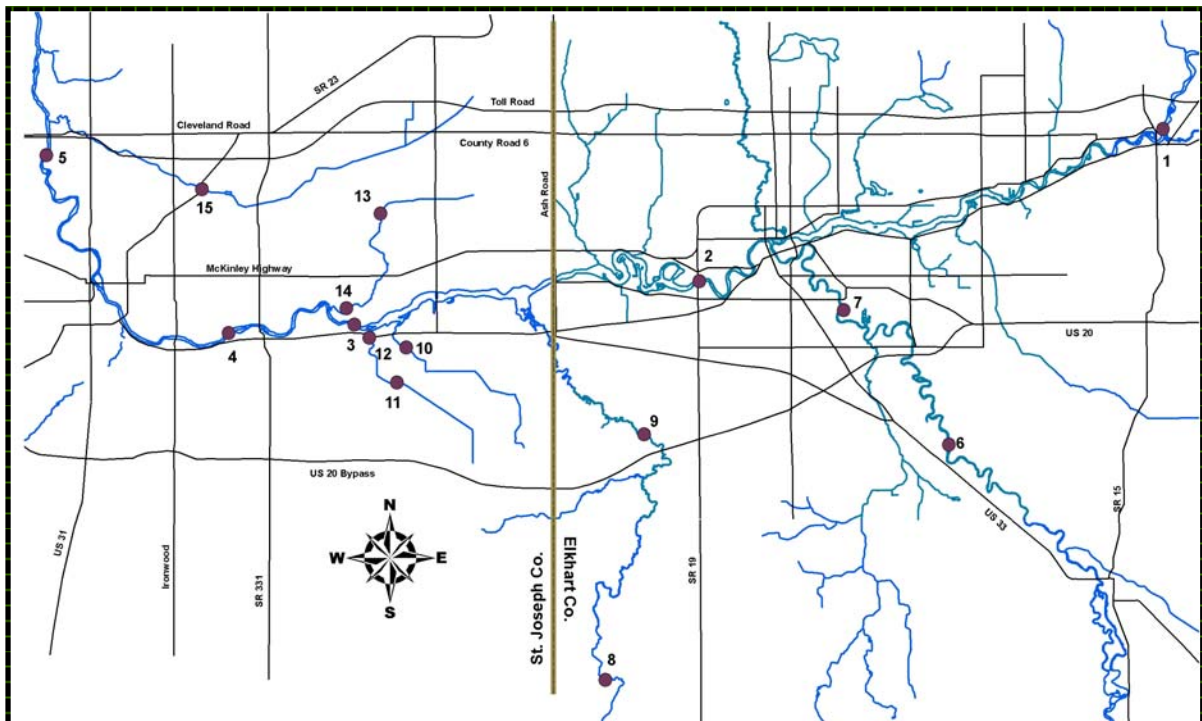


Figure 5: Location of fish tissue collection sites for 2007

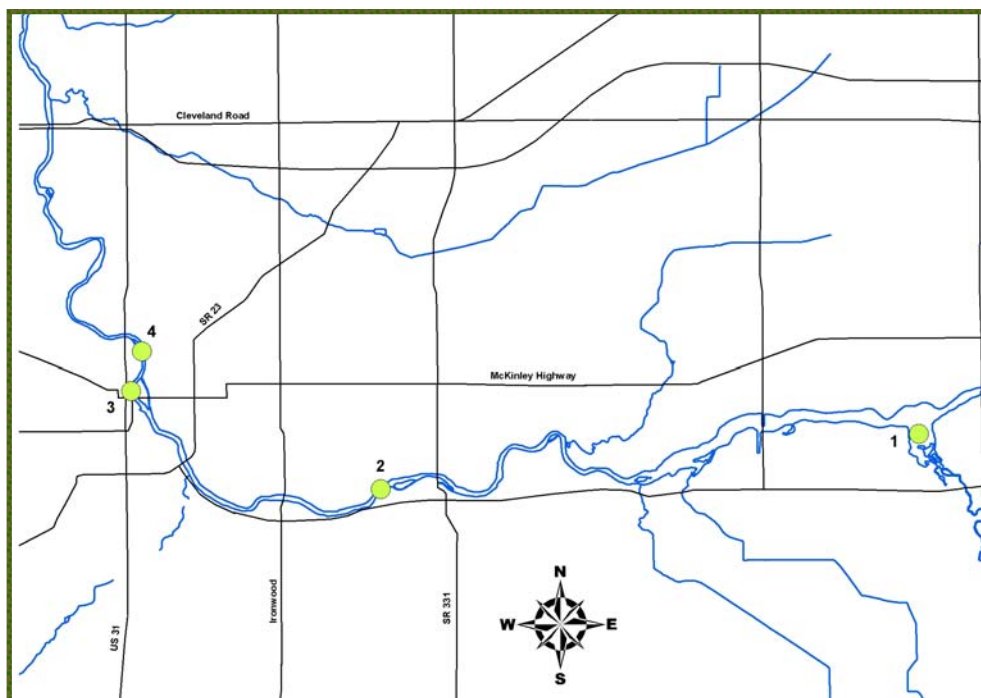


Table 4: Fish tissue sites, 2007

<u>Site Number</u>	<u>Stream</u>	<u>Station</u>
1	St. Joseph River	Baugo Bay
2	St. Joseph River	Logan Street
3	St. Joseph River	LaSalle Street
4	St. Joseph River	Michigan Street

time the site was visited. All scores were then averaged to give one final score (Table 2).

During the third week in August, MBI personnel placed Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) (Figure 3) at 15 sites that were also sampled for fish (Table 3 and Figure 4) following Ohio EPA macroinvertebrate sampling procedures (Ohio EPA 1987, 1989). Fourteen of the fifteen samplers were successfully retrieved approximately 6 weeks after being set and their contents were preserved in alcohol for later identification. The data gathered from the samplers is considered a quantitative sample where species are identified and specimens are counted. This information is then used to calculate ICI scores for each site. Qualitative sampling also took place with the use of a kick net through all available habitat near the location of the sampler. This extra sampling is used to capture additional species as well as provide information to make an estimate of stream health in the case where an ICI score can not be calculated because a sampler was un-retrievable. Ta-

ble 2 displays all ICI scores for 2007.

Fish tissue in the form of fillets was collected from bluegill (*Lepomis macrochirus*), common carp (*Cyprinus carpio*), golden redhorse (*Moxostoma erythrurum*), largemouth bass (*Micropterus salmoides*) Steelhead (*Oncorhynchus mykiss*), rock bass (*Ambloplites rupestris*), smallmouth bass, and walleye. Table 4 and figure 5 display the location of tissue sample collection. Each tissue sample sent in for analysis was a composite of fillets from three fish of the same species from the sample region. The shortest specimen collected was within 90% of the length of the longest specimen. The samples were collected follow-

ing the procedures in Appendix B (this report) and Appendix III in Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (1993).

Results and Discussion

During the summer of 2007, a total of 19,289 fish were collected in Elkhart County and 11,128 fish were collected in St. Joseph County (Appendix C). In St. Joseph county, these fish represented 60 species in 14 families and in Elkhart County, collected fish represented 66 species in 14 families. In total, 71 different species were captured from the two counties.

White sucker (*Catostomus commersonii*), creek chub (*Semotilus atromaculatus*), and rock bass were the top three species collected in Elkhart county, while longear sunfish (*Lepomis megalotis*), gizzard shad (*Dorosoma cepedianum*), and rock bass were the top three species sampled in St. Joseph County.

Indices

The IBI, ICI, and QHEI scores for 2006 are summarized in Table 2. Throughout this report these values will be presented in graphical form to illustrate longitudinal changes on the different streams. The IBI and ICI graphs have an attain-

ment line. Fish and benthic macro-invertebrate communities that score below this mark are considered impaired. There are many reasons (thermal pollution, habitat degradation, chemical spills, etc.) that contribute to these impairments.

Fish community conditions at the index sites ranged from very poor (7) at Ravina Park on Bowman Creek to excellent (55) at Bristol and Sherman Street on the St. Joseph River. The quality of the habitat at the index and investigative sites ranged from very poor (24) at Oakside Avenue on Woodward Ditch to excellent (78) at Indiana Avenue on the Elkhart River.

The Indiana Department of Environmental Management (IDEM) has established guidelines to determine if a body of water is being impaired or if its condition is supportive of aquatic life (IDEM 2006) for the IBI and QHEI. The ICI is not an index used by IDEM, however similar guidelines have been established by OHIO EPA for a nearby region, and those values are being used with the Elkhart and St. Joseph County data. Values of 36 or higher for IBI and ICI scores are indicators of a stream with the ability to support aquatic life. QHEI scores of 51 or larger indicate enough quality habitat is available to support aquatic communities.

Figure 6: IBI scores for the St. Joseph River, Elkhart and St. Joseph Counties

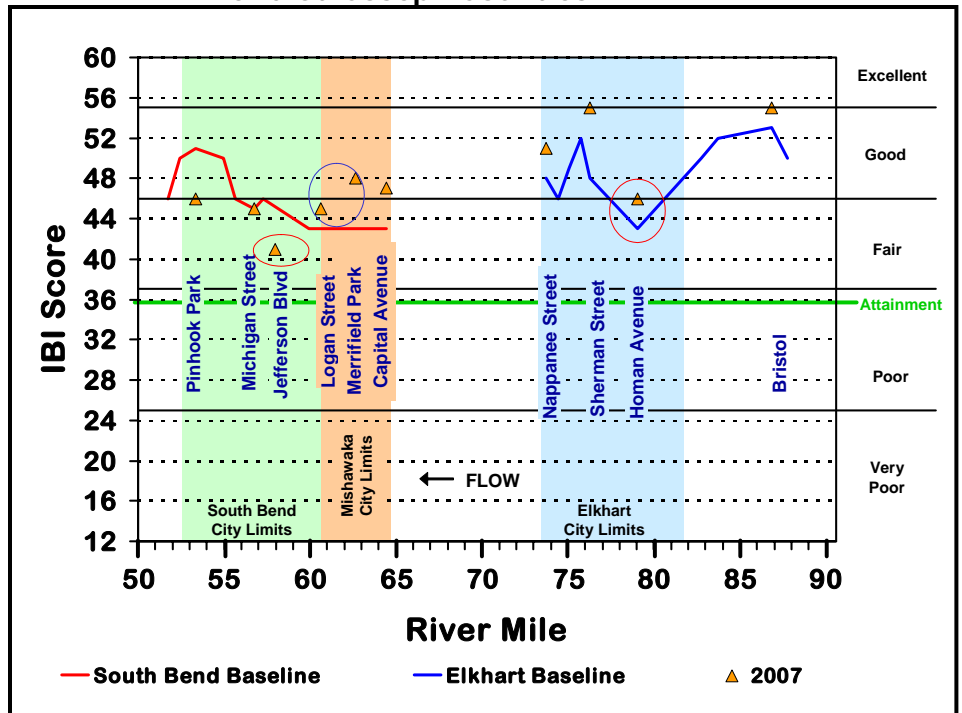


Figure 8: QHEI scores for the St. Joseph River, Elkhart and St. Joseph Counties

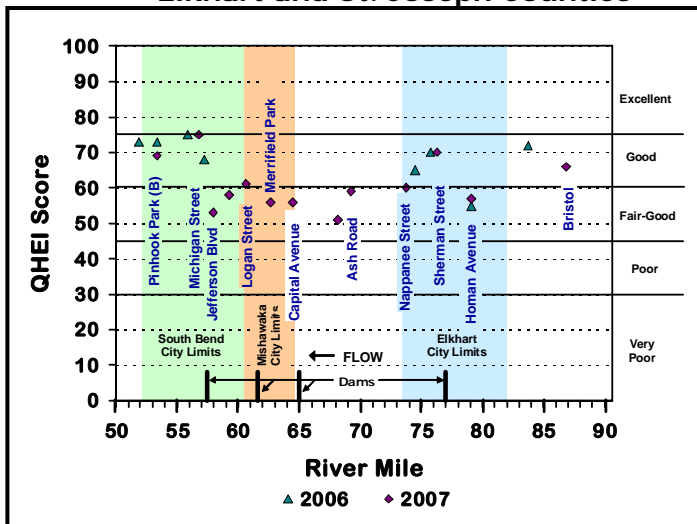
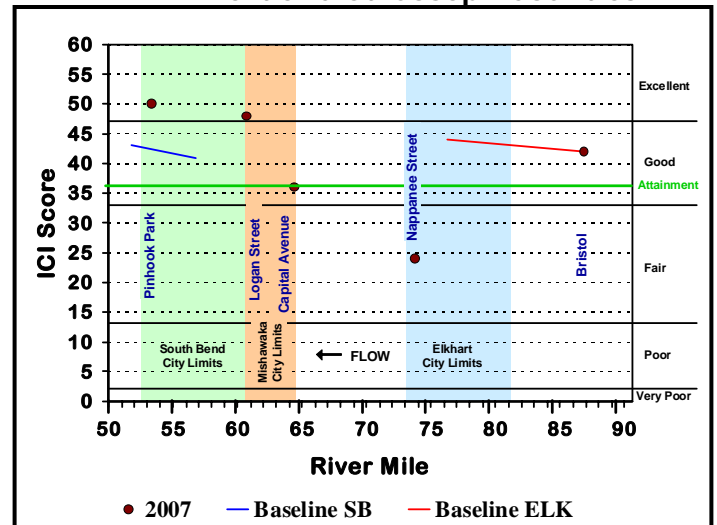


Figure 7: ICI scores for the St. Joseph River, Elkhart and St. Joseph Counties



The longitudinal trends in fish community condition for the entire Indiana portion of the St. Joseph River is displayed in Figure 6. Fish community condition continued to be good to excellent in the Elkhart Area. The exception is the Homan Avenue area, circled in red. 2007 marked the third, consecutive year of sampling near Homan Avenue. The average IBI for those three years was incorporated into the baseline. The reason for the dip in the baseline is that our current IBI is calibrated for rivers and streams and not for lake

Figure 9: IBI scores for the Elkhart River, Elkhart County

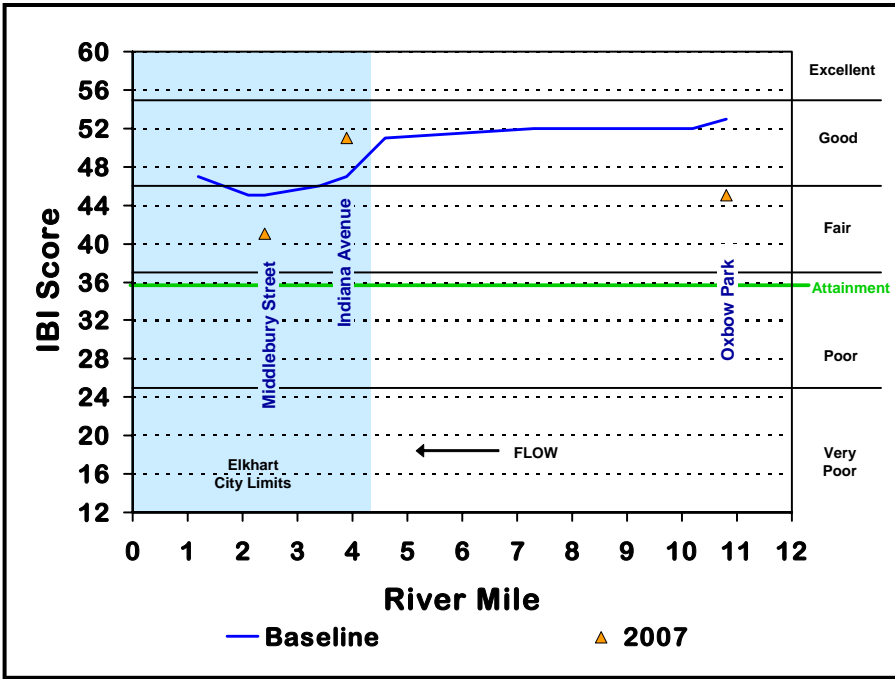
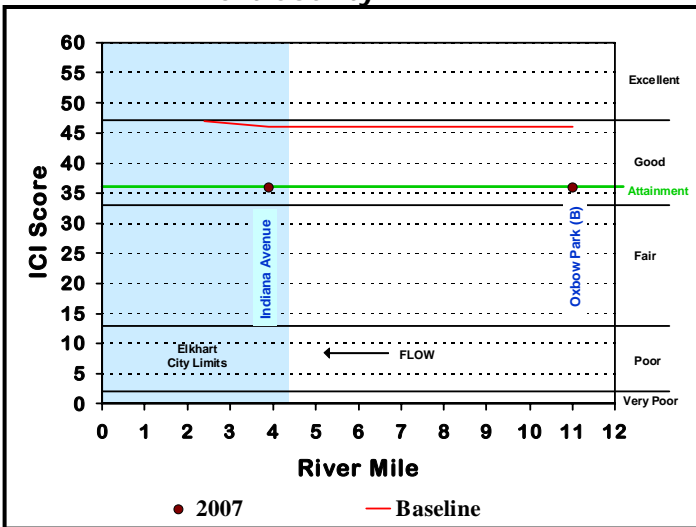


Figure 10: ICI scores for the Elkhart River, Elkhart County



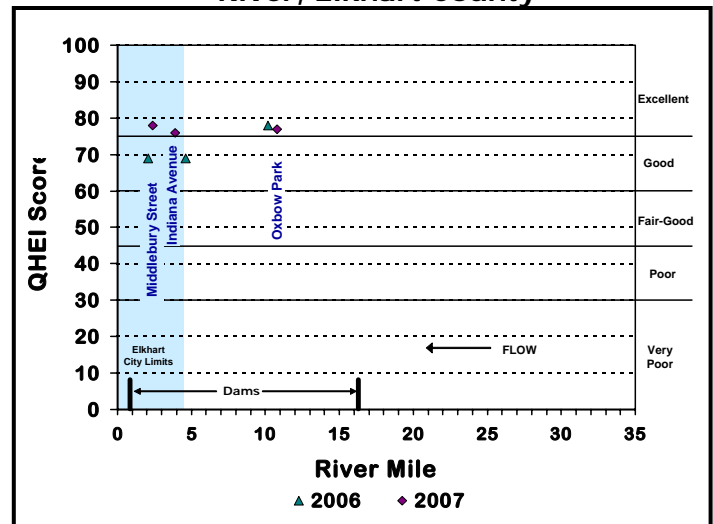
environments. The Homan Avenue area is in the Elkhart impoundment and the river acts more like a lake due to this area's proximity to the Johnson St. Dam. Macroinvertebrate scores for the Bristol area continued to fall into the good category (Figure 7) and that was expected based on the fish and habitat scores for that area. The ICI score for Nappanee Street was lower than expected because of the good IBI score and adequate QHEI score. However, after further examination of the placement of the artificial substrate, it was determined that the flow of water over the sampler was too high to allow ample colonization. It is believed

that the macroinvertebrate community is much better in that area, as there was a large percentage of insectivorous fish captured at that site. The Habitat scores (Figure 8) continue to be good for the Elkhart area, except at Homan avenue, where the majority of the shoreline is artificial seawalls and much of the natural habitat has been removed.

IBI scores for the St. Joseph River in St. Joseph County are not as promising (Figure 6). Some sites showed improvements, while others stayed the same or fell slightly. 2007 marked the first year that new sites were established within the Mishawaka city limits. These sites (circled in blue) scored in the fair to good range and were immediately above and below the old Uniroyal Dam in Mishawaka. These two sites are not included in the baseline and will not

be until three years of sampling are completed, in order for there to be an average score for each site calculated. The other site in Mishawaka was an original South Bend site established in 2001. This site had an improved IBI compared to the established baseline. The Jefferson Blvd area (circled in red) is similar to the Homan Avenue area in Elkhart. The scores for this site are not included in the baseline because we have not yet obtained sufficient data. The most downstream site saw a decline in its fish community structure compared to the baseline. It was not a large departure, however it is worth noting. QHEI scores

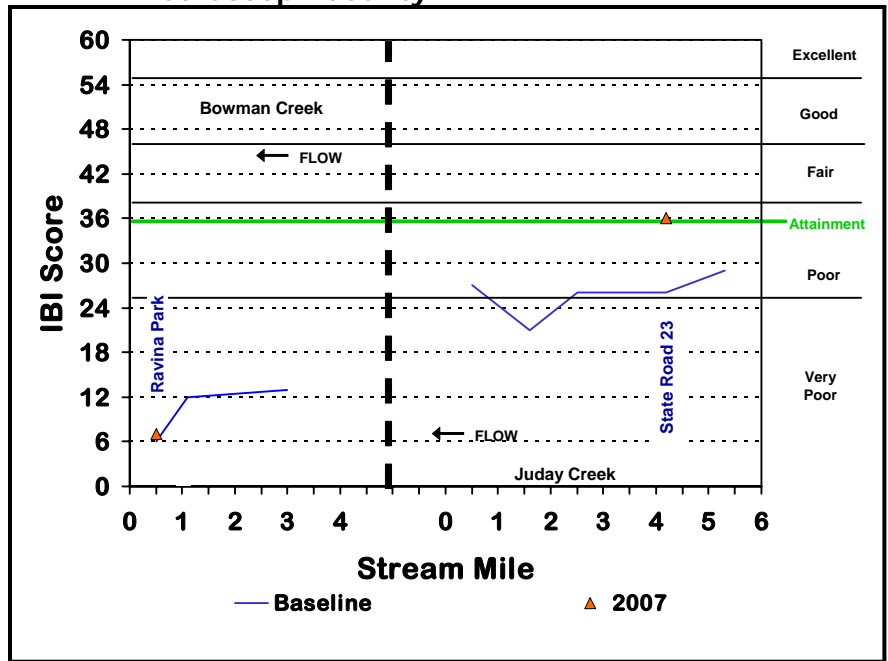
Figure 11: QHEI scores for the Elkhart River, Elkhart County



for St. Joseph County (Figure 8) rise as the river leaves the urban areas due to a more natural stream bank that is not littered with concrete sea-walls and has an overall wider riparian zone. ICI scores followed the same pattern as the QHEI scores (Figure 7). All three sites sampled were at or above the attainment line and the sites at Logan Street and Pinhook Park were in the excellent range. One reason for the Capital Avenue site being lower could be its proximity to the Twin Branch Dam, which could cause turbulent flow and not allow colonization of the samplers.

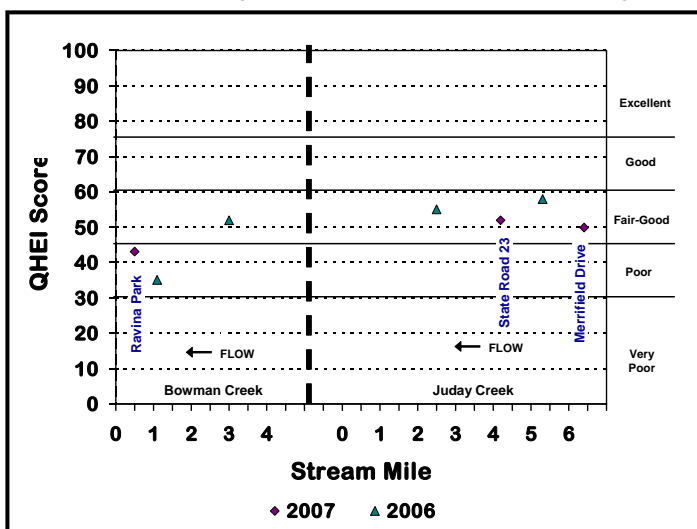
The 2007 IBI scores for the Elkhart River differ from the established baseline (Figure 9), but follow the pattern that was observed in 2004, the last time these three sites were sampled. IBI scores at Oxbow Park and Middlebury Street fell further and the IBI score at Indiana Avenue increased. The reasoning for the fall at Oxbow Park in 2004 was a bridge construction project just upstream of the area. That project has long since been completed. It is unknown at this time if there are residual effects of that project detrimentally affecting the fish communities downstream. A better explanation could be low water levels due to the drought like conditions that the watershed experienced. Shallow areas were either in-accessible or did not hold any fish. ICI scores (Figure 10) fell dramatically at Oxbow Park and Indiana Avenue from 2006 to 2007. These numbers help explain why the IBI at

Figure 12: IBI scores for Bowman Creek and Juday Creek, St. Joseph County



Oxbow was low; however it does not make sense that the ICI was low at Indiana Avenue yet the IBI was high. There may have been something in the water that was affecting the insect community through out that stretch of the Elkhart River. The Oxbow Park section may again be sampled in 2008 for both fish and macroinvertebrates. Figure 11 displays QHEI scores for the Elkhart River. The graph shows that there is sufficient, quality habitat to support healthy fish communities. The Elkhart River continues to maintain adequate habitat for fish communities. However, this habitat can not be utilized if it is out of the water.

Figure 14: QHEI scores for Bowman Creek and Juday Creek, St. Joseph County

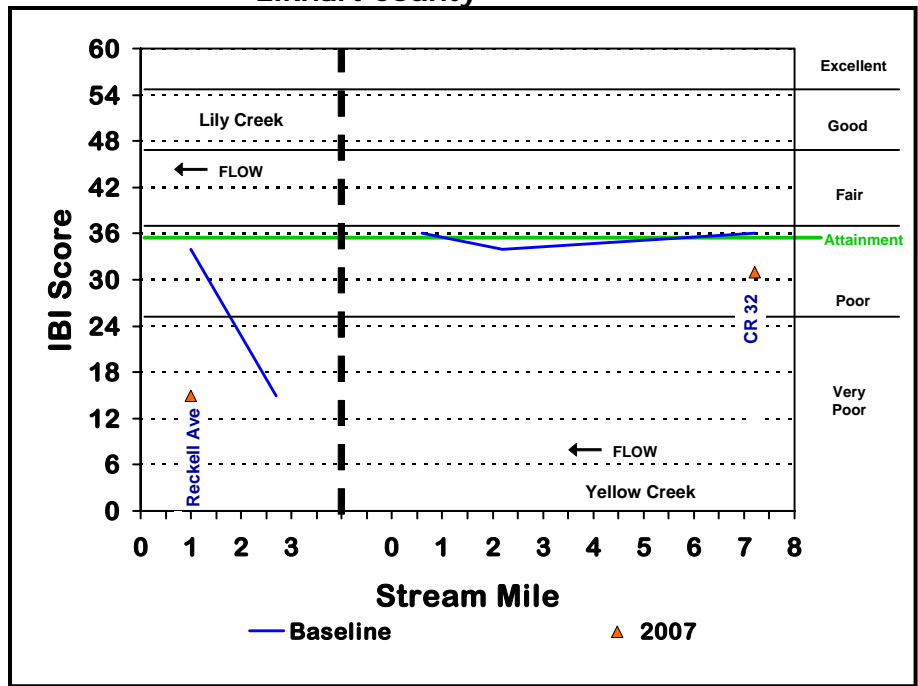


While it is important to monitor the main stem of the St. Joseph and Elkhart Rivers, it is as important to monitor the tributaries of these streams, as it may give us an idea as to why conditions are what they are in those major waterways. Similar longitudinal views are presented for area streams and they can be compared against past conditions.

Juday Creek and Bowman Creek are two tributaries of the St. Joseph River that flow through areas of South Bend. Other than the fact that both streams are heavily impacted by urban influences, these tributaries are quite different. Juday Creek is a cool/cold water stream that is capable of supporting trout, whereas Bowman creek is much warmer and has severely impaired biological communities.

As in the past, the 2007 IBI scores for Bowman Creek are disappointing (Figure 12). One of the main reasons for the low scores is that the flow in Bowman Creek is very intermittent. Through most of the summer there was no water in the channel at Ravina Park. After heavy rains in August, there was an abundance of water at this site and it was sampled. Only two fish were collected. Five weeks later there was barely a trickle. No fish were found during the second sampling event. The City of South bend is investigating ways to improve the flow in Bowman Creek. Habitat is also a limiting factor (Figure 14) in Bowman Creek. This will need to be enhanced as well, in order to see a positive increase in overall aquatic community health.

Figure 15: IBI scores for Lily Creek and Yellow Creek, Elkhart County



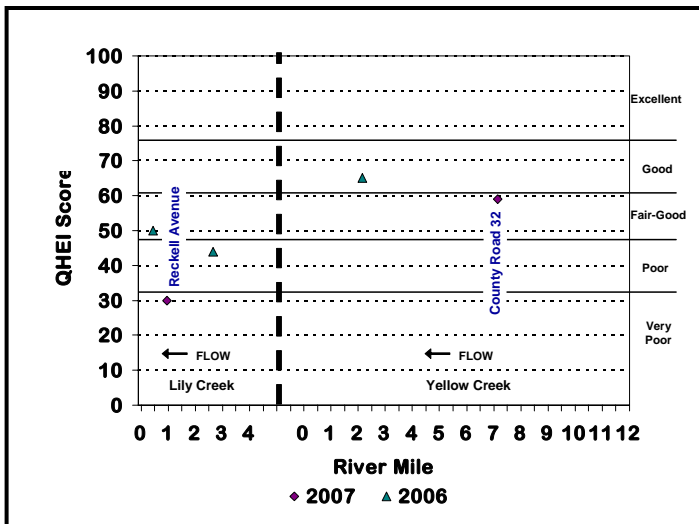
The IBI score for Juday Creek showed a positive increase in 2007 (Figure 12). This is the highest IBI recorded by Public Works & Utilities in Juday Creek. This was the first time since 2003 that this site was sampled. However, even though we saw an increase in the IBI, it is still in the poor area and barely reached the attainment line. Since Juday Creek is a cool/cold water stream, The current IBI may not give us an accurate portrayal of the biological integrity. Our current IBI is calibrated for warm water streams. There is currently a cool water IBI available, but at this time is not recognized by IDEM. A new IBI will be calculated for this site and will be com-

pared to the currently used IBI to see if there are any differences. The ICI score for State Road 23 was 46 for 2007, which is right at the division between good and excellent classification for the health of the macroinvertebrate community. Water quality in this stretch seems to have increased. Habitat scores stayed fairly consistent (Figure 14) for the length of Juday Creek.

In 2006, the IBI for Yellow Creek was above both the established baseline and the attainment line (Kring 2007). However, in 2007 that trend drastically changed (Figure 15). The IBI score at County Road 32 fell below the baseline and the stream is not attaining at this location. Nearly all fish species captured at this location were tolerant species and generalists when it came to feeding. This means that water conditions are bad and that there are not enough food sources to support a diverse fish community. The aquatics staff sampled Yellow Creek Lake in 2007. Only two fish were collected in a half hour of sampling. Some of the problems in Yellow Creek may start in the lake, since water flowing out of the lake is what starts Yellow Creek. Habitat continues to be fair-good in Yellow Creek (Figure 16), suggesting that there are other factors affecting the fish communities in Yellow Creek.

In 2007, Lily Creek continued to show that it can not support quality aquatic life (Figure 15). In 2006, the Park-Six site scored an 8 because the

Figure 16: QHEI scores for Lily Creek and Yellow Creek, Elkhart County

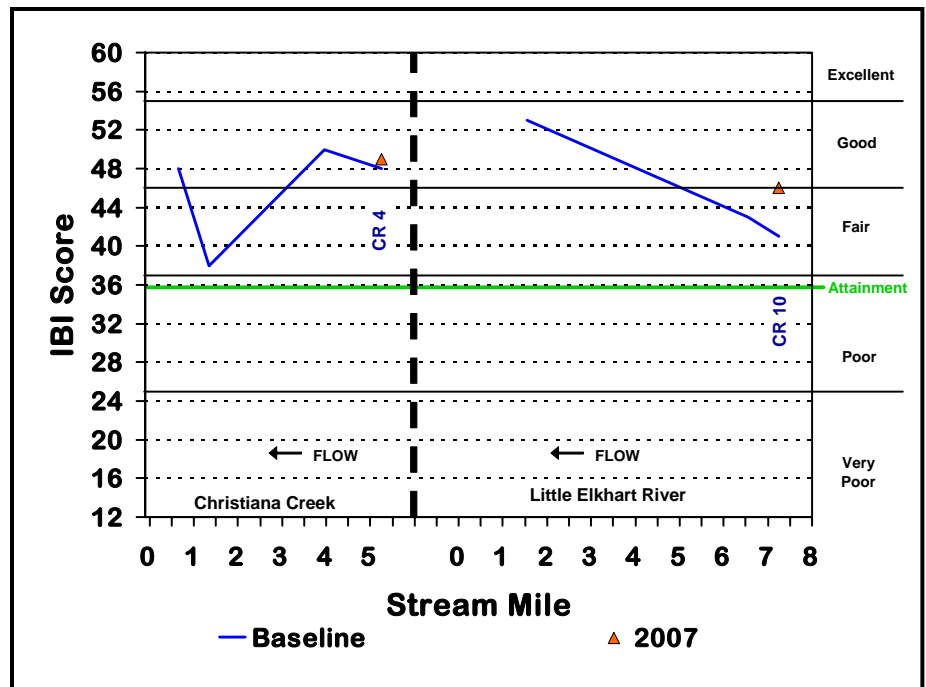


stream bed was dry during the second attempted sampling run (Kring, 2007). The IBI for Reckell Avenue in 2007 scored an 18, still way below the attainment line and the original baseline. Habitat scores were very poor for the 2007 site (Figure 16). There have been many alterations to this site since it was first sampled in 1999. Trees and stumps have been removed and there has been a lot of sedimentation in this area. The Reckell Avenue site is going to be sampled again in 2008 and we will also sample macroinvertebrates again to try to figure out what is really going on in the stream.

As in past years, the fish communities in Christiana Creek continue to be good (Figure 17). The County Road 4 site sampled in 2007 has maintained stable aquatic communities since it was first sampled in 1998. Figure 18 shows that there is ample quality habitat to support diverse fish communities. Christiana Creek is one of a few streams in Elkhart County that is not designated as a legal drain. This stream continues to be one of the highest quality waterways in our area. Data collected from this stream can show how well a stream can function when not plagued by detrimental anthropogenic disturbances.

The following three streams, the Little Elkhart River, Cobus Creek, and Puterbaugh Creek are all

Figure 17: IBI scores for Christiana Creek and the Little Elkhart River, Elkhart County



considered cool/cold water streams. As mentioned earlier, the currently used IBI calibration is for warm water streams. The scores presented are from this warm water calibration. Efforts are being made to score these types of streams with a new cool water index. However, until the State of Indiana recognizes such an index, scores will be calculated as in the past.

The Little Elkhart River continues to support a diverse and healthy fish community (Figure 17). This stream has consistently had IBI scores in the upper fair to good range with an occasional score in the excellent range (Foy 2005). However, as investigations continue on the calibration of a cool-water IBI, it appears that the current IBI may not be limiting the scores, but artificially inflating them. Cool water streams can be considered degraded if there is an abundance of warm water species present. Nearly half of the species collected during both sampling runs in 2007 at County Road 10 were species that are not considered cool water species. However, as previously mentioned, for the time being the Little Elkhart River will be scored as per present protocol and it is well exceeding expectations with regards to aquatic communities. Habitat quality within the Little Elkhart River remains some of the best in the area (Figure 18). It will be interesting in future years to see how well the Little Elkhart River really does score for a cool water stream.

Figure 18: QHEI scores for Christiana Creek and the Little Elkhart River, Elkhart County

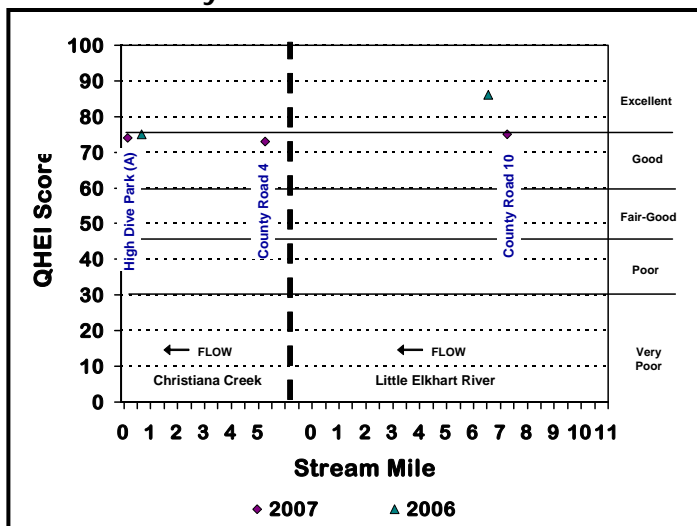
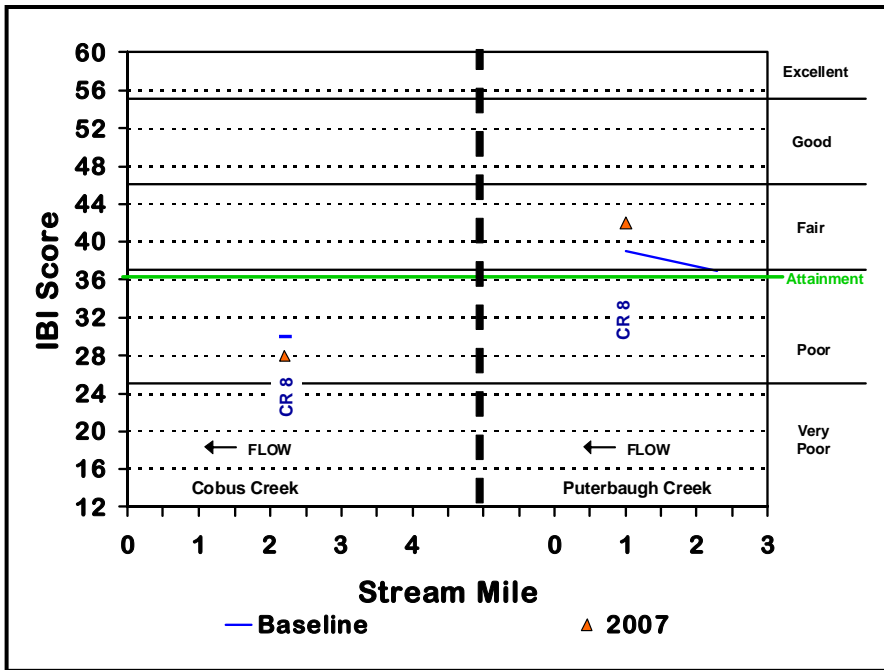


Figure 19: IBI scores for Cobus Creek and Puterbaugh Creek, Elkhart County



Cobus Creek is a cool/cold water stream that originates in Michigan and flows south towards the St. Joseph River. This stream may benefit in the future by being scored with a new index as many of the species collected at County Road 8 are considered cool water fishes. However, as for the present, IBI scores for Cobus Creek remain steady and fall short of the current attainment line (Figure 19). This stream is consistently stocked with both rainbow and brown trout to provide a put-and-take fishery for these salmonids. Figure 20 shows that there is adequate habitat to support a diverse fish community at this section of the stream. There are many natural meanders and plenty of riparian vegetation, however, sedimentation seems to be a problem through out this section of Cobus Creek.

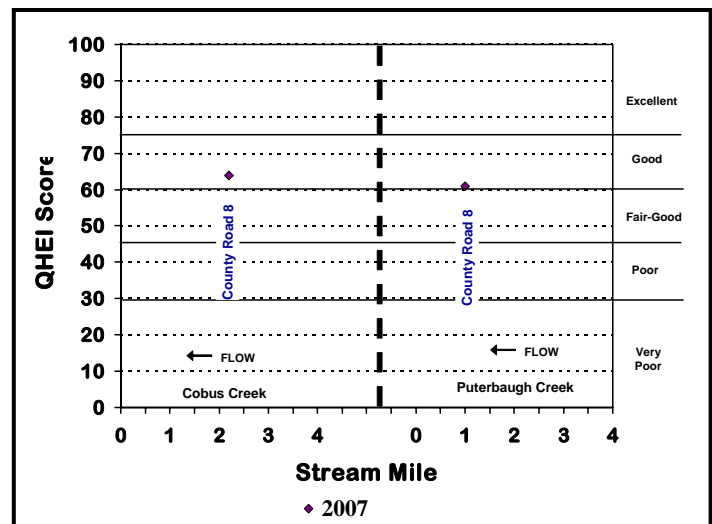
Puterbaugh Creek is also a cool/cold water stream and flows out of Heaton Lake in Elkhart. There are many springs that recharge this stream and keep the temperature consistently cool. This stream has a mix of cool and warm water species. The lower section of this stream may be influenced by the St. Joseph River in regards to species utilization. The County Road 8 site scored in the fair category in 2007 and was above the baseline (Figure 19). This section of Puterbaugh Creek supports a good population of darter species. Darters are good indicators of water quality and heterogeneous habitat. Figure 20 shows that the habitat available for aquatic organisms is good.

The County Road 8 site has a lot of natural bends and an abundance of vegetation that provides cover and protection for many of the species found there.

In 2007, four streams were added to the list to have index sites established on them. These streams are Baugo Creek in Elkhart County, and Willow Creek, Eller Ditch, and Woodward Ditch in St. Joseph County. Baugo Creek had been sampled many times over the last nine years, but the sampling done was only investigative and thus there were no IBI scores calculated for this stream. The other three streams are part of the Mishawaka portion of the project. None of these streams had been sampled by the City of Elkhart prior to 2007.

Baugo Creek is impacted by many anthropogenic influences and has severe bank erosion problems through out its drainage. Many of the detrimental impacts are seen to come from agricultural practices, but there are many urban impacts on the stream as well. In order to fully understand the integrity of the entire system, two index sites were established on the stream. One site was established upstream near the headwaters and the second site was established further downstream. The difference in drainage areas between the two sites is over 50² miles. Figure 21 shows that Baugo Creek is currently not supporting strong fish communities. The further downstream site is right on the attain-

Figure 20: QHEI scores for Cobus Creek and Puterbaugh Creek, Elkhart County



ment line, whereas the upstream site falls way below this line. There was an abundance of fish collected at each site, but most were tolerant species, especially at the upstream site. The health of the macroinvertebrate communities is just as disappointing (Figure 22). The Hester-Dendy sampler placed at CR 1(S) was buried and was not colonized. This can be attributed to the large sediment load that travels through Baugo Creek. There seems to be adequate available habitat in the stream (Figure 23). This stream does have a major sedimentation problem, especially during periods of heavy rain.

Willow Creek is a cold water stream that scored fairly well with the warm water IBI (Figure 21). There is a possibility that this stream may score even better with a cool water calibration of the IBI, especially at the downstream site. This stream can support trout and a few were collected during the summer of 2007. Adult steelhead were observed at two locations in the spring of 2007. The highest recorded temperature during five sampling events was 17.9°C. That is more than adequate to support trout production. The ICI scores for Willow Creek ranged from fair to good (Figure 22). The pattern of these scores were exactly opposite of the IBI scores. There was more flow at the downstream site that would have allowed for more drift downstream of macroinver-

Figure 23: QHEI scores for Baugo Creek, Elkhart County and Willow Creek, St. Joseph County

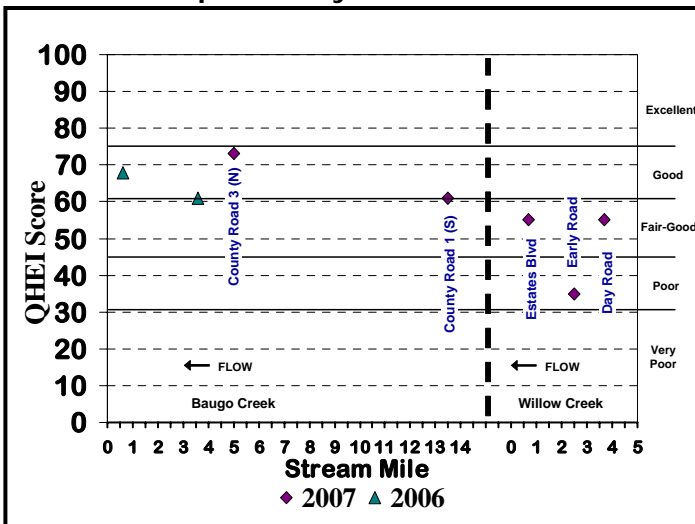


Figure 21: IBI scores for Baugo Creek, Elkhart County and Willow Creek, St. Joseph County

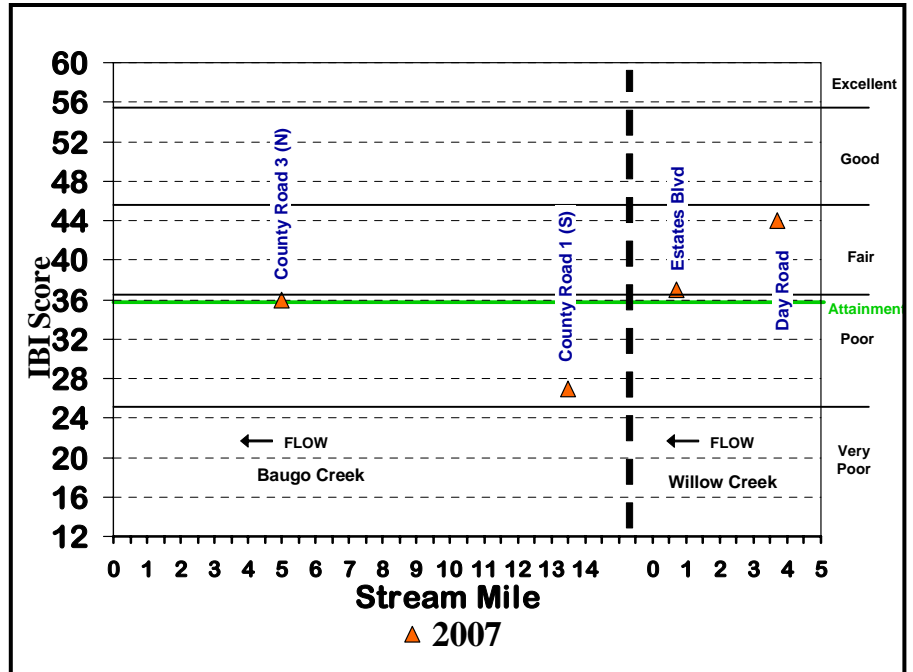
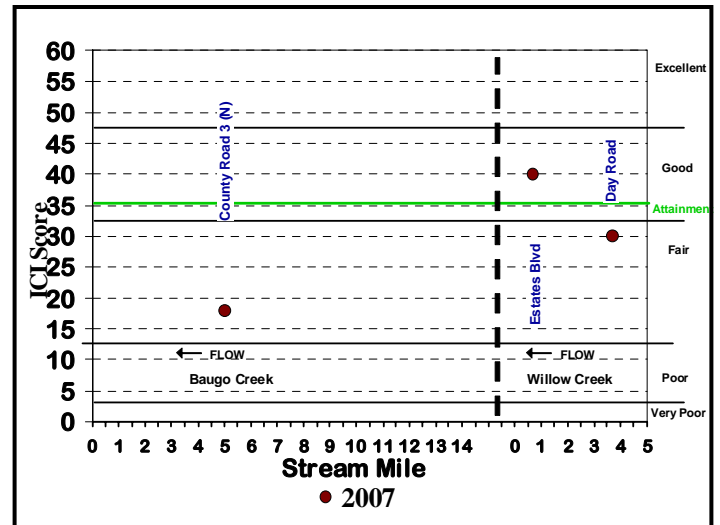


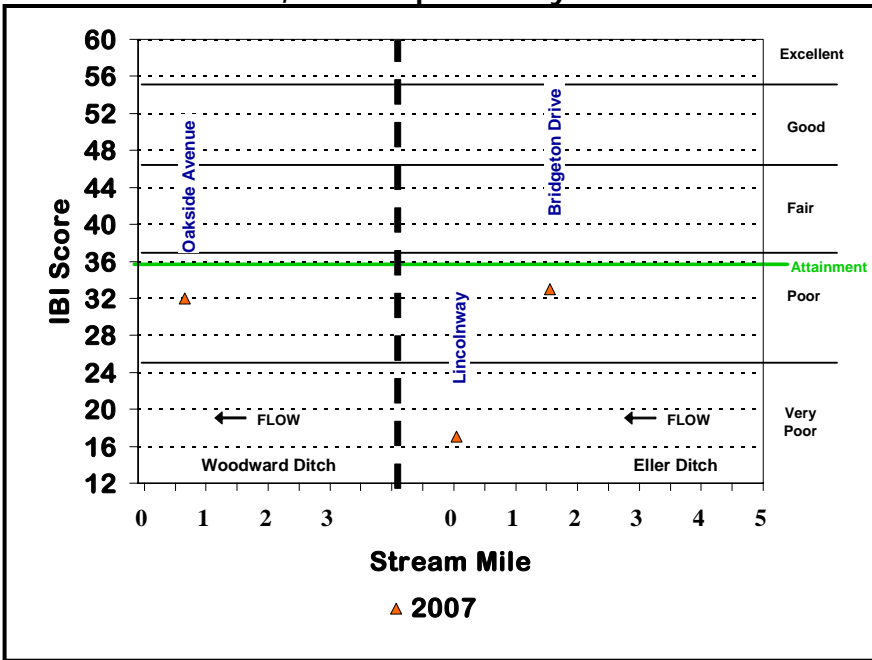
Figure 22: ICI scores for Baugo Creek, Elkhart County and Willow Creek, St. Joseph County



tebrates to find the artificial substrate. Figure 23 shows that habitat may be lacking to fully support a healthy fish community. The stream is heavily impacted by urban areas as there has been construction on many of the bridges/culverts that cross the stream. It is unfortunate that the aquatics staff was not able to collect data earlier so that pre- and post-construction comparisons could have been made.

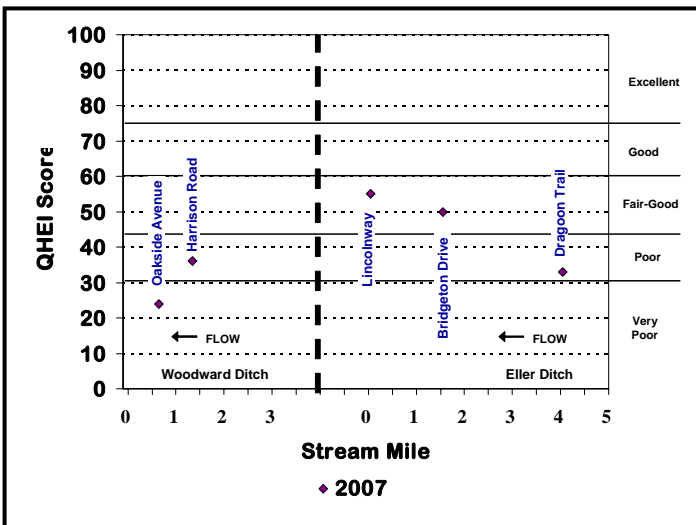
Eller Ditch is another cold water stream in the

Figure 24: IBI scores for Woodward Ditch and Eller Ditch, St. Joseph County



Mishawaka area. The highest temperature recorded at the two index sites was 14.9⁰ C. A reading of 20.9⁰ C was recorded at Dagoon Trail, however there was little to no flow and no canopy cover in this section. This stream can definitely support trout and that was evidenced at the Lincolnway site, when over 50 rainbow trout were collected during the first sampling event. However, as far as overall fish community health this site failed miserably (Figure 24). At this time there may not be a tool to accurately calculate the biological health of this stream, so the current IBI will be utilized. The upstream site displayed a more diversified fish community, but still scored

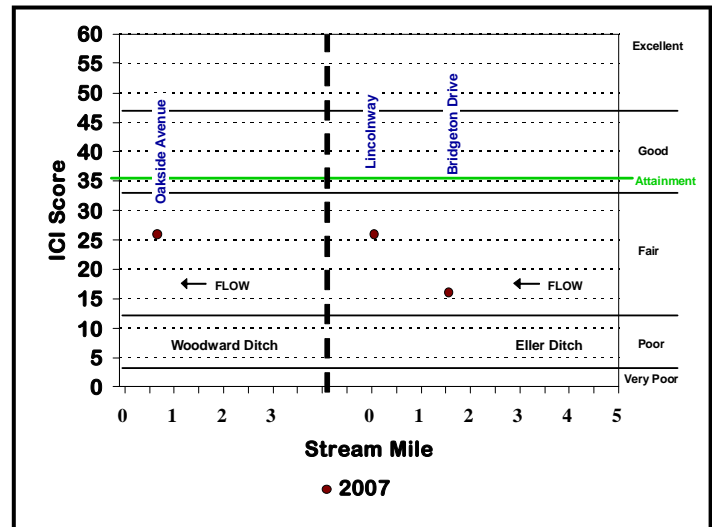
Figure 26: QHEI scores for Woodward Ditch and Eller Ditch, St. Joseph County



below the attainment line. This is not to say that improper tools are the only explanation of the low scores. There are both negative rural and urban impacts on this stream. As seen in Willow Creek, the ICI scores (Figure 25) displayed an opposite pattern than did the IBI scores. The sampler at Bridgeton Drive was partially buried and could be the reason why the ICI score was so low, as there was not adequate surface area to be colonized. Figure 26 displays habitat scores for Eller Ditch. There are improvements that need to be made to enhance the habitat available for fish and other aquatic organisms.

Woodward Ditch is the third of the cold water streams initially sampled in 2007. The highest temperature re-

Figure 25: ICI scores for Woodward Ditch and Eller Ditch, St. Joseph County



corded in three sampling events was 18⁰ C. There were no trout encountered in Woodward Ditch; although temperatures suggest that trout could survive in this stream. IBI scores suggest that not many fish do thrive in this stream (Figure 24). During the first sampling event at Oakside Avenue, only two species were collected. Four species were collected during the second event. The ICI score (Figure 25) for Woodward was similar to the IBI score. Both scores fell short of the individual attainment line for both indices. The ICI score was actually higher than expected based on the physical condition of Woodward Ditch. Figure 26

exemplifies the point that this stream in current condition does not have the habitat available to support healthy aquatic communities.

Tagging and Movement

Tagging in 2007 only took place during walleye sampling runs with IDNR. These events happened in the spring near the YMCA and Johnson Street Dam in Elkhart and in the fall from Baugo Bay to Maggie's Landing in Mishawaka. A total of 27 walleye were tagged during these two outings. Although there were only a few fish tagged and even a smaller amount recaptured, some amazing information was garnered.

Three smallmouth bass were recaptured in 2007. Two of the bass were originally tagged near Pinhook Park in South Bend. Both were caught by area anglers. One was recaptured near the original site of tagging and the other moved downstream approximately 0.7 miles to Auten Road. The third bass recaptured represented a more exciting experience. This bass was originally tagged in 2001 at State Road 23 on Juday Creek and then recaptured once in 2002. The same fish was then recaptured in 2007 at the same site where it had been tagged 6 years prior. This bass more than doubled its weight and added almost 100 millimeters to its length. That was the longest period of time between tagging and recapture recorded by the Public Works' aquatics staff.

There were 7 walleye recaptured in 2007. The longest time between tagging and recapture was 4 years for a walleye that was tagged near Johnson Street in Elkhart and recaptured near the same area. It is inconclusive whether or not this fish resided in that area or continued to migrate up and downstream through out the year.

There were 4 walleye that moved considerable distances since being tagged. Two went upstream and two went downstream. A nearly 25 inch walleye that was tagged near Pinhook Park in South Bend during the summer of 2006 was caught by an angler near Main Street in Mishawaka in 2007. This fish covered 8.6 miles and traversed the South Bend fish ladder during its journey. A walleye that was tagged near Baugo Bay in late September 2007, traveled just over 11 miles and was caught near Johnson Street in Elkhart 4 days before Christmas, 2007.

The two walleye that migrated downstream decided to leave Indiana altogether. The first was

tagged near Brick Road In South Bend and traveled 8 miles to the City of Niles, MI. Not to be out done, another walleye headed towards Niles as well. This fish however, took a lot longer route. The walleye was tagged near the YMCA in Elkhart in the spring of 2006 and journeyed almost 33 miles downstream! This fish was caught by a fisherman in August, 2007. It is unknown how this fish navigated itself around the Twin Branch dam in Mishawaka, since there is not a fish ladder located at this dam.

Fish Tissue

The Indiana FCA for 2007 was updated and many species were added for both Elkhart and St. Joseph Counties. All tissue samples in 2007 came from fish collected in St. Joseph County. Collections were based on the updated FCA, as well as gathering information from new areas around Mishawaka.

Eight species were selected to be sampled from St. Joseph County (Appendix B). Three of the species were sampled at two of the stations. Species sampled were bluegill, common carp, golden redhorse, largemouth bass, rock bass, smallmouth bass, steelhead, and walleye. All of these species are currently on the FCA for St. Joseph County except for walleye. The aquatics staff felt since walleye are such a popular sport fish through out the St. Joseph River, it is important it inform local citizens on the level of contaminants in this species. Walleye are currently on the FCA for Elkhart County. The results for the walleye tissue revealed mercury levels were a group 1 and PCB levels were a group 3. These data on PCB level warrant that walleye should be on the FCA for St. Joseph County.

Bluegill was a new species added to the FCA for 2007. The aquatics staff was interested in collecting bluegill tissue because the thought was that the levels of PCBs reported in the FCA were high. Bluegills were collected from downtown South Bend. The results from tissue collected by the aquatics staff showed that bluegill fall into group 1 for both mercury and PCBs. The FCA reports bluegill 7 inches and over as a group 4 for PCBs. More bluegill tissue will be collected from South Bend in order compare and get consistent results.

Common carp were collected from two different areas around Mishawaka, at Logan Street and Baugo Bay. Mercury levels were a group 1 for fish at Logan Street and group 2 for fish in

Baugo Bay. PCB levels were a group 3 for both locations. The FCA showed that PCB levels were a group higher below Twin Branch Dam and there is no data for comparison in Baugo Bay.

Golden redhorse tissue was collected at the same two sites that carp tissue was collected. The FCA reports that all sizes of Golden redhorse are in the "Do Not Eat" group 5 for PCBs for areas below Twin Branch Dam; however, the results for tissue collected by Elkhart fell into group 3 for PCBs. More samples of golden redhorse tissue will be collected in St. Joseph County. Both sets of tissue fell into the group 2 for mercury.

Largemouth bass were collected from Baugo Bay. Results agreed closely with the levels expressed in the FCA for Baugo Bay. Both mercury and PCB levels fell into the group 1 classification.

Rock bass tissue was collected at both Logan Street and Baugo Bay. Rock Bass are currently not on the FCA for St. Joseph County below Twin Branch, but are for above Twin Branch. Tissue from both locations were in group 1 for both mercury and PCBs.

Smallmouth bass tissue was collected near Logan Street in Mishawaka. The specimens collected were smaller than what is legal to keep as established by IDNR regulations; however fish of this size were collected to be compared with the current FCA. The data collected by Elkhart showed levels lower than that in the 2007 FCA. Mercury levels were at a group 1 and PCB levels were at a group 2 compared to a group 3 for PCBs in the FCA.

Steelhead were collected near Logan Street in Mishawaka. These fish are also known as lake run rainbow trout. Mercury levels fell into the group 1 category and the PCB levels into the group 3 category which is the same as the FCA.

Conclusion

Long-term biological monitoring through out the Indiana portion of the St. Joseph River watershed continues to unravel the health of the aquatic communities that inhabit the watershed. In 2007, the City of Mishawaka joined the effort and this opened up new areas of the watershed to be monitored by the aquatics staff. There are now index sites established all along the entire main stem St. Joseph River. Three new tributaries in the Mishawaka area were also added to the study,

as well as new index sites established on Baugo Creek.

In 2007, IBI scores for the St. Joseph River ranged from fair to excellent and tended to follow the established baselines. Sites in Bristol and at Sherman Street in Elkhart received excellent ratings. The sites sampled in the impounded areas continued to score low because the IBI is calibrated for more fluvial systems. ICI scores ranged from fair to excellent at the five sampling locations on the river. Habitat scores continue to range from fair to good all along the St. Joe.

In 2007, The IBI scores for the Elkhart River differed slightly from the established baseline. IBI scores for Oxbow Park were lower again similar to 2004. The perceived reason for the low scores in 2004 was a bridge construction project upstream. The reason for the low scores in 2007 may have had to do with low water conditions. ICI scores fell dramatically at the two sites sampled. Further investigation will need to be done to find the cause of this drop. QHEI scores continue to be good for the Elkhart River, as this section of the river has some of the best habitat in the area.

Aquatic integrity for Bowman Creek continues to be in the very poor-poor range. The main reason for this is the fact that a large portion of this stream runs dry for most of the summer. Not until heavy rains in late August, was this stream able to be sampled. Habitat scores continue to be low and are another reason for low IBI scores. Serious work needs to be done to help improve the health of the aquatic communities in Bowman Creek.

The IBI score for Juday Creek showed a nice increase in 2007. This is the highest average IBI score recorded for Juday Creek by the aquatics staff. However, the IBI scores are still low and barely reaching the attainment line set by IDEM. The ICI score for Juday Creek was high and showed a positive increase for the stream. QHEI scores fell into the fair-good range and that is typical for this stream.

In 2006, IBI scores increased for Yellow Creek over the baseline; unfortunately in 2007 the IBI scores fell below both the baseline and the attainment line. Most of the fish collected in Yellow Creek at County Road 32 were highly tolerant species. Yellow Creek Lake was sampled in 2007 and only two specimens were collected. Habitat scores for Yellow Creek were in the fair-good range, sug-

gesting that there are other factors affecting the fish communities.

Lily Creek is continuing to show a decrease in the health of its aquatic communities. While it didn't dry up like it did in 2006, there seems to be a lot of sedimentation taking place in the stream, limiting available habitat for fish. There has been a major loss of riparian habitat at the Reckell Avenue site. This site will be monitored again in 2008 and macroinvertebrates will be sampled as well.

Christiana Creek continues to be one of the highest quality streams in the area. IBI scores for 2007 confirm this claim. There is a large diversity of fish species in this stream. There is ample habitat to support this wide diversity. The headwaters of this stream are a series of lakes that help trap excess sediment and buffer flows during high water events.

IBI scores were on the rise again in 2007 for the Little Elkhart River. Although considered a cool-water stream, the Little Elkhart supports a wide array of both warm and coolwater species. It is hard to know at this time how accurate the IBI scores really are. QHEI scores continue to show that the Little Elkhart River has enough good habitat to support a wide diversity of fish.

IBI scores for Cobus Creek remain low. This is one stream that may benefit from a different calibration of the IBI. Most of the species present in the stream are considered cool water species. Rainbow and brown trout are stocked into this stream annually. Habitat scores for this stream were in the good range. The site sampled has many natural meanders and plenty of woody debris for habitat; however there does appear to be a sedimentation problem within this stream.

Puterbaugh Creek is a cool water stream that is recharged by many springs. The IBI scores for 2007 showed an improvement, as they were above the attainment line and the established baseline. Many darter species are present at the County Road 8 site. Darters are good indicators of high water quality and habitat. This site also has a lot of quality habitat including many natural bends and an abundance of vegetation.

Baugo Creek was one of streams where new index sites were established. As believed, IBI scores for this stream were low. Many of the species collected from Baugo Creek are highly tolerant of pollution and other disturbances. There are high

sediment loads in this stream, especially heavy rain events. Macroinvertebrate scores were low for Baugo Creek. This was not a surprise based on fish scores. QHEI scores indicate that there is adequate habitat to support a more robust fish population.

Willow Creek is a cool water stream that is capable of supporting trout. A few small trout were collected in 2007. Adult steelhead were observed in the stream in the spring at two separate locations. The IBI scores for the stream were higher than expected, especially at the most upstream site. ICI scores ranged from fair to good in Willow Creek. Habitat scores fell into the fair-good range, as this stream is highly impacted by the urban communities it flows through.

Eller Ditch is another very cold stream that is able to support trout. Over 50 rainbow trout were collected during June at the Lincolnway site in Mishawaka. However, outside of these fish, there was not much diversity. IBI scores for this stream were very low, especially at the Lincolnway site. ICI scores in Eller Ditch also ranged from fair to good. QHEI scores for Eller Ditch were in the fair-good category. Upstream reaches seem to have a sedimentation issue. This stream is highly affected by both urban and rural influences.

Woodard Ditch is the third cold water stream in the Mishawaka area. This stream could support trout, but none were collected in 2007. The IBI scores for Woodward Ditch were low and the stream had a very low fish diversity. The ICI score for Woodward Ditch fell into the fair range and was better than expected for this stream. Habitat scores for this stream were very low and sedimentation is a large problem in this stream, especially in the lower reach where flow is minimal.

Tagging efforts in 2007 were limited to two trips of walleye sampling with the IDNR. At the present the IDNR does not want Public Works & Utilities to tag excessive numbers of fish over long periods of time. Twenty seven walleye were tagged during these events. Some valuable information was gathered from recaptured fish in 2007. A smallmouth bass that was tagged in 2001 in Juday Creek was recaptured in 2007 at the same location. The fish had doubled its weight and added 100 millimeters to its length. A couple of walleye made long journeys up and down the St. Joseph River. One walleye traveled upstream over 11 miles from near the Twin Branch dam to the Johnson Street dam in Elkhart. The longest trip was a

walleye that went over 30 miles downstream from the YMCA in Elkhart to the City of Niles in Michigan! It is unknown how this fish was able to navigate around or through the Twin Branch dam.

Tissue samples were collected from 8 species of fish in 2007 to be analyzed for PCBs and Mercury. This information is used to supplement the Indiana FCA. Bluegill were collected in downtown South Bend and were in group 1 for both mercury and PCBs. Common carp were collected at both Baugo Bay and Logan Street in Mishawaka. The carp from Logan Street were in group 1 for mercury and group 3 for PCBs. The carp from Baugo Bay were in group 2 for mercury and group 3 for PCBs. Golden redhorse were collected from the same two areas that the carp were. Golden redhorse from Logan Street were a group 2 for mercury and a group 3 for PCBs and a group 2 for mercury and group 1 for PCBs at Baugo Bay. Largemouth Bass were collected from Baugo Bay and were group 1 for both mercury and PCBs. Rock bass were collected from both Baugo Bay and Logan Street. The tissue for the rock bass was a group 1 for mercury and PCBs at both locations. Smallmouth bass were collected at Logan street and the tissue was a group 1 for mercury and group 2 for PCBs. Steelhead were also collected at Logan Street. The tissue for these lake run rainbow trout was a group 1 for mercury and a group 3 for PCBs. Walleye were collected in downtown South Bend and were a group 1 for mercury and group 3 for PCBs.

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Thanks go to the cities of Elkhart, Mishawaka, and South Bend for their leadership in the area of aquatic resource protection. Through the establishment of an inter-local agreement between Elkhart and the other two cities, data is now being collected to help preserve and protect a shared resource, the St. Joseph River Watershed.

A special thanks go to the administration and support staff of Elkhart's Public Works & Utilities for their continued assistance and support of this program and their true dedication to the environment. Individuals that made a significant contribution to the program are: Lynn Newvine, Joe Foy, Laura Kolo, Mark Salee, Sarah Hudson, Barry Abell, Jason Able, Matt Heineman, Travis Meyer, Ronda DeCaire, Megan Kolaczyk, and Envirocorps.

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SUMMER 2007



A Pirate Perch



Summer Crew (L-R): Len, Ben, Tiffanie, and Ryann



A Rainbow Darter



Tiffanie with big Smallmouth Bass



Len with two nice Largemouth Bass



Ben with Bowfin



Ryann with two beautiful Longear Sunfish



Ryann and Ben with two large Steelhead



Tiffanie with Common Carp

APPENDICES



Appendix A

Index of Biotic Integrity metrics

Index of Biotic Integrity metrics used to evaluate headwater stream (<20 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter/madtom/sculpin species
3. Percent headwater species
4. Number of minnow species
5. Number of sensitive species
6. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent pioneer species (individuals)
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

Index of Biotic Integrity metrics used to evaluate wadeable stream (>20-<1,000 square miles drainage area) sites in the St. Joseph River drainage:

1. Total number of species
2. Number of darter species
3. Number of sunfish species
4. Number of sucker species
5. Number of sensitive species
6. Percent tolerant
7. Percent omnivores
8. Percent insectivores
9. Percent carnivores
10. Number of fish collected
11. Percent simple lithophils
12. Percent DELT anomalies

Invertebrate Community Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Total number of taxa
2. Total number of mayfly taxa
3. Total number of caddisfly taxa
4. Total number of dipteran taxa
5. Percent mayfly composition
6. Percent caddisfly composition
7. Percent tribe Tanytarsini midge composition
8. Percent other dipteran and non-insect composition
9. Percent tolerant organisms
10. Total number of qualitative EPT (mayflies, stoneflies and caddisflies) taxa

Qualitative Habitat Evaluation Index categories and metrics used to evaluate sites in the St. Joseph River drainage:

1. Substrate
 - type
 - number of types present
 - origin
 - silt cover
 - extent of embeddedness

2. Instream Cover
 - type
 - amount

3. Channel Morphology
 - sinuosity
 - development
 - channelization
 - stability

4. Riparian Zone and Bank Erosion
 - riparian width
 - floodplain quality
 - bank erosion

5. Pool/Glide and Riffle/Run Quality
 - maximum pool depth
 - pool/riffle morphology
 - pool/riffle/run current velocity
 - riffle/run depth
 - riffle/run substrate
 - riffle/run embeddedness

6. Gradient



Appendix B

Fish tissue preparation and results

Materials needed:

- Reynolds aluminum foil
- freezer wrap
- deionized (DI) water
- 1/2 gallon, 1 gallon, and jumbo size freezer bags w/write-on labels
- skinners
- stainless steel fillet knives
- knife sharpener
- scalars
- ice
- cooler

A group of three fish per species was selected based on size. The smallest fish in each group was greater than or equal to 90% of the length of the largest fish in that group. The largest fish or fish that fell into a length range for species on the advisory were selected. The fish were kept as close in size as possible within a group because the tissue from the three fish in each group was composited (mixed together) before the analyses were completed.

All of the tissue was in the form of boneless fillets taken from the fish. All of the fish, except the channel catfish, had skin-on fillets taken. Before the tissue was removed, the fillet knives, scalars and skinners were cleaned and rinsed with DI water, and freezer wrap was placed where the fish were to be processed. The knives, scalars and skinners were washed in river water and rinsed with DI

water after each species was processed and new freezer wrap was placed before another species was processed. For skin-on samples, the scales were removed before the fillet was taken. For skin-off samples, the skin was scored around the edge of the fillet and then removed before the fillet was taken. It was important to be consistent with where the cut of the fillet ended and to not include any of the body cavity or viscera. Once the fillets were removed, they were rinsed in river water and then rinsed with DI water before being placed on aluminum foil. The foil was large enough to hold the three fillets for each species at a site. When all three fillets were placed on the foil, it was then wrapped and placed in a labeled freezer bag and placed on ice in a cooler. The fish tissue was placed in a freezer upon returning to the lab, and kept frozen until sent to the contract lab for analyses.

Fish Tissue Results

Stream	Species	Station	Length Range (inches, PW&U)	Advisory Length Range (State)	Mercury Group (PW&U)	Advisory Mercury Group (State)	PCB Group (PW&U)	Advisory PCB Group (State)
	Year							
St. Joseph River, St. Joseph County								
Bluegill								
	2007	Michigan Street	6.8 - 7.3	7+	1	2	1	4
Common Carp								
	2007	Baugo Bay	25.6 - 26.9	NA	2	2	3	2
	2007	Logan Street	28.3 - 30.7	≤ 20	1	2	3	4
Golden Redhorse								
	2007	Baugo Bay	17.2 - 18.7	NA	2	2	1	2
	2007	Logan Street	16.7 - 17.7	All	2	2	3	5
Largemouth Bass								
	2007	Baugo Bay	11.1 - 12.1	Up to 13	1	2	1	1
Rock Bass								
	2007	Baugo Bay	6.8 - 7.5	Up to 8	1	2	1	1
	2007	Logan Street	8.0 - 8.3	NA	1	2	1	2
Smallmouth Bass								
	2007	Logan Street	8.7 - 10.2	9+	1	2	2	3
Steelhead (Lake Michigan run Rainbow Trout)								
	2007	Logan Street	25.9 - 28.2	25 - 31	1	2	3	3
Walleye								
	2007	LaSalle Street	16.5 - 18.0	NA	1	2	3	2

Appendix C

Summary of fish collected by county, 2007

Summary of species captured at index sites in Elkhart County, 2007

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
White Sucker	1,520	8.68	176,271	387.8	14.87
Rock Bass	1,362	7.78	96,662	212.7	8.15
Stoneroller, Central	1,276	7.29	9,467	20.8	0.80
Striped Shiner	1,253	7.16	13,802	30.4	1.16
Creek Chub	1,214	6.94	19,594	43.1	1.65
Mimic Shiner	1,078	6.16	1,877	4.1	0.16
Bluntnose Minnow	1,049	5.99	3,649	8.0	0.31
Smallmouth Bass	903	5.16	93,957	206.7	7.93
Blacknose Dace	774	4.42	2,847	6.3	0.24
Bluegill	651	3.72	27,462	60.4	2.32
Hornyhead Chub	634	3.62	15,984	35.2	1.35
Mottled Sculpin	602	3.44	3,036	6.7	0.26
Longear Sunfish	576	3.29	17,318	38.1	1.46
Common Shiner	548	3.13	8,250	18.2	0.70
Johnny Darter	516	2.95	665	1.5	0.06
Northern Hog Sucker	402	2.30	83,257	183.2	7.02
Golden Redhorse	355	2.03	163,176	359.0	13.76
Rainbow Darter	317	1.81	602	1.3	0.05
Logperch	282	1.61	3,431	7.5	0.29
Shorthead Redhorse	237	1.35	108,676	239.1	9.17
Spotfin Shiner	222	1.27	908	2.0	0.08
Sand Shiner	222	1.27	574	1.3	0.05
Largemouth Bass	201	1.15	26,331	57.9	2.22
Green Sunfish	197	1.13	3,974	8.7	0.34
Longnose Dace	158	0.90	394	0.9	0.03
Rosyface Shiner	103	0.59	287	0.6	0.02
Silverjaw Minnow	90	0.51	268	0.6	0.02
Chestnut Lamprey	84	0.48	798	1.8	0.07
Pumpkinseed	80	0.46	2,695	5.9	0.23
Yellow Bullhead	67	0.38	4,801	10.6	0.40
Orangethroat Darter	57	0.33	68	0.1	0.01
Blackside Darter	53	0.30	239	0.5	0.02
Grass Pickerel	45	0.26	805	1.8	0.07
Steelcolor Shiner	37	0.21	109	0.2	0.01
Silver Redhorse	36	0.21	44,500	97.9	3.75
Black Redhorse	35	0.20	8,804	19.4	0.74
River Redhorse	26	0.15	71,000	156.2	5.99
Common Carp	25	0.14	104,804	230.6	8.84
Black Crappie	23	0.13	1,941	4.3	0.16
American Brook Lamprey	22	0.13	131	0.3	0.01
Spotted Sucker	21	0.12	5,318	11.7	0.45
Central Mudminnow	18	0.10	99	0.2	0.01
Walleye	16	0.09	5,106	11.2	0.43
Brown Trout	15	0.09	1,399	3.1	0.12
Warmouth	12	0.07	731	1.6	0.06
Bowfin	11	0.06	11,460	25.2	0.97
Quillback	10	0.06	16,750	36.9	1.41
Redear Sunfish	8	0.05	809	1.8	0.07
Northern Pike	7	0.04	10,031	22.1	0.85
Stonecat	7	0.04	339	0.7	0.03
Golden Shiner	6	0.03	50	0.1	0.00
Longnose Gar	5	0.03	1,540	3.4	0.13
Fathead Minnow	5	0.03	13	0.0	0.00
Rainbow Trout	4	0.02	819	1.8	0.07
Hybrid Sunfish	4	0.02	258	0.6	0.02
Greenside Darter	4	0.02	13	0.0	0.00
Brown Bullhead	3	0.02	1,972	4.3	0.17
Channel Catfish	3	0.02	1,957	4.3	0.17
Gizzard Shad	3	0.02	1,216	2.7	0.10
Greater Redhorse	2	0.01	1,783	3.9	0.15
Tadpole Madtom	2	0.01	25	0.1	0.00
Spotted Gar	1	0.01	290	0.6	0.02
Lake Chubsucker	1	0.01	74	0.2	0.01
Yellow Perch	1	0.01	70	0.2	0.01
Pirate Perch	1	0.01	10	0.0	0.00
Blackchin Shiner	1	0.01	1	0.0	0.00
Sub-Total	17,503	100	1,185,547	2608.2	100

Summary of species captured at investigative sites in Elkhart County, 2007

Common Name	Total Number	% by Number
Common Carp	479	26.82
White Sucker	281	15.73
Creek Chub	151	8.45
Johnny Darter	140	7.84
Bluegill	119	6.66
Fathead Minnow	92	5.15
Longear Sunfish	88	4.93
Smallmouth Bass	85	4.76
Blacknose Dace	57	3.19
Central Mudminnow	39	2.18
Stoneroller, Central	31	1.74
Rock Bass	31	1.74
Striped Shiner	30	1.68
Northern Hog Sucker	30	1.68
Largemouth Bass	22	1.23
Pumpkinseed	20	1.12
Golden Redhorse	12	0.67
Orangethroat Darter	10	0.56
Yellow Bullhead	7	0.39
Rainbow Darter	7	0.39
Spotfin Shiner	6	0.34
Bluntnose Minnow	6	0.34
Green Sunfish	6	0.34
Bowfin	4	0.22
Silver Redhorse	4	0.22
Common Shiner	4	0.22
Gizzard Shad	4	0.22
Logperch	3	0.17
Black Crappie	3	0.17
Northern Pike	2	0.11
Grass Pickerel	2	0.11
Shorthead Redhorse	2	0.11
Hornyhead Chub	2	0.11
Hybrid Sunfish	1	0.06
Chestnut Lamprey	1	0.06
Silverjaw Minnow	1	0.06
Pirate Perch	1	0.06
Longnose Gar	1	0.06
Spotted Sucker	1	0.06
Golden Shiner	1	0.06
Sub-Total	1,786	100

Index Sites	17,503
Investigative Sites	1,786
Elkhart County Total	19,289

Summary of species captured at index sites in St. Joseph County, 2007

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Longear Sunfish	1514	20.31	46,941	103.3	4.37
Rock Bass	1038	13.93	61,278	134.8	5.70
Smallmouth Bass	835	11.20	91,616	201.6	8.52
Blacknose Dace	519	6.96	1,744	3.8	0.16
Bluegill	440	5.90	15,830	34.8	1.47
Creek Chub	322	4.32	4,771	10.5	0.44
Mottled Sculpin	308	4.13	1,330	2.9	0.12
Golden Redhorse	304	4.08	170,745	375.6	15.88
Bluntnose Minnow	272	3.65	749	1.6	0.07
White Sucker	215	2.88	42,480	93.5	3.95
Rainbow Trout	198	2.66	21,891	48.2	2.04
Pumpkinseed	190	2.55	7,912	17.4	0.74
Shorthead Redhorse	151	2.03	103,396	227.5	9.62
Johnny Darter	148	1.99	712	1.6	0.07
Largemouth Bass	128	1.72	17,722	39.0	1.65
Green Sunfish	122	1.64	4,409	9.7	0.41
Yellow Bullhead	85	1.14	10,882	23.9	1.01
Northern Hog Sucker	79	1.06	30,982	68.2	2.88
Mimic Shiner	75	1.01	116	0.3	0.01
Spotted Sucker	65	0.87	16,347	36.0	1.52
Common Carp	57	0.76	269,960	593.9	25.11
Logperch	53	0.71	989	2.2	0.09
Quillback	50	0.67	67,870	149.3	6.31
Black Redhorse	46	0.62	29,901	65.8	2.78
Spotfin Shiner	35	0.47	133	0.3	0.01
Hybrid Sunfish	26	0.35	1,421	3.1	0.13
Central Mudminnow	21	0.28	112	0.2	0.01
Silver Redhorse	18	0.24	28,008	61.6	2.60
Gizzard Shad	16	0.21	7,222	15.9	0.67
Blackside Darter	14	0.19	54	0.1	0.01
Coho Salmon	13	0.17	7	0.0	0.00
Spottail Shiner	12	0.16	25	0.1	0.00
Walleye	10	0.13	4,433	9.8	0.41
Orangethroat Darter	9	0.12	18	0.0	0.00
Brown Bullhead	8	0.11	1,940	4.3	0.18
Greenside Darter	8	0.11	24	0.1	0.00
Rainbow Darter	8	0.11	16	0.0	0.00
Black Crappie	5	0.07	495	1.1	0.05
Chestnut Lamprey	5	0.07	65	0.1	0.01
River Redhorse	4	0.05	6,390	14.1	0.59
Greater Redhorse	4	0.05	1,896	4.2	0.18
Stonecat	4	0.05	250	0.6	0.02
Steelcolor Shiner	4	0.05	26	0.1	0.00
Black Bullhead	3	0.04	705	1.6	0.07
Warmouth	3	0.04	502	1.1	0.05
Longnose Gar	3	0.04	442	1.0	0.04
Redear Sunfish	2	0.03	282	0.6	0.03
Brown Trout	2	0.03	146	0.3	0.01
White Crappie	1	0.01	96	0.2	0.01
Sand Shiner	1	0.01	2	0.0	0.00
Fathead Minnow	1	0.01	1	0.0	0.00
Sub-Total	7,454	100	1,075,284	2,365.6	100

Summary of species captured at investigative sites in St. Joseph County, 2007

Common Name	Total Number	% by Number
Gizzard Shad	1,560	42.46
Bluegill	298	8.11
Longear Sunfish	294	8.00
Mottled Sculpin	198	5.39
Smallmouth Bass	187	5.09
White Sucker	141	3.84
Logperch	131	3.57
Largemouth Bass	118	3.21
Rock Bass	106	2.89
Golden Redhorse	74	2.01
Blacknose Dace	61	1.66
Creek Chub	59	1.61
Pumpkinseed	54	1.47
Spotfin Shiner	51	1.39
Johnny Darter	47	1.28
Brook Silverside	45	1.22
Common Carp	38	1.03
Mimic Shiner	38	1.03
Spotted Sucker	38	1.03
Bluntnose Minnow	21	0.57
Green Sunfish	17	0.46
Yellow Bullhead	11	0.30
Golden Shiner	10	0.27
Shorthead Redhorse	9	0.24
Quillback	8	0.22
Black Crappie	7	0.19
Walleye	6	0.16
Brown Bullhead	6	0.16
Chestnut Lamprey	5	0.14
Warmouth	4	0.11
Silver Redhorse	4	0.11
Central Mudminnow	4	0.11
Bowfin	2	0.05
Striped Shiner	2	0.05
Greater Redhorse	2	0.05
Hybrid Sunfish	2	0.05
Orangethroat Darter	2	0.05
Greenside Darter	2	0.05
Spotted Gar	1	0.03
Blackside Darter	1	0.03
Steelcolor Shiner	1	0.03
Rainbow Trout	1	0.03
Rainbow Darter	1	0.03
Brown Trout	1	0.03
Grass Pickerel	1	0.03
Channel Catfish	1	0.03
Yellow Perch	1	0.03
Lake Chubsucker	1	0.03
White Crappie	1	0.03
Northern Hog Sucker	1	0.03
Sub-Total	3,674	100

Index Sites	7,454
Investigative Sites	3,674
St. Joseph County Total	11,128



Appendix D

**Summary of fish collected by site, 2007
(Reference Table 2 for site numbers and locations)**

STREAM	St. Joseph River, Elkhart County								
	1		2		3		4		5
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
~American Brook Lamprey	X								
Black Crappie	X	X	X	X	X	X	X	X	X
~Black Redhorse	X	X		X	X	X	X		
Blackside Darter		X			X	X		X	
Bluegill	X	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X		X	X	X	
Bowfin	X				X		X	X	
Brown Bullhead	X								
#Channel Catfish		X				X			
Chestnut Lamprey	X	X	X		X	X	X	X	X
#Common Carp	X	X	X	X	X	X	X	X	X
#Gizzard Shad							X		X
Golden Redhorse	X	X	X	X	X	X	X	X	X
#Golden Shiner				X					
Grass Pickerel		X							
~Greater Redhorse							X		
#Green Sunfish				X	X	X	X		X
Greenside Darter		X	X			X			
~Hornyhead Chub	X	X				X		X	
Hybrid Sunfish				X	X				
Largemouth Bass	X	X	X	X	X	X	X	X	X
Logperch	X	X	X	X	X	X	X	X	
Longear Sunfish	X	X	X	X	X	X	X	X	X
#Longnose Gar	X	X			X		X		X
~Mimic Shiner	X	X	X	X	X	X	X	X	
Northern Hog Sucker	X	X			X	X	X	X	
Northern Pike	X		X	X					
Orangethroat Darter			X		X	X			
Pumpkinseed	X	X	X	X	X	X	X	X	X
#Quillback					X		X	X	
Rainbow Darter		X				X	X	X	
Redear Sunfish	X			X	X				
~River Redhorse		X			X	X	X	X	
Rock Bass	X	X	X	X	X	X	X	X	X
~Rosyface Shiner	X	X		X	X	X			
Sand Shiner	X			X					
Shorthead Redhorse	X	X		X	X	X	X	X	X
Silver Redhorse	X	X	X	X	X	X	X	X	X
Smallmouth Bass	X	X	X	X	X	X	X	X	X
Spotfin Shiner		X	X	X	X	X	X	X	
Spotted Gar					X				
Spotted Sucker				X		X	X	X	X
Steelcolor Shiner		X	X			X	X		
Striped Shiner	X	X		X		X	X	X	
Walleye		X			X	X	X	X	
Warmouth	X						X	X	
#White Sucker	X	X	X	X	X	X	X	X	X
Yellow Bullhead	X	X	X	X				X	
Yellow Perch							X		

~ - denotes a species that is INTOLERANT of environmental disturbances such as degraded water quality or habitat
- denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

STREAM	St. Joseph River, Mishawaka Area										
	Site Number	6		7		8		9		10	
			Day	Night	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
Black Crappie	X		X	X			X				
~Black Redhorse				X	X	X					
Blackside Darter			X		X		X		X		
Bluegill	X	X	X	X	X	X	X	X	X		
#Bluntnose Minnow	X	X	X	X	X	X	X	X	X		
Bowfin	X										
Brook Silverside	X		X								
Brown Bullhead									X		
#Channel Catfish			X								
Chestnut Lamprey	X			X		X					
#Common Carp	X	X	X	X	X	X	X	X	X		
#Gizzard Shad	X	X	X	X	X		X	X			
Golden Redhorse	X	X	X	X	X	X	X	X	X		
#Golden Shiner	X		X								
#Green Sunfish	X	X	X	X	X	X	X	X	X		
Greenside Darter			X		X		X	X	X		
Hybrid Sunfish	X			X	X	X	X	X	X		
Largemouth Bass	X	X	X	X	X	X	X	X	X		
Logperch	X	X	X	X			X	X	X		
Longear Sunfish	X	X	X	X	X	X	X	X	X		
~Mimic Shiner	X	X	X		X		X				
Northern Hog Sucker					X	X		X	X		
Orangethroat Darter							X		X		
Pumpkinseed	X		X	X	X	X	X	X	X		
#Quillback			X	X	X	X	X	X	X		
Rainbow Darter			X						X		
Rainbow Trout				X		X		X	X		
~River Redhorse							X		X		
Rock Bass	X	X	X	X	X	X	X	X	X		
Sand Shiner									X		
Shorthead Redhorse	X	X			X	X	X	X	X		
Silver Redhorse	X	X	X	X		X	X	X	X		
Smallmouth Bass	X	X	X	X	X	X	X	X	X		
Spotfin Shiner	X	X	X	X	X		X		X		
Spottail Shiner					X						
Spotted Gar			X								
Spotted Sucker	X		X	X	X	X	X	X	X		
Steelcolor Shiner			X		X	X			X		
~Stonecat									X		
Striped Shiner			X								
Walleye	X		X					X			
Warmouth		X	X								
White Crappie			X		X						
#White Sucker	X		X	X	X	X	X	X	X		
Yellow Bullhead	X	X	X	X	X	X	X	X	X		

-- denotes a species that is INTOLERANT of environmental disturbances such as degraded water quality or habitat
 #- denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

STREAM	St. Joseph River, South Bend Area						
	11	12		13		14	
	Site Number	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass
#Black Bullhead		X	X				
Black Crappie			X				
~Black Redhorse				X	X	X	X
Blackside Darter			X				
Bluegill	X	X	X	X	X	X	X
#Bluntnose Minnow		X	X				
Brown Bullhead	X	X	X				
Chestnut Lamprey	X					X	X
#Common Carp	X	X	X	X		X	X
#Gizzard Shad		X	X			X	
Golden Redhorse	X	X	X	X	X	X	X
~Greater Redhorse	X		X			X	
#Green Sunfish	X					X	X
Greenside Darter			X		X		
Hybrid Sunfish	X	X				X	
Largemouth Bass	X	X	X	X		X	X
Logperch		X	X	X	X	X	X
Longear Sunfish	X	X	X	X	X	X	X
#Longnose Gar		X	X		X		
~Mimic Shiner		X				X	
Northern Hog Sucker	X		X	X	X	X	X
Pumpkinseed	X	X	X	X	X	X	X
#Quillback	X	X		X	X	X	X
Rainbow Darter				X			
Redear Sunfish						X	
~River Redhorse		X			X		
Rock Bass	X	X	X	X	X	X	X
Shorthead Redhorse	X			X	X	X	X
Silver Redhorse			X	X		X	
Smallmouth Bass	X	X	X	X	X	X	X
Spotfin Shiner	X			X	X	X	X
Spotted Sucker	X	X	X			X	X
Steelcolor Shiner						X	
~Stonecat				X			
Walleye			X			X	
Warmouth						X	X
#White Sucker	X	X	X			X	X
Yellow Bullhead	X	X	X	X	X	X	X

~ - denotes a species that is INTOLERANT of environmental disturbances such as degraded water quality or habitat
- denotes a species that is TOLERANT of environmental disturbances such as degraded water quality or habitat

STREAM	Little Elkhart River		Puterbaugh Creek		Lily Creek		Christiana Creek		
	15		16		17		18		19
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	
~American Brook Lamprey	X	X	X				X	X	
~Blackchin Shiner								X	
#Blacknose Dace	X	X				X			
Blackside Darter	X	X	X	X					
Bluegill	X	X	X	X			X		X
#Bluntnose Minnow	X		X	X			X	X	
Bowfin						X		X	
Brown Trout	X	X							
#Central Mudminnow		X		X					
Chestnut Lamprey	X	X		X			X		
#Common Carp							X	X	
Common Shiner	X	X							
#Creek Chub	X	X	X	X		X			
#Fathead Minnow	X								
Golden Redhorse							X	X	X
Grass Pickerel	X	X	X	X		X	X	X	X
#Green Sunfish	X	X	X						X
~Hornyhead Chub	X	X					X	X	X
Hybrid Sunfish									X
Johnny Darter	X	X	X	X					
Lake Chubsucker								X	
Largemouth Bass	X	X		X			X	X	X
Logperch		X	X						X
Longear Sunfish								X	X
Mottled Sculpin	X	X	X	X					
Northern Hog Sucker	X	X					X	X	X
Northern Pike				X					
Orangethroat Darter	X		X	X			X	X	X
Pumpkinseed	X	X							
Rainbow Darter	X		X	X			X	X	X
Rainbow Trout	X								
Redear Sunfish							X		
Rock Bass							X	X	X
Silver Redhorse							X		X
Smallmouth Bass	X	X					X	X	X
Spotfin Shiner							X	X	X
Steelcolor Shiner								X	
~Stonecat							X	X	
Stoneroller, Central			X	X		X			
Striped Shiner							X	X	X
Tadpole Madtom							X		
Warmouth	X	X						X	
#White Sucker	X	X	X	X	X	X	X	X	X
Yellow Bullhead							X	X	X

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STREAM	Elkhart River						Swoveland Ditch	Dausman Ditch	
	20		21		22		23	24	25
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass			
~American Brook Lamprey			X						
Black Crappie							X		
~Black Redhorse		X			X				
#Blacknose Dace								X	
Blackside Darter	X	X		X		X			
Bluegill	X	X	X	X	X	X	X		X
#Bluntnose Minnow	X	X	X	X	X	X		X	
Bowfin	X						X		
#Central Mudminnow								X	X
Chestnut Lamprey	X	X	X	X	X	X			
#Common Carp							X	X	X
Common Shiner	X	X	X	X	X			X	
#Creek Chub				X				X	X
#Fathead Minnow									X
Golden Redhorse	X	X	X	X	X	X			
#Golden Shiner									X
Grass Pickerel	X	X					X		
~Greater Redhorse		X							
#Green Sunfish	X	X	X	X	X	X	X		X
~Hornyhead Chub	X	X	X	X	X	X			
Hybrid Sunfish	X								
Johnny Darter		X		X				X	X
Largemouth Bass	X	X	X	X	X	X	X	X	
Longear Sunfish	X	X	X	X	X	X			
~Longnose Dace			X						
~Mimic Shiner				X					
Northern Hog Sucker	X	X	X	X	X	X			
Northern Pike							X		
Orangethroat Darter			X						
Pirate Perch						X		X	
Pumpkinseed		X		X			X		
Rainbow Darter			X			X			
Redear Sunfish			X	X					
~River Redhorse			X						
Rock Bass	X	X	X	X	X	X			
~Rosyface Shiner		X	X	X		X			
Sand Shiner			X	X					
Silverjaw Minnow								X	
Smallmouth Bass	X	X	X	X	X	X			
Spotfin Shiner		X	X	X	X	X			
Spotted Sucker	X	X							
Steelcolor Shiner				X					
~Stonecat		X				X			
Stoneroller, Central	X			X				X	
Striped Shiner	X	X	X	X	X	X		X	
#White Sucker	X	X	X	X	X	X	X	X	X
Yellow Bullhead	X		X	X	X	X	X		

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STREAM	Yellow Creek		Cobus Creek		Baugo Creek				Woodward Ditch		
	26		27		28		29		30	31	
	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass		1st Pass	2nd Pass
~American Brook Lamprey			X	X							
#Blacknose Dace	X	X	X	X	X	X	X	X	X	X	X
Blackside Darter											
Bluegill	X	X					X				
#Bluntnose Minnow	X	X			X	X	X	X			
Brown Trout			X	X							
#Central Mudminnow			X	X		X					
#Common Carp					X		X				
Common Shiner	X	X	X		X	X	X	X			
#Creek Chub	X	X	X	X	X	X	X	X	X		X
#Fathead Minnow	X					X					
#Golden Shiner	X	X				X			X		
Grass Pickerel			X	X							
#Green Sunfish	X	X		X	X	X		X			
~Hornyhead Chub	X										
Hybrid Sunfish		X									
Johnny Darter	X	X			X	X	X	X	X	X	X
Largemouth Bass		X	X								
~Longnose Dace							X	X			
~Mimic Shiner						X		X			
Mottled Sculpin			X	X							
Orangethroat Darter							X		X		
Pumpkinseed	X										
Quillback							X				
Rainbow Trout			X	X							
Rock Bass							X	X			
Sand Shiner					X	X	X	X			
Silver Redhorse							X				
Silverjaw Minnow	X	X			X	X	X	X			
Smallmouth Bass							X	X			
Spotfin Shiner								X			
~Stonecat								X			
Stoneroller, Central	X	X			X	X	X	X			
Striped Shiner	X	X			X	X	X	X			
#White Sucker	X	X	X	X	X	X	X	X	X		X

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STREAM	Eller Ditch				Willow Creek					
	32	33		34		35		36	37	
Site Number		1st Pass	2nd Pass	1st Pass	2nd Pass	1st Pass	2nd Pass		1st Pass	2nd Pass
#Blacknose Dace	N	X	X			X	X	X	X	X
Bluegill	O	X	X	X						X
Brown Trout	F							X	X	
#Central Mudminnow	I					X	X	X	X	X
Coho Salmon	S				X					
#Creek Chub	H	X				X	X		X	X
#Fathead Minnow										X
#Green Sunfish	C							X	X	X
Hybrid Sunfish	O								X	
Johnny Darter	L		X							
Mottled Sculpin	L					X	X	X	X	X
Orangethroat Darter	E				X					
Rainbow Darter	C			X						
Rainbow Trout	T	X		X	X			X		X
Smallmouth Bass	E			X						
#White Sucker	D	X	X						X	X

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STREAM	Bowman Creek		Juday Creek			Dixon West Place Ditch
	38		39	40		
Site Number	1st Pass	2nd Pass		1st Pass	2nd Pass	
#Blacknose Dace		N	X	X	X	
Bluegill	X	O		X	X	X
Brown Trout				X		
#Central Mudminnow		F			X	X
#Common Carp		I				X
#Creek Chub	X	S	X	X	X	
Grass Pickerel		H				X
#Green Sunfish			X	X	X	X
Johnny Darter		C	X	X	X	X
Lake Chubsucker		O				X
Largemouth Bass		L	X		X	X
Mottled Sculpin		L	X	X	X	
Rock Bass		E		X	X	
Smallmouth Bass		C		X	X	
#White Sucker		T	X	X	X	X
Yellow Bullhead		E		X	X	
Yellow Perch		D				X

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Appendix E

Summary of macroinvertebrates (insects) collected by site, 2007

Macroinvertebrates were collected in two ways to calculate the Invertebrate Community Index (ICI). The first method employed a sampling device known as a Hester-Dendy multi-plate sampler. Macroinvertebrates collected using this method were identified and counted (Quantitative column in the following tables). The second method was a sweep with a net of all the available habitat types in the area of the Hester-Dendy in an effort to identify other macroinvertebrates in the stream that may not colonize the Hester-Dendy samplers. Macroinvertebrates collected in this way were identified and simply counted as being present (Qualitative column).

Site: St. Joseph River, Bristol

Collection Date: 9/24/2007

Site Number: 1

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
<i>Hydra sp</i>	1		<i>Stelechomyia perpulchra</i>	10	
<i>Turbellaria</i>	16	+	<i>Rheotanytarsus sp</i>	50	
<i>Nemertea</i>	1		<i>Tanytarsus sp</i>	10	
<i>Oligochaeta</i>	0	+	<i>Tabanus sp</i>	0	+
<i>Hyalella azteca</i>	4	+	<i>Hemerodromia sp</i>	5	
<i>Gammarus sp</i>	0	+	<i>Hydrobiidae</i>	0	+
<i>Baetis intercalaris</i>	9		<i>Elimia sp</i>	27	+
<i>Pseudocloeon propinquum</i>	3	+	<i>Physella sp</i>	3	
<i>Isonychia sp</i>	22	+	<i>Planorbella sp</i>	0	+
<i>Stenacron sp</i>	12		<i>Ferrissia sp</i>	10	
<i>Stenonema exiguum</i>	108	+	<i>Corbicula fluminea</i>	0	+
<i>Stenonema pulchellum</i>	0	+	<i>Dreissena polymorpha</i>	0	+
<i>Serratella deficiens</i>	3		<i>Sphaerium sp</i>	0	+
<i>Tricorythodes sp</i>	1				
<i>Caenis sp</i>	0	+			
<i>Anthopotamus sp</i>	0	+			
<i>Hetaerina sp</i>	1				
<i>Coenagrionidae</i>	2	+	No. Quantitative Taxa	42	
<i>Argia sp</i>	0	+	No. Qualitative Taxa	32	
<i>Basiaeschna janata</i>	0	+	Total No. Taxa	63	
<i>Gomphus sp</i>	0	+	Number of Organisms	617	
<i>Pteronarcys sp</i>	2		ICI	42	
<i>Acroneuria abnormis</i>	7				
<i>Sialis sp</i>	0	+			
<i>Neureclipsis sp</i>	4				
<i>Polycentropus sp</i>	1				
<i>Cheumatopsyche sp</i>	15				
<i>Hydropsyche simulans</i>	40	+			
<i>Brachycentrus numerosus</i>	25	+			
<i>Neophylax sp</i>	0	+			
<i>Helicopsyche borealis</i>	6	+			
<i>Ceraclea sp</i>	1				
<i>Nectopsyche exquisita</i>	0	+			
<i>Oecetis persimilis</i>	2				
<i>Petrophila sp</i>	1				
<i>Dineutus sp</i>	0	+			
<i>Dubiraphia vittata group</i>	0	+			
<i>Macronychus glabratus</i>	3	+			
<i>Stenelmis sp</i>	0	+			
<i>Simulium sp</i>	2				
<i>Conchapelopia sp</i>	10				
<i>Nilotanytus fimbriatus</i>	4				
<i>Corynoneura "celeripes" (sensu Simpson & Bode,</i>	56				
<i>Corynoneura lobata</i>	48				
<i>Rheocricotopus (Psilocricotopus) robacki</i>	10				
<i>Thienemanniella xena</i>	22				
<i>Tvetenia discoloripes group</i>	10				
<i>Cryptochironomus sp</i>	0	+			
<i>Polypedilum (Uresipedilum) flavum</i>	30				
<i>Polypedilum (P.) illinoense group</i>	20				

Site: St. Joseph River, Nappanee Street

Collection Date: 9/24/2007

Site Number: 2

Taxa Name	Quantitative	Qualitative		
<i>Hydra sp</i>	21			
<i>Turbellaria</i>	18	+		
<i>Nemertea</i>	24	+		
<i>Oligochaeta</i>	2268	+	No. Quantitative Taxa	34
<i>Erpobdella punctata punctata</i>	2		No. Qualitative Taxa	27
<i>Gammarus sp</i>	14	+	Total No. Taxa	44
<i>Plauditus dubius</i> or <i>P. virilis</i>	0	+	Number of Organisms	3354
<i>Baetis intercalaris</i>	32		ICI	24
<i>Isonychia sp</i>	1			
<i>Stenacron sp</i>	30	+		
<i>Serratella deficiens</i>	4			
<i>Tricorythodes sp</i>	36	+		
<i>Caenis sp</i>	0	+		
<i>Coenagrionidae</i>	1	+		
<i>Argia sp</i>	0	+		
<i>Macromia sp</i>	1			
<i>Polycentropus sp</i>	17	+		
<i>Cheumatopsyche sp</i>	6	+		
<i>Hydropsyche simulans</i>	2			
<i>Mystacides sepulchralis</i>	0	+		
<i>Nectopsyche exquisita</i>	0	+		
<i>Triaenodes injustus</i>	0	+		
<i>Peltodytes sp</i>	0	+		
<i>Stenelmis sp</i>	4	+		
<i>Tipula sp</i>	0	+		
<i>Corynoneura lobata</i>	4			
<i>Cricotopus (C.) sp</i>	217	+		
<i>Cricotopus (Isocladius) sylvestris group</i>	224	+		
<i>Rheocricotopus (Psilocricotopus) robacki</i>	7			
<i>Thienemanniella lobapodema</i>	2			
<i>Thienemanniella xena</i>	29			
<i>Chironomus (C.) riparius group</i>	77	+		
<i>Dicrotendipes neomodestus</i>	7			
<i>Polypedilum (Uresipedilum) flavum</i>	84			
<i>Polypedilum (P.) illinoense group</i>	63	+		
<i>Rheotanytarsus pellucidus</i>	21			
<i>Tanytarsus sp</i>	7			
<i>Hemerodromia sp</i>	25			
<i>Hydrobiidae</i>	0	+		
<i>Elimia sp</i>	16	+		
<i>Physella sp</i>	55	+		
<i>Gyraulus sp</i>	21			
<i>Ferrissia sp</i>	14	+		
<i>Corbicula fluminea</i>	0	+		

Site: St. Joseph River, Capital Avenue

Collection Date: 9/26/2007

Site Number: 3

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
<i>Turbellaria</i>	48	+	<i>Hydrobiidae</i>	4	+
<i>Nemertea</i>	6		<i>Elimia sp</i>	71	+
<i>Oligochaeta</i>	25		<i>Physella sp</i>	0	+
<i>Caecidotea sp</i>	23		<i>Gyraulus sp</i>	0	+
<i>Hyalella azteca</i>	5	+	<i>Ferrissia sp</i>	7	
<i>Gammarus sp</i>	34		<i>Corbicula fluminea</i>	0	+
<i>Plauditus dubius</i> or <i>P. virilis</i>	1		<i>Dreissena polymorpha</i>	2	+
<i>Baetis intercalaris</i>	8		<i>Pisidium sp</i>	9	
<i>Pseudocloeon propinquum</i>	0	+	<i>Sphaerium sp</i>	0	+
<i>Procloeon irrubrum</i>	0	+			
<i>Isonychia sp</i>	3				
<i>Stenacron sp</i>	221		No. Quantitative Taxa	49	
<i>Stenonema exiguum</i>	67		No. Qualitative Taxa	22	
<i>Stenonema pulchellum</i>	15		Total No. Taxa	59	
<i>Tricorythodes sp</i>	37	+	Number of Organisms	946	
<i>Caenis sp</i>	12		ICI	36	
<i>Coenagrionidae</i>	0	+			
<i>Argia sp</i>	10	+			
<i>Sialis sp</i>	1				
<i>Nyctiophylax sp</i>	6				
<i>Polycentropus sp</i>	8				
<i>Cheumatopsyche sp</i>	208	+			
<i>Hydropsyche simulans</i>	1				
<i>Hydroptila sp</i>	0	+			
<i>Brachycentrus numerosus</i>	2	+			
<i>Oecetis persimilis</i>	0	+			
<i>Triaenodes injustus</i>	0	+			
<i>Ancyronyx variegata</i>	1				
<i>Dubiraphia vittata group</i>	12	+			
<i>Macronychus glabratus</i>	6	+			
<i>Stenelmis sp</i>	4				
<i>Simulium sp</i>	1				
<i>Ceratopogonidae</i>	1	+			
<i>Ablabesmyia mallochi</i>	2				
<i>Ablabesmyia rhamphe group</i>	2				
<i>Conchapelopia sp</i>	5				
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	5				
<i>Cricotopus (C.) bicinctus</i>	4				
<i>Thienemanniella lobapodema</i>	2				
<i>Thienemanniella xena</i>	1				
<i>Chironomus (C.) sp</i>	2				
<i>Cryptochironomus sp</i>	2				
<i>Phaenopsectra obediens group</i>	44				
<i>Polypedilum (Uresipedilum) flavum</i>	5				
<i>Polypedilum (P.) fallax group</i>	2				
<i>Polypedilum (Tripodura) scalaenum group</i>	2				
<i>Tribelos jucundum</i>	3				
<i>Pseudochironomus sp</i>	2				
<i>Rheotanytarsus sp</i>	2				
<i>Tanytarsus sp</i>	2				

Site: St. Joseph River, Logan Street

Collection Date: 9/26/2007

Site Number: 4

Taxa Name	Quantitative	Qualitative
<i>Spongillidae</i>	0	+
<i>Turbellaria</i>	294	+
<i>Nemertea</i>	2	
<i>Oligochaeta</i>	6	+
<i>Gammarus sp</i>	4	+
<i>Plauditus dubius</i> or <i>P. virilis</i>	2	
<i>Baetis intercalaris</i>	353	+
<i>Pseudocloeon propinquum</i>	2	+
<i>Isonychia sp</i>	29	
<i>Stenacron sp</i>	84	+
<i>Stenonema exiguum</i>	18	
<i>Stenonema mexicanum integrum</i>	14	+
<i>Stenonema pulchellum</i>	65	
<i>Serratella deficiens</i>	3	
<i>Tricorythodes sp</i>	68	+
<i>Coenagrionidae</i>	0	+
<i>Argia sp</i>	0	+
<i>Cheumatopsyche sp</i>	1118	+
<i>Hydropsyche bidens</i>	29	
<i>Hydropsyche frisoni</i>	15	
<i>Hydropsyche simulans</i>	58	+
<i>Macrostemum zebratum</i>	6	
<i>Glossosoma sp</i>	0	+
<i>Brachycentrus numerosus</i>	3	
<i>Neophylax sp</i>	0	+
<i>Helicopsyche borealis</i>	0	+
<i>Nectopsyche exquisita</i>	0	+
<i>Oecetis persimilis</i>	0	+
<i>Triaenodes injustus</i>	0	+
<i>Macronychus glabratus</i>	2	
<i>Stenelmis sp</i>	2	
<i>Pericoma sp</i>	0	+
<i>Simulium sp</i>	4	
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	3	
<i>Cricotopus (C.) bicinctus</i>	8	
<i>Thienemanniella xena</i>	3	
<i>Tvetenia discoloripes group</i>	44	
<i>Polypedilum (Uresipedilum) flavum</i>	12	
<i>Rheotanytarsus sp</i>	24	
<i>Hemerodromia sp</i>	6	
<i>Hydrobiidae</i>	17	+
<i>Elimia sp</i>	28	+
<i>Corbicula fluminea</i>	0	+

No. Quantitative Taxa: 32
 No. Qualitative Taxa: 23
 Total No. Taxa 43
 Number of Organisms 2326
 ICI 48

Site: St. Joseph River, Pinhook Park

Collection Date: 9/26/2007

Site Number: 5

Taxa Name	Quantitative	Qualitative		
<i>Turbellaria</i>	10	+		
<i>Oligochaeta</i>	3	+		
<i>Helobdella stagnalis</i>	0	+		
<i>Caecidotea sp</i>	2	+	No. Quantitative Taxa	32
<i>Hyalella azteca</i>	0	+	No. Qualitative Taxa	34
<i>Gammarus sp</i>	3	+	Total No. Taxa	47
<i>Hydracarina</i>	1	+	Number of Organisms	838
<i>Plauditus dubius or P. virilis</i>	6	+	ICI	50
<i>Baetis intercalaris</i>	195	+		
<i>Plauditus punctiventris</i>	0	+		
<i>Isonychia sp</i>	18	+		
<i>Stenacron sp</i>	50	+		
<i>Stenonema exiguum</i>	44	+		
<i>Stenonema pulchellum</i>	12			
<i>Serratella deficiens</i>	3			
<i>Tricorythodes sp</i>	118	+		
<i>Caenis sp</i>	4			
<i>Hetaerina sp</i>	0	+		
<i>Argia sp</i>	0	+		
<i>Belostoma sp</i>	0	+		
<i>Neureclipsis sp</i>	0	+		
<i>Polycentropus sp</i>	0	+		
<i>Cheumatopsyche sp</i>	98	+		
<i>Hydropsyche simulans</i>	139	+		
<i>Hydropsyche venularis</i>	0	+		
<i>Macrostemum zebratum</i>	1	+		
<i>Brachycentrus numerosus</i>	14	+		
<i>Helicopsyche borealis</i>	0	+		
<i>Nectopsyche exquisita</i>	0	+		
<i>Oecetis persimilis</i>	1			
<i>Triaenodes injustus</i>	0	+		
<i>Petrophila sp</i>	0	+		
<i>Psephenus herricki</i>	0	+		
<i>Macronychus glabratus</i>	7	+		
<i>Stenelmis sp</i>	1	+		
<i>Simulium sp</i>	3			
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	1			
<i>Corynoneura lobata</i>	3			
<i>Thienemanniella xena</i>	13			
<i>Tvetenia discoloripes group</i>	9			
<i>Polypedilum (Uresipedilum) flavum</i>	6			
<i>Polypedilum (P.) illinoense group</i>	3			
<i>Rheotanytarsus sp</i>	54			
<i>Hemerodromia sp</i>	5			
<i>Elimia sp</i>	3	+		
<i>Ferrissia sp</i>	8	+		
<i>Corbicula fluminea</i>	0	+		

Site: Elkhart River, Oxbow Park

Collection Date: 9/25/2007

Site Number: 6

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
<i>Hydra sp</i>	1		<i>Polypedilum (P.) illinoense</i> group	16	
<i>Turbellaria</i>	15		<i>Polypedilum (Tripodura) scalae-</i> <i>num group</i>	3	
<i>Nemertea</i>	9		<i>Rheotanytarsus sp</i>	16	
<i>Gammarus sp</i>	1	+	<i>Tanytarsus sp</i>	3	
<i>Orconectes sp</i>	0	+	<i>Hemerodromia sp</i>	1	
<i>Hydracarina</i>	1		<i>Hydrobiidae</i>	0	+
<i>Plauditus dubius or P. virilis</i>	2	+	<i>Elimia sp</i>	5	+
<i>Baetis flavistriga</i>	5		<i>Ferrissia sp</i>	43	
<i>Baetis intercalaris</i>	36	+	<i>Corbicula fluminea</i>	0	+
<i>Plauditus punctiventris</i>	0	+	<i>Pisidium sp</i>	1	
<i>Isonychia sp</i>	18	+	<i>Sphaerium sp</i>	0	+
<i>Leucrocuta sp</i>	0	+			
<i>Stenacron sp</i>	0	+			
<i>Stenonema exiguum</i>	0	+			
<i>Serratella deficiens</i>	32		No. Quantitative Taxa	44	
<i>Tricorythodes sp</i>	3	+	No. Qualitative Taxa	33	
<i>Calopteryx sp</i>	0	+	Total No. Taxa	61	
<i>Hetaerina sp</i>	0	+	Number of Organisms	421	
<i>Argia sp</i>	0	+	ICI	36	
<i>Basiaeschna janata</i>	0	+			
<i>Pteronarcys sp</i>	0	+			
<i>Paragnetina media</i>	4	+			
<i>Aagnetina capitata complex</i>	3	+			
<i>Corydalus cornutus</i>	2	+			
<i>Chimarra obscura</i>	2	+			
<i>Lype diversa</i>	2				
<i>Neureclipsis sp</i>	1				
<i>Nyctiophylax sp</i>	1				
<i>Cheumatopsyche sp</i>	35	+			
<i>Ceratopsyche morosa group</i>	8	+			
<i>Ceratopsyche sparna</i>	1				
<i>Hydropsyche simulans</i>	19	+			
<i>Hydropsyche venularis</i>	17				
<i>Brachycentrus numerosus</i>	0	+			
<i>Micrasema sp.</i>	1				
<i>Oecetis persimilis</i>	0	+			
<i>Triaenodes injustus</i>	0	+			
<i>Petrophila sp</i>	0	+			
<i>Psephenus herricki</i>	0	+			
<i>Ancyronyx variegata</i>	2				
<i>Macronychus glabratus</i>	7	+			
<i>Stenelmis sp</i>	1	+			
<i>Simulium sp</i>	2				
<i>Corynoneura lobata</i>	3				
<i>Nanocladius (N.) crassicornus or N. (N.)</i> <i>"rectinervis"</i>	8				
<i>Rheocricotopus (Psilocricotopus) robacki</i>	45				
<i>Thienemanniella lobapodema</i>	6				
<i>Thienemanniella xena</i>	24				
<i>Tvetenia discoloripes group</i>	3				
<i>Polypedilum (Uresipedilum) flavum</i>	13				

Site: Elkhart River, Indiana Avenue

Collection Date: 9/24/2007

Site Number: 7

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
<i>Turbellaria</i>	7		<i>Microtendipes pedellus</i> group	2	
<i>Nemertea</i>	2		<i>Polypedilum (Uresipedilum) flavum</i>	16	
<i>Oligochaeta</i>	2		<i>Polypedilum (P.) fallax</i> group	8	
<i>Helobdella triserialis</i>	1		<i>Polypedilum (P.) illinoense</i> group	0	+
<i>Gammarus</i> sp	13	+	<i>Cladotanytarsus</i> sp	2	
<i>Orconectes</i> sp	0	+	<i>Rheotanytarsus</i> sp	10	+
<i>Plauditus dubius</i> or <i>P. virilis</i>	1	+	<i>Chrysops</i> sp	0	+
<i>Baetis intercalaris</i>	7	+	<i>Hemerodromia</i> sp	4	
<i>Isonychia</i> sp	13	+	<i>Elimia</i> sp	32	+
<i>Leucrocuta</i> sp	5	+	<i>Ferrissia</i> sp	39	+
<i>Stenacron</i> sp	19	+	<i>Pisidium</i> sp	0	+
<i>Stenonema exiguum</i>	35	+	<i>Sphaerium</i> sp	5	+
<i>Serratella deficiens</i>	7				
<i>Tricorythodes</i> sp	10	+			
<i>Caenis</i> sp	6				
<i>Calopteryx</i> sp	0	+			
<i>Hetaerina</i> sp	0	+	No. Quantitative Taxa	47	
<i>Coenagrionidae</i>	0	+	No. Qualitative Taxa	35	
<i>Argia</i> sp	2	+	Total No. Taxa	62	
<i>Gomphus</i> sp	0	+	Number of Organisms	402	
<i>Pteronarcys</i> sp	2	+	ICI	36	
<i>Acroneuria</i> sp	3				
<i>Agnatina capitata</i> complex	3	+			
<i>Sialis</i> sp	0	+			
<i>Corydalus cornutus</i>	1				
<i>Lype diversa</i>	1				
<i>Neureclipsis</i> sp	5				
<i>Polycentropus</i> sp	2				
<i>Cheumatopsyche</i> sp	32	+			
<i>Ceratopsyche morosa</i> group	7				
<i>Ceratopsyche sparna</i>	2				
<i>Hydropsyche depravata</i> group	0	+			
<i>Hydropsyche simulans</i>	22	+			
<i>Brachycentrus numerosus</i>	10	+			
<i>Micrasema</i> sp.	1				
<i>Neophylax</i> sp	0	+			
<i>Lepidostoma</i> sp	2				
<i>Helicopsyche borealis</i>	0	+			
<i>Triaenodes injustus</i>	0	+			
<i>Psephenus herricki</i>	0	+			
<i>Macronychus glabratus</i>	18				
<i>Optioservus</i> sp	1				
<i>Stenelmis</i> sp	6	+			
<i>Simulium</i> sp	1	+			
<i>Nilotanytus fimbriatus</i>	4				
<i>Corynoneura "celeripes"</i> (sensu Simpson & Bode, 1980)	3				
<i>Rheocricotopus (Psilocricotopus) robacki</i>	22				
<i>Thienemanniella lobapodema</i>	1				
<i>Thienemanniella xena</i>	5				
<i>Tvetenia discoloripes</i> group	0	+			

Site: Baugo Creek, County Road 1 (S)

Collection Date: 9/25/2007

Site Number: 8

Taxa Name	Quantitative	Qualitative	
<i>Turbellaria</i>	0	+	
<i>Oligochaeta</i>	0	+	
<i>Erpobdella punctata punctata</i>	0	+	
<i>Gammarus sp</i>	0	+	No. Quantitative Taxa 0
<i>Stenacron sp</i>	0	+	No. Qualitative Taxa 28
<i>Calopteryx sp</i>	0	+	Total No. Taxa 28
<i>Coenagrionidae</i>	0	+	Number of Organisms NA
<i>Argia sp</i>	0	+	ICI NA
<i>Notonecta sp</i>	0	+	
<i>Cheumatopsyche sp</i>	0	+	
<i>Hydropsyche depravata group</i>	0	+	
<i>Peltodytes sp</i>	0	+	
<i>Hydroporus sp</i>	0	+	
<i>Laccophilus sp</i>	0	+	
<i>Berosus sp</i>	0	+	
<i>Tropisternus sp</i>	0	+	
<i>Helichus sp</i>	0	+	
<i>Dubiraphia vittata group</i>	0	+	
<i>Stenelmis sp</i>	0	+	
<i>Simulium sp</i>	0	+	
<i>Conchapelopia sp</i>	0	+	
<i>Helopelopia sp</i>	0	+	
<i>Thienemanniella xena</i>	0	+	
<i>Dicrotendipes neomodestus</i>	0	+	
<i>Polypedilum (P.) illinoense group</i>	0	+	
<i>Stictochironomus sp</i>	0	+	
<i>Stratiomys sp</i>	0	+	
<i>Physella sp</i>	0	+	

Site: Baugo Creek, County Road 3 (N)

Collection Date: 9/25/2007

Site Number: 9

Taxa Name	Quantitative	Qualitative		
<i>Turbellaria</i>	0	+		
<i>Oligochaeta</i>	1460	+		
<i>Erpobdella punctata punctata</i>	1			
<i>Belostoma sp</i>	1	+	No. Quantitative Taxa	30
<i>Ranatra sp</i>	0	+	No. Qualitative Taxa	20
<i>Cheumatopsyche sp</i>	159	+	Total No. Taxa	38
<i>Ceratopsyche morosa group</i>	77		Number of Organisms	2545
<i>Hydropsyche depravata group</i>	78	+	ICI	18
<i>Helichus sp</i>	0	+		
<i>Ancyronyx variegata</i>	3	+		
<i>Dubiraphia vittata group</i>	4			
<i>Stenelmis sp</i>	4			
<i>Antocha sp</i>	4			
<i>Tipula sp</i>	0	+		
<i>Simulium sp</i>	0	+		
<i>Ablabesmyia mallochi</i>	0	+		
<i>Helopelopia sp</i>	190			
<i>Corynoneura lobata</i>	2			
<i>Cricotopus (C.) sp</i>	19	+		
<i>Cricotopus (C.) bicinctus</i>	57	+		
<i>Cricotopus (C.) trifascia</i>	0	+		
<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	10			
<i>Rheocricotopus (Psilocricotopus) robacki</i>	10			
<i>Thienemanniella xena</i>	21			
<i>Dicrotendipes neomodestus</i>	38			
<i>Microtendipes pedellus group</i>	10			
<i>Polypedilum (P.) illinoense group</i>	152	+		
<i>Polypedilum (Tripodura) scalaenum group</i>	19	+		
<i>Stictochironomus sp</i>	16	+		
<i>Paratanytarsus sp</i>	10			
<i>Rheotanytarsus pellucidus</i>	19			
<i>Rheotanytarsus sp</i>	10			
<i>Tanytarsus sp</i>	47	+		
<i>Tanytarsus glabrescens group sp 7</i>	47			
<i>Hemerodromia sp</i>	28			
<i>Elimia sp</i>	1			
<i>Ferrissia sp</i>	48	+		
<i>Corbicula fluminea</i>	0	+		

Site: Woodward Ditch, Oakside Avenue

Collection Date: 9/25/2007

Site Number: 10

Taxa Name	Quantitative	Qualitative		
<i>Oligochaeta</i>	196			
<i>Helobdella stagnalis</i>	1			
<i>Erpobdella punctata punctata</i>	1			
<i>Caecidotea sp</i>	2	+	No. Quantitative Taxa	31
<i>Gammarus sp</i>	69	+	No. Qualitative Taxa	16
<i>Orconectes sp</i>	0	+	Total No. Taxa	38
<i>Baetis intercalaris</i>	0	+	Number of Organisms	689
<i>Stenacron sp</i>	53	+	ICI	26
<i>Calopteryx sp</i>	0	+		
Coenagrionidae	1			
<i>Lype diversa</i>	4			
<i>Cheumatopsyche sp</i>	12	+		
<i>Hydropsyche depravata group</i>	1			
<i>Glossosoma sp</i>	0	+		
<i>Pycnopsyche sp</i>	0	+		
<i>Dubiraphia vittata group</i>	1	+		
<i>Stenelmis sp</i>	2			
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	36			
<i>Corynoneura lobata</i>	100			
<i>Cricotopus (C.) bicinctus</i>	3			
<i>Parakiefferiella sp</i>	19			
<i>Parametriocnemus sp</i>	9			
<i>Thienemanniella xena</i>	5			
<i>Tvetenia discoloripes group</i>	1	+		
<i>Cryptochironomus sp</i>	3			
<i>Microtendipes pedellus group</i>	75	+		
<i>Paratendipes albimanus or P. duplicatus</i>	41			
<i>Phaenopsectra obediens group</i>	9			
<i>Polypedilum (P.) fallax group</i>	13			
<i>Polypedilum (P.) illinoense group</i>	13			
<i>Polypedilum (Tripodura) halterale group</i>	0	+		
<i>Stictochironomus sp</i>	1	+		
<i>Stempellinella sp</i>	3			
<i>Tanytarsus sp</i>	3			
<i>Tanytarsus glabrescens group sp 7</i>	6			
<i>Physella sp</i>	0	+		
<i>Corbicula fluminea</i>	3	+		
<i>Pisidium sp</i>	3			

Site: Eller Ditch, Bridgeton Drive

Collection Date: 9/25/2007

Site Number: 11

Taxa Name	Quantitative	Qualitative		
<i>Hydra sp</i>	4			
<i>Turbellaria</i>	67	+		
<i>Nemertea</i>	5			
<i>Oligochaeta</i>	765	+	No. Quantitative Taxa	22
<i>Caecidotea sp</i>	17		No. Qualitative Taxa	12
<i>Gammarus sp</i>	27	+	Total No. Taxa	29
<i>Baetis intercalaris</i>	1	+	Number of Organisms	1082
<i>Hydropsyche depravata group</i>	1		ICI	16
<i>Helichus sp</i>	0	+		
<i>Pilaria sp</i>	0	+		
<i>Tipula sp</i>	0	+		
<i>Thienemannimyia group</i>	4			
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	12			
<i>Cricotopus (C.) bicinctus</i>	0	+		
<i>Eukiefferiella brevicealcar group</i>	0	+		
<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	4			
<i>Parametriocnemus sp</i>	20			
<i>Thienemanniella xena</i>	2			
<i>Tvetenia bavarica group</i>	8			
<i>Paratendipes albimanus or P. duplicatus</i>	20	+		
<i>Phaenopsectra obediens group</i>	8			
<i>Polypedilum (Uresipedilum) flavum</i>	4			
<i>Polypedilum (P.) illinoense group</i>	16			
<i>Stictochironomus sp</i>	0	+		
<i>Paratanytarsus sp</i>	0	+		
<i>Rheotanytarsus sp</i>	59			
<i>Tanytarsus sp</i>	36			
<i>Stratiomyidae</i>	1			
<i>Ephydriidae</i>	1			

Site: Eller Ditch, Lincolnway

Collection Date: 9/25/2007

Site Number: 12

Taxa Name	Quantitative	Qualitative		
<i>Turbellaria</i>	53	+		
<i>Oligochaeta</i>	1644	+		
<i>Gammarus sp</i>	17	+		
<i>Baetis intercalaris</i>	16	+	No. Quantitative Taxa	25
<i>Pseudocloeon propinquum</i>	1		No. Qualitative Taxa	14
<i>Cheumatopsyche sp</i>	104	+	Total No. Taxa	31
<i>Ceratopsyche morosa group</i>	1		Number of Organisms	2746
<i>Hydropsyche depravata group</i>	148	+	ICI	26
<i>Nectopsyche exquisita</i>	0	+		
<i>Tipula sp</i>	2	+		
<i>Simulium sp</i>	0	+		
<i>Diamesa sp</i>	0	+		
<i>Brillia flavifrons group</i>	7			
<i>Cricotopus (C.) sp</i>	190			
<i>Eukiefferiella brevicar group</i>	22			
<i>Parametriocnemus sp</i>	44			
<i>Rheocricotopus (Psilocricotopus) robacki</i>	7			
<i>Tvetenia bavarica group</i>	190			
<i>Chironomus (C.) sp</i>	7			
<i>Dicrotendipes neomodestus</i>	0	+		
<i>Microtendipes pedellus group</i>	7			
<i>Paratendipes albimanus or P. duplicatus</i>	22			
<i>Polypedilum (Uresipedilum) aviceps</i>	88			
<i>Polypedilum (Uresipedilum) flavum</i>	66			
<i>Polypedilum (P.) illinoense group</i>	51			
<i>Stictochironomus sp</i>	0	+		
<i>Rheotanytarsus sp</i>	37			
<i>Tanytarsus sp</i>	7			
<i>Tabanus sp</i>	0	+		
<i>Physella sp</i>	11	+		
<i>Pisidium sp</i>	4			

Site: Willow Creek, Day Road

Collection Date: 9/25/2007

Site Number: 13

Taxa Name	Quantitative	Qualitative		
<i>Oligochaeta</i>	26	+		
<i>Gammarus sp</i>	17	+		
<i>Hydracarina</i>	8	+		
<i>Baetis intercalaris</i>	163	+	No. Quantitative Taxa	26
<i>Coenagrionidae</i>	0	+	No. Qualitative Taxa	20
<i>Argia sp</i>	4	+	Total No. Taxa	34
<i>Basiaeschna janata</i>	0	+	Number of Organisms	1233
<i>Belostoma sp</i>	0	+	ICI	30
<i>Cheumatopsyche sp</i>	4			
<i>Ceratopsyche morosa group</i>	1			
<i>Limnephilus sp</i>	0	+		
<i>Tipula sp</i>	1	+		
<i>Simulium sp</i>	24	+		
<i>Ceratopogonidae</i>	2			
<i>Conchapelopia sp</i>	79			
<i>Prodiamesa olivacea</i>	0	+		
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	22			
<i>Corynoneura lobata</i>	8			
<i>Cricotopus (C.) bicinctus</i>	0	+		
<i>Cricotopus (Isocladius) sylvestris group</i>	15			
<i>Parametrioctenus sp</i>	266			
<i>Psectrocladius (Allopsectrocladius) sp</i>	0	+		
<i>Thienemanniella xena</i>	62	+		
<i>Tvetenia bavarica group</i>	35			
<i>Microtendipes pedellus group</i>	10			
<i>Polypedilum (Uresipedilum) flavum</i>	15			
<i>Stictochironomus sp</i>	5	+		
<i>Rheotanytarsus sp</i>	286			
<i>Tanytarsus sp</i>	25	+		
<i>Tanytarsus glabrescens group sp 7</i>	5			
<i>Chrysops sp</i>	0	+		
<i>Hemerodromia sp</i>	2			
<i>Physella sp</i>	98	+		
<i>Gyraulus sp</i>	50	+		

Site: Willow Creek, Estates Blvd

Collection Date: 9/25/2007

Site Number: 14

Taxa Name	Quantitative	Qualitative	
<i>Nemertea</i>	2		
<i>Oligochaeta</i>	16	+	
<i>Helobdella triserialis</i>	0	+	
<i>Gammarus sp</i>	76	+	No. Quantitative Taxa 30
<i>Hydracarina</i>	6		No. Qualitative Taxa 21
<i>Baetis intercalaris</i>	0	+	Total No. Taxa 41
<i>Stenonema vicarium</i>	56	+	Number of Organisms 1021
<i>Calopteryx sp</i>	0	+	ICI 40
<i>Coenagrionidae</i>	0	+	
<i>Boyeria vinosa</i>	1	+	
<i>Perlodidae</i>	10		
<i>Lype diversa</i>	4		
<i>Cheumatopsyche sp</i>	128	+	
<i>Ceratopsyche slossonae</i>	52	+	
<i>Hydropsyche depravata group</i>	55	+	
<i>Ptilostomis sp</i>	0	+	
<i>Brachycentrus numerosus</i>	5	+	
<i>Helichus sp</i>	0	+	
<i>Macronychus glabratus</i>	15		
<i>Optioservus sp</i>	167		
<i>Stenelmis sp</i>	2		
<i>Pilaria sp</i>	0	+	
<i>Tipula sp</i>	0	+	
<i>Simulium sp</i>	4		
<i>Helopelopia sp</i>	13		
<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	22		
<i>Corynoneura lobata</i>	9		
<i>Cricotopus (C.) sp</i>	13		
<i>Parametriocnemus sp</i>	39		
<i>Thienemanniella lobapodema</i>	3		
<i>Thienemanniella xena</i>	23		
<i>Tvetenia bavarica group</i>	46		
<i>Cryptochironomus sp</i>	0	+	
<i>Polypedilum (Uresipedilum) flavum</i>	78	+	
<i>Polypedilum (P.) fallax group</i>	26		
<i>Polypedilum (P.) illinoense group</i>	13		
<i>Rheotanytarsus sp</i>	111		
<i>Hemerodromia sp</i>	14		
<i>Hydrobiidae</i>	0	+	
<i>Physella sp</i>	0	+	
<i>Corbicula fluminea</i>	12	+	

Site: Juday Creek, State Road 23

Collection Date: 9/25/2007

Site Number: 15

Taxa Name	Quantitative	Qualitative	
<i>Turbellaria</i>	4		
<i>Nemertea</i>	4		
<i>Oligochaeta</i>	52		
<i>Hyalella azteca</i>	0	+	No. Quantitative Taxa 42
<i>Gammarus sp</i>	13		No. Qualitative Taxa 20
<i>Orconectes sp</i>	0	+	Total No. Taxa 51
<i>Hydracarina</i>	12		Number of Organisms 2123
<i>Stenacron sp</i>	25	+	ICI 46
<i>Stenonema exiguum</i>	4	+	
<i>Stenonema vicarium</i>	1		
<i>Tricorythodes sp</i>	31	+	
<i>Caenis sp</i>	248	+	
<i>Ephemera sp</i>	14	+	
<i>Calopteryx sp</i>	0	+	
<i>Coenagrionidae</i>	0	+	
<i>Sialis sp</i>	0	+	
<i>Polycentropus sp</i>	4		
<i>Cheumatopsyche sp</i>	304	+	
<i>Hydropsyche depravata group</i>	4		
<i>Hydroptila sp</i>	8		
<i>Mystacides sepulchralis</i>	8		
<i>Nectopsyche exquisita</i>	0	+	
<i>Dubiraphia vittata group</i>	32	+	
<i>Macronychus glabratus</i>	0	+	
<i>Stenelmis sp</i>	1		
<i>Simulium sp</i>	0	+	
<i>Ceratopogonidae</i>	12		
<i>Ablabesmyia mallochi</i>	6		
<i>Helopelopia sp</i>	77		
<i>Nilotanytus fimbriatus</i>	6		
<i>Corynoneura lobata</i>	15		
<i>Cricotopus (C.) bicinctus</i>	13		
<i>Cricotopus (Isocladius) sylvestris group</i>	13		
<i>Parametriocnemus sp</i>	51		
<i>Rheocricotopus (Psilocricotopus) robacki</i>	251		
<i>Thienemanniella xena</i>	1		
<i>Tvetenia bavarica group</i>	13		
<i>Dicrotendipes neomodestus</i>	19		
<i>Microtendipes pedellus group</i>	45		
<i>Phaenopsectra obediens group</i>	6		
<i>Stictochironomus sp</i>	6		
<i>Paratanytarsus sp</i>	6		
<i>Rheotanytarsus pellucidus</i>	103		
<i>Rheotanytarsus sp</i>	379		
<i>Tanytarsus sp</i>	32	+	
<i>Hemerodromia sp</i>	40		
<i>Physella sp</i>	2	+	
<i>Gyraulus sp</i>	1		
<i>Ferrissia sp</i>	194	+	
<i>Corbicula fluminea</i>	63	+	
<i>Sphaerium sp</i>	0	+	

