State of Ohio
Environmental Protection Agency

Division of Surface Water

Biological and Water Quality Study of the Ottawa River and Sibley Creek

Dura Avenue Landfill Area

Lucas County

November 30, 2007

Ted Strickland, Governor
Chris Korleski, Director

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OEPA Report EAS/2007-11-9

prepared for
State of Ohio Environmental Protection Agency
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TABLE OF CONTENTS

SUMMARY

Ottawa River

Based on the performance of the biological communities, the entire one mile of the Ottawa River study area was in non-attainment of the Warmwater Habitat aquatic life use (Table 1). The non-attainment was caused by poor/ fair fish and poor macroinvertebrate community results. The urbanized condition of the Ottawa River within the study segment (combined sewer overflows), poor river habitat (reduced or absent current, homogeneous fine substrates, reduced instream cover), and elevated sediment contaminants contributed to the impaired biological communities. Although degraded biological conditions are still present in the Ottawa River, improvements have continued to occur since 2002 and 1996. The amount of organic enrichment appears to have decreased from 2002 when macroinvertebrate densities from the quantitative samples were approximately a factor of ten higher than in 2007.

Sediment samples collected from the four Ottawa River locations had total PCB and PAH compounds at levels which exceeded the *Probable Effect Concentration* (PEC), indicating a level above which harmful biological effects are likely to be observed. An evaluation of PCB trends in the Ottawa River between 2002 and 2007 revealed generally consistent levels; however, a notable decline was observed in the section of river adjacent to the Dura Ave. Landfill remedial wall (2002 = 8.5 mg/kg, 2007 = 2.3 mg/kg).

Ohio EPA has established various levels of concern and recommended consumption levels for fish contaminants in the Ohio Fish Consumption Advisory Program. Total PCBs have a '*do not eat*' level at or above 2.0 mg/kg. Based on the 2007 fish fillet (common carp) results, all samples were above the '*do not eat*' level. Whole body fish (pumpkinseed sunfish) samples from the Ottawa River were also elevated at all four sampling locations. No obvious longitudinal trends were noted in PCB concentrations of fillet or whole body samples, and there appeared to be no direct association with proximity to the Dura Ave. Landfill.

Sibley Creek

Based on the performance of the biological communities, the lower mile of Sibley Creek was in non-attainment of the Limited Resource Water benchmarks (Table 1). The non-attainment was caused by very poor macroinvertebrate community results (along with very poor fish results at RM 0.8). Acutely toxic conditions existed in Sibley Creek at RM 0.8, where fish were absent.

Sediment samples collected from Sibley Creek upstream from Dura Ave. Landfill had total PCB and PAH compounds which exceeded the *Probable Effect Concentration* (PEC), indicating a level above which harmful biological effects are likely to be observed. Below the surface layer of silt and muck, the bottom sediments of Sibley Creek at RM 0.8 were heavily saturated with a black material with a creosote/coal tar odor. Disturbance of the sediments released an oily substance that created an extensive oil sheen on the surface of the water. These conditions were observed further downstream at RMs 0.2 and 0.1, although to a lesser extent. Similar observations were noted during sampling in 2002 and 1996. The highest level of total PCBs occurred in Sibley Creek adjacent to the Dura Ave. Landfill.

FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or "biosurvey," is an interdisciplinary monitoring effort coordinated on a waterbody specific or watershed scale. This effort may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire drainage basins, multiple and overlapping stressors, and tens of sites. Each year Ohio EPA conducts biosurveys in 4-5 watersheds study areas with an aggregate total of 250-300 sampling sites.

The Ohio EPA employs biological, chemical, and physical monitoring and assessment techniques in biosurveys in order to meet three major objectives: 1) determine the extent to which use designations assigned in the Ohio Water Quality Standards (WQS) are either attained or not attained; 2) determine if use designations assigned to a given water body are appropriate and attainable; and 3) determine if any changes in key ambient biological, chemical, or physical indicators have taken place over time, particularly before and after the implementation of point source pollution controls or best management practices. The data gathered by a biosurvey is processed, evaluated, and synthesized in a biological and water quality report. Each biological and water quality study contains a summary of major findings and recommendations for revisions to WQS, future monitoring needs, or other actions which may be needed to resolve existing impairment of designated uses. While the principal focus of a biosurvey is on the status of aquatic life uses, the status of other uses such as recreation and water supply, as well as human health concerns, are also addressed.

The findings and conclusions of a biological and water quality study may factor into regulatory actions taken by Ohio EPA (*e.g.,* NPDES permits, Director's Orders, the Ohio Water Quality Standards [OAC 3745-1], Water Quality Permit Support Documents [WQPSDs]), and are eventually incorporated into State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, and the biennial Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]).

Hierarchy of Indicators

A carefully conceived ambient monitoring approach, using cost-effective indicators consisting of ecological, chemical, and toxicological measures, can ensure that all relevant pollution sources are judged objectively on the basis of environmental results. Ohio EPA relies on a tiered approach in attempting to link the results of administrative activities with true environmental measures. This integrated approach includes a hierarchical continuum from administrative to true environmental indicators (Figure 1). The six "levels" of indicators include: 1) actions taken by regulatory agencies (permitting, enforcement, grants); 2) responses by the regulated community (treatment works, pollution prevention); 3) changes in discharged quantities (pollutant loadings); 4) changes in ambient conditions (water quality, habitat); 5) changes in uptake and/or assimilation (tissue contamination, biomarkers, wasteload allocation); and, 6) changes in health, ecology, or other effects (ecological condition, pathogens). In this process the results of administrative activities (levels 1 and 2) can be linked to efforts to improve water quality (levels 3, 4, and 5) which should translate into the environmental "results" (level 6). Thus, the aggregate effect of billions of dollars spent on water pollution control since the early 1970s can now be determined with quantifiable measures of environmental condition. Superimposed on this hierarchy is the concept of stressor, exposure, and response indicators. *Stressor* indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications. *Exposure* indicators are those which measure the effects of stressors and can include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent. *Response* indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices which comprise Ohio's biological criteria. Other response indicators could include target assemblages, *i.e.,* rare, threatened, endangered, special status, and

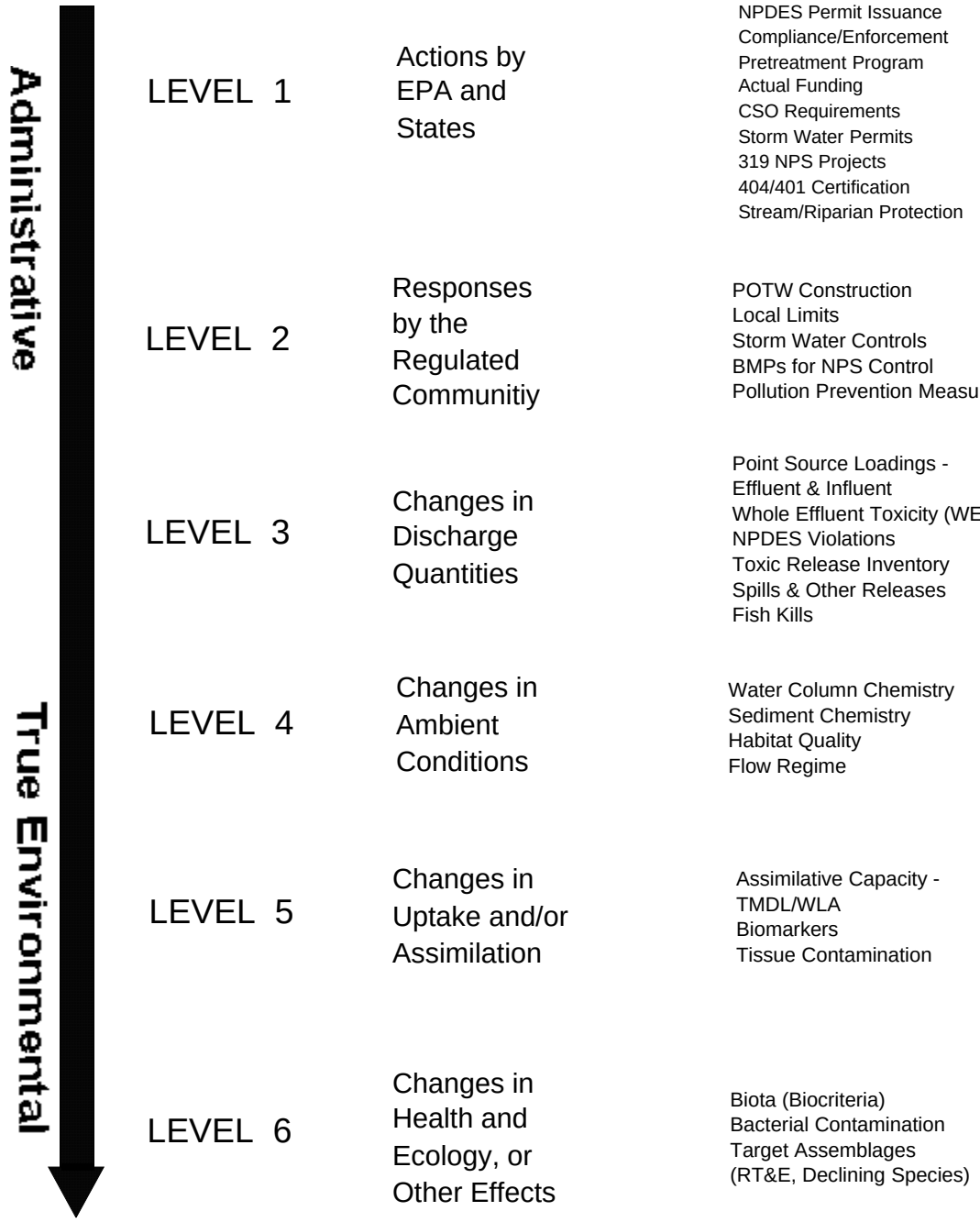

Figure 1. Hierarchy of administrative and environmental indicators which can be used for water quality management activities such as monitoring and assessment, reporting, and the evaluation of overall program effectiveness. This is patterned after a model developed by the U.S. EPA.

declining species or bacterial levels which serve as surrogates for the recreation uses. These indicators represent the essential technical elements for watershed-based management approaches. The key, however, is to use the different indicators *within* the roles which are most appropriate for each.

Describing the causes and sources associated with observed impairments revealed by the biological criteria and linking this with pollution sources involves an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and biological response signatures within the biological data itself. Thus the assignment of principal causes and sources of impairment represents the association of impairments (defined by response indicators) with stressor and exposure indicators. The principal reporting venue for this process on a watershed or subbasin scale is a biological and water quality report. These reports then provide the foundation for aggregated assessments such as the Integrated Water Quality Monitoring and Assessment Report (305[b] and 303[d]), the Ohio Nonpoint Source Assessment, and other technical bulletins.

Ohio Water Quality Standards: Designated Aquatic Life Use

The Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1) consist of designated uses and chemical, physical, and biological criteria designed to represent measurable properties of the environment that are consistent with the goals specified by each use designation. Use designations consist of two broad groups, aquatic life and non-aquatic life uses. In applications of the Ohio WQS to the management of water resource issues in Ohio's rivers and streams, the aquatic life use criteria frequently result in the most stringent protection and restoration requirements, hence their emphasis in biological and water quality reports. Also, an emphasis on protecting for aquatic life generally results in water quality suitable for all uses. The five different aquatic life uses currently defined in the Ohio WQS are described as follows:

1) *Warmwater Habitat (WWH)* - this use designation defines the "typical" warmwater assemblage of aquatic organisms for Ohio rivers and streams; *this use represents the principal restoration target for the majority of water resource management efforts in Ohio.*

2) *Exceptional Warmwater Habitat (EWH)* - this use designation is reserved for waters which support "unusual and exceptional" assemblages of aquatic organisms which are characterized by a high diversity of species, particularly those which are highly intolerant and/or rare, threatened, endangered, or special status (*i.e.,* declining species); *this designation represents a protection goal for water resource management efforts dealing with Ohio's best water resources.*

3) *Coldwater Habitat (CWH)* - this use is intended for waters which support assemblages of cold water organisms and/or those which are stocked with salmonids with the intent of providing a put-and-take fishery on a year round basis which is further sanctioned by the Ohio DNR, Division of Wildlife; this use should not be confused with the Seasonal Salmonid Habitat (SSH) use which applies to the Lake Erie tributaries which support periodic "runs" of salmonids during the spring, summer, and/or fall.

4) *Modified Warmwater Habitat (MWH)* - this use applies to streams and rivers which have been subjected to extensive, maintained, and essentially permanent hydromodifications such that the biocriteria for the WWH use are not attainable *and where the activities have been sanctioned by state or federal law;* the representative aquatic assemblages are generally composed of species which are tolerant to low dissolved oxygen, silt, nutrient enrichment, and poor quality habitat.

5) *Limited Resource Water (LRW)* - this use applies to small streams (usually <3 mi^2 drainage area) and other water courses which have been irretrievably altered to the extent that no appreciable assemblage of aquatic life can be supported; such waterways generally include small streams in extensively urbanized areas, those which lie in watersheds with extensive drainage modifications, those which completely lack water on a recurring annual basis (*i.e.,* true ephemeral streams), or other irretrievably altered waterways.

Chemical, physical, and/or biological criteria are generally assigned to each use designation in accordance with the broad goals defined by each. As such the system of use designations employed in the Ohio WQS constitutes a "tiered" approach in that varying and graduated levels of protection are provided by each. This hierarchy is especially apparent for parameters such as dissolved oxygen, ammonia-nitrogen, temperature, and the biological criteria. For other parameters such as heavy metals, the technology to construct an equally graduated set of criteria has been lacking, thus the same water quality criteria may apply to two or three different use designations.

Ohio Water Quality Standards: Non-Aquatic Life Uses

In addition to assessing the appropriateness and status of aquatic life uses, each biological and water quality survey also addresses non-aquatic life uses such as recreation, water supply, and human health concerns as appropriate. The recreation uses most applicable to rivers and streams are the Primary Contact Recreation (PCR) and Secondary Contact Recreation (SCR) uses. The criterion for designating the PCR use can be having a water depth of at least one meter over an area of at least 100 square feet or, lacking this, where frequent human contact is a reasonable expectation. If a water body does not meet either criterion, the SCR use applies. The attainment status of PCR and SCR is determined using bacterial indicators (*e.g.,* fecal coliform, *E. coli)* and the criteria for each are specified in the Ohio WQS.

Attainment of recreation uses are evaluated based on monitored bacteria levels. The Ohio Water Quality Standards state that all waters should be free from any public health nuisance associated with raw or poorly treated sewage (Administrative Code 3745-1-04, Part F). Additional criteria (Administrative Code 3745-1-07) apply to waters that are designated as suitable for full body contact such as swimming (PCR- primary contact recreation) or for partial body contact such as wading (SCR- secondary contact recreation). These standards were developed to protect human health, because even though fecal coliform bacteria are relatively harmless in most cases, their presence indicates that the water has been contaminated with fecal matter.

Water supply uses include Public Water Supply (PWS), Agricultural Water Supply (AWS), and Industrial Water Supply (IWS). Public Water Supplies are simply defined as segments within 500 yards of a potable water supply or food processing industry intake. The AWS and IWS use designations generally apply to all waters unless it can be clearly shown that they are not applicable. An example of this would be an urban area where livestock watering or pasturing does not take place, thus the AWS use would not apply. Chemical criteria are specified in the Ohio WQS for each use and attainment status is based primarily on chemical-specific indicators. Human health concerns are additionally addressed with fish tissue data, but any consumption advisories are issued by the Ohio Department of Health.

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Report preparation and analysis: David Altfater, Mike Gray
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INTRODUCTION

The Ottawa River study area included the mainstem from the first railroad trestle upstream from the Dura Avenue Landfill (RM 6.0) to Stickney Avenue (RM 5.0), and Sibley Creek from Lagrange Street (RM 0.8) to the mouth. A previous biological, sediment, and fish tissue study occurred within the study area in 2002. The study was designed to assess water resource conditions in the Ottawa River and Sibley Creek following completion of earlier remediation work at the Dura Avenue Landfill.

Specific objectives of the evaluation were to:

- determine the attainment status of the Warmwater Habitat aquatic life use designation for the Ottawa River and the Limited Resource Water use for Sibley Creek within the study area,
- evaluate sediment chemical quality at co-located biological stations in the Ottawa River and Sibley Creek in the vicinity of the Dura Landfill property, and
- assess fish tissue contaminant levels for fillet and whole body samples from the Ottawa River.

The Ottawa River watershed is in the Huron-Erie Lake Plain (HELP) ecoregion. The aquatic life use in the Ottawa River currently is Warmwater Habitat (WWH) and the use designation for Sibley Creek is Limited Resource Water (LRW) based on data collected in 1993 and 1996. The Ottawa River in the lower nine miles exhibits lacustuary conditions. A lacustuary is defined as a transition zone in a river that flows into a large freshwater lake and is continuously affected by the water levels in the lake. At lacustuary sampling locations, the fish and macroinvertebrate communities were assessed using interim lacustuary biocriteria developed by the Ohio EPA.

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

Table 1. Aquatic life use attainment status for stations sampled in the Ottawa River and Sibley Creek, 2007. The Index of Biotic Integrity (IBI) and Lacustuary version (LIBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) and Lacustuary version (LICI) 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. Attainment goals, shown in the table below, are based on applicable fish and macroinvertebrate target criteria for the Limited Resource Waters (Sibley Creek) use designation or Interim Criterion for Lake Erie Lacustuaries (Ottawa River).

River Mile Sample Site	Attainment Status[a]	*LIBI*/IBI	MIwb	*LICI*/ICI	QHEI	Comments
Ottawa River *(Lacustuary)*						
5.8	NON	*32**	6.1*	*18**	43.5	Upstream Dura Landfill
5.5	NON	*25**	6.0*	*22**	41.5	Adjacent Dura IRM Wall
5.3	NON	*32**	6.9	*18**	45.0	Adjacent lower Dura Landfill
5.0	NON	*27**	6.6*	*16**	38.0	Downstream Dura Landfill
Sibley Creek *(Riverine)*						
0.8	NON	12*	NA	VP*	42.0	Upstream Dura Landfill – Lagrange Ave.
0.2	NON	24	NA	VP*	41.0	Adjacent Dura Landfill
0.1	NON	32	NA	VP*	41.0	Adjacent Dura Landfill

Interim Lacustuary Biocriteria – Ottawa River	
INDEX	**Target Criteria**
LIBI	42
MIwb	8.6
LICI	42

Limited Resource Water Benchmarks – Sibley Creek	
INDEX	**Target Criteria**
IBI	18
ICI	8

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

Table 2. Sampling locations in the Ottawa River and Sibley Creek , Dura Ave. Landfill area, 2007. Type of sampling included fish community (F), macroinvertebrate community (M), sediment (S), and fish tissue (T).

Stream/ River Mile	Type of Sampling	Latitude	Longitude	Landmark
Ottawa River				
5.8	F,M,S,T	41° 41' 38.6"	83° 32' 6.1"	Near RR bridge – upstream Dura Ave. Landfill
5.5	F,M,S,T	41° 41' 47.6"	83° 31' 53.2"	Adjacent IRM barrier wall – Dura Ave. Landfill
5.3	F,M,S,T	41° 41' 55.3"	83° 31' 47.2"	Adj. lower Dura Landfill – upstream landfill overflow channel
5.0	F,M,S,T	41° 42' 11.1"	83° 31' 41.7"	Downstream Dura Ave. Landfill – Stickney Ave.
Sibley Creek				
0.8	F,M,S	41° 41' 44.2"	83° 32' 50.3"	Lagrange Road
0.2	F,M	41° 41' 47.4"	83° 32' 12.1"	Adjacent Dura Ave. Landfill
0.1	F,M,S	41° 41' 44.7"	83° 32' 2.9"	Near mouth – adjacent Dura Ave. Landfill

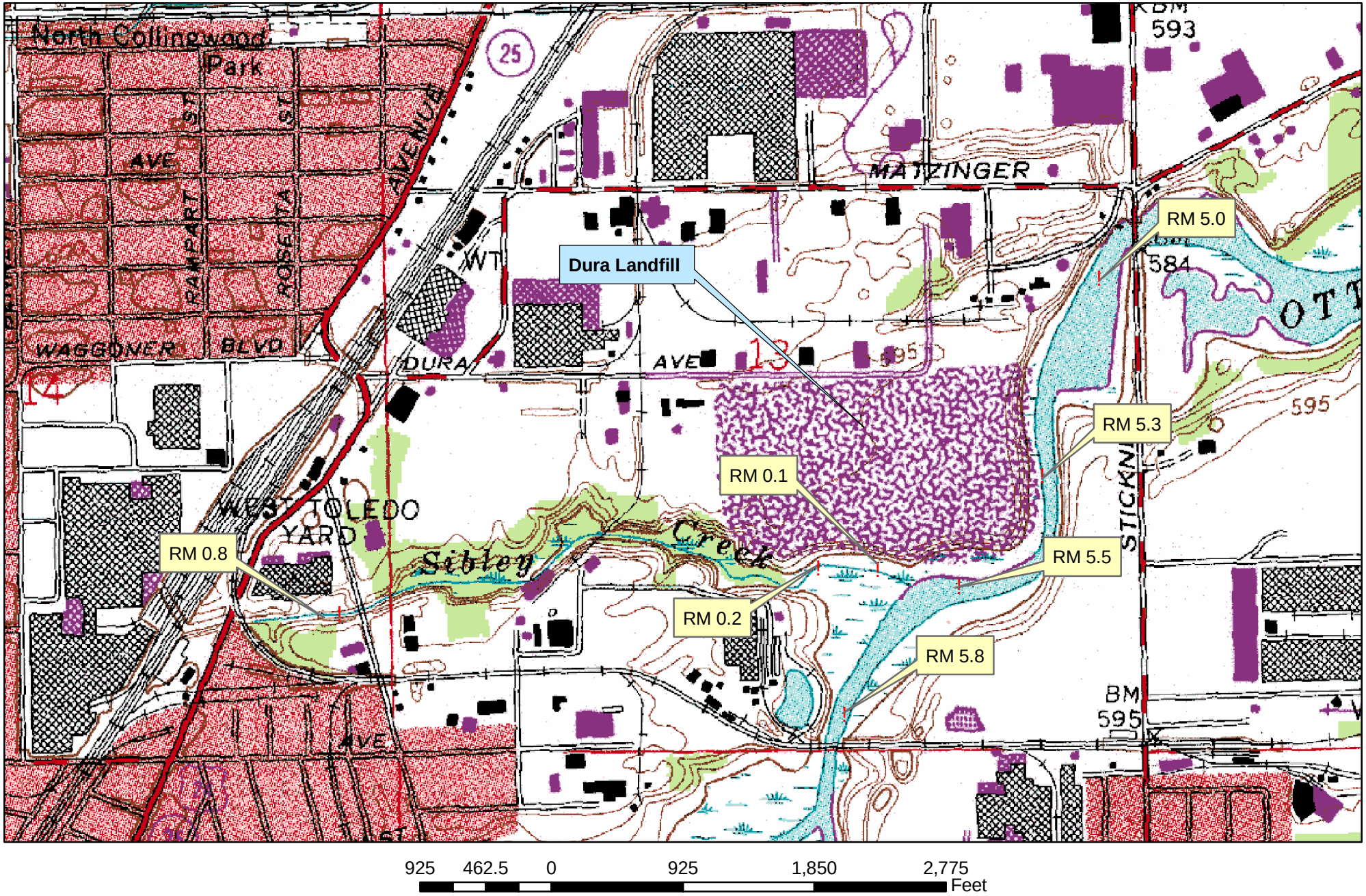

Figure 2. Sampling locations in the Ottawa River and Sibley Creek, 2007.

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 2006d), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio Environmental Protection Agency 1987b, 1989a, 1989b, 2006a, 2006b), Biological Criteria for the Protection of Aquatic Life, Volumes IV: Fish and Macroinvertebrate Indicies for Ohio's Lake Erie Nearshore Waters, Harbors, and Lacustuaries (Ohio EPA 1997, Draft), 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 2006c), and Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2001), and Ohio EPA Fish Tissue Collection Manual (Ohio EPA 2005).

Use Attainment

Attainment/non-attainment of aquatic life uses for the Ottawa River and Sibley Creek were determined respectively, by using interim lacustuary biological criteria and limited resource water biocriteria benchmarks. 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.

Performance expectations for the basic aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH] were developed using the regional reference site approach (Hughes et al. 1986; Omernik 1987). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of an aquatic life use is FULL if all three indices (or those available) meet the applicable criteria, PARTIAL if at least one of the indices did not attain and performance did not fall below the fair category, and NON if all indices either fail to attain or any index indicates poor or very poor performance. Biological results for the Ottawa River were compared to interim lacustuary biocriteria. Lacustuary biocriteria were developed to assess those segments of rivers and streams located in the boundary area between Lake Erie and free-flowing rivers. Biological results for Sibley Creek were compared to Limited Resource Water benchmark biocriteria, which are used to prevent acutely toxic conditions.

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 2006c). 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 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

Sediment Assessment

Fine grain sediment samples were collected multi-incrementally in the upper four inches of bottom material at each location using decontaminated stainless steel scoops. At each location, between 16 and 30 scoops of fine grained material were collected from a 300 - 400 meter section of the Ottawa River or a 100 meter section of Sibley Creek. Sediment incremental samples were homogenized in stainless steel pans, transferred into glass jars with teflon lined lids, placed on ice (to maintain 4^{o}C) in a cooler, and shipped to a 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). Sediment evaluations were conducted using guidelines established in MacDonald *et al.* (2000), along with a comparison of results to Ohio Sediment Reference Values (Ohio EPA 2003a).

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and from the natural habitats at all Ottawa 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 multihabitat 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, and margin). Qualitative only sampling was performed at each Sibley Creek sampling site. 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 1989a, 2006b).

Fish Community Assessment

Fish were sampled twice at each Ottawa River site using pulsed DC boat electrofishing methods and once at each Sibley Creek site using pulsed DC wading electrofishing. Fish were processed in the field, and included identifying each individual to species, counting, weighing (Ottawa River only), 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 1989a).

Fish Tissue

Fish tissue samples were collected from each of the four biological sampling locations on the Ottawa River. Both whole body (pumpkinseed sunfish) and fillet (common carp) samples were processed at each site. Fish samples were filleted in the field using decontaminated stainless steel fillet knives. Whole body and fillet samples were wrapped in aluminum foil, put in a sealed plastic bag, and placed on dry ice. Sampling and decontamination protocols followed those listed in the Ohio EPA Fish Tissue Collection Manual (2005); however, it is not necessary to clean aluminum foil which was used directly from the roll. Fish tissue samples were shipped to a contract laboratory.

Field Instrument Calibration

Laser rangefinders, used to measure sampling distance, were calibrated once at the Groveport Field Facility prior to summer field sampling activities. Fish weighing scales were checked against certified weights once per month during the field season.

Causal Associations

Using the results, conclusions, and recommendations of this report requires an understanding of the methodology used to determine the use attainment status and assigning probable causes and sources of impairment. The identification of impairment in rivers and streams is straightforward - the numerical biological criteria are used to judge aquatic life use attainment and impairment (partial and non-attainment). The rationale for using the biological criteria, within a weight of evidence framework, has been extensively discussed elsewhere (Karr *et al.* 1986; Karr 1991; Ohio EPA 1987a,b; Yoder 1989; Miner and Borton 1991; Yoder 1991; Yoder 1995). Describing the causes and sources associated with observed impairments relies on an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, land use data, and biological results (Yoder and Rankin 1995). Thus the assignment of principal causes and sources of impairment in this report represent the association of impairments (based on response indicators) with stressor and exposure indicators. The reliability of the identification of probable causes and sources is increased where many such prior associations have been identified, or have been experimentally or statistically linked together. The ultimate measure of success in water resource management is the restoration of lost or damaged ecosystem attributes including aquatic community structure and function. While there have been criticisms of misapplying the metaphor of ecosystem “health” compared to human patient “health” (Suter 1993), in this document we are referring to the process for evaluating biological integrity and causes or sources associated with observed impairments, not whether human health and ecosystem health are analogous concepts.

RESULTS

Sediment Quality

Sediment samples were collected at four locations in the Ottawa River and two locations in Sibley Creek by the Ohio EPA on September 18, 2007. Sampling locations were co-located at biological sampling sites. Samples were analyzed for arsenic, lead, PCBs, semivolatile organic compounds, and organochlorinated pesticides. Specific chemical parameters tested and results are listed in Appendix Table 1. Sediment data were evaluated using guidelines established in *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems* (MacDonald *et.al*. 2000), and *Ohio Specific Sediment Reference Values (SRVs)* for metals (Ohio EPA 2003a). 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.

All four sampling locations in the Ottawa River and both Sibley Creek stations exhibited some degree of sediment chemical contamination. All sediment samples collected from the Ottawa River and Sibley Creek exceeded the PEC for total PCBs. Total PCB levels were relatively consistent among Ottawa River sites. The highest level of total PCBs occurred in Sibley Creek adjacent to the Dura Ave. Landfill. Both individual PAH compounds and total PAH levels were reported at elevated levels at all Ottawa River locations and in Sibley Creek at Lagrange Road (RM 0.8). The sediments of Sibley Creek at RM 0.8 are heavily saturated with a black material with a creosote/ coal tar odor. Disturbance of the sediments released an oily substance that created an extensive oil sheen on the surface of the water. The metabolites of DDT - DDD and DDE - were documented at elevated levels in Ottawa River and Sibley Creek. These were measured above PEC guidelines. Lead levels were above PEC guidelines at two of the four Ottawa River sites, and in Sibley Creek upstream from Dura Landfill. Overall sediment conditions in the Ottawa River and Sibley Creek suggest contamination levels likely to cause harmful effects to river biology. These impaired conditions were not directly associated with proximity to the Dura Ave. Landfill.

Table 3. Chemical parameters measured above screening levels in sediment samples collected by Ohio EPA from the Ottawa River and Sibley Creek, September, 2007. Contamination levels were determined for parameters using consensus-based sediment quality guidelines (MacDonald et.al. 2000). Sediment reference values are listed in the Ohio EPA Ecological Risk Assessment Guidance (2003). Shaded numbers indicate values above the following: Threshold Effect Concentration -TEC (yellow), Probable Effect Concentration – PEC (red) and Sediment Reference Value (orange). Sampling locations are indicated by river mile (RM).

	Ottawa River				Sibley Creek	
Parameter	**RM 5.8**	**RM 5.5**	**RM 5.3**	**RM 5.0**	**RM 0.8**	**RM 0.1**
Total PCBs (ug/kg)	1500	2300	1920	2500	1040	5100
Total PAHs (ug/kg)	31,500	40,180	35,600	22,600	107,500	1890
Anthracene (ug/kg)	<1300	1600	<1200	<640	3500	<620
Benz(a)anthracene (ug/kg)	2200	3100	2600	1700	7900	<620
Benzo(a)pyrene (ug/kg)	2600	2800	3000	2000	7700	<620
Chrysene (ug/kg)	3300	3400	3600	2400	10,000	<620
Dibenz(a,h)anthracene (ug/kg)	<1300	840	<1200	<640	2800	<620
Fluoranthene (ug/kg)	5300	6000	6100	3700	15,000	790
Fluorene (ug/kg)	<1300	830	<1200	<640	1700	<620
Naphthalene (ug/kg)	<1300	680	<1200	<640	<1300	<620
Phenanthrene (ug/kg)	2200	5300	3100	1600	13,000	<620
Pyrene (ug/kg)	4900	5900	5800	3700	17,000	1100
4,4'-DDD (ug/kg)	63	36	45	39	290	33
4,4'-DDE (ug/kg)	33	18	40	32	62	29
4,4'-DDT (ug/kg)	<17	17	10	13	<50	22
Endrin (ug/kg)	<17	<8.3	<7.9	<8.2	<50	12
Heptachlor epoxide (ug/kg)	<17	12	11	15	<50	9.8
Lead (mg/kg)	94.5	132	112	150	187	58.7

< - Not detected at or above the method detection limit (MDL value reported with the less than symbol).

Physical Habitat

Physical habitat was evaluated in the Ottawa River and Sibley Creek at each biological sampling location using the Qualitative Habitat Evaluation Index (QHEI); scores are detailed in Table 4.

Stream morphology in the Ottawa River within the study area consists of lacustuary flow conditions influenced by Maumee Bay. Bottom substrates are predominated by muck and silt, with lesser amounts of sand, boulders, detritus, and artificial riprap. No riffles or runs occur within the Ottawa River study area. Qualitative Habitat Evaluation Index (QHEI) scores for the Ottawa River within the study area range between 38.0 and 45.0. These scores were indicative of poor stream and riparian habitat. Habitat scores were comparable between sites sampled in 2002 and 2007.

Sibley Creek was evaluated near the mouth (RM 0.1), adjacent to the Dura Ave. Landfill further upstream at RM 0.2, and at RM 0.8. Sibley Creek is a small stream, with shallow pools and very shallow riffles (less than 5 cm in depth). Bottom substrates are predominated by muck and sand, with smaller amounts of gravel and artificial riprap. The stream bottom is extensively embedded with fine-grained material, resulting in reduced cover for aquatic organisms. The stream channel is recovering from past modifications at all three locations. QHEI scores ranged between 41.0 and 42.0, reflective of poor quality habitat for fish and macroinvertebrate communities.

Below the surface layer of silt and muck, the bottom sediments of Sibley Creek at RM 0.8 are heavily saturated with a black material with a creosote/ coal tar odor. Disturbance of the bottom sediments released an oily substance that created an extensive oil sheen on the surface of the water. These conditions were observed further downstream at RMs 0.2 and 0.1, although to a lesser extent.

Table 4. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites on the Ottawa River and Sibley Creek, 2007.

			WWH Attributes											**MWH 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**	**(MWH H.I.+1)/ (WWH+1) Ratio**	**(MWH M.I.+1)/ (WWH+1) Ratio**
River Mile	QHEI	Gradient (ft/mile)																																				
Ottawa River Year: 2007																																						
5.8	**43.5**	0.10	■					■			■		3		◆		◆		2		●			●	●					●	●		●	6	0.75	2.25
5.5	**41.5**	0.10	■					■			■		3		◆		◆		2		●			●	●					●	●		●	6	0.75	2.25
5.3	**45.0**	0.10	■					■			■		3		◆				1		●			●	●					●	●		●	6	0.50	2.00
5.0	**38.0**	0.10	■					■			■		3		◆		◆		2		●			●	●					●	●		●	6	0.75	2.25
Sibley Creek Year: 2007																																						
0.8	**42.0**	16.67											0			◆	◆	◆	3	●	●			●					●	●	●		6	4.00	10.0
0.2	**41.0**	5.36									■		1		◆	◆	◆		3	●	●			●					●	●	●		6	2.00	5.00
0.1	**41.0**	5.36									■		1		◆	◆	◆		3	●	●			●					●	●	●		6	2.00	5.00

Fish Community

Within the Dura Ave. Landfill project area, a total of 1,814 fish representing 25 species were collected from the Ottawa River between August and September, 2007. Relative numbers and species collected per location are presented in Appendix Table 2 and IBI metrics are presented in Appendix Table 3.

Fish communities were sampled in the Ottawa River at four locations; one upstream from Dura Ave. Landfill, one adjacent to the remedial barrier wall, one adjacent to the Dura Ave. Landfill downstream from the remedial barrier wall, and one downstream from Dura Ave. Landfill. The fish communities from all four sampling locations exhibited biological degradation. The lacustuary IBI (LIBI: 25-32) and MIwb (6.0-6.9) scores were in the poor to fair range. All four sites did not meet the applicable biocriteria. Collectively, however, fish communities within the Ottawa River study area showed an improvement between 2002 and 2007.

The physical condition of fish was monitored at each sampling site by recording the incidence of DELT (deformities, fin erosions, lesions/ulcers, and tumors) anomalies. Biosurvey results collected by Ohio EPA show a high frequency of DELT anomalies to be an accurate indication of pollution stress usually caused by multiple sublethal stresses as the result of degraded water quality (*i.e*. often a combination of toxic impacts combined with marginal D.O. concentrations). Within Ohio, there are ample correlations between sites with chemically contaminated sediments (*e.g.* metals, PAHs), very high percent occurrence of DELT anomalies (>10-20%), and very low Index of Biotic Integrity and Modified Index of Well-Being scores (Yoder 1991). Elevated levels of DELT anomalies were recorded during 2007, with results ranging between 2.3% and 10.0%. These levels were comparable to results from 2002 (5.3% to 7.5%).

Fish communities were sampled at three locations in Sibley Creek, two adjacent to the Dura Ave. Landfill at RMs 0.1 and 0.2, and one upstream at Lagrange Street (RM 0.8). Acutely toxic conditions existed in Sibley Creek at RM 0.8, where fish were absent. Fish were absent from the Lagrange Street site during sampling conducted in 1993 and 1996 (Ohio EPA 1996), and nearly absent during 2002 (Ohio EPA 2003b). Improvement in the fish community occurred at RM 0.2 and RM 0.1, with both locations achieving the Limited Resource Waters biocriteria benchmark for fish.

Table 5. Fish community summaries based on pulsed D.C. electrofishing sampling conducted by Ohio EPA in the Ottawa River and Sibley Creek from August - September, 2007. Relative numbers and weight are per 1.0 km for Ottawa River sites and 0.3 km for Sibley Creek.

Stream River Mile	Sampling Method	Species (Mean)	Species (Total)	Relative Number	Relative Wt. (kg)	QHEI	MIwb	LIBI/IBI	Narrative Evaluation
Ottawa River									
5.8	Boat	15.5	18	451	40.0	43.5	6.1*	32*	Fair
5.5	Boat	13.0	16	331	93.0	41.5	6.0*	25*	Poor
5.3	Boat	15.0	19	512	39.2	45.0	6.9*	32*	Fair
5.0	Boat	15.5	20	637	137.0	38.0	6.6*	27*	Poor
Sibley Creek									
0.8	Wading	NA	0	0	NA	42.0	NA	12*	Very Poor
0.2	Wading	NA	6	150	NA	41.0	NA	24	Poor
0.1	Wading	NA	6	42	NA	41.0	NA	32	Fair

Interim Lacustuary Biocriteria – Ottawa River	
INDEX	**Target Criteria**
LIBI	42
MIwb	8.6

Limited Resource Water Benchmarks – Sibley Creek	
INDEX	**Target Criteria**
IBI	18

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

Macroinvertebrate Community

The macroinvertebrate communities at four Ottawa River sites were sampled in 2007 using qualitative (multi-habitat composite) and quantitative (artificial substrate) sampling protocols. Qualitative sampling protocols only were used at the Sibley Creek sites. Results are summarized in Table 6. The LICI metrics and the raw data are attached as Appendix Tables 4 and 5.

The macroinvertebrate communities from all of the Ottawa River sampling locations were evaluated as poor, indicative of non-attainment of the Warmwater Habitat use designation. The macroinvertebrate community LICI scores ranged from 16 to 22 with no apparent correlation associated with proximity of the Dura Ave. Landfill. Normal longitudinal trends in flowing rivers are confounded in lacustuary areas due to longer water retention times, increase rates of sediment deposition, and upstream movement of water caused by seiches. The macroinvertebrate communities from all sampling locations were indicative of degraded river conditions. In the quantitative samples, the percentage of macroinvertebrates that were tolerant of organic enrichment and/or toxic conditions varied from 92% to 96%. The macroinvertebrate community has improved slightly from 2002 results, when LICI scores ranged from 6 to 12 and river mile sites 5.8, 5.5, and 5.3 were evaluated as very poor. In 2002, the composition of the macroinvertebrate community was similar to the 2007 results, with 96% to 99% of the macroinvertebrates tolerant of organic enrichment and/ or toxic conditions. However, the amount of organic enrichment appears to have decreased from 2002 when macroinvertebrate densities from the quantitative samples were approximately a factor of ten higher than in 2007.

The macroinvertebrate communities from the three Sibley Creek sampling locations were all evaluated as very poor. The upstream site at RM 0.8 was the most degraded with only 4 macroinvertebrate taxa collected in limited numbers. All of the taxa in the qualitative sample from this site were tolerant of organic enrichment and toxic conditions. Macroinvertebrates were more numerous at RMs 0.2 and 0.1 sampling locations, but most were pollution tolerant taxa. Potential causes for the observed impacts in Sibley Creek are discussed in the physical habitat section.

Table 6. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in the Ottawa River and Sibley Creek, 2007.

Stream/ River Mile	Density Number/ft^2	Total Taxa	Quantitative Taxa	Qualitative Taxa	Qualitative EPT[a]	LICI	Evaluation
Ottawa River							
5.8	267	30	23	17	0	18	Poor
5.5	52	25	24	5	0	22	Poor
5.3	239	28	27	5	0	18	Poor
5.0	237	36	29	14	0	16	Poor
Sibley Creek							
0.8	-	4	-	4	0	-	Very Poor
0.2	-	11	-	11	0	-	Very Poor
0.1	-	6	-	6	0	-	Very Poor

Interim Lacustuary Biocriteria – Ottawa River	
INDEX	**Target Criteria**
LICI	42

Limited Resource Water Benchmark – Sibley Creek	
INDEX	**Target Criteria**
ICI	8

[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.

Fish Tissue

Fish tissue samples were collected from four locations on the Ottawa River during September, 2007. Eight samples were analyzed for PCBs, organochlorinated pesticides, and percent lipids. Summarized results are presented in Table 7; complete analytical results are detailed in Appendix Table 6.

The concentration of total PCB Aroclors in common carp fillet samples from the Ottawa River ranged between 3.20 mg/kg and 5.50 mg/kg. Ohio EPA has established various levels of concern and recommended consumption levels for fish contaminants in the Ohio Fish Consumption Advisory Program. Total PCBs have a '*do not eat*' level at or above 2.0 mg/kg. All common carp fillet samples were above the '*do not eat*' level. No obvious longitudinal trends were noted in PCB concentrations of fillet samples. Although numerous pesticides were detected at measurable levels in common carp fillets, all values were below unrestricted consumption levels.

Whole body PCB and pesticide concentrations were measured in pumpkinseed sunfish (composite samples) from all four Ottawa River biological monitoring stations. Total PCBs ranged between 1.86 and 2.28 mg/kg at the four locations, with no obvious longitudinal trends.

The ability of an organism to bioaccumulate lipophilic organic chemicals is assumed to be proportional to its lipid content (Ohio EPA 1994). Since PCBs are lipophilic and lipid content varies between fish species and between individuals, lipid normalization helps to characterize relative site contamination by PCBs. The PCB data in Table 7 are normalized to 1% lipid content. Normalized PCB values were comparable between sampling locations and also between fish species. A longitudinal trend in PCB levels was not apparent.

Table 7. Summary of tissue contaminants detected in fillet and whole body fish collected from the Ottawa River, 2007

	Common Carp (fillet)				**Pumpkinseed Sunfish** (whole body)			
Parameter	RM 5.8	RM 5.5	RM 5.3	RM 5.0	RM 5.8	RM 5.5	RM 5.3	RM 5.0
PCBs (mg/kg)								
PCB-1242	<1.30	<3.60	<1.60	<2.60	<1.20	**1.60**	**1.60**	<1.30
PCB-1248	**2.50**	**3.90**	**2.10**	**3.00**	**1.20**	<1.20	<1.20	**1.50**
PCB-1254	**1.20**	**1.60**	**1.10**	**1.30**	**0.66**	**0.68**	**0.58**	**0.69**
PCB-1260	**0.52**	<1.00	<0.50	<1.00	<0.50	<0.50	<0.50	<0.50
Total PCBs (calculated)	**4.22**	**5.50**	**3.20**	**4.30**	**1.86**	**2.28**	**2.18**	**2.19**
1% Lipid Normalized PCBs	**1.05**	**0.71**	**1.14**	**1.48**	**0.98**	**1.14**	**1.09**	**1.15**
Pesticides (ug/kg)								
delta-BHC	**61**	<25	<15	<25	<5.0	<5.0	<5.0	<5.0
4,4'-DDD	**93**	**110**	**64**	**92**	**38**	**54**	**42**	**43**
4,4'-DDE	**140**	**150**	**100**	**130**	**82**	**66**	**57**	**67**
4,4'-DDT	**48**	**55**	**42**	**48**	**10**	**28**	**20**	**7.9**
Dieldrin	<25	<25	<15	<25	**13**	**21**	**20**	**15**
Endrin	<25	<25	<15	<25	<5.0	<5.0	<5.0	**5.4**
Endrin aldehyde	<25	<25	<15	<25	**5**	<5.0	<5.0	<5.0
Heptachlor	<25	<25	<15	<25	**5.2**	**6.8**	**5.6**	**5.9**
Heptachlor epoxide	<25	<25	<15	<25	**7.7**	**7.6**	**6.2**	**6.5**
Percent Lipids	**4.0**	**7.7**	**2.8**	**2.9**	**1.9**	**2.0**	**2.0**	**1.9**

NOTICE TO USERS

Ohio EPA incorporated biological criteria into the Ohio Water Quality Standards (WQS; Ohio Administrative Code 3745-1) regulations in February 1990 (effective May 1990). These criteria consist of numeric values for the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), both of which are based on fish assemblage data, and the Invertebrate Community Index (ICI), which is based on macroinvertebrate assemblage data. Criteria for each index are specified for each of Ohio's five ecoregions (as described by Omernik 1987), and are further organized by organism group, index, site type, and aquatic life use designation. These criteria, along with the existing chemical and whole effluent toxicity evaluation methods and criteria, figure prominently in the monitoring and assessment of Ohio's surface water resources.

The following documents support the use of biological criteria by outlining the rationale for using biological information, the methods by which the biocriteria were derived and calculated, the field methods by which sampling must be conducted, and the process for evaluating results:

Ohio Environmental Protection Agency. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Monit. & Assess., Surface Water Section, Columbus, Ohio.

Ohio Environmental Protection Agency. 1989b. Addendum to Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 1989c. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. Water Quality Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

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Ohio Environmental Protection Agency. 2006c. Methods for assessing habitat in flowing waters: Using the Qualitative Habitat Evaluation Index (QHEI). Ohio EPA Tech. Bull. EAS/2006-06-1. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

In addition to the preceding guidance documents, the following publications by the Ohio EPA should also be consulted as they present supplemental information and analyses used by the Ohio EPA to implement the biological criteria.

DeShon, J.D. 1995. Development and application of the invertebrate community index (ICI), pp. 217-243. in W.S. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Risk-based Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

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Yoder, C.O. and E.T. Rankin. 1995. Biological criteria program development and implementation in Ohio, pp. 109-144. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. Biological response signatures and the area of degradation value: new tools for interpreting multimetric data, pp. 263-286. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. 1995. Policy issues and management applications for biological criteria, pp. 327-344. in W. Davis and T. Simon (eds.). Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Publishers, Boca Raton, FL.

Yoder, C.O. and E.T. Rankin. 1995. The role of biological criteria in water quality monitoring, assessment, and regulation. Environmental Regulation in Ohio: How to Cope With the Regulatory Jungle. Inst. of Business Law, Santa Monica, CA. 54 pp.

Yoder, C.O. and M.A. Smith. 1999. Using fish assemblages in a State biological assessment and criteria program: essential concepts and considerations, pp. 17-63. in T. Simon (ed.). Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities. CRC Press, Boca Raton, FL.

These documents and this report may be obtained by writing to:

Ohio EPA, Division of Surface Water
Ecological Assessment Section
4675 Homer Ohio Lane
Groveport, Ohio 43125
(614) 836-8786

or

www.epa.state.oh.us/dsw/formspubs.html

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Appendix Table 1. Sediment sampling results for semivolatile organic compounds, pesticides, and PCBs from the Ottawa River and Sibley Creek, September, 2007.

Stream	**Ottawa River**	**Ottawa River**	**Ottawa River**	**Ottawa River**	**Sibley Creek**	**Sibley Creek**
River Mile	**5.8**	**5.5**	**5.3**	**5.0**	**0.8**	**0.1**
Date Sampled	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006
Time Sampled	2:30 PM	12:55 PM	11:45 AM	10:45 AM	3:30 PM	4:30 PM
Semivolatile Organic Compounds (ug/kg)						
Acenaphthene	<1300	<640	<1200	<640	**1300**	<620
Acenaphthylene	<1300	<640	<1200	<640	<1300	<620
Anthracene	<1300	**1600**	<1200	<640	**3500**	<620
Benz[a]anthracene	**2200**	**3100**	**2600**	**1700**	**7900**	<620
Benzo[b]fluoranthene	**3900**	**3100**	**4000**	**2100**	**9200**	<620
Benzo[k]fluoranthene	**2900**	**2200**	**2700**	**2200**	**5800**	<620
Benzo[g,h,i]perylene	**2200**	**1900**	**2400**	**1700**	**6400**	<620
Benzo[a]pyrene	**2600**	**2800**	**3000**	**2000**	**7700**	<620
bis(2-Chloroethoxy)methane	<1300	<640	<1200	<640	<1300	<620
bis(2-Chloroethyl)ether	<1300	<640	<1200	<640	<1300	<620
bis(2-Chloroisopropyl)ether	<1300	<640	<1200	<640	<1300	<620
bis(2-Ethylhexyl)phthalate	**3300**	**2500**	**3900**	**3500**	**2800**	**7800**
4-Bromophenyl-phenyl ether	<1300	<640	<1200	<640	<1300	<620
Butyl benzyl phthalate	<1300	<640	<1200	<640	<1300	<620
4-Chloroaniline	<1300	<640	<1200	<640	<1300	<620
4-Chloro-3-methylphenol	<1300	<640	<1200	<640	<1300	<620
2-Chloronaphthalene	<1300	<640	<1200	<640	<1300	<620
2-Chlorophenol	<1300	<640	<1200	<640	<1300	<620
4-Chlorophenyl-phenylether	<1300	<640	<1200	<640	<1300	<620
Chrysene	**3300**	**3400**	**3600**	**2400**	**10,000**	<620
Dibenz[a,h]anthracene	<1300	**840**	<1200	<640	**2800**	<620
Dibenzofuran	<1300	**730**	<1200	<640	<1300	<620
Di-n-butylphthalate	<1300	<640	<1200	<640	<1300	<620
1,2-Dichlorobenzene	<1300	<640	<1200	<640	<1300	<620
1,3-Dichlorobenzene	<1300	<640	<1200	<640	<1300	<620
1,4-Dichlorobenzene	<1300	<640	<1200	<640	<1300	<620
3,3'-Dichlorobenzidine	<6400	<3100	<5900	<3100	<6300	<3000
2,4-Dichlorophenol	<1300	<640	<1200	<640	<1300	<620
Diethylphthalate	<1300	<640	<1200	<640	<1300	<620
2,4-Dimethylphenol	<1300	<640	<1200	<640	<1300	<620
Dimethyl phthalate	<1300	<640	<1200	<640	<1300	<620
4,6-Dinitro-2-methylphenol	<6400	<3100	<5900	<3100	<6300	<3000
2,4-Dinitrophenol	<6400	<3100	<5900	<3100	<6300	<3000
2,4-Dinitrotoluene	<1300	<640	<1200	<640	<1300	<620
2,6-Dinitrotoluene	<1300	<640	<1200	<640	<1300	<620
Di-n-octyl phthalate	<1300	<640	<1200	**800**	**1300**	**890**
Fluoranthene	**5300**	**6000**	**6100**	**3700**	**15,000**	**790**
Fluorene	<1300	**830**	<1200	<640	**1700**	<620
Hexachlorobenzene	<1300	<640	<1200	<640	<1300	<620
Hexachlorobutadiene	<1300	<640	<1200	<640	<1300	<620
Hexachlorocyclopentadiene	<6400	<3100	<5900	<3100	<6300	<3000
Hexachloroethane	<1300	<640	<1200	<640	<1300	<620

Appendix Table 1. Continued.

Stream	Ottawa River	Ottawa River	Ottawa River	Ottawa River	Sibley Creek	Sibley Creek
River Mile	5.8	5.5	5.3	5.0	0.8	0.1
Date Sampled	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006
Time Sampled	2:30 PM	12:55 PM	11:45 AM	10:45 AM	3:30 PM	4:30 PM
Semivolatile Organic Compounds (ug/kg)						
Indeno[1,2,3-cd]pyrene	**2000**	**1800**	**2300**	**1500**	**6200**	<620
Isophorone	<1300	<640	<1200	<640	<1300	<620
2-Methylnaphthalene	<1300	1600	<1200	<640	<1300	<620
2-Methylphenol	<1300	<640	<1200	<640	<1300	<620
4-Methylphenol	<1300	<640	<1200	<640	<1300	<620
Naphthalene	<1300	**680**	<1200	<640	<1300	<620
2-Nitroaniline	<6400	<3100	<5900	<3100	<6300	<3000
3-Nitroaniline	<6400	<3100	<5900	<3100	<6300	<3000
4-Nitroaniline	<6400	<3100	<5900	<3100	<6300	<3000
Nitrobenzene	<1300	<640	<1200	<640	<1300	<620
2-Nitrophenol	<1300	<640	<1200	<640	<1300	<620
4-Nitrophenol	<6400	<3100	<5900	<3100	<6300	<3000
N-Nitrosodiphenylamine	<1300	<640	<1200	<640	<1300	<620
N-Nitroso-di-n-propylamine	<1300	<640	<1200	<640	<1300	<620
Pentachlorophenol	<6400	<3100	<5900	<3100	<6300	<3000
Phenanthrene	**2200**	**5300**	**3100**	**1600**	**13,000**	<620
Phenol	<1300	<640	<1200	<640	<1300	<620
Pyrene	**4900**	**5900**	**5800**	**3700**	**17,000**	**1100**
1,2,4-Trichlorobenzene	<1300	<640	<1200	<640	<1300	<620
2,4,5-Trichlorophenol	<1300	<640	<1200	<640	<1300	<620
2,4,6-Trichlorophenol	<1300	<640	<1200	<640	<1300	<620
Pesticides (ug/kg)						
Aldrin	<17	<8.3	<7.9	<8.2	<50	<7.9
alpha-BHC	<17	<8.3	<7.9	<8.2	<50	<7.9
beta-BHC	**17 COL**	<8.3	**14 COL**	<8.2	**76 COL**	<7.9
delta-BHC	<17	<8.3	<7.9	**94**	<50	**92**
gamma-BHC (Lindane)	<17	<8.3	<7.9	<8.2	<50	<7.9
Chlordane (Technical)	<170	<130 G	<130 G	<120 G	<500	<310 G
4,4'-DDD	**63 COL**	**36 COL**	**45 COL**	**39 COL**	**290**	**33**
4,4'-DDE	**33**	**18 COL**	**40**	**32**	**62**	**29 COL**
4,4'-DDT	<17	**17**	**10 COL**	**13**	<50	**22 COL**
Dieldrin	<17	<8.3	<7.9	<8.2	<50	<7.9
Endrin	<17	<8.3	<7.9	<8.2	<50	**12 COL**
Endrin aldehyde	<17	<8.3	<7.9	<8.2	<50	<7.9
Endosulfan I	<17	<8.3	<7.9	<8.2	<50	<7.9
Endosulfan II	<17	<8.3	<7.9	<8.2	<50	<7.9
Endosulfan sulfate	<17	<8.3	<7.9	<8.2	<50	<7.9
Heptachlor	<17	**11 COL**	<7.9	**13 COL**	<50	**19**
Heptachlor epoxide	<17	**12 COL**	**11 COL**	**15 COL**	<50	**9.8 COL**
Methoxychlor	<33	<16	<15	<16	<98	<15
Toxaphene	<670	<330	<310	<330	<2000	<570 G

Appendix Table 1. Continued.

Stream	**Ottawa River**	**Ottawa River**	**Ottawa River**	**Ottawa River**	**Sibley Creek**	**Sibley Creek**
River Mile	**5.8**	**5.5**	**5.3**	**5.0**	**0.8**	**0.1**
Date Sampled	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006	9/18/2006
Time Sampled	2:30 PM	12:55 PM	11:45 AM	10:45 AM	3:30 PM	4:30 PM
PCBs (ug/kg)						
Aroclor 1016	<1200 G	<1700 G	<1200 G	<1900 G	<250 G	<1600 G
Aroclor 1221	<780 G	<1500 G	<850 G	<1400 G	<160	<840 G
Aroclor 1232	<1600 G	<2400 G	<1600 G	<2500 G	<250 G	<2300 G
Aroclor 1242	**1500**	**2300**	**1600**	**2500**	<160	**1900**
Aroclor 1248	<900 G	<980 G	<800 G	<1200 G	**370 AP**	**1900**
Aroclor 1254	<330	<640	**320**	<640	**440**	**1300**
Aroclor 1260	<330	<640	<310	<640	**230**	<620
Metals (mg/kg)						
Arsenic	**5.9**	**5**	**5.7**	**4.8**	**9.5**	**7.4**
Lead	**94.5**	**132**	**112**	**150**	**187**	**58.7**
Other						
Percent Moisture	45	38	46	38	39	31

< - Not detected at or above the reporting limit (RL value reported with the less than symbol).

G - Elevated reporting limit due to matrix interference.

COL - More than 40% Relative Percent Difference (RPD) between primary and confirmation column results. The lower of the two results is reported.

AP - Altered pattern.

Appendix Table 2. Ohio EPA fish results from the Ottawa River and Sibley Creek, Dura Landfill area, 2007.

River Code: **04-300**	Stream: **Ottawa River**	Sample Date: **2007**
River Mile: **5.80**	Location: upst. Dura Landfill	Date Range: 08/10/2007
Time Fished: 3888 sec	Drainage: 160.0 sq mi	Thru: 09/19/2007
Dist Fished: 1.00 km	Basin: Ottawa 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		2	2.00	0.44	0.20	0.51	101.50
White Sucker	W	O	S	T	3	3.00	0.67	0.04	0.09	11.67
Common Carp	G	O	M	T	21	21.00	4.66	33.23	83.04	1,582.14
Goldfish	G	O	M	T	6	6.00	1.33	1.11	2.77	184.83
Golden Shiner	N	I	M	T	18	18.00	3.99	0.18	0.45	10.06
Creek Chub	N	G	N	T	3	3.00	0.67	0.02	0.04	5.00
Emerald Shiner	N	I	M		72	72.00	15.96	0.19	0.47	2.61
Spottail Shiner	N	I	M	P	15	15.00	3.33	0.04	0.09	2.33
Fathead Minnow	N	O	C	T	9	9.00	2.00	0.02	0.05	2.44
Bluntnose Minnow	N	O	C	T	64	64.00	14.19	0.16	0.40	2.50
Central Stoneroller	N	H	N		1	1.00	0.22	0.00	0.00	2.00
Brown Bullhead		I	C	T	1	1.00	0.22	0.07	0.17	67.00
White Perch	E		M		9	9.00	2.00	0.07	0.18	8.11
Largemouth Bass	F	C	C		5	5.00	1.11	0.26	0.66	52.80
Green Sunfish	S	I	C	T	2	2.00	0.44	0.05	0.11	22.50
Bluegill Sunfish	S	I	C	P	10	10.00	2.22	0.20	0.50	19.86
Pumpkinseed Sunfish	S	I	C	P	204	204.00	45.23	3.98	9.96	19.53
Bluegill X Pumpkinseed					2	2.00	0.44	0.10	0.25	50.00
Green Sf X Bluegill Sf					1	1.00	0.22	0.08	0.19	75.00
Yellow Perch			M		3	3.00	0.67	0.03	0.07	10.00
Mile Total					451	451.00		40.01		
Number of Species					18					
Number of Hybrids					2					

River Code: **04-300**	Stream: **Ottawa River**	Sample Date: **2007**
River Mile: **5.50**	Location:	Date Range: 08/09/2007
Time Fished: 2747 sec	Drainage: 166.0 sq mi	Thru: 09/19/2007
Dist Fished: 0.80 km	Basin: Ottawa 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		2	2.50	0.75	0.05	0.05	20.00
Common Carp	G	O	M	T	44	55.00	16.60	77.30	83.09	1,405.54
Goldfish	G	O	M	T	13	16.25	4.91	4.38	4.70	269.23
Golden Shiner	N	I	M	T	4	5.00	1.51	0.04	0.04	8.00
Emerald Shiner	N	I	M		8	10.00	3.02	0.05	0.06	5.13
Spotfin Shiner	N	I	M		1	1.25	0.38	0.00	0.00	2.00
Fathead Minnow	N	O	C	T	1	1.25	0.38	0.00	0.00	2.00
Bluntnose Minnow	N	O	C	T	14	17.50	5.28	0.08	0.08	4.29
Yellow Bullhead		I	C	T	2	2.50	0.75	0.47	0.51	189.00
Brown Bullhead		I	C	T	3	3.75	1.13	0.25	0.27	66.33
White Perch	E		M		1	1.25	0.38	0.04	0.04	29.00
Largemouth Bass	F	C	C		10	12.50	3.77	1.44	1.55	115.00
Green Sunfish	S	I	C	T	12	15.00	4.53	0.54	0.58	35.86
Bluegill Sunfish	S	I	C	P	32	40.00	12.08	1.00	1.07	24.96
Pumpkinseed Sunfish	S	I	C	P	109	136.25	41.13	6.21	6.67	45.57
Green Sf X Bluegill Sf					8	10.00	3.02	1.20	1.29	119.63
Logperch	D	I	S	M	1	1.25	0.38	0.00	0.00	3.00
Mile Total					265	331.25		93.04		
Number of Species					16					
Number of Hybrids					1					

River Code: **04-300**	Stream: **Ottawa River**	Sample Date: **2007**
River Mile: **5.30**	Location: adj. Dura Landfill	Date Range: 08/09/2007
Time Fished: 3979 sec	Drainage: 166.0 sq mi	Thru: 09/19/2007
Dist Fished: 0.90 km	Basin: Ottawa 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	1.11	0.22	0.02	0.06	20.00
Bigmouth Buffalo	C	I	M		1	1.11	0.22	1.94	4.96	1,750.00
White Sucker	W	O	S	T	2	2.22	0.43	0.20	0.51	91.00
Common Carp	G	O	M	T	17	18.89	3.69	26.72	68.12	1,414.71
Goldfish	G	O	M	T	11	12.22	2.39	2.81	7.17	230.18
Golden Shiner	N	I	M	T	48	53.33	10.41	0.29	0.75	5.52
Creek Chub	N	G	N	T	1	1.11	0.22	0.00	0.01	4.00
Emerald Shiner	N	I	M		37	41.11	8.03	0.10	0.27	2.53
Spottail Shiner	N	I	M	P	3	3.33	0.65	0.01	0.03	4.00
Fathead Minnow	N	O	C	T	25	27.78	5.42	0.07	0.17	2.41
Bluntnose Minnow	N	O	C	T	52	57.78	11.28	0.11	0.27	1.86
Yellow Bullhead		I	C	T	1	1.11	0.22	0.07	0.17	59.00
Brown Bullhead		I	C	T	2	2.22	0.43	0.21	0.54	95.00
Largemouth Bass	F	C	C		11	12.22	2.39	0.53	1.35	43.18
Green Sunfish	S	I	C	T	33	36.67	7.16	0.90	2.31	24.67
Bluegill Sunfish	S	I	C	P	18	20.00	3.90	0.59	1.51	29.69
Pumpkinseed Sunfish	S	I	C	P	191	212.22	41.43	4.31	10.99	20.31
Green Sf X Bluegill Sf					5	5.56	1.08	0.30	0.76	54.00
Yellow Perch			M		1	1.11	0.22	0.01	0.03	10.00
Logperch	D	I	S	M	1	1.11	0.22	0.01	0.01	5.00
	Mile Total				461	512.22		39.23		
	Number of Species				19					
	Number of Hybrids				1					

River Code: **04-300**	Stream: **Ottawa River**	Sample Date: **2007**
River Mile: **5.00**	Location: Stickney Ave.	Date Range: 08/09/2007
Time Fished: 3947 sec	Drainage: 166.0 sq mi	Thru: 09/19/2007
Dist Fished: 1.00 km	Basin: Ottawa 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		2	2.00	0.31	0.05	0.04	25.50
Shorthead Redhorse	R	I	S	M	1	1.00	0.16	0.01	0.01	10.00
White Sucker	W	O	S	T	4	4.00	0.63	0.04	0.03	9.75
Common Carp	G	O	M	T	84	84.00	13.19	118.94	86.81	1,416.00
Goldfish	G	O	M	T	20	20.00	3.14	3.82	2.78	190.74
Golden Shiner	N	I	M	T	71	71.00	11.15	0.46	0.34	6.52
Emerald Shiner	N	I	M		67	67.00	10.52	0.15	0.11	2.25
Spottail Shiner	N	I	M	P	1	1.00	0.16	0.01	0.00	6.00
Fathead Minnow	N	O	C	T	3	3.00	0.47	0.00	0.00	1.33
Bluntnose Minnow	N	O	C	T	52	52.00	8.16	0.09	0.06	1.69
Yellow Bullhead		I	C	T	1	1.00	0.16	0.18	0.13	178.00
Brown Bullhead		I	C	T	4	4.00	0.63	0.40	0.29	99.75
White Perch	E		M		1	1.00	0.16	0.01	0.01	12.00
White Crappie	S	I	C		1	1.00	0.16	0.09	0.06	89.00
Largemouth Bass	F	C	C		14	14.00	2.20	1.21	0.88	86.57
Green Sunfish	S	I	C	T	15	15.00	2.35	0.28	0.20	18.65
Bluegill Sunfish	S	I	C	P	34	34.00	5.34	0.76	0.55	22.32
Pumpkinseed Sunfish	S	I	C	P	255	255.00	40.03	8.98	6.56	35.23
Green Sf X Bluegill Sf					3	3.00	0.47	0.30	0.22	100.67
Green Sf X Pumpkinseed					1	1.00	0.16	0.12	0.09	120.00
Yellow Perch			M		2	2.00	0.31	0.32	0.24	161.00
Freshwater Drum			M	P	1	1.00	0.16	0.79	0.58	792.00
	Mile Total				637	637.00		137.02		
	Number of Species				20					
	Number of Hybrids				2					

River Code: **04-310**	Stream: **Sibley Creek**	Sample Date: **2007**
River Mile: **0.80**	Location: Lagrange St.	Date Range: 08/10/2007
Time Fished: 600 sec	Drainage: 2.5 sq mi	
Dist Fished: 0.10 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
No Fish					0	0.00	0			
Mile Total					0					
Number of Species					0					
Number of Hybrids					0					

River Code: **04-310**	Stream: **Sibley Creek**	Sample Date: **2007**
River Mile: **0.20**	Location: near mouth	Date Range: 08/10/2007
Time Fished: 870 sec	Drainage: 2.6 sq mi	
Dist Fished: 0.08 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Creek Chub	N	G	N	T	29	108.75	72.50			
Fathead Minnow	N	O	C	T	1	3.75	2.50			
Central Stoneroller	N	H	N		1	3.75	2.50			
Western Mosquitofish	E	I	N		4	15.00	10.00			
Largemouth Bass	F	C	C		4	15.00	10.00			
Green Sunfish	S	I	C	T	1	3.75	2.50			
Mile Total					40	150.00				
Number of Species					6					
Number of Hybrids					0					

River Code: **04-310**	Stream: **Sibley Creek**	Sample Date: **2007**
River Mile: **0.10**	Location: at mouth	Date Range: 08/10/2007
Time Fished: 530 sec	Drainage: 2.6 sq mi	
Dist Fished: 0.10 km	Basin: Maumee River No of Passes: 1	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Creek Chub	N	G	N	T	2	6.00	14.29			
Fathead Minnow	N	O	C	T	1	3.00	7.14			
Central Stoneroller	N	H	N		2	6.00	14.29			
Yellow Bullhead		I	C	T	2	6.00	14.29			
Western Mosquitofish	E	I	N		2	6.00	14.29			
Largemouth Bass	F	C	C		5	15.00	35.71			
Mile Total					14	42.00				
Number of Species					6					
Number of Hybrids					0					

Appendix Table 3. Index of Biotic Integrity scores and metrics, and Modified Index of well-being scores, for the Ottawa River and Sibley Creek, 2007.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Centrarch. species	Sensitive species	Benthic species	Cyprinid species	Percent of Individuals: Exotics	Tolerant fishes	Omni-vores	Top carnivores	Phyto-phils	DELT anomalies	Rel.No. minus tolerants /(1.0 km)	Modified: LIBI	Modified: Iwb
Ottawa River - (04-300)																	
Year: 2007																	
5.80	A	08/10/2007	160	12(3)	5(3)	0(0)	3(1)	5(5)	10(3)	19(3)	14(5)	1(1)	50.2(5)	2.1(3)	486(3)	35	6.2
5.80	A	09/19/2007	160	14(3)	5(3)	0(0)	3(1)	7(5)	6(5)	40(1)	34(3)	1(1)	51.9(5)	3.9(1)	412(1)	29	6.0
5.50	A	08/09/2007	10000	11(3)	5(3)	1(1)	4(3)	4(3)	37(1)	59(0)	46(1)	3(1)	23.1(5)	13.3(0)	293(1)	22	5.4
5.50	A	09/19/2007	10000	10(3)	5(3)	0(0)	2(1)	4(3)	10(3)	16(3)	12(5)	5(1)	64.9(5)	6.9(0)	365(1)	28	6.6
5.30	A	08/09/2007	10000	11(3)	5(3)	1(1)	3(1)	4(3)	8(5)	33(1)	20(3)	1(1)	48.5(5)	2.5(3)	440(1)	30	6.9
5.30	A	09/19/2007	10000	15(3)	5(3)	0(0)	4(3)	6(5)	5(5)	48(0)	26(3)	3(1)	58.9(5)	2.0(3)	582(3)	34	6.9
5.00	A	08/09/2007	10000	11(3)	5(3)	0(0)	2(1)	4(3)	23(1)	45(1)	32(3)	2(1)	42.4(5)	9.8(0)	524(3)	24	6.4
5.00	A	09/19/2007	10000	15(3)	6(3)	1(1)	5(3)	4(3)	12(3)	37(1)	21(3)	3(1)	61.6(5)	4.6(1)	746(3)	30	6.9

♦ - IBI is low end adjusted.

Appendix Table 3. Index of Biotic Integrity scores and metrics, and Modified Index of well-being scores, for the Ottawa River and Sibley Creek, 2007.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Percent of Individuals: Tolerant fishes	Omni-vores	Pioneering fishes	Insect-ivores	DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI
Sibley Creek - (04-310)																
Year: 2007																
0.80	E	08/10/2007	2.5	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0(1)	0.0(1)	0(1) * *	12
0.20	E	08/10/2007	2.6	5(3)	3(3)	0(1)	0(1)	0(1)	0(1)	78(1)	3(5)	78(1)	13(1)	0.0(5)	34(1) *	24
0.10	E	08/10/2007	2.6	5(3)	3(3)	0(1)	0(1)	0(1)	0(1)	36(3)	7(5)	21(5)	29(3)	0.0(5)	27(1) * *	32

♦ - IBI is low end adjusted.

* - < 200 Total individuals in sample

** - < 50 Total individuals in sample

● - One or more species excluded from IBI calculation.

Appendix Table 4. Ohio EPA macroinvertebrate results from the Ottawa River and Sibley Creek, Dura Landfill area, 2007.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Ottawa River
upst. Dura Landfill

Collection Date: 09/18/2007 River Code: 04-300 RM: 5.80

Taxa Code	Taxa	Quant/Qual		Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	11				
03600	*Oligochaeta*	1021	+			
04664	*Helobdella stagnalis*		+			
04901	*Erpobdellidae*		+			
05800	*Caecidotea sp*		+			
13400	*Stenacron sp*	1				
22001	*Coenagrionidae*	1	+			
22300	*Argia sp*	1	+			
42700	*Belostoma sp*		+			
44501	*Corixidae*		+			
60900	*Peltodytes sp*		+			
78655	*Procladius (Holotanypus) sp*	1	+			
80420	*Cricotopus (C.) bicinctus*	1				
80490	*Cricotopus (Isocladius) intersectus group*	3				
80510	*Cricotopus (Isocladius) sylvestris group*	1				
82730	*Chironomus (C.) decorus group*	14	+			
82820	*Cryptochironomus sp*		+			
83002	*Dicrotendipes modestus*	5				
83040	*Dicrotendipes neomodestus*	8	+			
83050	*Dicrotendipes lucifer*	5				
83051	*Dicrotendipes simpsoni*	19				
83300	*Glyptotendipes (G.) sp*	23	+			
84000	*Parachironomus sp*	1				
84460	*Polypedilum (P.) fallax group*	22	+			
84470	*Polypedilum (P.) illinoense*	62	+			
84540	*Polypedilum (Tripodura) scalaenum group*	1				
85500	*Paratanytarsus sp*	6				
85821	*Tanytarsus glabrescens group sp 7*	12				
96120	*Menetus (Micromenetus) dilatatus*	108				
96900	*Ferrissia sp*	10	+			

No. Quantitative Taxa: 23 Total Taxa: 30
No. Qualitative Taxa: 17 LICI: **18**
Number of Organisms: 1337 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Ottawa River

Collection Date: 09/18/2007 River Code: 04-300 RM: 5.50

Taxa Code	Taxa	Quant/Qual		Taxa Code	Taxa	Quant/Qual
03221	*Pectinatella magnifica*	1				
03360	*Plumatella sp*	1	+			
03600	*Oligochaeta*	133				
06700	*Crangonyx sp*		+			
22300	*Argia sp*	1	+			
65800	*Berosus sp*	1				
78120	*Labrundinia maculata*	1				
80350	*Corynoneura sp*	1				
80410	*Cricotopus (C.) sp*	1				
80420	*Cricotopus (C.) bicinctus*	3				
80510	*Cricotopus (Isocladius) sylvestris group*	2				
81200	*Nanocladius sp*	1				
83050	*Dicrotendipes lucifer*	1				
83051	*Dicrotendipes simpsoni*	2				
83300	*Glyptotendipes (G.) sp*	8				
84450	*Polypedilum (Uresipedilum) flavum*	2				
84460	*Polypedilum (P.) fallax group*	1	+			
84470	*Polypedilum (P.) illinoense*	61				
84540	*Polypedilum (Tripodura) scalaenum group*	1				
85500	*Paratanytarsus sp*	3				
85821	*Tanytarsus glabrescens group sp 7*	5				
95100	*Physella sp*	1				
96120	*Menetus (Micromenetus) dilatatus*	8				
96900	*Ferrissia sp*	21	+			
98001	*Sphaeriidae*	2				

No. Quantitative Taxa: 24 Total Taxa: 25

No. Qualitative Taxa: 5 LICI: **22**

Number of Organisms: 262 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Ottawa River
adj. Dura Landfill

Collection Date: 09/18/2007 River Code: 04-300 RM: 5.30

Taxa Code	Taxa	Quant/Qual		Taxa Code	Taxa	Quant/Qual
01801	*Turbellaria*	22	+			
03360	*Plumatella sp*	1				
03600	*Oligochaeta*	1072				
06700	*Crangonyx sp*	1				
13400	*Stenacron sp*	1				
21200	*Calopteryx sp*		+			
22001	*Coenagrionidae*	2				
22300	*Argia sp*	8	+			
77120	*Ablabesmyia mallochi*	3				
80350	*Corynoneura sp*	1				
80410	*Cricotopus (C.) sp*	2				
81231	*Nanocladius (N.) crassicornus or N. (N.) "rectinervis"*	2				
83002	*Dicrotendipes modestus*	3				
83040	*Dicrotendipes neomodestus*	1				
83050	*Dicrotendipes lucifer*	6				
83051	*Dicrotendipes simpsoni*	1				
83300	*Glyptotendipes (G.) sp*	30	+			
84200	*Paratendipes sp*	1				
84430	*Polypedilum (P.) albicorne*	3				
84450	*Polypedilum (Uresipedilum) flavum*	1				
84460	*Polypedilum (P.) fallax group*	2				
84470	*Polypedilum (P.) illinoense*	12				
84540	*Polypedilum (Tripodura) scalaenum group*	2				
84800	*Tribelos jucundum*	2				
85500	*Paratanytarsus sp*	7				
85821	*Tanytarsus glabrescens group sp 7*	3				
96120	*Menetus (Micromenetus) dilatatus*	7				
96900	*Ferrissia sp*	1	+			

No. Quantitative Taxa: 27 Total Taxa: 28
No. Qualitative Taxa: 5 LICI: **18**
Number of Organisms: 1197 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Ottawa River
Stickney Ave.

Collection Date: 09/18/2007 River Code: 04-300 RM: 5.00

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
00653	*Eunapius fragilis*	+			
01320	*Hydra sp*	1			
01801	*Turbellaria*	37			
03451	*Urnatella gracilis*	2			
03600	*Oligochaeta*	982 +			
04664	*Helobdella stagnalis*	+			
04666	*Helobdella triserialis*	+			
05800	*Caecidotea sp*	+			
06700	*Crangonyx sp*	1			
08250	*Orconectes (Procericambarus) rusticus*	+			
08601	*Hydrachnidia*	2			
22001	*Coenagrionidae*	1 +			
22300	*Argia sp*	4 +			
45400	*Trichocorixa sp*	+			
60900	*Peltodytes sp*	+			
77500	*Conchapelopia sp*	2			
80410	*Cricotopus (C.) sp*	1			
80510	*Cricotopus (Isocladius) sylvestris group*	1			
82730	*Chironomus (C.) decorus group*	1			
83002	*Dicrotendipes modestus*	3			
83040	*Dicrotendipes neomodestus*	6			
83300	*Glyptotendipes (G.) sp*	13 +			
84000	*Parachironomus sp*	6			
84415	*Polypedilum (P.) sp*	1			
84450	*Polypedilum (Uresipedilum) flavum*	3			
84460	*Polypedilum (P.) fallax group*	3			
84470	*Polypedilum (P.) illinoense*	32 +			
84540	*Polypedilum (Tripodura) scalaenum group*	4			
84790	*Tribelos fuscicorne*	2 +			
84800	*Tribelos jucundum*	1			
85500	*Paratanytarsus sp*	4			
85821	*Tanytarsus glabrescens group sp 7*	8			
95100	*Physella sp*	3			
96120	*Menetus (Micromenetus) dilatatus*	32			
96900	*Ferrissia sp*	30 +			
98001	*Sphaeriidae*	1			

No. Quantitative Taxa: 29 Total Taxa: 36
No. Qualitative Taxa: 14 LICI: **16**
Number of Organisms: 1187 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Sibley Creek
Lagrange St.

Collection Date: 09/18/2007 River Code: 04-310 RM: 0.80

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+			
77250	*Alotanypus venustus*	+			
84470	*Polypedilum (P.) illinoense*	+			
95100	*Physella sp*	+			

No. Quantitative Taxa: 0 Total Taxa: 4
No. Qualitative Taxa: 4 ICI:
Number of Organisms: 0 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Sibley Creek
near mouth

Collection Date: 09/18/2007 River Code: 04-310 RM: 0.20

Taxa Code	Taxa	Quant/Qual
03600	*Oligochaeta*	+
04664	*Helobdella stagnalis*	+
06700	*Crangonyx sp*	+
07910	*Fallicambarus (Creaserinus) fodiens*	+
22001	*Coenagrionidae*	+
28001	*Libellulidae*	+
28955	*Plathemis lydia*	+
60900	*Peltodytes sp*	+
80420	*Cricotopus (C.) bicinctus*	+
84470	*Polypedilum (P.) illinoense*	+
98200	*Pisidium sp*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 11
No. Qualitative Taxa: 11 ICI:
Number of Organisms: 0 Qual EPT: 0

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Sibley Creek
at mouth

Collection Date: 09/18/2007 River Code: 04-310 RM: 0.10

Taxa Code	Taxa	Quant/Qual
04935	*Erpobdella punctata punctata*	+
06700	*Crangonyx sp*	+
22001	*Coenagrionidae*	+
67800	*Tropisternus sp*	+
72900	*Culex sp*	+
84470	*Polypedilum (P.) illinoense*	+

Taxa Code	Taxa	Quant/Qual

No. Quantitative Taxa: 0 Total Taxa: 6
No. Qualitative Taxa: 6 ICI:
Number of Organisms: 0 Qual EPT: 0

Appendix Table 5. Invertebrate Community Index scores and metrics for the Ottawa River, 2007.

River Mile	Percent Lacus-tuary	Number of			Percent:								
		Total Taxa	Sensitive Taxa	Dipteran Taxa	Mayflies & Caddisflies	Gath-erers[a]	Sensitive Organisms	Other Diptera[b]	Predom Taxon	Diptera/ ft^2	Qual. EPT	Eco-region	LICI
Ottawa River (04-300)													
Year: 2007													
5.80	**64.4**	**23(2)**	**2(0)**	**16(4)**	**0.1(2)**	**90.6(0)**	**1.0(2)**	**98.4(0)**	**76.4(2)**	**36.8(6)**	**0(0)**	**1**	**18**
5.50	**61.1**	**24(4)**	**1(0)**	**15(4)**	**0.0(0)**	**83.6(2)**	**1.9(2)**	**96.2(0)**	**50.8(4)**	**18.6(6)**	**0(0)**	**1**	**22**
5.30	**58.9**	**27(4)**	**2(0)**	**18(4)**	**0.1(2)**	**98.0(0)**	**0.3(2)**	**98.2(0)**	**89.6(0)**	**16.4(6)**	**0(0)**	**1**	**18**
5.00	**55.6**	**29(4)**	**2(0)**	**17(4)**	**0.0(0)**	**93.3(0)**	**0.8(2)**	**98.6(0)**	**82.7(0)**	**18.2(6)**	**0(0)**	**1**	**16**

[a] Percent of total gatherers as individuals excluding zebra mussels *(Dreissena polymorpha).*

[b] Percent of dipterans as individuals excluding the midge tribe Tanytarsini.

Appendix Table 6. Fish tissue analytical results of whole body and fillet samples from the Ottawa River, 2007. Values are reported on a wet weight basis.

River Mile	**5.8**	**5.8**	**5.5**	**5.5**	**5.3**	**5.3**	**5.0**	**5.0**
Fish Species	common carp	pumpkinseed sunfish	common carp	pumpkinseed sunfish	common carp	pumpkinseed sunfish	common carp	pumpkinseed sunfish
Sample Type	SFFC	WBC	SFFC	WBC	SFFC	WBC	SFFC	WBC
Date Sampled	9/19/2007	9/19/2007	9/19/2007	9/19/2007	9/19/2007	9/19/2007	9/19/2007	9/19/2007
Percent Lipids	**4.0**	**1.9**	**7.7**	**2.0**	**2.8**	**2.0**	**2.9**	**1.9**
PCBs (ug/kg)								
PCB-1016	<1100 G	<880 G	<3000 G	<1100 G	<1300 G	<1100 G	<2100 G	<1200 G
PCB-1221	<500	<500	<1500 G	<630 G	<630 G	<620 G	<1100 G	<650 G
PCB-1232	<1700 G	<1400 G	<4400 G	<1800 G	<1900 G	<1800 G	<3100 G	<2000 G
PCB-1242	<1300 G	<1200 G	<3600 G	**1600 AP**	<1600 G	**1600 AP**	<2600 G	<1300 G
PCB-1248	**2500 AP**	**1200 AP**	**3900 AP**	<1200 G	**2100 AP**	<1200 G	**3000 AP**	**1500 AP**
PCB-1254	**1200 AP**	**660 AP**	**1600 AP**	**680 AP**	**1100 AP**	**580 AP**	**1300 AP**	**690 AP**
PCB-1260	**520 AP**	<500	<1000	<500	<500	<500	<1000	<500
Pesticides (ug/kg)								
Aldrin	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
alpha-BHC	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
beta-BHC	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
delta-BHC	**61**	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
gamma-BHC (Lindane)	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
Chlordane (technical)	<270	<170 G	<430 G	<190 G	<320 G	<160 G	<310 G	<160 G
4,4'-DDD	**93**	**38**	**110**	**54**	**64**	**42**	**92**	**43**
4,4'-DDE	**140**	**82**	**150**	**66**	**100**	**57**	**130**	**67**
4,4'-DDT	**48**	**10 COL**	**55**	**28**	**42**	**20**	**48**	**7.9 COL**
Dieldrin	<25	**13**	<25	**21**	<15	**20**	<25	**15**
Endrin	<25	<5.0	<25	<5.0	<15	<5.0	<25	**5.4 COL**
Endosulfan I	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
Endosulfan II	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
Endosulfan Sulfate	<25	<5.0	<25	<5.0	<15	<5.0	<25	<5.0
Endrin aldehyde	<25	**5**	<25	<5.0	<15	<5.0	<25	<5.0
Heptachlor	<25	**5.2 COL**	<25	**6.8 COL**	<15	**5.6 COL**	<25	**5.9 COL**
Heptachlor Epoxide	<25	**7.7 COL**	<25	**7.6 COL**	<15	**6.2 COL**	<25	**6.5 COL**
Methoxychlor	<50	<10	<50	<10	<30	<10	<50	<10
Toxaphene	<1000	<230 G	<1000	<360 G	<600	<320 G	<1000	<210 G

G - Elevated reporting limit due to matrix interference.

AP - Altered pattern.

COL - More than 40% Relative Percent Difference (RPD) between primary and confirmation column results. The lower of the two results is reported.