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Environmental
Protection Agency

Division of Surface Water

Biological and Water Quality Study of the Mahoning River

Former Youngstown Sheet and Tube, Campbell
Seamless Tube Mill Property



John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

Biological and Water Quality Study

Mahoning River

(Former YS&T Seamless Tube Mill, Campbell Facility)

2010

Mahoning County, Ohio
January 10, 2011
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EXECUTIVE SUMMARY

A total of 1.3 miles of the Mahoning River was assessed by the Ohio EPA in 2010. Based on the performance of the biological communities, the entire 1.3 miles of the Mahoning River were in non-attainment of the Warmwater Habitat (WWH) aquatic life use (Table 1). The non-attainment was caused by poor to fair fish results and a fair macroinvertebrate community. The urbanized condition of the Mahoning River within the study segment (municipal wastewater discharges and sewer overflows), habitat modifications, and elevated sediment contaminants contributed to the impaired biological communities. Sediment contamination within the lower reach of the Mahoning River, which includes the Warren to stateline area, is pervasive and related to legacy discharges. These conditions do not appear associated with chemical constituents released under current conditions at the former YS&T, Campbell Works.

Biological communities have improved in the Mahoning River study segment since 1994, when fish and macroinvertebrate communities were in the poor to very poor range. Results during 2010 documented fair to poor results.

RECOMMENDATIONS

The aquatic life use designation of WWH has been confirmed in this study and previous Ohio EPA biological and water quality studies, and should be maintained. Physical habitat conditions, river pool depths, and recreational activity verified that the Primary Contact Recreation use is appropriate for the Mahoning River.

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Stream sampling: Mike Gray, David Altfater, John Kwolek, Greg Orr

Data support: Dennis Mishne

Report preparation and analysis: David Altfater, Mike Gray

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INTRODUCTION

A 1.3 mile section of the Mahoning River was assessed during 2010, evaluating biological, sediment, and surface water resources. This study was undertaken to assess water resource conditions in the Mahoning River upstream, adjacent, and downstream from the former YS&T Seamless Tube Mill, Campbell property. This water resource project is part of a Targeted Brownfield Assessment (TBA).

Specific objectives of the evaluation were to:

- Assess biological conditions in the Mahoning River by evaluating fish and macroinvertebrate communities,
- Evaluate surficial sediment and surface water chemical quality in the Mahoning River,
- Determine the aquatic life use attainment status of the Mahoning River with regard to the WWH aquatic life use designation codified in the Ohio Water Quality Standards, and
- Perform the work to satisfy the requirements of VAP rule OAC 3745-300-09.

The Mahoning River is located in the Erie-Ontario Lake Plain (EOLP) ecoregion. The Mahoning River is currently assigned the WWH aquatic life use designation for the lower 102 miles.

Aquatic life use attainment conditions are presented in Table 1, and sampling locations are detailed in Table 2 and graphically presented in Figure 1.

Table 1. Aquatic life use attainment status for sampling locations in the Mahoning River, former YS&T Campbell property area, 2010. 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. River sites are located in the Erie-Ontario Lake Plain (EOLP) ecoregion. In the Ohio Water Quality Standards, the Mahoning River is designated Warmwater Habitat (WWH). If biological impairment has occurred, the cause(s) and source(s) of the impairment are noted.

Sample Location River Mile	Aquatic Life Use Designation	Aquatic Life Attainment Status	IBI	MIwb	ICI	Stream Habitat ^a	Aquatic Life Use Impairment Cause/Source
17.4	WWH	NON	<u>23</u> *	7.9*	18*	54.0 (fair)	Habitat alteration, organic enrichment, metals, PAHs, DELT anomalies/ Impoundment, contaminated sediments, combined sewer overflows, urbanization
17.0	WWH	NON	26*	7.4*	24*	54.5 (fair)	
16.5	WWH	NON	<u>23</u> *	6.7*	22*	52.0 (fair)	

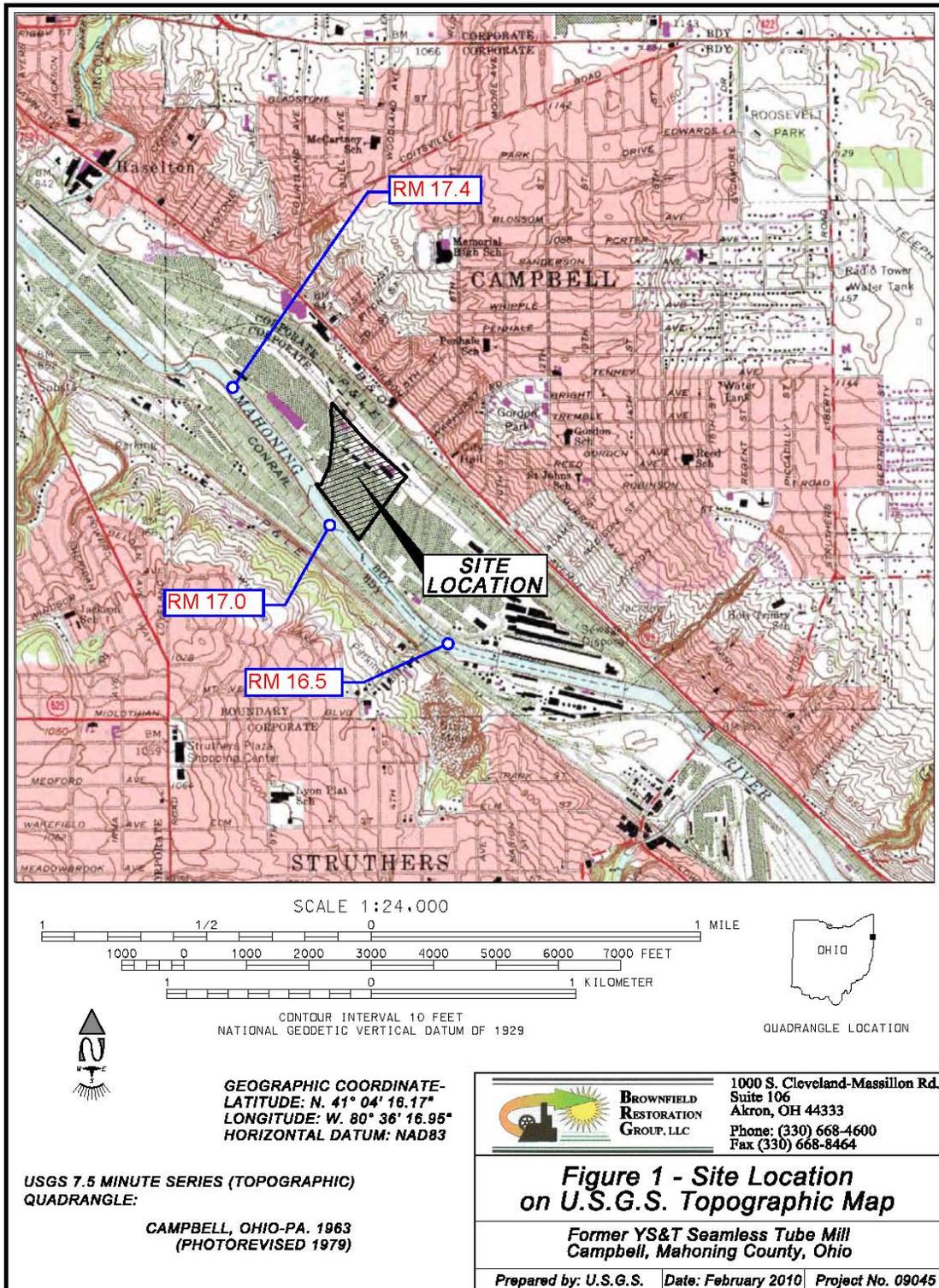
BIOCRITERIA		
INDEX - Site Type	WWH	EWB
IBI: Boat	40	48
MIwb: Boat	8.7	9.6
ICI	34	46

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
^{ns} Nonsignificant departure from biocriterion (≤ 4 IBI or ICI units, 0.5 MIwb units).
^a Narrative habitat evaluations are based on QHEI scores as follows: Excellent =75-100, Good = 60-74, Fair = 45-59, Poor = 30-44 and Very Poor <30.

Table 2. Sampling locations in the Mahoning River, former YS&T Campbell property area, 2010. Type of sampling included fish community (F), macroinvertebrate community (M), surface water (W), and sediment (S).

River Mile	Type of Sampling	Latitude	Longitude	Landmark
17.4	F,M,W,S	41.07439	- 80.61189	Upstream former YS&T Campbell property
17.0	F,M,W,S	41.07081	- 80.60780	Adjacent former YS&T Campbell property
16.5	F,M,W,S	41.06469	- 80.60139	Downstream former YS&T Campbell property

Figure 1. Sampling locations in the Mahoning River, former YS&T Campbell property area, 2010. Base map was provided by Brownfield Restoration Group, from the VAP Phase I Property Assessment (PA) completed in April of 2010.



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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), Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (Ohio EPA 2006), and Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2001).

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 1) 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 a sampling location description. Biological results were compared to WWH biocriteria. The Mahoning River is currently listed as WWH in the Ohio Water Quality Standards.

Stream Habitat Evaluation

Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995; Ohio EPA 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 were generally conducive to the establishment of warmwater faunas while those which scored in excess of 75 often typify habitat conditions which have the ability to support exceptional faunas.

Sediment and Surface Water Assessment

Fine grain sediment samples were collected multi-incrementally in the upper four inches of bottom material at each biological location using decontaminated stainless steel scoops. At each location, between 20 and 25 scoops of fine grained material over a 500 meter section of river were collected. Sediment incremental samples were mixed in stainless steel pans (VOC sample jars were filled prior to mixing), transferred into glass jars with teflon lined lids, placed on ice (to maintain 4°C) in a cooler, and shipped to an Ohio EPA contract lab. Sediment data are reported on a dry weight basis. Decontamination of sediment sampling equipment followed the procedures outlined in the Ohio EPA sediment sampling guidance manual (Ohio EPA 2001). Surface water samples were collected directly into appropriate containers, preserved and delivered to an Ohio EPA contract lab. Surface water samples were collected once from each location from the upper 12 inches of water. Collected water was preserved using appropriate methods, as outlined in Parts II and III of the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2009). Surface water samples were evaluated using comparisons to Ohio Water Quality Standards criteria, reference conditions, or published literature. Sediment evaluations were conducted using guidelines established in MacDonald *et al.* (2000), along with a comparison of metals results to Ohio Sediment Reference Values (Ohio EPA 2003) and Ecological Screening Values (USEPA 2003).

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and from the natural habitats at the Mahoning River sites. 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. At the time of the artificial substrate collection, a qualitative multi-habitat composite sample was also collected. This sampling effort consisted of an inventory of all observed macroinvertebrate taxa from the 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 contained 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 EPA 1989b, 2008b).

Fish Community Assessment

Fish were sampled twice at each Mahoning River site using pulsed DC boat electrofishing methods. Fish were processed in the field, and included identifying each individual to species, counting and weighing fish, and recording any external abnormalities. Discussion of the fish community assessment methodology used in this report is contained 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 EPA 1989b, 2008b).

RESULTS

Surface Water

Chemical analyses were conducted on surface water samples collected on August 9, 2010 from three locations in the Mahoning River (Appendix Table 1). Surface water samples were analyzed for total analyte list inorganics (metals), PCBs, volatile organic compounds, and semivolatile organic compounds. Nearly all measurements of volatile organics and semivolatile organic compounds tested in river water at all three locations were reported as not detected. Of the parameters reported with low detectable concentrations, none of the chemicals were above Ohio water quality criteria. PCB concentrations were reported as not detected. All metals concentrations were low, and were below applicable Ohio WQS for aquatic life and human health criteria.

Nutrients, ammonia-N, dissolved oxygen and bacteriological parameters were not tested as part of this evaluation. For monitored parameters, good chemical water quality was evident in all river samples.

Sediment

Surficial sediment samples were collected at three locations in the Mahoning River by the Ohio EPA on August 9, 2010. Sampling locations were co-located with biological sampling sites. Samples were analyzed for total analyte list inorganics (metals), volatile organic compounds, semivolatile organic compounds, PCBs, total petroleum hydrocarbons, and cyanide. Specific chemical parameters tested and results are listed in Appendix Table 2. Sediment data were evaluated using Ohio Sediment Reference Values (Ohio EPA 2003), along with guidelines established in *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems* (MacDonald *et.al.* 2000), and *Ecological Screening Levels (ESLs)* (USEPA 2003). The consensus-based sediment guidelines define two levels of ecotoxic effects. A *Threshold Effect Concentration* (TEC) is a level of sediment chemical quality below which harmful effects are unlikely to be observed. A *Probable Effect Concentration* (PEC) indicates a level above which harmful effects are likely to be observed. ESL values, considered protective benchmarks, were derived by USEPA, Region 5 using a variety of sources and methods.

Sediment samples were conservatively sampled by focusing on depositional areas of fine grain material (silts and clays). These areas typically are represented by higher contaminant levels, compared to coarse sands and gravels. Fine grained depositional areas were not a predominant substrate type at all three sites; however, fine substrates were common along the river margins.

Metals, semivolatile organic compounds, and PCBs above screening benchmarks are presented in Table 3. Sediment collected from all three locations in the Mahoning River (upstream, adjacent, and downstream from the former YS&T Campbell property) was considered likely to be harmful to sediment-dwelling organisms (MacDonald *et.al.* 2000). At all three sediment sampling locations, highly elevated levels of polycyclic aromatic hydrocarbons (PAHs) were observed (Table 3); the highest levels were noted at the downstream site at RM 16.5. Metals parameters were elevated at all three locations in the Mahoning River, with the highest levels reported upstream and downstream from the former YS&T Campbell seamless tube mill property. PCB measurements revealed slightly elevated levels documented in the sediments at all three sampling locations. The large number of chemical compounds exceeding PEC levels at all Mahoning River locations suggest toxic sediment levels. Disturbance of the soft sediments from the Mahoning River along the shoreline released oil to the water surface. Diesel range organics were measured at elevated levels at all Mahoning River sites (Appendix Table 2). Sediment contamination within the lower reach of the Mahoning River, which includes the Warren to stateline area, is pervasive and related to legacy discharges. The contamination of the Mahoning River sediments in the study area likely contributed to the impairment observed in the biological community in this impounded section of river.

Table 3. Chemical parameters measured above screening levels in samples collected by Ohio EPA from surficial sediments in the Mahoning River, August, 2010. Contamination levels were determined for parameters using Ohio Sediment Reference Values (SRVs), consensus-based sediment quality guidelines (MacDonald, et.al. 2000) and ecological screening levels (USEPA 2003). Shaded numbers indicate values above the following: SRVs (blue), Threshold Effect Concentration –TEC (yellow), Probable Effect Concentration – PEC (red) and Ecological Screening Levels (orange). Sampling locations are indicated by river mile (RM).

Parameter	RM 17.4	RM 17.0	RM 16.5	RM 16.5 Duplicate
Arsenic (mg/kg)	16.7	14.0	26.5	25.0
Lead (mg/kg)	261	132	297	334
Antimony (mg/kg)	0.74 J	0.88 J	ND	4.7 J
Cadmium (mg/kg)	2.0	0.62 J	1.9 J	2.4 J
Chromium (mg/kg)	233	115	101	113
Copper (mg/kg)	170	102	162	191
Iron (mg/kg)	80000 B	108000 B	144000 B	166000 B
Manganese (mg/kg)	1120 B	1390 B	1570 B	1780 B
Nickel (mg/kg)	99.7	64.0	55.9	58.8
Silver (mg/kg)	3.7	0.92 J	1.4 J	1.6 J
Zinc (mg/kg)	1410	827	1200	1270
Mercury (mg/kg)	0.61	0.3	0.62	0.92
2-Butanone (ug/kg)	5.7 J	8.4 J	16 J	56 J
Acenaphthene (ug/kg)	270	260	1200	1400
Acenaphthylene (ug/kg)	310	430	710	1000
Anthracene (ug/kg)	490	950	2100	2400
Benzo(a)anthracene (ug/kg)	1700	3200	3400	4500
Benzo(k)fluoranthene (ug/kg)	750	1500	1800	1900
Benzo(ghi)perylene (ug/kg)	1100	2000	2000	2700
Benzo(a)pyrene (ug/kg) (ug/kg)	1600	3100	3100	3900
bis(2-Ethylhexyl)phthalate (ug/kg)	760 J	780 J	910 J	1100 J
Chrysene (ug/kg)	1600	3100	3700	4400
Dibenz(a,h)anthracene (ug/kg)	380	600	900	990
Dibenzofuran (ug/kg)	130 J	240 J	1200 J	1400 J
Fluoranthene (ug/kg)	3500	7600	9200	12000
Fluorene (ug/kg)	230	420	1800	2100
Indeno(1,2,3-cd)pyrene (ug/kg)	900	1700	1800	2300
2-Methylnaphthalene (ug/kg)	ND	120	510	440
Naphthalene (ug/kg)	240	270	2000	1800
Phenanthrene (ug/kg)	1300	3400	5400	6200
Pyrene (ug/kg)	2700	5700	7300	9000
Total PAHs (ug/kg)	19,500	39,190	52,220	64,030
Total PCBs (ug/kg)	155	220	350	350

J - Estimated result. Result is less than RL.

B - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ND - not detected at or above the method detection limit.

Stream Physical Habitat

Physical habitat was evaluated at each fish sampling location. Physical habitat was assessed using the Qualitative Habitat Evaluation Index (QHEI); scores are detailed in Table 4. Mahoning River sampling locations were represented by channel impounded conditions. This resulted in 100 percent pool habitat. The lack of riffle areas at all three sampling sites reduced the QHEI scores compared with natural free-flowing rivers. Surrounding land use was largely commercial/industrial/urban. Although gravel and sand were the two predominant substrate types, moderate levels of silt and bottom embeddedness was observed. Sediment deposition was restricted to areas along both banks. River flows in the Mahoning River are regulated by several reservoirs, with minimum base flows higher in the summer than during the winter - opposite of natural conditions in Ohio. QHEI scores for the Mahoning River sites ranged between 54.5 and 52.0. These scores are indicative of fair river habitat and limit the potential to support WWH biological communities.

Table 4. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the Mahoning River, former YS&T Campbell property area, 2010.

River Mile	QHEI	Habitat Rating	MWH Attributes																															
			WWH Attributes										MWH Attributes																					
													High Influence					Moderate Influence																
			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	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/ No Cover	Max. Depth <40 cm (WD, HW sites)	Total High Influence Attributes	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
Mahoning River Year: 2010																																		
17.4	54.0	Fair	■	■							■		3				◆		1	●					●	●		●	●		●	6	0.50	2.00
17.0	54.5	Fair	■	■							■		3				◆		1	●					●	●		●	●		●	6	0.50	2.00
16.5	52.0	Fair	■	■							■		3				◆		1	●					●	●		●	●		●	6	0.50	2.00

Fish Community

A total of 809 fish representing 25 species were collected from the Mahoning River in the former YS&T Campbell property area between August and September, 2010. Relative numbers and species collected per location are presented in Appendix Table 3 and IBI metrics are presented in Appendix Table 4. Sampling locations were evaluated using WWH biocriteria. Fish communities ranged from poor to fair in the Mahoning River. Results from all three fish sampling locations indicated comparable quality from upstream to downstream, with no obvious trends associated with the former YS&T, Campbell seamless tube line property. IBI scores were in the poor to low fair range in the Mahoning River, with scores of 23, 26, and 23, upstream to downstream, respectively. These IBI values did not achieve the ecoregional biocriterion established for WWH streams and rivers in Ohio (Table 5). Modified Index of Well-Being (MIwb) scores were in the fair range, with values of 7.9, 7.4, and 6.7, upstream to downstream, respectively. These MIwb scores also did not achieve the ecoregional biocriterion established for WWH streams and rivers in Ohio. External anomalies on fish (deformities, eroded fins, lesions, tumors) occurred at elevated levels (1.8-7%) in the fish communities of the Mahoning River. Along with elevated DELT anomalies, the low number of fish per site and absence of relatively pollution sensitive suckers contributed to the poor to fair fish performance.

Table 5. Fish community summaries based on pulsed D.C. electrofishing sampling conducted by Ohio EPA in the Mahoning River, former YS&T Campbell property area, from August and September, 2010. Relative numbers are per 1.0 km. The applicable aquatic life use designation is WWH.

Stream River Mile	Sampling Method	Species (Mean)	Species (Total)	Relative Number	QHEI	Index of Biotic Integrity	Modified Index of Well-being	Narrative Evaluation
17.4	Boat	17	21	350	54.0	<u>23</u> *	7.9*	Poor/ Fair
17.0	Boat	13	16	213	54.5	26*	7.4*	Fair
16.5	Boat	15	17	246	52.0	<u>23</u> *	6.7*	Poor/ Fair

Ecoregion Biocriteria: Erie Ontario Lake Plain (EOLP)		
INDEX - Site Type	WWH	EWH
IBI: Boat	40	48
MIwb: Boat	8.7	9.6

* 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).

Macroinvertebrate Community

The macroinvertebrate communities from the Mahoning River in the vicinity of the YS&T property were sampled in 2010 using quantitative (artificial substrate) and qualitative (natural substrate multi-habitat composite) sampling protocols. Results are summarized in Table 6. The ICI metrics with the associated scores and the raw data are attached as Appendix Tables 5 and 6.

The macroinvertebrate communities from the sampling locations upstream, adjacent, and downstream from the YS&T property were all evaluated as fair with ICI scores of 18, 24, and 22, respectively. The macroinvertebrate community did not attain the designated WWH use at any of the sampling locations. The YS&T property did not appear to have an impact on the macroinvertebrate community. The impairment of the macroinvertebrate community can be attributed to poor habitat due to impounded conditions caused by a lowhead dam, contaminated sediments throughout the study area, CSO discharges, and upstream permitted discharges.

Table 6. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Mahoning River, 2010.

Stream/ River Mile	Density Number/ft ²	Total Taxa	Quantitative Taxa	Qualitative Taxa	Qualitative EPT ^a	ICI	Evaluation
<i>Mahoning River</i>							
17.4	1038	38	30	20	2	18*	Fair
17.0	654	52	38	31	1	24*	Fair
16.5	474	46	32	33	3	22*	Fair

Ecoregion Biocriteria: Erie Ontario Lake Plain (EOLP)		
INDEX	WWH	EWH
ICI	34	46

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

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

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

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APPENDICES – MAHONING RIVER, 2010

Appendix Table 1. Surface water chemistry results for the Mahoning River, 2010.

Appendix Table 2. Sediment chemistry results for the Mahoning River, 2010.

Appendix Table 3. Ohio EPA fish results for the Mahoning River, 2010.

Appendix Table 4. Index of Biotic Integrity (IBI) scores and metrics for the Mahoning River, 2010.

Appendix Table 5. Invertebrate Community Index (ICI) scores and metrics for the Mahoning River, 2010.

Appendix Table 6. Ohio EPA macroinvertebrate results for the Mahoning River, 2010.

Appendix Table 1. Results of chemical surface water sampling conducted by Ohio EPA in the Mahoning River, August 9, 2010.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
TAL Metals (ug/l)				
Aluminum	278	1150	403	355
Arsenic	ND	3.3 J	4.6 J	4.6 J
Lead	3.3	6.1	ND	2.2 J
Antimony	2.5 J	2.3 J	ND	ND
Barium	30.7 B,J	36.1 B,J	32.2 B,J	31.7 B,J
Selenium	ND	ND	ND	ND
Beryllium	ND	ND	ND	ND
Thallium	0.23 B,J	0.22 B,J	0.19 B,J	0.22 B,J
Cadmium	ND	ND	ND	ND
Calcium	41800 B	37900 B	43100 B	43000 B
Chromium	ND	4.4 J	ND	2.3 J
Cobalt	ND	ND	ND	ND
Copper	ND	4.8 J	ND	ND
Iron	531	2,380	781	628
Magnesium	11400	10300	11700	11600
Manganese	131 B	171 B	149 B	141 B
Nickel	4.1 J	8.4 J	4.0 J	4.9 J
Potassium	6170 B	5670 B	6330 B	6310 B
Silver	ND	ND	ND	ND
Sodium	47,300	40,700	45,300	47,100
Vanadium	1.4 J	2.7 J	1.2 J	1.1 J
Zinc	16.3 B,J	41.8 B	14.5 B,J	18.0 B,J
Mercury	ND	ND	ND	ND
Volatile Organic Analytes (ug/l)				
Acetone	ND	1.3 J	1.2 J	1.5 J
Benzene	ND	ND	5.4	5.2
Bromodichloromethane	0.19 J	ND	ND	ND
Bromoform	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
Carbon disulfide	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Chloroform	0.35 J	0.33 J	0.24 J	0.24 J
Chloromethane	ND	ND	ND	ND
1,2-Dibromo-3-chloro-propane	ND	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND

Appendix Table 1. Continued.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Volatile Organic Analytes (ug/l)				
1,2-Dichloroethane	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
n-Hexane	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	0.53 J	ND	0.49 J	0.44 J
1,2,4-Trichlorobenzene	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND
Semi-volatile Organic Analytes (ug/kg)				
Acenaphthene	0.36	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
Acetophenone	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND
Benzo(ghi)perylene	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND
bis(2-Chloroethyl)-ether	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	0.81 J,B	2.0 B	1.5 J,B	3.4 B
4-Bromophenyl phenylether	ND	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND
4-Chlorophenyl phenylether	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND

Appendix Table 1. Continued.

Stream	Mahoning River 17.4	Mahoning River 17.0	Mahoning River 16.5	Mahoning River 16.5 - Duplicate
River Mile				
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Semi-volatile Organic Analytes (ug/l)				
Dibenzofuran	ND	ND	ND	ND
Di-n-butyl phthalate	1.0 B	1.0 B	1.1 B	1.1 B
3,3'-Dichlorobenzidine	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
Diethyl phthalate	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	0.31
Fluorene	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND
N-Nitrosodi-n-propyl-amine	ND	ND	ND	ND
2,2'-oxybis(1-Chloropropane)	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND
Phenol	ND	ND	ND	ND
Pyrene	ND	ND	ND	0.28
2,4,5-Trichlorophenol	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
PCBs (ug/l)				
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	ND	ND	ND	ND

J - Estimated result. Result is less than RL.

B - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ND - not detected at or above the method detection limit.

Appendix Table 2. Results of sediment sampling conducted by Ohio EPA in the Mahoning River, August 9, 2010.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
TAL Metals and Cyanide (mg/kg)				
Aluminum	10100	6500	7140	7680
Arsenic	16.7	14.0	26.5	25.0
Lead	261	132	297	334
Antimony	0.74 J	0.88 J	ND	4.7 J
Barium	134 B	82.1 B	104 B	125 B
Selenium	ND	ND	ND	ND
Beryllium	0.69 J	0.43 J	0.43 J	0.47 J
Thallium	3.7	3.5	ND	ND
Cadmium	2.0	0.62 J	1.9 J	2.4 J
Calcium	11300 B	45900 B	17800 B	18300 B
Chromium	233	115	101	113
Cobalt	10.7	10.4	10.4	11.7
Copper	170	102	162	191
Iron	80000 B	108000 B	144000 B	166000 B
Magnesium	2590	3010	3260	3100
Manganese	1120 B	1390 B	1570 B	1780 B
Nickel	99.7	64.0	55.9	58.8
Potassium	848 B	653 B,J	610 B,J	652 B,J
Silver	3.7	0.92 J	1.4 J	1.6 J
Sodium	118 J	ND	136 J	ND
Vanadium	21.0	18.4	22.2 J	24.3 J
Zinc	1410	827	1200	1270
Mercury	0.61	0.3	0.62	0.92
Total Cyanide	0.73 J	2.6	3.1	3.3
Volatile Organic Analytes (ug/kg)				
Acetone	15 J	27 J	61	180 J,B
Benzene	ND	ND	13	36 J
Bromodichloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
2-Butanone	5.7 J	8.4 J	16 J	56 J
Carbon disulfide	ND	ND	3.5 J	21 J,B
Carbon tetrachloride	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
1,2-Dibromo-3-chloro-propane	ND	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	1.8 J	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND

Appendix Table 2. Continued.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Volatile Organic Analytes (ug/kg)				
1,1-Dichloroethane	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
Ethylbenzene	ND	0.52 J	10 J	25 J
n-Hexane	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
Isopropylbenzene	0.46 J	ND	31 J	56
Methylene chloride	8.7 B	6.1 J,B	6.8 J,B	63 B
4-Methyl-2-pentanone	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	0.90 J,B	1.2 J,B	7.6 J	14 J
1,2,4-Trichlorobenzene	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Xylenes (total)	2.5 J	ND	49 J	230
Semi-volatile Organic Analytes (ug/kg)				
Acenaphthene	270	260	1200	1400
Acenaphthylene	310	430	710	1000
Acetophenone	ND	ND	ND	ND
Anthracene	490	950	2100	2400
Benzo(a)anthracene	1700	3200	3400	4500
Benzo(b)fluoranthene	2300	4600	4100	5600
Benzo(k)fluoranthene	750	1500	1800	1900
Benzo(ghi)perylene	1100	2000	2000	2700
Benzo(a)pyrene	1600	3100	3100	3900
bis(2-Chloroethoxy)methane	ND	ND	ND	ND
bis(2-Chloroethyl)-ether	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	760 J	780 J	910 J	1100 J
4-Bromophenyl phenylether	ND	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND

Appendix Table 2. Continued.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
Semi-volatile Organic Analytes (ug/kg)				
4-Chlorophenyl phenylether	ND	ND	ND	ND
Chrysene	1600	3100	3700	4400
Dibenz(a,h)anthracene	380	600	900	990
Dibenzofuran	130 J	240 J	1200 J	1400 J
Di-n-butyl phthalate	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
Diethyl phthalate	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND
Fluoranthene	3500	7600	9200	12000
Fluorene	230	420	1800	2100
Hexachlorobenzene	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	900	1700	1800	2300
Isophorone	ND	ND	ND	ND
2-Methylnaphthalene	ND	120	510	440
2-Methylphenol	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND
Naphthalene	240	270	2000	1800
2-Nitroaniline	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND
N-Nitrosodi-n-propyl-amine	ND	ND	ND	ND
2,2'-oxybis(1-Chloropropane)	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	1300	3400	5400	6200
Phenol	ND	ND	ND	ND
Pyrene	2700	5700	7300	9000
2,4,5-Trichlorophenol	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND

Appendix Table 2. Continued.

Stream	Mahoning River	Mahoning River	Mahoning River	Mahoning River
River Mile	17.4	17.0	16.5	16.5 - Duplicate
Date Sampled	8/9/2010	8/9/2010	8/9/2010	8/9/2010
PCBs (ug/kg)				
Aroclor 1016	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND
Aroclor 1248	73	120	190	190
Aroclor 1254	ND	ND	ND	ND
Aroclor 1260	82	100	160	160
Other Parameters				
Diesel Range Organics (C10-C20) - mg/kg	260	150	680	210
Diesel Range Organics (C20-C34) - mg/kg	1400	610	2200	460
Gasoline Range Organics (C6-C12) - ug/kg	1500	370	8300	18000
Percent Solids	65.2	61.8	53.5	54.7

J - Estimated result. Result is less than RL.

B - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

ND - not detected at or above the method detection limit.

River Code: 18-001	Stream: Mahoning River	Sample Date: 2010
River Mile: 17.40	Location: upst. Sherman property	Date Range: 08/09/2010
Time Fished: 2825 sec	Drainage: 1018.0 sq mi	Thru: 09/23/2010
Dist Fished: 1.00 km	Basin: Mahoning River	No of Passes: 2
		Sampler Type: A

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	1	1.00	0.29	0.12	0.10	120.00
Northern Hog Sucker	R	I	S M	2	2.00	0.57	0.16	0.13	79.00
White Sucker	W	O	S T	7	7.00	2.00	3.65	3.06	521.14
Common Carp	G	O	M T	17	17.00	4.86	71.30	59.76	4,194.12
River Chub	N	I	N I	4	4.00	1.14	0.32	0.26	78.75
Spotfin Shiner	N	I	M	39	39.00	11.14	0.14	0.12	3.67
Bluntnose Minnow	N	O	C T	98	98.00	28.00	0.34	0.28	3.47
Channel Catfish	F		C	21	21.00	6.00	30.53	25.58	1,453.57
Yellow Bullhead		I	C T	4	4.00	1.14	0.97	0.81	242.50
Blackstripe Topminnow		I	M	1	1.00	0.29	0.00	0.00	1.00
Rock Bass	S	C	C	4	4.00	1.14	0.14	0.12	34.50
Smallmouth Bass	F	C	C M	10	10.00	2.86	1.94	1.62	193.60
Largemouth Bass	F	C	C	4	4.00	1.14	0.15	0.13	38.50
Green Sunfish	S	I	C T	21	21.00	6.00	0.78	0.65	37.00
Bluegill Sunfish	S	I	C P	20	20.00	5.71	0.28	0.24	14.24
Pumpkinseed Sunfish	S	I	C P	60	60.00	17.14	6.58	5.51	109.63
Green Sf X Pumpkinseed				3	3.00	0.86	0.23	0.19	76.00
Walleye	F	P	S	2	2.00	0.57	1.23	1.03	612.50
Yellow Perch			M	19	19.00	5.43	0.38	0.32	19.84
Logperch	D	I	S M	5	5.00	1.43	0.07	0.06	13.60
Greenside Darter	D	I	S M	3	3.00	0.86	0.01	0.01	2.33
Banded Darter	D	I	S I	5	5.00	1.43	0.02	0.02	3.60
<i>Mile Total</i>				350	350.00		119.31		
<i>Number of Species</i>				21					
<i>Number of Hybrids</i>				1					

Species List

River Code: 18-001 River Mile: 17.00 Time Fished: 3245 sec Dist Fished: 1.00 km	Stream: Mahoning River Location: adj. YST Campbell Works Drainage: 1018.0 sq mi Basin: Mahoning River	Sample Date: 2010 Date Range: 08/09/2010 Thru: 09/23/2010 No of Passes: 2 Sampler Type: A
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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 Pike	F	P	M		1	1.00	0.47	0.63	2.04	632.00
White Sucker	W	O	S	T	3	3.00	1.41	1.36	4.37	452.33
Common Carp	G	O	M	T	5	5.00	2.35	14.70	47.38	2,940.00
Spotfin Shiner	N	I	M		30	30.00	14.08	0.11	0.37	3.82
Bluntnose Minnow	N	O	C	T	34	34.00	15.96	0.06	0.20	1.79
Channel Catfish	F		C		4	4.00	1.88	6.13	19.74	1,531.25
Yellow Bullhead		I	C	T	1	1.00	0.47	0.36	1.14	355.00
White Crappie	S	I	C		6	6.00	2.82	0.04	0.13	6.67
Smallmouth Bass	F	C	C	M	6	6.00	2.82	0.59	1.91	98.67
Largemouth Bass	F	C	C		6	6.00	2.82	0.23	0.73	37.67
Green Sunfish	S	I	C	T	13	13.00	6.10	0.48	1.54	36.85
Bluegill Sunfish	S	I	C	P	19	19.00	8.92	0.12	0.39	6.32
Pumpkinseed Sunfish	S	I	C	P	62	62.00	29.11	5.61	18.09	90.54
Walleye	F	P	S		1	1.00	0.47	0.34	1.09	338.00
Yellow Perch			M		20	20.00	9.39	0.24	0.78	12.09
Logperch	D	I	S	M	2	2.00	0.94	0.03	0.09	14.00
<i>Mile Total</i>					213	213.00		31.02		
<i>Number of Species</i>					16					
<i>Number of Hybrids</i>					0					

Species List

River Code: 18-001	Stream: Mahoning River	Sample Date: 2010
River Mile: 16.50	Location: dst. Poland Ave.	Date Range: 08/09/2010
Time Fished: 3410 sec	Drainage: 1020.0 sq mi	Thru: 09/23/2010
Dist Fished: 1.00 km	Basin: Mahoning River	No of Passes: 2
		Sampler Type: A

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	4	4.00	1.63	0.97	0.89	242.75
White Sucker	W	O	S T	9	9.00	3.66	4.72	4.30	523.89
Common Carp	G	O	M T	22	22.00	8.94	90.81	82.86	4,127.66
Goldfish	G	O	M T	1	1.00	0.41	0.60	0.54	596.00
Golden Shiner	N	I	M T	3	3.00	1.22	0.02	0.01	5.00
Spotfin Shiner	N	I	M	58	58.00	23.58	0.31	0.28	5.31
Bluntnose Minnow	N	O	C T	38	38.00	15.45	0.17	0.15	4.44
Channel Catfish	F		C	5	5.00	2.03	4.61	4.20	921.60
Yellow Bullhead		I	C T	2	2.00	0.81	0.49	0.45	245.00
White Crappie	S	I	C	1	1.00	0.41	0.01	0.01	10.00
Smallmouth Bass	F	C	C M	2	2.00	0.81	0.75	0.68	375.00
Largemouth Bass	F	C	C	10	10.00	4.07	0.63	0.57	62.70
Green Sunfish	S	I	C T	30	30.00	12.20	1.51	1.38	50.27
Bluegill Sunfish	S	I	C P	29	29.00	11.79	0.16	0.15	5.66
Pumpkinseed Sunfish	S	I	C P	19	19.00	7.72	1.35	1.23	70.92
Green Sf X Pumpkinseed				1	1.00	0.41	0.10	0.09	98.00
Walleye	F	P	S	3	3.00	1.22	2.28	2.08	760.00
Yellow Perch			M	9	9.00	3.66	0.12	0.11	13.56
<i>Mile Total</i>				246	246.00		109.59		
<i>Number of Species</i>				17					
<i>Number of Hybrids</i>				1					

Appendix Table 4. Index of Biotic Integrity (IBI) scores and metrics for the Mahoning River, 2010.

River Mile	Type	Date	Drainage area (sq mi)	Number of				Percent of Individuals						DELTA anomalies	Rel.No. minus tolerants /(1.0 km)	Modified IBI	lwb
				Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni- vores	Top carnivores	Insect- ivores				
Mahoning River - (18-001)																	
Year: 2010																	
17.40	A	08/09/2010	1018	15(3)	4(5)	1(1)	0(1)	0(1)	6(1)	41(1)	30(1)	5(1)	49(3)	7.0(1)	168(1)	20	7.9
17.40	A	09/23/2010	1018	18(3)	3(3)	2(1)	2(3)	1(1)	8(1)	43(1)	39(1)	6(3)	45(3)	2.4(3)	238(3)	26	7.9
17.00	A	08/09/2010	1018	13(3)	4(5)	1(1)	0(1)	0(1)	4(1)	18(3)	11(5)	8(3)	70(5)	1.8(3)	182(1)	32	7.5
17.00	A	09/23/2010	1018	12(3)	4(5)	0(1)	0(1)	0(1)	2(1)	35(1)	29(1)	5(1)	54(3)	4.9(1)	132(1)	20	7.3
16.50	A	08/09/2010	1020	15(3)	4(5)	1(1)	0(1)	0(1)	2(1)	50(1)	35(1)	6(3)	52(3)	3.2(1)	122(1)	22	6.6
16.50	A	09/23/2010	1020	13(3)	3(3)	1(1)	0(1)	0(1)	7(1)	35(1)	25(3)	6(3)	64(5)	2.4(3)	160(1)	26	6.8

◆ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

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			
Mahoning River (18-001)													
Year: 2010													
17.40	1018	30(4)	3(2)	4(4)	14(6)	7.4(2)	3.9(0)	0.0(0)	88.7(0)	4.8(0)	2(0)	3	18
17.00	1018	38(6)	3(2)	4(4)	18(6)	12.8(4)	0.1(0)	0.2(2)	86.7(0)	7.4(0)	1(0)	3	24
16.50	1020	32(4)	2(0)	4(4)	17(6)	35.6(6)	1.6(0)	1.0(2)	61.2(0)	5.7(0)	3(0)	3	22

**Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection - Appendix Table 6**

Site: Mahoning River
upst. YST Campbell Works

Collection Date: 09/23/2010 River Code: 18-001 RM: 17.40

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00401	<i>Spongillidae</i>	+			
01320	<i>Hydra sp</i>	32			
01801	<i>Turbellaria</i>	466 +			
03600	<i>Oligochaeta</i>	184 +			
04661	<i>Helobdella elongata</i>	+			
04666	<i>Helobdella triserialis</i>	8 +			
04901	<i>Erpobdellidae</i>	+			
05800	<i>Caecidotea sp</i>	1 +			
06700	<i>Crangonyx sp</i>	+			
06810	<i>Gammarus fasciatus</i>	506 +			
08230	<i>Orconectes (Crockerinus) obscurus</i>	+			
11130	<i>Baetis intercalaris</i>	16			
13400	<i>Stenacron sp</i>	356 +			
16700	<i>Tricorythodes sp</i>	10			
22300	<i>Argia sp</i>	+			
51206	<i>Cyrnellus fraternus</i>	1			
51600	<i>Polycentropus sp</i>	1			
52200	<i>Cheumatopsyche sp</i>	174 +			
53800	<i>Hydroptila sp</i>	28			
68130	<i>Helichus sp</i>	+			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	36			
80410	<i>Cricotopus (C.) sp</i>	18			
80420	<i>Cricotopus (C.) bicinctus</i>	36 +			
80430	<i>Cricotopus (C.) tremulus group</i>	18			
81240	<i>Nanocladius (N.) distinctus</i>	18			
81825	<i>Rheocricotopus (Psilocricotopus) robacki</i>	45			
82070	<i>Synorthocladius semivirens</i>	430			
83002	<i>Dicrotendipes modestus</i>	9			
83040	<i>Dicrotendipes neomodestus</i>	107 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	286 +			
84470	<i>Polypedilum (P.) illinoense</i>	9			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	18			
84790	<i>Tribelos fuscicorne</i>	63			
87540	<i>Hemerodromia sp</i>	4			
93200	<i>Hydrobiidae</i>	1907 +			
96120	<i>Menetus (Micromenetus) dilatatus</i>	11			
96930	<i>Laevapex fuscus</i>	394 +			
97601	<i>Corbicula fluminea</i>	+			

No. Quantitative Taxa: 30 Total Taxa: 38
 No. Qualitative Taxa: 20 ICI: 18
 Number of Organisms: 5192 Qual EPT: 2

Ohio EPA/DSW Ecological Assessment Section
 Macroinvertebrate Collection

Site: Mahoning River
 adj. YST Campbell Works

Collection Date: 09/23/2010 River Code: 18-001 RM: 17.00

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	39	93200	<i>Hydrobiidae</i>	1749 +
01801	<i>Turbellaria</i>	85 +	95100	<i>Physella sp</i>	+
03600	<i>Oligochaeta</i>	219 +	96120	<i>Menetus (Micromenetus) dilatatus</i>	+
04661	<i>Helobdella elongata</i>	+	96264	<i>Planorbella (Pierosoma) pilsbryi</i>	1
04666	<i>Helobdella triserialis</i>	+	96930	<i>Laevapex fuscus</i>	154
04901	<i>Erpobdellidae</i>	2 +	97601	<i>Corbicula fluminea</i>	+
05800	<i>Caecidotea sp</i>	1 +	98200	<i>Pisidium sp</i>	+
06810	<i>Gammarus fasciatus</i>	100 +	99120	<i>Utterbackia imbecillis</i>	+
11130	<i>Baetis intercalaris</i>	1			
13400	<i>Stenacron sp</i>	413 +	No. Quantitative Taxa: 38		Total Taxa: 52
16700	<i>Tricorythodes sp</i>	5	No. Qualitative Taxa: 31		ICI: 24
22001	<i>Coenagrionidae</i>	+	Number of Organisms: 3272		Qual EPT: 1
22300	<i>Argia sp</i>	3 +			
27307	<i>Epitheca (Epicordulia) princeps</i>	1 +			
27409	<i>Neurocordulia yamaskanensis</i>	1			
43570	<i>Neoplea sp</i>	+			
44300	<i>Pelocoris sp</i>	+			
51206	<i>Cyrnellus fraternus</i>	1			
51600	<i>Polycentropus sp</i>	1			
52200	<i>Cheumatopsyche sp</i>	1			
53800	<i>Hydroptila sp</i>	1			
68601	<i>Ancyronyx variegata</i>	2 +			
77120	<i>Ablabesmyia mallochi</i>	+			
77130	<i>Ablabesmyia rhamphe group</i>	30 +			
78401	<i>Natarsia species A (sensu Roback, 1978)</i>	6			
78655	<i>Procladius (Holotanypus) sp</i>	6 +			
80410	<i>Cricotopus (C.) sp</i>	6			
80420	<i>Cricotopus (C.) bicinctus</i>	18			
80430	<i>Cricotopus (C.) tremulus group</i>	18 +			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	6 +			
81240	<i>Nanocladius (N.) distinctus</i>	6			
82070	<i>Synorthocladius semivirens</i>	54			
82730	<i>Chironomus (C.) decorus group</i>	+			
82820	<i>Cryptochironomus sp</i>	6 +			
83002	<i>Dicrotendipes modestus</i>	24			
83040	<i>Dicrotendipes neomodestus</i>	84 +			
83050	<i>Dicrotendipes lucifer</i>	6			
83410	<i>Harnischia curtilamellata</i>	6			
84315	<i>Phaenopsectra flavipes</i>	+			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	24			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	18			
84790	<i>Tribelos fuscicorne</i>	168 +			
85625	<i>Rheotanytarsus sp</i>	6			

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

Site: Mahoning River
dst. Poland Ave.

Collection Date: 09/23/2010 River Code: 18-001 RM: 16.50

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	<i>Hydra sp</i>	13	97601	<i>Corbicula fluminea</i>	+
01801	<i>Turbellaria</i>	12 +	98200	<i>Pisidium sp</i>	+
03600	<i>Oligochaeta</i>	120 +			
04666	<i>Helobdella triserialis</i>	+	No. Quantitative Taxa: 32		Total Taxa: 46
04901	<i>Erpobdellidae</i>	+	No. Qualitative Taxa: 33		ICI: 22
05800	<i>Caecidotea sp</i>	+	Number of Organisms: 2368		Qual EPT: 3
06700	<i>Crangonyx sp</i>	+			
06810	<i>Gammarus fasciatus</i>	116 +			
08230	<i>Orconectes (Crockerinus) obscurus</i>	+			
13400	<i>Stenacron sp</i>	839 +			
16700	<i>Tricorythodes sp</i>	4 +			
22001	<i>Coenagrionidae</i>	+			
22300	<i>Argia sp</i>	13 +			
23600	<i>Aeshna sp</i>	+			
27307	<i>Epiptera (Epicordulia) princeps</i>	+			
51206	<i>Cyrnellus fraternus</i>	12			
51600	<i>Polycentropus sp</i>	1			
52200	<i>Cheumatopsyche sp</i>	20 +			
53800	<i>Hydroptila sp</i>	4			
68601	<i>Ancyronyx variegata</i>	1 +			
70501	<i>Tipulidae</i>	8			
77120	<i>Ablabesmyia mallochi</i>	7 +			
77130	<i>Ablabesmyia rhamphe group</i>	24 +			
78140	<i>Labrundinia pilosella</i>	6			
78655	<i>Procladius (Holotanypus) sp</i>	6 +			
79000	<i>Tanypus sp</i>	+			
80410	<i>Cricotopus (C.) sp</i>	18 +			
80420	<i>Cricotopus (C.) bicinctus</i>	+			
80430	<i>Cricotopus (C.) tremulus group</i>	43 +			
81231	<i>Nanocladius (N.) crassicornus or N. (N.) "rectinervis"</i>	12			
81632	<i>Parakiefferiella n.sp 2</i>	7			
82070	<i>Synorthocladius semivirens</i>	37			
82730	<i>Chironomus (C.) decorus group</i>	7 +			
82820	<i>Cryptochironomus sp</i>	+			
83002	<i>Dicrotendipes modestus</i>	24			
83040	<i>Dicrotendipes neomodestus</i>	141 +			
84450	<i>Polypedilum (Uresipedilum) flavum</i>	67 +			
84470	<i>Polypedilum (P.) illinoense</i>	+			
84540	<i>Polypedilum (Tripodura) scalaenum group</i>	24			
84790	<i>Tribelos fuscicorne</i>	73 +			
85625	<i>Rheotanytarsus sp</i>	24			
93200	<i>Hydrobiidae</i>	476 +			
95100	<i>Physella sp</i>	7			
96930	<i>Laevapex fuscus</i>	202 +			