

# Biological and Water Quality Study of the Loss Creek-Sandusky River Watershed (HUC 04100011 04 02)

Crawford County, Ohio  
2011-2012



OHIO EPA Technical Report EAS/2012-8-10

Biological and Water Quality Study of the  
Loss Creek-Sandusky River Watershed  
(HUC 04100011 04 02)  
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Pre-Implementation Monitoring  
Great Lakes Restoration Initiative  
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## INTRODUCTION

In 2011, Ohio EPA was awarded a Great Lakes Restoration Initiative (GLRI) grant to implement a Lake Erie nutrient reduction demonstration project. This project will enhance implementation and effectiveness of nutrient reduction practices in one highly targeted HUC-12 watershed in the Sandusky River watershed (Loss Creek-Sandusky River HUC 04100011 04 02). During 2010, the Sandusky River was identified as discharging historically high levels of dissolved reactive phosphorus into Lake Erie (Ohio Environmental Protection Agency 2010). The watershed is dominated by agricultural land use and despite more than 10 years of participating in the Lake Erie Conservation Reserve Enhancement Program (CREP), the Sandusky River continues to experience very high levels of silt, sediment, and nutrients, much of which are exported to Sandusky Bay and Lake Erie. This project seeks to implement a series of highly targeted nutrient reduction practices that are identified in the approved upper Sandusky River Total Maximum Daily Load (TMDL) report (Ohio Environmental Protection Agency 2004). Successful implementation will demonstrate the improved environmental results of concentrating nutrient reduction actions in very small geographic areas such as the selected Loss Creek-Sandusky River HUC-12 watershed. The project will leverage state funding to increase the effectiveness of local implementation of nutrient reduction management actions and will provide demonstrations of effectiveness that will be valuable for implementing future projects as part of Ohio's overall nutrient reduction strategy.

To document resource changes in water quality and estimate nutrient loading reductions derived from the implementation of this project, Ohio EPA committed resources to provide pre-implementation project monitoring in 2011 and 2012. Follow-up post-implementation monitoring in the Loss Creek-Sandusky River HUC-12 watershed will be conducted in future years after sufficient time has elapsed following implementation activities. Pre-implementation monitoring included biological community assessments, physical habitat assessments, and surface water column chemistry analyses at sites in the HUC-12 to characterize current baseline conditions. The data collected will aid in future development of water quality models to forecast and track necessary criteria and loadings reductions to meet nutrient reduction strategy goals and Ohio Water Quality Standards criteria.

Specific objectives of the pre-implementation assessment phase of the Loss Creek-Sandusky River HUC-12 watershed were to:

- establish baseline biological, physical habitat, and chemical water quality conditions in the watershed prior to nutrient management actions implemented via this GLRI grant,
- determine the aquatic life use attainment status of streams in the watershed with regard to the Warmwater Habitat (WWH) aquatic life use designation codified in the Ohio Water Quality Standards,
- determine probable causes and sources of aquatic life use impairment at impaired watershed sites, and
- provide data to initiate development of water quality models to forecast and track nutrient loading reductions in the watershed and document reductions in nutrient export to the lower Sandusky basin.

Streams in the Loss Creek-Sandusky River HUC-12 watershed are located in the Eastern Corn Belt Plains (ECBP) ecoregion of Ohio. All monitored streams are currently assigned the Warmwater Habitat (WWH) aquatic life use designation.

## SUMMARY AND CONCLUSIONS

Ohio EPA completed two passes of fish community sampling and artificial and natural substrate collections of macroinvertebrate communities at two Sandusky River sites in 2011. One-pass fish sampling and qualitative, natural substrate macroinvertebrate sampling were completed at five additional Loss Creek, South Fork Loss Creek, and Allen Run sites in 2011. Two additional samples were collected from Allen Run in 2012 in response to a fish kill. All sites received a Qualitative Habitat Evaluation Index (QHEI) assessment in either 2011 or 2012 and five grab samples for stream chemistry analyses during summer/fall, 2011 and spring, 2012. Sampling locations are detailed in Table 1 and graphically

presented in Figure 1 and 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 3-6. Other relevant data, including raw data, are tabulated in Appendix Tables A.1-A.5.

Full attainment of the WWH aquatic life use was documented at both Sandusky River sampling sites, one located in the upper reaches of the HUC-12 upstream from the Loss Creek subwatershed and one near the downstream terminus of the HUC (Table 2). Index of Biotic Integrity (IBI), Modified Index of well-being (MIwb), and Invertebrate Community Index (ICI) scores for the fish and macroinvertebrate community collections exceeded ecoregional biocriteria and both sites were narratively assessed with an overall very good status. Diverse communities of both organism groups were present and species assemblage signatures typical of stressed or degraded resource conditions were not evident. Physical habitat conditions, as reflected by QHEI scores, were good to excellent and Sandusky River reaches in this part of the basin were assimilating and/or exporting nutrient loads with no observable impacts.

In the Loss Creek subwatershed, full WWH attainment was documented at the South Fork Loss Creek sampling site and the most downstream Loss Creek sampling location just prior to the Sandusky River confluence. Fish and macroinvertebrate communities were comprised of assemblages of organisms that were similar in species richness and composition to the ECBP reference condition. Physical habitat quality at both sites was excellent. However, aquatic life use impairment was detected at the two upstream Loss Creek sites driven by poor and low fair narrative assessments of the macroinvertebrate communities. At both sites, fish communities met ecoregional expectations and good communities were present. Macroinvertebrate community impairment was linked to embedded substrates, excessive sedimentation/siltation issues, and nutrient enrichment observed and measured at each of the sites, which were located in an agricultural landscape near or within stream reaches which were undergoing recovery from past channel modifications. QHEI scoring reflected the less than optimal physical habitat conditions, especially at the most upstream site where habitat quality, though scored as good, was tempered by numerous high and moderate influence modified habitat attributes.

A similar pattern occurred at the one 2011 site in the Allen Run subwatershed. Fish community status, as indicated by the IBI score, reflected near exceptional quality in spite of fair overall habitat quality, but the macroinvertebrate community was assessed as poor. Again, nutrient enrichment and a sedimentation/siltation impact associated with past, but recovering, channel modifications were implicated. However, a July, 2012 fish kill discovered at the site by an Ohio EPA crew suggested other more serious water quality issues may be influencing conditions. This was confirmed by results from a water quality sample collected on July 18, 2012, which documented an ammonia value of 35.9 mg/l, a level acutely toxic to most aquatic life. Monitoring in August and September, 2012 to further investigate and characterize the ammonia spill and subsequent fish kill, confirmed significant impairment had occurred to the fish community and, to a lesser extent, the macroinvertebrate community at the 2011 sampling location when compared to the 2011 results and additional 2012 samples from an upstream site.

Land use in the Loss Creek subwatershed is approximately 72% agricultural production, with about 14% in forest cover. Overall, the trend in Loss Creek between 2001, when the watershed was first sampled (Ohio Environmental Protection Agency 2003), and 2011 showed that the lower reach of Loss Creek is maintaining full aquatic life use attainment, and there was dramatic improvement in the South Fork Loss Creek. The South Fork site had the fewest elevated nutrient results, and in August 2011 and April 2012, the stream samples completely met all water quality standards criteria and nutrient targets. The Sandusky River has also shown an improvement since 2001 at the Leesville Road station upstream from the confluence of Loss Creek. It is important to have good water quality coming from the developed areas of Crestline and Bucyrus and the headwater tributaries to help sustain the current full aquatic life use attainment as the river flows towards Lake Erie.

In the impaired reaches of both Loss Creek and Allen Run, nutrient levels were elevated throughout the 2011-2012 assessment period, with spikes in both nitrate and phosphorus associated with storm events and/or seasonal farming activities in July, 2011 and May, 2012. Of most concern was the decline in biological attainment status for Allen Run from full attainment to non-attainment since first sampled in 2001. The poor 2011 macroinvertebrate assessment, coupled with the acutely toxic ammonia measurement from July 18, 2012, its associated fish kill, and subsequent decline in both fish and macroinvertebrate communities documented in late summer 2012 sampling, were strong evidence of a

serious water quality issue affecting the stream. Future sampling is planned to track recovery and ensure that the observed 2012 spill and kill was a transient event and not a signal of a persistent chronic problem. Land use and potential pollution sources include the western perimeter of Crestline, a recent large expansion at an adjacent agricultural cooperative with an associated railroad infrastructure, and a truck parts salvage yard farther upstream. The decline in water quality does not appear to have adversely affected the Sandusky main stem, but this trend in Allen Run needs to be reversed so as to ensure the continued full aquatic life use attainment status observed in the upper Sandusky River.

Protection of the existing riparian corridor and demonstration of new conservation farming technology and variable rate nutrient management systems supported through this GLRI grant is highly encouraged. Continued adoption of best management practices offered through other grant programs will allow all landowners in the watershed to participate in some activity to improve water resources in the Sandusky River basin and reduce nutrient loadings to Sandusky Bay and Lake Erie.

Table 1. Sampling locations in the Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012. Type of sampling included fish community (F), macroinvertebrate community (M), physical habitat (H), and stream chemistry (C).

River Mile	Type of Sampling	Latitude	Longitude	Local Landmark (Station ID)	Watershed Size at Site (mi <sup>2</sup> )
Sandusky River (05-001-000)					
127.80	F,M,H,C	40°47'54.08"	82°48'32.77"	Lower Leesville Rd. / Twp. Rd. 13 (U02P08)	35.0
122.00	F,M,H,C	40°50'17.88"	82°51'20.16"	St. Rt. 602 (U02G30)	61.0
Loss Creek (05-041-000)					
5.18	F,M,H,C	40°51'52.70"	82°45'50.60"	St. Rt. 96 (301595)	2.1
3.73	F,M,H,C	40°51'45.21"	82°46'32.53"	Loss Creek Rd. / Twp. Rd. 178 (301594)	2.9
0.96	F,M,H,C	40°50'30.18"	82°49'05.66"	Biddle Rd. / Twp. Rd. 44 (U02G03)	11.7
South Fork Loss Creek (Trib. at RM 2.98) (05-041-001)					
0.04	F,M,H,C	40°51'02.87"	82°47'33.39"	Loss Creek Rd. / Twp. Rd. 178 (201377)	6.8
Allen Run (05-043-000)					
2.30	F,M,H	40°46'15.79"	82°45'54.50"	Nazor Rd. / Twp. Rd. 48 (302076)	2.2
1.18	F,M,H,C	40°47'06.21"	82°46'26.05"	Crestline Rd. / Co. Rd. 35 (U02G20)	4.1

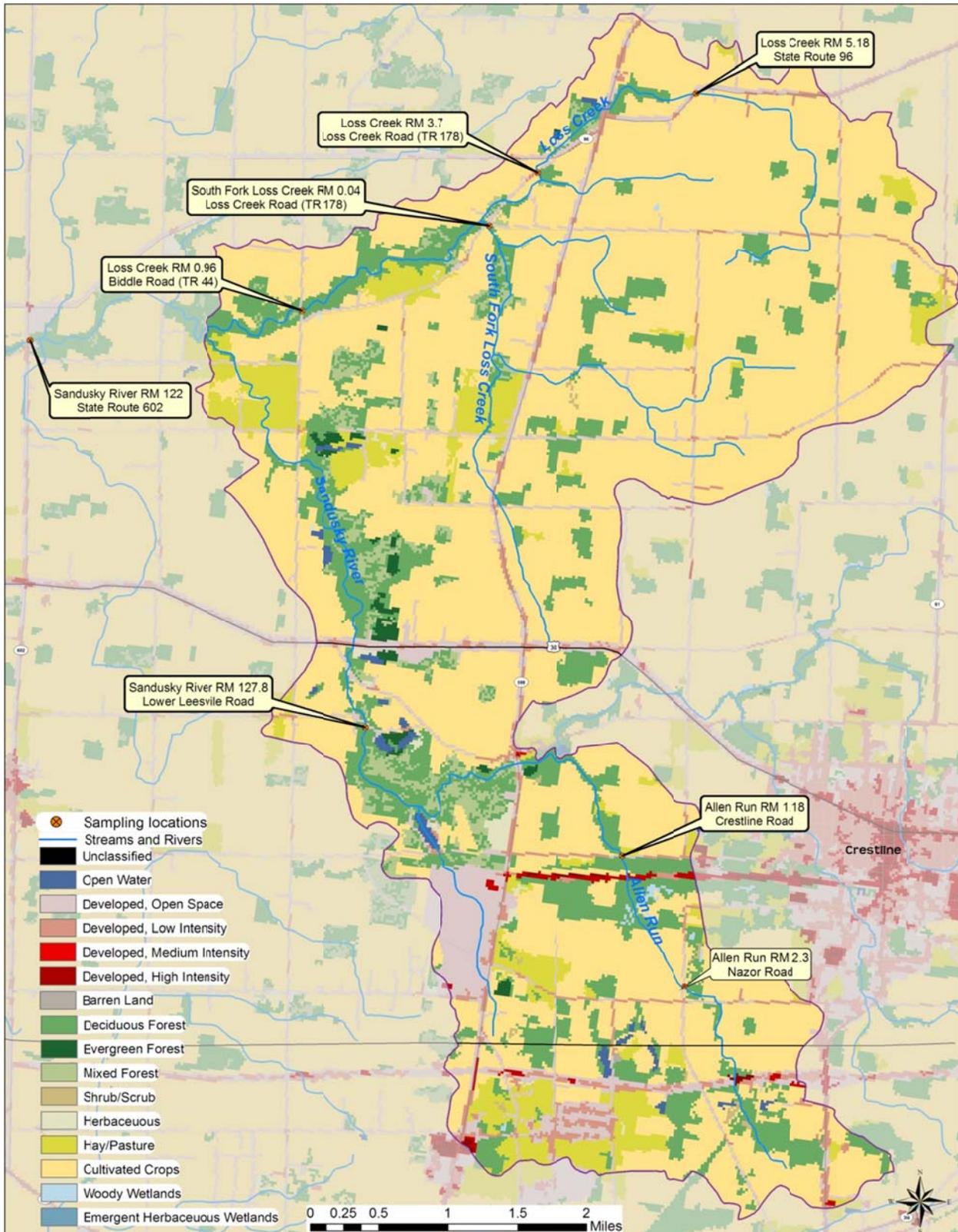
Table 2. Aquatic life use attainment status for sampling locations in the Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012. The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological 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 Administrative Code (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.

Sample Location River Mile (RM)	Watershed Size (mi <sup>2</sup> ) Site Type	Aquatic Life Use Attainment Status	IBI	MIwb	ICI <sup>a</sup>	QHEI	Aquatic Life Use Impairment Cause(s) Source(s)
Sandusky River 2011 (05-001-000) – WWH							
127.80	35.0 Wading	FULL	43	8.55	44	79.3	
122.00	61.0 Wading	FULL	46	7.85 <sup>ns</sup>	46	67.3	
Loss Creek 2011 (05-041-000) – WWH							
5.18	2.1 Headwater	NON	40	-	Poor*	59.5	nutrients, embedded substrates, sedimentation/siltation agriculture, channelization (recovering)
3.73	2.9 Headwater	PARTIAL	46	-	Low Fair*	74.0	nutrients, embedded substrates, sedimentation/siltation agriculture, upstream channelization (recovering)
0.96	11.7 Headwater	FULL	48	-	Good	72.8	
South Fork Loss Creek (Trib. at RM 2.98) 2011 (05-041-001) - WWH							
0.04	6.8 Headwater	FULL	46	-	Marg. Good <sup>ns</sup>	73.8	
Allen Run 2011-12 (05-043-000) – WWH							
1.18 (2011)	4.1 Headwater	NON	50	-	Poor*	52.5	nutrients, sedimentation/siltation agriculture, channelization (recovering)
2.30 (2012)	2.2 Headwater	NON	32*	-	Poor*	51.0	embedded substrates, sedimentation/siltation agriculture, channelization
1.18 (2012)	4.1 Headwater	NON	30*	-	Very Poor*	52.5	ammonia, nutrients, sedimentation/siltation source unknown, agriculture, channelization (recovering)

BIOCRITERIA (ECBP)			HABITAT		
INDEX - Site Type	WWH	EWB	QHEI Score (<20 mi <sup>2</sup> sites)	QHEI Score (>20 mi <sup>2</sup> 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.  
 \* Significant departure from ecoregion biocriterion; 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 Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012.



## METHODS

All chemical, physical, and biological field, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 2009), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio Environmental Protection Agency 1987b, 1989a, 1989b, 2008a, 2008b), 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 Loss Creek-Sandusky River HUC-12 watershed study area were compared to Warmwater Habitat (WWH) biocriteria.

### Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and from natural habitats at the two Sandusky River sites and from natural habitats only at the Loss Creek, South Fork Loss Creek, and Allen Run sites (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, 2008b).

### Fish Community Assessment

Fish were sampled once at each of the Loss Creek, South Fork Loss Creek, and Allen Run sites and twice at the two Sandusky River sites 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, 2008b).

### Physical Habitat Assessment

Aquatic habitat at sites in the Loss Creek-Sandusky 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 Loss Creek-Sandusky River HUC-12 watershed sampling site (Figure 1).

### **Chemical Water Quality**

Five surface water chemistry grab samples were collected from each of seven Loss Creek-Sandusky River HUC-12 watershed sampling locations between July, 2011 and May, 2012 (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 Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 2009).

## **RESULTS**

### **Macroinvertebrate Community**

Macroinvertebrate community sampling was conducted at seven sites in the Loss Creek-Sandusky River HUC-12 study area during 2011 with follow-up sampling at one repeat site and one new site in 2012. Quantitative artificial substrate data were collected and Invertebrate Community Index (ICI) scores were determined for the two Sandusky River sites and qualitative, natural substrate collections were made and relevant data attributes were calculated for six sites in the Loss Creek and Allen Run subwatersheds. Results are summarized in Table 3. ICI metrics and scores for the two Sandusky River sites and the raw data for all sites are attached as Appendix Tables 1 and 2. Sampling locations were evaluated using Warmwater Habitat (WWH) biocriteria codified in the Ohio Administrative Code (OAC 3745-1-07, Table 7-15).

Macroinvertebrates collected from artificial substrates from the two Sandusky River sites reflected very good community conditions. ICI scores of 44 and 46 at Lower Leesville Rd. (RM 127.8) and St. Rt. 602 (RM 122.0), respectively, easily achieved the WWH biocriterion (ICI=36). Both samples included overall diverse assemblages of organisms (69 and 81 taxa) with good representation of pollution sensitive taxa (14 and 19) and moderate numbers of pollution tolerant taxa (9 and 13). Noteworthy at both sites were very respectable taxa diversities of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), EPT taxa, which were a reflection of good water quality and physical habitat conditions. The 16 EPT taxa at Lower Leesville Rd. and 21 EPT taxa at St. Rt. 602 were near or exceeding the taxa diversity that would be expected at exceptional quality macroinvertebrate sites of similar watershed size in Ohio.

Macroinvertebrate communities collected from the natural substrates at the three Loss Creek sites revealed an upstream to downstream progression from degraded communities to one near the mouth which achieved WWH expectations. Communities at the upstream sampling locations at St. Rt. 96 (RM 5.18) and Loss Creek Rd. (RM 3.73) were both underperforming with narrative assessments of poor and low fair, respectively. While overall diversity was moderately high (42 and 37 taxa), pollution sensitive taxa were essentially absent (0 and 2) and EPT taxa were significantly reduced (4 and 5); both attributes were significantly less than what would be expected at good WWH sites of similar watershed size in Ohio. Field observations of excessive stream channel sedimentation/siltation and embedded substrates, due to channels recovering from past drainage modifications at or upstream from each site, were noted as likely physical habitat contributors to the macroinvertebrate community impairment. The macroinvertebrate community at Biddle Rd. (RM 0.96) improved to a good narrative assessment. Total taxa (52), total sensitive taxa (8), and total EPT taxa (14) diversities were marked increases over the two upstream sites and reflected a community performing at WWH expectations.

The South Fork Loss Creek macroinvertebrate community collected at Loss Creek Rd. (RM 0.04) was assessed as marginally good and narrowly achieving WWH expectations. While pollution sensitive taxa (5) were somewhat reduced, total and EPT taxa (50 and 10, respectively) were at levels which, while not overly diverse, were near what would be expected at good WWH streams of similar watershed size.

The Allen Run macroinvertebrate community collected at Crestline Rd. (RM 1.18) in 2011 was assessed as poor and did not meet ecoregional expectations for a WWH stream. The community was predominated by pollution tolerant taxa (19) while pollution sensitive and EPT taxa (1 and 3, respectively) were uncommon and considerably reduced from what would be expected in a good WWH stream of similar watershed size. A field observation of excessive sedimentation/siltation within a channel recovering from past modifications was noted as a likely physical habitat contributor to the macroinvertebrate community impairment. However, it seemed apparent that more than suboptimal substrate conditions were impacting the macroinvertebrates. Sampling in September, 2012 was conducted at Crestline Rd. and at Nazor Rd. (RM 2.3) in response to a July, 2012 ammonia spike and fish kill reported at the Crestline Rd. site. While macroinvertebrates were assessed as poor at the Nazor Rd. site (34 total taxa, 0 sensitive taxa, and 2 EPT taxa), the community at Crestline Rd. (23 total taxa, 0 sensitive taxa, and 0 EPT taxa) was incrementally worse, both compared to the community at Nazor Rd. and the one collected from Crestline Rd. in 2011. The very poor assessment reflected an impact and lingering effect from the measured ammonia spike earlier in the year.

Table 3. Summary of macroinvertebrate data collected by Ohio EPA from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012. The applicable aquatic life use designation is Warmwater Habitat (WWH).

River Mile	Density Number/ft <sup>2</sup>	Total Taxa	Pollution Sensitive Taxa	Pollution Tolerant Taxa	Total EPT <sup>a</sup>	ICI <sup>b</sup>	Narrative Evaluation
<b>Sandusky River - 2011</b>							
127.80	701	69	14	9	16	44	Very Good
122.00	1484	81	19	13	21	46	Very Good
<b>Loss Creek - 2011</b>							
5.18	-	42	0	13	4	<u>P*</u>	Poor
3.73	-	37	2	9	5	LF*	Low Fair
0.96	-	52	8	9	14	G	Good
<b>South Fork Loss Creek (Trib. at RM 2.98) - 2011</b>							
0.04	-	50	5	10	10	MG <sup>ns</sup>	Marginally Good
<b>Allen Run - 2011 and 2012</b>							
1.18 (2011)	-	44	1	19	3	<u>P*</u>	Poor
2.30 (2012)	-	34	0	17	2	<u>P*</u>	Poor
1.18 (2012)	-	23	0	15	0	<u>VP*</u>	Very Poor

<b>Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)</b>		
INDEX	WWH	EWH
ICI	36	46

a EPT=Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa richness, a measure of pollution sensitive organisms.

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 ( $\leq 4$  ICI units).

### **Fish Community and Physical Habitat**

A total of 11,908 fish representing 31 species and 3 hybrids were collected from the eight sites in the Loss Creek-Sandusky River HUC-12 study area during 2011 and 2012. 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 3a and 3b and relative numbers and species collected per location are presented in Appendix Table 4. Sampling locations were evaluated using Warmwater Habitat (WWH) biocriteria codified in the Ohio Administrative Code (OAC 3745-1-07, Table 7-15).

The two Sandusky River main stem sites reflected the good (RM 122.0) to excellent (RM 127.8) habitat conditions present and met WWH expectations with the Lower Leesville Rd. site (RM 127.8) receiving an IBI=44 and MIwb=8.55 and the St. Rt. 602 site (RM 122.0) receiving an IBI=46 and MIwb=7.85. Six darter species and the pollution sensitive stonecat madtom were collected at each location. While the number of darter species remained consistent between sites, insectivorous fish including golden redhorse and northern hog sucker along with several minnow and darter species comprised a greater percentage of the fish community at the lower site compared to the upper site, 68% to 25%, respectively.

However, the relative number of fish (total fish minus tolerant fish), percent of tolerant fish, and the MIwb decreased in a downstream direction. The MIwb is sensitive to environmental disturbances that result in shifts of fish community composition without large reductions in species richness, biomass and/or numbers. The decrease in MIwb score from an 8.55 at Lower Leesville Road (RM 127.8) to a 7.85 at St. Rt. 602 (RM 122.0) may indicate slightly lower overall fish community integrity. The three decreasing community attributes noted above were related to an increased presence and percent by weight of the pollution tolerant white sucker which comprised an average 2.1% by number and 14% by weight at the upstream site compared to an average 21% by number and 51.9% by weight at the downstream site (Appendix Table 4). The white sucker is considered a pioneering species adaptable to a wide range of environmental conditions and, therefore, may reflect fluxes in water quality or decreased habitat quality. While the QHEI scores decreased from 79.3 at the upstream location to 67.3 at the downstream location, the habitat available at each site was more than adequate to support WWH fish communities. The lower QHEI score at the downstream site was primarily attributed to less abundant instream cover and lower diversity of substrates, though this would not seem sufficient in and of itself to explain the increased presence of white sucker and associated decrease in the MIwb score.

The fish community of Loss Creek reflected the good to excellent habitat conditions present at each sampling location with general improvements in fish community integrity and overall habitat quality noted in a downstream direction. The QHEI scores increased from good (QHEI=59.5) at St. Rt. 96 (RM 5.18) to excellent at Loss Creek Rd. (RM 3.73) and Biddle Rd. (RM 0.96) with QHEI scores of 74.0 and 72.8, respectively. The substantial amount of diverse instream cover at each site provided ample habitat for the fish community and channel development improved from poor at St. Rt. 96 (RM 5.18) to fair at Loss Creek Rd. (RM 3.73) to fair-good at Biddle Road (RM 0.96). In a similar fashion, the IBI scores improved from good (IBI=40) at the most upstream location to very good at each of the downstream locations with an IBI=46 at Loss Creek Rd. (RM 3.73) and an IBI= 48 at Biddle Rd. (RM 0.96). The number of darter species also increased in a downstream direction with rainbow darter and johnny darter present at all locations, fantail darter present at the two downstream locations, and blackside darter, logperch darter and greenside darter all present at only the most downstream location (RM 0.96).

The South Fork Loss Creek fish community sampled at Loss Creek Rd. (RM 0.04) was assessed as very good and reflected the excellent habitat quality (QHEI=73.8) present. The combination of diverse substrates, moderate amounts of instream cover and well developed pools and riffles provided sufficient habitat for the sixteen fish species collected. Two moderately pollution sensitive species, northern hog sucker and rainbow darter, were noted; each requires swift, relatively silt-free riffle/run areas to thrive.

The highest scoring fish community was found in Allen Run, which received an IBI score of 50. Surprisingly, the site at Crestline Rd. (RM 1.18) had only fair habitat quality and received a QHEI of 52.5. A total of 18 species were collected including blackside darter, johnny darter, rainbow darter, and fantail darter. On July 18, 2012, an Ohio EPA sampling crew discovered 215 dead fish of various species (white suckers, sunfish, rockbass, creek chubs, darters, shiners, and others) in the stream at Crestline Rd. (RM 1.18). The crew collected a water sample and contacted the local Ohio DNR wildlife officer who investigated and determined that the kill was likely natural. In a phone conversation on July 25, 2012, the

wildlife officer stated that excessive air temperatures at that time likely increased temperatures and algal photorespiration in the stream resulting in a depletion of oxygen that caused the kill. Enhancing the riparian vegetation in this area may help reduce this type of event in the future and thereby prevent further fish kills. However, based on an extremely high ammonia value (35.9 mg/l) measured in Allen Run at Crestline Rd. on the day of the fish kill, follow-up sampling at Crestline Rd. and a location upstream at Nazor Rd. (RM 2.30) was conducted in late August, 2012 to document if an impact occurred to the fish community as compared to the 2011 Crestline Rd. results and a presumed unaffected upstream location. The loss of 8 species (including 4 darter species) and a significant decrease in relative number of fish at Crestline Rd. (RM 1.18) between 2011 and 2012 resulted in a decline in the IBI score to 30 which indicated that the community was significantly impacted by and has not recovered from the recent fish kill (exceptional to fair community quality). Fish community results from the site were also incrementally worse than those from the Nazor Rd. site (slightly lower IBI score, fewer total fish, and 1 fewer species) despite the latter's similarly fair physical habitat conditions but much smaller stream size.

Table 4. Fish community summaries based on pulsed D.C. headwater and wading electrofishing sampling conducted by Ohio EPA in the Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012. The applicable aquatic life use designation is Warmwater Habitat (WWH) for all sites.

River Mile	Site Type	Species (Total)	Species (Sensitive)	Relative Number <sup>a</sup>	QHEI	Index of Biotic Integrity	Modified Index of Well-being <sup>b</sup>	Narrative Evaluation
Sandusky River - 2011								
127.80	Wading	24	7	1906	79.3	44	8.55	Good
122.00	Wading	24	7	465	67.3	46	7.85 <sup>ns</sup>	Very Good/Marginally Good
Loss Creek - 2011 <sup>b</sup>								
5.18	Headwater	14	1	3226	59.5	40	-	Good
3.73	Headwater	18	1	3562	74.0	46	-	Very Good
0.96	Headwater	22	4	2370	72.8	48	-	Very Good
South Fork Loss Creek (Trib. at RM 2.98) - 2011								
0.04	Headwater	16	2	2512	73.8	46	-	Very Good
Allen Run - 2011 and 2012								
1.18 (2011)	Headwater	18	2	3500	52.5	50	-	Exceptional
2.30 (2012)	Headwater	11	0	1434	51.0	32*	-	Fair
1.18 (2012)	Headwater	10	0	561	52.5	30*	-	Fair

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

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

ns Non-significant departure from ecoregion biocriterion ( $\leq 4$  IBI units or 0.5 MIwb units).

a Relative numbers are per 300 meters (headwater and wading methods).

b MIwb not applicable at sites with  $< 20$  mi<sup>2</sup> drainage areas.



## Water Quality

Surface water grab samples were collected from the Loss Creek-Sandusky River HUC-12 watershed at seven locations on five occasions between July 19, 2011 and May 12, 2012. There is an ultrasonic flow meter temporarily installed just upstream from the St. Rt. 602 sampling station which records the stream flow from the entire study area, plus Paramour Creek and the headwaters of the Sandusky River. Stream cross section flows were also measured at this site, Allen Run at Crestline Rd., and Loss Creek at Biddle Rd. on each water sample collection day. There was a significant rain event in the watershed on July 19, 2011, just before and during the time the stream samples were collected. In general, flows in Loss Creek and the Sandusky River were sustained by higher than usual precipitation throughout the summer and fall of 2011. Surface water samples were analyzed for nutrients including nitrate+nitrite, ammonia, total phosphorus, dissolved orthophosphate, suspended and dissolved solids, and field meter measurements including dissolved oxygen, pH and temperature. Parameters that exceeded Ohio WQS criteria or statewide nutrient targets are reported in Table 6, and the full data set is compiled in Appendix Table 5. Interactive maps of surface water chemical data, downloadable to spreadsheet format, are available at the following link.

<http://wwwapp.epa.ohio.gov/dsw/gis/wq/index.php>

Submersible continuous monitors were deployed from August 16-18, 2011, at three sites to record hourly readings of four field water quality parameters; temperature, pH, dissolved oxygen (D.O.), and conductivity. The sites were Sandusky River at Beck Road, Allen Run at Crestline Road, and Loss Creek at Biddle Road. The data were summarized for a 48-hour period, and with the exception of D.O. dipping below the Outside Mixing Zone Average (OMZA) criterion of 5.0 mg/l for a period of 4 hours at the Sandusky River site, there were no exceedences of Ohio WQS criteria. The low point for the excursion was 4.75 mg/l which occurred at 7:00 AM. The likely reason for the wide D.O. minimum to maximum range and criteria exceedence is the large cattle farm 1.03 miles upstream from the site. Inputs from in-stream cattle and pasture runoff serve to bolster algal production enough to create the wide D.O. swings and lower D.O. readings.

The D.O. results for each site are summarized in Figure 2, and show the minimum, maximum, and 25<sup>th</sup>, 50<sup>th</sup>, and 75<sup>th</sup> percentile values for the 48 hourly readings for each site. The other parameters (temperature, pH, and conductivity) for each site were all within normal ranges for Ohio WWH waters and were not graphed.

Additional water chemistry samples were collected in Allen Run on August 29, 2011, and July 18, 2012, due to a suspicious tile flow and a fish kill, respectively. In August, 2011, a cloudy white substance was actively flowing from a tile on the right (east) bank of the stream, approximately thirty feet downstream from the culvert under Crestline Road. The adjacent farm operation has a limestone gravel lot on the west side of barns that leads to a yard drain connected to this tile. It is possible that water used to clean equipment had carried lime fines into the stream. A sample analyzed from the stream in the mixing zone showed slightly elevated levels of ammonia, TKN nitrogen, and phosphorus when compared to the other stream sample taken the same day from the upstream side of the culvert. These minor differences were not significant and likely did not cause water quality problems in the stream.

The more serious July, 2012 sample from Allen Run was collected in response to a fish kill observed by Ohio EPA staff and reported to Ohio DNR wildlife officers. The initial Ohio DNR investigation determined that stress from high water temperatures and low dissolved oxygen levels likely contributed to the incident. However, the ammonia test result from the ambient sample was later reported as 35.9 mg/l; a level acutely toxic to fish and most other aquatic life even during ideal weather conditions. Additional investigation will be conducted on Allen Run to determine the source and steps will be taken to prevent a future recurrence.

Table 6. Exceedances of Ohio Water Quality Standards criteria (OAC 3745-1) and statewide nutrient targets (Ohio EPA, 1999) for chemical parameters measured in the Loss Creek-Sandusky River HUC-12 watershed study area, 2011-2012.

Stream RM	Location	Parameter (value – mg/l unless noted)
Sandusky River		
127.80	Lower Leesville Rd.	Nitrate+nitrite – 4.01 <sup>a</sup> , 1.48 <sup>a</sup> , 2.63 <sup>a</sup> , 1.44 <sup>a</sup> , Total phosphorus – 0.277 <sup>b</sup> , 0.180 <sup>b</sup> , 0.131 <sup>b</sup> , 0.145 <sup>b</sup>
122.00	Beck Rd. and St. Rt. 602	Nitrate+nitrite – 1.85 <sup>a</sup> , 2.57 <sup>a</sup> , 1.37 <sup>a</sup> , Total phosphorus – 0.145 <sup>b</sup> , 0.128 <sup>b</sup> , 0.126 <sup>b</sup> , 0.116 <sup>b</sup>
Loss Creek		
5.18	St. Rt. 96	Nitrate+nitrite – 4.96 <sup>c</sup> , 3.39 <sup>c</sup> , 2.86 <sup>c</sup> , 262 <sup>c</sup> Total phosphorus – 0.388 <sup>d</sup> , 0.166 <sup>d</sup> , 0.129 <sup>d</sup>
3.73	Loss Creek Rd.	Nitrate+nitrite – 1.97 <sup>c</sup> , 1.63 <sup>c</sup> , 2.36 <sup>c</sup> , 1.78 <sup>c</sup> Total phosphorus – 0.301 <sup>d</sup> , 0.155 <sup>d</sup> , 0.176 <sup>d</sup>
0.96	Biddle Rd.	Nitrate+nitrite – 1.60 <sup>c</sup> , 1.56 <sup>c</sup> , 1.79 <sup>c</sup> , 2.62 <sup>c</sup> Total phosphorus – 0.337 <sup>d</sup> , 0.111 <sup>d</sup>
South Fork Loss Creek (Trib. at RM 2.98)		
0.04	Loss Creek Rd.	Nitrate+nitrite – 3.55 <sup>c</sup> , 1.35 <sup>c</sup> Total phosphorus – 0.194 <sup>d</sup> , 0.101 <sup>d</sup> , 0.183 <sup>d</sup>
Allen Run		
1.18	Crestline Rd.	Ammonia – 35.9 <sup>e</sup> Nitrate+nitrite – 2.57 <sup>c</sup> , 1.30 <sup>c</sup> , 2.29 <sup>c</sup> , 4.42 <sup>c</sup> , 1.38 <sup>c</sup> , 1.61 <sup>c</sup> Total phosphorus – 0.316 <sup>d</sup> , 0.192 <sup>d</sup> , 0.203 <sup>d</sup> , 0.712 <sup>d</sup> , 0.446 <sup>d</sup> , 0.509 <sup>d</sup>

<sup>a</sup> Exceedance of the nitrate-nitrite target for WWH Wadeable drainage area.

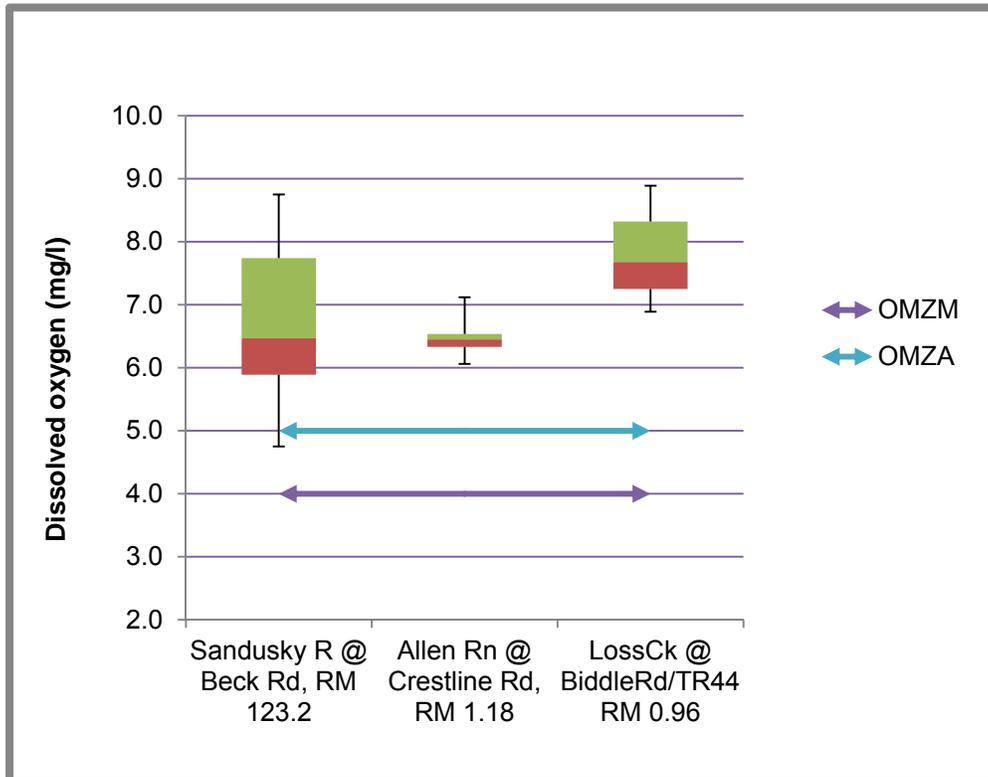
<sup>b</sup> Exceedance of the total phosphorus target for WWH Wadeable drainage area.

<sup>c</sup> Exceedance of the nitrate-nitrite target for WWH Headwater drainage area.

<sup>d</sup> Exceedance of the total phosphorus target for WWH Headwater drainage area.

<sup>e</sup> Violation of the outside mixing zone maximum total ammonia-nitrogen criterion.

Figure 2. Continuous monitor dissolved oxygen (D.O.) results for three Loss Creek-Sandusky River HUC-12 watershed study area sites, 2011. OMZM: Outside Mixing Zone Minimum criterion; OMZA: Outside Mixing Zone Average criterion.



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Links to documents without links provided above can be found at the following web site.  
<http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.aspx>

## **APPENDICES**

Appendix Table 1. Invertebrate Community Index (ICI) metrics and scores for Sandusky River sites sampled in the Loss Creek-Sandusky River HUC-12 study area, 2011.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco-region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddisflies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms			
Sandusky River (05-001)													
Year: 2011													
127.80	35.0	36(4)	6(4)	3(4)	19(4)	20.2(4)	3.8(2)	32.1(6)	42.9(4)	0.7(6)	16(6)	5	44
122.00	61.0	38(6)	6(4)	2(4)	16(4)	9.5(2)	3.0(2)	62.9(6)	23.8(6)	3.0(6)	21(6)	5	46

**Appendix Table 2. Macroinvertebrate community data collected from sites in the  
Loss Creek-Sandusky River HUC-12 study area, 2011-12.**

Ohio EPA/DSW Ecological Assessment Section  
 Macroinvertebrate Collection

Site: Sandusky River

Collection Date: 09/19/2011 River Code: 05-001 RM: 127.80

Lower Leesville Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	24	80410	<i>Cricotopus (C.) sp</i>	+
01801	<i>Turbellaria</i>	8 +	81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	46
03360	<i>Plumatella sp</i>	+	82101	<i>Thienemanniella taurocapita</i>	75
03600	<i>Oligochaeta</i>	24 +	82121	<i>Thienemanniella lobapodema</i>	85 +
05800	<i>Caecidotea sp</i>	+	82824	<i>Cryptochironomus ponderosus</i>	+
06201	<i>Hyaella azteca</i>	+	83840	<i>Microtendipes pedellus group</i>	23 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	+	84118	<i>Paracladopelma undine</i>	+
11120	<i>Baetis flavistriga</i>	269 +	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
11130	<i>Baetis intercalaris</i>	281 +	84315	<i>Phaenopsectra flavipes</i>	+
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	84450	<i>Polypedilum (Uresipedilum) flavum</i>	255 +
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+
11670	<i>Procloeon viridoculare</i>	+	84700	<i>Stenochironomus sp</i>	23 +
13000	<i>Leucrocota sp</i>	19 +	84888	<i>Xenochironomus xenolabis</i>	+
13400	<i>Stenacron sp</i>	106 +	85500	<i>Paratanytarsus sp</i>	+
13521	<i>Stenonema femoratum</i>	26 +	85625	<i>Rheotanytarsus sp</i>	905 +
17200	<i>Caenis sp</i>	8 +	85720	<i>Stempellinella fimbriata</i>	11 +
21200	<i>Calopteryx sp</i>	2 +	85800	<i>Tanytarsus sp</i>	+
22001	<i>Coenagrionidae</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	116
22300	<i>Argia sp</i>	+	85840	<i>Tanytarsus sepp</i>	93 +
28208	<i>Erythemis simplicicollis</i>	+	86200	<i>Tabanus sp</i>	+
50315	<i>Chimarra obscura</i>	+	87540	<i>Hemerodromia sp</i>	40
51600	<i>Polycentropus sp</i>	9 +	95100	<i>Physella sp</i>	+
52200	<i>Cheumatopsyche sp</i>	70 +	95907	<i>Gyraulus (Torquis) parvus</i>	+
52430	<i>Ceratopsyche morosa group</i>	55 +	96900	<i>Ferrissia sp</i>	1 +
53501	<i>Hydroptilidae</i>	+	98600	<i>Sphaerium sp</i>	+
57400	<i>Neophylax sp</i>	+			
59720	<i>Triaenodes ignitus</i>	+	No. Quantitative Taxa: 36		Total Taxa: 69
59970	<i>Petrophila sp</i>	17 +	No. Qualitative Taxa: 61		ICI: 44
60900	<i>Peltodytes sp</i>	+	Number of Organisms: 3507		Qual EPT: 16
68075	<i>Psephenus herricki</i>	2 +			
68601	<i>Ancyronyx variegata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	15			
69400	<i>Stenelmis sp</i>	+			
72700	<i>Anopheles sp</i>	+			
74100	<i>Simulium sp</i>	8 +			
74501	<i>Ceratopogonidae</i>	8			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	23 +			
77800	<i>Helopelopia sp</i>	23 +			
78140	<i>Labrundinia pilosella</i>	21 +			
78450	<i>Nilotanypus fimbriatus</i>	32			
80351	<i>Corynoneura n.sp 1</i>	27 +			
80370	<i>Corynoneura lobata</i>	757 +			

Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection

Site: Sandusky River

Collection Date: 09/19/2011 River Code: 05-001 RM: 122.00

St. Rt. 602

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	40	74501	<i>Ceratopogonidae</i>	16 +
01801	<i>Turbellaria</i>	10 +	77120	<i>Ablabesmyia mallochi</i>	+
03000	<i>Ectoprocta</i>	1	77500	<i>Conchapelopia sp</i>	48 +
03600	<i>Oligochaeta</i>	32 +	77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	190
04666	<i>Helobdella triserialis</i>	+	77800	<i>Helopelopia sp</i>	48
04686	<i>Placobdella papillifera</i>	+	78450	<i>Nilotanypus fimbriatus</i>	32
04964	<i>Mooreobdella microstoma</i>	+	78655	<i>Procladius (Holotanypus) sp</i>	+
05800	<i>Caecidotea sp</i>	+	80360	<i>Corynoneura "celeripes" (sensu Simpson &amp; Bode, 1980)</i>	+
08601	<i>Hydrachnidia</i>	48 +	80370	<i>Corynoneura lobata</i>	48
11120	<i>Baetis flavistriga</i>	56 +	81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	48
11130	<i>Baetis intercalaris</i>	1 +	82121	<i>Thienemanniella lobapodema</i>	464
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	82824	<i>Cryptochironomus ponderosus</i>	+
11651	<i>Procloeon sp (w/o hindwing pads)</i>	+	82885	<i>Cryptotendipes pseudotener</i>	+
11670	<i>Procloeon viridoculare</i>	+	83040	<i>Dicrotendipes neomodestus</i>	+
13000	<i>Leucrocuta sp</i>	+	83300	<i>Glyptotendipes (G.) sp</i>	+
13400	<i>Stenacron sp</i>	63 +	83820	<i>Microtendipes "caelum" (sensu Simpson &amp; Bode, 1980)</i>	+
13521	<i>Stenonema femoratum</i>	3 +	84155	<i>Paralauterborniella nigrohalteralis</i>	+
13570	<i>Maccaffertium terminatum</i>	+	84210	<i>Paratendipes albimanus or P. duplicatus</i>	+
16700	<i>Tricorythodes sp</i>	9 +	84450	<i>Polypedilum (Uresipedilum) flavum</i>	143 +
17200	<i>Caenis sp</i>	429 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	48 +
18700	<i>Hexagenia sp</i>	+	84700	<i>Stenochironomus sp</i>	+
21200	<i>Calopteryx sp</i>	5 +	84790	<i>Tribelos fuscicorne</i>	48 +
22001	<i>Coenagrionidae</i>	8 +	84888	<i>Xenochironomus xenolabis</i>	+
22300	<i>Argia sp</i>	20 +	85201	<i>Cladotanytarsus species group A</i>	+
43300	<i>Ranatra sp</i>	+	85500	<i>Paratanytarsus sp</i>	+
50315	<i>Chimarra obscura</i>	38 +	85615	<i>Rheotanytarsus pellucidus</i>	95
51400	<i>Nyctiophylax sp</i>	+	85625	<i>Rheotanytarsus sp</i>	1857 +
51600	<i>Polycentropus sp</i>	+	85720	<i>Stempellinella fimbriata</i>	400 +
52200	<i>Cheumatopsyche sp</i>	143 +	85800	<i>Tanytarsus sp</i>	+
52430	<i>Ceratopsyche morosa group</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	1285 +
53800	<i>Hydroptila sp</i>	+	85840	<i>Tanytarsus sepp</i>	95 +
57400	<i>Neophylax sp</i>	+	86100	<i>Chrysops sp</i>	+
58505	<i>Helicopsyche borealis</i>	+	95100	<i>Physella sp</i>	+
59300	<i>Mystacides sp</i>	+	96120	<i>Menetus (Micromenetus) dilatatus</i>	+
59970	<i>Petrophila sp</i>	+	96900	<i>Ferrissia sp</i>	145 +
60900	<i>Peltodytes sp</i>	+	97601	<i>Corbicula fluminea</i>	1 +
65800	<i>Berosus sp</i>	+	98600	<i>Sphaerium sp</i>	2 +
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	1			
68708	<i>Dubiraphia vittata group</i>	+			
68901	<i>Macronychus glabratus</i>	10 +	No. Quantitative Taxa: 38	Total Taxa: 81	
69400	<i>Stenelmis sp</i>	6 +	No. Qualitative Taxa: 71	ICI: 46	
74100	<i>Simulium sp</i>	+	Number of Organisms: 5936	Qual EPT: 21	

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Loss Creek  
St. Rt. 598

Collection Date: 08/09/2011 River Code: 05-041 RM: 5.18

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	<hr/> No. Quantitative Taxa: 0      Total Taxa: 42 No. Qualitative Taxa: 42      ICI: Number of Organisms: 0      Qual EPT: 4		
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
04935	<i>Erpobdella punctata punctata</i>	+			
08601	<i>Hydrachnidia</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
27500	<i>Somatochlora sp</i>	+			
44501	<i>Corixidae</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
53800	<i>Hydroptila sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
71900	<i>Tipula sp</i>	+			
72700	<i>Anopheles sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78140	<i>Labrundinia pilosella</i>	+			
78655	<i>Procladius (Holotanypus) sp</i>	+			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
82824	<i>Cryptochironomus ponderosus</i>	+			
83002	<i>Dicrotendipes modestus</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83300	<i>Glyptotendipes (G.) sp</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84700	<i>Stenochironomus sp</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
85840	<i>Tanytarsus sepp</i>	+			
95100	<i>Physella sp</i>	+			
95907	<i>Gyraulus (Torquis) parvus</i>	+			
96264	<i>Planorbella (Pierosoma) pilsbryi</i>	+			
96900	<i>Ferrissia sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Loss Creek  
Loss Creek Rd.

Collection Date: 08/09/2011 River Code: 05-041 RM: 3.73

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
04935	<i>Erpobdella punctata punctata</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
13521	<i>Stenonema femoratum</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
68075	<i>Psephenus herricki</i>	+			
68201	<i>Scirtidae</i>	+			
69400	<i>Stenelmis sp</i>	+			
72700	<i>Anopheles sp</i>	+			
72900	<i>Culex sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78140	<i>Labrundinia pilosella</i>	+			
80370	<i>Corynoneura lobata</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
82824	<i>Cryptochironomus ponderosus</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
85802	<i>Tanytarsus n. sp nr. curticornis</i>	+			
94400	<i>Fossaria sp</i>	+			
95100	<i>Physella sp</i>	+			
96900	<i>Ferrissia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0            Total Taxa: 37  
 No. Qualitative Taxa: 37            ICI:  
 Number of Organisms: 0            Qual EPT: 5

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Loss Creek  
Biddle Rd.

Collection Date: 08/09/2011 River Code: 05-041 RM: 0.96

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	85625	<i>Rheotanytarsus sp</i>	+
03360	<i>Plumatella sp</i>	+	85800	<i>Tanytarsus sp</i>	+
04935	<i>Erpobdella punctata punctata</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
08601	<i>Hydrachnidia</i>	+	85840	<i>Tanytarsus sepp</i>	+
11120	<i>Baetis flavistriga</i>	+	95100	<i>Physella sp</i>	+
11130	<i>Baetis intercalaris</i>	+	96002	<i>Helisoma anceps anceps</i>	+
11250	<i>Centroptilum sp (w/o hindwing pads)</i>	+	96900	<i>Ferrissia sp</i>	+
11650	<i>Procloeon sp (w/ hindwing pads)</i>	+	98600	<i>Sphaerium sp</i>	+
13000	<i>Leucrocuta sp</i>	+			
13400	<i>Stenacron sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 52
13521	<i>Stenonema femoratum</i>	+	No. Qualitative Taxa: 52		ICI:
17200	<i>Caenis sp</i>	+	Number of Organisms: 0		Qual EPT: 14
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
44501	<i>Corixidae</i>	+			
50315	<i>Chimarra obscura</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
52430	<i>Ceratopsyche morosa group</i>	+			
52530	<i>Hydropsyche depravata group</i>	+			
53800	<i>Hydroptila sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
59970	<i>Petrophila sp</i>	+			
64050	<i>Liodessus sp</i>	+			
67700	<i>Paracymus sp</i>	+			
68025	<i>Ectopria sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68201	<i>Scirtidae</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
69400	<i>Stenelmis sp</i>	+			
72700	<i>Anopheles sp</i>	+			
72900	<i>Culex sp</i>	+			
74100	<i>Simulium sp</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
82824	<i>Cryptochironomus ponderosus</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84700	<i>Stenochironomus sp</i>	+			
85500	<i>Paratanytarsus sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: South Fk. Loss Creek (RM 2.98)

Collection Date: 08/09/2011 River Code: 05-072 RM: 0.10

Loss Creek Rd.

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+	85800	<i>Tanytarsus sp</i>	+
03360	<i>Plumatella sp</i>	+	85821	<i>Tanytarsus glabrescens group sp 7</i>	+
03600	<i>Oligochaeta</i>	+	85840	<i>Tanytarsus sepp</i>	+
07860	<i>Cambarus (Puncticambarus) robustus</i>	+	86100	<i>Chrysops sp</i>	+
08601	<i>Hydrachnidia</i>	+	95100	<i>Physella sp</i>	+
11120	<i>Baetis flavistriga</i>	+	98600	<i>Sphaerium sp</i>	+
11130	<i>Baetis intercalaris</i>	+			
13000	<i>Leucrocuta sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 50
13400	<i>Stenacron sp</i>	+	No. Qualitative Taxa: 50		ICI:
13521	<i>Stenonema femoratum</i>	+	Number of Organisms: 0		Qual EPT: 10
17200	<i>Caenis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
23600	<i>Aeshna sp</i>	+			
23909	<i>Boyeria vinosa</i>	+			
42700	<i>Belostoma sp</i>	+			
50301	<i>Chimarra aterrima</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
53800	<i>Hydroptila sp</i>	+			
58505	<i>Helicopsyche borealis</i>	+			
60900	<i>Peltodytes sp</i>	+			
68075	<i>Psephenus herricki</i>	+			
68130	<i>Helichus sp</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
69400	<i>Stenelmis sp</i>	+			
71900	<i>Tipula sp</i>	+			
72340	<i>Dixella sp</i>	+			
72700	<i>Anopheles sp</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78140	<i>Labrundinia pilosella</i>	+			
80351	<i>Corynoneura n.sp 1</i>	+			
80363	<i>Corynoneura sp 12</i>	+			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
81650	<i>Parametriocnemus sp</i>	+			
82882	<i>Cryptotendipes sp 2</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
84315	<i>Phaenopsectra flavipes</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	+			
84700	<i>Stenochironomus sp</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Allen Run  
Nazor Rd.

Collection Date: 09/07/2012 River Code: 05-043 RM: 2.30

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
01900	<i>Nemertea</i>	+			
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
04664	<i>Helobdella stagnalis</i>	+			
04666	<i>Helobdella triserialis</i>	+			
11200	<i>Callibaetis sp</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
28955	<i>Plathemis lydia</i>	+			
44501	<i>Corixidae</i>	+			
55300	<i>Ptilostomis sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
65800	<i>Berosus sp</i>	+			
68201	<i>Scirtidae</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
68708	<i>Dubiraphia vittata group</i>	+			
72700	<i>Anopheles sp</i>	+			
78655	<i>Procladius (Holotanypus) sp</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83002	<i>Dicrotendipes modestus</i>	+			
83051	<i>Dicrotendipes simpsoni</i>	+			
84000	<i>Parachironomus sp</i>	+			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
86100	<i>Chrysops sp</i>	+			
95100	<i>Physella sp</i>	+			
95907	<i>Gyraulus (Torquis) parvus</i>	+			
96120	<i>Menetus (Micromenetus) dilatatus</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0                      Total Taxa: 34  
 No. Qualitative Taxa: 34                      ICI:  
 Number of Organisms: 0                      Qual EPT: 2

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Allen Run  
Crestline Rd.

Collection Date: 09/07/2012 River Code: 05-043 RM: 1.18

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03360	<i>Plumatella sp</i>	+			
03600	<i>Oligochaeta</i>	+			
04664	<i>Helobdella stagnalis</i>	+			
04964	<i>Mooreobdella microstoma</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
28705	<i>Pachydiplax longipennis</i>	+			
28955	<i>Plathemis lydia</i>	+			
42700	<i>Belostoma sp</i>	+			
72700	<i>Anopheles sp</i>	+			
78702	<i>Psectrotanypus dyari</i>	+			
80510	<i>Cricotopus (Isocladius) sylvestris group</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83300	<i>Glyptotendipes (G.) sp</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
95100	<i>Physella sp</i>	+			
96002	<i>Helisoma anceps anceps</i>	+			
96120	<i>Menetus (Micromenetus) dilatatus</i>	+			
96900	<i>Ferrissia sp</i>	+			
98200	<i>Pisidium sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

No. Quantitative Taxa: 0	Total Taxa: 23
No. Qualitative Taxa: 23	ICI:
Number of Organisms: 0	Qual EPT: 0

**Ohio EPA/DSW Ecological Assessment Section  
Macroinvertebrate Collection**

Site: Allen Run  
Crestline Rd.

Collection Date: 08/08/2011 River Code: 05-043 RM: 1.18

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01801	<i>Turbellaria</i>	+			
03360	<i>Plumatella sp</i>	+	No. Quantitative Taxa: 0		Total Taxa: 44
03600	<i>Oligochaeta</i>	+	No. Qualitative Taxa: 44		ICI:
04664	<i>Helobdella stagnalis</i>	+	Number of Organisms: 0		Qual EPT: 3
08250	<i>Orconectes (Procericambarus) rusticus</i>	+			
11120	<i>Baetis flavistriga</i>	+			
11130	<i>Baetis intercalaris</i>	+			
21200	<i>Calopteryx sp</i>	+			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	+			
23600	<i>Aeshna sp</i>	+			
27500	<i>Somatochlora sp</i>	+			
42700	<i>Belostoma sp</i>	+			
52200	<i>Cheumatopsyche sp</i>	+			
60900	<i>Peltodytes sp</i>	+			
68201	<i>Scirtidae</i>	+			
68707	<i>Dubiraphia quadrinotata</i>	+			
69400	<i>Stenelmis sp</i>	+			
72700	<i>Anopheles sp</i>	+			
74501	<i>Ceratopogonidae</i>	+			
77120	<i>Ablabesmyia mallochi</i>	+			
77500	<i>Conchapelopia sp</i>	+			
78655	<i>Procladius (Holotanypus) sp</i>	+			
78702	<i>Psectrotanypus dyari</i>	+			
79400	<i>Zavrelimyia sp</i>	+			
82711	<i>Chironomus (C.) sp 1</i>	+			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	+			
83002	<i>Dicrotendipes modestus</i>	+			
83040	<i>Dicrotendipes neomodestus</i>	+			
83051	<i>Dicrotendipes simpsoni</i>	+			
83330	<i>Glyptotendipes (G.) barbipes</i>	+			
83600	<i>Kiefferulus (K.) dux</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	+			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84480	<i>Polypedilum (P.) laetum group</i>	+			
84800	<i>Tribelos jucundum</i>	+			
85500	<i>Paratanytarsus sp</i>	+			
85625	<i>Rheotanytarsus sp</i>	+			
85800	<i>Tanytarsus sp</i>	+			
85821	<i>Tanytarsus glabrescens group sp 7</i>	+			
95100	<i>Physella sp</i>	+			
96900	<i>Ferrissia sp</i>	+			
98600	<i>Sphaerium sp</i>	+			

Appendix Table 3a. Fish community summary statistics for headwater site samples collected in the Loss Creek-Sandusky River HUC-12 study area, 2011-12.

River Mile	Type	Date	Drainage area (sq mi)	Number of						Percent of Individuals					Rel.No. minus tolerants /(0.3km)	IBI	
				Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omni- vores	Pioneering fishes	Insect- ivores	DELT anomalies			
<i>Allen Run - (05-043)</i>																	
Year: 2012																	
2.30	E	08/29/2012	2.2	11(5)	6(5)	1(1)	0(1)	1(1)	3(3)	72(1)	23(1)	56(1)	15(3)	0.0(5)	408(5)	32	
1.20	E	08/29/2012	4.1	10(3)	7(5)	1(1)	0(1)	0(1)	3(3)	91(1)	8(5)	83(1)	7(1)	0.0(5)	109(3)	30	
Year: 2011																	
1.20	E	08/18/2011	4.1	18(5)	6(5)	2(3)	2(3)	4(5)	6(5)	41(3)	28(1)	22(5)	43(5)	0.0(5)	2054(5)	50	

Appendix Table 3b. Fish community summary statistics for wading site samples collected in the Loss Creek-Sandusky River HUC-12 study area, 2011.

River Mile	Type	Date	Drainage area (sq mi)	Number of					Percent of Individuals					Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb	
				Total species	Sunfish species	Sucker species	Intolerant species	Darter species	Simple Lithophils	Tolerant fishes	Omni- vores	Top carnivores	Insect- ivores				DELT anomalies
Sandusky River - (05001)																	
Year: 2011																	
127.80	D	08/03/2011	35	20(5)	3(3)	2(3)	1(1)	6(5)	13(1)	13(5)	8(5)	1.6(3)	23(1)	0.0(5)	1906(5)	42	8.5
127.80	E	09/13/2011	35	22(5)	3(3)	3(3)	1(1)	6(5)	16(1)	21(5)	12(5)	4.3(3)	28(3)	0.0(5)	1280(5)	44	8.6
122.00	D	08/18/2011	61	21(5)	3(3)	4(5)	1(1)	5(5)	47(5)	32(3)	21(3)	8.9(5)	69(5)	0.0(5)	276(3)	48	8.2
122.00	D	09/13/2011	61	21(5)	3(3)	3(3)	1(1)	6(5)	39(5)	37(3)	28(3)	4.9(3)	66(5)	0.0(5)	329(3)	44	7.5

**Appendix Table 4. Fish community data collected from sites in the  
Loss Creek-Sandusky River HUC-12 study area, 2011-12.**

# Species List

River Code: <b>05-001</b>	Stream: <b>Sandusky River</b>	Sample Date: <b>2011</b>
River Mile: <b>127.80</b>	Location: Lower Leesville Rd.	Date Range: 08/03/2011
Time Fished: 6055 sec	Drainage: 35.0 sq mi	Thru: 09/13/2011
Dist Fished: 0.42 km	Basin: Sandusky River	Sampler Type: D E
	No of Passes: 2	

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Golden Redhorse	R	I	S	M	1	0.75	0.04	0.00	0.02	4.00
Northern Hog Sucker	R	I	S	M	13	9.14	0.48	0.31	2.20	33.87
White Sucker	W	O	S	T	54	38.73	2.03	1.99	14.02	51.71
Western Blacknose Dace	N	G	S	T	1	0.75	0.04	0.00	0.01	2.00
Creek Chub	N	G	N	T	155	111.27	5.84	3.31	23.29	29.85
Striped Shiner	N	I	S		2	1.36	0.07	0.00	0.02	2.00
Common Shiner	N	I	S		7	5.25	0.28	0.03	0.21	5.71
Spotfin Shiner	N	I	M		90	63.89	3.35	0.19	1.36	3.01
Silverjaw Minnow	N	I	M		34	24.68	1.30	0.10	0.69	3.97
Bluntnose Minnow	N	O	C	T	195	139.77	7.33	0.45	3.15	3.19
Central Stoneroller	N	H	N		1,543	1,087.84	57.08	4.64	32.66	4.19
Striped Sh X Common Sh		I			1	0.68	0.04	0.00	0.01	2.00
Yellow Bullhead		I	C	T	5	3.61	0.19	0.05	0.34	13.80
Stonecat Madtom		I	C	I	15	10.36	0.54	0.22	1.53	21.00
Rock Bass	S	C	C		37	26.25	1.38	0.98	6.87	37.35
Smallmouth Bass	F	C	C	M	34	25.30	1.33	0.30	2.09	12.26
Green Sunfish	S	I	C	T	27	19.43	1.02	0.17	1.18	8.56
Bluegill Sunfish	S	I	C	P	90	65.05	3.41	0.47	3.28	7.20
Green Sf X Hybrid					1	0.75	0.04	0.03	0.19	35.00
Hybrid X Sunfish					2	1.36	0.07	0.03	0.20	21.00
Blackside Darter	D	I	S		5	3.61	0.19	0.05	0.33	13.40
Logperch	D	I	S	M	25	17.93	0.94	0.23	1.62	12.76
Johnny Darter	D	I	C		22	15.14	0.79	0.01	0.09	0.85
Greenside Darter	D	I	S	M	168	119.59	6.28	0.45	3.15	3.72
Rainbow Darter	D	I	S	M	109	77.18	4.05	0.17	1.21	2.22
Fantail Darter	D	I	C		51	36.14	1.90	0.04	0.28	1.08
<i>Mile Total</i>					2,687	1,905.82		14.21		
<i>Number of Species</i>					23					
<i>Number of Hybrids</i>					3					

## Species List

River Code: <b>05-001</b>	Stream: <b>Sandusky River</b>	Sample Date: <b>2011</b>
River Mile: <b>122.00</b>	Location: St. Rt. 602	Date Range: 08/18/2011
Time Fished: 4035 sec	Drainage: 61.0 sq mi	Thru: 09/13/2011
Dist Fished: 0.40 km	Basin: Sandusky River	Sampler Type: D
	No of Passes: 2	

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Golden Redhorse	R	I	S	M	1	0.75	0.16	0.04	0.12	48.00
Northern Hog Sucker	R	I	S	M	20	15.00	3.23	1.70	5.79	113.10
White Sucker	W	O	S	T	136	102.00	21.94	14.90	50.88	146.05
Spotted Sucker	R	I	S		3	2.25	0.48	0.45	1.54	199.67
Common Carp	G	O	M	T	2	1.50	0.32	5.33	18.19	3,550.00
Creek Chub	N	G	N	T	4	3.00	0.65	0.15	0.50	48.50
Redfin Shiner	N	I	N		49	36.75	7.90	0.05	0.18	1.43
Common Shiner	N	I	S		1	0.75	0.16	0.00	0.01	5.00
Spotfin Shiner	N	I	M		70	52.50	11.29	0.13	0.45	2.48
Bluntnose Minnow	N	O	C	T	16	12.00	2.58	0.43	1.45	35.50
Central Stoneroller	N	H	N		3	2.25	0.48	0.01	0.03	3.33
Yellow Bullhead		I	C	T	11	8.25	1.77	0.79	2.69	95.36
Stonecat Madtom		I	C	I	10	7.50	1.61	0.28	0.97	37.80
Rock Bass	S	C	C		27	20.25	4.35	1.31	4.46	64.44
Smallmouth Bass	F	C	C	M	7	5.25	1.13	1.80	6.16	343.57
Largemouth Bass	F	C	C		7	5.25	1.13	0.15	0.51	28.57
Green Sunfish	S	I	C	T	48	36.00	7.74	0.49	1.68	13.67
Bluegill Sunfish	S	I	C	P	80	60.00	12.90	0.79	2.68	13.10
Blackside Darter	D	I	S		14	10.50	2.26	0.05	0.18	5.14
Logperch	D	I	S	M	25	18.75	4.03	0.25	0.86	13.37
Johnny Darter	D	I	C		2	1.50	0.32	0.00	0.01	2.00
Greenside Darter	D	I	S	M	53	39.75	8.55	0.14	0.47	3.43
Rainbow Darter	D	I	S	M	10	7.50	1.61	0.03	0.09	3.50
Fantail Darter	D	I	C		21	15.75	3.39	0.03	0.12	2.19
<i>Mile Total</i>					620	465.00		29.28		
<i>Number of Species</i>					24					
<i>Number of Hybrids</i>					0					

# Species List

River Code: <b>05-041</b>	Stream: <b>Loss Creek</b>	Sample Date: <b>2011</b>
River Mile: <b>5.20</b>	Location: St. Rt. 96	Date Range: 08/04/2011
Time Fished: 1842 sec	Drainage: 2.1 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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	137	274.00	8.49	2.01	16.74	7.35
Western Blacknose Dace	N	G	S	T	111	222.00	6.88	0.30	2.50	1.35
Creek Chub	N	G	N	T	556	1,112.00	34.47	4.02	33.42	3.61
Common Shiner	N	I	S		1	2.00	0.06	0.03	0.27	16.00
Silverjaw Minnow	N	I	M		11	22.00	0.68	0.05	0.40	2.18
Fathead Minnow	N	O	C	T	40	80.00	2.48	0.10	0.86	1.29
Bluntnose Minnow	N	O	C	T	127	254.00	7.87	0.52	4.36	2.06
Central Stoneroller	N	H	N		507	1,014.00	31.43	4.36	36.22	4.29
Yellow Bullhead		I	C	T	2	4.00	0.12	0.11	0.90	27.00
Green Sunfish	S	I	C	T	6	12.00	0.37	0.12	0.96	9.67
Bluegill Sunfish	S	I	C	P	4	8.00	0.25	0.06	0.53	8.00
Hybrid X Sunfish					1	2.00	0.06	0.06	0.53	32.00
Johnny Darter	D	I	C		96	192.00	5.95	0.20	1.65	1.03
Rainbow Darter	D	I	S	M	8	16.00	0.50	0.04	0.36	2.71
Brook Stickleback		I	C		6	12.00	0.37	0.04	0.30	3.00
<i>Mile Total</i>					1,613	3,226.00		12.02		
<i>Number of Species</i>					14					
<i>Number of Hybrids</i>					1					

## Species List

River Code: <b>05-041</b>	Stream: <b>Loss Creek</b>	Sample Date: <b>2011</b>
River Mile: <b>3.70</b>	Location: Loss Creek Rd.	Date Range: 08/03/2011
Time Fished: 1522 sec	Drainage: 2.9 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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	89	178.00	5.00	4.24	25.03	23.81
Western Blacknose Dace	N	G	S	T	66	132.00	3.71	0.21	1.26	1.61
Creek Chub	N	G	N	T	410	820.00	23.02	6.57	38.78	8.01
Redfin Shiner	N	I	N		11	22.00	0.62	0.04	0.26	2.00
Common Shiner	N	I	S		5	10.00	0.28	0.07	0.41	7.00
Spotfin Shiner	N	I	M		3	6.00	0.17	0.01	0.04	1.00
Silverjaw Minnow	N	I	M		6	12.00	0.34	0.04	0.26	3.67
Fathead Minnow	N	O	C	T	1	2.00	0.06	0.00	0.01	1.00
Bluntnose Minnow	N	O	C	T	100	200.00	5.61	0.39	2.29	1.94
Central Stoneroller	N	H	N		931	1,862.00	52.27	4.59	27.07	2.46
Yellow Bullhead		I	C	T	1	2.00	0.06	0.06	0.38	32.00
Largemouth Bass	F	C	C		5	10.00	0.28	0.11	0.66	11.20
Green Sunfish	S	I	C	T	5	10.00	0.28	0.15	0.87	14.80
Bluegill Sunfish	S	I	C	P	12	24.00	0.67	0.12	0.68	4.83
Hybrid X Sunfish					1	2.00	0.06	0.04	0.21	18.00
Johnny Darter	D	I	C		96	192.00	5.39	0.21	1.22	1.07
Rainbow Darter	D	I	S	M	19	38.00	1.07	0.06	0.37	1.67
Fantail Darter	D	I	C		19	38.00	1.07	0.03	0.18	0.79
Brook Stickleback		I	C		1	2.00	0.06	0.00	0.01	1.00
<i>Mile Total</i>					1,781	3,562.00		16.94		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					1					

# Species List

River Code: <b>05-041</b>	Stream: <b>Loss Creek</b>	Sample Date: <b>2011</b>
River Mile: <b>1.00</b>	Location: Biddle Rd.	Date Range: 08/03/2011
Time Fished: 1980 sec	Drainage: 11.6 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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
Northern Hog Sucker	R	I	S	M	1	2.00	0.08	0.16	0.89	82.00
White Sucker	W	O	S	T	239	478.00	20.17	4.07	22.07	8.52
Western Blacknose Dace	N	G	S	T	5	10.00	0.42	0.02	0.11	2.00
Creek Chub	N	G	N	T	190	380.00	16.03	5.70	30.89	15.00
Redfin Shiner	N	I	N		8	16.00	0.68	0.03	0.15	1.75
Striped Shiner	N	I	S		5	10.00	0.42	0.11	0.57	10.60
Common Shiner	N	I	S		15	30.00	1.27	0.32	1.71	10.53
Spotfin Shiner	N	I	M		10	20.00	0.84	0.05	0.27	2.50
Bluntnose Minnow	N	O	C	T	91	182.00	7.68	0.30	1.64	1.66
Central Stoneroller	N	H	N		450	900.00	37.97	5.07	27.47	5.63
Striped Sh X Common Sh		I			23	46.00	1.94	0.48	2.62	10.52
Yellow Bullhead		I	C	T	2	4.00	0.17	0.21	1.12	51.50
Brown Bullhead		I	C	T	7	14.00	0.59	0.51	2.75	36.29
Rock Bass	S	C	C		2	4.00	0.17	0.08	0.46	21.00
Largemouth Bass	F	C	C		4	8.00	0.34	0.22	1.19	27.50
Green Sunfish	S	I	C	T	29	58.00	2.45	0.58	3.14	10.00
Bluegill Sunfish	S	I	C	P	17	34.00	1.43	0.17	0.92	5.00
Hybrid X Sunfish					1	2.00	0.08	0.04	0.24	22.00
Blackside Darter	D	I	S		8	16.00	0.68	0.06	0.34	3.88
Logperch	D	I	S	M	1	2.00	0.08	0.02	0.11	10.00
Johnny Darter	D	I	C		43	86.00	3.63	0.07	0.36	0.76
Greenside Darter	D	I	S	M	4	8.00	0.34	0.06	0.35	8.00
Rainbow Darter	D	I	S	M	17	34.00	1.43	0.07	0.40	2.18
Fantail Darter	D	I	C		13	26.00	1.10	0.04	0.23	1.64
<i>Mile Total</i>					1,185	2,370.00		18.45		
<i>Number of Species</i>					22					
<i>Number of Hybrids</i>					2					

## Species List

River Code: <b>05-072</b>	Stream: <b>South Fk. Loss Creek (RM 2.98)</b>	Sample Date: <b>2011</b>
River Mile: <b>0.10</b>	Location: Loss Creek Rd.	Date Range: 08/03/2011
Time Fished: 1467 sec	Drainage: 6.8 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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
Northern Hog Sucker	R	I	S	M	1	2.00	0.08	0.02	0.19	10.00
White Sucker	W	O	S	T	40	80.00	3.18	0.95	9.21	11.85
Western Blacknose Dace	N	G	S	T	117	234.00	9.32	0.48	4.68	2.06
Creek Chub	N	G	N	T	457	914.00	36.39	5.49	53.34	6.01
Common Shiner	N	I	S		3	6.00	0.24	0.08	0.82	14.00
Spotfin Shiner	N	I	M		7	14.00	0.56	0.05	0.50	3.67
Silverjaw Minnow	N	I	M		16	32.00	1.27	0.10	0.99	3.20
Bluntnose Minnow	N	O	C	T	61	122.00	4.86	0.23	2.23	1.89
Central Stoneroller	N	H	N		379	758.00	30.18	2.21	21.42	2.91
Striped Sh X Common Sh		I			2	4.00	0.16	0.04	0.39	10.00
Largemouth Bass	F	C	C		3	6.00	0.24	0.05	0.47	8.00
Green Sunfish	S	I	C	T	6	12.00	0.48	0.11	1.11	9.50
Bluegill Sunfish	S	I	C	P	2	4.00	0.16	0.02	0.16	4.00
Blackside Darter	D	I	S		2	4.00	0.16	0.01	0.08	2.00
Johnny Darter	D	I	C		64	128.00	5.10	0.13	1.26	1.02
Rainbow Darter	D	I	S	M	53	106.00	4.22	0.19	1.88	1.83
Fantail Darter	D	I	C		43	86.00	3.42	0.13	1.26	1.51
<i>Mile Total</i>					1,256	2,512.00		10.29		
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					1					

# Species List

River Code: <b>05-043</b>	Stream: <b>Allen Run</b>	Sample Date: <b>2012</b>
River Mile: <b>2.30</b>	Location: Nazor Rd.	Date Range: 08/29/2012
Time Fished: 1600 sec	Drainage: 2.2 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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	70	140.00	9.76			
Western Blacknose Dace	N	G	S	T	59	118.00	8.23			
Creek Chub	N	G	N	T	260	520.00	36.26			
Common Shiner	N	I	S		44	88.00	6.14			
Fathead Minnow	N	O	C	T	7	14.00	0.98			
Bluntnose Minnow	N	O	C	T	91	182.00	12.69			
Central Stoneroller	N	H	N		119	238.00	16.60			
Yellow Bullhead		I	C	T	1	2.00	0.14			
Green Sunfish	S	I	C	T	25	50.00	3.49			
Bluegill Sunfish	S	I	C	P	24	48.00	3.35			
Green Sf X Hybrid					2	4.00	0.28			
Johnny Darter	D	I	C		15	30.00	2.09			
<i>Mile Total</i>					717	1,434.00				
<i>Number of Species</i>					11					
<i>Number of Hybrids</i>					1					

# Species List

River Code: <b>05-043</b>	Stream: <b>Allen Run</b>	Sample Date: <b>2012</b>
River Mile: <b>1.20</b>	Location: Crestline Rd.	Date Range: 08/29/2012
Time Fished: 1398 sec	Drainage: 4.1 sq mi	
Dist Fished: 0.16 km	Basin: Sandusky 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	15.00	1.24	0.83	9.62	55.13
Western Blacknose Dace	N	G	S	T	45	84.38	6.98	0.27	3.12	3.18
Creek Chub	N	G	N	T	470	881.25	72.87	5.09	59.28	5.78
Common Shiner	N	I	S		16	30.00	2.48	0.28	3.27	9.38
Spotfin Shiner	N	I	M		9	16.88	1.40	0.11	1.27	6.44
Fathead Minnow	N	O	C	T	4	7.50	0.62	0.02	0.27	3.00
Bluntnose Minnow	N	O	C	T	42	78.75	6.51	0.26	3.05	3.33
Central Stoneroller	N	H	N		28	52.50	4.34	0.76	8.87	14.52
Green Sunfish	S	I	C	T	18	33.75	2.79	0.64	7.44	18.94
Bluegill Sunfish	S	I	C	P	5	9.38	0.78	0.33	3.82	35.00
<i>Mile Total</i>					645	1,209.38		8.59		
<i>Number of Species</i>					10					
<i>Number of Hybrids</i>					0					

# Species List

River Code: <b>05-043</b>	Stream: <b>Allen Run</b>	Sample Date: <b>2011</b>
River Mile: <b>1.20</b>	Location: Crestline Rd.	Date Range: 08/18/2011
Time Fished: 948 sec	Drainage: 4.1 sq mi	
Dist Fished: 0.15 km	Basin: Sandusky 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	365	730.00	20.86	10.67	44.40	14.61
Spotted Sucker	R	I	S		1	2.00	0.06	0.13	0.54	65.00
Western Blacknose Dace	N	G	S	T	16	32.00	0.91	0.12	0.52	3.88
Creek Chub	N	G	N	T	202	404.00	11.54	2.93	12.21	7.26
Common Shiner	N	I	S		98	196.00	5.60	0.74	3.10	3.80
Fathead Minnow	N	O	C	T	22	44.00	1.26	0.11	0.44	2.40
Bluntnose Minnow	N	O	C	T	97	194.00	5.54	0.58	2.40	2.97
Central Stoneroller	N	H	N		238	476.00	13.60	2.41	10.02	5.06
Yellow Bullhead		I	C	T	2	4.00	0.11	0.16	0.65	39.00
Black Bullhead		I	C	P	1	2.00	0.06	0.13	0.54	65.00
Smallmouth Bass	F	C	C	M	5	10.00	0.29	0.07	0.30	7.20
Largemouth Bass	F	C	C		4	8.00	0.23	0.04	0.15	4.50
Green Sunfish	S	I	C	T	19	38.00	1.09	0.39	1.62	10.26
Bluegill Sunfish	S	I	C	P	561	1,122.00	32.06	3.74	15.57	3.33
Hybrid X Sunfish					41	82.00	2.34	1.57	6.53	19.13
Blackside Darter	D	I	S		1	2.00	0.06	0.00	0.02	2.00
Johnny Darter	D	I	C		50	100.00	2.86	0.11	0.47	1.13
Rainbow Darter	D	I	S	M	13	26.00	0.74	0.06	0.27	2.46
Fantail Darter	D	I	C		14	28.00	0.80	0.07	0.27	2.33
<i>Mile Total</i>					1,750	3,500.00		24.03		
<i>Number of Species</i>					18					
<i>Number of Hybrids</i>					1					

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

<b>Sandusky River @ Lower Leesville Rd (RM 127.8)</b>		<b>U02P08</b>				
<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time Collected	hhmmss	10:36:16	9:57:54	9:44:39	10:16:53	12:11:52
Temperature	°C	23.83	18.18	14.68	13.27	15.92
Dissolved Oxygen	mg/L	7.53	8.61	9.49	11.29	9.59
Dissolved Oxygen	%	89.3	91.4	93.6	108.1	97.1
pH	s.u.	8.03	8.45	8.02	8.07	7.83
Conductivity	uS/cm	0.703	0.545	0.448	0.593	0.506
Conductivity @ 25C	uS/cm	0.719	0.627	0.557	0.765	0.613
Total Dissolved Solids	mg/L	462	476	360	448	400
Total Suspended Solids	mg/L	90	<5	5	<5	35
Alkalinity	mg/L	175	250	173	244	146
Ammonia	mg/L	0.092	0.119	<0.050	<0.050	0.084
COD	mg/L	20	22	<20	<20	29
Chloride	mg/L	75.4	32.1	46.2	67.6	69.3
Conductivity	umhos/cm	736	769	590	770	624
Nitrate+nitrite	mg/L	4.01	1.48	2.63	0.78	1.44
Nitrite	mg/L	0.070	0.083	<0.020	0.033	0.044
Orthophosphate, dissolved	mg/L	0.262	0.158	0.108	0.037	0.068
Sulfate	mg/L	75.3	122	60.5	102	86.4
TKN	mg/L	0.60	1.01	0.63	0.60	0.99
Total Phosphorus	mg/L	0.277	0.180	0.131	0.070	0.145

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

<b>Sandusky River @ Beck Rd and SR 602 (RM 122.0) U02P26</b>		<b>U02G30</b>				
<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time	hhmmss	12:36:14	11:10:42	10:58:16	11:23:49	13:21:56
Temperature	°C	24.9	20.07	14.75	14.28	16.95
Dissolved Oxygen	mg/L	6.3	6.14	8.54	11.67	8.86
Dissolved Oxygen	%	76.2	67.7	84.4	114.2	91.8
pH	s.u.	7.76	7.78	7.99	8.07	8.04
Conductivity	uS/cm	0.483	0.504	0.396	0.554	0.622
Conductivity @ 25C	uS/cm	0.484	0.557	0.492	0.697	0.735
Total Dissolved Solids	mg/L	326	324	312	412	470
Total Suspended Solids	mg/L	62	11	8	6	33
Alkalinity	mg/L	153	150	154	250	214
Ammonia	mg/L	0.136	0.060	<0.050	<0.050	<0.050
COD	mg/L	20	<20	<20	<20	21
Chloride	mg/L	38.1	46.4	40.5	53.6	70.9
Conductivity	umhos/cm	497	559	519	705	754
Nitrate+nitrite	mg/L	1.85	0.71	2.57	0.37	1.37
Nitrite	mg/L	0.029	<0.020	<0.020	0.034	0.032
Orthophosphate, dissolved	mg/L	0.096	0.087	0.093	0.013	0.050
Sulfate	mg/L	44.9	53.6	<5.0	86.3	114
TKN	mg/L	0.60	0.63	0.63	0.62	0.76
Total Phosphorus	mg/L	0.145	0.123	0.126	0.044	0.116

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

<b>Loss Creek @ CR 96 (RM 5.18)</b>		<b>301595</b>				
<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time	hhmmss	10:58:49	10:17:47	10:02:05	10:34:20	12:31:44
Temperature	°C	22.5	17.14	13.62	11.37	15.99
Dissolved Oxygen	mg/L	6.53	7.25	7.95	12.85	11.83
Dissolved Oxygen	%	75.5	75.5	76.7	117.8	120.1
pH	s.u.	7.29	7.85	7.86	7.9	8.03
Conductivity	uS/cm	0.238	0.699	0.619	0.545	0.609
Conductivity @ 25C	uS/cm	0.249	0.822	0.79	0.737	0.735
Total Dissolved Solids	mg/L	228	472	476	450	446
Total Suspended Solids	mg/L	156	<5	<5	<5	<5
Alkalinity	mg/L	58.1	200	229	267	214
Ammonia	mg/L	0.208	0.186	<0.050	<0.050	0.530
COD	mg/L	38	28	<20	<20	<20
Chloride	mg/L	22.3	104	80.2	51.9	69.8
Conductivity	umhos/cm	254	839	818	746	748
Nitrate+nitrite	mg/L	4.96	0.37	3.39	2.86	2.62
Nitrite	mg/L	0.095	<0.020	0.030	0.090	0.138
Orthophosphate, dissolved	mg/L	0.258	0.119	0.132	0.014	0.034
Sulfate	mg/L	25.5	71.4	64.3	83.1	93.0
TKN	mg/L	0.91	1.18	0.92	0.52	1.28
Total Phosphorus	mg/L	0.388	0.166	0.129	0.040	0.077

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

<b>Loss Creek @ Loss Creek Rd (RM 3.73)</b>		<b>301594</b>				
<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time Collected	hhmmss	11:12:30	10:29:09	10:13:11	10:43:35	12:45:13
Temperature	°C	23.12	16.81	13.71	12.25	16.49
Dissolved Oxygen	mg/L	7.05	5.79	8.28	11.89	11.59
Dissolved Oxygen	%	82.5	59.8	80	111.2	118.9
pH	s.u.	7.73	7.84	7.91	7.98	8.09
Conductivity	uS/cm	0.587	585	0.551	0.599	0.695
Conductivity @ 25C	uS/cm	0.609	0.693	0.702	0.792	0.83
Total Dissolved Solids	mg/L	412	408	428	472	500
Total Suspended Solids	mg/L	302	5	<5	<5	6
Alkalinity	mg/L	137	178	200	229	210
Ammonia	mg/L	0.153	<0.050	<0.050	<0.050	<0.050
COD	mg/L	32	26	<20	<20	20
Chloride	mg/L	79.2	65.3	70.7	76.6	93.5
Conductivity	umhos/cm	624	700	723	803	852
Nitrate+nitrite	mg/L	1.97	1.63	2.36	0.89	1.78
Nitrite	mg/L	0.026	<0.020	<0.020	0.043	0.074
Orthophosphate, dissolved	mg/L	0.136	0.123	0.159	0.013	0.013
Sulfate	mg/L	57.8	68.4	71.4	108	127
TKN	mg/L	0.67	0.69	0.75	0.77	1.05
Total Phosphorus	mg/L	0.301	0.155	0.176	0.048	0.062

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

**Loss Creek @ Biddle Rd (RM 0.96)**

**U02G03**

<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time	hhmmss	11:45:33	10:52:51	10:42:35	11:08:55	13:07:00
Temperature	°C	23.54	18.35	13.94	12.77	16.7
Dissolved Oxygen	mg/L	7.46	7.05	8.18	11.27	11
Dissolved Oxygen	%	87.9	75.2	79.4	106.7	113.3
pH	s.u.	7.85	7.96	7.93	8.08	8.21
Conductivity	uS/cm	0.324	0.472	0.362	0.524	0.545
Conductivity @ 25C	uS/cm	0.334	0.54	0.459	0.683	0.647
Total Dissolved Solids	mg/L	232	318	292	394	446
Total Suspended Solids	mg/L	870	6	<5	<5	<5
Alkalinity	mg/L	110	153	155	241	214
Ammonia	mg/L	0.173	<0.050	<0.050	<0.050	0.53
COD	mg/L	21	27	21	<20	<20
Chloride	mg/L	30.5	50.8	36.2	55.0	69.8
Conductivity	umhos/cm	343	546	478	688	748
Nitrate+nitrite	mg/L	1.60	1.56	1.79	0.13	2.62
Nitrite	mg/L	<0.020	<0.020	<0.020	0.024	0.138
Orthophosphate, dissolved	mg/L	0.098	0.023	0.100	<0.010	0.034
Sulfate	mg/L	37.8	39.4	<5.0	73.8	93
TKN	mg/L	0.40	1.30	0.68	0.53	1.28
Total Phosphorus	mg/L	0.337	0.054	0.111	0.037	0.077

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

**South Fk Loss Creek @ Loss Creek Rd (RM 0.04)**

**201377**

<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time Collected	hhmmss	11:25:21	10:38:09	10:24:59	10:51:15	12:53:38
Temperature	°C	22.95	17.17	13.82	12.41	16.43
Dissolved Oxygen	mg/L	7.2	8.98	9.12	11.96	10.25
Dissolved Oxygen	%	83.8	93.5	88.3	112.3	105
pH	s.u.	7.58	8.13	8.01	8.05	8.12
Conductivity	uS/cm	0.252	0.531	0.4	0.546	0.565
Conductivity @ 25C	uS/cm	0.263	0.625	0.508	0.719	0.675
Total Dissolved Solids	mg/L	216	366	312	426	402
Total Suspended Solids	mg/L	238	10	<5	<5	<5
Alkalinity	mg/L	73.2	185	183	260	231
Ammonia	mg/L	0.155	<0.050	<0.050	<0.050	<0.050
COD	mg/L	29	25	<20	<20	<20
Chloride	mg/L	23.5	54.6	36.6	54.1	54.3
Conductivity	umhos/cm	269	634	522	729	686
Nitrate+nitrite	mg/L	3.55	0.78	1.35	0.19	0.17
Nitrite	mg/L	0.025	<0.020	<0.020	0.032	0.022
Orthophosphate, dissolved	mg/L	0.147	0.045	0.075	<0.010	<0.010
Sulfate	mg/L	21.2	41.7	<5.0	66.6	71.4
TKN	mg/L	0.59	0.68	0.57	0.46	0.50
Total Phosphorus	mg/L	0.194	0.061	0.101	0.030	0.183

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets.

<b>Allen Run @ Crestline Rd (RM 1.18)</b>		<b>U02G20</b>				
<b>Date collected</b>		<b>7/19/2011</b>	<b>8/29/2011</b>	<b>9/29/2011</b>	<b>4/19/2012</b>	<b>5/1/2012</b>
Time Collected	hhmmss	10:04:42	9:41:30	9:29:13	10:01:15	11:58:43
Temperature	°C	23.09	16.56	14.46	12.35	14.97
Dissolved Oxygen	mg/L	6.5	6.63	7.7	11.43	8.99
Dissolved Oxygen	%	75.9	68.1	75.6	107.2	89.2
pH	s.u.	7.51	7.68	7.67	7.56	7.41
Conductivity	uS/cm	0.361	0.0617	0.505	0.564	0.389
Conductivity @ 25C	uS/cm	0.375	0.735	0.632	0.743	0.481
Total Dissolved Solids	mg/L	272	376	394	432	332
Total Suspended Solids	mg/L	292	<5	6	<5	20
Alkalinity	mg/L	86.0	184	203	266	131
Ammonia	mg/L	0.765	<0.050	0.678	0.434	1.27
COD	mg/L	26	23	<20	<20	43
Chloride	mg/L	28.7	57.8	32.2	51.8	33.8
Conductivity	umhos/cm	386	643	661	737	487
Nitrate+nitrite	mg/L	2.57	1.30	2.29	0.29	4.42
Nitrite	mg/L	0.089	<0.020	0.138	0.055	0.134
Orthophosphate, dissolved	mg/L	0.213	0.119	0.171	0.032	0.614
Sulfate	mg/L	54.5	66.1	97.5	87.5	81.1
TKN	mg/L	1.40	0.37	1.04	0.87	2.34
Total Phosphorus	mg/L	0.316	0.192	0.203	0.060	0.712

**Appendix Table 5. Water quality data collected from sites in the Loss Creek-Sandusky River HUC-12 study area, 2011-2012.**

Results in shaded cells exceed ecoregional nutrient targets or WQS criterion (red).

**Allen Run dst Crestline Rd. (RM 1.18) - tile mixing zone**

Date Collected	8/29/2011	
Time h:mm:ss	11:39:12	
Temperatur°C	19.54	
Dissolved Omg/L	6.28	
Dissolved O%	68.9	
pH s.u.	7.83	
Conductivit uS/cm	1.627	
Conductivit uS/cm	1.816	
Total Disso mg/L	580	
Total Suspemg/L	8	
Arsenic ug/L	2.3	
Cadmium ug/L	<0.20	Ammonia mg/L 2.82
Chromium ug/L	<2.0	COD mg/L 36
Copper ug/L	2.6	Chloride mg/L 90.5
Lead ug/L	<2.0	Conductivumhos/cm 1010
Nickel ug/L	4.9	Nitrate+nit mg/L 1.38
Selenium ug/L	<2.0	Nitrite mg/L 0.079
Aluminum ug/L	<200	Sulfate mg/L 114
Barium ug/L	68	TKN mg/L 4.53
Calcium mg/L	98	Total Phospmg/L 0.446
Hardness, Tmg/L	376	
Iron ug/L	485	
Magnesiummg/L	32	
Manganeseug/L	122	
Potassium mg/L	7	
Sodium mg/L	61	
Strontium ug/L	1870	
Zinc ug/L	<10	
Alkalinity mg/L	276	

**Allen Run dst Crestline Rd. (RM 1.18) - fish kill**

(no field parameters measured)

Date Collected	7/18/2012
Time h:mm	10:10
CBOD20 mg/L	13
Total Disso mg/L	468
Total Suspemg/L	10
Arsenic ug/L	3.9
Cadmium ug/L	<0.20
Chromium ug/L	<2.0
Copper ug/L	3.4
Lead ug/L	<2.0
Nickel ug/L	5.4
Selenium ug/L	<2.0
Aluminum ug/L	<200
Barium ug/L	52
Calcium mg/L	75
Hardness, Tmg/L	311
Iron ug/L	310
Magnesiummg/L	30
Manganeseug/L	174
Potassium mg/L	7
Sodium mg/L	19
Strontium ug/L	1300
Zinc ug/L	<10
Ammonia mg/L	35.9
COD mg/L	20
Chloride mg/L	29.4
Nitrate+nit mg/L	1.61
Nitrite mg/L	0.376
Sulfate mg/L	107
TKN mg/L	35.1
Total Phospmg/L	0.509