

ELKHART-SOUTH BEND AQUATIC COMMUNITY MONITORING



**ANNUAL REPORT
2012**

Clean
river
Healthy
neighborhoods



ELKHART ■ SOUTH BEND

Cover Photo: A juvenile longnose Gar from Jefferson Boulevard on the St. Joseph River

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AQUATIC COMMUNITY MONITORING IN ELKHART AND ST. JOSEPH COUNTIES ON THE ST. JOSEPH RIVER AND SELECTED TRIBUTARIES 2012



Victoria with a channel cat
from the Lexington Avenue
Bridge

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April, 2013

INTRODUCTION

For many years, the Cities of South Bend and Elkhart have collected surface water samples from our local rivers to determine pollutant concentrations. In 1998, the City of Elkhart initiated biological community monitoring to compliment chemical and microbial sampling. The City of South Bend joined forces with Elkhart in 2001, and since then both communities have gathered a great deal of information on the health of our local waterways. Since the initiation of monitoring in 1998, chemical and biological data suggest that water quality is slowly improving on some local streams. There are some issues that remain, which includes unstable drainage practices, sedimentation, stormwater problems, and combined sewer overflows. However, through a series of actions from government entities, watershed organizations, and the general public, the quality of our local waterways should only get better as we move into the future.

In 2012, the Cities of Elkhart and South Bend, through the City of Elkhart's Aquatics Program, continued to monitor local fish populations in area rivers and streams. The information that was gathered was integrated into an overall water quality program for each City. While the cities measure the chemical and microbial composition of local stream water, having the additional biological data gives a more accurate representation of the overall health of each stream. The way that biological communities are assembled can change as a result of a past or long-term disturbance. Chemical and microbial testing, while very important in pinpointing contaminants, is simply a snapshot of current conditions. In many cases, having both sets of data can help determine the cause and effect of disturbances to our local streams.

During the first 6 years (1998-2003), Elkhart's Aquatics Program established core fish sampling sites on the St. Joseph River and many of its primary tributaries in the Elkhart area. For 3 consecutive years, data were collected from these sites and a baseline was established for each stream. Baseline data are now used to compare with current monitoring results to determine if impairments or enhancements are taking place in Elkhart area streams.

In 2001, the City of South Bend combined forces with Elkhart's Aquatics staff, establishing a unique biological monitoring partnership between municipalities. As with the Elkhart area, core sampling sites were determined and similar baselines were established for South Bend over a 6 year period (2001-2006). This year (2012) was the sixth year that the initial sites had been sampled since the baseline period, providing the stakeholders of South Bend with data to determine whether water quality in their area is improving or diminishing.

The Aquatics Program consists of more than just traversing through local streams collecting fish data. A considerable portion of the Program is education. The biologist travels to local schools and watershed stakeholder group meetings, giving presentations and demonstrations, in an effort to increase awareness of, and promote conservation for, the bountiful aquatic resources we have in this area.

Indices

The Index of Biotic Integrity (IBI) is the system that is used to assess the local fish communities. The IBI was developed by Dr. James Karr in 1981 as a tool for assessing water/stream quality based

on the fish communities that are present. The IBI was modified by Dr. Thomas Simon in 1997 for use in the St. Joseph River Watershed. The IBI is a great tool in that complex biological information can be analyzed to provide measurements of stream quality for non-biologists and members of the general public. The IBI is comprised of 3 broad categories (species composition, trophic composition, and fish condition) which are broken down into 12 smaller categories, known as metrics (see Appendix A). These metrics are given a score based on their similarity to least impacted (reference) sites. One (1) of 3 scores can be given for each metric: 1 (not similar to reference conditions), 3 (somewhat similar to reference conditions), or 5 (very similar to reference conditions). In general, the total score for a site will range from 12 to 60, but in an instance where no fish are present at a site, a score of 0 is given. These scores can then be graphed and placed into 1 to 5 classifications (very poor, poor, fair, good, or excellent), which describes the overall condition of the fish community being monitored.

Figure 1. MBI biologist gauges flow at a Hester-Dendy Sampler Location on the Elkhart River

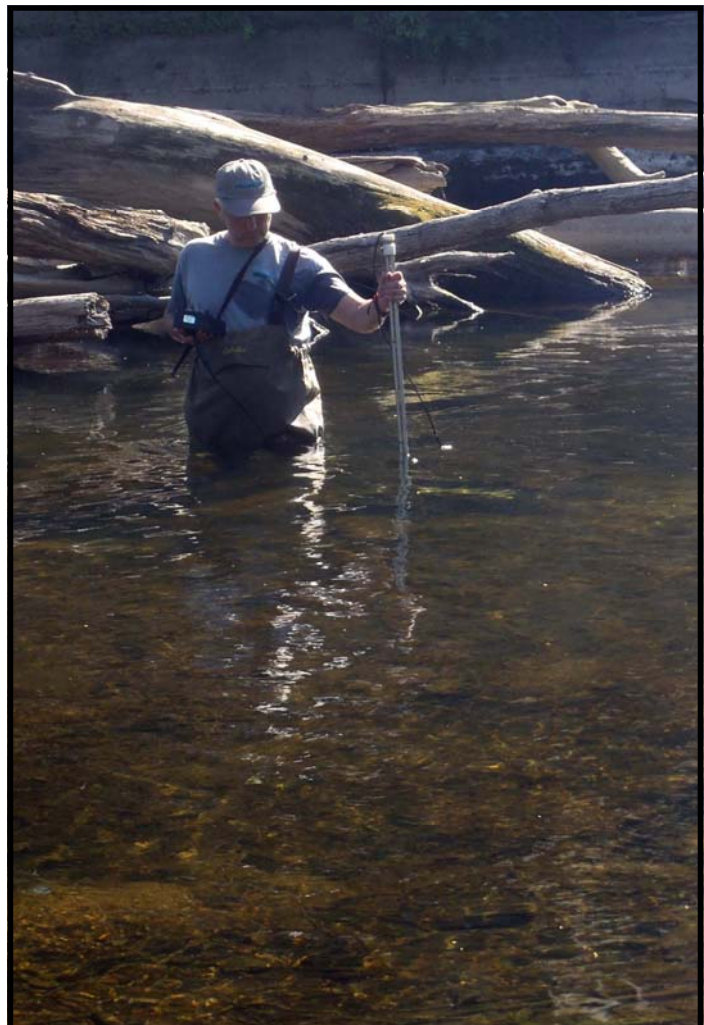
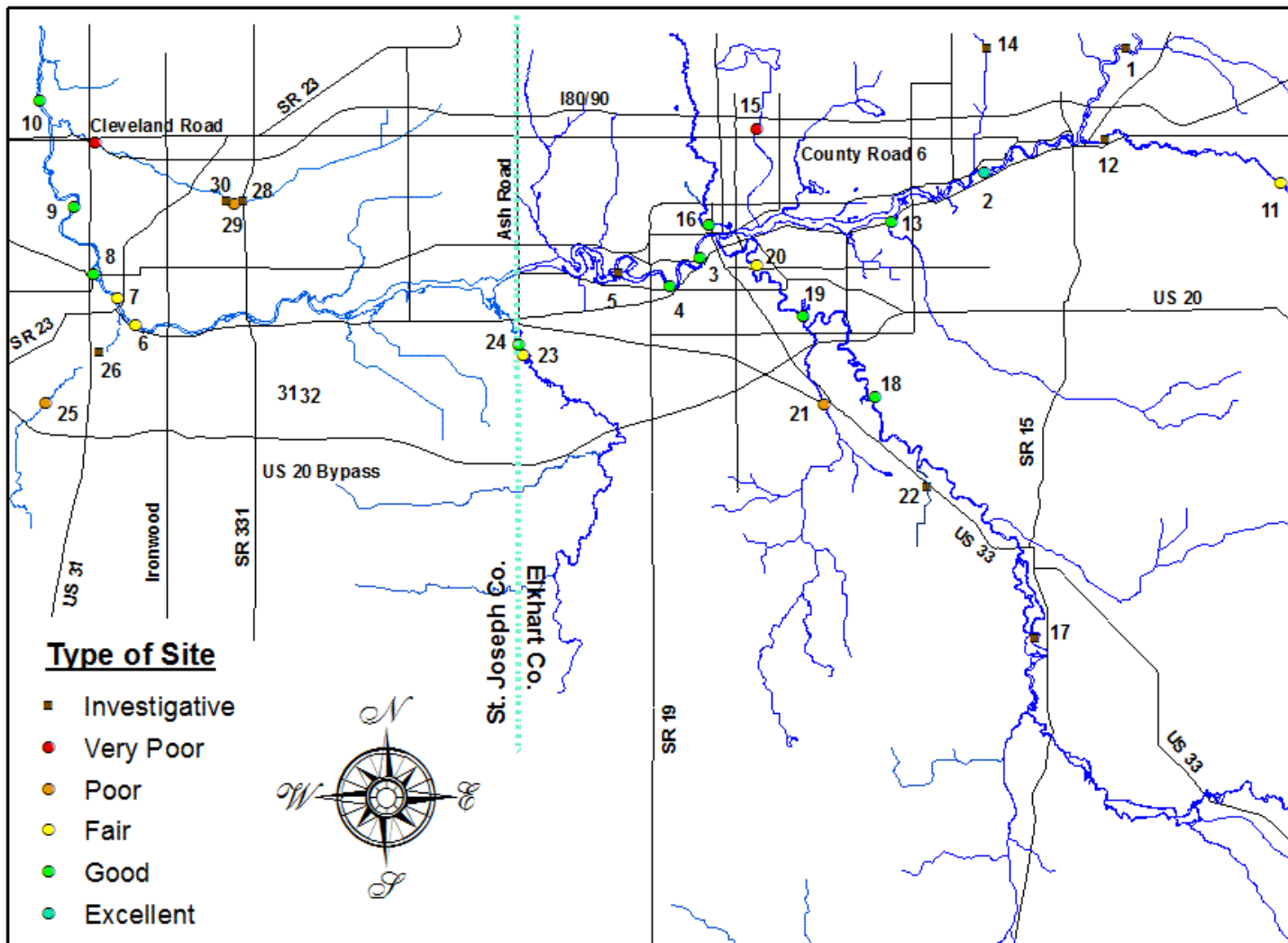


Figure 2: Fish sampling sites in Elkhart and St. Joseph Counties and associated fish community conditions for 2012



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, the Aquatics Program 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 6 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. It may also show specific habitat degradation issues that need to be addressed.

Fish are not the only aquatic organisms that can be monitored to determine overall health of rivers and streams. Through a sub-contract with the Midwest Biodiversity Institute (Figure 1) (MBI, Columbus, Ohio), the Aquatics Program is also moni-

toring benthic (bottom dwelling) macroinvertebrates (visible animals without backbones). Fourteen (14) sites were sampled in 2012 and results were compared to their respective baseline values. The macroinvertebrate communities are assessed with the Invertebrate Community Index (ICI) developed by the Ohio Environmental Protection Agency (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 different from the typical community), or 1 (very different from the typical community). The site scores range from 0 to 60 and are classified similar to IBI scores. This combination of fish, habitat, macroinvertebrate, and chemical monitoring provides the cities of Elkhart and South Bend with the most comprehensive view of the health of our streams.

Table 1: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2012

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2012	2012	2012
St. Joseph River	State Line (East)	1	Investigative	Elkhart	Boat			81
	Nibbyville (A)	2	Index	Elkhart	Boat	56		83
	Lexington Avenue	3	Index	Elkhart	Boat	54	48	81
	McNaughton Park	4	Index	Elkhart	Boat	48	38	76
	Treasure Island	5	Investigative	Elkhart	Boat			53
	Sample Street	6	Index	St. Joseph	Boat	37		56
	Jefferson Boulevard	7	Index	St. Joseph	Boat	40		56
	LaSalle Street	8	Index	St. Joseph	Boat	48	42	88
	Keller Park	9	Index	St. Joseph	Boat	54	40	84
	Brick Road	10	Index	St. Joseph	Boat	49	44	82
Little Elkhart River*	County Road 35	11	Index	Elkhart	Tote Barge	45	52	94
	Oakridge Cemetery	12	Investigative	Elkhart	Tote Barge			81
Pine Creek*	State Road 120	13	Index	Elkhart	Tote Barge	46		66
Washington TWP Ditch*	County Road 2	14	Investigative	Elkhart	Back Pack			53
Lily Creek	Park Six Drive	15	Index	Elkhart	Back Pack	<u>6</u>		<u>13</u>
Christiana Creek	North Main Well Field	16	Index	Elkhart	Tote Barge	51	52	80
Elkhart River	Goshen Pond	17	Investigative	Elkhart	Boat			53
	Oxbow Park (B)	18	Index	Elkhart	Boat	47	36	85
	Environmental Center (A)	19	Index	Elkhart	Boat	46		79
	Central High School	20	Index	Elkhart	Boat	42	42	72
Yellow Creek	Concord High School	21	Index	Elkhart	Boat	37	44	54
Leedy Ditch	Peddlers Village	22	Investigative	Elkhart	Back Pack			<u>29</u>
Baugo Creek	Restoration Site	23	Index	Elkhart /St. Joseph	Tote Barge	41	44	78
	Restoration (Below)	24	Index	Elkhart/St. Joseph	Tote Barge	46		83
Phillips Ditch	Chippewa Avenue	25	Index	St. Joseph	Back Pack	<u>25</u>	<u>32</u>	63
Bowman Creek	Fox Street	26	Investigative	St. Joseph	Back Pack			<u>18</u>

* denotes a cool/cold water stream
Underlined values are indicative of a stream impairment

Table 1: Fish sampling sites and Index Scores in Elkhart and St. Joseph Counties, 2012 (continued)

Stream	Site	Site Number	Type of Site	County	Method	IBI Scores	ICI Scores	QHEI Scores
						2012	2012	2012
Juday Creek*	Main Street (A)	27	Investigative	St. Joseph	Tote Barge			<u>30</u>
	Grape Road	28	Index	St. Joseph	Tote Barge	36	<u>20</u>	54
	Tanglewood	29	Investigative	St. Joseph	Tote Barge			51
	Myrtle Street	30	Index	St. Joseph	Tote Barge	<u>30</u>	50	61

The Indiana Department of Environmental Management (IDEM) has established guidelines to determine if a body of water is impaired or if its condition is supportive of aquatic life for the IBI and QHEI (IDEM 2010). 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 greater indicate enough quality habitat is available to support aquatic communities.

In addition to performing water quality monitoring in the St. Joseph River basin, fish collections are conducted to determine the overall species diversity throughout the watershed. Walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomieu*) populations are monitored from previous tagging events in cooperation with the Indiana Department of Natural Resources (IDNR). Tissue from 7 fish species was collected and analyzed for mercury and polychlorinated biphenyl (PCB) content. Current Indiana Fish Consumption Advisory data for the State of Indiana (Table 10) displays many species from the Indiana portion of the St. Joseph River Watershed. The cities involved in the Program believe it is vital to continually provide local citizens with the most updated information on fish consumption.

Methods

For the past 14 years, the Aquatics staff has used 2 collection protocols (investigative sampling and index sampling) to quickly catalog the major fish species and to quantify water quality in the St. Joseph River Watershed. Investigative sites are sampled once during the season and the fish collected at these sites are identified to

species, the largest and smallest specimens are measured to the nearest millimeter (mm), and all fish are counted and then released. Index sites are sampled twice during the season, with a minimum 5 week “rest” period between sampling events. Individual species maximum and minimum lengths are recorded, all fish are counted, and game fish are weighed and measured individually, while non-game fish are mass weighed.

The length of stream sampled at an index site is dependent on the wetted width of the stream. The length of sites is 15 times this width, with a minimum of 50 meters and a maximum of 500 meters. Differences in sampling and processing (Foy 2004) have allowed multiple investigative sites to be sampled in a day versus 1 or 2 index sites. Every species collected at each site is verified either by retaining and preserving a small specimen for the Public Works & Utilities voucher museum or by photographing a large specimen. This practice allows for the verification of the field and lab identifications if needed.

In 2012, 8 index and 3 investigative sites were sampled in St. Joseph County and 12 index and 6 investigative sites were sampled in Elkhart County. Two (2) index sites on Baugo Creek were located right on the Elkhart/St. Joseph County border. (Figure 2 and Table 1). IBI scores were calculated for each of the index sites and an average from the 2 visits was obtained to give the final score (Table 1).

Fish were collected from all sites using either boat mounted, tote barge, or backpack electrofishing equipment. The type of gear used depended 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 3 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.

During each fish sampling event, stream habitat information was methodically collected using the QHEI as developed by Ohio EPA (Rankin 1989). Given that each index site was sampled twice, scores were averaged to give a final score (Table 1).

In early July 2012, MBI personnel placed Hester-Dendy samplers (artificial substrates used to collect small aquatic organisms) (Figure 3) at 14 sites that were also sampled for fish (Table 2 and Figure 4) following Ohio EPA macroinvertebrate sampling procedures (Ohio EPA 1987, 1989). All 14 samplers were successfully retrieved approximately 7 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 was then used to calculate ICI scores for each site. Qualitative sampling also took place at each site 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

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



Table 2: Macroinvertebrate Sampling Sites, 2012

Site Number	Stream	Location	Site Number	Stream	Location
1	St. Joseph River	Lexington Ave.	8	Elkhart River	Oxbow Park (B)
2	St. Joseph River	McNaughton Park	9	Elkhart River	Central High School
3	St. Joseph River	LaSalle	10	Yellow Creek	Concord High School
4	St. Joseph River	Keller Park	11	Baugo Creek	Restoration
5	St. Joseph River	Brick Road	12	Juday Creek	Grape Road
6	Little Elkhart River	County Road 35	13	Juday Creek	Myrtle Street
7	Christiana Creek	NMWF	14	Phillips Ditch	Chippewa Ave.

Figure 4: Location of macroinvertebrate sampling sites for 2012

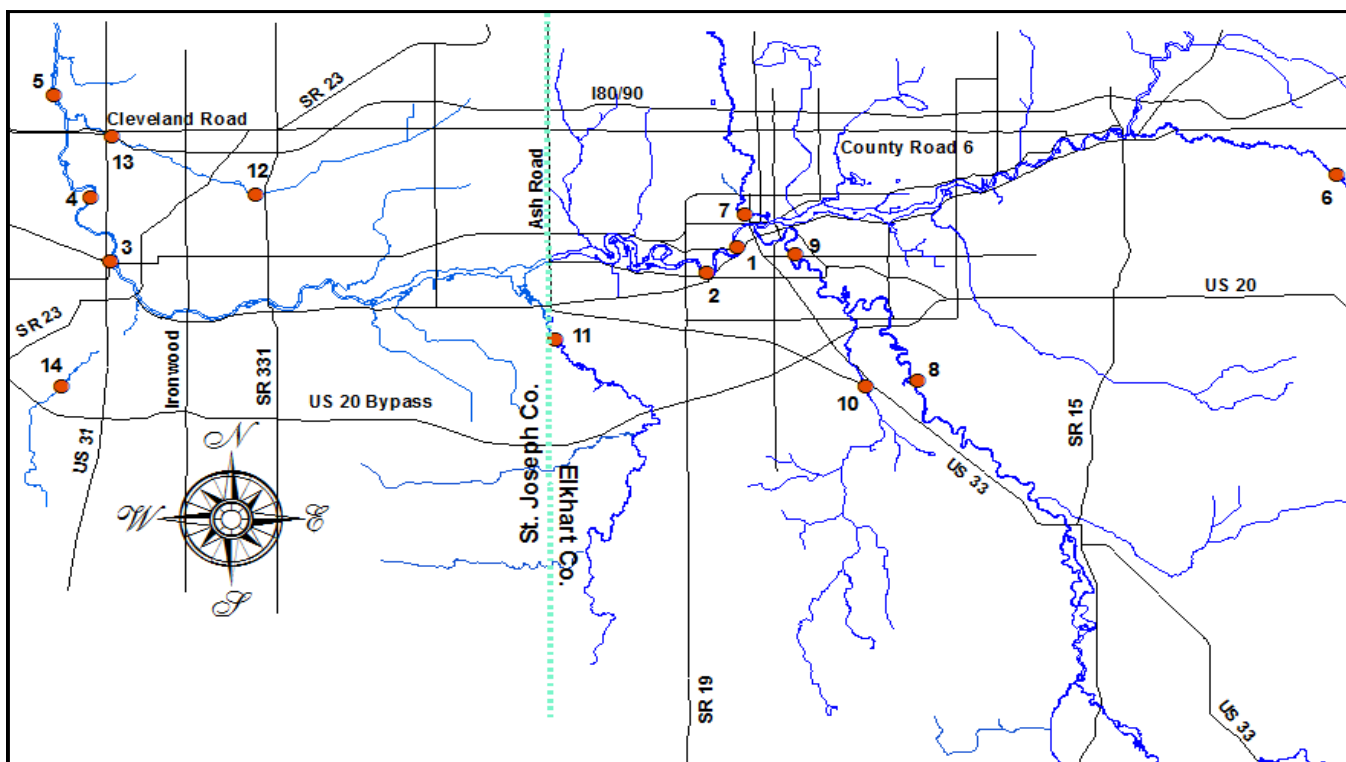
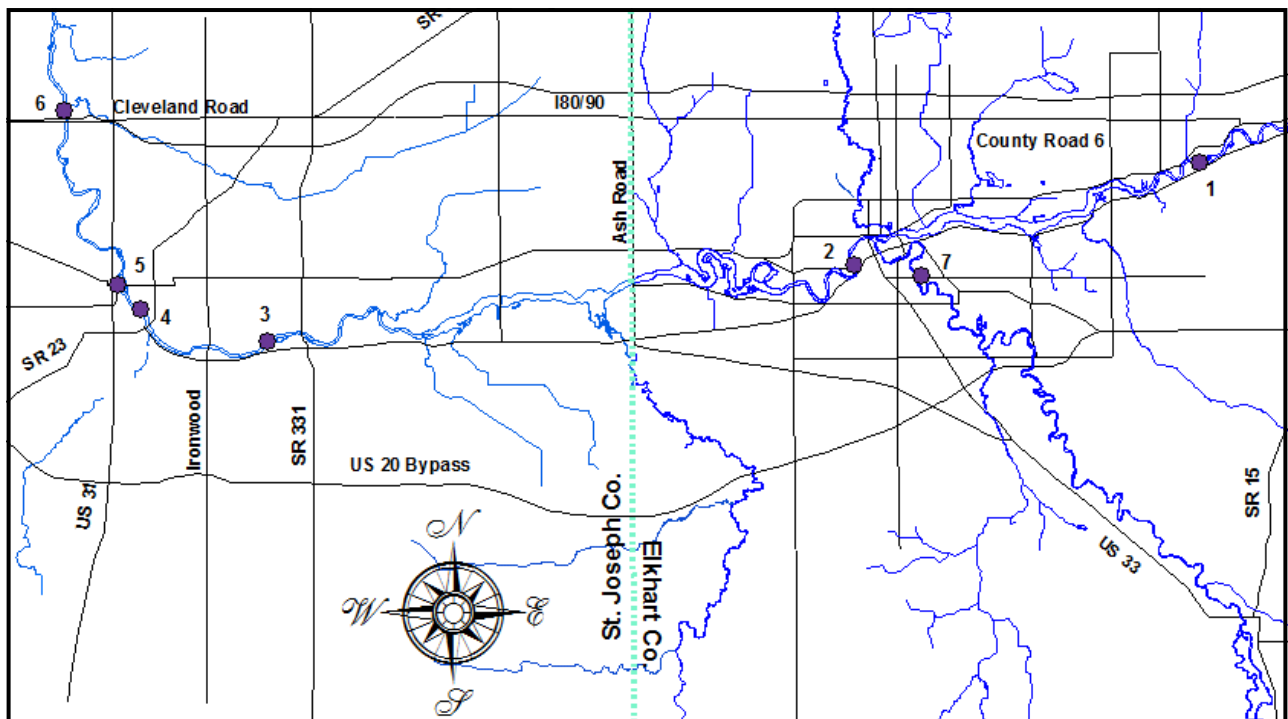


Figure 5: Location of fish tissue collection sites for 2012



ICI score can not be calculated due to the loss or vandalism of a sampler.

Fish tissue in the form of skin-on fillets was collected from smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), largemouth bass (*Micropterus salmoides*), shorthead redhorse (*Moxostoma macrolepidotum*), steelhead trout (*Oncorhynchus mykiss*), walleye (*Sander vitreus*), and northern pike (*Esox Lucius*). Table 3 and Figure 5 display the locations of tissue sample collection. Each tissue sample sent in for laboratory analysis (Pace Analytical, Green Bay, WI) was a composite of fillets from 3 fish of the same species from the sample reach. The shortest specimen was within 90% of the length of the longest specimen. The samples were collected following the procedures in Appendix B (this report) and Appendix III in "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (1993).

Long-term index monitoring consists of rotational sampling of stream stations. Each station is visited at least once every 3 years to gather biological and chemical data and to compare against previous sampling results.

Table 3: Location of fish tissue collection sites for 2012

<u>Site Number</u>	<u>Stream</u>	<u>Location</u>
1	St. Joseph River	Nibbyville (A)
2	St. Joseph River	Lexington Ave.
3	St. Joseph River	Logan Street
4	St. Joseph River	Jefferson Blvd
5	St. Joseph River	LaSalle Street
6	St. Joseph River	Darden Road
7	Elkhart River	Central High

Results and Discussion

During the summer of 2012, a total of 18,164 fish, representing 16 families and 67 species, were collected in Elkhart County. The 2 sites along Baugo Creek accounted for 4,668 of the fish that were collected, most of which were small minnow species. In St. Joseph County, 5,685 fish, representing 13 families and 51 species were collected. In total, 70 different species were captured from the 2 counties. Mimic shiners (*Notropis volucellus*), white suckers (*Catostomus commersonii*), and rock bass (*Ambloplites rupestris*) were the most abundant species collected in Elkhart County, while smallmouth bass, rock bass, and longear sunfish (*Lepomis megalotis*) were the most abundant in St. Joseph County. See Appendix C for more detailed information.

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

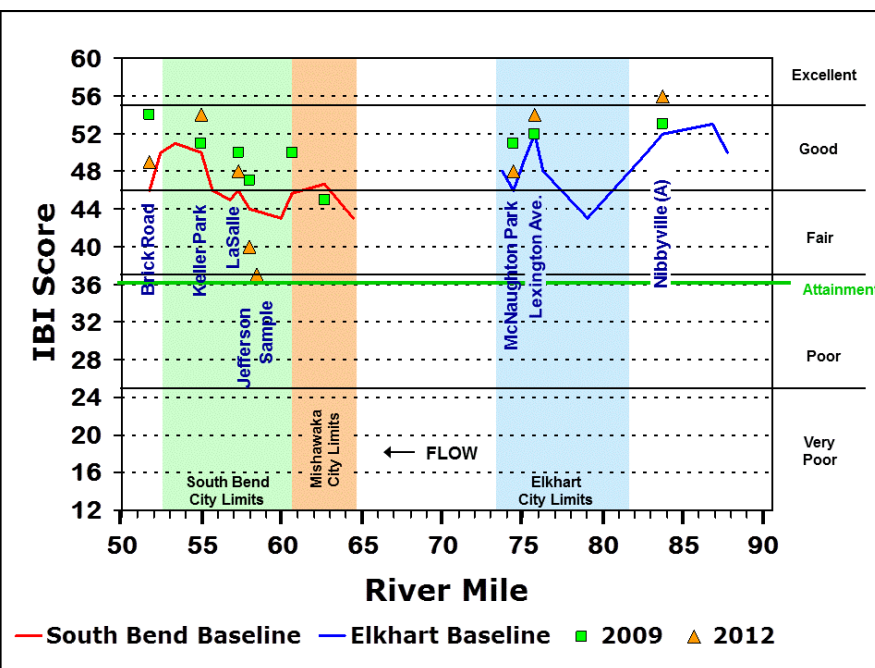
Fish community conditions at the index sites ranged from very poor (6) at Park Six Drive on Lily Creek to excellent (56) at Nibbyville (A) on the St. Joseph River. Macroinvertebrate community scores ranged from poor (20) at Grape Road on Juday Creek to excellent (52) at North Main Wellfield on Christiana Creek and County Road 35 on the Little Elkhart River. Habitat quality ranged from very poor (13) at Park Six Drive on Lily Creek to excellent (94) at County Road 35 on the Little Elkhart River.

Since the completion of baseline monitoring, fish IBI scores have been obtained 3 times over a period of 8 years at most index sites in Elkhart County. IBI scores can be influenced by natural conditions such as flooding or drought events and sometimes it can be difficult to determine whether stream quality is improving or diminishing because of natural variability. By averaging IBI scores from the last 3 monitoring events, variability can be reduced to give a good overall picture of stream health since the completion of baseline sampling. In this report we will present a comparison between baseline and post-baseline average IBI scores for several streams in Elkhart County.

St. Joseph River

The longitudinal trends in fish community condition for the entire Indiana portion of the St. Joseph River are displayed in Figure 6. Fish, macroinvertebrate, and habitat index scores are presented in Table 4. The Elkhart County portion of the river continues to support good to excellent fish communities. The McNaughton Park site scored the lowest of the 3 Elkhart County sites which is consistent with past monitoring results. Nibbyville (A) had an excellent IBI score of 56 which was up slightly from 2009, but the same as the score from 2006. Lexington Avenue also had an impressive IBI score for the third consecutive time since the completion of baseline monitoring.

Macroinvertebrate community scores remained relatively consistent at the Lexington Avenue site with an ICI score in the very good range. However, the ICI score at McNaughton Park was significantly lower since the last time it was sampled and just 3 points away from being considered an impaired macroinvertebrate community. The sec-



tion of the St. Joseph River at McNaughton Park is where the river transitions into the impoundment caused by the Twin Branch dam. Urban impacts in addition to unnatural influences caused by the impoundment could have contributed to this low score. However, it is likely that the drought conditions of 2012 also played a role.

In St. Joseph County, IBI scores for the St. Joseph River remained good for the sites located downstream of the South Bend Dam. Brick Road (49) did see a substantial drop from 2009 when the site had an IBI score of 54, but the 2012 score was still well above the baseline value of 46. The macroinvertebrate community score was also higher in 2012 compared to when it was last sampled in 2009. Similar reductions in fish IBI scores were observed at other sites in relatively close proximity to Brick Road; Darden Road in 2011 and Pinhook (B) in 2010 suggesting an issue in the lower section of South Bend. However, not too far upstream at Keller Park, fish species diversity was very high in 2012 promoting an almost excellent IBI score of 54. Surprisingly, even though the fish IBI score was up in 2012 at Keller Park, the macroinvertebrate community score was significantly lower than the last time it was sampled. Drought conditions in 2012 promoted excessive algae growth all along the river. These conditions made sampling shallow sites like Keller Park for macroinvertebrates rather difficult because the algae covered and clogged the sampling devices. However, these conditions along with low flows and high temperatures associated with the

Table 4. Index scores for St. Joseph River sites, Elkhart and St. Joseph Counties

Station	County	River Mile	Fish IBI Scores				2012 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2006	2009	2012		2009	2012
Nibbyville (A)	Elkhart	83.7	52	56	53	56	83		
Lexington Ave.	Elkhart	75.7	50	56	52	54	81	Good	48
McNaughton	Elkhart	74.4	49	50	51	48	76	44	38
Sample Street	St. Joseph	58.4				37	56		
Jefferson Blvd	St. Joseph	57.9	44		47	40	56		
LaSalle Ave.	St. Joseph	57.2	46	44	50	48	88		42
Keller Park	St. Joseph	54.9	50		51	54	84	50	40
Brick Road	St. Joseph	51.7	46	48	54	49	82	40	44

drought may have also had a negative impact on the macroinvertebrate community. The IBI score at LaSalle Avenue (48) was good once again, but was down slightly from the last time the site was sampled in 2009. The macroinvertebrate community was sampled for the first time in 2012 yielding a score of 42. It is assumed that this score was also influenced by dry conditions in 2012.

The IBI score at Jefferson Boulevard (40) was significantly lower than the baseline value of 44. When this site was last sampled in 2009, the IBI score was 47. The Aquatics Program also completed index sampling at Sample Street (located approximately 1.5 miles upstream of Jefferson Boulevard) for the first time in 2012. This site also had a very low IBI score of 37 which is just above IDEMs standard of attainment. These very low scores do raise some concern, but are very likely attributed to the drought conditions in 2012. The total number of fish collected at the Jefferson Boulevard and Sample Street sites were very low in 2012. An average of 296 fish were collected at Sample Street on both sampling passes. At Jefferson Boulevard, a relatively normal number of 594 fish were collected during the first sampling pass and only 261 were collected during the second sampling pass. The first sampling pass occurred during the early part of the sampling season before the river levels dropped and water temperatures increased significantly. Water temperatures during this time were 65°F and dis-

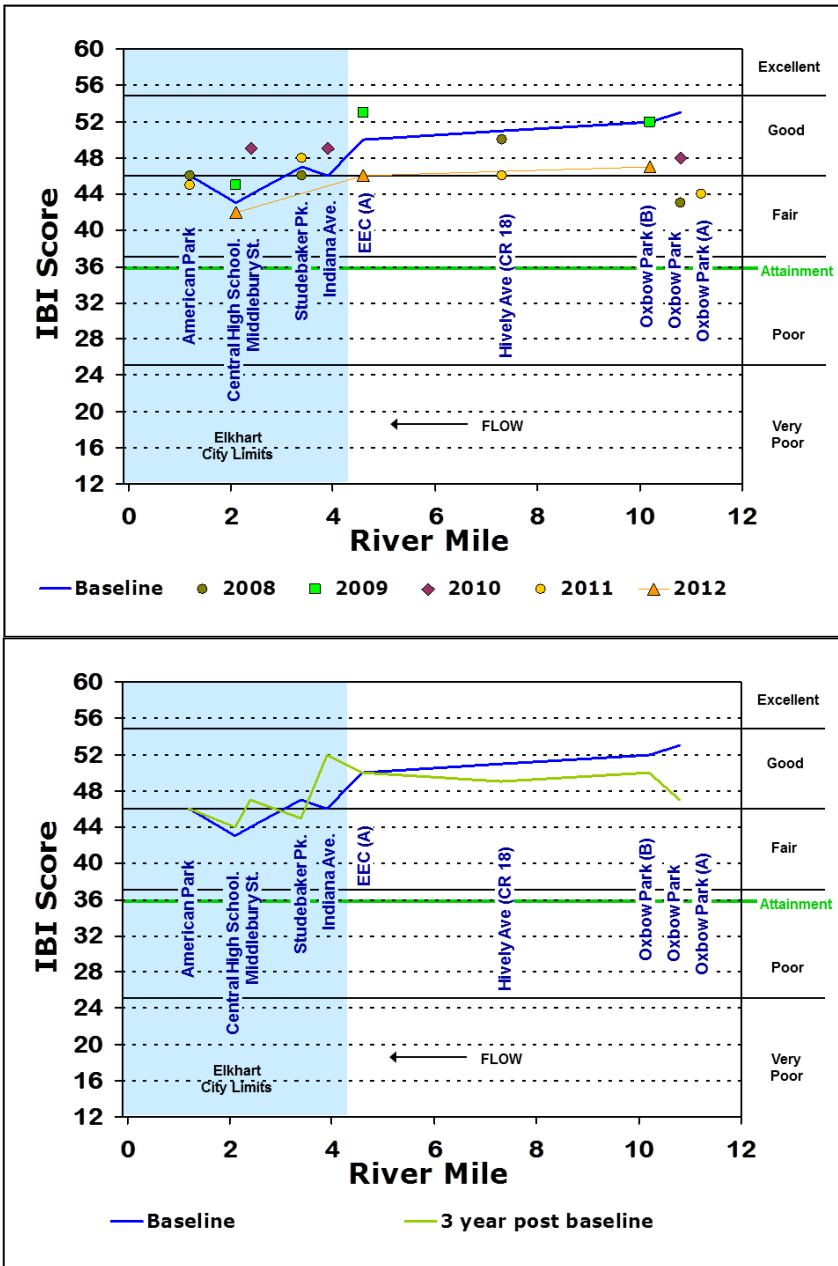
solved oxygen (DO) concentrations were 8.86 milligrams per liter (mg/L). However, during the second sampling pass at Jefferson Boulevard, water temperatures rose to 82.5°F and DO concentration dropped to 5.36 mg/L. Monitoring this upper section in South Bend in upcoming years will help to determine the cause of the low IBI scores in 2012, although temperature and dissolved oxygen data suggest that the drought conditions were a major contributor.

Elkhart River

All long-term monitoring sites along the Elkhart River have been sampled 3 times since the completion of baseline monitoring in 2003. Figure 7 compares the average IBI scores since the completion of baseline monitoring to the baseline monitoring results. Within Elkhart City limits minor fluctuations above and below the baseline occur with significant improvement occurring at Indiana Avenue and a slight drop occurring at Studebaker Park. Ultimately this section of river in Elkhart is maintaining fair to good stream quality. It is apparent, however, that long-term trends upstream of Elkhart suggest a decline in stream quality particularly in the Oxbow Park area.

Macroinvertebrate community scores on the Elkhart River plummeted from 2009 to 2012 (Table 5). Normally such a major decline would represent a concern, however, drought conditions

Figure 7: IBI scores for the Elkhart River, Elkhart County



were likely playing a role. Macroinvertebrates on the Elkhart River will be closely monitored in coming years, particularly upstream of Elkhart where stream integrity appears to have diminished.

Bowman Creek

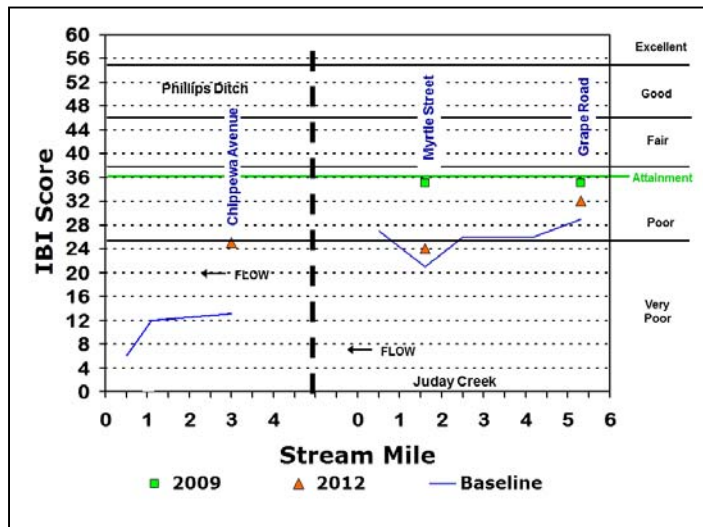
The 2012 IBI score of 25 for Chippewa Avenue on Phillips Ditch was well above the baseline value of 13 (Table 8 and Figure 6). While a score of 25 is still low and reflective of an impaired fish community, this site also scored 25 in 2009 suggesting a significant long-term improvement in the fish community.

In years past, there were some significant stream modifications to this section of Phillips Ditch. However, in recent years the City of South Bend worked with regulatory agencies to correct these issues, which may be the reason for the boost to the fish community. The fish communities at this site in 2009 and 2012 reflect a stream that is in the initial stages rejuvenation, with high numbers of fish being collected, and the 3 most abundant fish species being tolerant pioneering species. This section of stream could, however, remain impaired due to agricultural influences from the upper reaches of the watershed where investigative sampling in previous years revealed a low abundance of fish and the presence of mostly tolerant species. Macroinvertebrate community scores for this site also reflect a stream impairment, however, the score in 2012 (32) was up significantly from 2009 and is not too much lower than the stream quality attainment standard of 36. It will be interesting to see how this site scores in future monitoring events.

Table 5. Index scores for Elkhart River sites, Elkhart County

Station	River Mile	Fish IBI Scores				2012 Habitat Scores	(ICI) Macroinvertebrate Scores	
		Baseline	2006	2009	2012		2009	2012
Oxbow Park (B)	10.2	53	52	52	47	85	52	36
Environmental Center (A)	4.6	50	50	53	46	79		
Central High School	2.1	43	44	45	42	72	54	42

Figure 8: IBI scores for Bowman Creek and Juday Creek, St. Joseph County

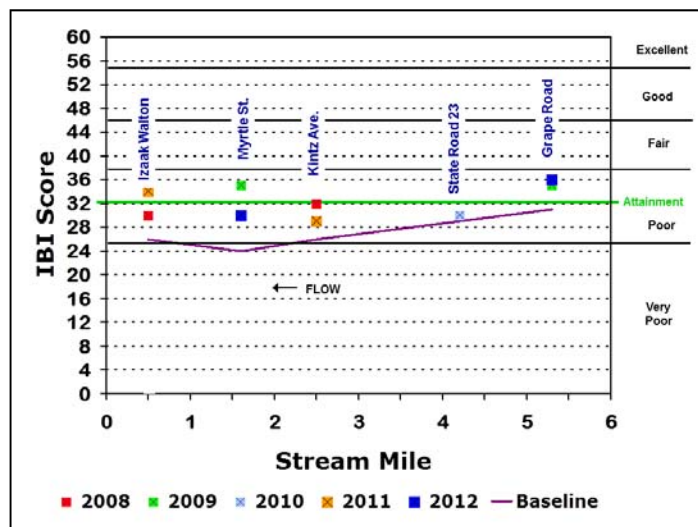


Juday Creek

In 2011, it was decided to report the IBI scores using a Coolwater Index for Juday Creek. An analysis of fish community data using the conventional IBI and the Coolwater IBI suggested that the Coolwater IBI provides a more accurate representation of fish community integrity in this stream (see 2011 report). IBI scores using the conventional IBI are summarized in Figure 8 and Table 6, and IBI scores using the Coolwater IBI are presented in Figure 9 and Table 6. IBI scores using the Coolwater IBI will only be discussed.

The 2012 IBI score for the Grape Road site was 36 which is up significantly from the baseline score and slightly higher than the 2009 score of 35. The fish community at Grape Road has changed slightly since baseline monitoring. The types of species that have been collected has remained the same since baseline monitoring, but there has been a significant reduction in the abundance of creek chubs in recent years. The Myrtle Street site has also improved significantly since baseline monitoring by posting an IBI score of 30 in 2012. This

Figure 9: IBI Scores for Juday Creek using the coolwater methodology. Note that the attainment line is set at 32 using the coolwater methodology.



number is down significantly from 2009, however, when the site had an IBI score of 35. Similar to Grape Road and other Juday Creek sites, the abundance of creek chubs has a strong influence on the IBI score at this station, where the higher the abundance the lower the score will be. This is expected as creek chubs are a very tolerant fish species.

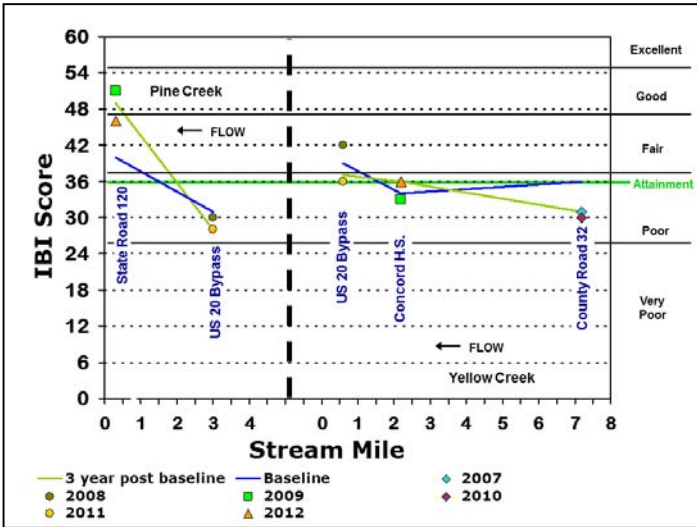
Myrtle Street had an impressive macroinvertebrate community score in 2012 of 50 which is considered excellent. It is interesting that Juday Creek has good to excellent macroinvertebrate communities at most index sites, but has impaired or barely attaining fish communities. Because of the controversy we have expressed with the fish IBI methods for Juday Creek, macroinvertebrate community analysis has proven to be invaluable for this stream and indicates that the stream is in relatively good condition.

Investigative surveys along Juday Creek in previous years have illustrated that many of the sources of stream degradation occur upstream of

Table 6: Index scores for Bowman Creek and Juday Creek sites, St. Joseph County

Stream	Station	Stream Mile	Fish IBI Scores (Coolwater IBI Scores)			2012 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2009	2012		2009	2012
Phillips Ditch	Chippewa Ave.	3.0	13	25	25	63	28	32
Juday Creek	Grape Road	5.3	29 (26)	35 (35)	32 (36)	54		20
Juday Creek	Myrtle Street	1.7	21 (24)	35 (35)	24 (30)	61	46	50

Figure 10: IBI scores for Pine Creek and Yellow Creek, Elkhart County



South Bend. Like most area streams, the headwaters have been heavily modified and straightened for drainage purposes. Even the site at Grape Road has been significantly straightened and suffers from habitat impairment. The stream bed at this site is very uniform and is embedded with fine sand and silt, which doesn't provide a lot of habitat for aquatic organisms. This may be the reason why this site had a poor ICI score of 20 in 2012, which is vastly lower than the macroinvertebrate community scores posted at upstream locations. Given that this stream is mostly a groundwater driven system, it is unlikely that the drought conditions of 2012 played a major role in the poor macroinvertebrate score. It is more likely that sedimentation issues are a limiting factor on the health of the macroinvertebrate community.

Pine Creek

Pine Creek at State Road 120 had a decent IBI score of 46 in 2012 which is well above the baseline value of 40 (Figure 10 and Table 7). This is the lowest this site has scored since the completion

of baseline monitoring. In 2006 and 2009, this site had respective IBI scores of 50 and 51. Upon arrival for sampling at this site in 2012, it was observed that ditch "maintenance" work had occurred at some point over the winter of 2011/2012. Removal of woody habitat from the stream and riparian habitat from its southern banks had occurred as a consequence of this work. This lowered the habitat score at the site to 66, which has generally been between 70 and 80 in previous years. This alteration of stream habitat could be the reason for the reduced IBI score in 2012. Average IBI scores since the completion of baseline monitoring suggest significant long-term improvement at this site. However, the fish community at the downstream Pine Creek site (US 20 Bypass) has diminished since the completion of baseline monitoring (see Figure 10).

Yellow Creek

IBI scores for Yellow Creek tend to fluctuate at all sites that are monitored. There was no exception to this rule at the Concord High School site in 2012 where the IBI score was 37 and higher than the last time this site was sampled in 2009. Long-term monitoring suggests a slight increase in fish community integrity and a slight decrease at the downstream location at the US 20 Bypass (Figure 10). Of the 3 long-term monitoring sites on Yellow Creek, the only significant change has occurred at County Road 32, where the average IBI score has fallen by 4 since the completion of baseline monitoring. Contaminant concentrations have been shown to be extremely elevated in ditches receiving septic effluent from rural communities within the Yellow Creek Watershed. The Yellow Creek Watershed has also been heavily modified for drainage. Only the last mile and half contains natural meanders, a good riparian buffer and relatively complex instream habitat. Due to substantial straightening and modification of the stream, it is very hydrologically unstable which is why the biological community scores continue to fluctuate year after year. It is not uncommon for the water

Table 7: Index scores for Yellow Creek and Pine Creek, Elkhart County

Stream	Station	River Mile	Fish IBI Scores				2012 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2006	2009	2012		2009	2012
Yellow Creek	Concord High School	2.2	34	38	33	37	54	34	44
Pine Creek	State Road 120	0.2	40	50	51	46	66	38	
Lily Creek	Park Six Drive	2.7	15	8	15	6	13		

Table 8: Index scores for Christiana Creek and the Little Elkhart River, Elkhart County

Stream	Station	River Mile	Fish IBI Scores				2012 Habitat Scores	(ICI) Macroinvertebrate Scores	
			Baseline	2006	2009	2012		2009	2012
Christiana Creek	North Main Well Field	0.7	48	52	53	51	80	48	52
Little Elkhart River	County Road 35	6.5	43	43	49	45	94	44	52

level in Yellow Creek to increase 5 feet or more following a heavy rain event bringing with it vast amounts of sediment and pollutants from the communities and agricultural land that it drains.

Lily Creek

Of the streams monitored by the Aquatics Program in Elkhart County, Lily Creek has the most impaired fish communities (Table 7). The major limitation for Lily Creek is its lack of water during the dry summer months. There have been several times throughout the years, that the Park Six Drive site on Lily Creek has dried up by the second sample pass. This year (2012), was no exception, as the creek dried up by late June due to the drought conditions. Lily Creek drains Simonton Lake and enters the St. Joseph River just above the Johnson Street Dam.

Christiana Creek

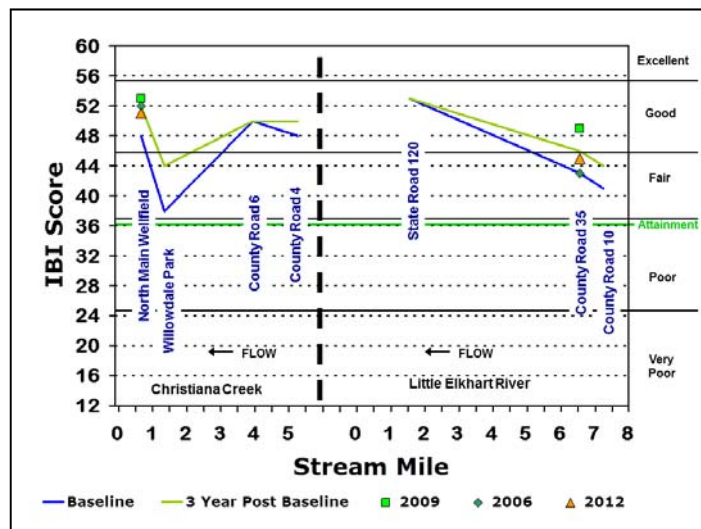
The IBI scores from the North Main Wellfield (NMWF) site on Christiana Creek in 2006 to 2012 demonstrate a long-term improvement at this location (Figure 11 and Table 8). Significant improvement has also been demonstrated upstream of the NMWF site at Willowdale Park in 2008 and 2011. Monitoring at the other sites along Christiana Creek (County Road 4 and County Road 6) suggest little to no long-term improvement towards the edge of Elkhart City limits. However, both locations have always had very healthy aquatic communities since the inception of monitoring. In addition to the impressive fish community score at the NMWF site, the 2012 macroinvertebrate score of 52 along with the habitat score of 80 illustrate the superior quality of Christiana Creek relative to other local St. Joseph River tributaries.

Little Elkhart River

The Little Elkhart River at County Road 35 had an IBI score slightly above the baseline in 2012. Long-term monitoring of this site suggests a slight increase in fish community integrity at this loca-

tion and upstream at County Road 10, while scores have not deviated too far from the baseline at State Road 120 closer to the mouth of St. Joseph River (Figure 11). The macroinvertebrate community score was significantly higher in 2012 compared to 2009. Macroinvertebrates represent a more short term picture of stream integrity relative to the fish community. So, the high ICI score in 2012 may be indicative of favorable conditions from 2011 to 2012. Conservation agencies have

Figure 11: IBI scores for Christiana Creek and the Little Elkhart River, Elkhart County



been spending a lot of time and effort reducing agricultural impacts to the Little Elkhart River in recent years, which may be the reason for the elevated macroinvertebrate score and slight improvements in fish community integrity since baseline monitoring. It will be interesting to see if this trend continues into the future.

Baugo Creek

In 2010, the Aquatics team initiated index sampling at 2 new sites on Baugo Creek. The Elkhart County Drainage Board implemented stream restoration practices along several stretches of Baugo Creek. The 2 new sites that were chosen by the Aquatics Program were within and downstream of

the most significant restoration project, which is located right at the St. Joseph County line. The impetus for monitoring these sites is to determine the impact this restoration work has on the biological communities within the stream.

Figure 12: IBI scores of Baugo Creek, Elkhart and St. Joseph Counties

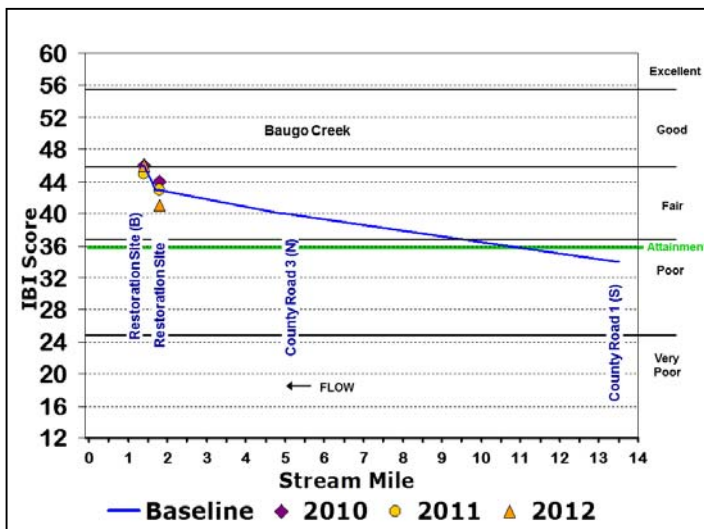


Figure 12 illustrates the baseline that has been established for Baugo Creek, which includes 3 years of baseline monitoring from 2010 to 2012 at the restoration sites. Similar to streams like the Little Elkhart River and Pine Creek, baseline data show fish community integrity increasing in a downstream direction as the stream becomes larger and drains more land area. As you move upstream in St. Joseph River tributaries, the streams become smaller and are more modified for agricultural land use which limits habitat availability and impacts water quality.

Macroinvertebrate community investigations were also performed at the Restoration Site on Baugo Creek revealing a significant increase in macroinvertebrate integrity since the completion of restoration activities in 2010. The 2011 ICI score indicated a sharp increase in macroinvertebrate integ-

city with ICI scores jumping from 36 in 2010 to 48 in 2011. The ICI score dropped in 2012 to 44, although this value was still well above the initial score recorded in 2010. Future monitoring of the fish and macroinvertebrate communities at this site will help determine the long-term benefit of these restoration practices.

Fish Tissue

In 2012, tissue was collected from fish in both Elkhart and St. Joseph Counties. Collections were based on the current Fish Consumption Advisory (FCA) for area streams and potential data gaps within the FCA. The FCA provides guidance on the rate of consumption of local wild fishes (Table 10). Based on PCB or mercury concentrations, fish species within a certain size range will be placed within an FCA Grouping. Table 11 summarizes each grouping and the associated guidance. It should be noted that the State FCA has more restrictive guidance for individuals that are considered to be part of the "sensitive population." Women who are pregnant or are breastfeeding, women who plan to have children, or children under the age of 15 are considered to be part of the sensitive population. For more information on local fish consumption, visit the Indiana State Department of Health's website (<http://www.in.gov/isdh/23650.htm>).

Many variables play a role in contaminant concentrations in fish. Our results have shown varying contaminant concentrations from year to year and among different sizes of fish. However, concentrations do not tend to vary that significantly and an understanding of contaminant concentrations can be determined by gathering data multiple times. In general, larger fish will tend to have higher concentrations of contaminants in their tissue. The following narrative describes results from the Aquatics Programs fish tissue collections from Elkhart and St. Joseph Counties:

Smallmouth bass (11 inches) and Rock Bass (8-9 inches) were collected from the Elkhart River in

Table 9: Index scores for Baugo Creek, Elkhart and St. Joseph County

Stream	Station	River Mile	Fish IBI Scores				2012 Habitat Scores	ICI Macroinvertebrate Scores		
			2010	2011	2012	Baseline		2010	2011	2012
Baugo Creek	Restoration	1.8	44	43	41	43	76	36	48	44
Baugo Creek	Restoration (B)	1.4	46	45	46	46	81			

Table 10: Fish consumption information taken from the Fish4Health Website

Location	Species	Fish Size (inches)	Contaminant	Group	Sensitive Population Group*
Elkhart River <i>Elkhart County</i>	Rock Bass	Up to 7		1	2
	Smallmouth Bass	Up to 12		1	2
Christiana Creek <i>Elkhart County</i>	Northern Hogsucker	Up to 14		1	2
	Rock Bass	Up to 7		1	2
	Yellow Bullhead	Up to 9		1	2
St. Joseph River <i>Elkhart County</i>	Bluegill	Up to 8		1	2
	Channel Catfish	All	PCBs	3	5
	Common Carp	Up to 31	PCBs	3	5
		31+	PCBs	4	5
	Rock Bass	Up to 7		1	2
	Redhorse Species	17+	PCBs	3	5
	Walleye	25+	PCBs	3	5
White Sucker	Up to 14		1	2	
St. Joseph River <i>St. Joseph County (Baugo Bay Area to Twin Branch Dam)</i>	Bluegill	Up to 8		1	2
	Channel Catfish	Up to 22	PCBs	3	5
		22+	PCBs	4	5
	Largemouth Bass	Up to 13		1	2
	Rock Bass	Up to 8		1	2
	Spotted Sucker	Up to 17		1	2
White Sucker	Up to 14		1	2	
St. Joseph River <i>St. Joseph County (Twin Branch Dam to Indiana State Line)</i>	Bluegill	7+	PCBs	4	5
	Channel Catfish	All	PCBs	4	5
	Chinook Salmon	28+	PCBs	4	5
	Rock Bass	Up to 7	PCBs	2	3
	Smallmouth Bass	Up to 12	PCBs & Mercury	2	3
	Steelhead Trout	30+	PCBs	4	5
	Yellow Bullhead	Up to 10	PCBs	2	3
Juday Creek	White Sucker	17+	PCBs	3	5

In previous years, the State of Indiana published an annual Fish Consumption Advisory (FCA) providing guidance for consuming fish for many water bodies throughout the state of Indiana. Indiana is no longer publishing an annual report, but has shifted to presenting results on the Fish4Health website (<http://fn.cfs.purdue.edu/fish4health/>). The former FCA reports also provided guidance groupings (see Table 12 for Groupings). Although these guidance groupings are not used on the Fish4Health website, we will continue to use them for consistency in our report.

Table 11: Fish consumption information taken from the Fish4Health Website

Group	Guidance
Group 1	Unrestricted consumption
Group 2	Limit consumption to 1 meal per week
Group 3	Limit consumption to 1 meal every month
Group 4	Restrict consumption to 1 meal every 2 months
Group 5	DO NOT EAT

*The sensitive population is described as women of a child bearing age, nursing mothers, or children under the age of 15.

Elkhart. Smallmouth bass fell in Group 1 for mercury and Group 2 for PCBs, while rock bass fell in Group 1 PCBs but Group 2 for mercury. These species are both listed Group 1 in the statewide advisory, although the rock bass collected by the state were only 7 inches long.

Northern pike (26-28 inches) were collected for tissue samples for the first time in 2012 above the Elkhart dam on the St. Joseph River. Pike are a commonly sought game species and are very abundant on the St. Joseph River. Anglers sometimes compare the taste of the pike to that of a walleye, although they can be difficult to clean because of their "y-bone." Pike fell into Group 2 for PCBs and Mercury which is relatively low given their size and the fact that they are a top predatory species. The size limit for northern pike is 20 inches, so smaller legal size fish may have even lower concentrations of PCBs and mercury.

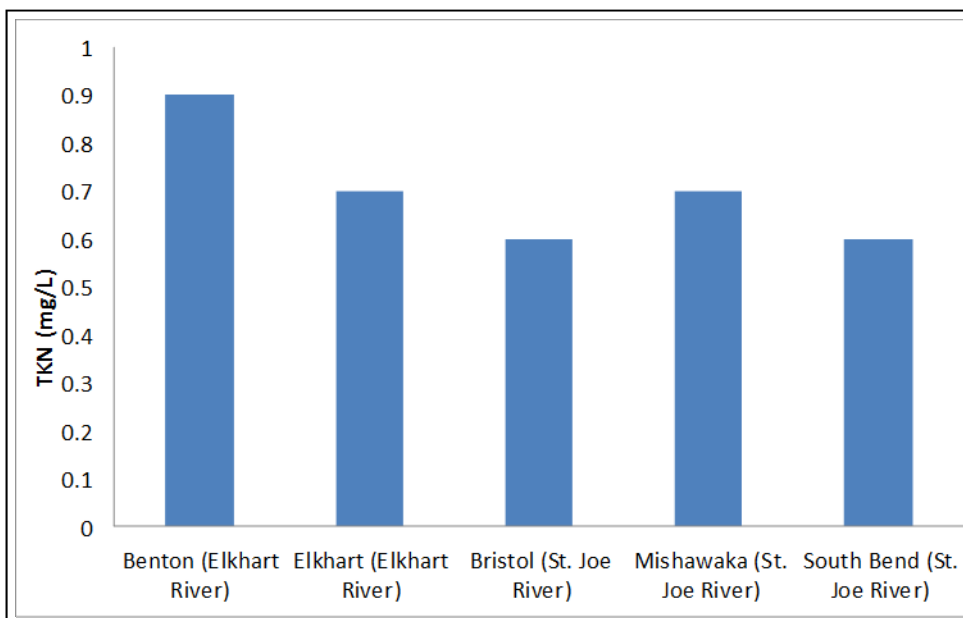
Shorthead redhorse were collected from 3 locations in 2012. In Elkhart County, fish from 15-16 inches in length they were collected from Lexington Avenue close to downtown Elkhart. These fish fell in Group 1 for mercury and Group 2 for PCBs. The statewide advisory currently lists "redhorse species" (17 inches or greater) in Group 3 for PCBs. In St. Joseph County, shorthead redhorse were collected from Logan Street (just upstream of South Bend) and from LaSalle Avenue (downstream of the South Bend dam). The fish collected from Logan Street were 17-17.5 inches long and fell in Group 2 for mercury and Group 3 for PCBs. Those collected from LaSalle Avenue

were 15.5-16 inches long and were in Group 2 for mercury and Group 5 for PCBs. The Statewide advisory currently does not list the redhorse species in South Bend. Given the high PCB concentrations in redhorse from downtown South Bend, these fish should probably be listed in the State FCA.

Walleye were another species that were collected in Elkhart and St. Joseph Counties. For the third consecutive year, Walleye in the 15 inch size range were collected in close proximity to downtown Elkhart. As with previous years, mercury and PCB concentrations were relatively low and fell in Group 1 for both contaminants. Walleye are a very popular game species in the St. Joseph River and are commonly kept and consumed by anglers. Walleye (15-16 inches) were also collected from LaSalle Avenue in downtown South Bend. Similar to previous years, PCBs tend to be a little higher in downtown South Bend with South Bend walleye falling in Group 3 for PCBs. These results are relatively consistent with walleye tissue results from previous years.

Largemouth bass (14-16 inches) were collected from the St. Joseph River above the South Bend dam for the second straight year. Consistent with 2011, fish fell in Group 2 for mercury and Group 1 for PCBs, although the fish collected in 2011 were slightly smaller. Largemouth bass, similar in size to the those collected in 2010 were also collected above the dam in Elkhart in 2012 and had very similar concentrations of mercury and PCBs. Based on these results, it appears that mercury accumulation might be more of an issue that PCB accumulation in largemouth bass.

Figure 13: Median Concentrations of Total Kjeldahl Nitrogen (TKN). IDEM Fixed Station Sampling 2006-2013.

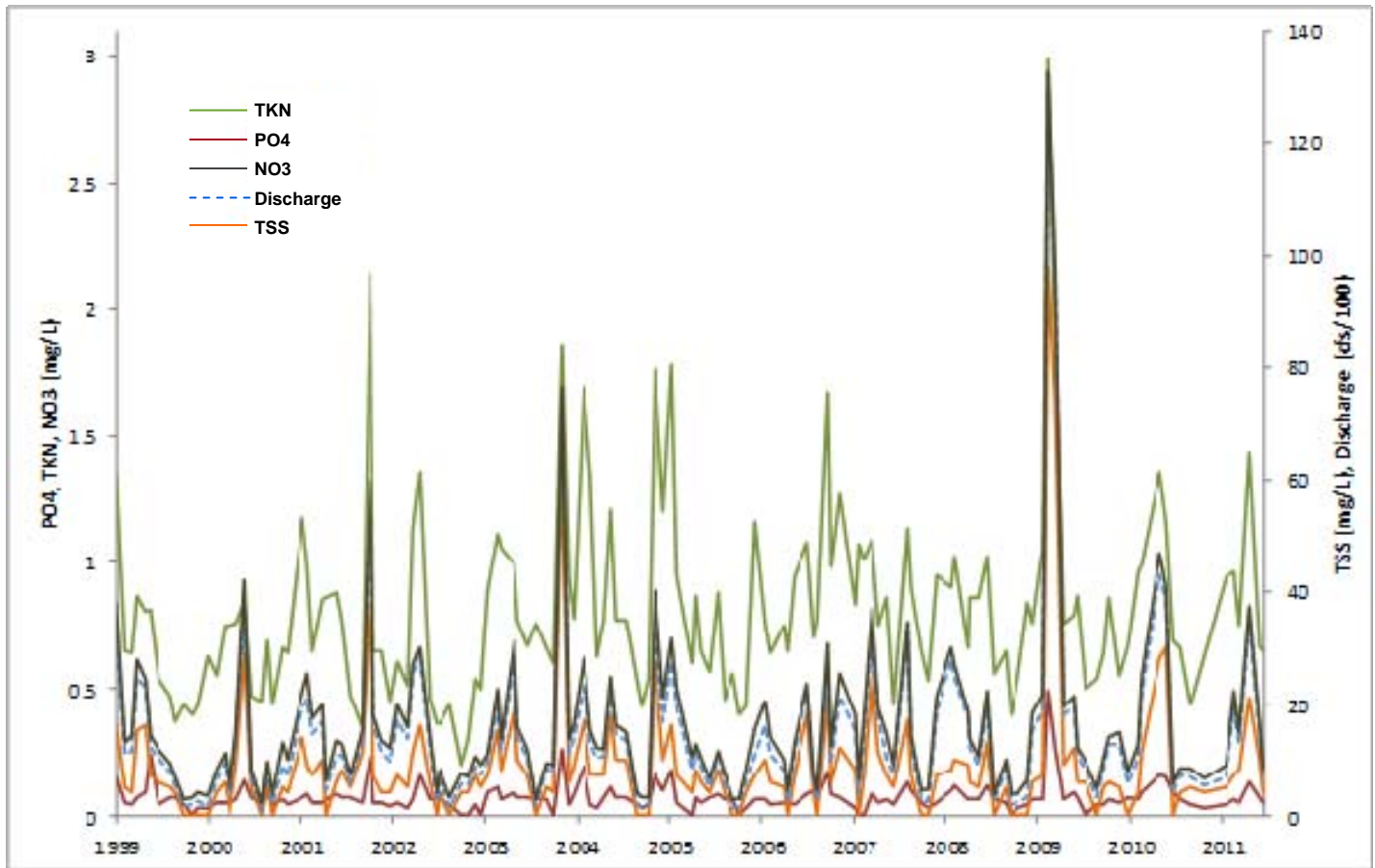


Steelhead trout (27-29 inches) were also collected in 2012. Consistent with results from our programs testing from 2007-2009, fish fell in Group 1 for mercury and Group 3 for PCBs indicating that consuming this species should be limited to once per month. The state advisory suggests limiting consumption to once every 2 months, although the States guidance pertains to fish greater than 30 inches.

Surface Water Chemical Data

In our 2010 and 2011 reports, we

Figure 14: A depiction of total suspended solids (TSS), total kjeldahl nitrogen (TKN), nitrate (NO₃), phosphorus (PO₄), and river flow (discharge). IDEM Fixed Station: Elkhart River SR120 (Jackson Blvd.), Elkhart 1999-2011.

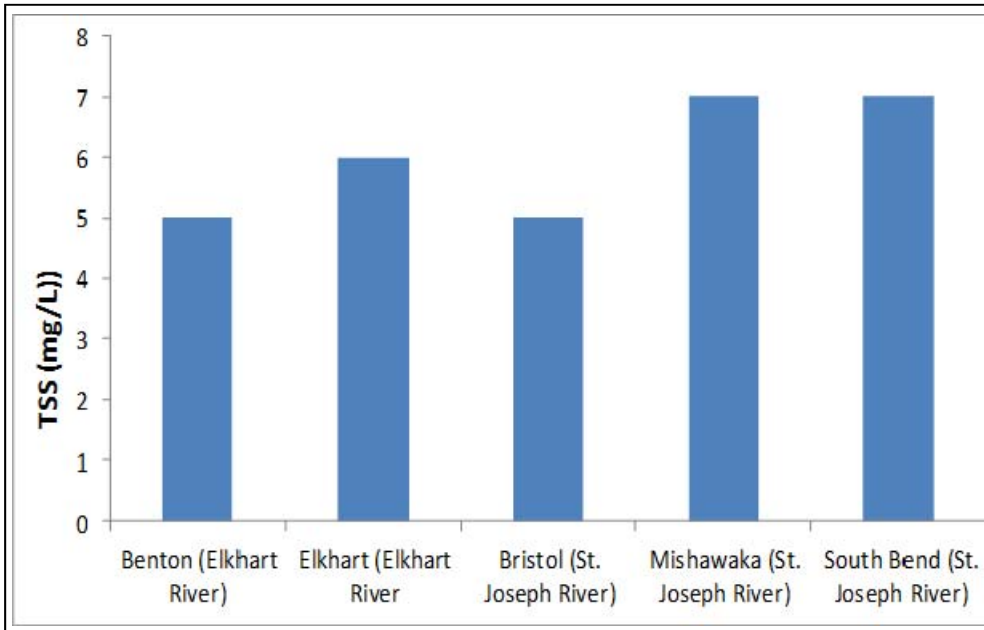


provided an overview of general pollutant concentrations in the Elkhart and St. Joseph Rivers. The Cities of Elkhart and South Bend have been collecting water samples from local waterways for many years. In addition, IDEM has also been monitoring the Elkhart and St. Joseph Rivers upstream and downstream of Elkhart and South Bend since at least 1990. IDEM has sampled for numerous contaminants, from heavy metals to pesticides. However, their most thorough datasets are limited to general chemical parameters like total suspended solids and nutrient pollutants like nitrogen and phosphorus. IDEM has been monitoring stations on the Elkhart River: US 33 in Benton and SR 120 in downtown Elkhart. IDEM also has 3 stations on the St. Joseph River: at the Bristol Boat Launch, Merrifield Park in Mishawaka, and Auten Road in South Bend. A review of IDEM's general chemical data did not reveal any surprises. In general, the Elkhart River has significantly higher concentrations of most contaminants compared to the St. Joseph River, which confirms the results of the City of Elkhart's chemical monitoring in the Elkhart area. Average concentrations of phosphorus (PO₄) were significantly

higher at the 2 Elkhart River sites compared to the stations on the St. Joseph River. EPA's proposed criteria for PO₄ is 0.031 mg/L (Frakenberger & Esman, 2012). Median concentrations of PO₄ at all stations on the St. Joseph and Elkhart Rivers exceed this concentration, with the Elkhart River sites having the highest median concentrations at 0.06 mg/L. In addition, concentrations of total kjeldahl nitrogen (TKN), were significantly higher at the Elkhart River Benton site relative to all other locations (Figure 13). TKN is a measurement of the organic form of nitrogen plus ammonia. The source of the higher TKN in rural portion of the watershed is likely from fertilizer run-off or livestock operations.

Total suspended solids data confirm visual observations of sediment impacts in the St. Joseph River (Figure 15). Through surface water monitoring, the City of Elkhart has demonstrated that the Elkhart River Watershed contributes a significant amount of sediment to the St. Joseph River (Deegan, 2011). However, IDEM's data shows that suspended solids increase in the Mishawaka section of the St. Joseph River and can be seen all

Figure 15: Median Concentrations of Total Suspended Solids (TSS). IDEM Fixed Station Sampling 2006-2013.



the way downstream of South Bend. In fact, suspended solid concentrations are actually higher on the main stem of the St. Joseph River in Mishawaka and South Bend than they are in the Elkhart River. Field observations in the Mishawaka section of the river reveal significant plumes of sediment entering the St. Joseph River from Baugo Creek following heavy rain events. These observations can also be confirmed by looking at select aerial and satellite imagery of Baugo Bay. Sediment movement is essential for natural maintenance of river habitat. However, in heavy loads caused by runoff and erosion, it can have detrimental effects. Excess sediment can have an impact on the respiration, feeding, and reproduction of aquatic animals. Sediment particles can also carry tightly bound contaminants including nutrients, pesticides and many others.

Figure 14, illustrates 1 of the biggest problems facing the St. Joseph River system. As discussed in our 2010 and 2011 reports, many St. Joseph River tributaries have been highly modified for agricultural drainage. In addition, urban areas within the watershed provide an onslaught of stormwater from impervious surfaces like rooftops and parking lots. This causes tributaries like the Elkhart River and Baugo Creek to have flashy flow regimes accompanied with spikes in pollutant concentrations. The relationship between river discharge (the amount of water flowing in the Elkhart River and suspended solids is significantly correlated ($R^2 = 0.504$). Furthermore, nutrient pollutant concentrations (PO_4 , TKN, NO_3) are also sig-

nificantly correlated with flow and the amount of suspended sediment in the Elkhart River. The bottom line, as illustrated in Figure 14, is that as river flow increases resulting from a rain event, so does the quantity of sediment and other pollutants entering the St. Joseph River from its tributaries.

Conclusion

In recent years we reported trends that support a slight increase in stream quality across the Indiana portion of the St. Joseph River Watershed. However, it is apparent, based on incorporation of 2012 data that not all streams are improving. This year marked the first time in which several Elkhart County

streams have been monitored at least 3 times since the completion of baseline monitoring providing enough data to gauge long-term trends in stream quality. Streams like the Little Elkhart River and Christiana Creek appear to have improved slightly since the completion of baseline monitoring. However, streams like the Elkhart River and Yellow Creek have not improved or have declined at several sites. These streams are hydrologically unstable and can rise to flooding conditions following a heavy rain event carrying sediment and other pollutants to the St. Joseph River.

Surface water monitoring data support the notion that Baugo Creek is a significant detriment to the improvement of the St. Joseph River, causing a major spike in total suspended solid concentrations in the St. Joseph River.

Macroinvertebrate Community integrity at the Grape Road site on Juday Creek dropped significantly in 2012. While drought conditions on other streams may have played a role in reduced ICI scores, Juday Creek is a coolwater stream that maintains lower temperatures and stream base flow levels, so the drought conditions should not have been a major limitation in 2012. It is apparent, based on habitat analysis, that this section of Juday Creek is significantly embedded with fine sand and silt caused by sedimentation from upstream land use activities.

Monitoring activities and fish community analysis was hampered by the moderate drought that occurred in 2012. Fish populations migrated to cer-

tain sections of river or deeper water to avoid extreme heat and low oxygen levels. This was particularly noticeable above the South Bend Dam, where the total number of fish collected was cut in half at the Jefferson Boulevard site between the first and second sampling pass. Macroinvertebrate community surveys also showed major deviations from previous sampling events on the 2 rivers. Drought conditions may be a major reason for the significant drops in macroinvertebrate community integrity at several river sites, however, scores did not change significantly on the tributary streams. While biological integrity is ordinarily superior in the 2 main rivers compared to most tributary streams, drought conditions may have revealed stream integrity issues that are not obvious under normal conditions.

Acknowledgements

Thanks to the 2012 field crew of Ryan Baldwin, Nathan Taitano, Victoria Wesolowski, Madelyn Boyer and Phelicia Joswiak for their hard work during the fish sampling season. Thanks also to the staff of Elkhart Public Works and Utilities and their counterparts at the City of South Bend for their continued support of the Aquatics Program. Recognition is also extended to local groups such as the Michiana Walleye Association, Elkhart River Restoration Association, Friends of the St. Joe River, and many others that support the work of the Aquatics Program and the improvement of the St. Joseph River Watershed.

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SUMMER 2012



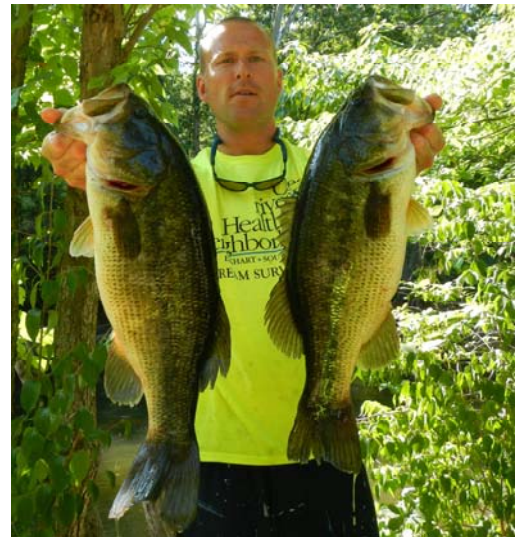
The 2012 Field Crew (L-R) Madelyn, Nathan, Victoria, Ryan (Phelicia not present)



A huge (15inch) grass pickerel from the St. Joe in Elkhart



Ryan holds on to a big smallmouth bass from downtown South Bend

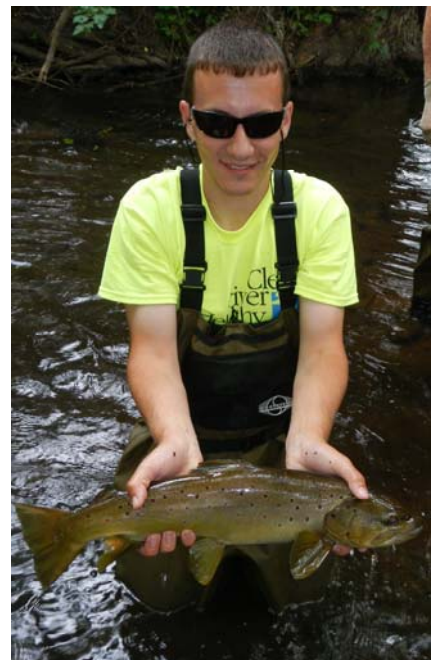


Daragh with 2 chunky large-mouth bass from Oxbow Park on the Elkhart River

Nathan with a nice muskie from the St. Joe in Elkhart



A rock bass feasts on a very large crayfish in Christiana Creek



Ryan with a large brown trout from Juday Creek



An ellipse mussel crawls along the river bottom at the Brick Road site in South Bend

APPENDICES



Appendix A

Metrics for Biological Indices

The Northern Indiana Till Plain 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

The Northern Indiana Till Plain 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

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with less than or equal to 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent headwater species
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent pioneer species
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent DELT anomalies

The Coolwater Index of Biotic Integrity metrics used to evaluate sites in Indiana with greater than 100 square miles drainage area:

1. Number of Native Species
2. Number of darter/madtom/sculpin species
3. Percent catostomidae (sucker family)
4. Percent coolwater species
5. Percent sensitive and intolerant Species
6. Percent tolerant
7. Percent detritivore
8. Percent invertivore
9. Percent carnivore
10. Number of fish collected (minus tolerant individuals)
11. Percent simple lithophils
12. Percent DELT anomalies

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 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. 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

Station (s)	Species	Length Range (inches)	Advisory Length Range (inches)	Hg Advisory Group (PW)	Hg Advisory Group (state)	PCB Advisory Group (PW)	PCB Advisory Group (State)
Elkhart River Central High School	Smallmouth Bass	10.7-11.0	Up to 12	1	1	2	1
Elkhart River Central High School	Rock Bass	8.3-8.8	Up to 7	2	1	1	1
St. Joseph River Nibbyville (A)	Northern Pike	25.9-28.1	Up to 30	2	-	2	-
St. Joseph River Lexington Avenue	Shorthead Redhorse	15.3-16.0	17+	1	-	2	3
St. Joseph River Lexington Avenue	Walleye	15.2-15.7	25+	1	-	1	3
St. Joseph River Logan Street	Shorthead Redhorse	17.0-17.4	-	2	-	3	-
St. Joseph River Jefferson	Largemouth Bass	14.2-15.9	-	2	-	1	-
St. Joseph River LaSalle Street	Shorthead Redhorse	15.3-16.0	-	2	-	5	-
St. Joseph River LaSalle Street	Walleye	15.4-16.5	-	2	-	3	-
St. Joseph River Darden	Steelhead	26.9-28.8	30+	1	-	3	4

Appendix C

Summary of fish collected by county, 2012

Summary of species captured at index sites in Elkhart County, 2012

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Mimic Shiner	3,204	19.29	4,312	9.51	0.45
White Sucker	1,577	9.50	127,032	280.06	13.38
Rock Bass	1,057	6.36	83,829	184.81	8.83
Sand Shiner	1,048	6.31	1,794	3.96	0.19
Bluntnose Minnow	1,046	6.30	2,880	6.35	0.30
Spotfin Shiner	990	5.96	3,770	8.31	0.40
Smallmouth Bass	767	4.62	86,260	190.17	9.09
Bluegill	710	4.28	23,396	51.58	2.46
Longear Sunfish	529	3.19	14,503	31.97	1.53
Creek Chub	494	2.97	5,709	12.59	0.60
Stoneroller, Central	489	2.94	2,002	4.41	0.21
Rainbow Darter	471	2.84	716	1.58	0.08
Logperch	357	2.15	2,659	5.86	0.28
Golden Redhorse	348	2.10	173,404	382.29	18.27
Blacknose Dace	347	2.09	1,179	2.60	0.12
Mottled Sculpin	343	2.07	986	2.17	0.10
Johnny Darter	307	1.85	542	1.19	0.06
Common Shiner	305	1.84	3,718	8.20	0.39
Striped Shiner	266	1.60	5,395	11.89	0.57
Northern Hog Sucker	239	1.44	69,588	153.42	7.33
Shorthead Redhorse	207	1.25	72,643	160.15	7.65
Largemouth Bass	199	1.20	27,060	59.66	2.85
Rosyface Shiner	122	0.73	258	0.57	0.03
Green Sunfish	115	0.69	3,516	7.75	0.37
Longnose Dace	92	0.55	617	1.36	0.07
Silverjaw Minnow	84	0.51	224	0.49	0.02
Yellow Bullhead	80	0.48	7,287	16.07	0.77
Blackside Darter	79	0.48	219	0.48	0.02
Orangethroat Darter	71	0.43	87	0.19	0.01
Brown Trout	68	0.41	5,432	11.98	0.57
Steelcolor Shiner	68	0.41	153	0.34	0.02
Spotted Sucker	67	0.40	11,253	24.81	1.19
Hornyhead Chub	49	0.30	795	1.75	0.08
Grass Pickerel	35	0.21	1,416	3.12	0.15
Brook Silverside	34	0.20	26	0.06	0.00
Chestnut Lamprey	29	0.17	289	0.64	0.03
Common Carp	28	0.17	84,908	187.19	8.95
Silver Redhorse	27	0.16	36,604	80.70	3.86
Black Bullhead	26	0.16	524	1.16	0.06
Black Crappie	25	0.15	2,340	5.16	0.25
Pumpkinseed	24	0.14	509	1.12	0.05
Central Mudminnow	23	0.14	227	0.50	0.02

Summary of species captured at index sites in Elkhart County, 2012 (continued)

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Greenside Darter	17	0.10	51	0.11	0.01
Redear Sunfish	16	0.10	1,427	3.15	0.15
River Redhorse	15	0.09	41,900	92.37	4.41
Walleye	15	0.09	6,980	15.39	0.74
Northern Pike	13	0.08	13,073	28.82	1.38
Pirate Perch	12	0.07	98	0.22	0.01
Yellow Perch	10	0.06	447	0.99	0.05
American Brook Lamprey	10	0.06	74	0.16	0.01
Banded Killifish	9	0.05	44	0.10	0.00
Hybrid Sunfish	7	0.04	125	0.28	0.01
Warmouth	5	0.03	103	0.23	0.01
Gizzard Shad	5	0.03	31	0.07	0.00
Quillback	4	0.02	4,500	9.92	0.47
Black Redhorse	4	0.02	1,200	2.65	0.13
White Crappie	3	0.02	43	0.09	0.00
Fathead Minnow	3	0.02	6	0.01	0.00
Bowfin	2	0.01	1,300	2.87	0.14
Rainbow Trout	2	0.01	605	1.33	0.06
Stonecat	2	0.01	65	0.14	0.01
Lake Chubsucker	2	0.01	32	0.07	0.00
Tadpole Madtom	2	0.01	17	0.04	0.00
Longnose Gar	2	0.01	15	0.03	0.00
Channel Catfish	1	0.01	7,000	15.43	0.74
Golden Shiner	1	0.01	6	0.01	0.00
Total	16,608	100.00	949,203	2,092.64	100.00

Summary of species captured at investigative sites in Elkhart County, 2012

Common Name	Total Number	% by Number	Common Name	Total Number	% by Number
Mimic Shiner	192	12.34	Gizzard Shad	2	0.13
Smallmouth Bass	188	12.08	Common Shiner	2	0.13
Bluegill	179	11.50	Rainbow Trout	2	0.13
Golden Redhorse	119	7.65	Orangethroat Darter	1	0.06
Spotfin Shiner	96	6.17	Yellow Perch	1	0.06
Striped Shiner	74	4.76	Stonecat	1	0.06
Rock Bass	67	4.31	Redear Sunfish	1	0.06
Bluntnose Minnow	67	4.31	Blackstripe Topminnow	1	0.06
Rosyface Shiner	58	3.73	Yellow Bullhead	1	0.06
Longear Sunfish	54	3.47	Longnose Gar	1	0.06
Northern Hog Sucker	45	2.89	Total	1,556	100
Largemouth Bass	42	2.70			
Spotted Sucker	42	2.70			
Blackside Darter	40	2.57			
White Sucker	38	2.44			
Pumpkinseed	20	1.29			
Steelcolor Shiner	20	1.29			
Mottled Sculpin	20	1.29			
Common Carp	17	1.09			
Shorthead Redhorse	17	1.09			
Logperch	16	1.03			
Blacknose Dace	15	0.96			
Longnose Dace	14	0.90			
Sand Shiner	12	0.77			
Hornyhead Chub	12	0.77			
Creek Chub	10	0.64			
Greenside Darter	9	0.58			
Northern Pike	7	0.45			
Black Crappie	5	0.32			
Walleye	5	0.32			
Grass Pickerel	5	0.32			
Golden Shiner	5	0.32			
Brown Trout	5	0.32			
Bowfin	4	0.26			
Green Sunfish	4	0.26			
Brook Silverside	4	0.26			
Silver Redhorse	3	0.19			
Warmouth	3	0.19			
Johnny Darter	3	0.19			
Rainbow Darter	3	0.19			
Central Mudminnow	2	0.13			
Chestnut Lamprey	2	0.13			

Index Sites	16,608
Investigative Sites	1,556
Elkhart County Total	18,164

Summary of species captured at index sites in St. Joseph County, 2012

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Smallmouth Bass	743	14.81	119,521	263.50	14.85
Rock Bass	730	14.55	46,962	103.53	5.84
Longear Sunfish	689	13.74	24,210	53.37	3.01
Creek Chub	360	7.18	6,289	13.86	0.78
Spotfin Shiner	358	7.14	1,342	2.96	0.17
Mimic Shiner	357	7.12	584	1.29	0.07
Golden Redhorse	264	5.26	170,258	375.35	21.16
Mottled Sculpin	207	4.13	1,179	2.60	0.15
Black Redhorse	153	3.05	89,128	196.49	11.08
Bluntnose Minnow	135	2.69	359	0.79	0.04
Shorthead Redhorse	102	2.03	59,357	130.86	7.38
Bluegill	100	1.99	3,405	7.51	0.42
Logperch	93	1.85	1,099	2.42	0.14
Northern Hog Sucker	89	1.77	26,602	58.65	3.31
Green Sunfish	74	1.48	1,351	2.98	0.17
Spotted Sucker	56	1.12	17,176	37.87	2.13
White Sucker	48	0.96	9,281	20.46	1.15
Largemouth Bass	47	0.94	16,019	35.32	1.99
Yellow Bullhead	37	0.74	4,720	10.41	0.59
Steelcolor Shiner	36	0.72	158	0.35	0.02
Johnny Darter	30	0.60	51	0.11	0.01
Fathead Minnow	29	0.58	63	0.14	0.01
Blackside Darter	28	0.56	63	0.14	0.01
Brook Silverside	26	0.52	21	0.05	0.00
Greenside Darter	21	0.42	88	0.19	0.01
Walleye	20	0.40	19,502	42.99	2.42
Common Carp	19	0.38	85,400	188.27	10.61
Blacknose Dace	19	0.38	92	0.20	0.01
Pumpkinseed	17	0.34	1,329	2.93	0.17
Redear Sunfish	13	0.26	2,041	4.50	0.25
Rainbow Trout	13	0.26	1,018	2.24	0.13
Chestnut Lamprey	11	0.22	104	0.23	0.01
River Redhorse	10	0.20	24,000	52.91	2.98
Quillback	10	0.20	14,900	32.85	1.85
Central Mudminnow	10	0.20	61	0.13	0.01
Northern Pike	9	0.18	13,280	29.28	1.65
Longnose Gar	7	0.14	1,027	2.26	0.13
Black Bullhead	7	0.14	78	0.17	0.01
Silver Redhorse	6	0.12	11,100	24.47	1.38
Brown Bullhead	6	0.12	1,445	3.19	0.18
Rainbow Darter	5	0.10	7	0.02	0.00
Greater Redhorse	4	0.08	11,100	24.47	1.38

Summary of species captured at index sites in St. Joseph County, 2012

Common Name	Total Number	% by Number	Total Weight (g)	Total Weight (lbs)	% by Weight
Brown Trout	4	0.08	2,280	5.03	0.28
Channel Catfish	3	0.06	11,716	25.83	1.46
Gizzard Shad	3	0.06	4,554	10.04	0.57
Striped Shiner	3	0.06	28	0.06	0.00
Black Crappie	1	0.02	199	0.44	0.02
Hybrid Sunfish	1	0.02	32	0.07	0.00
Golden Shiner	1	0.02	30	0.07	0.00
Stonecat	1	0.02	6	0.01	0.00
Spottail Shiner	1	0.02	6	0.01	0.00
Total	5,016	100.00	804,621	1,773.89	100.00

Summary of species captured at investigative sites in St. Joseph County, 2012

Common Name	Total Number	% by Number
Creek Chub	213	31.84
White Sucker	180	26.91
Blacknose Dace	90	13.45
Mottled Sculpin	89	13.30
Johnny Darter	59	8.82
Green Sunfish	30	4.48
Largemouth Bass	5	0.75
Brown Trout	3	0.45
Total	669	100

Index Sites	5,016
Investigative Sites	669
St. Joseph County Total	5,685

Appendix D

**Summary of fish collected by site, 2012
(Reference Table 1 for site numbers and locations)**

Stream		St. Joseph River, Elkhart County, 2012						
Site	State Line (E)	Nibbyville (A)		Lexington Ave		McNaughton Park		Treasure Island Co. Park
		1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	
#Banded Killifish				X				
Black Crappie	X	X	X	X	X	X	X	X
~Black Redhorse			X					
Blackside Darter	X	X	X	X	X		X	
Bluegill	X	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X	X	X	X	X	X
Bowfin	X	X						X
~Brook Silverside	X	X	X		X		X	
#Channel Catfish					X			
Chestnut Lamprey		X		X		X	X	X
#Common Carp			X	X	X	X	X	X
#Gizzard Shad								X
~Golden Redhorse	X	X	X	X	X	X	X	X
Grass Pickerel			X	X	X			
#Green Sunfish		X	X	X	X		X	
~Greenside Darter	X						X	
~Hornyhead Chub	X							
Hybrid Sunfish				X		X		
Johnny Darter	X	X		X				X
Lake Chubsucker			X					
Largemouth Bass	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
#Longnose Gar	X		X					
~Mimic Shiner	X	X	X	X	X	X	X	X
~Northern Hog Sucker	X	X	X	X	X	X	X	
Northern Pike	X	X	X			X	X	X
~Orangethroat Darter				X	X			
Pirate Perch			X					
Pumpkinseed	X			X	X		X	X
#Quillback				X	X			
~Rainbow Darter	X		X			X	X	
Redear Sunfish	X				X	X	X	
~River Redhorse		X	X	X	X		X	
~Rock Bass	X	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X					
~Sand Shiner				X				X

-- denotes a species that is SENSITIVE to 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, Elkhart County, 2012							
Site	State Line (E)	Nibbyville (A)		Lexington Ave		McNaughton Park		Treasure Island Co. Park
		1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	
~Shorthead Redhorse	X	X	X	X	X	X	X	X
~Silver Redhorse	X	X	X		X	X	X	X
~Smallmouth Bass	X	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	X
#Spotted Sucker	X	X	X					X
Steelcolor Shiner	X		X	X		X	X	X
~Stonecat	X		X					
Striped Shiner	X	X	X					
Walleye				X	X	X	X	X
Warmouth						X	X	X
#White Sucker		X		X	X	X	X	X
#Yellow Bullhead		X	X		X	X	X	X
Yellow Perch	X	X	X					

~ - denotes a species that is SENSITIVE to 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, St. Joseph County, 2012									
	Sample Street		Jefferson Blvd		LaSalle Street		Keller Park		Brick Road	
	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass
Black Crappie							X			
~Black Redhorse					X	X	X	X	X	X
Blackside Darter			X		X		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
~Brook Silverside		X								
#Brown Bullhead				X					X	
#Channel Catfish								X		X
Chestnut Lamprey					X		X		X	
#Common Carp	X	X		X			X	X		
#Creek Chub										X
#Gizzard Shad	X					X				
~Golden Redhorse	X	X	X	X	X	X	X	X	X	X
#Golden Shiner								X		
~Greater Redhorse		X		X	X					
#Green Sunfish	X	X	X	X		X				
~Greenside Darter					X	X	X	X		
Hybrid Sunfish			X							
Johnny Darter							X			
Largemouth Bass	X	X	X	X		X	X	X	X	X
~Logperch					X	X	X	X	X	X
~Longear Sunfish	X	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	X
#Northern Hog Sucker		X			X	X	X	X	X	X
Northern Pike			X		X		X	X	X	
Pumpkinseed	X	X	X				X	X	X	
#Quillback	X		X		X	X	X	X		
~Rainbow Darter							X	X		
Rainbow Trout					X				X	
Redear Sunfish	X					X	X	X	X	
~River Redhorse			X		X	X	X			
~Rock Bass	X	X	X	X	X	X	X	X	X	X
~Shorthead Redhorse		X			X	X	X	X	X	X
~Silver Redhorse					X	X	X		X	
~Smallmouth Bass	X	X	X	X	X	X	X	X	X	X
Spotfin Shiner	X	X	X	X	X	X	X	X	X	X
Spottail Shiner										X

- - denotes a species that is SENSITIVE to 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, St. Joseph County, 2012									
Site	Sample Street		Jefferson Blvd		LaSalle Street		Keller Park		Brick Road	
	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass
Spotted Sucker	X	X	X	X			X	X	X	X
Steelcolor Shiner	X		X	X	X	X				
~Stonecat					X					
Striped Shiner							X			
Walleye	X	X			X	X	X		X	X
#White Sucker	X		X	X	X		X	X	X	X
#Yellow Bullhead	X	X		X					X	X

~ - denotes a species that is SENSITIVE to 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

Tributaries of St. Joseph River, Elkhart County, 2012

Stream	Little Elkhart River		Washington TWP Ditch	Pine Creek		Lily Creek		
	Oakridge Cemetary	CR 35		CR 2	SR 120 (Res)		Park Six Drive	
Site		1 st Pass	2 nd Pass		1st Pass	2nd Pass	1st Pass	2nd Pass
~American Brook Lamprey		X				X		
#Black Bullhead					X	X		
Black Crappie		X	X					
#Blacknose Dace		X	X	X				
Blackside Darter	X	X	X		X	X		
Bluegill	X	X	X		X	X		
#Bluntnose Minnow	X		X		X	X	X	
Brown Trout	X	X	X	X				
#Central Mudminnow	X	X	X		X	X	X	
Chestnut Lamprey			X		X			
#Common Carp					X			
Common Shiner			X					
#Creek Chub	X	X	X		X	X		
#Fathead Minnow		X						
~Golden Redhorse		X						
Grass Pickerel	X	X	X		X	X		
#Green Sunfish	X	X	X		X	X		
~Hornyhead Chub	X	X			X			
Johnny Darter		X	X		X	X		
Largemouth Bass		X	X			X		
~Logperch	X	X	X		X			
~Longear Sunfish					X			
Mottled Sculpin	X	X	X		X	X		
~Northern Hog Sucker	X	X	X					
Northern Pike				X	X			
~Orangethroat Darter	X		X		X	X		
Pirate Perch					X			
~Rainbow Darter	X	X			X			
Rainbow Trout	X	X	X					
Redear Sunfish		X						
~Rock Bass	X				X	X		
~Rosyface Shiner	X		X					
~Sand Shiner	X							
~Smallmouth Bass	X		X	X				

No Fish

~ - denotes a species that is SENSITIVE to 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

Tributaries of St. Joseph River, Elkhart County, 2012

Stream	Little Elkhart River		Washington TWP Ditch	Pine Creek		Lily Creek		
Site	Oakridge Cemetary	CR 35		CR 2	SR 120 (Res)		Park Six Drive	
		1 st Pass	2 nd Pass		1st Pass	2nd Pass	1st Pass	2nd Pass
Spotfin Shiner			X					No Fish
Stoneroller, Central		X	X		X	X		
Striped Shiner	X	X			X	X		
#White Sucker	X	X	X	X	X	X	X	
#Yellow Bullhead					X	X		

~ - denotes a species that is SENSITIVE to 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

Tributaries of St. Joseph River , Elkhart & St. Joseph Counties, 2012

Stream	Christiana Creek		Leedy Ditch	Yellow Creek		Baugo Creek			
	NMWF		Peddlers Village	Concord High School		Restoration		Restoration (B)	
	1 st Pass	2 nd Pass	1 st Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass
#Banded Killifish							X	X	X
#Black Bullhead					X				
#Blacknose Dace				X	X	X	X	X	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	X
#Central Mudminnow				X	X	X			X
Chestnut Lamprey	X	X							
#Common Carp							X	X	
Common Shiner	X			X	X		X	X	X
#Creek Chub	X	X	X	X	X	X	X	X	X
#Fathead Minnow				X					
#Gizzard Shad							X		X
~Golden Redhorse	X	X					X		X
#Golden Shiner							X		
#Green Sunfish	X			X	X	X		X	
~Greenside Darter				X			X	X	X
~Hornyhead Chub	X			X	X				
Hybrid Sunfish					X		X	X	
Johnny Darter			X	X	X	X	X	X	X
Largemouth Bass	X	X			X		X		X
~Logperch	X	X				X	X	X	X
~Longear Sunfish						X	X	X	X
~Longnose Dace				X	X	X	X	X	X
~Mimic Shiner								X	X
~Northern Hog Sucker	X	X							
Northern Pike							X		
~Orangethroat Darter		X		X	X		X		X
Pirate Perch						X	X		X
Pumpkinseed							X		X
~Rainbow Darter	X			X	X	X	X	X	X
~Rock Bass	X	X				X	X	X	X
~Rosyface Shiner		X							
~Sand Shiner						X	X	X	X
~Shorthead Redhorse	X	X					X	X	X
~Silver Redhorse	X								
Silverjaw Minnow				X	X	X	X	X	X

~ - denotes a species that is SENSITIVE to 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

Tributaries of St. Joseph River , Elkhart & St. Joseph Counties, 2012

Stream	Christiana Creek		Leedy Ditch	Yellow Creek		Baugo Creek			
Site	NMWF		Peddlers Village	Concord High School		Restoration		Restoration (B)	
	1 st Pass	2 nd Pass	1 st Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass
~Smallmouth Bass	X	X			x	X	X	x	X
Spotfin Shiner	X	X				X	X	X	X
Steelcolor Shiner									X
~Stonecat		X							
Stoneroller, Central				X	X	X	X	X	X
Striped Shiner	x	X		X		X	X	X	X
Tadpole Madtom						X			
Walleye									
#White Sucker		X	X	X	X	X	X	X	X
#Yellow Bullhead		X				X		X	x

~ - denotes a species that is SENSITIVE to 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	Elkhart River, Elkhart County, 2012						
Site	Goshen Pond	Oxbow Park (B)		EEC (A)		Central High School	
		1 st Pass	2 nd Pass	1 st Pass	2 nd Pass	1 st Pass	2 nd Pass
~American Brook Lamprey			x			x	X
Black Crappie					x		
Blackside Darter			X		X		
Blackstripe Topminnow	X						
Bluegill	X	X	X	X	X	X	X
#Bluntnose Minnow	X	X	X		X	X	X
Bowfin	X	X					
Chestnut Lamprey		X		X		X	
#Common Carp	X						
Common Shiner	X		X			X	
#Creek Chub			X				
~Golden Redhorse	X	X	X	X	X	X	X
#Golden Shiner	X						
Grass Pickerel			X			X	
#Green Sunfish		X	X		X	X	X
~Hornyhead Chub		X	X	X	X	X	X
Largemouth Bass	X	X	X	X	X	X	X
~Longear Sunfish	X	X	X	X	X	X	X
~Northern Hog Sucker		X	X	X	X	X	X
Northern Pike	X	X			X		
Pirate Perch		X	X				
Pumpkinseed	X		X		X		
~Rainbow Darter			X				X
Redear Sunfish				X	X		
~Rock Bass	X	X	X	X	X	X	X
~Rosyface Shiner	X	X	X		X		
~Sand Shiner					X	X	
~Smallmouth Bass	X	X	X	X	X	X	X
Spotfin Shiner		X	X	X	X	X	X
Spotted Sucker	X	X	X	X	X	X	X
Steelcolor Shiner		X		X			
Striped Shiner		X	X	X	X		
#White Sucker	X	X	X	X	X	X	X
#Yellow Bullhead		X	X		X		x

~ - denotes a species that is SENSITIVE to 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

Tributaries to St. Joseph River, St. Joseph County, 2012

Stream	Juday Creek						Bowman Creek	Phillips Ditch	
	Main Street (A)	Grape Road		Tanglewood	Myrtle Street		Fox Street	Chippewa Avenue	
		1 st Pass	2 nd Pass		1 st Pass	2 nd Pass		1 st Pass	2 nd Pass
#Black Bullhead								X	x
#Blacknose Dace	X	X	X	X	X	X			
Brown Trout	X	X	X	X					
#Central Mudminnow								X	X
#Creek Chub	X	X	X	X	X	X	X	X	X
#Fathead Minnow								X	X
#Green Sunfish	X	X	X	X	X		X	X	X
Johnny Darter	X	X	X	X	X				
Largemouth Bass	X		X	X					X
Mottled Sculpin	X	X	X	X	X	X			
~Rainbow Darter					X				
Rainbow Trout		X	X		X				
~Rock Bass						X			
~Smallmouth Bass						X			
#White Sucker	X	X	X	X	X	X			

~ - denotes a species that is SENSITIVE to 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



Appendix E

Summary of macroinvertebrates (insects) collected by site, 2012

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 (HD 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 HD samplers. Macroinvertebrates collected in this way were identified and simply counted as being present (Qualitative column).

Site: St. Joseph (Lexington Ave.)

Collection Date: 8/7/2012

Site Number: 3

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Hydra sp	32		Stenelmis sp	4	+
Turbellaria	123	+	Ceratopogonidae	0	+
Oligochaeta	0	+	Ablabesmyia rhamphe group	56	+
Caecidotea sp	0	+	Hayesomyia senata or T. norena	56	
Hyalella azteca	4	+	Nilotanypus fimbriatus	27	
Gammarus sp	0	+	Corynoneura lobata	48	
Orconectes (Procericambarus) rusticus	0	+	Cricotopus sp	56	
Hydracarina	8		Dicrotendipes modestus	0	+
Baetidae	8		Dicrotendipes neomodestus	1099	+
Plauditus dubius or P. virilis	9		Microtendipes pedellus group	0	+
Callibaetis sp	0	+	Polypedilum (Uresipedilum) flavum	27	
Proclouon sp	0	+	Polypedilum (P.) illinoense	27	+
Isonychia sp	18		Rheotanytarsus sp	797	+
Leucrocuta sp	4		Hydrobiidae	4	
Stenacron sp	19	+	Elimia sp	4	+
Maccaffertium exiguum	28	+	Physella sp	4	+
Maccaffertium mediopunctatum	24	+	Gyraulus (Torquis) parvus	8	
Maccaffertium pulchellum	50	+	Planorbella sp	0	+
Maccaffertium terminatum	27	+	Ferrissia sp	0	+
Serratella sp	21	+	Corbicula fluminea	0	+
Tricorythodes sp	340	+	Pisidium sp	0	+
Caenis sp	8	+			
Coenagrionidae	0	+			
Argia sp	1	+	No. Quantitative Taxa:	42	
Paragnetina sp	1		No. Qualitative Taxa:	41	
Ranatra sp	0	+	Total Taxa:	62	
Polycentropus sp	0	+	Number of Organisms:	4360	
Cheumatopsyche sp	1134	+	Qual EPT:	16	
Hydropsyche aerata	90	+	ICI:	48	
Macrostemum zebratum	12				
Potamyia flava	11				
Hydroptila sp	105				
Oxyethira sp	4				
Neophylax sp	0	+			
Pycnopsyche sp	0	+			
Oecetis sp	4				
Triaenodes injustus	0	+			
Petrophila sp	1				
Psephenus herricki	0	+			
Ancyronyx variegata	8				
Macronychus glabratus	49	+			

Site: St. Joseph (McNaughton Park)

Collection Date: 8/8/2012

Site Number: 4

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Spongillidae	0	+	Glyptotendipes (G.) sp	8	
Hydra sp	8		Polypedilum flavum	67	
Turbellaria	90	+	Polypedilum (P.) illinoense	0	+
Oligochaeta	4		Stenochironomus sp	30	+
Caecidotea sp	0	+	Tribelos fuscicorne	22	
Hyalella azteca	1	+	Pseudochironomus sp	0	+
Crangonyx sp	0	+	Rheotanytarsus sp	59	
Gammarus sp	1	+	Physella sp	5	
Hydracarina	0	+			
Callibaetis sp	0	+			
Stenacron sp	159	+	No. Quantitative Taxa:	37	
Maccaffertium exiguum	10	+	No. Qualitative Taxa:	26	
Maccaffertium mediopunctatum	0	+	Total Taxa:	49	
Maccaffertium mexicanum integrum	2		Number of Organisms:	1646	
Maccaffertium pulchellum	24	+	Qual EPT:	11	
Maccaffertium terminatum	1		ICI:	38	
Tricorythodes sp	272	+			
Coenagrionidae	5				
Argia sp	8				
Sisyridae	18	+			
Nyctiophylax sp	31	+			
Polycentropus sp	0	+			
Cheumatopsyche sp	57	+			
Hydropsyche sp	4				
Hydroptila sp	61	+			
Oxyethira sp	9				
Brachycentrus numerosus	0	+			
Oecetis persimilis	1				
Macronychus glabratus	56	+			
Stenelmis sp	0	+			
Limonia sp	0	+			
Chironomidae	8				
Tanypodinae	8				
Ablabesmyia mallochi	37				
Ablabesmyia rhamphe group	8				
Hayesomyia senata or T. norena	8				
Corynoneura lobata	21				
Cricotopus (C.) sp	14				
Cricotopus (C.) bicinctus	22				
Dicrotendipes fumidus	8				
Dicrotendipes neomodestus	499	+			

Site: St. Joseph River (LaSalle)

Collection Date: 8/8/2012

Site Number: 8

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Spongillidae	0	+	Dicrotendipes neomodestus	220	
Hydra sp	16		Polypedilum flavum	108	+
Turbellaria	802	+	Polypedilum (P.) illinoense	0	+
Oligochaeta	20		Stenochironomus sp	7	
Erpobdellidae	0	+	Xenochironomus xenolabis	14	
Gammarus sp	15	+	Rheotanytarsus sp	122	+
Hydracarina	12	+	Hemerodromia sp	12	
Plauditus dubius or P. virilis	1	+	Hydrobiidae	4	
Baetis intercalaris	5	+	Elimia sp	170	+
Iswaeon anoka	0	+	Fossaria sp	0	+
Isonychia sp	5	+	Physella sp	0	+
Stenacron sp	467	+	Gyraulus (Torquis) parvus	4	
Maccaffertium exiguum	4	+	Ferrissia sp	25	+
Maccaffertium mediopunctatum	1		Corbicula fluminea	0	+
Maccaffertium pulchellum	14	+	Lampsilis radiata luteola	0	+
Maccaffertium terminatum	21	+			
Serratella sp	7	+			
Tricorythodes sp	138	+	No. Quantitative Taxa:	45	
Argia sp	8	+	No. Qualitative Taxa:	38	
Boyeria vinosa	1		Total Taxa:	56	
Nyctiophylax sp	5		Number of Organisms:	2754	
Cheumatopsyche sp	181	+	Qual EPT:	17	
Hydropsyche aerata	0	+	ICI:	42	
Hydropsyche phalerata	5	+			
Macrostemum zebratum	9	+			
Protoptila sp	6	+			
Hydroptila sp	57	+			
Ochrotrichia sp	13				
Ceraclea sp	0	+			
Nectopsyche sp	2				
Oecetis persimilis	1				
Petrophila sp	109	+			
Macronychus glabratus	36	+			
Stenelmis sp	0	+			
Ablabesmyia mallochi	7				
Hayesomyia senata or T. norena	14				
Cardiocladius obscurus	7	+			
Corynoneura "celeripes"	24				
Cricotopus sp	14				
Cricotopus (C.) bicinctus	34	+			
Tvetenia discoloripes group	7	+			

Site: St. Joseph River (Keller Park)

Collection Date: 8/8/2012

Site Number: 9

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Hydra sp	12		Helopelopia sp	4	
Turbellaria	45	+	Procladius (Holotanypus) sp	0	+
Nematoda	1		Tanypus neopunctipennis	0	+
Oligochaeta	0	+	Corynoneura "celeripes"	8	
Helobdella papillata	0	+	Corynoneura lobata	4	
Caecidotea sp	0	+	Cricotopus (C.) bicinctus	4	
Crangonyx sp	0	+	Thienemanniella xena	8	+
Gammarus sp	0	+	Tvetenia discoloripes group	11	
Orconectes sp	0	+	Chironomus (C.) decorus group	0	+
Plauditus sp	5		Dicrotendipes modestus	0	+
Plauditus dubius or P. virilis	12	+	Dicrotendipes neomodestus	0	+
Baetis intercalaris	51		Polypedilum (Uresipedilum) flavum	276	+
Isxaeon anoka	0	+	Polypedilum (P.) illinoense	11	+
Isonychia sp	72		Stenochironomus sp	34	
Stenacron sp	9		Rheotanytarsus sp	15	
Maccaffertium exiguum	68		Hemerodromia sp	8	
Maccaffertium pulchellum	75		Hydrobiidae	1	+
Maccaffertium terminatum	23		Elimia sp	127	+
Serratella sp	64		Fossaria sp	0	+
Tricorythodes sp	65	+	Physella sp	20	+
Coenagrionidae	0	+	Planorbella (Pierosoma) pilsbryi	0	+
Argia sp	28	+	Ferrissia sp	4	
Paragnetina sp	1		Corbicula fluminea	0	+
Corixidae	0	+	Strophitus undulatus undulatus	0	+
Cheumatopsyche sp	173		Lampsilis radiata luteola	0	+
Hydropsyche aerata	16		Lampsilis cardium	0	+
Hydropsyche phalerata	119				
Macrostemum zebratum	41		No. Quantitative Taxa:	42	
Protoptila sp	8		No. Qualitative Taxa:	36	
Hydroptila sp	9		Total Taxa:	67	
Ochrotrichia sp	13		Number of Organisms:	1487	
Helicopsyche borealis	0	+	Qual EPT:	5	
Nectopsyche sp	0	+	ICI:	40	
Oecetis persimilis	9				
Petrophila sp	8				
Peltodytes sp	0	+			
Laccophilus sp	0	+			
Macronychus glabratus	17	+			
Stenelmis sp	0	+			
Simuliidae	4				
Hayesomyia senata or T. norena	4				

Site: St. Joseph River (Brick Road)

Collection Date: 8/8/2012

Site Number: 10

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Spongillidae	0	+	Oecetis persimilis	0	+
Turbellaria	97	+	Petrophila sp	29	
Oligochaeta	16	+	Peltodytes sp	0	+
Helobdella papillata	0	+	Tropisternus sp	0	+
Caecidotea sp	0	+	Psephenus herricki	0	+
Hyalella azteca	4		Macronychus glabratus	13	+
Crangonyx sp	0	+	Stenelmis sp	5	+
Gammarus sp	0	+	Simulium sp	2	
Orconectes (Crockerinus) propinquus	0	+	Ablabesmyia janta	7	
Hydracarina	0	+	Ablabesmyia mallochi	10	+
Plauditus sp	1		Hayesomyia senata or T. norena	7	
Plauditus dubius or P. virilis	0	+	Pentaneura inconspicua	7	
Baetis flavistriga	4		Rheopelopia paramaculipennis	7	
Baetis intercalaris	46		Corynoneura lobata	24	
Isonychia sp	153	+	Parametriocnemus sp	0	+
Stenacron sp	27	+	Thienemanniella xena	0	+
Maccaffertium exiguum	41	+	Chironomus (C.) decorus group	0	+
Maccaffertium mediopunctatum	2	+	Dicrotendipes modestus	0	+
Maccaffertium pulchellum	31		Dicrotendipes neomodestus	0	+
Maccaffertium terminatum	5		Phaenopsectra obediens group	7	+
Serratella sp	25	+	Polypedilum (Uresipedilum) flavum	497	+
Tricorythodes sp	45	+	Polypedilum (P.) fallax group	7	
Caenis sp	0	+	Polypedilum (P.) illinoense	10	+
Hetaerina sp	4	+	Stenochironomus sp	17	
Coenagrionidae	0	+	Tribelos fuscicorne	7	
Argia sp	38	+	Tribelos jucundum	0	+
Anax sp	0	+	Xenochironomus xenolabis	0	+
Boyeria vinosa	1		Rheotanytarsus sp	20	
Sisyridae	0	+	Elimia sp	181	+
Polycentropus sp	8		Physella sp	25	+
Cheumatopsyche sp	315	+	Planorbella (Pierosoma) pilsbryi	0	+
Hydropsyche aerata	8		Ferrissia sp	6	+
Hydropsyche phalerata	61	+	Corbicula fluminea	0	+
Macrostemum zebratum	4		Utterbackia imbecillis	0	+
Proptila sp	4	+	Lasmigona compressa	0	+
Hydroptila sp	23		Actinonaias ligamentina carinata	0	+
Ochrotrichia sp	18		Lampsilis cardium	0	+
Brachycentrus numerosus	20	+	No. Quantitative Taxa:	49	
Neophylax sp	0	+	No. Qualitative Taxa:	56	
Lepidostoma sp	2	+	Total Taxa:	80	
Helicopsyche borealis	0	+	Number of Organisms:	1893	
Nectopsyche pavidata	1	+	Qual EPT:	17	
Oecetis sp	1		ICI:	44	

Site: Little Elkhart River (CR 35)

Collection Date: 8/6/2012 Site Number: 11

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Turbellaria	14	+	Antocha sp	1	+
Oligochaeta	4	+	Conchapelopia sp	4	
Caecidotea sp	0	+	Hayesomyia senata or T. norena	9	+
Crangonyx sp	1		Pagastia orthogonia	0	+
Gammarus sp	28	+	Brillia flavifrons group	4	
Hydracarina	0	+	Corynoneura lobata	28	
Baetis tricaudatus	3	+	Cricotopus (C.) sp	13	
Plauditus dubius or P. virilis	0	+	Cricotopus (C.) bicinctus	17	+
Baetis flavistriga	183	+	Cricotopus (C.) tremulus group	4	
Pseudocloeon propinquum	0	+	Parametricnemus sp	39	+
Isonychia sp	5		Rheocricotopus (Psilocricotopus) robacki	30	+
Leucrocuta sp	0	+	Thienemanniella taurocapita	20	
Stenacron sp	17	+	Thienemanniella xena	20	
Maccaffertium exiguum	75	+	Tvetenia bavarica group	22	+
Maccaffertium pulchellum	71	+	Tvetenia discoloripes group	4	+
Maccaffertium vicarium	100	+	Cryptotendipes sp 2	0	+
Serratella sp	5		Cryptotendipes pseudotener	0	+
Tricorythodes sp	0	+	Dicrotendipes neomodestus	4	
Hetaerina sp	0	+	Microtendipes "caelum"	26	
Boyeria vinosa	1	+	Microtendipes pedellus group	60	+
Gomphidae	0	+	Paratendipes albimanus or P. duplicatus	0	+
Hagenius brevistylus	0	+	Polypedilum (Uresipedilum) flavum	13	
Plecoptera	1		Polypedilum (P.) fallax group	4	
Pteronarcys sp	1		Polypedilum (P.) laetum group	17	
Paragnetina sp	1	+	Paratanytarsus sp	9	
Lype diversa	6		Rheotanytarsus sp	133	
Psychomyia flavida	17		Tanytarsus sp	4	
Cheumatopsyche sp	162	+	Tanytarsus sepp	4	
Ceratopsyche morosa group	54	+	Elimia sp	0	+
Ceratopsyche sparna	21	+	Physella sp	1	+
Hydropsyche depravata group	14	+	Corbicula fluminea	0	+
Hydroptila sp	6	+			
Brachycentrus numerosus	40	+			
Neophylax sp	0	+			
Pycnopsyche sp	0	+			
Lepidostoma sp	3				
Helicopsyche borealis	0	+			
Mystacides sepulchralis	0	+			
Ancyronyx variegata	1				
Macronychus glabratus	7	+			
Stenelmis sp	2	+			
			No. Quantitative Taxa:	53	
			No. Qualitative Taxa:	47	
			Total Taxa:	72	
			Number of Organisms:	1333	
			Qual EPT:	21	
			ICI:	52	

Site: Christiana Creek (North Main Well Field)

Collection Date: 8/7/2012

Site Number: 16

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Turbellaria	34		Ceratopsyche morosa group	2	+
Nemertea	1		Ceratopsyche sparna	102	+
Caecidotea sp	0	+	Hydropsyche depravata group	108	+
Gammarus sp	8	+	Hydropsyche phalerata	22	+
Acentrella sp	2		Hydroptila sp	3	
Plauditus sp	17		Ochrotrichia sp	8	
Baetis tricaudatus	11		Brachycentrus numerosus	136	+
Plauditus dubius or P. virilis	0	+	Neophylax sp	0	+
Baetis flavistriga	12	+	Pycnopsyche sp	0	+
Baetis intercalaris	365	+	Helicopsyche borealis	0	+
Pseudocloeon propinquum	0	+	Oecetis persimilis	0	+
Isxaeon anoka	0	+	Parapoynx sp	1	
Heterocloeon curiosum	0	+	Petrophila sp	0	+
Procloeon sp (w/o hindwing pads)	0	+	Dineutus sp	1	
Isonychia sp	4		Psephenus herricki	0	+
Stenacron sp	5	+	Macronychus glabratus	24	+
Maccaffertium exiguum	123	+	Stenelmis sp	17	+
Maccaffertium mediopunctatum	21	+	Antocha sp	1	
Maccaffertium pulchellum	80	+	Simuliidae	0	+
Maccaffertium terminatum	12	+	Simulium sp	72	
Serratella sp	112	+	Nilotanytus fimbriatus	1	
Tricorythodes sp	4	+	Rheopelopia paramaculipennis	4	
Caenis sp	0	+	Rheocricotopus robacki	4	
Hexagenia atrocaudata	0	+	Thienemanniella similis	8	
Hetaerina sp	0	+	Thienemanniella xena	9	
Coenagrionidae	0	+	Tvetenia discoloripes group	49	
Argia sp	0	+	Dicrotendipes neomodestus	4	
Corydalus cornutus	3	+	Polypedilum flavum	67	+
Psychomyia flavida	0	+	Rheotanytarsus sp	88	+
Neureclipsis sp	2	+	Hemerodromia sp	16	+
Hydropsychidae	8		Elimia sp	0	+
Polypedilum (Tripodura) scalaenum group	5		Ferrissia sp	16	
Saetheria tylus	1		Corbicula fluminea	0	+
Stictochironomus sp	4	+	Dreissena polymorpha	0	+
Cladotanytarsus vanderwulpi group Type 3	1				
Rheotanytarsus pellucidus	1	+	No. Quantitative Taxa:	44	
Tanytarsus sp	1		No. Qualitative Taxa:	45	
Tanytarsus glabrescens group sp 7	1		Total Taxa:	66	
Hemerodromia sp	1		Number of Organisms:	2021	
Pisidium sp	1		Qual EPT:	28	
Cheumatopsyche sp	434	+	ICI:	52	

Site: Elkhart River - Oxbow (B)

Collection Date: 8/6/2012 Site Number: 18

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Spongillidae	0	+	Nilotanypus fimbriatus	3	
Hydra sp	6		Procladius (Holotanypus) sp	0	+
Turbellaria	78	+	Rheopelopia paramaculipennis	3	
Oligochaeta	12	+	Corynoneura lobata	19	
Placobdella parasitica	0	+	Rheocricotopus robacki	1	
Caecidotea sp	0	+	Cryptochironomus sp	1	
Crangonyx sp	4	+	Dicotendipes neomodestus	1	
Gammarus sp	23	+	Microtendipes pedellus group	1	
Baetis flavistriga	0	+	Paratendipes albimanus or P. duplicatus	0	+
Baetis intercalaris	2		Polypedilum (Uresipedilum) flavum	3	
Isonychia sp	1		Polypedilum (P.) illinoense	14	+
Leucrocuta sp	2		Polypedilum (P.) laetum group	1	
Nixe sp	0	+	Rheotanytarsus sp	10	
Stenacron sp	20	+	Tanytarsus sp	1	
Maccaffertium exiguum	35	+	Tanytarsus glabrescens group sp 7	9	
Maccaffertium pulchellum	34	+	Tanytarsus sepp	9	
Maccaffertium terminatum	2		Hemerodromia sp	2	
Tricorythodes sp	45	+	Hydrobiidae	4	+
Caenis sp	6	+	Elimia sp	28	+
Calopterygidae	2		Helisoma anceps anceps	1	+
Calopteryx sp	0	+	Planorbella (Pierosoma) pilsbryi	0	+
Coenagrionidae	0	+	Ferrissia sp	18	
Argia sp	3	+	Corbicula fluminea	0	+
Boyeria vinosa	0	+	Sphaerium sp	4	+
Gomphus sp	0	+			
Plecoptera	1				
Agneta capitata complex	0	+	No. Quantitative Taxa:	46	
Cheumatopsyche sp	95	+	No. Qualitative Taxa:	39	
Brachycentrus numerosus	22	+	Total Taxa:	65	
Pycnopsyche sp	2	+	Number of Organisms:	560	
Nectopsyche sp	1		Qual EPT:	11	
Gyrinus sp	0	+	ICI:	36	
Haliphus sp	0	+			
Psephenus herricki	0	+			
Ancyronyx variegata	2				
Dubiraphia vittata group	0	+			
Macronychus glabratus	23	+			
Stenelmis sp	4	+			
Clinotanypus pinguis	0	+			
Conchapelopia sp	1				
Hayesomyia senata or T. norena	1				

Site: Elkhart River (Central High School)

Collection Date: 8/6/2012 Site Number: 20

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Spongillidae	0	+	Corynoneura lobata	2	
Hydra sp	4		Thienemanniella xena	2	
Turbellaria	186	+	Chironomus (C.) decorus group	0	+
Nematoda	1		Cryptotendipes pseudotener	0	+
Oligochaeta	0	+	Dicrotendipes modestus	0	+
Gammarus sp	47	+	Dicrotendipes neomodestus	1	+
Plauditus sp	1		Glyptotendipes (G.) sp	2	
Baetis flavistriga	8		Microtendipes pedellus group	1	
Baetis intercalaris	7		Polypedilum flavum	8	
Pseudocloeon propinquum	4	+	Polypedilum (P.) fallax group	1	
Iswaeon anoka	0	+	Polypedilum (P.) illinoense	1	
Centroptilum sp	0	+	Stenochironomus sp	2	
Isonychia sp	85		Paratanytarsus sp	3	
Leucrocuta sp	4		Rheotanytarsus sp	2	
Nixe sp	1		Tanytarsus glabrescens group sp 7	8	
Stenacron sp	26	+	Hydrobiidae	0	+
Maccaffertium exiguum	92	+	Elimia sp	45	+
Maccaffertium pulchellum	167	+	Physella sp	4	+
Maccaffertium terminatum	30	+	Helisoma anceps anceps	1	+
Serratella sp	1	+	Ferrissia sp	8	+
Tricorythodes sp	82	+			
Caenis sp	2				
Hetaerina sp	0	+	No. Quantitative Taxa:	43	
Coenagrionidae	0	+	No. Qualitative Taxa:	39	
Argia sp	1	+	Total Taxa:	61	
Pteronarcys sp	1	+	Number of Organisms:	968	
Paragnetina sp	9	+	Qual EPT:	16	
Corixidae	0	+	ICI:	42	
Cheumatopsyche sp	52	+			
Brachycentrus numerosus	6	+			
Pycnopsyche sp	0	+			
Helicopsyche borealis	0	+			
Nectopsyche sp	0	+			
Peltodytes sp	0	+			
Psephenus herricki	0	+			
Macronychus glabratus	47	+			
Stenelmis sp	0	+			
Diptera	0	+			
Conchapelopia sp	3				
Hayesomyia senata or T. norena	3	+			
Nilotanypus fimbriatus	7				

Site: Yellow Creek (Concord High School)

Collection Date: 8/6/2012 Site Number: 21

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Turbellaria	0	+	Dicrotendipes neomodestus	207	
Fredericella sp	19		Microtendipes "caelum"	24	
Plumatella sp	1		Microtendipes pedellus group	275	+
Oligochaeta	28	+	Polypedilum (P.) illinoense	46	
Caecidotea sp	0	+	Polypedilum scalaenum group	24	
Crangonyx sp	52	+	Stictochironomus sp	0	+
Gammarus sp	135	+	Tanytarsini	24	
Orconectes sanbornii sanbornii	0	+	Paratanytarsus sp	92	
Baetis flavistriga	42	+	Rheotanytarsus sp	24	
Stenacron sp	14	+	Tanytarsus sp	116	
Hetaerina sp	4	+	Tanytarsus glabrescens group sp 7	1128	+
Coenagrionidae	1		Tanytarsus sepp	46	
Boyeria vinosa	1	+	Hemerodromia sp	4	
Corixidae	0	+	Physella sp	5	+
Sigara sp	0	+	Ferrissia sp	33	+
Trichocorixa sp	0	+	Sphaerium sp	0	+
Cheumatopsyche sp	199	+			
Ceratopsyche morosa group	72	+			
Ceratopsyche sparna	0	+	No. Quantitative Taxa:	41	
Hydropsyche depravata group	25	+	No. Qualitative Taxa:	33	
Hydroptila sp	8		Total Taxa:	57	
Brachycentrus numerosus	0	+	Number of Organisms:	3251	
Helichus sp	4	+	Qual EPT:	7	
Ancyronyx variegata	8		ICI:	44	
Dubiraphia sp	0	+			
Macronychus glabratus	1				
Antocha sp	8				
Tipula sp	1	+			
Simulium sp	0	+			
Chironomidae	46				
Conchapelopia sp	184	+			
Hayesomyia senata or T. norena	116				
Helopelopia sp	0	+			
Pentaneura inconspicua	24				
Thienemannimyia group	70				
Corynoneura sp	24				
Corynoneura lobata	24				
Cricotopus (C.) sp	0	+			
Rheocricotopus robacki	92				
Tvetenia bavarica group	0	+			
Chironomus (C.) sp	0	+			

Site: Baugo Creek (Restoration Site)

Collection Date: 8/7/2012

Site Number: 23

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Eunapius fragilis	0	+	Polypedilum (Uresipedilum) flavum	109	+
Turbellaria	20	+	Polypedilum (P.) fallax group	7	
Fredericella sp	7		Stenochironomus sp	15	
Oligochaeta	16	+	Stictochironomus sp	0	+
Gammaridae	0	+	Xenochironomus xenolabis	0	+
Acentrella sp	8		Rheotanytarsus pellucidus	7	+
Baetis tricaudatus	1		Rheotanytarsus sp	261	+
Baetis flavistriga	122	+	Tanytarsus glabrescens group sp 7	29	
Baetis intercalaris	68	+	Hemerodromia sp	24	
Maccaffertium exiguum	18		Physella sp	0	+
Maccaffertium pulchellum	4		Ferrissia sp	9	+
Tricorythodes sp	16		Pisidium sp	2	
Calopteryx sp	0	+			
Hetaerina sp	0	+			
Coenagrionidae	0	+			
Argia sp	0	+	No. Quantitative Taxa:	37	
Boyeria vinosa	0	+	No. Qualitative Taxa:	28	
Cheumatopsyche sp	168	+	Total Taxa:	52	
Ceratopsyche morosa group	1772	+	Number of Organisms:	3745	
Hydropsyche depravata group	793	+	Qual EPT:	5	
Oecetis persimilis	1		ICI:	44	
Berosus sp	0	+			
Macronychus glabratus	0	+			
Stenelmis sp	0	+			
Antocha sp	28				
Tipula sp	1				
Simulium sp	1				
Conchapelopia sp	36				
Hayesomyia senata or T. norena	73				
Nilotanypus fimbriatus	1				
Nanocladius (N.) spinipennis	22				
Rheocricotopus (Psilocricotopus) robacki	29				
Tvetenia discoloripes group	22				
Cryptochironomus sp	0	+			
Dicrotendipes neomodestus	7				
Dicrotendipes simpsoni	7				
Glyptotendipes (G.) sp	7				
Microtendipes "caelum"	15	+			
Microtendipes pedellus group	19	+			
Phaenopsectra obediens group	0	+			

Site: Phillips Ditch (Chippewa Ave.)

Collection Date: 8/7/2012

Site Number: 25

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Hydra sp	2		Tanytarsus sepp	3	
Turbellaria	3	+	Clinocera (C.) sp	1	
Oligochaeta	4	+	Ferrissia sp	1	
Caecidotea sp	0	+	Sphaerium sp	0	+
Gammarus sp	25				
Cambarus sp	0	+			
Baetis tricaudatus	7	+			
Calopteryx sp	7	+			
Hetaerina sp	15	+	No. Quantitative Taxa:	27	
Coenagrionidae	0	+	No. Qualitative Taxa:	29	
Boyeria grafiana	0	+	Total Taxa:	45	
Cheumatopsyche sp	15	+	Number of Organisms:	367	
Hydropsyche depravata group	18	+	Qual EPT:	4	
Neophylax sp	0	+	ICI:	32	
Helichus sp	0	+			
Macronychus glabratus	78	+			
Optioservus sp	3				
Stenelmis sp	0	+			
Pilaria sp	0	+			
Anopheles sp	0	+			
Simulium sp	0	+			
Conchapelopia sp	3				
Brillia flavifrons group	0	+			
Corynoneura sp	4				
Corynoneura lobata	8				
Parametriocnemus sp	10	+			
Thienemanniella xena	24				
Tvetenia bavarica group	2				
Tvetenia discoloripes group	0	+			
Cryptochironomus sp	0	+			
Dicrotendipes neomodestus	0	+			
Dicrotendipes simpsoni	0	+			
Microtendipes "caelum"	3				
Microtendipes pedellus group	52	+			
Paratendipes albimanus or P. duplicatus	0	+			
Polypedilum (Uresipedilum) aviceps	50				
Polypedilum (Uresipedilum) flavum	3				
Polypedilum (P.) fallax group	5				
Polypedilum (Tripodura) scalaenum group	3				
Stictochironomus sp	0	+			
Rheotanytarsus sp	18	+			

Site: Juday Creek (Grape Road)

Collection Date: 8/7/2012

Site Number: 28

Taxa Name	Quantitative	Qualitative		
Oligochaeta	61			
Caecidotea sp	0	+	No. Quantitative Taxa:	24
Crangonyx sp	0	+	No. Qualitative Taxa:	20
Gammarus sp	1	+	Total Taxa:	40
Orconectes rusticus x sanbornii	3		Number of Organisms:	98
Stenacron sp	0	+	Qual EPT:	5
Maccaffertium vicarium	0	+	ICI:	20
Calopterygidae	0	+		
Coenagrionidae	0	+		
Boyeria grafiana	0	+		
Boyeria vinosa	0	+		
Sialis sp	0	+		
Cheumatopsyche sp	3	+		
Hydropsyche depravata group	0	+		
Hydroptilidae	1			
Oxyethira sp	1			
Brachycentrus numerosus	0	+		
Laccobius sp	0	+		
Dubiraphia sp	1			
Simuliidae	1			
Simulium sp	0	+		
Chironomidae	1			
Ablabesmyia sp	1			
Pentaneura inconspicua	0	+		
Procladius (Holotanypus) sp	0	+		
Pagastia orthogonia	2			
Rheocricotopus (Psilocricotopus) robacki	1			
Cryptochironomus sp	1			
Cryptotendipes sp	0	+		
Phaenopsectra obediens group	3			
Polypedilum (Uresipedilum) aviceps	1			
Polypedilum (Tripodura) scalaenum group	5			
Saetheria tylus	1			
Stictochironomus sp	4	+		
Cladotanytarsus vanderwulpi group Type 3	1			
Rheotanytarsus pellucidus	1	+		
Tanytarsus sp	1			
Tanytarsus glabrescens group sp 7	1			
Hemerodromia sp	1			
Pisidium sp	1			

Site: Juday Creek (Myrtle Street)

Collection Date: 8/7/2012

Site Number: 30

Taxa Name	Quantitative	Qualitative	Taxa Name	Quantitative	Qualitative
Hydra sp	1		Tvetenia discoloripes group	5	
Turbellaria	21	+	Dicrotendipes neomodestus	0	+
Nemertea	4		Dicrotendipes simpsoni	1	
Caecidotea sp	0	+	Parachironomus sp	1	
Gammarus sp	0	+	Polypedilum (Uresipedilum) flavum	10	+
Hydracarina	0	+	Rheotanytarsus pellucidus	1	
Baetis tricaudatus	2		Rheotanytarsus sp	2	
Baetis flavistriga	11	+	Tanytarsus glabrescens group	1	
Baetis intercalaris	21		Corbicula fluminea	0	+
Stenacron sp	113	+			
Maccaffertium exiguum	57	+			
Maccaffertium pulchellum	84	+			
Maccaffertium terminatum	4		No. Quantitative Taxa:	36	
Maccaffertium vicarium	14		No. Qualitative Taxa:	28	
Tricorythodes sp	0	+	Total Taxa:	50	
Caenis sp	0	+	Number of Organisms:	813	
Ephemera sp	0	+	Qual EPT:	15	
Calopteryx sp	0	+	ICI:	52	
Gomphus sp	0	+			
Chimarra obscura	0	+			
Cheumatopsyche sp	298	+			
Ceratopsyche morosa group	61	+			
Ceratopsyche sparna	2				
Hydropsyche depravata group	42	+			
Hydroptila sp	1				
Brachycentrus numerosus	9	+			
Pycnopsyche sp	0	+			
Mystacides sepulchralis	0	+			
Oecetis persimilis	0	+			
Macronychus glabratus	15	+			
Optioservus sp	1	+			
Stenelmis sp	3	+			
Chironomidae	2				
Tanypodinae	1				
Nilotanypus fimbriatus	2	+			
Orthoclaadiinae	1				
Corynoneura lobata	4				
Parametriocnemus sp	6				
Rheocricotopus (Psilocricotopus) robacki	2				
Thienemanniella xena	9				
Tvetenia bavarica group	1				



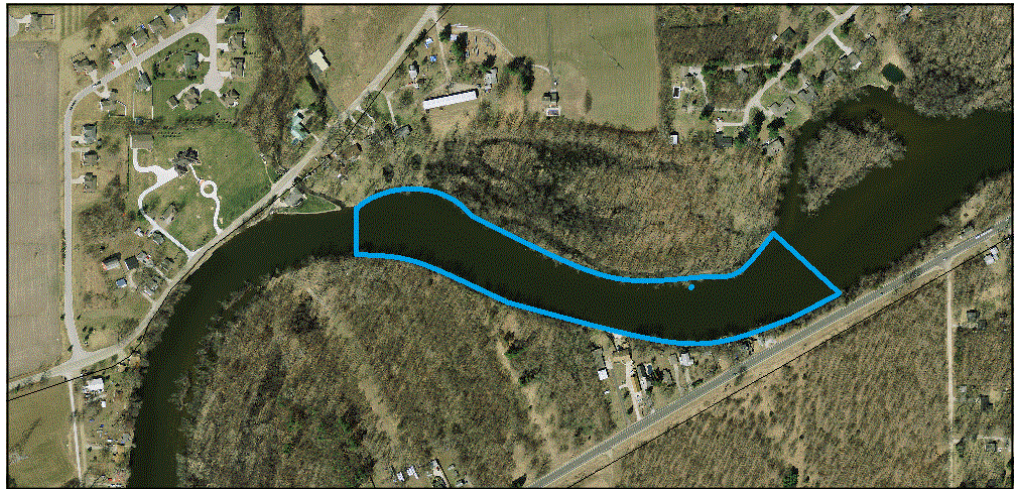
Appendix F

Aerial Site Location Maps



Site #1: St. Joseph River State Line East

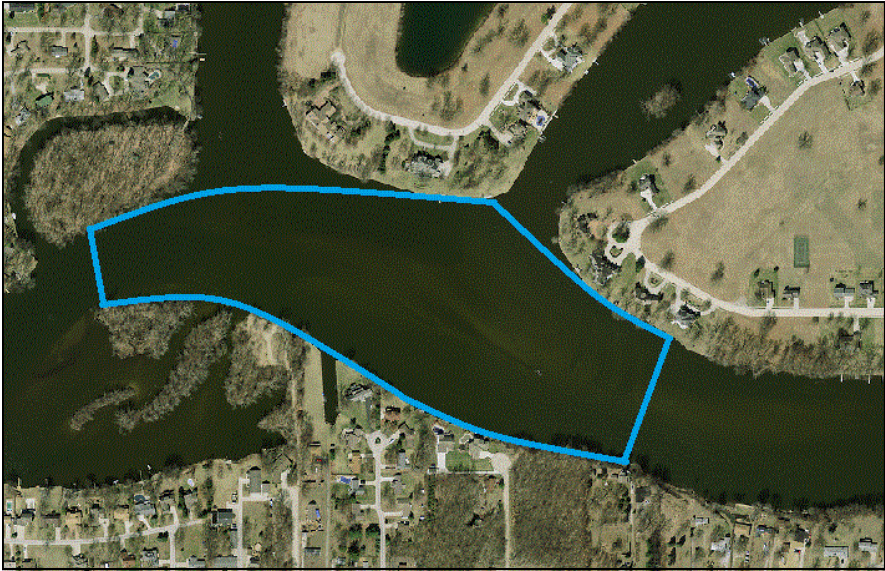
Site #2: St. Joseph River Nibbyville (A)



Site #3: St. Joseph River Lexington Ave.



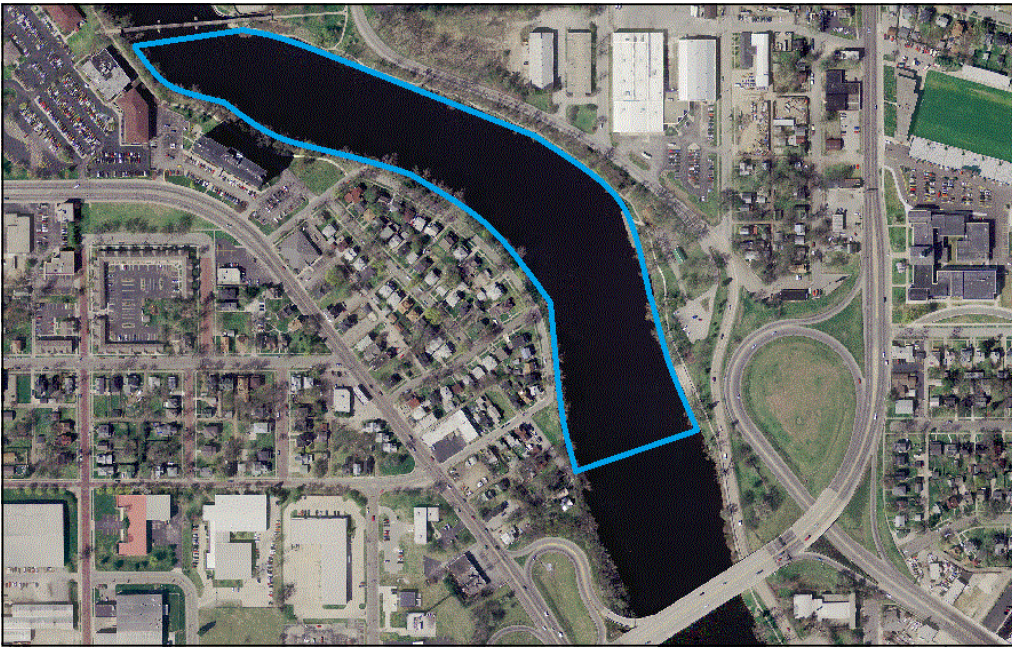
Site #4: St. Joseph River McNaughton Park



Site #5: St. Joseph River Treasure Island

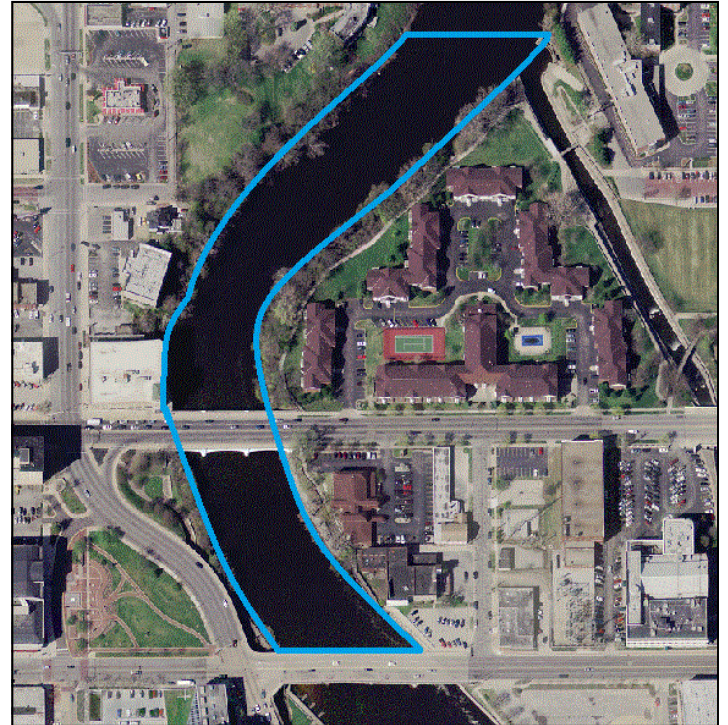
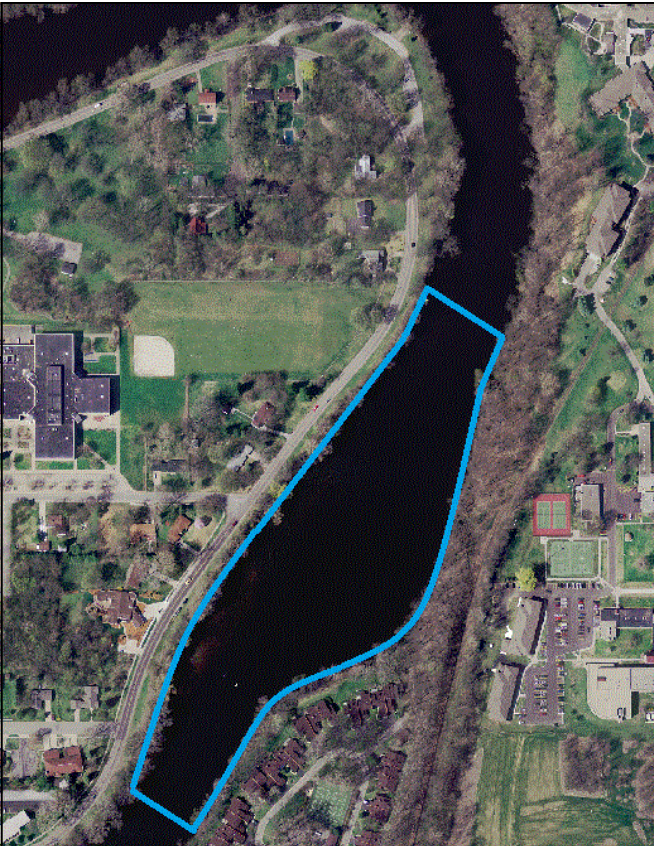


Site #6: St. Joseph River Sample Street



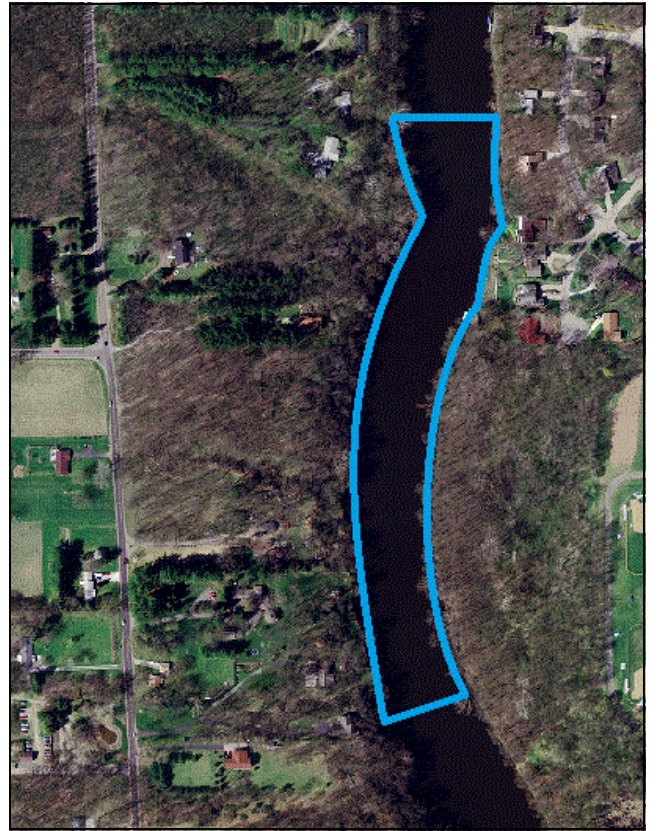
Site #7: St. Joseph River Jefferson Blvd.

Site #8: St. Joseph River LaSalle Ave.

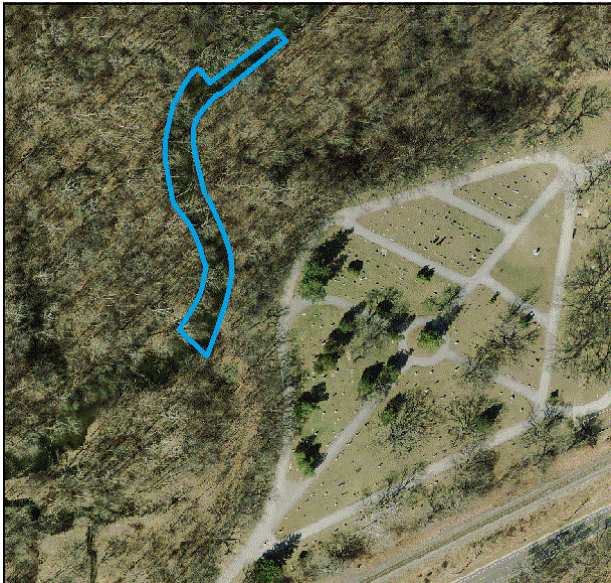


Site #9: St. Joseph River Keller Park

Site #10: St. Joseph River Brick Road



Site #11: Little Elkhart River CR 35



Site #12: Little Elkhart River Oakridge Cemetery



Site #13: Pine Creek State Road 120 (Res)

Site #14: Washington Township Ditch CR 2

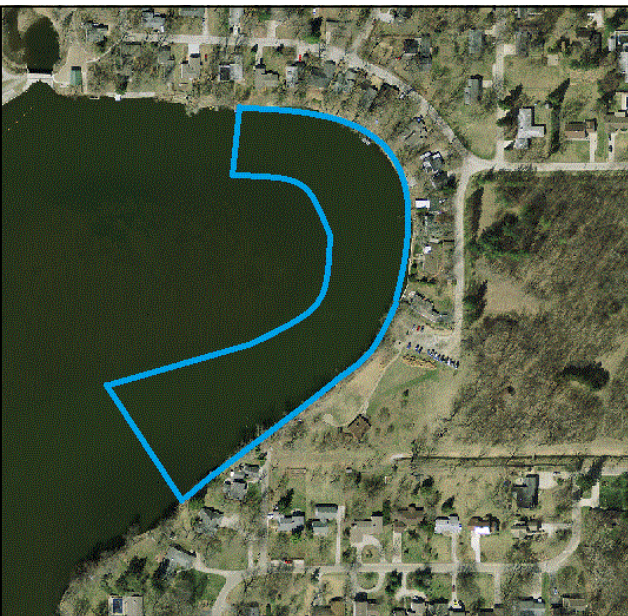




Site #15: Lily Creek Park Six Drive



Site #16: Christiana Creek North Main Wellfield



Site #17: Elkhart River Goshen Pond



Site #18: Elkhart River Oxbow (B)



Site #19: Elkhart River EEC (A)

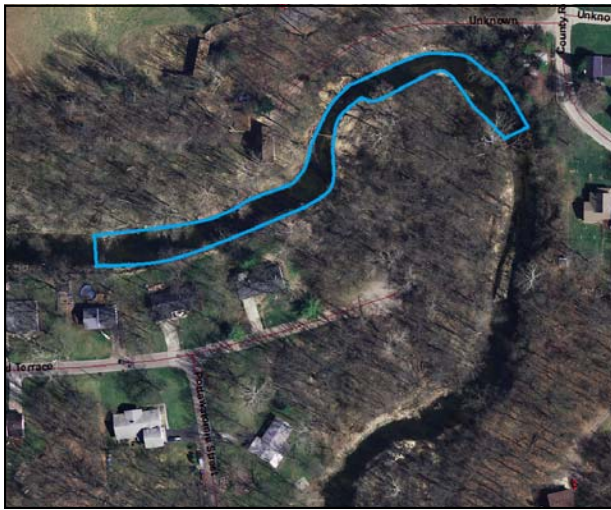
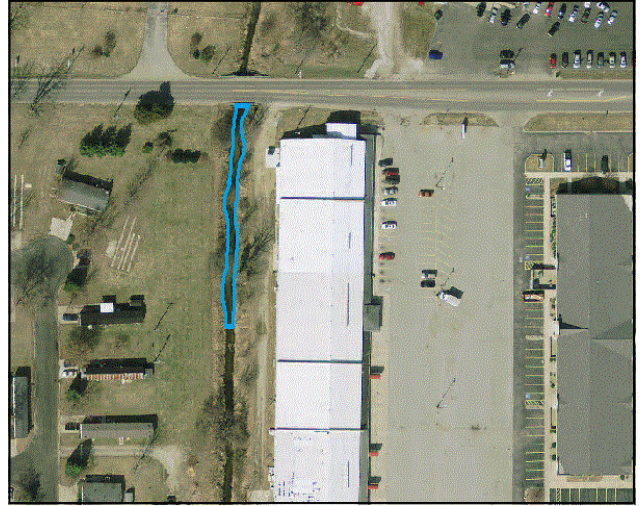
Site #20: Elkhart River Central High School





Site #21: Yellow Creek Concord High School

Site #22: Leedy Ditch Peddlers Village



Site #23: Baugo Creek Restoration



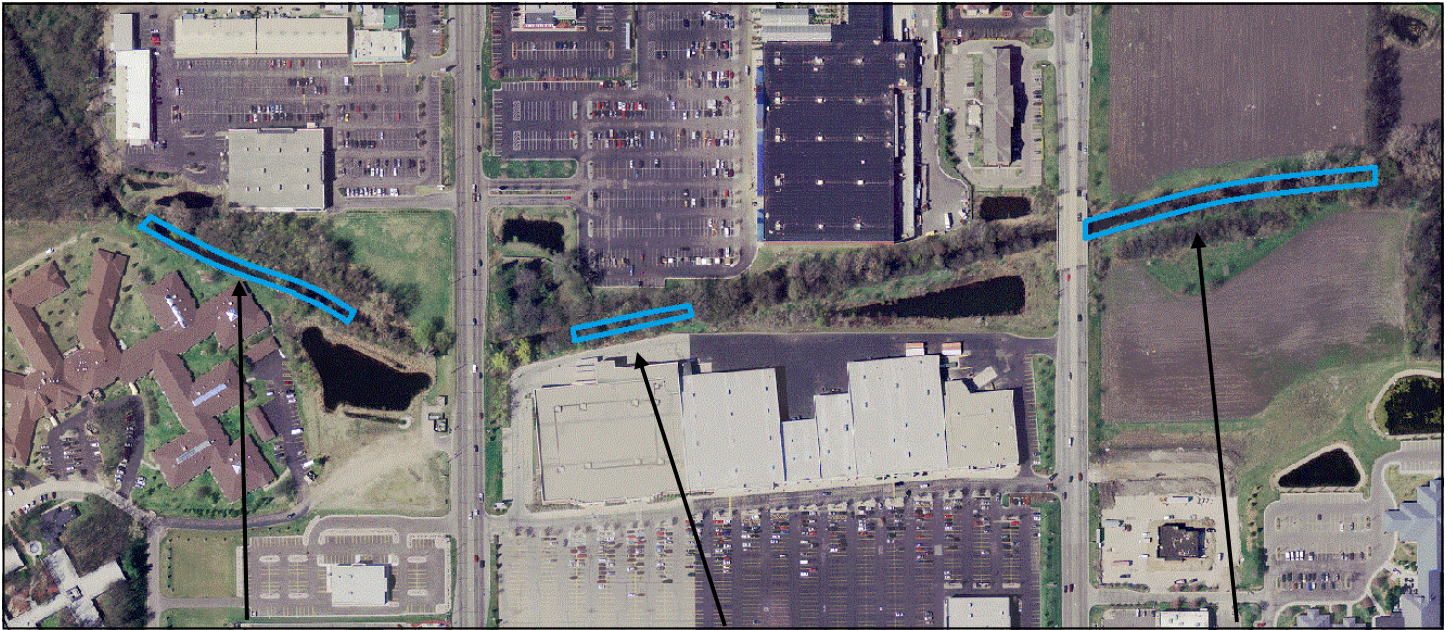
Site #24: Baugo Creek Restoration (Below)



Site #25: Phillips Ditch Chippewa Ave.



Site #26: Bowman Creek Fox Street



Site #29: Juday Creek Tanglewood

Site #28: Juday Creek Grape Road

Site #27: Juday Creek Main Street (A)



Site #30: Juday Creek Myrtle Street.

