Biological and Water Quality Study of the Lye Creek (Blanchard River) Watershed

(HUC 04100008 0204)
2012-2013

Hancock County, Ohio

Ohio EPA Technical Report EAS/2014-05-04

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Biological and Water Quality Study of the Lye Creek (Blanchard River) Watershed (HUC 04100008 0204) Hancock County, Ohio 2012-2013

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INTRODUCTION

Dissolved phosphorus inputs into the western basin of Lake Erie from the Maumee River watershed are at historic levels and are believed to be a significant cause for harmful algae blooms (cyanobacteria) that have reappeared in recent years. Multiple local, state and federal agencies as well as nongovernmental partners are mobilizing to implement a variety of nutrient reduction projects within the basin. For example, USDA-NRCS is working with several parties within the upper Blanchard River watershed for a special EQIP project that will enhance the benefits derived from the phosphorus reduction demonstration project funded by the GLRI Upper Blanchard Phosphorus Reduction Initiative grant. This project is designed to demonstrate the effectiveness of targeting agricultural nutrient reduction (and other) practices at a focused scale in which measurable reductions in nitrogen and phosphorus may be achieved. The project also proposes a more holistic approach that includes not only robust source reduction efforts, but also will implement additional practices that are designed to reduce sediment loadings and improve flow and habitat conditions within the Lye Creek watershed (HUC 0410008 0204) in Hancock County, Ohio. The project will be a collaborative partnership among Ohio EPA, the Hancock County SWCD, Hancock County Health Department, Environmental Defense Fund (EDF), the Ohio Department of Natural Resources and the USDA-NRCS.

During the 2013 field season (July through October) chemical, physical, and biological sampling was conducted in the Lye Creek watershed (HUC 04100008 0204) to assess and characterize baseline water resource conditions prior to full implementation of the Upper Blanchard Phosphorus Reduction Initiative. The watershed lies within the Blanchard River basin, a tributary of the Auglaize River and, ultimately the Maumee River. The Lye Creek watershed is located in northwest Ohio in Hancock County and is comprised of approximately 17,920 acres (28 mi^2) - of which 82.6% is in agricultural row crop production. Other land uses within the Lye Creek watershed include developed land (9.5%), forest (5.0%) and grass/pasture (2.9%) (Source: National Land Data Set, 2006).

The current aquatic life use designation of Lye Creek and its primary tributary, Silver Creek, is unverified Warmwater Habitat (WWH). Based on limited sampling in 2005, Lye Creek was recommended for the Modified Warmwater Habitat (MWH) use due to extensive channel modifications. However, preliminary biological and habitat sampling in 2012 at five Lye Creek and Silver Creek sites indicated that WWH is the appropriate aquatic life use based on fish community assemblages (Table 2). Based on the 2005 sampling and updated with the 2012 survey results, principal causes of impairment in the Lye Creek watershed are direct habitat alterations, nutrient/eutrophication biological indicators, organic enrichment (sewage) biological indicators, phosphorus, excessive algal growth, and particle distribution (embeddedness). Primary impairment sources identified are crop production with subsurface drainage and channelization.

Specific objectives of the survey were to:

- Establish the present biological conditions in the Lye Creek watershed by evaluating fish and macroinvertebrate communities;
- Identify the relative concentrations and loadings of nutrients and other selected parameters in surface water;
- Assess physical habitat influences on stream biotic integrity;
- Determine beneficial use attainment status and recommend changes if appropriate; and
- Confirm or revise causes and sources of beneficial use impairment as determined by earlier studies.

The entire watershed is located within the Eastern Corn Belt Plains (ECBP) ecoregion and there are no permitted point source dischargers present. Stream samples, including sample type, drainage area and location information are listed in Table 1 and represented graphically in Figure 1.

SUMMARY AND CONCLUSIONS

Ohio EPA completed two passes of fish community sampling and artificial and natural substrate collections of macroinvertebrate communities at the most downstream Lye Creek site in 2012 and/or 2013. One-pass fish sampling and qualitative, natural substrate macroinvertebrate sampling were completed at four additional Lye Creek and Silver Creek sites in 2012 and 2013. All sites received a Qualitative Habitat Evaluation Index (QHEI) assessment both years and six grab samples for stream chemistry analyses during spring, summer, and fall, 2013. A continuous monitoring water quality sonde was deployed at one location for one three-day period to evaluate diel measurements of field dissolved oxygen, pH, temperature, and conductivity. Sampling locations are detailed in Table 1 and graphically presented in Figure 1; aquatic life use attainment status is presented in Table 2. Summarized sample attributes from all biological, physical habitat, and chemical water quality sites are included as Tables 3-8. Other relevant data, including raw data, are tabulated in Appendix Tables 1-6.

WWH aquatic life use impairment was documented at all the Lye Creek watershed sites in both 2012 and 2013. However, impairment was mostly limited to macroinvertebrate communities which were assessed as fair, poor, or very poor at all sites during each of the two sampling years. Macroinvertebrate communities at all sites were overwhelmingly predominated by pollution tolerant taxa with none or only a few taxa present which are considered pollution sensitive. Fish communities, as represented by Index of Biotic Integrity (IBI) scores, consistently met WWH expectations at four of the five sites in 2013 and 2012. With the exception of the Silver Creek site in 2012, IBI scores reflected marginally good to exceptional conditions with a range from 36 to 50; the applicable WWH biocriterion for the IBI is 40 (with 36-38 scores considered non-significant departures). Fish community impairment at Lye Creek RM 2.63 during both years was due to low Modified Index of well-being (MIwb) scores which reflected structural imbalances in fish abundance and diversity at this site.

While physical habitat quality, as measured by the QHEI, reflected no better than fair conditions at any site and was a significant causal factor in the observed biological impairment, there were also indications of chemical water quality stressors exacerbating conditions, particularly elevated levels of nutrients which drove excessive algal productivity resulting in sporadic low dissolved oxygen levels at several sites during 2013. Nonpoint source agricultural impacts, and potentially some failing home sewage treatment systems and other dispersed sources of untreated sewage in the watershed, contributed to nutrient enrichment from excessive nitrate+nitrite and total phosphorus in all or parts of Lye Creek and Silver Creek. Elevated levels of total phosphorus at the headwaters and decreasing levels at the downstream sampling locations demonstrated uptake of total phosphorus by the biomass. The increase in nitrate+nitrite progressing downstream demonstrated that the amount entering the stream exceeds the amount the biomass can assimilate resulting in total phosphorus being the limiting factor for algal growth in the stream. As such, total phosphorus export from the watershed to the Blanchard River is probably at an acceptable level; however, this nutrient is likely contributing to eutrophication and aquatic life use impairment observed at the sites in Lye Creek and Silver Creek. Conversely, due to persistent measurements of nitrate+nitrite above the statewide target at all sites, Lye Creek likely is a net exporter of this nutrient to the downstream watershed.

Table 1. Sampling locations in the Lye Creek (Blanchard River) HUC-12 watershed study area, 2012-2013. Type of sampling included fish community (F), macroinvertebrate community (M), physical habitat (H), stream chemistry (C), and water quality sonde (D).

Point of Record River Mile	Type of Sampling	Latitude	Longitude	Local Landmark (Station ID)	Watershed Size at Site (mi^2)
Lye Creek (04-190-000)					
10.20	F,M,H,C	40.926600	-83.594500	S of Houcktown at Hancock Co. Rd. 8 (302113)	4.9
9.45	F,M,H,C	40.935400	-83.591200	at Houcktown at Hancock Co. Rd. 26 (P05K40)	7.8
6.66	F,M,H,C	40.971700	-83.591200	SE of Findlay at Jackson Twp. Rd. 168 (P05K41)	12.8
2.63	F,M,H,C,D	41.015000	-83.608300	at Hancock Co. Rd. 205 (P05K42)	25.7
Silver Creek (04-191-001)					
0.75	F,M,H,C	40.971400	-83.575100	SE of Findlay at Jackson Twp. Rd. 168 (302115)	4.1

Table 2. Aquatic life use attainment status for sampling locations in the Lye Creek (Blanchard River) HUC-12 watershed study area, 2012-2013. The Index of Biotic Integrity (IBI), Modified Index of well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Sampling locations were evaluated using Warmwater Habitat (WWH) aquatic life use biocriteria codified in the Ohio Water Quality Standards (OAC 3745-1-07, Table 7-15) for the Eastern Corn Belt Plains (ECBP) ecoregion of Ohio. If biological impairment has occurred, the cause(s) and source(s) of the impairment, based on the weight of evidence of data, are noted.

Point of Record River Mile	Watershed Size (mi^2) Site Type	Aquatic Life Use Attainment Status	IBI '13/'12	MIwb '13/'12	ICI[a] '13/'12	QHEI '13/'12	Aquatic Life Use Impairment Cause(s) ---------- Source(s)
Lye Creek 2013/2012 (04-190-000) – WWH							
10.20	4.9 Headwater	**Partial**	42/44	-	F*/VP*	48.0/28.0	direct habitat alterations, excess algal growth, nutrient/eutrophication biological indicators, particle distribution (embeddedness) ---------- channelization, crop production with subsurface drainage
9.45	7.8 Headwater	**NON**	50/44	-	P*/P*	49.5/32.5	direct habitat alterations, excess algal growth, nutrient/eutrophication biological indicators, organic enrichment (sewage) biological indicators, particle distribution (embeddedness) ---------- channelization, crop production with subsurface drainage, on-site treatment systems (septic systems and similar decentralized systems)
6.66	12.8 Headwater	**Partial**	42/40	-	LF*/P*	48.0/46.3	direct habitat alterations, excess algal growth, nutrient/eutrophication biological indicators, organic enrichment (sewage) biological indicators, particle distribution (embeddedness) ---------- animal feeding operations, channelization, crop production with subsurface drainage, sewage discharges in unsewered areas
2.63	25.7 Wading	**Partial**	36^{ns}/40	$7.1*/7.9^{ns}$	24*/P*	39.3/45.5	direct habitat alterations, excess algal growth, nutrient/eutrophication biological indicators, particle distribution (embeddedness) ---------- channelization, crop production with subsurface drainage
Silver Creek 2013/2012 (04-191-000) – WWH							
0.75	4.1 Headwater	**NON**	44/22*	-	P*/-	26.0/34.5	direct habitat alterations, nutrient/eutrophication biological indicators, particle distribution (embeddedness) ---------- channelization, crop production with subsurface drainage

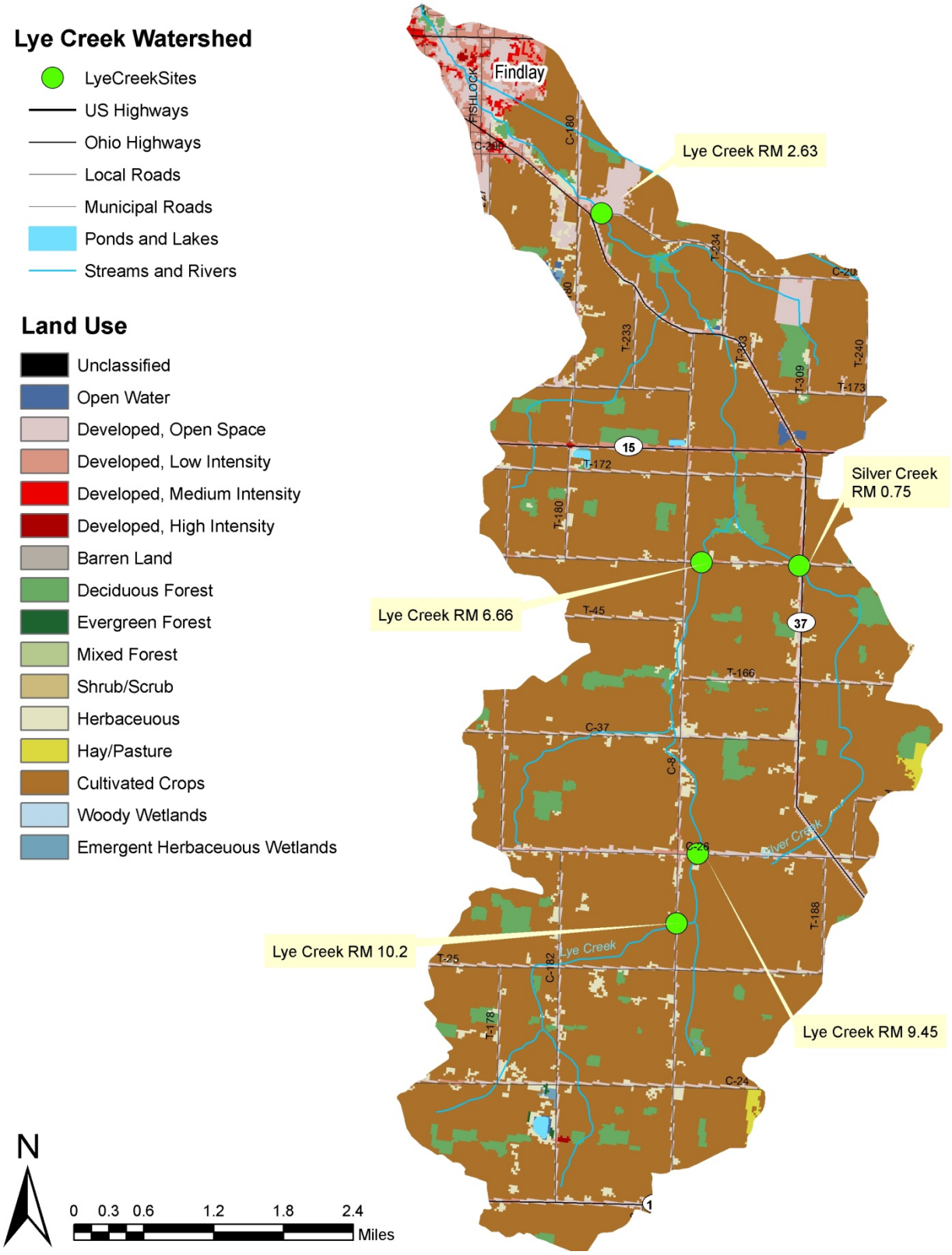
BIOCRITERIA (ECBP)			HABITAT		
INDEX - Site Type	WWH	EWH	QHEI Score (<20 mi^2 sites)	QHEI Score (>20 mi^2 sites)	Quality
IBI: Headwater	**40**	50	≥70	≥75	Excellent
IBI: Wading	**40**	50	55-69	60-74	Good
MIwb: Wading	**8.3**	9.4	43-54	45-59	Fair
ICI	**36**	46	<43/<30	<45/<30	Poor/Very Poor

a Narrative assessment used in lieu of ICI score based on qualitative sampling data when no quantitative data collected (F-fair, LF-low fair, P-poor, VP-very poor).

* Significant departure from ecoregion biocriterion(≥4 IBI or ICI units and ≥0.5 MIwb units); poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤4 IBI or ICI units and ≤0.5 MIwb units).

Figure 1. Sampling locations (biological, physical habitat, and stream chemistry) and current land uses in the Lye Creek (Blanchard River) HUC-12 watershed study area, 2012-2013.



METHODS

All chemical, physical, and biological field, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Surface Water Field Sampling Manual for Water Column Chemistry, Bacteria and Flows (Ohio Environmental Protection Agency 2013), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio Environmental Protection Agency 1987b, 1989a, 1989b, 2014a, 2014b), The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989), and Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (Ohio Environmental Protection Agency 2006).

Determining Use Attainment

Use attainment status is a term describing the degree to which environmental indicators are either above or below criteria specified by the Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1). Assessing aquatic use attainment status involves a primary reliance on the Ohio EPA biological criteria (OAC 3745-1-07; Table 7-15). These are confined to ambient assessments and apply to rivers and streams outside of mixing zones. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community. Three attainment status results are possible at each sampling location - full, partial, or non-attainment. Full attainment means that all of the applicable indices meet the biocriteria. Partial attainment means that one or more of the applicable indices fails to meet the biocriteria. Non-attainment means that none of the applicable indices meet the biocriteria or one of the organism groups reflects poor or very poor performance. An aquatic life use attainment table (Table 2) is constructed based on the sampling results and is arranged from upstream to downstream and includes the sampling locations indicated by river mile, the applicable biological indices, the use attainment status (*i.e.,* full, partial, or non-attainment), the Qualitative Habitat Evaluation Index (QHEI), and causes and sources if impairment is indicated. Biological results for sites in the Lye Creek (Blanchard River) HUC-12 watershed study area were compared to Warmwater Habitat (WWH) biocriteria established for the Eastern Corn Belt Plains ecoregion of Ohio.

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and from natural habitats at one 2013 Lye Creek site near its confluence with the Blanchard River and from natural habitats only at the other Lye Creek and Silver Creek sites sampled in both 2012 and 2013 (Figure 1). The artificial substrate collection provided quantitative data and consisted of a composite sample of five modified Hester-Dendy multiple-plate samplers colonized for six weeks. The natural habitat sampling effort provided presence/absence data and consisted of an inventory of all observed macroinvertebrate taxa from natural habitats at each site with no attempt to quantify populations other than notations on the predominance of specific taxa or taxa groups within major macrohabitat types (*e.g.,* riffle, run, pool, margin). Detailed discussion of macroinvertebrate field and laboratory procedures is detailed in Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio Environmental Protection Agency 1989a, 2014b).

Fish Community Assessment

Fish were sampled with one pass each in both 2012 and 2013 at four headwater Lye Creek and Silver Creek sites and with two passes each in 2012 and 2013 at the one wading Lye Creek site near its confluence with the Blanchard River using pulsed DC headwater or wading electrofishing methods depending on watershed size at each sampling zone (Figure 1). Fish were processed in the field which included identifying each individual to species, counting individuals at all sites, weighing individuals at

wading sites, and recording any external abnormalities. Discussion of the fish community assessment methodology used in this report is detailed in Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio Environmental Protection Agency 1989a, 2014b).

Physical Habitat Assessment

Aquatic habitat at sites in the Lye Creek (Blanchard River) HUC-12 watershed study area was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989; Ohio Environmental Protection Agency 2006). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values higher than 60 are generally conducive to the establishment of warm water faunas while those which score in excess of 75 often typify habitat conditions which have the ability to support exceptional faunas. Habitat assessments using QHEI protocols were completed at each Lye Creek (Blanchard River) HUC-12 fish sampling reach (Figure 1).

Chemical Water Quality

Six surface water chemistry grab samples were collected from each of five Lye Creek (Blanchard River) HUC-12 watershed sampling locations between April 25, 2013 and August 12, 2013 (Figure 1). Stations were established in free-flowing sections of the streams and were primarily collected from bridge crossings. Surface water samples were collected directly into appropriate containers, preserved and delivered to Ohio EPA's Environmental Services laboratory. Collected water was preserved using appropriate methods, as outlined in the Surface Water Field Sampling Manual for Water Column Chemistry, Bacteria and Flows (Ohio Environmental Protection Agency 2013).

RESULTS

Macroinvertebrate Community

Macroinvertebrate community sampling was conducted at four sites in Lye Creek during 2012 with follow-up sampling at each of the sites and one additional site (Silver Creek) in 2013. Quantitative artificial substrate data were collected and an Invertebrate Community Index (ICI) score was determined for one 2013 Lye Creek site at river mile (RM) 2.62, the most downstream site; qualitative, natural substrate collections were made and relevant data attributes were calculated for all other Lye Creek collections and the one Silver Creek collection in 2013. Results are summarized in Table 3 which also includes historical data collected from three Lye Creek sites in 2005. ICI metrics and scores for the most downstream Lye Creek site and raw data for all sites are attached as Appendix Tables 1 and 2. Sampling locations were evaluated using the Warmwater Habitat (WWH) aquatic life use narrative or the WWH biocriterion codified in the Ohio Administrative Code (OAC 3745-1-07, Table 7-15).

Macroinvertebrate communities in Lye Creek did not meet WWH aquatic life use expectations at any of the four sampling locations in both 2012 and 2013. In 2013, the uppermost sampling location at RM 10.2 supported nine EPT taxa (*i.e.*, insects commonly known as mayflies, stoneflies, and caddisflies, generally considered sensitive to pollution), which was the highest number of EPT taxa for all the sites on Lye Creek. This community was evaluated as fair and supported a higher number of EPT taxa because there was habitat diversity due to riffles in the vicinity of the bridge. In 2012, this same site

(RM 10.2) had no EPT taxa which may have been due to drought conditions and its attendant effects on habitat conditions that year. The next two downstream sampling locations at RMs 9.45 and 6.66 were evaluated as poor and low fair, respectively, in both 2005 and 2013. Though RM 9.45 had the highest number of qualitative taxa for all the sites in 2013, it had the lowest number of EPT taxa with only four and there were no pollution sensitive taxa. The most downstream sampling location (RM 2.63) had seven EPT in 2013 and an ICI of 24 (fair); this score was very similar to the score of 20 determined in 2005. At all Lye Creek sites, pollution tolerant macroinvertebrate taxa predominated the communities.

Silver Creek also did not meet WWH expectations in 2013. At the one site sampled (RM 0.75), the macroinvertebrate community was evaluated as poor. This site had no pollution sensitive species and only three EPT taxa. Abundant algae was noted on the field sheets as a significant issue.

Table 3. Summary of macroinvertebrate data collected by Ohio EPA from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Lye Creek (Blanchard River) HUC-12 watershed study area, 2012-2013. Also included are historical data collected from Lye Creek during a 2005 Blanchard River basin survey. The applicable aquatic life use designation is Warmwater Habitat (WWH) for all sites.

Absolute Location Point River Mile	Density (Number/ft^2)	Qual. Taxa	Pollution Sensitive Taxa	Pollution Tolerant Taxa	Qual. EPT[a]	ICI[b]	Narrative Evaluation
Lye Creek - 2013							
10.20	-	41	2	16	9	F*	Fair
9.45	-	44	0	20	4	P*	Poor
6.66	-	39	2	16	6	LF*	Low Fair
2.63	381	42	4	21	6	24*	Fair
Lye Creek - 2012							
10.20	-	13	0	8	0	VP*	Very Poor
9.40	-	22	0	14	2	P*	Poor
6.70	-	23	0	13	1	P*	Poor
2.60	-	29	1	18	3	P*	Poor
Lye Creek - 2005							
9.40	-	37	1	18	1	P*	Poor
6.70	-	27	1	10	5	LF*	Low Fair
2.60	1029	25	2	11	4	20*	Fair
Silver Creek - 2013							
0.75	-	31	0	20	3	P*	Poor

Ecoregion Biocriterion: Eastern Corn Belt Plains (ECBP)		
INDEX	WWH	EWH
ICI	36	46

a Qual. EPT=Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa richness, a measure of pollution sensitive organisms collected from natural substrates at the sampling location.

b Narrative assessment used in lieu of ICI score based on qualitative sampling data when no quantitative data are collected.

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.

ns Nonsignificant departure from biocriterion (≤4 ICI units).

Fish Community and Physical Habitat

A total of 5,046 fish representing 32 species and 2 hybrids were collected from the five sites in the Lye Creek watershed in both 2012 and 2013. Results are summarized in Table 4; attributes of physical habitat, as scored by the QHEI for each fish zone, are tabulated in Table 5. IBI metrics and scores are presented in Appendix Tables 3 and 4 and relative numbers and species collected per location are presented in Appendix Table 5. Sampling locations were evaluated using Warmwater Habitat (WWH) biocriteria codified in the Ohio Administrative Code (OAC 3745-1-07, Table 7-15).

Physical habitat in the Lye Creek study area ranged from fair to very poor quality due to the extensive amount of channel modification throughout. The two upstream sites (RMs 10.20 and 9.45) scored much worse in 2012 than 2013 due to drought-like conditions which left many habitat features high and dry. There was a general lack of flow in Lye Creek during the 2012 sampling period. South of Houcktown (RM 10.20), the flow in Lye Creek was minimal, down to isolated pools which appeared to be ground water fed. Intermittent flow and dry channel sections were also encountered upstream from Hancock Co. Rd. 205 (RM 2.63) at the most downstream sampling location. The habitat in Silver Creek ranged from poor to very poor and was also characterized by physical channel modifications. Drainage area (4.1 mi^2) at the Silver Creek site (RM 0.80) was similar to that of the most upstream site on Lye Creek (4.9 mi^2), but did not appear to have a rejuvenating ground water seep as the fish community performed poorly here.

Figure 2. The over-wide channel, sluggish flow, agricultural runoff and lack of riparian shading in Lye Creek at Hancock Co. Rd. 205 (RM 2.63) provide ideal conditions for primary productivity as demonstrated above.

Fish communities in Lye Creek fully met the existing WWH aquatic life use criteria at three of the four sampling locations despite the lack of good quality habitat. Partial use attainment was scored at the Hancock Co. Rd. 205 (RM 2.63) sampling location due to low MIwb scores in both 2012 and 2013 samples. The September 24, 2013, sampling pass at this location had the lowest relative number of fish with less than 200 individuals. In contrast, Lye Creek at RM 9.45 had the highest relative number of fish in both 2012 and 2013 and scored at an exceptional level (IBI=50) in 2013. During 2013, total diversity at the Lye Creek sites ranged from 17 to 22 species and collections included one to three moderately sensitive to sensitive species (longear sunfish, logperch, rainbow darter, and/or silver shiner).

The 2012 fish community in Silver Creek (RM 0.80) was poor (IBI=22) and had the highest numbers of tolerant and pioneering fish species caught in the study area. This impairment was thought to have been from the drought-like conditions encountered during the 2012 field season. However, Silver Creek fully attained the existing WWH aquatic life use criteria in 2013 (IBI=44) having the lowest number of tolerant and pioneering fish caught among all samples in the study area.

The benefit of having samples from back to back summers with contrasting precipitation has demonstrated how the lack of riparian shading and habitat can exacerbate desiccated conditions within the smaller drainages of the Lye Creek watershed (*i.e.*, Silver Creek). It seemed likely that the Lye Creek headwaters (RM 10.20) did not experience a significant difference in IBI score between years because of the stabilizing effect of flow augmentation from adequate sources of ground water.

Table 4. Fish community summaries based on pulsed D.C. headwater and wading electrofishing sampling conducted by Ohio EPA in the Lye Creek HUC-12 watershed study area, 2012-2013. Also included are historical data collected from Lye Creek during a 2005 Blanchard River basin survey. The applicable aquatic life use designation is Warmwater Habitat (WWH) for all sites.

River Mile	Site Type	Species (Total)	Species (Sensitive)	Relative Number[a]	QHEI	Index of Biotic Integrity	Modified Index of Well-being[b]	Narrative Evaluation
Lye Creek - 2013								
10.20	Headwater	17	3	378.0	48.0	42	-	Good
9.45	Headwater	22	3	1600.0	49.5	50	-	Exceptional
6.66	Headwater	19	3	640.0	48.0	42	-	Good
2.63 (Pass 1)	Wading	15	1	362.0	39.3	36ns	7.9ns	Marginally good
2.63 (Pass 2)	Wading	14	1	160.0	-	36ns	6.4*	Marginally good/Fair
Lye Creek – 2012								
10.20	Headwater	11	0	768.0	28.0	44	-	Good
9.45	Headwater	22	4	2200.7	32.5	44	-	Good
6.66	Headwater	22	3	490.5	46.3	40	-	Good
2.63 (Pass 1)	Wading	21	2	732.0	45.5	42	8.0ns	Good/Marginally good
2.63 (Pass 2)	Wading	17	1	814.0	37.0	38ns	7.8ns	Marginally good/Fair
Lye Creek – 2005								
2.63	Wading	25	4	784.5	39.5	32*	6.4*	Fair
Silver Creek – 2013								
0.80	Headwater	15	1	746.0	26.0	44	-	Good
Silver Creek – 2012								
0.80	Headwater	7	0	553.9	34.5	22*	-	Poor

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)		
INDEX – Site Type	WWH	EWH
IBI: Headwater	40	50
IBI: Wading	40	50
MIwb: Wading	8.3	9.4

a Relative numbers are per 300 meters (headwater and wading methods).
b MIwb not applicable at sites with < 20 mi^2 drainage areas.
* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
ns Non-significant departure from ecoregion biocriterion (≤4 IBI units or ≤0.5 MIwb units).

Table 5. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for sampling sites in the Lye Creek HUC-12 watershed study area, 2012-2013, and one site assessed in 2005.

Key QHEI Components

River Mile	QHEI	Habitat Rating	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max. Depth >40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	MWH Attributes – *High Influence*: Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD,HW sites)	**Total High Influence Attributes**	MWH Attributes – *Moderate Influence*: Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total Moderate Influence Attributes**	**(MWH H.I.+1)/ (WWH+1) Ratio**	**(MWH M.I.+1)/ (WWH+1) Ratio**
Lye Creek (04-190-000) Year: 2012																																	
10.20	28.0	Very Poor						■					1	◆	◆	◆		◆	4		●			●			●	●	●		●	6	2.50	5.50
9.40	32.5	Poor						■			■		2	◆	◆	◆			3		●			●				●	●		●	6	1.33	3.00
6.70	46.3	Fair		■				■			■		3	◆		◆			2		●			●				●	●	●		5	0.75	2.00
2.63	45.5	Fair						■			■		2	◆	◆				2		●		●	●	●			●	●		●	7	1.00	3.33
2.63	37.0	Fair		■				■					2	◆			◆	◆	3		●			●	●		●	●	●		●	7	1.33	3.67
Lye Creek (04-190-000) Year: 2013																																	
10.20	48.0	Fair		■				■					2	◆		◆	◆	◆	4	●	●			●				●	●	●		6	1.67	3.67
9.40	49.5	Fair		■				■			■		3			◆	◆		2	●	●			●				●	●	●		6	0.75	2.25
6.70	48.0	Fair		■				■					2			◆	◆	◆	3	●	●			●				●	●	●		6	1.33	3.33
2.63	39.3	Poor		■							■		2	◆			◆		2		●			●	●			●	●		●	6	1.00	3.00
Lye Creek (04-190-000) Year: 2005																																	
2.63	39.5	Poor		■				■			■		3	◆			◆		2		●			●	●			●	●		●	6	0.75	2.25
Silver Creek (04-191-000) Year: 2012																																	
0.80	34.5	Poor		■				■					2	◆	◆	◆		◆	4		●			●				●	●	●		5	1.67	3.33
Silver Creek (04-191-000) Year: 2013																																	
0.80	26.0	Very Poor		■							■		2	◆	◆	◆	◆		4		●			●			●	●			●	5	1.67	3.33

Water Quality

Surface water grab samples were collected from the Lye Creek watershed at five locations on six occasions between April 25 and August 12, 2013. Surface water samples were analyzed for nutrients including nitrate+nitrite, ammonia, TKN, total phosphorus, and dissolved orthophosphate. Additional parameter coverage included suspended and dissolved solids, alkalinity, chloride, sulfate, and field meter measurements including dissolved oxygen, pH, conductivity, and temperature. Parameters that exceeded Ohio WQS criteria are reported in Table 6 and nutrient measurements that exceeded statewide targets are reported in Table 7; the full data set is compiled in Appendix Table 6.

Three dissolved oxygen measurements below the WWH aquatic life use average WQS criterion were observed in June at three of the four Lye Creek sampling locations; one measurement below the average criterion and two below the minimum dissolved oxygen criterion were also observed at the one Silver Creek site on two days in June and one in August (Table 6). Biological activity, water flow/turbulence, pollution, and stream temperature can influence the dissolved oxygen in streams. During summer months, flow is often decreased, pollutant sources are less diluted, water temperatures are higher, and biological activities are increased. In the Lye Creek watershed, conditions such as these likely contributed to the generally low dissolved oxygen levels and criterion exceedances measured at the three Lye Creek and one Silver Creek sites.

The Lye Creek watershed is predominantly surrounded by agricultural land use and elevated nitrate+nitrite and total phosphorus levels above statewide targets were observed at all five locations sampled in 2013 (Table 7, Figure 3). Nitrate+nitrite geometric means in Lye Creek gradually increased from upstream to downstream then declined slightly at the last sampling location at RM 2.63 nearest the confluence with the Blanchard River. Nitrate+nitrite levels increased as additional nitrate+nitrite load entered the stream in excess of what could be assimilated by the biomass. Total phosphorus geometric means were elevated above the statewide target at the upstream sampling locations at RMs 10.20 and 9.45 and then decreased below the target at the two downstream sampling locations and in Silver Creek near the confluence with Lye Creek. Ammonia levels throughout the entire watershed did not exceed the Ohio WQS criteria at any of the locations sampled.

A submersible continuous monitoring water quality sonde was deployed from August 13-15, 2013, at Lye Creek Co. Rd. 205 (RM 2.63) to record hourly readings of four field water quality parameters: temperature, pH, dissolved oxygen, and conductivity. No exceedances of Ohio WQS criteria were captured during this time period. However, wide diel ranges of dissolved oxygen (>13.5 mg/L) were observed that are indicative of high primary production and hypereutrophic conditions (Figure 4 and Table 8). The high fluctuations observed and the mild temperatures during the survey implied that, in more severe conditions, the dissolved oxygen minimums might fall below the WQS criterion. The pH range was approaching one (1) S.U./day which further indicated that primary production was at a high level as pH fluctuations reflected changing CO_2 concentrations as plants photosynthesized.

Table 6. Exceedances of Ohio Water Quality Standards criteria (OAC 3745-1) for parameters measured in the Lye Creek (Blanchard River) HUC-12 watershed study area, 2013.

Stream RM	Location	Parameter (value – mg/l unless noted)
Lye Creek		
10.20	Hancock Co. Rd. 8	temperature – 18.1°C[a] (May 9) dissolved oxygen – 4.46[b] (June 6)
9.45	Hancock Co. Rd. 26	dissolved oxygen – 4.36[b] (June 6)
2.63	Hancock Co. Rd. 205	dissolved oxygen – 4.84[b] (June 6)
Silver Creek		
0.74	Jackson Twp. Rd. 168	dissolved oxygen – 3.19[c] (June 6), 3.74[c] (June 19), 4.57[b] (August 12)

a Exceedance of the average May temperature criterion (17.8°C) for streams in the Lake Erie basin.
b Exceedance of the outside mixing zone average dissolved oxygen criterion (5.0 mg/l) for WWH streams.
c Exceedance of the outside mixing zone minimum dissolved oxygen criterion (4.0 mg/l) for WWH streams.

Table 7. Seasonal geometric mean values (mg/l) for nutrients (nitrate+nitrite and total phosphorus) calculated from six grab samples collected at five sites in the Lye Creek (Blanchard River) HUC-12 watershed, 2013. Yellow shaded values are above statewide recommended geometric mean targets (Ohio EPA, 1999)[1].

Stream RM	Location	Parameter (Geometric Mean [mg/l])
Lye Creek		
10.20	Hancock Co. Rd. 8 (headwater)	total phosphorus (0.100); nitrate+nitrite (1.15)
9.45	Hancock Co. Rd. 26 (headwater)	total phosphorus (0.106); nitrate+nitrite (1.35)
6.66	Jackson Twp. Rd. 168 (headwater)	total phosphorus (0.036); nitrate+nitrite (2.86)
2.63	Hancock Co. Rd. 205 (wading)	total phosphorus (0.042); nitrate+nitrite (1.49)
Silver Creek		
0.74	Jackson Twp. Rd. 168 (headwater)	total phosphorus (0.065); nitrate+nitrite (3.07)

[1] Target geometric means for total phosphorus are 0.08 mg/l (WWH) for headwater stream sites and 0.10 mg/l (WWH) for wading stream sites; target geometric means for nitrate+nitrite are 1.0 mg/l (WWH) for both headwater and wading stream sites.

Figure 3. Plot of seasonal geometric mean values (mg/l) for nutrients (nitrate+nitrite and total phosphorus) calculated from six grab samples collected at five sites in the Lye Creek (Blanchard River) HUC-12 watershed, 2013.

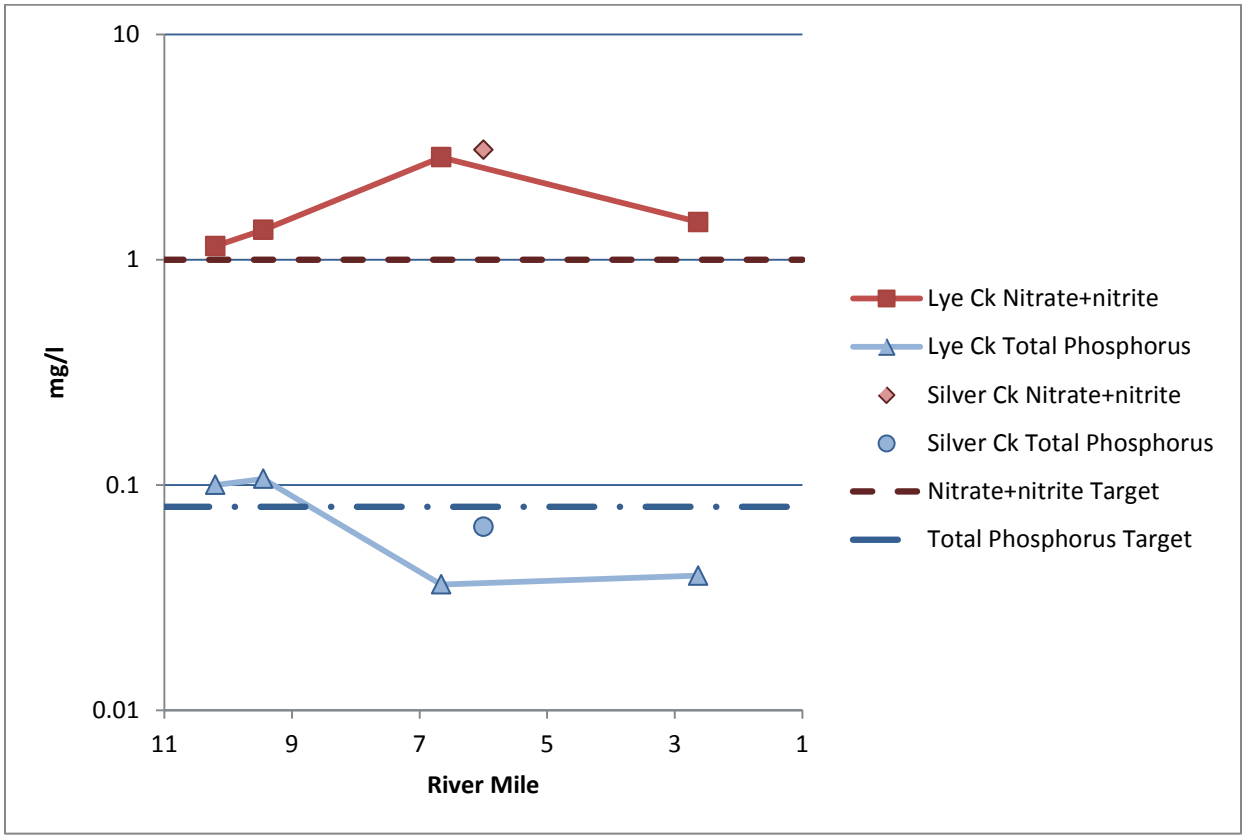


Figure 4. Plot of continuous field parameters collected with a submersible water quality sonde at Lye Creek Co. Rd. 205 (RM 2.63), August 13-15, 2013, with sensors tracking temperature (Temp), dissolved oxygen (LDO), pH, and specific conductivity (SpCond).

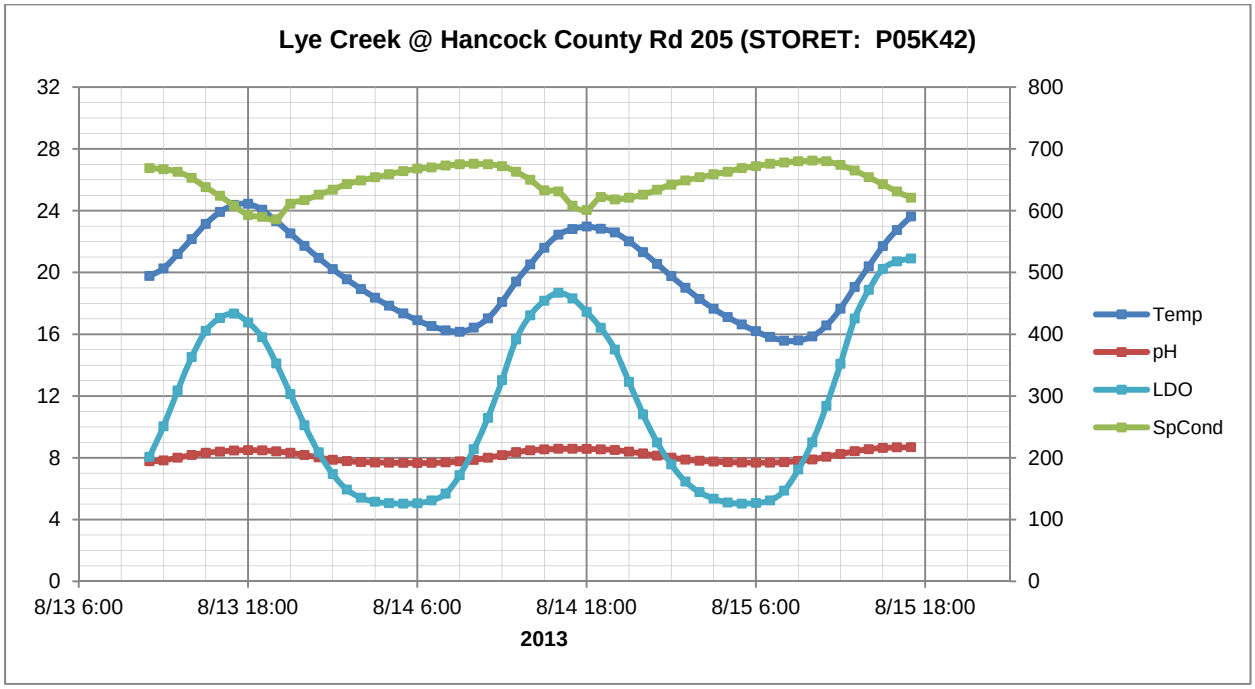


Table 8. Summary of water quality parameters collected with a submersible water quality sonde at Lye Creek Co. Rd. 205 (RM 2.63), August 13-15, 2013.[1]

	Dissolved Oxygen				pH			
	Min	Max	Average	Range	Min	Max	Average	Range
Range A	5.03	17.34	9.90	12.31	7.66	8.49	8.00	0.83
Range B	5.03	18.68	10.83	13.65	7.66	8.58	8.11	0.92
Range C	5.03	18.68	11.00	13.65	7.68	8.58	8.58	0.90

	Temperature				Specific Conductivity	
	Min	Max	Average	Range	Max	Average
Range A	16.16	24.44	20.26	8.28	676	642
Range B	16.16	22.97	19.43	6.81	676	648
Range C	15.58	22.97	22.97	7.39	681	681

1 Three 24-hour cycles capture unique ranges between critical values during a 48-hour sonde deployment. Range A is from 8/13/13 at 11:00 am to 8/14/13 at 10:00 am. Range B is from 8/14/13 at 4:00 am to 8/15/13 at 3:00 am. Range C is from 8/14/13 at 4:00 pm to 8/15/13 at 3:00 pm.

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APPENDICES

Appendix Table 1. Invertebrate Community Index (ICI) metrics and scores for samples collected with quantitative methods from Lye Creek, 2013 and 2005.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco-region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms			
Lye Creek (04-190)													
Year: 2013													
2.63	**25.7**	**38(6)**	**2(0)**	**1(2)**	**19(4)**	**1.2(2)**	**0.1(2)**	**1.4(2)**	**92.0(0)**	**9.8(4)**	**6(2)**	**5**	**24**
Year: 2005													
2.60	**25.7**	**32(4)**	**2(0)**	**4(6)**	**13(2)**	**4.6(2)**	**1.0(2)**	**0.2(2)**	**89.4(0)**	**79.0(0)**	**4(2)**	**5**	**20**

Appendix Table 2. Macroinvertebrate community data collected from sites in Lye Creek and Silver Creek, 2013, 2012, and 2005.

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 06/18/2013 River Code: 04-190 RM: 10.20 Hancock Co. Rd. 8

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04935	*Erpobdella punctata punctata*	+
04964	*Erpobdella microstoma*	+
08220	*Orconectes (Gremicambarus) immunis*	+
08601	*Hydrachnidia*	+
11020	*Acerpenna pygmaea*	+
11120	*Baetis flavistriga*	+
11200	*Callibaetis sp*	+
13000	*Leucrocuta sp*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
17200	*Caenis sp*	+
22300	*Argia sp*	+
28705	*Pachydiplax longipennis*	+
52200	*Cheumatopsyche sp*	+
53800	*Hydroptila sp*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
69400	*Stenelmis sp*	+
74100	*Simulium sp*	+
77500	*Conchapelopia sp*	+
78200	*Larsia sp*	+
78655	*Procladius (Holotanypus) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
83003	*Dicrotendipes fumidus*	+
83840	*Microtendipes pedellus group*	+
84001	*Parachironomus potamogeti*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84470	*Polypedilum (P.) illinoense*	+
84750	*Stictochironomus sp*	+
85500	*Paratanytarsus sp*	+
85625	*Rheotanytarsus sp*	+
85800	*Tanytarsus sp*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
95907	*Gyraulus (Torquis) parvus*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 41

No. Qualitative Taxa: 41 ICI: Fair

Number of Organisms: 0 Qual EPT: 9

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 06/19/2013 River Code: 04-190 RM: 9.45 Hancock Co. Rd. 26

Taxa Code	Taxa	Quant/Qual
01320	*Hydra sp*	+
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04685	*Placobdella ornata*	+
04930	*Erpobdella sp*	+
07701	*Cambaridae*	+
08601	*Hydrachnidia*	+
11200	*Callibaetis sp*	+
12501	*Heptageniidae*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
52200	*Cheumatopsyche sp*	+
53800	*Hydroptila sp*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
72700	*Anopheles sp*	+
74100	*Simulium sp*	+
74501	*Ceratopogonidae*	+
77500	*Conchapelopia sp*	+
78200	*Larsia sp*	+
78655	*Procladius (Holotanypus) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
80510	*Cricotopus (Isocladius) sylvestris group*	+
82730	*Chironomus (C.) decorus group*	+
82820	*Cryptochironomus sp*	+
83002	*Dicrotendipes modestus*	+
83040	*Dicrotendipes neomodestus*	+
83051	*Dicrotendipes simpsoni*	+
83158	*Endochironomus nigricans*	+
83300	*Glyptotendipes (G.) sp*	+
83840	*Microtendipes pedellus group*	+
84001	*Parachironomus potamogeti*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84450	*Polypedilum (Uresipedilum) flavum*	+
84470	*Polypedilum (P.) illinoense*	+
84750	*Stictochironomus sp*	+
85400	*Micropsectra sp*	+
85500	*Paratanytarsus sp*	+
85800	*Tanytarsus sp*	+
85814	*Tanytarsus glabrescens group*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
98600	*Sphaerium sp*	+
99100	*Pyganodon grandis*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 44

No. Qualitative Taxa: 44 ICI: Poor

Number of Organisms: 0 Qual EPT: 4

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 06/19/2013 River Code: 04-190 RM: 6.66 Jackson Twp. Rd. 168

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03040	*Fredericella sp*	+
03600	*Oligochaeta*	+
04930	*Erpobdella sp*	+
05900	*Lirceus sp*	+
06201	*Hyalella azteca*	+
08250	*Orconectes (Procericambarus) rusticus*	+
08601	*Hydrachnidia*	+
11020	*Acerpenna pygmaea*	+
11200	*Callibaetis sp*	+
13000	*Leucrocuta sp*	+
13400	*Stenacron sp*	+
28208	*Erythemis simplicicollis*	+
28500	*Libellula sp*	+
52200	*Cheumatopsyche sp*	+
53800	*Hydroptila sp*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
67000	*Helophorus sp*	+
68702	*Dubiraphia bivittata*	+
69400	*Stenelmis sp*	+
74100	*Simulium sp*	+
74501	*Ceratopogonidae*	+
77500	*Conchapelopia sp*	+
77800	*Helopelopia sp*	+
78655	*Procladius (Holotanypus) sp*	+
80420	*Cricotopus (C.) bicinctus*	+
82820	*Cryptochironomus sp*	+
83040	*Dicrotendipes neomodestus*	+
83840	*Microtendipes pedellus group*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84750	*Stictochironomus sp*	+
85625	*Rheotanytarsus sp*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
95907	*Gyraulus (Torquis) parvus*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
98200	*Pisidium sp*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 39

No. Qualitative Taxa: 39 ICI: Low Fair

Number of Organisms: 0 Qual EPT: 6

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 07/31/2013 River Code: 04-190 RM: 2.63

Hancock Co. Rd. 205

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	33	
01801	*Turbellaria*	1122	+
03600	*Oligochaeta*	176	+
04666	*Helobdella papillata*	63	+
04935	*Erpobdella punctata punctata*	1	+
04964	*Erpobdella microstoma*		+
06201	*Hyalella azteca*	37	+
08601	*Hydrachnidia*	18	+
11200	*Callibaetis sp*		+
13521	*Stenonema femoratum*	2	
17200	*Caenis sp*	20	+
22001	*Coenagrionidae*	1	+
22300	*Argia sp*		+
27307	*Epitheca (Epicordulia) princeps*		+
28955	*Plathemis lydia*		+
42700	*Belostoma sp*		+
43300	*Ranatra sp*		+
45400	*Trichocorixa sp*		+
53800	*Hydroptila sp*	2	+
58505	*Helicopsyche borealis*		+
59555	*Oecetis inconspicua complex sp F (sensu Floyd, 1995)*		+
59730	*Triaenodes melaca*		+
60900	*Peltodytes sp*		+
65800	*Berosus sp*	42	+
68702	*Dubiraphia bivittata*	59	+
69400	*Stenelmis sp*		+
74501	*Ceratopogonidae*		+
77120	*Ablabesmyia mallochi*	2	
77130	*Ablabesmyia rhamphe group*	3	
77355	*Clinotanypus pinguis*		+
77800	*Helopelopia sp*	2	
78655	*Procladius (Holotanypus) sp*	2	+
80370	*Corynoneura lobata*	5	
80420	*Cricotopus (C.) bicinctus*		+
81259	*Nanocladius (N.) "rectinervis" (sensu Simpson and Bode, 1980)*	14	
82121	*Thienemanniella lobapodema*	2	
82820	*Cryptochironomus sp*		+
82885	*Cryptotendipes pseudotener*	2	
83000	*Dicrotendipes sp*	2	
83002	*Dicrotendipes modestus*	8	
83040	*Dicrotendipes neomodestus*	26	+
84210	*Paratendipes albimanus or P. duplicatus*	8	+
84300	*Phaenopsectra obediens group*	3	
84470	*Polypedilum (P.) illinoense*	5	
84520	*Polypedilum (Tripodura) halterale group*	2	+
84800	*Tribelos jucundum*	8	+
84960	*Pseudochironomus sp*	2	+
85800	*Tanytarsus sp*	7	
85821	*Tanytarsus glabrescens group sp 7*	20	
93200	*Hydrobiidae*	133	+
95100	*Physella sp*	6	+
95907	*Gyraulus (Torquis) parvus*	58	+
96264	*Planorbella (Pierosoma) pilsbryi*	1	
98200	*Pisidium sp*	6	+
98600	*Sphaerium sp*	1	+
99100	*Pyganodon grandis*		+
99240	*Lasmigona complanata*		+
99860	*Lampsilis radiata luteola*		+

No. Quantitative Taxa: 38 Total Taxa: 58

No. Qualitative Taxa: 42 ICI: **24**

Number of Organisms: 1904 Qual EPT: 6

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek
Hancock Co. Rd. 8

Collection Date: 08/08/2012 River Code: 04-190 RM: 10.20

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04666	*Helobdella papillata*	+
08601	*Hydrachnidia*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
28955	*Plathemis lydia*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
69400	*Stenelmis sp*	+
82730	*Chironomus (C.) decorus group*	+
93200	*Hydrobiidae*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 13

No. Qualitative Taxa: 13 ICI: Very Poor

Number of Organisms: 0 Qual EPT: 0

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 08/08/2012 River Code: 04-190 RM: 9.40

Hancock Co. Rd. 26

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
08601	*Hydrachnidia*	+
11200	*Callibaetis sp*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
28208	*Erythemis simplicicollis*	+
28500	*Libellula sp*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
69400	*Stenelmis sp*	+
72700	*Anopheles sp*	+
78200	*Larsia sp*	+
82730	*Chironomus (C.) decorus group*	+
82770	*Chironomus (C.) riparius group*	+
83300	*Glyptotendipes (G.) sp*	+
84000	*Parachironomus sp*	+
84020	*Parachironomus carinatus*	+
93200	*Hydrobiidae*	+
95907	*Gyraulus (Torquis) parvus*	+
96120	*Menetus (Micromenetus) dilatatus*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 22

No. Qualitative Taxa: 22 ICI: Poor

Number of Organisms: 0 Qual EPT: 2

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 08/09/2012 River Code: 04-190 RM: 6.70 Jackson Twp. Rd. 168

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
04666	*Helobdella papillata*	+
04685	*Placobdella ornata*	+
04964	*Erpobdella microstoma*	+
06201	*Hyalella azteca*	+
08250	*Orconectes (Procericambarus) rusticus*	+
08601	*Hydrachnidia*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
23704	*Anax junius*	+
28955	*Plathemis lydia*	+
42700	*Belostoma sp*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
68702	*Dubiraphia bivittata*	+
69400	*Stenelmis sp*	+
72700	*Anopheles sp*	+
74501	*Ceratopogonidae*	+
77355	*Clinotanypus pinguis*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
98600	*Sphaerium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 23

No. Qualitative Taxa: 23 ICI: Poor

Number of Organisms: 0 Qual EPT: 1

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 08/09/2012 River Code: 04-190 RM: 2.60 Hancock Co. Rd. 205

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03600	*Oligochaeta*	+
04666	*Helobdella papillata*	+
06201	*Hyalella azteca*	+
08601	*Hydrachnidia*	+
11200	*Callibaetis sp*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
23704	*Anax junius*	+
27600	*Epitheca (Tetragoneuria) sp*	+
28208	*Erythemis simplicicollis*	+
28500	*Libellula sp*	+
28705	*Pachydiplax longipennis*	+
28955	*Plathemis lydia*	+
42700	*Belostoma sp*	+
57400	*Neophylax sp*	+
60900	*Peltodytes sp*	+
67800	*Tropisternus sp*	+
68025	*Ectopria sp*	+
68702	*Dubiraphia bivittata*	+
72700	*Anopheles sp*	+
72900	*Culex sp*	+
77355	*Clinotanypus pinguis*	+
80510	*Cricotopus (Isocladius) sylvestris group*	+
82800	*Cladopelma sp*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
96900	*Ferrissia sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 29

No. Qualitative Taxa: 29 ICI: Poor

Number of Organisms: 0 Qual EPT: 3

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 07/19/2005 River Code: 04-190 RM: 9.40 Hancock Co. Rd. 26

Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
08601	*Hydrachnidia*	+
17200	*Caenis sp*	+
22001	*Coenagrionidae*	+
22300	*Argia sp*	+
23704	*Anax junius*	+
28955	*Plathemis lydia*	+
60900	*Peltodytes sp*	+
65800	*Berosus sp*	+
66500	*Enochrus sp*	+
67100	*Hydrobius sp*	+
68300	*Cyphon sp*	+
68702	*Dubiraphia bivittata*	+
68708	*Dubiraphia vittata group*	+
68901	*Macronychus glabratus*	+
69400	*Stenelmis sp*	+
74501	*Ceratopogonidae*	+
77355	*Clinotanypus pinguis*	+
77800	*Helopelopia sp*	+
78200	*Larsia sp*	+
78401	*Natarsia species A (sensu Roback, 1978)*	+
78655	*Procladius (Holotanypus) sp*	+
82730	*Chironomus (C.) decorus group*	+
83040	*Dicrotendipes neomodestus*	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	+
84750	*Stictochironomus sp*	+
85800	*Tanytarsus sp*	+
93200	*Hydrobiidae*	+
95100	*Physella sp*	+
95907	*Gyraulus (Torquis) parvus*	+
96264	*Planorbella (Pierosoma) pilsbryi*	+
96900	*Ferrissia sp*	+
98600	*Sphaerium sp*	+
99100	*Pyganodon grandis*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 37

No. Qualitative Taxa: 37 ICI: Poor

Number of Organisms: 0 Qual EPT: 1

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 07/19/2005 River Code: 04-190 RM: 6.70 Jackson Twp. Rd. 168

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	+			
04935	*Erpobdella punctata punctata*	+			
04964	*Erpobdella microstoma*	+			
06201	*Hyalella azteca*	+			
08250	*Orconectes (Procericambarus) rusticus*	+			
08601	*Hydrachnidia*	+			
13400	*Stenacron sp*	+			
17200	*Caenis sp*	+			
22001	*Coenagrionidae*	+			
28955	*Plathemis lydia*	+			
53800	*Hydroptila sp*	+			
58505	*Helicopsyche borealis*	+			
59728	*Triaenodes marginatus*	+			
65800	*Berosus sp*	+			
68702	*Dubiraphia bivittata*	+			
68708	*Dubiraphia vittata group*	+			
69400	*Stenelmis sp*	+			
74501	*Ceratopogonidae*	+			
78130	*Labrundinia neopilosella*	+			
78600	*Pentaneura inconspicua*	+			
78655	*Procladius (Holotanypus) sp*	+			
84210	*Paratendipes albimanus or P. duplicatus*	+			
85800	*Tanytarsus sp*	+			
93200	*Hydrobiidae*	+			
95100	*Physella sp*	+			
95907	*Gyraulus (Torquis) parvus*	+			
96264	*Planorbella (Pierosoma) pilsbryi*	+			

No. Quantitative Taxa: 0 Total Taxa: 27

No. Qualitative Taxa: 27 ICI: Low Fair

Number of Organisms: 0 Qual EPT: 5

Ohio EPA Macroinvertebrate Collection

Site: Lye Creek

Collection Date: 08/30/2005 River Code: 04-190 RM: 2.60 Hancock Co. Rd. 205

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	1	
01801	*Turbellaria*	320	+
03600	*Oligochaeta*	4064	
04664	*Helobdella stagnalis*		+
04687	*Placobdella parasitica*		+
06201	*Hyalella azteca*	63	+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*	1	
11200	*Callibaetis sp*	2	
17200	*Caenis sp*	233	+
22001	*Coenagrionidae*	8	+
22300	*Argia sp*	2	
28001	*Libellulidae*	9	
28955	*Plathemis lydia*		+
45900	*Notonecta sp*		+
53800	*Hydroptila sp*	1	
54300	*Oxyethira sp*	1	
57400	*Neophylax sp*		+
58505	*Helicopsyche borealis*		+
59001	*Leptoceridae*	48	
59570	*Oecetis nocturna*		+
59580	*Oecetis persimilis*	1	
60900	*Peltodytes sp*		+
65800	*Berosus sp*	221	+
68702	*Dubiraphia bivittata*	9	+
69400	*Stenelmis sp*	2	
72700	*Anopheles sp*		+
74501	*Ceratopogonidae*	16	
77355	*Clinotanypus pinguis*		+
77750	*Hayesomyia senata or Thienemannimyia norena*	2	
78130	*Labrundinia neopilosella*	8	+
78200	*Larsia sp*	63	+
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	13	
82800	*Cladopelma sp*	2	
83002	*Dicrotendipes modestus*	13	+
83040	*Dicrotendipes neomodestus*	13	
83300	*Glyptotendipes (G.) sp*	4	
84540	*Polypedilum (Tripodura) scalaenum group*	2	
84960	*Pseudochironomus sp*		+
85625	*Rheotanytarsus sp*	2	
85821	*Tanytarsus glabrescens group sp 7*	2	
85840	*Tanytarsus sepp*	4	
86100	*Chrysops sp*		+
93200	*Hydrobiidae*	14	+
98200	*Pisidium sp*		+
98600	*Sphaerium sp*	1	+

No. Quantitative Taxa: 32 Total Taxa: 46

No. Qualitative Taxa: 25 ICI: **20**

Number of Organisms: 5145 Qual EPT: 4

Ohio EPA Macroinvertebrate Collection

Site: Silver Creek
Jackson Twp. Rd. 168

Collection Date: 06/18/2013 River Code: 04-191 RM: 0.75

Taxa Code	Taxa	Quant/Qual
03360	*Plumatella sp*	+
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
04930	*Erpobdella sp*	+
05900	*Lirceus sp*	+
06700	*Crangonyx sp*	+
08220	*Orconectes (Gremicambarus) immunis*	+
11200	*Callibaetis sp*	+
13400	*Stenacron sp*	+
13521	*Stenonema femoratum*	+
22001	*Coenagrionidae*	+
60900	*Peltodytes sp*	+
66500	*Enochrus sp*	+
68702	*Dubiraphia bivittata*	+
68707	*Dubiraphia quadrinotata*	+
74501	*Ceratopogonidae*	+
78655	*Procladius (Holotanypus) sp*	+
80380	*Corynoneura scutellata*	+
80510	*Cricotopus (Isocladius) sylvestris group*	+
82730	*Chironomus (C.) decorus group*	+
83003	*Dicrotendipes fumidus*	+
84210	*Paratendipes albimanus or P. duplicatus*	+
84470	*Polypedilum (P.) illinoense*	+
84750	*Stictochironomus sp*	+
85400	*Micropsectra sp*	+
85500	*Paratanytarsus sp*	+
85800	*Tanytarsus sp*	+
94400	*Fossaria sp*	+
95100	*Physella sp*	+
95907	*Gyraulus (Torquis) parvus*	+
98200	*Pisidium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 31

No. Qualitative Taxa: 31 ICI: Poor

Number of Organisms: 0 Qual EPT: 3

Appendix Table 3. Index of Biotic Integrity (IBI) metrics and scores for headwater site samples collected from Lye Creek and Silver Creek, 2013 and 2012.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Lye Creek - (04-190)																
Year: 2013																
10.20	E	08/29/2013	4.9	16(5)	5(3)	0(1)	3(3)	3(3)	5(5)	43(3)	18(3)	37(3)	46(5)	0.0(5)	216(3)	42
9.40	E	08/29/2013	7.8	21(5)	7(5)	0(1)	3(3)	3(3)	5(3)	28(5)	8(5)	23(5)	69(5)	0.0(5)	1154(5)	50
6.70	E	08/29/2013	12.2	17(5)	6(3)	0(1)	3(3)	4(3)	5(3)	40(3)	16(5)	27(5)	34(3)	0.0(5)	386(3)	42
Year: 2012																
10.20	E	08/22/2012	4.9	11(3)	6(5)	0(1)	0(1)	1(1)	3(3)	21(5)	11(5)	19(5)	77(5)	0.0(5)	608(5)	44
9.40	E	07/03/2012	7.8	20(5)	8(5)	0(1)	4(3)	4(5)	5(3)	43(3)	26(3)	31(3)	40(3)	0.0(5)	1206(5)	44
6.70	E	07/03/2012	12.2	20(5)	8(5)	0(1)	3(3)	2(1)	3(1)	43(3)	16(5)	31(3)	52(5)	0.0(5)	281(3)	40
Silver Creek - (04-191)																
Year: 2013																
0.80	E	08/28/2013	4.1	14(5)	5(3)	0(1)	1(1)	2(3)	2(1)	17(5)	7(5)	12(5)	43(5)	0.0(5)	618(5)	44
Year: 2012																
0.80	E	07/03/2012	4.1	7(3)	3(3)	0(1)	0(1)	1(1)	1(1)	85(1)	79(1)	82(1)	21(3)	0.0(5)	81(1)	22

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 4. Index of Biotic Integrity (IBI) metrics and scores for wading site samples collected from Lye Creek, 2013, 2012, and 2005.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Percent of Individuals: Simple Lithophils	Tolerant fishes	Omni-vores	Top carnivores	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)		IBI	Modified Iwb
Lye Creek - (04190)																		
Year: 2013																		
2.60	E	08/29/2013	26	14(3)	3(3)	1(1)	0(1)	1(1)	25(3)	22(5)	25(3)	1.1(3)	72(5)	0.0(5)	282(3)		36	7.9
2.60	E	09/24/2013	26	12(3)	3(3)	2(3)	0(1)	1(1)	14(1)	23(5)	19(3)	8.8(5)	71(5)	0.0(5)	124(1)	*	36	6.4
Year: 2012																		
2.60	E	07/02/2012	26	19(5)	4(5)	1(1)	0(1)	0(1)	39(5)	29(5)	23(3)	1.2(3)	70(5)	0.0(5)	521(3)		42	7.9
2.60	D	08/22/2012	26	16(3)	6(5)	0(1)	0(1)	0(1)	11(1)	25(5)	8(5)	3.2(3)	89(5)	0.0(5)	614(3)		38	na
Year: 2005																		
2.60	D	10/06/2005	26	24(5)	4(5)	1(1)	0(1)	5(5)	5(1)	73(1)	67(1)	0.2(1)	33(3)	0.0(5)	219(3)		32	6.4

na - Qualitative data, Modified Iwb not applicable.

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 5. Fish community data collected from sites in Lye Creek and Silver Creek, 2013, 2012, and 2005.

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2012**
River Mile: **10.20**	Location: Co. Rd. 8	Date Range: 08/22/2012
Time Fished: 2671 sec	Drainage: 4.9 sq mi	
Dist Fished: 0.15 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Creek Chub	N	G	N	T	23	46.00	5.99			
Striped Shiner	N	I	S		4	8.00	1.04			
Common Shiner	N	I	S		1	2.00	0.26			
Fathead Minnow	N	O	C	T	17	34.00	4.43			
Bluntnose Minnow	N	O	C	T	26	52.00	6.77			
Central Stoneroller	N	H	N		24	48.00	6.25			
Yellow Bullhead		I	C	T	7	14.00	1.82			
Tadpole Madtom		I	C		2	4.00	0.52			
Blackstripe Topminnow		I	M		272	544.00	70.83			
Green Sunfish	S	I	C	T	7	14.00	1.82			
Orangethroat Darter	D	I	S		1	2.00	0.26			
Mile Total					384	768.00				
Number of Species					11					
Number of Hybrids					0					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2013**
River Mile: **10.20**	Location: Co. Rd. 8	Date Range: 08/29/2013
Time Fished: 1357 sec	Drainage: 4.9 sq mi	
Dist Fished: 0.15 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	4	8.00	2.12			
Common Carp	G	O	M	T	2	4.00	1.06			
Creek Chub	N	G	N	T	32	64.00	16.93			
Striped Shiner	N	I	S		12	24.00	6.35			
Fathead Minnow	N	O	C	T	22	44.00	11.64			
Bluntnose Minnow	N	O	C	T	5	10.00	2.65			
Central Stoneroller	N	H	N		35	70.00	18.52			
Yellow Bullhead		I	C	T	7	14.00	3.70			
Black Bullhead		I	C	P	1	2.00	0.53			
Tadpole Madtom		I	C		7	14.00	3.70			
Blackstripe Topminnow		I	M		28	56.00	14.81			
Largemouth Bass	F	C	C		2	4.00	1.06			
Green Sunfish	S	I	C	T	9	18.00	4.76			
Longear Sunfish	S	I	C	M	19	38.00	10.05			
Logperch	D	I	S	M	1	2.00	0.53			
Rainbow Darter	D	I	S	M	2	4.00	1.06			
Orangethroat Darter	D	I	S		1	2.00	0.53			
Mile Total					189	378.00				
Number of Species					17					
Number of Hybrids					0					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2012**
River Mile: **9.40**	Location: Co. Rd. 26	Date Range: 07/03/2012
Time Fished: 2127 sec	Drainage: 7.8 sq mi	
Dist Fished: 0.16 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	18	33.75	1.58			
Common Carp	G	O	M	T	35	65.63	3.08			
Creek Chub	N	G	N	T	88	165.00	7.74			
Redfin Shiner	N	I	N		1	1.88	0.09			
Striped Shiner	N	I	S		187	350.63	16.45			
Spotfin Shiner	N	I	M		10	18.75	0.88			
Silverjaw Minnow	N	I	M		2	3.75	0.18			
Fathead Minnow	N	O	C	T	36	67.50	3.17			
Bluntnose Minnow	N	O	C	T	203	380.63	17.85			
Central Stoneroller	N	H	N		231	433.13	20.32			
Yellow Bullhead		I	C	T	99	185.63	8.71			
Tadpole Madtom		I	C		54	101.25	4.75			
Blackstripe Topminnow		I	M		10	18.75	0.88			
Rock Bass	S	C	C		1	1.88	0.09			
Smallmouth Bass	F	C	C	M	5	9.38	0.44			
Green Sunfish	S	I	C	T	15	28.13	1.32			
Longear Sunfish	S	I	C	M	62	116.25	5.45			
Green Sf X Longear Sf					68	127.50	5.98			
Johnny Darter	D	I	C		4	7.50	0.35			
Greenside Darter	D	I	S	M	1	1.88	0.09			
Rainbow Darter	D	I	S	M	5	9.38	0.44			
Orangethroat Darter	D	I	S		2	3.75	0.18			
Mile Total					1,137	2,131.88				
Number of Species					21					
Number of Hybrids					1					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2013**
River Mile: **9.40**	Location: Co. Rd. 26	Date Range: 08/29/2013
Time Fished: 1998 sec	Drainage: 7.8 sq mi	
Dist Fished: 0.15 km	Basin: Maumee River	No of Passes: 1
		Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Gizzard Shad		O	M		31	62.00	3.88			
White Sucker	W	O	S	T	9	18.00	1.13			
Common Carp	G	O	M	T	5	10.00	0.63			
Creek Chub	N	G	N	T	22	44.00	2.75			
Silver Shiner	N	I	S	I	4	8.00	0.50			
Striped Shiner	N	I	S		101	202.00	12.63			
Spotfin Shiner	N	I	M		13	26.00	1.63			
Fathead Minnow	N	O	C	T	8	16.00	1.00			
Bluntnose Minnow	N	O	C	T	12	24.00	1.50			
Central Stoneroller	N	H	N		160	320.00	20.00			
Yellow Bullhead		I	C	T	28	56.00	3.50			
Black Bullhead		I	C	P	16	32.00	2.00			
Tadpole Madtom		I	C		42	84.00	5.25			
Blackstripe Topminnow		I	M		113	226.00	14.13			
Largemouth Bass	F	C	C		4	8.00	0.50			
Green Sunfish	S	I	C	T	139	278.00	17.38			
Bluegill Sunfish	S	I	C	P	7	14.00	0.88			
Orangespotted Sunfish	S	I	C		1	2.00	0.13			
Longear Sunfish	S	I	C	M	79	158.00	9.88			
Johnny Darter	D	I	C		3	6.00	0.38			
Rainbow Darter	D	I	S	M	1	2.00	0.13			
Orangethroat Darter	D	I	S		2	4.00	0.25			
Mile Total					800	1,600.00				
Number of Species					22					
Number of Hybrids					0					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2012**
River Mile: **6.70**	Location:	Date Range: 07/03/2012
Time Fished: 2590 sec	Drainage: 12.8 sq mi	
Dist Fished: 0.20 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Common Carp	G	O	M	T	6	9.00	1.83			
Golden Shiner	N	I	M	T	1	1.50	0.31			
Creek Chub	N	G	N	T	29	43.50	8.87			
Striped Shiner	N	I	S		1	1.50	0.31			
Common Shiner	N	I	S		2	3.00	0.61			
Spotfin Shiner	N	I	M		28	42.00	8.56			
Fathead Minnow	N	O	C	T	1	1.50	0.31			
Bluntnose Minnow	N	O	C	T	45	67.50	13.76			
Central Stoneroller	N	H	N		18	27.00	5.50			
Yellow Bullhead		I	C	T	38	57.00	11.62			
Brown Bullhead		I	C	T	4	6.00	1.22			
Tadpole Madtom		I	C		7	10.50	2.14			
Western Banded Killifish [E]		I	M	S	1	1.50	0.31			
Blackstripe Topminnow		I	M		10	15.00	3.06			
Rock Bass	S	C	C		15	22.50	4.59			
Smallmouth Bass	F	C	C	M	3	4.50	0.92			
Largemouth Bass	F	C	C		5	7.50	1.53			
Green Sunfish	S	I	C	T	16	24.00	4.89			
Longear Sunfish	S	I	C	M	51	76.50	15.60			
Green Sf X Longear Sf					36	54.00	11.01			
Johnny Darter	D	I	C		1	1.50	0.31			
Orangethroat Darter	D	I	S		9	13.50	2.75			
Mile Total					327	490.50				
Number of Species					21					
Number of Hybrids					1					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2013**
River Mile: **6.70**	Location:	Date Range: 08/29/2013
Time Fished: 1432 sec	Drainage: 12.8 sq mi	
Dist Fished: 0.15 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	8	16.00	2.50			
Common Carp	G	O	M	T	15	30.00	4.69			
Creek Chub	N	G	N	T	28	56.00	8.75			
Striped Shiner	N	I	S		3	6.00	0.94			
Spotfin Shiner	N	I	M		1	2.00	0.31			
Fathead Minnow	N	O	C	T	2	4.00	0.63			
Bluntnose Minnow	N	O	C	T	26	52.00	8.13			
Central Stoneroller	N	H	N		128	256.00	40.00			
Yellow Bullhead		I	C	T	26	52.00	8.13			
Tadpole Madtom		I	C		7	14.00	2.19			
Blackstripe Topminnow		I	M		17	34.00	5.31			
Largemouth Bass	F	C	C		3	6.00	0.94			
Green Sunfish	S	I	C	T	22	44.00	6.88			
Longear Sunfish	S	I	C	M	21	42.00	6.56			
Green Sf X Bluegill Sf					2	4.00	0.63			
Logperch	D	I	S	M	1	2.00	0.31			
Johnny Darter	D	I	C		2	4.00	0.63			
Rainbow Darter	D	I	S	M	1	2.00	0.31			
Orangethroat Darter	D	I	S		7	14.00	2.19			
Mile Total					320	640.00				
Number of Species					18					
Number of Hybrids					1					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2005**
River Mile: **2.60**	Location: Co. Rd. 205	Date Range: 10/06/2005
Time Fished: 1320 sec	Drainage: 25.7 sq mi	
Dist Fished: 0.17 km	Basin: Maumee River No of Passes: 1	Sampler Type: D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
White Sucker	W	O	S	T	18	31.77	3.96	1.85	26.24	58.33
Common Carp	G	O	M	T	1	1.77	0.22	0.06	0.88	35.00
Golden Shiner	N	I	M	T	6	10.59	1.32	0.13	1.86	12.40
Creek Chub	N	G	N	T	1	1.77	0.22	0.03	0.37	15.00
Redfin Shiner	N	I	N		4	7.06	0.88	0.01	0.16	1.50
Common Shiner	N	I	S		1	1.77	0.22	0.01	0.20	8.00
Spotfin Shiner	N	I	M		1	1.77	0.22	0.00	0.06	2.00
Silverjaw Minnow	N	I	M		12	21.18	2.64	0.04	0.55	1.82
Fathead Minnow	N	O	C	T	3	5.29	0.66	0.03	0.37	5.00
Bluntnose Minnow	N	O	C	T	281	495.88	61.76	2.81	39.77	5.66
Central Stoneroller	N	H	N		2	3.53	0.44	0.05	0.65	13.00
Yellow Bullhead		I	C	T	2	3.53	0.44	0.16	2.32	46.50
Black Bullhead		I	C	P	7	12.35	1.54	0.90	12.80	73.14
Tadpole Madtom		I	C		11	19.41	2.42	0.11	1.53	5.56
Blackstripe Topminnow		I	M		44	77.65	9.67	0.15	2.12	1.93
Largemouth Bass	F	C	C		1	1.77	0.22	0.01	0.13	5.00
Green Sunfish	S	I	C	T	19	33.53	4.18	0.34	4.80	10.11
Bluegill Sunfish	S	I	C	P	5	8.82	1.10	0.05	0.68	5.40
Longear Sunfish	S	I	C	M	14	24.71	3.08	0.23	3.23	9.23
Pumpkinseed Sunfish	S	I	C	P	1	1.77	0.22	0.03	0.48	19.00
Logperch	D	I	S	M	1	1.77	0.22	0.01	0.16	6.00
Johnny Darter	D	I	C		16	28.24	3.52	0.04	0.50	1.23
Greenside Darter	D	I	S	M	1	1.77	0.22	0.01	0.07	3.00
Rainbow Darter	D	I	S	M	1	1.77	0.22	0.00	0.06	2.00
Orangethroat Darter	D	I	S		2	3.53	0.44	0.01	0.07	1.50
	Mile Total				455	802.94		7.06		
	Number of Species				25					
	Number of Hybrids				0					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2012**
River Mile: **2.60**	Location: Co. Rd. 205	Date Range: 07/02/2012
Time Fished: 4982 sec	Drainage: 25.7 sq mi	Thru: 08/22/2012
Dist Fished: 0.35 km	Basin: Maumee River No of Passes: 2	Sampler Type: E D

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Gizzard Shad		O	M		3	3.00	0.39			
Redfin Pickerel		P	M	P	2	1.75	0.23	0.12	1.77	82.00
White Sucker	W	O	S	T	10	7.50	0.97	1.23	17.79	82.20
Common Carp	G	O	M	T	37	35.25	4.56	1.78	25.71	169.71
Golden Shiner	N	I	M	T	12	11.00	1.42	0.09	1.33	15.25
Creek Chub	N	G	N	T	12	9.00	1.16	0.12	1.76	6.80
Redfin Shiner	N	I	N		23	17.25	2.23	0.05	0.76	1.53
Striped Shiner	N	I	S		218	173.50	22.45	1.82	26.28	6.82
Common Shiner	N	I	S		6	6.00	0.78			
Spotfin Shiner	N	I	M		15	11.25	1.46	0.10	1.46	4.50
Silverjaw Minnow	N	I	M		1	0.75	0.10	0.00	0.03	1.00
Fathead Minnow	N	O	C	T	66	49.50	6.40	0.13	1.90	1.33
Bluntnose Minnow	N	O	C	T	28	21.00	2.72	0.04	0.63	1.05
Central Stoneroller	N	H	N		11	8.25	1.07	0.28	4.05	17.00
Yellow Bullhead		I	C	T	3	2.50	0.32	0.04	0.63	14.50
Black Bullhead		I	C	P	4	4.00	0.52			
Tadpole Madtom		I	C		8	6.75	0.87	0.04	0.51	4.60
Blackstripe Topminnow		I	M		175	156.00	20.18	0.13	1.93	1.17
Rock Bass	S	C	C		9	8.00	1.03	0.05	0.76	8.75
Smallmouth Bass	F	C	C	M	1	0.75	0.10	0.10	1.47	68.00
Largemouth Bass	F	C	C		7	7.00	0.91			
Green Sunfish	S	I	C	T	73	70.00	9.06	0.23	3.28	12.58
Bluegill Sunfish	S	I	C	P	69	66.75	8.64	0.27	3.90	20.00
Orangespotted Sunfish	S	I	C		1	1.00	0.13			
Longear Sunfish	S	I	C	M	93	89.00	11.51	0.25	3.62	10.44
Pumpkinseed Sunfish	S	I	C	P	1	1.00	0.13			
Green Sf X Longear Sf					7	5.25	0.68	0.03	0.46	3.00
	Mile Total				895	773.00		6.93		
	Number of Species				26					
	Number of Hybrids				1					

Species List

River Code: **04-190**	Stream: **Lye Creek**	Sample Date: **2013**
River Mile: **2.60**	Location: Co. Rd. 205	Date Range: 08/29/2013
Time Fished: 3401 sec	Drainage: 25.7 sq mi	Thru: 09/24/2013
Dist Fished: 0.30 km	Basin: Maumee River	No of Passes: 2	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Gizzard Shad		O	M		13	13.00	4.98	1.35	4.44	104.15
Redfin Pickerel		P	M	P	4	4.00	1.53	0.10	0.33	25.50
White Sucker	W	O	S	T	27	27.00	10.34	2.94	9.66	108.96
Spotted Sucker	R	I	S		1	1.00	0.38	0.45	1.48	450.00
Common Carp	G	O	M	T	19	19.00	7.28	18.48	60.65	972.63
Golden Shiner	N	I	M	T	1	1.00	0.38	0.02	0.05	16.00
Striped Shiner	N	I	S		28	28.00	10.73	0.93	3.05	33.21
Bluntnose Minnow	N	O	C	T	1	1.00	0.38	0.00	0.01	2.00
Central Stoneroller	N	H	N		1	1.00	0.38	0.00	0.01	3.00
Tadpole Madtom		I	C		9	9.00	3.45	0.07	0.22	7.44
Blackstripe Topminnow		I	M		51	51.00	19.54	0.08	0.26	1.55
Largemouth Bass	F	C	C		5	5.00	1.92	0.78	2.57	156.40
Green Sunfish	S	I	C	T	10	10.00	3.83	0.31	1.02	31.00
Bluegill Sunfish	S	I	C	P	50	50.00	19.16	1.57	5.16	31.44
Longear Sunfish	S	I	C	M	35	35.00	13.41	0.66	2.17	18.86
Green Sf X Bluegill Sf					1	1.00	0.38	0.02	0.05	16.00
Johnny Darter	D	I	C		3	3.00	1.15	0.01	0.02	2.00
Freshwater Drum			M	P	2	2.00	0.77	2.70	8.86	1,350.00
	Mile Total				261	261.00		30.47		
	Number of Species				17					
	Number of Hybrids				1					

Species List

River Code: **04-191**	Stream: **Silver Creek**	Sample Date: **2012**
River Mile: **0.80**	Location: Twp. Rd. 168	Date Range: 07/03/2012
Time Fished: 902 sec	Drainage: 4.1 sq mi	
Dist Fished: 0.20 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Creek Chub	N	G	N	T	3	4.50	0.83			
Fathead Minnow	N	O	C	T	188	282.00	52.22			
Bluntnose Minnow	N	O	C	T	95	142.50	26.39			
Yellow Bullhead		I	C	T	13	19.50	3.61			
Blackstripe Topminnow		I	M		52	78.00	14.44			
Green Sunfish	S	I	C	T	7	10.50	1.94			
Orangethroat Darter	D	I	S		2	3.00	0.56			
Mile Total					360	540.00				
Number of Species					7					
Number of Hybrids					0					

Species List

River Code: **04-191**	Stream: **Silver Creek**	Sample Date: **2013**
River Mile: **0.80**	Location: Twp. Rd. 168	Date Range: 08/28/2013
Time Fished: 2118 sec	Drainage: 4.1 sq mi	
Dist Fished: 0.15 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Common Carp	G	O	M	T	4	8.00	1.07			
Redfin Shiner	N	I	N		28	56.00	7.51			
Striped Shiner	N	I	S		5	10.00	1.34			
Fathead Minnow	N	O	C	T	18	36.00	4.83			
Bluntnose Minnow	N	O	C	T	3	6.00	0.80			
Central Stoneroller	N	H	N		25	50.00	6.70			
Yellow Bullhead		I	C	T	17	34.00	4.56			
Tadpole Madtom		I	C		1	2.00	0.27			
Blackstripe Topminnow		I	M		53	106.00	14.21			
Largemouth Bass	F	C	C		162	324.00	43.43			
Green Sunfish	S	I	C	T	22	44.00	5.90			
Bluegill Sunfish	S	I	C	P	7	14.00	1.88			
Longear Sunfish	S	I	C	M	25	50.00	6.70			
Johnny Darter	D	I	C		2	4.00	0.54			
Orangethroat Darter	D	I	S		1	2.00	0.27			
	Mile Total				373	746.00				
	Number of Species				15					
	Number of Hybrids				0					

Appendix Table 6. Water quality and field data collected from sites in Lye Creek and Silver Creek, 2013.

		Stream Location:	**LYE CREEK S OF HOUCKTOWN @ HANCOCK CO. RD. 8**			
		River Mile:	**10.20**	**Station: 302113**		
PARAMETER	UNITS	04/25/13	05/09/13	6/6/13	7/30/13	8/12/13
CBOD20	mg/L	7.3	-	-	-	-
Total Dissolved Solids	mg/L	350	438	516	400	476
Total Suspended Solids	mg/L	58	12	<5	8	<5
Alkalinity	mg/L	87.9	247	222	251	275
Ammonia	mg/L	0.087	<0.050	0.13	<0.050	0.059
COD	mg/L	29	<20	<20	<20	<20
Chloride	mg/L	22.2	49.5	71	43.2	67.4
Conductivity	umhos/cm	-	749	781	664	824
Nitrate+nitrite	mg/L	4.45	3.32	0.38	2.62	0.18
Nitrite	mg/L	0.069	0.052	0.024	0.02	<0.020
Orthophosphate, dissolved	mg/L	0.144	0.011	0.065	0.088	0.043
Sulfate	mg/L	35	81.6	87.2	58.4	75.9
TKN	mg/L	0.76	0.3	0.57	0.72	0.57
Total Phosphorus	mg/L	0.327	0.03	0.09	0.139	0.063
FIELD PARAMETERS						
Time	hhmmss	-	10:17:00	8:41:45	8:59:06	9:07:00
Conductivity	uS/cm	-	620	641	554	741
Conductivity @ 25C	uS/cm	-	714	747	650	819
Dissolved Oxygen	mg/L	-	12.32	4.46	8.01	5.37
Dissolved Oxygen	%	-	130.7	46.8	83.5	59.2
pH	s.u.	-	8.21	7.6	7.72	7.83
Temperature	°C	-	18.1	17.6	17.3	20
	Shaded values are exceedances of Ohio WQS criteria.					

Appendix Table 6. (continued)

		Stream Location:	LYE CREEK AT HOUCKTOWN @ HANCOCK CO. RD. 26			
		River Mile: 9.45	Station: P05K40			
PARAMETER	UNITS	04/25/13	05/09/13	6/6/13	7/30/13	8/12/13
CBOD20	mg/L	7.6	-	-	-	-
Total Dissolved Solids	mg/L	338	440	444	400	468
Total Suspended Solids	mg/L	42	8	53	9	8
Alkalinity	mg/L	90.3	264	213	262	281
Ammonia	mg/L	0.176	<0.050	0.079	<0.050	0.05
COD	mg/L	65	<20	20	22	<20
Chloride	mg/L	21.5	45.7	59.4	42.4	56.5
Conductivity	umhos/cm	-	758	728	658	828
Nitrate+nitrite	mg/L	5.3	3.68	1.12	3.04	0.29
Nitrite	mg/L	0.049	0.064	0.043	<0.020	<0.020
Orthophosphate, dissolved	mg/L	0.171	<0.010	0.01	0.076	0.035
Sulfate	mg/L	32.5	78	80.5	55.2	77.9
TKN	mg/L	1.43	<0.20	2.65	0.59	0.57
Total Phosphorus	mg/L	0.426	0.021	0.282	0.136	0.055
FIELD PARAMETERS						
Time	hhmmss	-	10:04:00	8:33:10	8:49:19	8:57:00
Conductivity	uS/cm	-	607	586	543	722
Conductivity @ 25C	uS/cm	-	720	689	642	805
Dissolved Oxygen	mg/L	-	8.55	4.36	7.45	5.02
Dissolved Oxygen	%	-	88.2	45.3	77	54.9
pH	s.u.	-	7.75	7.51	7.63	7.64
Temperature	°C	-	16.8	17.2	16.9	19.6
	Shaded values are exceedances of Ohio WQS criteria.					

Appendix Table 6. (continued)

		Stream Location:	LYE CREEK SE OF FINDLAY @ JACKSON TWP. RD. 168			
		River Mile: 6.66	Station: P05K41			
PARAMETER	UNITS	04/25/13	05/09/13	6/6/13	7/30/13	8/12/13
CBOD20	mg/L	7.3	-	-	-	-
Total Dissolved Solids	mg/L	332	412	398	374	436
Total Suspended Solids	mg/L	38	<5	<5	<5	<5
Alkalinity	mg/L	95.5	231	184	252	260
Ammonia	mg/L	0.128	<0.050	<0.050	<0.050	<0.050
COD	mg/L	28	<20	<20	143	<20
Chloride	mg/L	21	43.3	50	32.1	51.7
Conductivity	umhos/cm	-	690	651	611	754
Nitrate+nitrite	mg/L	5.82	4.13	2.81	3.79	1.51
Nitrite	mg/L	0.032	0.062	0.065	0.027	<0.020
Orthophosphate, dissolved	mg/L	0.145	<0.010	<0.010	0.084	0.043
Sulfate	mg/L	29.6	64.8	69.9	49.1	65.3
TKN	mg/L	1.16	0.2	0.48	0.73	0.55
Total Phosphorus	mg/L	0.323	0.013	0.016	0.109	0.061
FIELD PARAMETERS						
Time	hhmmss	10:49:34	9:42:00	8:22:58	8:38:25	8:42:00
Conductivity	uS/cm	0	557	522	513	662
Conductivity @ 25C	uS/cm	318.3	661	620	599	738
Dissolved Oxygen	mg/L	9.55	10.99	6.14	7.02	6.64
Dissolved Oxygen	%	79.6	113.3	63.2	73.5	72.7
pH	s.u.	7.28	7.94	7.58	7.47	7.61
Temperature	°C	7.5	16.8	16.7	17.5	19.7
	Shaded values are exceedances of Ohio WQS criteria.					

Appendix Table 6. (continued)

		Stream Location:	LYE CREEK @ HANCOCK CO. RD. 205			
		River Mile: 2.63	Station: P05K42			
PARAMETER	UNITS	04/25/13	05/09/13	6/6/13	7/30/13	8/12/13
CBOD20	mg/L	6.7	-	-	-	-
Total Dissolved Solids	mg/L	334	344	410	360	394
Total Suspended Solids	mg/L	36	5	<5	<5	<5
Alkalinity	mg/L	109	200	196	255	259
Ammonia	mg/L	0.11	<0.050	0.052	<0.050	<0.050
COD	mg/L	25	<20	<20	40	<20
Chloride	mg/L	25.9	40.8	51.1	33.5	45.2
Conductivity	umhos/cm	-	623	638	594	695
Nitrate+nitrite	mg/L	6.54	3.56	1.4	3.2	0.8
Nitrite	mg/L	0.046	0.041	0.042	<0.020	<0.020
Orthophosphate, dissolved	mg/L	0.139	<0.010	<0.010	0.058	0.018
Sulfate	mg/L	29.3	52.7	59	42.7	49.5
TKN	mg/L	0.8	<0.20	0.58	0.68	0.52
Total Phosphorus	mg/L	0.28	0.017	0.018	0.086	0.026
FIELD PARAMETERS						
Time	hhmmss	11:26:15	9:10:00	8:02:07	8:15:56	8:21:00
Conductivity	uS/cm	0	497.3	519	498.7	612
Conductivity @ 25C	uS/cm	358.5	591	611	582	682
Dissolved Oxygen	mg/L	9.48	8.9	4.84	7.68	5.97
Dissolved Oxygen	%	79.2	91.8	50.2	80.4	65.4
pH	s.u.	7.32	7.79	7.57	7.47	7.58
Temperature	°C	7.5	16.7	17.1	17.5	19.6
	Shaded values are exceedances of Ohio WQS criteria.					

Appendix Table 6. (continued)

		Stream Location:	SILVER CREEK SE OF FINDLAY @ JACKSON TWP. RD. 168			
		River Mile: 0.75	Station: 302115			
PARAMETER	UNITS	04/25/13	05/09/13	6/6/13	7/30/13	8/12/13
CBOD20	mg/L	6.6	-	-	-	-
Total Dissolved Solids	mg/L	298	352	364	348	390
Total Suspended Solids	mg/L	22	<5	<5	<5	7
Alkalinity	mg/L	105	210	197	248	250
Ammonia	mg/L	0.099	<0.050	0.086	<0.050	0.077
COD	mg/L	28	<20	<20	<20	<20
Chloride	mg/L	26.8	41.1	47.4	33.6	47
Conductivity	umhos/cm	-	603	601	586	685
Nitrate+nitrite	mg/L	7.61	5.1	2.6	3.2	1.42
Nitrite	mg/L	0.054	0.067	0.077	0.027	0.04
Orthophosphate, dissolved	mg/L	0.186	0.012	0.02	0.055	0.04
Sulfate	mg/L	24.9	39.6	38.7	35	42
TKN	mg/L	1.01	0.25	0.56	0.61	0.59
Total Phosphorus	mg/L	0.329	0.023	0.035	0.085	0.08
FIELD PARAMETERS						
Time	hhmmss	10:58:12	9:29:00	8:16:46	8:27:25	8:32:00
Conductivity	uS/cm	0	478.3	494.3	486.4	600
Conductivity @ 25C	uS/cm	355.4	578	585	573	673
Dissolved Oxygen	mg/L	8.66	7.03	3.19	6.47	4.57
Dissolved Oxygen	%	72.3	71.3	33	67.3	49.7
pH	s.u.	7.12	7.51	7.34	7.38	7.4
Temperature	°C	7.5	16	16.9	17.1	19.3
	Shaded values are exceedances of Ohio WQS criteria.					