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Ohio Environmental Protection Agency
Division of Surface Water

Biological and Water Quality Study of the Ohio River and Munn Run

Former New Boston Coke and Diesel Repair Shop Property – New Boston

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

Biological and Water Quality Study

Ohio River and Munn Run

(Former New Boston Coke and Diesel Repair Shop Property)

2011

Scioto County, Ohio
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prepared by
Ohio Environmental Protection Agency
Lazarus Government Center
50 West Town Street, Suite 700
Columbus, Ohio 43215

Division of Surface Water
Ecological Assessment Section
4675 Homer Ohio Lane
Groveport, Ohio 43125

John R. Kasich, Governor
State of Ohio

Scott J. Nally, Director
Environmental Protection Agency

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EXECUTIVE SUMMARY

The biological and water quality conditions of a 2.5 mile section of the Ohio River adjacent to the former New Boston Coke property were assessed by the Ohio EPA during 2011. Additionally, surface water chemical testing was conducted in Munn Run upstream and downstream from the Diesel Repair Shop property. Based on the performance of the biological communities, the entire 2.5 miles of the Ohio River were in full attainment of the Warmwater Habitat aquatic life use (Table 1). Although Ohio biocriteria do not apply to the Ohio River, for comparison purposes and to establish relative attainment conditions, biocriteria results were assessed using narrative evaluations. Good chemical water quality was evident in Ohio River and Munn Run samples. Biological communities within the study area of the Ohio River were not impaired by chemical contaminants in the bottom sediments. This is due to very low contaminant levels and the limited deposits of fine grained material at each sampling location. Surface water, sediment, and biological results indicate that New Boston Coke and the Diesel Repair Shop properties are not impairing the Ohio River and Munn Run.

New Boston Coke Property

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Report preparation and analysis: David Altfater, Mike Gray
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INTRODUCTION

A 2.5 mile section of the Ohio River was assessed during 2011, evaluating biological, sediment, and surface water resources. Additionally, surface water samples were collected in the lower 0.4 miles of Munn Run. This study was undertaken to assess water resource conditions in the Ohio River and Munn Run upstream, adjacent, and downstream from the New Boston Coke property, including the Diesel Repair Shop. This water resource project is part of a Targeted Brownfield Assessment (TBA) and fulfills part of the VAP Phase II Property Assessment of the New Boston Coke property.

Specific objectives of the evaluation were to:

- Assess biological conditions in the Ohio River by evaluating fish and macroinvertebrate communities,
- Evaluate surface water chemical quality in the Ohio River and Munn Run,
- Evaluate surficial sediment quality in the Ohio River,
- Determine the aquatic life use attainment status of the Ohio River with regard to the Warmwater Habitat (WWH) aquatic life use using a narrative evaluation, and
- Perform the work to satisfy the requirements of VAP rule OAC 3745-300-09.

The Ohio River and Munn Run within the study area are located in the Western Allegheny Plateau (WAP) ecoregion. The Ohio River and Munn Run are currently assigned the WWH aquatic life use designation in the Ohio Water Quality Standards.

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 Ohio River, New Boston Coke property area, 2011. 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 mORFIn biological index developed by ORSANCO is based on 13 metrics used to assess fish community health. 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 Western Allegheny Plateau (WAP) ecoregion. In the Ohio Water Quality Standards, the Ohio River is designated Warmwater Habitat (WWH). Attainment status is based on a narrative evaluation of the Ohio River biological results.

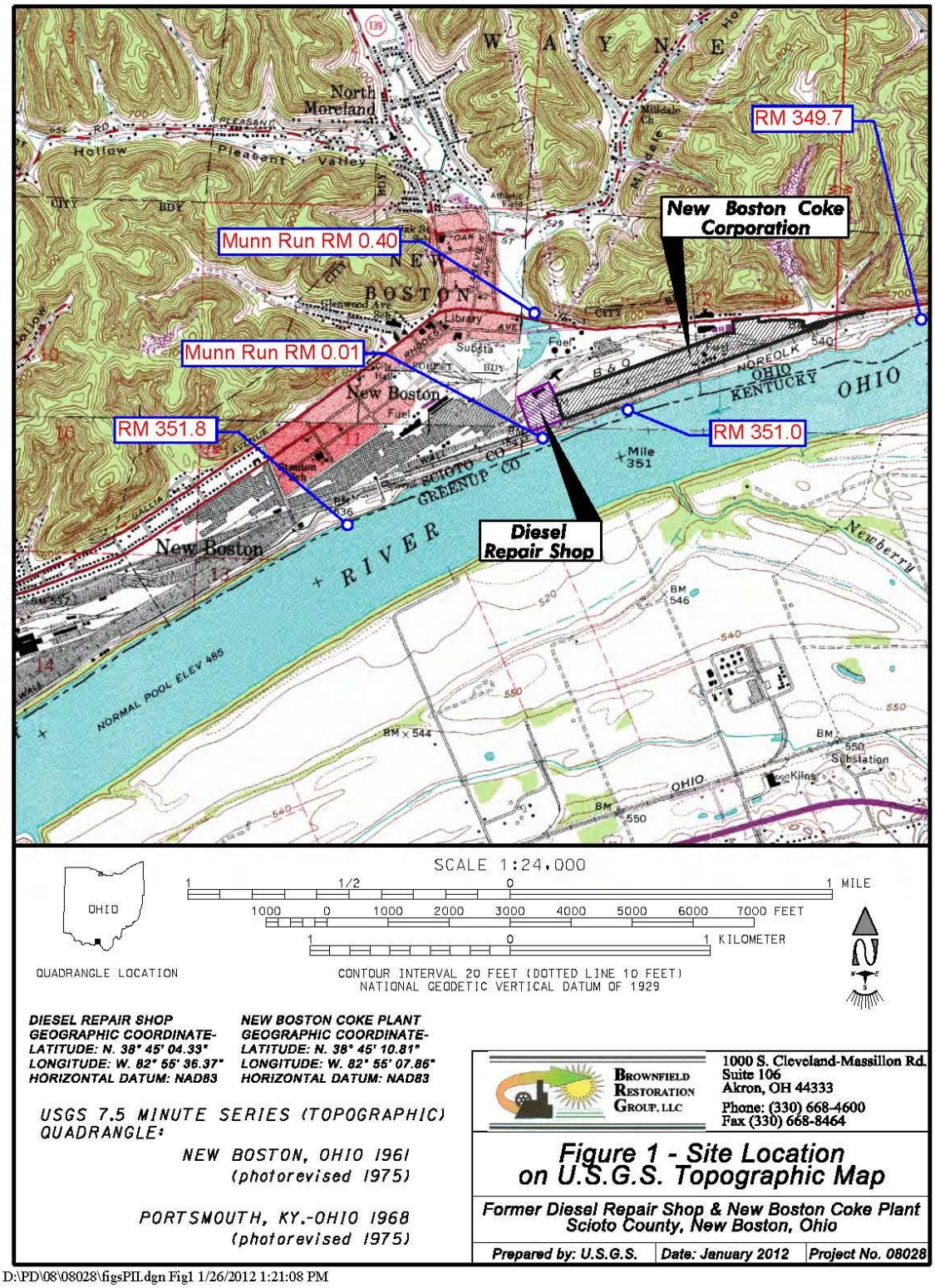
Sample Location River Mile	Aquatic Life Use Designation	Aquatic Life Attainment Status	IBI	MIwb	mORFIn	ICI	Stream Habitat	Aquatic Life Use Impairment Cause/Source
349.7	WWH	**FULL**	53 (E)	10.6 (E)	59 (E)	42 (VG)	63.0 (G)	None
351.0	WWH	**FULL**	42 (G)	9.6 (E)	42 (VG)	NA	61.8 (G)	None
351.8	WWH	**FULL**	48 (E)	10.1 (E)	49 (VG)	NA	63.0 (G)	None

Narrative evaluations: E – exceptional/excellent, VG - very good, G - good, MG - marginally good, F -fair, P - poor, VP – very poor

Table 2. Sampling locations in the Ohio River and Munn Run, New Boston Coke property area, 2011. Type of sampling included fish community (F), macroinvertebrate community (M), surface water (W), and sediment (S).

River Mile	Type of Sampling	Latitude	Longitude	Landmark
Ohio River				
349.7	F,M,W,S	38.75609	-82.90184	Upstream New Boston Coke property
351.0	F,M,W,S	38.7508	-82.9219	Adjacent New Boston Coke property
351.8	F,M,W,S	38.7456	-82.9372	Downstream New Boston Coke property/ Munn Run
Munn Run				
0.40	W	38.75538	-82.92739	Upstream Diesel Repair Shop property
0.01	W	38.749497	-82.926787	Downstream Diesel Repair Shop property/ at mouth

Figure 1. Sampling locations in the Ohio River and Munn Run, New Boston Coke and Diesel Repair Shop property areas, 2011. Base map was provided by Brownfield Restoration Group.



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. As Ohio's biological criteria do not apply to Ohio River sampling sites, a narrative evaluation of the biological results was used to assess ecological conditions. The Ohio 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 Ohio River 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 $4^{o}C$) 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 twice 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)

and USEPA Ecological Screening Levels (USEPA 2003), along with a comparison of metals results to Ohio Sediment Reference Values (Ohio EPA 2003).

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates set at each of the Ohio River sampling locations. A qualitative sample from natural substrate habitats was not collected because high flow conditions prevented sampling suitable habitat. 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. 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 Ohio River site using pulsed DC boat electrofishing methods. Electrofishing was conducted during nighttime hours. 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 by Ohio EPA 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). In addition, ORSANCO developed the original Ohio River Fish Index (ORFIn) which was subsequently modified (*m*ORFIn). *m*ORFIn scores, which are numerical representations of the relative condition of Ohio River fish communities, are based on a suite of measurable attributes. The *m*ORFIn contains 13 metrics of various aspects of the fish community including diversity, abundance, feeding and reproductive guilds, pollution tolerance, and fish health.

RESULTS

Surface Water

Chemical analyses were conducted on surface water samples collected on July 26 and September 6, 2011 from three locations in the Ohio River and two locations in Munn Run (Appendix Tables 1 and 2). Surface water samples were analyzed for total analyte list inorganics (metals), PCBs, volatile organic compounds, and semivolatile organic compounds.

In the Ohio River, one semivolatile organic chemical, bis(2-ethylhexyl)phthalate, was reported in the upstream sample above the Outside Mixing Zone Average (OMZA) aquatic life water quality criterion. Aside from one other reported result for bis(2-ethylhexyl)phthalate (detected but below the water quality criterion) concentrations of PCBs, volatile organics, and semivolatile organic compounds tested in Ohio River water at all three locations were reported as not detected. All metals measurements were low, and were below applicable Ohio WQS aquatic life criteria. However, total arsenic measurements exceeded the human health drinking standard at all Ohio River stations – these exceedances are not related to New Boston Coke or Munn Run influences.

Munn Run water samples were collected upstream and downstream from the former diesel repair shop property. All metal parameter concentrations were low, and were below applicable Ohio WQS aquatic life and human health criteria. One bis(2-ethylhexyl)phthalate measurement exceeded the OMZA criterion, and this occurred at the upstream location. All other organic chemical parameters tested were reported as not detected or at very low concentrations.

Nutrients, ammonia-N, dissolved oxygen and bacteriological parameters were not tested as part of this evaluation. Excluding the typical wastewater chemical parameters noted above, good chemical water quality was evident in all stream samples.

Sediment

Surficial sediment samples were collected at three locations in the Ohio River by the Ohio EPA on September 6, 2011. 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 3. 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 uncommon at all three sites.

Metals and semivolatile organic compounds above screening benchmarks are presented in Table 3. Sediment collected from all three locations in the Ohio River (upstream, adjacent, and downstream from the New Boston Coke property) was considered unlikely to be harmful to sediment-dwelling organisms (MacDonald *et.a*l. 2000). At all three sediment sampling locations, slightly elevated levels of polycyclic aromatic hydrocarbons (PAHs) were observed (Table 4); the highest levels were noted at the downstream site at RM 351.8. Metals parameters were below reference levels at all three locations in the Ohio River, and PCB measurements were non-elevated. Diesel range organics were measured at elevated levels at all Ohio River sites (Appendix Table 3). Biological communities within the study area of the Ohio River are not impaired by chemical contaminants in the bottom sediments. This is due to very low contaminant levels and the limited deposits of fine grained material at each sampling location.

Table 3. Chemical parameters measured above screening levels in samples collected by Ohio EPA from surficial sediments in the Ohio River, September, 2011. 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 349.7	RM 351.0	RM 351.8
Cobalt (mg/kg)	10.3	12.2	8.63
Benzo(a)anthracene (ug/kg)	126J	162J	1020
Benzo(k)fluoranthene (ug/kg)	139J	164J	935
Benzo(ghi)perylene (ug/kg)	ND	ND	714
Benzo(a)pyrene (ug/kg) (ug/kg)	147J	178J	1180
Chrysene (ug/kg)	139J	181J	1200
Fluoranthene (ug/kg)	271	291	2250
Fluorene (ug/kg)	390	ND	160
Indeno(1,2,3-cd)pyrene (ug/kg)	ND	ND	663
Phenanthrene (ug/kg)	136J	135J	805
Pyrene (ug/kg)	225	242J	1850
Total PAHs (ug/kg)	1310	1510	11,727

J - Estimated result. Result is less than RL.
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. Ohio 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 is largely commercial/industrial/urban. Gravel, sand, and cobble were the predominant substrate types among the three Ohio River sampling locations and, along with normal levels of silt and bottom embeddedness, contributed to good quality substrate conditions. Fast flow conditions were noted at the upstream site (RM 349.7), while slower flow conditions occurred at the adjacent (RM 351.0) and downstream (RM 351.8) sites. A notable difference in habitat quality was observed between the adjacent site, and the upstream and downstream sites. The adjacent site lacked any aquatic vegetation – both submerged and emergent. The upstream and downstream sites had moderate to abundant vegetation beds which produced large numbers of fish while electrofishing. QHEI scores for the Ohio River sites ranged between 61.8 and 63.0. These scores are indicative of marginally good river habitat.

Table 4. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites in the Ohio River, New Boston Coke property area, 2011.

			MWH Attributes																														
			WWH Attributes											*High Influence*						*Moderate Influence*														
Key QHEI Components			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**
River Mile	**QHEI**	**Habitat Rating**																															
Ohio River Year: 2011																																	
349.7	**63.0**	Marginally Good	■	■				■		■	■		5			◆			1					●				●				●	3
351.0	**61.8**	Marginally Good	■	■				■		■	■		5			◆			1					●				●				●	3
351.8	**63.0**	Marginally Good	■	■				■	■	■	■		6			◆			1					●								●	2

Fish Community

A total of 3,230 fish representing 35 species were collected from the Ohio River in the New Boston Coke property area between July and September, 2011. Relative numbers and species collected per location are presented in Appendix Table 4 and IBI metrics are presented in Appendix Table 5. Sampling locations were evaluated using Ohio EPA Warmwater Habitat biocriteria and the mORFIn fish index developed by the Ohio River Valley Water Sanitation Commission (ORSANCO). Using the original Index of Biotic Integrity (IBI) as a model, ORSANCO developed the Ohio River Fish Index (ORFIn) to examine the fish community data that are collected from the Ohio River. The ORFIn assesses the fish community by examining the number of species, the types of species and the ecological structure of the fish community at a site. This is done by looking at 13 attributes of the community, called metrics, and comparing them to expected values. The original ORFIn was modified (mORFIn) in 2008 by updating the scoring system and re-evaluating river habitat classes.

For comparison purposes, the IBI and MIwb scores were compared to narrative ranges for sites in the Western Allegheny Plateau ecoregion; biocriteria identified in the Ohio Water Quality Standards do not apply to the Ohio River (Table 5). Fish communities from these three sites were reflective of good to exceptional quality. Based on this comparison, the Ohio River fish sites fully achieved the Warmwater Habitat use designation. Similar conclusions were noted when evaluating the fish community using the ORSANCO mORFIn index. Results from mORFIn scoring revealed the three Ohio River fish communities representative of very good to excellent quality and meeting the Ohio River aquatic life use designation.

Table 5. Fish community summaries based on pulsed D.C. electrofishing sampling conducted by Ohio EPA in the Ohio River, New Boston Coke property area, from July and September, 2011. 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	mORFIn	Narrative Evaluation
349.7	Boat-Night	24.5	31	1084	63.0	53	10.6	59	Exceptional/ Excellent
351.0	Boat-Night	22.5	26	1192	61.8	42	9.6	42	Good to Exceptional
351.8	Boat-Night	24.5	27	954	63.0	48	10.1	49	Very Good to Exceptional

Macroinvertebrate Community

The macroinvertebrate communities from the Ohio River sampling locations in the vicinity of the New Boston Coke facility property were sampled in 2011 using quantitative (artificial substrate) sampling protocols. Results are summarized in Table 6. The ICI metrics with the associated scores and the raw data are attached as Appendix Tables 6 and 7. The Hester Dendy sampler from the upstream sampling location (River Mile 349.7) was the only useable data. The sampler from the adjacent site had inadequate flow velocity to allow adequate colonization of the sampler. The raw data for the adjacent site are included in Appendix Tables 6 and 7 but were not used to determine attainment. The sampler from the downstream sampling location was not recovered. For this reason, the attainment status and assignment of potential impacts on the biological community from the New Boston Coke facility is based solely upon the fish community assessment.

The macroinvertebrate community from the upstream site met the WWH criterion with an ICI score of 42 and was evaluated as very good.

Table 6. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) in the Ohio River, 2011. NA = not applicable.

Stream/ River Mile	Density Number/ft^2	Total Taxa	Quantitative Taxa	Qualitative Taxa	Qualitative EPT[a]	ICI	Evaluation
Ohio River							
349.7	1041	27	27	NA	NA	42	Very Good
351.0	-	-	-	NA	NA	-	-
351.8	NA	NA	NA	NA	NA	NA	NA

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

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APPENDICES – OHIO RIVER AND MUNN RUN, 2011

Appendix Table 1. Results of chemical surface water sampling conducted by Ohio EPA in the Ohio River and Munn Run, July 26, 2011.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	7/26/2011	7/26/2011	7/26/2011	7/26/2011	7/26/2011
TAL Metals (ug/l)					
Aluminum	466	403	367	139	247
Arsenic	12.7	11.1	14	11.6	11
Lead	ND	ND	ND	ND	10.7
Antimony	ND	ND	ND	ND	0.824J
Barium	58.7	57.1	55.5	34	52.6
Selenium	ND	ND	ND	ND	ND
Beryllium	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND
Calcium	41,400	41,300	40,600	32,200	41,200
Chromium	ND	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND
Iron	664	574	549	617	450
Magnesium	13,900	13,400	13,100	10,900	13,300
Manganese	52.9	51.1	48.7	321	48.8
Nickel	ND	ND	ND	ND	ND
Potassium	2880	2800	2720	4080	3060
Silver	ND	ND	ND	ND	ND
Sodium	29,600	29,800	28,800	17,200	28,400
Vanadium	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND
Volatile Organic Analytes (ug/l)					
Acetone	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND
Bromobenzene	ND	ND	ND	ND	ND
Bromochloromethane	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND
n-Butylbenzene	ND	ND	ND	ND	ND
sec-Butylbenzene	ND	ND	ND	ND	ND
tert-Butylbenzene	ND	ND	ND	ND	ND
Carbon disulfide	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND
2-Chlorotoluene	ND	ND	ND	ND	ND

Appendix Table 1. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	7/26/2011	7/26/2011	7/26/2011	7/26/2011	7/26/2011
Volatile Organic Analytes (ug/l)					
Dibromomethane	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND
1,3-Dichloropropane	ND	ND	ND	ND	ND
2,2-Dichloropropane	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND
1,1-Dichloropropene	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND
n-Hexane	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND	ND
p-Isopropyltoluene	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
n-Propylbenzene	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	ND
m-,p-Xylene	ND	ND	ND	ND	ND

Appendix Table 1. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	7/26/2011	7/26/2011	7/26/2011	7/26/2011	7/26/2011
Semi-volatile Organic Analytes (ug/kg)					
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND
3-,4-Methylphenol	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND
4-Bromophenyl phenylether	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND	ND
4-Chlorophenyl phenylether	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND
Benzo(ghi)perylene	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	ND	ND
Benzyl alcohol	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND
bis(2-Chloroethyl)-ether	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)-ether	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	12	ND	4.91J	84.6	ND
Butyl benzyl phthalate	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
Di-n-butyl phthalate	ND	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND

Appendix Table 1. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	7/26/2011	7/26/2011	7/26/2011	7/26/2011	7/26/2011
Semi-volatile Organic Analytes (ug/kg)					
Dibenzofuran	ND	ND	ND	ND	ND
Diethyl phthalate	ND	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND
N-Nitrosodi-n-propyl-amine	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND
PCBs (ug/l)					
Aroclor 1016	ND	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND	ND
Aroclor 1260	ND	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 chemical surface water sampling conducted by Ohio EPA in the Ohio River and Munn Run, September 6, 2011.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	9/6/2011	9/6/2011	9/6/2011	9/6/2011	9/6/2011
TAL Metals (ug/l)					
Aluminum	492	488	655	1060	611
Arsenic	13.6	17.2	12.4	7.34J	13.4
Lead	ND	ND	ND	ND	ND
Antimony	ND	ND	ND	ND	ND
Barium	65.8	67.1	66.4	33.9	39.1
Selenium	ND	ND	ND	ND	ND
Beryllium	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND
Calcium	43,900	45,000	43,300	26,600	32,000
Chromium	ND	ND	ND	ND	ND
Cobalt	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND
Iron	856	827	1160	1400	1060
Magnesium	15,200	15,400	15,000	9,780	10,900
Manganese	77	76.4	94.2	26.4	48
Nickel	ND	ND	ND	ND	ND
Potassium	3490	3510	3470	3650	3710
Silver	ND	ND	ND	ND	ND
Sodium	38,200	39,600	37,900	14,100	18,700
Vanadium	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	10.1J	11.1J
Mercury	ND	ND	ND	ND	0.102J
Volatile Organic Analytes (ug/l)					
Acetone	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	1.21J
Bromobenzene	ND	ND	ND	ND	ND
Bromochloromethane	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND
n-Butylbenzene	ND	ND	ND	ND	ND
sec-Butylbenzene	ND	ND	ND	ND	ND
tert-Butylbenzene	ND	ND	ND	ND	ND
Carbon disulfide	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND
2-Chlorotoluene	ND	ND	ND	ND	ND

Appendix Table 2. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	9/6/2011	9/6/2011	9/6/2011	9/6/2011	9/6/2011
Volatile Organic Analytes (ug/l)					
Dibromomethane	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND
1,3-Dichloropropane	ND	ND	ND	ND	ND
2,2-Dichloropropane	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND
1,1-Dichloropropene	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	1.27J
n-Hexane	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND	ND
p-Isopropyltoluene	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
n-Propylbenzene	ND	ND	ND	ND	0.443J
Styrene	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	5.69
1,2,3-Trichlorobenzene	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND	2.28J
1,3,5-Trimethylbenzene	ND	ND	ND	ND	0.548J
Vinyl acetate	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND	1.98J
m-,p-Xylene	ND	ND	ND	ND	4.84J

Appendix Table 2. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	9/6/2011	9/6/2011	9/6/2011	9/6/2011	9/6/2011
Semi-volatile Organic Analytes (ug/kg)					
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND
2-Methylphenol	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND
3-,4-Methylphenol	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND
4-Bromophenyl phenylether	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND
4-Chloroaniline	ND	ND	ND	ND	ND
4-Chlorophenyl phenylether	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND
Benzo(ghi)perylene	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	ND	ND
Benzyl alcohol	ND	ND	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND
bis(2-Chloroethyl)-ether	ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)-ether	ND	ND	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND	3.32J	ND
Butyl benzyl phthalate	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
Di-n-butyl phthalate	ND	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND

Appendix Table 2. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**	**Munn Run**	**Munn Run**
River Mile	**349.7**	**351.0**	**351.8**	**0.40**	**0.01**
Date Sampled	9/6/2011	9/6/2011	9/6/2011	9/6/2011	9/6/2011
Semi-volatile Organic Analytes (ug/kg)					
Dibenzofuran	ND	ND	ND	ND	ND
Diethyl phthalate	ND	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND
N-Nitrosodi-n-propyl-amine	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND
PCBs (ug/l)					
Aroclor 1016	ND	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND	ND
Aroclor 1254	ND	ND	ND	ND	ND
Aroclor 1260	ND	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 3. Results of sediment sampling conducted by Ohio EPA in the Ohio River and Munn Run, September 6, 2011.

Stream	**Ohio River**	**Ohio River**	**Ohio River**
River Mile	**349.7**	**351.0**	**351.8**
Date Sampled	9/6/2011	9/6/2011	9/6/2011
TAL Metals and Cyanide (mg/kg)			
Aluminum	4700	5900	3660
Arsenic	5.62	6.5	5.08
Lead	18.4	25.6	28.7
Antimony	ND	ND	ND
Barium	49.5	65.7	44.8
Selenium	0.749J	0.826J	0.569J
Beryllium	0.572	0.791	0.529
Thallium	ND	ND	ND
Cadmium	ND	ND	ND
Calcium	2680	2270	5400
Chromium	11.8	13.4	21
Cobalt	10.3	12.2	8.63
Copper	10.8	16.5	12.3
Iron	19,500B	21,200B	21,200B
Magnesium	1790	1540	2080
Manganese	495	522	511
Nickel	19.7	22.5	17.4
Potassium	414	511	296
Silver	ND	ND	ND
Sodium	64.4	81.7	54.3
Vanadium	11.5	13.9	11.3
Zinc	74.9	92.5	118
Mercury	0.0368J	0.031J	0.0163J
Total Cyanide	ND	ND	ND
Volatile Organic Analytes (ug/kg)			
1,1,1,2-Tetrachloroethane	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND
1,1-Dichloropropene	ND	ND	ND
1,2,3-Trichlorobenzene	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND
1,2-Dibromomethane	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND
1,3-Dichloropropane	ND	ND	ND

Appendix Table 3. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**
River Mile	**349.7**	**351.0**	**351.8**
Date Sampled	9/6/2011	9/6/2011	9/6/2011
Volatile Organic Analytes (ug/kg)			
1,4-Dichlorobenzene	ND	ND	ND
2,2-Dichloropropane	ND	ND	ND
2-Butanone	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND
2-Chlorotoluene	ND	ND	ND
2-Hexanone	ND	ND	ND
4-Chlorotoluene	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND
Acetone	ND	ND	ND
Benzene	ND	ND	ND
Bromobenzene	ND	ND	ND
Bromochloromethane	ND	ND	ND
Bromodichloromethane	ND	ND	ND
Bromoform	ND	ND	ND
Bromomethane	ND	ND	ND
Carbon disulfide	ND	ND	ND
Carbon tetrachloride	ND	ND	ND
Chlorobenzene	ND	ND	ND
Chlorodibromomethane	ND	ND	ND
Chloroethane	ND	ND	ND
Chloroform	ND	ND	ND
Chloromethane	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND
Dibromomethane	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND
Ethylbenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Isopropylbenzene	ND	ND	ND
Methyl t-butyl ether	ND	ND	ND
m-,p-Xylene	ND	ND	ND
Methylene chloride	ND	ND	ND
n-Butylbenzene	ND	ND	ND
n-Hexane	ND	ND	ND
n-Propylbenzene	ND	ND	ND
Naphthalene	ND	ND	ND
o-Xylene	ND	ND	ND
p-Isopropyltoluene	ND	ND	ND
sec-Butylbenzene	ND	ND	ND
Styrene	ND	ND	ND
tert-Butylbenzene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
Toluene	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND
Trichloroethene	ND	ND	ND

Appendix Table 3. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**
River Mile	**349.7**	**351.0**	**351.8**
Date Sampled	9/6/2011	9/6/2011	9/6/2011
Volatile Organic Analytes (ug/kg)			
Trichlorofluoromethane	ND	ND	ND
Vinyl acetate	ND	ND	ND
Vinyl chloride	ND	ND	ND
Semi-volatile Organic Analytes (ug/kg)			
1,2,3-Trichlorobenzene	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND
2,6-Dinitrotoluene	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND
2-Chlorophenol	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND
2-Methylphenol	ND	ND	ND
2-Nitroaniline	ND	ND	ND
2-Nitrophenol	ND	ND	ND
3,3'-Dichlorobenzidine	ND	ND	ND
3-,4-Methylphenol	ND	ND	ND
3-Nitroaniline	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND
4-Bromophenyl phenylether	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND
4-Chloroaniline	ND	ND	ND
4-Chlorophenyl phenylether	ND	ND	ND
4-Nitroaniline	ND	ND	ND
4-Nitrophenol	ND	ND	ND
Acenaphthene	ND	ND	ND
Acenaphthylene	ND	ND	ND
Anthracene	ND	ND	ND
Benzo(a)anthracene	126J	162J	1020
Benzo(a)pyrene	147J	178J	1180
Benzo(b)fluoranthene	127J	157J	1110
Benzo(ghi)perylene	ND	ND	714
Benzo(k)fluoranthene	139J	164J	935
Benzoic acid	ND	ND	ND
Benzyl alcohol	ND	ND	ND
bis(2-Chloroethoxy)methane	ND	ND	ND
bis(2-Chloroethyl)-ether	ND	ND	ND
bis(2-Chloroisopropyl)-ether	ND	ND	ND
bis(2-Ethylhexyl)phthalate	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND

Appendix Table 3. Continued.

Stream	**Ohio River**	**Ohio River**	**Ohio River**
River Mile	**349.7**	**351.0**	**351.8**
Date Sampled	9/6/2011	9/6/2011	9/6/2011
Semi-volatile Organic Analytes (ug/kg)			
Chrysene	139J	181J	1200
Di-n-butyl phthalate	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND
Dibenzofuran	ND	ND	ND
Diethyl phthalate	ND	ND	ND
Dimethyl phthalate	ND	ND	ND
Fluoranthene	271	291	2250
Fluorene	ND	ND	ND
Hexachlorobenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND
Hexachloroethane	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	663
Isophorone	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND
N-Nitrosodi-n-propyl-amine	ND	ND	ND
Naphthalene	ND	ND	ND
Nitrobenzene	ND	ND	ND
Pentachlorophenol	ND	ND	ND
Phenanthrene	136J	135J	805
Phenol	ND	ND	ND
Pyrene	225	242J	1850
PCBs (ug/kg)			
Aroclor 1016	ND	ND	ND
Aroclor 1221	ND	ND	ND
Aroclor 1232	ND	ND	ND
Aroclor 1242	ND	ND	ND
Aroclor 1248	ND	ND	ND
Aroclor 1254	ND	ND	ND
Aroclor 1260	ND	ND	15.7J
Other Parameters			
Diesel Range Organics (C10-C20) - mg/kg	ND	5100J	3470J
Diesel Range Organics (C20-C34) - mg/kg	11,600	26,800	19,700
Diesel Range Organics (C10-C28) - mg/kg	ND	ND	ND
Gasoline Range Organics (C6-C12) - ug/kg	ND	ND	ND
Percent Solids	67.8	56.5	70.7

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: **25-001**	Stream: **Ohio River**	Sample Date: **2011**
River Mile: **351.80**	Location: dst. New Boston Coke	Date Range: 07/27/2011
Time Fished: 4450 sec	Drainage: 60700.0 sq mi	Thru: 09/07/2011
Dist Fished: 1.00 km	Basin: Ohio River No of Passes: 2	Sampler Type: N

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Longnose Gar		P	M		2	2.00	0.21	0.66	0.49	327.50
Skipjack Herring		P	M		2	2.00	0.21	0.04	0.03	20.50
Gizzard Shad		O	M		341	341.00	35.74	17.65	13.21	51.77
Smallmouth Buffalo	C	I	M		12	12.00	1.26	17.56	13.13	1,463.19
Quillback	C	O	M		7	7.00	0.73	5.23	3.91	746.43
River Carpsucker	C	O	M		10	10.00	1.05	8.14	6.09	814.20
Highfin Carpsucker	C	O	M		4	4.00	0.42	0.20	0.15	50.25
Silver Redhorse	R	I	S	M	6	6.00	0.63	8.83	6.60	1,470.83
Golden Redhorse	R	I	S	M	39	39.00	4.09	13.16	9.84	337.42
River Redhorse [S]	R	I	S	I	5	5.00	0.52	4.80	3.59	960.40
Smallmouth Redhorse	R	I	S	M	47	47.00	4.93	16.66	12.46	354.50
Silver Chub	N	I	M		1	1.00	0.10	0.02	0.02	22.00
Emerald Shiner	N	I	M		47	47.00	4.93	0.12	0.09	2.60
Spotfin Shiner	N	I	M		1	1.00	0.10	0.01	0.00	5.00
Channel Shiner	N	I	M	I	267	267.00	27.99	0.38	0.29	1.43
Channel Catfish	F		C		68	68.00	7.13	17.03	12.74	250.44
Flathead Catfish	F	P	C		3	3.00	0.31	1.62	1.21	540.00
White Bass	F	P	M		15	15.00	1.57	2.54	1.90	169.00
Str. Bass X Wh. Bass	E				2	2.00	0.21	0.55	0.41	277.00
White Crappie	S	I	C		2	2.00	0.21	0.37	0.28	184.50
Smallmouth Bass	F	C	C	M	13	13.00	1.36	9.33	6.98	717.85
Spotted Bass	F	C	C		13	13.00	1.36	2.75	2.06	211.46
Green Sunfish	S	I	C	T	4	4.00	0.42	0.03	0.02	8.25
Bluegill Sunfish	S	I	C	P	14	14.00	1.47	0.55	0.41	39.29
Longear Sunfish	S	I	C	M	3	3.00	0.31	0.08	0.06	28.00
Sauger	F	P	S		16	16.00	1.68	3.50	2.62	218.75
Walleye	F	P	S		3	3.00	0.31	0.53	0.39	176.00
Sauger X Walleye	E	P			2	2.00	0.21	0.29	0.21	142.50
Freshwater Drum			M	P	5	5.00	0.52	1.07	0.80	213.40
Mile Total					954	954.00		133.69		
Number of Species					27					
Number of Hybrids					2					

River Code: **25-001**	Stream: **Ohio River**	Sample Date: **2011**
River Mile: **351.00**	Location: adj. New Boston Coke	Date Range: 07/26/2011
Time Fished: 4388 sec	Drainage: 60700.0 sq mi	Thru: 09/06/2011
Dist Fished: 1.00 km	Basin: Ohio River No of Passes: 2	Sampler Type: N

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Longnose Gar		P	M		6	6.00	0.50	2.89	3.26	481.50
Skipjack Herring		P	M		1	1.00	0.08	0.01	0.01	5.00
Gizzard Shad		O	M		642	642.00	53.86	32.42	36.57	50.49
Smallmouth Buffalo	C	I	M		5	5.00	0.42	5.85	6.60	1,170.00
Quillback	C	O	M		2	2.00	0.17	1.30	1.47	650.00
Highfin Carpsucker	C	O	M		4	4.00	0.34	0.61	0.68	151.50
Silver Redhorse	R	I	S	M	13	13.00	1.09	11.08	12.49	851.92
Golden Redhorse	R	I	S	M	10	10.00	0.84	4.32	4.87	432.00
Smallmouth Redhorse	R	I	S	M	23	23.00	1.93	3.57	4.03	155.22
Common Carp	G	O	M	T	2	2.00	0.17	3.68	4.15	1,837.50
Emerald Shiner	N	I	M		111	111.00	9.31	0.22	0.25	2.00
Spotfin Shiner	N	I	M		1	1.00	0.08	0.00	0.00	4.00
Bullhead Minnow	N	O	C		3	3.00	0.25	0.02	0.02	5.00
Channel Shiner	N	I	M	I	226	226.00	18.96	0.35	0.39	1.55
Channel Catfish	F		C		12	12.00	1.01	4.71	5.32	392.67
Flathead Catfish	F	P	C		2	2.00	0.17	1.02	1.15	510.00
White Bass	F	P	M		20	20.00	1.68	2.15	2.43	107.70
Str. Bass X Wh. Bass	E				1	1.00	0.08	0.37	0.42	368.00
White Crappie	S	I	C		2	2.00	0.17	0.44	0.49	218.00
Smallmouth Bass	F	C	C	M	5	5.00	0.42	1.83	2.07	366.80
Spotted Bass	F	C	C		22	22.00	1.85	3.76	4.24	170.89
Bluegill Sunfish	S	I	C	P	33	33.00	2.77	0.95	1.07	28.65
Longear Sunfish	S	I	C	M	8	8.00	0.67	0.29	0.33	36.13
Redear Sunfish	E	I	C		1	1.00	0.08	0.22	0.25	220.00
Sauger	F	P	S		20	20.00	1.68	4.54	5.12	226.95
Walleye	F	P	S		1	1.00	0.08	0.91	1.03	910.00
Sauger X Walleye	E	P			5	5.00	0.42	0.65	0.73	130.00
Freshwater Drum			M	P	11	11.00	0.92	0.52	0.59	47.18
Mile Total					1,192	1,192.00		88.65		
Number of Species					26					
Number of Hybrids					2					

River Code: **25-001**	Stream: **Ohio River**	Sample Date: **2011**
River Mile: **349.70**	Location: upst. New Boston Coke	Date Range: 07/26/2011
Time Fished: 3384 sec	Drainage: 60700.0 sq mi	Thru: 09/06/2011
Dist Fished: 1.00 km	Basin: Ohio River No of Passes: 2	Sampler Type: N

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		91	91.00	8.39	8.73	6.56	95.89
Smallmouth Buffalo	C	I	M		6	6.00	0.55	6.80	5.11	1,133.33
Quillback	C	O	M		5	5.00	0.46	3.05	2.29	609.00
River Carpsucker	C	O	M		4	4.00	0.37	2.09	1.57	522.50
Highfin Carpsucker	C	O	M		1	1.00	0.09	0.15	0.11	150.00
Silver Redhorse	R	I	S	M	8	8.00	0.74	9.90	7.44	1,237.50
Black Redhorse	R	I	S	I	7	7.00	0.65	2.96	2.22	422.14
Golden Redhorse	R	I	S	M	49	49.00	4.52	19.14	14.39	390.70
River Redhorse [S]	R	I	S	I	9	9.00	0.83	13.66	10.27	1,517.78
Smallmouth Redhorse	R	I	S	M	105	105.00	9.69	25.39	19.09	241.83
Emerald Shiner	N	I	M		194	194.00	17.90	0.42	0.32	2.18
River Shiner	N	I	S		1	1.00	0.09	0.02	0.01	15.00
Spotfin Shiner	N	I	M		1	1.00	0.09	0.01	0.01	7.00
Bullhead Minnow	N	O	C		1	1.00	0.09	0.00	0.00	3.00
Channel Shiner	N	I	M	I	375	375.00	34.59	0.67	0.50	1.79
Channel Catfish	F		C		20	20.00	1.85	5.60	4.21	280.00
Flathead Catfish	F	P	C		2	2.00	0.18	1.70	1.28	850.00
White Bass	F	P	M		20	20.00	1.85	1.72	1.29	85.85
Str. Bass X Wh. Bass	E				1	1.00	0.09	0.31	0.23	310.00
White Crappie	S	I	C		5	5.00	0.46	1.36	1.02	272.40
Smallmouth Bass	F	C	C	M	21	21.00	1.94	7.32	5.50	348.56
Spotted Bass	F	C	C		57	57.00	5.26	8.66	6.51	151.96
Largemouth Bass	F	C	C		1	1.00	0.09	0.24	0.18	235.00
Green Sunfish	S	I	C	T	1	1.00	0.09	0.02	0.01	15.00
Bluegill Sunfish	S	I	C	P	25	25.00	2.31	0.85	0.64	33.88
Longear Sunfish	S	I	C	M	2	2.00	0.18	0.07	0.05	35.50
Redear Sunfish	E	I	C		1	1.00	0.09	0.15	0.12	154.00
Pumpkinseed Sunfish	S	I	C	P	1	1.00	0.09	0.05	0.03	46.00
Sauger	F	P	S		19	19.00	1.75	4.38	3.29	230.53
Walleye	F	P	S		1	1.00	0.09	0.75	0.56	750.00
Logperch	D	I	S	M	1	1.00	0.09	0.01	0.01	12.00
Sauger X Walleye	E	P			4	4.00	0.37	1.13	0.85	282.50
Freshwater Drum			M	P	45	45.00	4.15	5.73	4.30	127.22
Mile Total					1,084	1,084.00		133.02		
Number of Species					31					
Number of Hybrids					2					

Appendix Table 5. Index of Biotic Integrity (IBI) scores and metrics for the Ohio River, 2011.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Percent of Individuals: Rnd-bodied suckers	Percent of Individuals: Simple Lithophils	Percent of Individuals: Tolerant fishes	Percent of Individuals: Omni-vores	Percent of Individuals: Top carnivores	Percent of Individuals: Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb
Ohio River - (25-001)																	
Year: 2011																	
351.80	N	07/27/2011	60700	24(5)	4(5)	7(5)	2(3)	15(1)	17(5)	0(5)	13(5)	7(3)	75(5)	0.0(5)	918(5)	52	10.3
351.80	N	09/07/2011	60700	25(5)	4(5)	7(5)	2(3)	6(1)	8(5)	0(5)	61(1)	7(3)	20(1)	0.0(5)	982(5)	44	9.9
351.00	N	07/26/2011	60700	22(5)	2(3)	6(5)	1(1)	10(1)	12(5)	0(5)	22(3)	8(3)	68(5)	0.0(5)	730(5)	46	10.0
351.00	N	09/06/2011	60700	20(3)	3(3)	6(5)	1(1)	1(1)	3(5)	0(5)	69(1)	6(3)	22(1)	0.0(5)	1650(5)	38	9.2
349.70	N	07/26/2011	60700	23(5)	3(3)	8(5)	3(3)	22(3)	25(5)	0(5)	19(3)	13(5)	63(5)	0.0(5)	644(5)	52	10.7
349.70	N	09/06/2011	60700	25(5)	4(5)	8(5)	3(3)	14(1)	16(5)	0(5)	5(5)	11(5)	77(5)	0.1(5)	1522(5)	54	10.5

♦ - 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			
Ohio River (25-001)													
Year: 2011													
349.70 R	**60700**	**27(4)**	**5(6)**	**7(4)**	**8(6)**	**12.4(6)**	**44.7(4)**	**3.3(6)**	**39.6(0)**	**3.9(0)**	**0(6)**	**4**	**42**

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection - Appendix Table 7

Site: Ohio River

Collection Date: 09/06/2011 River Code: 25-001 RM: 351.00 R adj. New Boston Coke

Taxa Code	Taxa	Quant/Qual
01200	*Cordylophora lacustris*	16
01320	*Hydra sp*	9
01801	*Turbellaria*	5
03600	*Oligochaeta*	2370
07055	*Corophium lacustre*	37
13400	*Stenacron sp*	8
27404	*Neurocordulia molesta*	1
51206	*Cyrnellus fraternus*	444
52001	*Hydropsychidae*	16
77470	*Coelotanypus sp*	7
83040	*Dicrotendipes neomodestus*	7
83050	*Dicrotendipes lucifer*	642
83300	*Glyptotendipes (G.) sp*	14
84700	*Stenochironomus sp*	27
84790	*Tribelos fuscicorne*	41
84960	*Pseudochironomus sp*	27
85800	*Tanytarsus sp*	7
97710	*Dreissena polymorpha*	172

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 18 Total Taxa: 18

No. Qualitative Taxa: 0 ICI: **26**

Number of Organisms: 3850 EPT: 3

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection - Appendix Table 7

Site: Ohio River

Collection Date: 09/06/2011 River Code: 25-001 RM: 349.70 R upst. New Boston Coke

Taxa Code	Taxa	Quant/Qual
01200	*Cordylophora lacustris*	16
01320	*Hydra sp*	665
01801	*Turbellaria*	83
03600	*Oligochaeta*	96
13400	*Stenacron sp*	498
13550	*Maccaffertium mexicanum integrum*	25
13561	*Maccaffertium pulchellum*	36
16700	*Tricorythodes sp*	42
17200	*Caenis sp*	42
27404	*Neurocordulia molesta*	1
51206	*Cyrnellus fraternus*	222
51300	*Neureclipsis sp*	1
52200	*Cheumatopsyche sp*	1654
52560	*Hydropsyche orris*	406
52570	*Hydropsyche simulans*	8
52801	*Potamyia flava*	20
53800	*Hydroptila sp*	13
77750	*Hayesomyia senata or Thienemannimyia norena*	29
81250	*Nanocladius (N.) minimus*	48
83040	*Dicrotendipes neomodestus*	87
83050	*Dicrotendipes lucifer*	580
84450	*Polypedilum (Uresipedilum) flavum*	19
84700	*Stenochironomus sp*	68
84960	*Pseudochironomus sp*	19
85625	*Rheotanytarsus sp*	174
96900	*Ferrissia sp*	108
97710	*Dreissena polymorpha*	244

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 27 Total Taxa: 27

No. Qualitative Taxa: 0 ICI: **42**

Number of Organisms: 5204 EPT: 12