State of Ohio
Environmental Protection Agency

Division of Surface Water

Biological and Water Quality Study of Chapman Creek

Tremont City Landfill Area

Clark County

December 14, 2007

Ted Strickland, Governor
Chris Korleski, Director

Biological and Water Quality Study

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2007

Clark County, Ohio
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SUMMARY

A total of two miles of Chapman Creek were assessed by the Ohio EPA in the vicinity of the Tremont City Landfill property during 2007. Based on the performance of the biological communities, the entire two miles of Chapman Creek were in full attainment of the Coldwater Habitat (CWH) aquatic life use (Table 1). Chapman Creek surface water and sediment chemical testing results were considered within acceptable ecological levels. A small decline in the macroinvertebrate community occurred adjacent to the Tremont City Landfill property; however, the Invertebrate Community Index score still reflected exceptional ecological quality. Biological communities have improved in the Chapman Creek study segment since 2000.

Chapman Creek is currently listed as Superior High Quality Waters (SHQW) in the Ohio Water Quality Standards. Because the SHQW designation is used for exceptional quality waterways, it offers added protection from pollutant loadings to the stream.

RECOMMENDATIONS

The aquatic life use designation of Coldwater Habitat (CWH) for Chapman Creek has been confirmed in previous Ohio EPA biological and water quality studies. This study verified continued CWH performance for Chapman Creek for the lower 3 miles of stream.

Chapman Creek is listed as Superior High Quality Waters (SHQW) in the Antidegradation Rule (OAC 3745-1-05) of the Ohio Water Quality Standards. Chapman Creek was designated SHQW based on the presence of threatened species and a high level of biological integrity. Chapman Creek supports threatened fish species, has a large population of redside dace - a declining fish species, a high level of macroinvertebrate biological integrity, and coldwater organisms are prevalent. This study verified the SHQW designation.

Physical habitat conditions and pool depths verified that the Primary Contact Recreation use is appropriate for Chapman Creek.

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

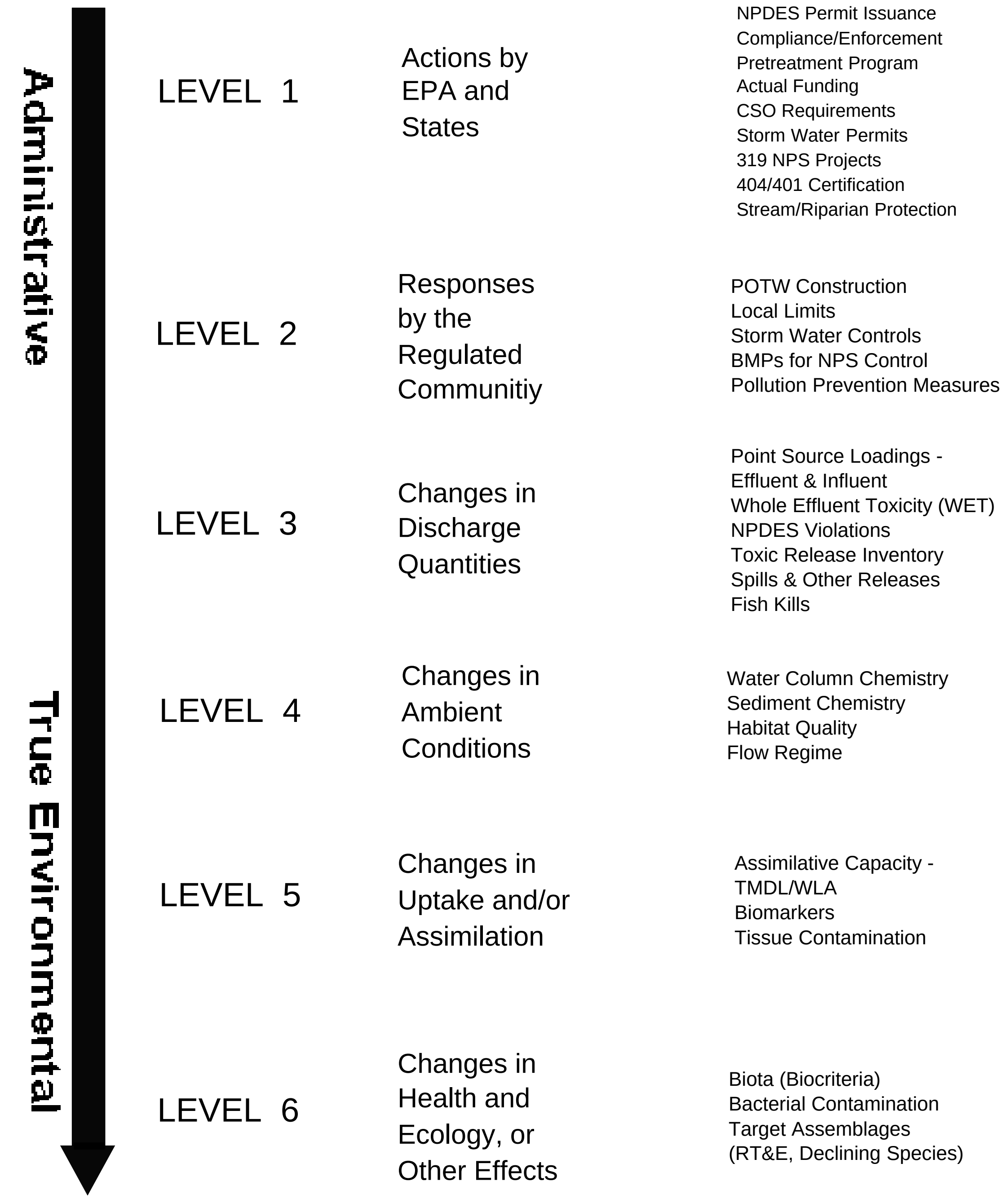

Figure 1. Hierarchy of administrative and environmental indicators which can be used for water quality management activities such as monitoring and assessment, reporting, and the evaluation of overall program effectiveness. This is patterned after a model developed by the U.S. EPA.

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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Reviewers - Jeff DeShon, Marc Smith

INTRODUCTION

The former Tremont City Landfill is being re-evaluated by an Ohio EPA site assessment team due to a request by U.S. EPA. As part of this re-evaluation, Ohio EPA - Southwest District Office staff requested that the Ohio EPA – Division of Surface Water conduct an ecological and surface water assessment of Chapman Creek, a stream adjacent to the southern portion of the landfill property, and which is tributary to the Mad River.

Specific objectives of the evaluation were to:

- Establish biological conditions in Chapman Creek in the vicinity of the Tremont City Landfill property by evaluating fish and macroinvertebrate communities,
- Evaluate sediment and surface water chemical quality at co-located biological stations in Chapman Creek in the vicinity of the Tremont City Landfill property, and
- Determine the aquatic life use attainment status of Chapman Creek with regard to the Coldwater Habitat (CWH) aquatic life use designation codified in the Ohio Water Quality Standards.

The study segment of Chapman Creek is located in the Eastern Corn Belt Plains (ECBP) ecoregion. Chapman Creek is currently assigned the Coldwater Habitat (CWH) 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 2.

Table 1. Aquatic life use attainment status for sampling locations in Chapman Creek, 2007. The Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of the biological community. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support a biological community. Stream sites are located in Eastern Corn Belt Plains (ECBP) ecoregion. This section of Chapman Creek is designated Coldwater Habitat (CWH) in the Ohio Water Quality Standards. If biological impairment has occurred, the cause(s) and source(s) of the impairment are noted.

Sample Site River Mile	Attainment Status	IBI	MIwb	ICI	QHEI	Location	Cause	Source
2.6	FULL	39 ns	8.7	58	74.5	Upstream Tremont City Landfill	None	None
2.1	FULL	39 ns	8.7	50	72.0	Adjacent Tremont City Landfill	None	None
1.6	FULL	44	9.0	56	77.0	Downstream Tremont City Landfill	None	None

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP) (OAC 3745-1-07, Table 7-15)		
INDEX - Site Type	WWH	EWH
IBI: Wading	40	50
MIwb: Wading	8.3	9.4
ICI	36	46

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

Table 2. Sampling locations in Chapman Creek , Tremont City Landfill area, 2007. Type of sampling included fish community (F), macroinvertebrate community (M), surface water (W), and sediment (S).

Stream/ River Mile	Type of Sampling	Latitude	Longitude	Landmark
2.6	F,M,W,S	40° 01’ 00”	83° 51’ 56”	Upstream Tremont City Landfill, Willow Dale Rd.
2.1	F,M,W,S	40° 00’ 55”	83° 51’ 22”	Adjacent Tremont City Landfill, along Snyder Domer Rd.
1.6	F,M,W,S	40° 00’ 47”	83° 50’ 55”	Downstream Tremont City Landfill, upstream Hominy Ridge Rd.

Figure 1. Map of Chapman Creek study area, 2007 showing sampling locations.

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), 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 2001a).

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. All biological results were compared to WWH biocriteria, along with an assessment of coldwater habitat species abundance and density. Chapman Creek is currently listed as a Coldwater Habitat (CWH) stream 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 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 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 location using decontaminated stainless steel scoops. At each location, between 15 and 20 scoops of fine grained material over a 200 meter section of stream 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^oC) 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 2001a). 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 2003a) or specified by the contract lab. HOBO© continuous temperature recorders were placed at each stream sample location to evaluate water temperature during summer conditions to help assess the coldwater habitat designation. Surface water samples were evaluated using comparisons to Ohio Water Quality Standards criteria, reference conditions, or published literature. Sediment evaluations were conducted using guidelines established in MacDonald *et al.* (2000), along with a comparison of metals results to Ohio Sediment Reference Values (Ohio EPA 2003b).

Macroinvertebrate Community Assessment

Macroinvertebrates were collected from artificial substrates and from the natural habitats at all three stream 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, margin). Detailed discussion of macroinvertebrate field and laboratory procedures is contained in Biological Criteria for the Protection of Aquatic Life: Volume III, Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio EPA 1989a, 2006b).

Fish Community Assessment

Fish were sampled twice at each fish site using pulsed DC wading electrofishing methods. Fish were processed in the field, and included identifying each individual to species, counting, weighing, 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).

Field Instrument Calibration

Field instruments are calibrated using manufacturer recommended procedures along with procedures noted in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (2006d) and Biological Criteria for the Protection of Aquatic Life, Volume III (1989b). 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

Surface Water Quality

Chemical analyses were conducted on surface water samples collected on August 15 and September 26, 2007 from three locations in the study area (Table 3, Appendix Tables 1 - 2). Surface water samples were analyzed for total analyte list inorganics (metals), PCBs, volatile organic compounds, semivolatile organic compounds, and organochlorinated pesticides. Parameters which were in exceedence of Ohio WQS criteria are reported in Table 3. HOBO© temperature recorders were placed in Chapman Creek at the three sampling locations to assess temperature regimes related to the Coldwater Habitat aquatic life use designation (Appendix Table 2).

None of the chemicals measured in this study exceeded water quality criteria developed for the protection of aquatic life and human health. Concentrations of all but one (chloromethane) of the organic parameters tested (volatiles, semivolatiles, pesticides, and PCBs) were reported as not detected. In addition, metals concentrations were very low, with over half of the tested parameters less than lab detection limits. Parameters with measurable concentrations were below applicable Ohio WQS aquatic life and human health criteria. Nutrients, ammonia-N, dissolved oxygen and bacteriological parameters were not tested as part of this evaluation.

Table 3. Exceedences of Ohio Water Quality Standards criteria (OAC3745-1) for chemical/physical parameters measured in Chapman Creek, 2007.

Stream River Mile	**Parameter (value – ug/l)**
Chapman Creek	
RM 2.6	None
RM 2.1	None
RM 1.6	None

Extensive monitoring of stream water temperatures from mid-August to late-September, 2007 occurred at the three biological monitoring locations. Data were collected every half hour over a six week period using HOBO© temperature recorders attached to cinder blocks placed on the stream bottom. Summarized water temperature results are presented in Appendix Table 2. Temperature measurements in Chapman Creek were consistent among the three sampling locations. Maximum temperatures during the August-September sampling period were below 25°C and daily mean temperatures were at or below 20°C for 81% of the time period. Class III-Primary Headwater Habitat streams (which are generally less than one square mile drainage) have <u>on average</u> daily water temperature less than 20°C in summer months (July-August-September), even in isolated pools of water that are connected by interstitial groundwater flow (Ohio EPA 2002). Defining characteristics for Class III streams are: 1) an association with cold-cool groundwater recharge, and 2) a permanency of flow throughout the year, either on the surface of the stream bed, or interstitially in the subsurface alluvium. Monitoring of water temperature during this study confirmed that cool water conditions were prevalent in lower Chapman Creek.

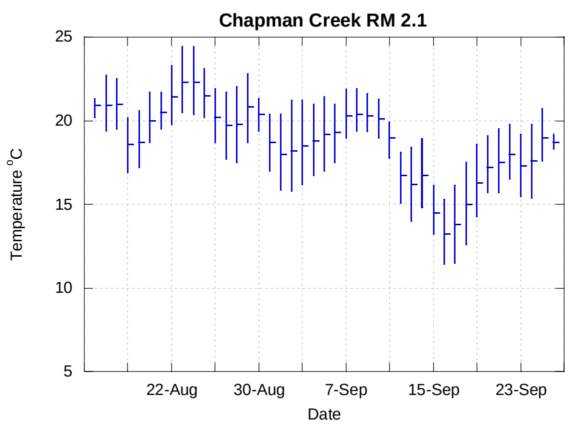

Figure 3. Daily maximum, average, and minimum temperature measurements (based on half-hourly monitoring) in Chapman Creek adjacent (RM 2.1) to the Tremont City Landfill, August 15 - September 26, 2007.

Sediment Quality

Sediment samples were collected at three locations in Chapman Creek by the Ohio EPA on September 26, 2007. Sampling locations were co-located with biological sampling sites. Samples were analyzed for total analyte list inorganics (23 metals), volatile organic compounds, semivolatile organic compounds, organochlorinated pesticides, and PCBs. Specific chemical parameters tested and results are listed in Appendix Table 3. 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 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.

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 sands and gravels. All Chapman Creek sediment sampling occurred in areas along the stream bank, which were represented by sparse deposits of fine grained material. These nearbank areas comprised only a small fraction of the bottom substrates of Chapman Creek. Stream substrates were predominated by gravel, sand, and cobble material.

Chemical parameters measured above ecological screening guidelines are presented in Table 4. Of the metal parameters tested in this study, only silver was detected above Ohio Sediment Reference values or *Threshold Effect Concentrations* (TEC). Silver was measured slightly above the Ohio SRV guideline (no TEC value) at two sampling locations, and all silver measurements were estimated values (qualified with 'J'). Six polycyclic aromatic hydrocarbon (PAH) compounds were reported above TEC levels, primarily occurring at the downstream station at RM 1.6. These levels of PAHs were considered within acceptable ecological levels – no parameters were above *Probable Effect Concentrations* (PEC).

Table 4. Chemical parameters measured above screening levels in sediment samples collected by Ohio EPA from Chapman 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), and Sediment Reference Value (orange). Sampling locations are indicated by river mile (RM).

	Chapman Creek		
Parameter	**RM 2.6**	**RM 2.1**	**RM 1.6**
Silver (mg/kg)	0.593J	0.639J	0.404J
Phenanthrene (ug/kg)	<132	<178	574
Fluorenthene (ug/kg)	<132	264J	937
Pyrene (ug/kg)	<132	208J	682
Benzo(a)anthracene (ug/kg)	<132	<178	338
Chrysene (ug/kg)	<132	<178	341
Benzo(a)pyrene (ug/kg)	<132	<178	283J

J - The analyte was positively identified, but the quantitation was below the reporting limit (RL).

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

Stream Physical Habitat

Physical habitat was evaluated in Chapman Creek at each fish sampling location. Physical habitat was assessed using the Qualitative Habitat Evaluation Index (QHEI); scores are detailed in Table 5.

QHEI scores for Chapman Creek sites ranged between 72.0 and 74.5. These scores are indicative of good stream habitat, and are adequate for supporting Warmwater Habitat biological communities.

Gravel and sand predominated the bottom substrates at the two upper sites (RMs 2.6 and 2.1); cobble predominated at RM 1.6. Other important substrate types common among the three sites included cobbles and boulders. Natural channel conditions were evident at each location assessed, with a moderate to narrow riparian corridor established. Instream channel development was good, with a mixture of pool, riffle and run habitats. Maximum pool depths at the threes sites varied between 75 and 110 centimeters**,** with deeper pool areas (greater than 70 cm) important for supporting diverse fish communities. Bottom embeddedness, the degree to which cobble, gravel and boulder substrates are surrounded or covered by fine materials, was normal at each site. Concrete slabs have been dumped along an extensive length of Chapman Creek at RM 1.6. This material is providing bank and road stabilization where Chapman Creek flows very close to Snyder Domer Road.

Table 5. Qualitative Habitat Evaluation Index (QHEI) scores and physical attributes for fish sampling sites on Chapman Creek, 2007.

Key QHEI Components

			WWH Attributes											**MWH Attributes** *High Influence*						**MWH Attributes** *Moderate Influence*														
River Mile	QHEI	Gradient (ft/mile)	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**
Chapman Creek Year: 2007																																		
2.6	**74.5**	17.54	■	■		■	■	■		■	■	■	8						0				●					●				2	0.11	0.33
2.1	**72.0**	27.77	■	■		■	■	■		■	■	■	8						0				●					●				2	0.11	0.33
1.6	**77.0**	28.57	■	■		■	■	■		■	■	■	8						0									●				1	0.11	0.22

Fish Community

A total of 14,063 fish representing 22 species were collected from Chapman Creek between August and September, 2007. Relative numbers and species collected per location are presented in Appendix Table 5 and IBI metrics are presented in Appendix Table 4. Sampling locations were evaluated using Warmwater Habitat biocriteria, along with an assessment of coldwater species abundance and density. Sampling locations were selected to assess potential contributions of contaminants from the Tremont City Landfill property.

Chapman Creek fish communities at all three sampling locations achieved the WWH biocriterion. IBI scores for these three sites ranged from 39 to 44, and MIwb scores ranged from 8.7 to 9.0, all within the marginally good to very good range (Table 6).

Specific coldwater species collected from Chapman Creek included redside dace and mottled sculpin, and these were used to assess the appropriateness of the CWH aquatic life use. The abundance of these two species at each site varied between 24.5% (RM 2.6) and 31.3% (RM 1.6). Cumulatively at the 3 sites, 26.9% of the fish community was comprised of coldwater species. The abundance of coldwater fish species, as well as the overall good quality of the fish communities, documented achievement of the CWH aquatic life use (Ohio EPA 2006e).

The 2007 fish results revealed a slight improvement in the fish community compared with sampling conducted in 2000. Average IBI and MIwb scores from the three sites sampled in 2000 were 38 and 8.7, respectively (Ohio EPA 2001b). Comparable sites from 2007 had average IBI and MIwb scores of 41 and 8.8, respectively. Coldwater fish species abundance was also similar between both sampling years.

Table 6. Fish community summaries based on pulsed D.C. wading electrofishing sampling conducted by Ohio EPA in Chapman Creek from August and September, 2007. Relative numbers and weight are per 0.3 km for wading sites. The applicable aquatic life use designation is CWH (using WWH biocriteria as benchmarks).

Stream River Mile	Sampling Method	Species (Mean)	Species (Total)	Relative Number	Relative Weight (kg)	QHEI	Modified Index of Well-Being	Index of Biotic Integrity	Narrative Evaluation
Chapman Creek									
2.6	Wading	15.5	17	3979	17.4	74.5	8.7	39 ns	Marginally Good/Good
2.1	Wading	15.0	16	3872	15.8	72.0	8.7	39 ns	Marginally Good/Good
1.6	Wading	18.5	21	2793	18.1	77.0	9.0	44	Good/Very Good

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)
(Ohio Administrative Code 3745-1-07, Table 7-15)

INDEX - Site Type	WWH	EWH
IBI: Wading	40	50
MIwb: Wading	8.3	9.4

* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
ns Nonsignificant departure from biocriterion (≤4 IBI units; ≤0.5 MIwb units).

Macroinvertebrate Community

The macroinvertebrate communities at three Chapman Creek sites were sampled in 2007 using qualitative (multi-habitat composite) and quantitative (artificial substrate) sampling protocols. Results are summarized in Table 7. The ICI metrics with the associated scores, and the raw data are attached as Appendix Tables 6 and 7.

The macroinvertebrate communities from all three Chapman Creek sampling locations not only achieved the WWH biocriterion but met the Exceptional Warmwater Habitat criterion. The ICI scores for the RMs 2.6, 2.1, and 1.6 sites were 58, 50, and 56, respectively. The decline in the ICI score at the adjacent site (RM 2.1) appear to be caused by a localized impact. Tolerant organisms are taxa that increase in relative abundance in the presence of pollution sources. Sensitive organisms respond in an opposite manner to the tolerant organisms. The percent tolerant organisms increased from 4.4% at RM 2.6 to 15.6% at RM 2.1, and declined to 6.9% downstream at RM 1.6 (Appendix Table 6). The number of sensitive taxa in the quantitative sample declined from 28 taxa at RM 2.6 to 16 at RM 2.1 and then increased to 31 at RM 1.6.

Chapman Creek is designated Coldwater Habitat (CWH). The number of coldwater macroinvertebrate taxa from Chapman Creek samples documented attainment of the CWH use as well as the appropriateness of the CWH designation. The number of coldwater macroinvertebrate taxa collected ranged from 6 taxa at RM 2.6 to 4 taxa at RMs 2.1 and 1.6. In addition, 4 of the taxa at RM 2.6, and 3 taxa at RMs 2.1 and 1.6 are listed as strong coldwater indicators (Ohio EPA 2006e).

The 2007 macroinvertebrate sampling indicated some improvement from the 2000 survey results especially at the upstream and downstream sampling locations. The ICI scores in 2000 were 48 at RM 2.6, 48 at RM 2.0, and 52 at RM 1.1.

Table 7. Summary of macroinvertebrate data collected from artificial substrates (quantitative sampling) and natural substrates (qualitative sampling) in Chapman Creek, 2007.

Stream/ River Mile	Density Number/ft^2	Total Taxa	Quantitative Taxa	Qualitative Taxa	Qualitative EPT[a]	ICI	Evaluation
Chapman Creek							
2.6	587	68	51	50	19	58	Exceptional
2.1	452	61	37	44	19	50	Exceptional
1.6	448	63	48	35	16	56	Exceptional

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP) (Ohio Administrative Code 3745-1-07, Table 7-15)		
INDEX	WWH	EWH
ICI	36	46

[a] EPT=total Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa richness, a measure of pollution sensitive organisms.
* Significant departure from ecoregion biocriterion; poor and very poor results are underlined.
[ns] Nonsignificant departure from biocriterion (≤4 ICI units).

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.

Ohio Environmental Protection Agency. 1990. The use of biological criteria in the Ohio EPA surface water monitoring and assessment program. Div. Water Qual. Plan. & Assess., Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006a. 2006 updates to Biological Criteria for the Protection of Aquatic Life: Volume II and Volume II Addendum. Users manual for biological field assessment of Ohio surface waters. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

Ohio Environmental Protection Agency. 2006b. 2006 updates to Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

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.

Rankin, E. T. 1995. The use of habitat assessments in water resource management programs, pp. 181-208. 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 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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Ohio Environmental Protection Agency. 2006b. 2006 updates to Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

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Ohio Environmental Protection Agency. 2006d. Ohio EPA manual of surveillance methods and quality assurance practices, updated edition. Division of Environmental Services, Columbus, Ohio.

Ohio Environmental Protection Agency. 2006e. Guidance for assigning the Coldwater Habitat, Native Fauna aquatic life use designation, draft, December, 2006. Div. of Surface Water, Ecol. Assess. Sect., Columbus, Ohio.

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Yoder, C.O. 1989. The development and use of biological criteria for Ohio surface waters. U.S. EPA, Criteria and Standards Div., Water Quality Stds. 21st Century, 1989: 139-146.

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.

Appendix Table 1. Results of chemical surface water sampling conducted by Ohio EPA in Chapman Creek, August 15 and September 26, 2007. Bolded results are above lab detection limits.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**
River Mile	**2.6**	**2.6**	**2.1**	**2.1**	**1.6**	**1.6**
Date Sampled	8/15/2007	9/26/2007	8/15/2007	9/26/2007	8/15/2007	9/26/2007
Time Sampled	9:00 AM	9:10 AM	12:15 PM	12:40 PM	3:00 PM	3:45 PM
TAL Metals (ug/l)						
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminum	<50	<50	<50	<50	<50	<50
Silver	<5	<5	<5	<5	<5	<5
Arsenic	<5	<5	<5	<5	<5	<5
Barium	**133**	**128**	**129**	**136**	**124**	**123**
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Calcium	**86,400**	**74,500**	**83,800**	**79,800**	**79,000**	**73,700**
Cadmium	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Cobalt	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Chromium	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Copper	<5	<5	<5	<5	<5	<5
Iron	**69**	**107**	**296**	**132**	**291**	**93.3**
Potassium	**2100**	**2460**	**2050**	**2490**	**2200**	**2410**
Magnesium	**33,600**	**30,500**	**32,800**	**32,000**	**34,100**	**30,200**
Manganese	**25.7**	**27**	**13.6**	**12.4**	**9.93J**	**8.96J**
Sodium	**12,400**	**11,800**	**11,400**	**11,500**	**12,400**	**11,300**
Nickel	<5	<5	<5	<5	<5	<5
Lead	<12.5	<12.5	<2.5	<12.5	<12.5	<12.5
Vanadium	<25	<25	<50	<25	<25	<25
Zinc	<5	<5	<5	<5	<5	<5
Antimony	<0.25	<0.25	**0.27J**	<0.25	<0.25	<0.25
Selenium	<5	<5	<5	<5	<5	<5
Thallium	<0.05	**0.114J**	<0.05	**0.0828J**	**0.0933J**	**0.143J**
Volatile Organic Analytes (ug/l)						
Acetone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Bromobenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Bromochloromethane	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Bromodichloromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Bromoform	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bromomethane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
2-Butanone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
n-Butylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
sec-Butylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
tert-Butylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Carbon disulfide	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorobenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Chlorodibromomethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chloroethane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
2-Chloroethyl vinyl ether	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Appendix Table 1. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**
River Mile	**2.6**	**2.6**	**2.1**	**2.1**	**1.6**	**1.6**
Date Sampled	8/15/2007	9/26/2007	8/15/2007	9/26/2007	8/15/2007	9/26/2007
Time Sampled	9:00 AM	9:10 AM	12:15 PM	12:40 PM	3:00 PM	3:45 PM
Volatile Organic Analytes (ug/l)						
Chloroform	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Chloromethane	<0.25	**1.71**	<0.25	**2.82**	<0.25	**1.28**
2-Chlorotoluene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
4-Chlorotoluene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2-Dibromo-3-chloropropane	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dibromomethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Dibromomethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2-Dichlorobenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,3-Dichlorobenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,4-Dichlorobenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Dichlorodifluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dichloroethane	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,2-Dichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dichloroethene	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
trans-1,2-Dichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2-Dichloropropane	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Dichloropropane	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,2-Dichloropropane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
cis-1,3-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
trans-1,3-Dichloropropene	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloropropene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Ethylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
2-Hexanone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Hexachlorobutadiene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Isopropylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
p-Isopropyltoluene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
4-Methyl-2-pentanone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Methylene chloride	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Naphthalene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
n-Propylbenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Styrene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,1,1,2-Tetrachloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1,2,2-Tetrachloroethane	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Tetrachloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Toluene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2,3-Trichlorobenzene	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,2,4-Trichlorobenzene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1,2-Trichloroethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Trichloroethene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Trichlorofluoromethane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2,3-Trichloropropane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,2,4-Trimethylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,3,5-Trimethylbenzene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Vinyl acetate	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Vinyl chloride	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

Appendix Table 1. Continued.

Stream	Chapman Creek	Chapman Creek	Chapman Creek	Chapman Creek	Chapman Creek	Chapman Creek
River Mile	**2.6**	**2.6**	**2.1**	**2.1**	**1.6**	**1.6**
Date Sampled	8/15/2007	9/26/2007	8/15/2007	9/26/2007	8/15/2007	9/26/2007
Time Sampled	9:00 AM	9:10 AM	12:15 PM	12:40 PM	3:00 PM	3:45 PM
Volatile Organic Analytes (ug/l)						
o-Xylene	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
m-,p-Xylene	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Semi-volatile Organic Analytes (ug/l)						
Phenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
bis-(2-Chloroethyl) ether	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Chlorophenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1,3-Dichlorobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1,4-Dichlorobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzyl alcohol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1,2-Dichlorobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Methylphenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
3-,4-Methylphenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
bis(2-Chloroisopropyl) ether	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
N-Nitroso-di-n-propylamine	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Hexachloroethane	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Nitrobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Isophorone	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Nitrophenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4-Dimethylphenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzoic acid	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
bis(2-Chloroethoxy)methane	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4-Dichlorophenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
1,2,4-Trichlorobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Naphthalene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Chloroaniline	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Hexachlorobutadiene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Chloro-3-methylphenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Methylnaphthalene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Hexachlorocyclopentadiene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,6-Trichlorophenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4,5-Trichlorophenol	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Chloronaphthalene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Nitroaniline	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
Dimethylphthalate	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Acenaphthylene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,6-Dinitrotoluene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
3-Nitroaniline	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
Acenaphthene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4-Dinitrophenol	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
4-Nitrophenol	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
Dibenzofuran	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2,4-Dinitrotoluene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Diethylphthalate	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Chlorophenyl-phenyl ether	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Fluorene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5

Appendix Table 1. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**
River Mile	**2.6**	**2.6**	**2.1**	**2.1**	**1.6**	**1.6**
Date Sampled	8/15/2007	9/26/2007	8/15/2007	9/26/2007	8/15/2007	9/26/2007
Time Sampled	9:00 AM	9:10 AM	12:15 PM	12:40 PM	3:00 PM	3:45 PM
Semi-volatile Organic Analytes (ug/l)						
4-Nitroaniline	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
4,6-Dinitro-2-methylphenol	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
N-Nitrosodiphenylamine	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Bromophenyl-phenylether	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Hexachlorobenzene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pentachlorophenol	<12.5	<12.5	<12.5	<12.5	<12.5	<12.5
Phenanthrene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Anthracene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Di-N-butylphthalate	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Fluoranthene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pyrene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Butylbenzylphthalate	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
3,3'-Dichlorobenzidine	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(a)anthracene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Chrysene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
bis(2-Ethylhexyl) phthalate	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Di-n-octylphthalate	<2.5	<2.5	**5.4**	<2.5	<2.5	<2.5
Benzo(b)fluoranthene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(k)fluoranthene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(a)pyrene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Indeno(1,2,3-cd)pyrene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Dibenzo(a,h)anthracene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Benzo(g,h,i)perylene	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pesticides (ug/l)						
4,4'-DDD	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4,4'-DDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4,4'-DDT	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
alpha-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
beta-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dieldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan I	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan II	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan Sulfate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin aldehyde	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
gamma-BHC (Lindane)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor Epoxide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methoxychlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
alpha Chlordane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
gamma Chlordane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toxaphene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Appendix Table 1. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**
River Mile	**2.6**	**2.6**	**2.1**	**2.1**	**1.6**	**1.6**
Date Sampled	8/15/2007	9/26/2007	8/15/2007	9/26/2007	8/15/2007	9/26/2007
Time Sampled	9:00 AM	9:10 AM	12:15 PM	12:40 PM	3:00 PM	3:45 PM
PCBs (ug/l)						
Aroclor 1016	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1221	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1232	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1242	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1248	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1254	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Aroclor 1260	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

J - The analyte was positively identified, but the quantitation was below the reporting limit.

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

Appendix Table 2. Half-hourly measurements of water temperature at three locations in Chapman Creek using HOBO© water temp Pro v2 data loggers, August - September, 2007.

	CHAPMAN CREEK RM 2.6			CHAPMAN CREEK RM 2.1			CHAPMAN CREEK RM 1.6		
	Water Temperature ^oC			Water Temperature ^oC			Water Temperature ^oC		
Date	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
15-Aug	20.9	21.2	20.2	20.9	21.3	20.2	20.9	22.0	20.1
16-Aug	20.9	22.6	19.0	20.9	22.7	19.4	20.9	22.9	19.2
17-Aug	20.9	22.1	19.5	21.0	22.5	19.5	21.1	22.9	19.5
18-Aug	18.6	19.8	16.6	18.6	20.2	16.9	18.6	20.5	16.6
19-Aug	18.7	20.3	17.1	18.7	20.6	17.2	18.7	20.7	17.0
20-Aug	19.9	21.5	18.5	20.0	21.7	18.7	19.9	21.8	18.5
21-Aug	20.4	21.7	19.4	20.5	21.7	19.5	20.5	21.7	19.5
22-Aug	21.4	23.7	19.7	21.4	23.3	19.8	21.1	23.4	19.8
23-Aug	22.3	24.4	20.2	22.3	24.4	20.5	22.3	24.5	20.3
24-Aug	22.3	24.1	20.2	22.3	24.4	20.4	22.3	24.6	20.3
25-Aug	21.4	22.8	20.0	21.5	23.1	20.2	21.5	22.9	20.2
26-Aug	20.2	21.8	18.5	20.2	21.9	18.7	20.2	22.0	18.6
27-Aug	19.7	21.7	17.5	19.7	21.7	17.7	19.7	21.9	17.5
28-Aug	19.9	22.8	17.4	19.8	22.0	17.5	19.7	22.2	17.4
29-Aug	20.9	23.7	18.5	20.8	22.8	18.7	20.8	23.1	18.7
30-Aug	20.4	22.5	19.2	20.4	21.3	19.4	20.3	21.1	19.4
31-Aug	18.5	19.8	16.8	18.7	20.4	17.0	18.7	20.7	16.9
1-Sep	18.3	20.2	15.7	18.0	20.4	15.9	17.9	20.3	15.7
2-Sep	18.5	21.5	18.5	18.2	21.2	15.8	18.0	20.8	15.5
3-Sep	18.6	21.0	15.9	18.5	21.2	16.2	18.4	20.9	15.9
4-Sep	18.8	20.5	16.5	18.8	21.0	16.7	18.7	21.4	16.5
5-Sep	19.2	21.0	17.4	19.2	21.4	17.0	19.2	21.8	16.9
6-Sep	19.2	20.9	17.4	19.3	21.0	17.5	19.2	21.2	17.3
7-Sep	20.3	21.8	18.9	20.3	21.9	19.0	20.3	22.2	18.8
8-Sep	20.3	21.8	19.2	20.4	21.9	19.4	20.4	22.0	19.3
9-Sep	20.3	21.5	19.3	20.3	21.6	19.4	20.3	21.6	19.3
10-Sep	20.2	21.7	18.9	20.1	21.3	19.0	20.0	21.3	18.9
11-Sep	18.9	19.7	17.7	19.0	19.9	17.8	18.9	20.0	17.6
12-Sep	16.7	18.2	14.9	16.7	18.1	15.1	16.6	18.1	14.9
13-Sep	16.3	18.5	13.9	16.2	18.4	14.0	16.1	18.4	13.8
14-Sep	16.8	19.0	14.8	16.7	18.9	14.8	16.6	18.9	14.7
15-Sep	14.5	16.4	13.1	14.5	16.1	13.2	14.3	15.9	12.9
16-Sep	13.3	15.2	11.3	13.2	15.3	11.4	13.0	15.2	11.0
17-Sep	13.9	16.2	11.4	13.8	16.1	11.5	13.6	16.0	11.2
18-Sep	15.1	17.5	12.5	15.0	17.5	12.6	14.8	17.4	12.3
19-Sep	16.4	18.4	14.2	16.3	18.6	14.3	16.2	18.5	14.0
20-Sep	17.2	18.9	15.6	17.2	19.1	15.7	17.0	18.9	15.5
21-Sep	17.6	19.3	15.5	17.5	19.5	15.7	17.4	19.5	15.4
22-Sep	18.2	19.9	16.4	18.0	19.8	16.5	17.9	19.6	15.1
23-Sep	17.3	18.9	15.4	17.3	19.2	15.5	17.2	19.3	15.3
24-Sep	17.8	20.3	15.2	17.6	19.8	15.4	17.5	19.9	15.1
25-Sep	19.0	20.4	17.4	19.0	20.7	17.6	19.0	20.7	17.4
26-Sep	18.5	19.3	18.2	18.7	19.2	18.3	18.6	19.4	18.2

Appendix Table 3. Results of sediment sampling conducted by Ohio EPA in Chapman Creek, September 26, 2007. Bolded results are above lab detection limits.

Stream	Chapman Creek	Chapman Creek	Chapman Creek		
River Mile	**2.6**	**2.1**	**1.6**	Sediment	MacDonald
Date Sampled	9/26/2007	9/26/2007	9/26/2007	Reference	2000
Time Sampled	9:20 AM	1:00 PM	4:00 PM	Values (SRV)	TEC
TAL Metals (mg/kg)					
Mercury	<0.0128	<0.0185	<0.0159	0.12	0.18
Aluminum	**2960**	**4410**	**3100**	39,000	NA
Silver	**0.593J**	**0.639J**	**0.404J**	0.43	NA
Arsenic	**5.13**	**5.45**	**3.78**	18	9.79
Barium	**47.5**	**65.8**	**61.7**	240	NA
Beryllium	**0.118J**	**0.182J**	**0.124J**	0.8	NA
Calcium	**76,500**	**65,400**	**58,700**	120,000	NA
Cadmium	**0.264J**	**0.358J**	**0.329J**	0.9	0.99
Cobalt	**2.65**	**3.62**	**2.58**	12	NA
Chromium	**4.65**	**6.6**	**4.66**	40	43.4
Copper	**6.14**	**8.53**	**6.56**	34	31.6
Iron	**7090**	**8150**	**6690**	33,000	NA
Potassium	**533**	**719**	**542**	11,000	NA
Magnesium	**26,300**	**17,400**	**10,900**	35,000	NA
Manganese	**129**	**196**	**188**	780	NA
Sodium	**113**	**94.7**	**77.3**	NA	NA
Nickel	**6.4**	**8.19**	**5.97**	42	22.7
Lead	**6.61**	**11.3**	**7.83**	47	35.8
Vanadium	**8.45**	**10.9**	**7.69**	40	NA
Zinc	**25.2**	**37.5**	**29.7**	160	121
Antimony	<0.0656	<0.0926	<0.0782	0.92	NA
Selenium	<2.5	<0.617	<0.604	2.3	NA
Thallium	**0.13**	**0.152**	**0.156**	4.7	NA
Volatile Organic Analytes (ug/kg)					
Acetone	**12.5J**	**25.0**	<8.66	NA	NA
Benzene	<0.676	<0.933	<0.866	NA	NA
Bromobenzene	<0.676	<0.933	<0.866	NA	NA
Bromochloromethane	<0.676	<0.933	<0.866	NA	NA
Bromodichloromethane	<0.676	<0.933	<0.866	NA	NA
Bromoform	<0.676	<0.933	<0.866	NA	NA
Bromomethane	<1.35	<1.87	<1.73	NA	NA
2-Butanone	<3.38	<4.67	<4.33	NA	NA
n-Butylbenzene	<0.676	<0.933	<0.866	NA	NA
sec-Butylbenzene	<0.676	<0.933	<0.866	NA	NA
tert-Butylbenzene	<0.676	<0.933	<0.866	NA	NA
Carbon disulfide	<0.676	<0.933	<0.866	NA	NA
Carbon tetrachloride	<0.676	<0.933	<0.866	NA	NA
Chlorobenzene	<0.676	<0.933	<0.866	NA	NA
Chlorodibromomethane	<0.676	<0.933	<0.866	NA	NA
Chloroethane	<1.35	<1.87	<1.73	NA	NA
2-Chloroethyl vinyl ether	<2.71	<3.73	<3.47	NA	NA

Appendix Table 3. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**		
River Mile	**2.6**	**2.1**	**1.6**	Sediment	MacDonald
Date Sampled	9/26/2007	9/26/2007	9/26/2007	Reference	2000
Time Sampled	9:20 AM	1:00 PM	4:00 PM	Values (SRV)	TEC
Volatile Organic Analytes (ug/kg)					
Chloroform	<0.676	<0.933	<0.866	NA	NA
Chloromethane	<2.71	<3.73	<3.47	NA	NA
2-Chlorotoluene	<0.676	<0.933	<0.866	NA	NA
4-Chlorotoluene	<0.676	<0.933	<0.866	NA	NA
1,2-Dibromo-3-chloropropane	<2.71	<3.73	<3.47	NA	NA
1,2-Dibromomethane	<0.676	<0.933	<0.866	NA	NA
Dibromomethane	<0.676	<0.933	<0.866	NA	NA
1,2-Dichlorobenzene	<0.676	<0.933	<0.866	NA	NA
1,3-Dichlorobenzene	<0.676	<0.933	<0.866	NA	NA
1,4-Dichlorobenzene	<0.676	<0.933	<0.866	NA	NA
Dichlorodifluoromethane	<1.35	<1.87	<1.73	NA	NA
1,1-Dichloroethane	<1.35	<1.87	<1.73	NA	NA
1,2-Dichloroethane	<0.676	<0.933	<0.866	NA	NA
1,1-Dichloroethene	<0.676	<0.933	<0.866	NA	NA
cis-1,2-Dichloroethene	<0.676	<0.933	<0.866	NA	NA
trans-1,2-Dichloroethene	<0.676	<0.933	<0.866	NA	NA
1,2-Dichloropropane	<0.676	<0.933	<0.866	NA	NA
1,3-Dichloropropane	<0.676	<0.933	<0.866	NA	NA
2,2-Dichloropropane	<0.676	<0.933	<0.866	NA	NA
cis-1,3-Dichloropropene	<0.676	<0.933	<0.866	NA	NA
trans-1,3-Dichloropropene	<0.676	<0.933	<0.866	NA	NA
1,1-Dichloropropene	<0.676	<0.933	<0.866	NA	NA
Ethylbenzene	<0.676	<0.933	<0.866	NA	NA
2-Hexanone	<3.38	<4.67	<4.33	NA	NA
Hexachlorobutadiene	<0.676	<0.933	<0.866	NA	NA
Isopropylbenzene	<0.676	<0.933	<0.866	NA	NA
p-Isopropyltoluene	<0.676	<0.933	<0.866	NA	NA
4-Methyl-2-pentanone	<3.38	<4.67	<4.33	NA	NA
Methylene chloride	<1.35	**4.50J**	<1.73	NA	NA
Naphthalene	<0.676	<0.933	<0.866	NA	NA
n-Propylbenzene	<0.676	<0.933	<0.866	NA	NA
Styrene	<0.676	<0.933	<0.866	NA	NA
1,1,1,2-Tetrachloroethane	<0.676	<0.933	<0.866	NA	NA
1,1,2,2-Tetrachloroethane	<0.676	<0.933	<0.866	NA	NA
Tetrachloroethene	<0.676	<0.933	<0.866	NA	NA
Toluene	<0.676	**6.10J**	<0.866	NA	NA
1,2,3-Trichlorobenzene	<0.676	<0.933	<0.866	NA	NA
1,2,4-Trichlorobenzene	<0.676	<0.933	<0.866	NA	NA
1,1,1-Trichloroethane	<0.676	<0.933	<0.866	NA	NA
1,1,2-Trichloroethane	<0.676	<0.933	<0.866	NA	NA
Trichloroethene	<0.676	<0.933	<0.866	NA	NA
Trichlorofluoromethane	<1.35	<1.87	<1.73	NA	NA
1,2,3-Trichloropropane	<1.35	<1.87	<1.73	NA	NA
1,2,4-Trimethylbenzene	<0.676	<0.933	<0.866	NA	NA
1,3,5-Trimethylbenzene	<0.676	<0.933	<0.866	NA	NA
Vinyl acetate	<1.35	<1.87	<1.73	NA	NA
Vinyl chloride	<1.35	<1.87	<1.73	NA	NA

Appendix Table 3. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**		
River Mile	**2.6**	**2.1**	**1.6**	Sediment Reference Values (SRV)	MacDonald 2000 TEC
Date Sampled	9/26/2007	9/26/2007	9/26/2007		
Time Sampled	9:20 AM	1:00 PM	4:00 PM		
Volatile Organic Analytes (ug/kg)					
o-Xylene	<0.676	<0.933	<0.866	NA	NA
m-,p-Xylene	<0.676	<0.933	<0.866	NA	NA
Semi-volatile Organic Analytes (ug/kg)					
Phenol	<132	<178	<156	NA	NA
bis-(2-Chloroethyl) ether	<132	<178	<156	NA	NA
2-Chlorophenol	<132	<178	<156	NA	NA
1,3-Dichlorobenzene	<132	<178	<156	NA	NA
1,4-Dichlorobenzene	<132	<178	<156	NA	NA
Benzyl alcohol	<132	<178	<156	NA	NA
1,2-Dichlorobenzene	<132	<178	<156	NA	NA
2-Methylphenol	<132	<178	<156	NA	NA
3-,4-Methylphenol	<132	<178	<156	NA	NA
bis(2-Chloroisopropyl) ether	<132	<178	<156	NA	NA
N-Nitroso-di-n-propylamine	<132	<178	<156	NA	NA
Hexachloroethane	<132	<178	<156	NA	NA
Nitrobenzene	<132	<178	<156	NA	NA
Isophorone	<132	<178	<156	NA	NA
2-Nitrophenol	<132	<178	<156	NA	NA
2,4-Dimethylphenol	<132	<178	<156	NA	NA
Benzoic acid	<527	<710	<623	NA	NA
bis(2-Chloroethoxy)methane	<132	<178	<156	NA	NA
2,4-Dichlorophenol	<132	<178	<156	NA	NA
1,2,4-Trichlorobenzene	<132	<178	<156	NA	NA
Naphthalene	<132	<178	<156	NA	176
4-Chloroaniline	<132	<178	<156	NA	NA
Hexachlorobutadiene	<132	<178	<156	NA	NA
4-Chloro-3-methylphenol	<132	<178	<156	NA	NA
2-Methylnaphthalene	<132	<178	<156	NA	NA
Hexachlorocyclopentadiene	<132	<178	<156	NA	NA
2,4,6-Trichlorophenol	<132	<178	<156	NA	NA
2,4,5-Trichlorophenol	<132	<178	<156	NA	NA
2-Chloronaphthalene	<132	<178	<156	NA	NA
2-Nitroaniline	<527	<710	<623	NA	NA
Dimethylphthalate	<132	<178	<156	NA	NA
Acenaphthylene	<132	<178	<156	NA	NA
2,6-Dinitrotoluene	<132	<178	<156	NA	NA
3-Nitroaniline	<527	<710	<623	NA	NA
Acenaphthene	<132	<178	<156	NA	NA
2,4-Dinitrophenol	<527	<710	<623	NA	NA
4-Nitrophenol	<527	<710	<623	NA	NA
Dibenzofuran	<132	<178	<156	NA	NA
2,4-Dinitrotoluene	<132	<178	<156	NA	NA
Diethylphthalate	<132	<178	<156	NA	NA
4-Chlorophenyl-phenyl ether	<132	<178	<156	NA	NA
Fluorene	<132	<178	<156	NA	77.4

Appendix Table 3. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**		
River Mile	**2.6**	**2.1**	**1.6**	Sediment	MacDonald
Date Sampled	9/26/2007	9/26/2007	9/26/2007	Reference	2000
Time Sampled	9:20 AM	1:00 PM	4:00 PM	Values (SRV)	TEC
Semi-volatile Organic Analytes (ug/kg)					
4-Nitroaniline	<527	<710	<623	NA	NA
4,6-Dinitro-2-methylphenol	<527	<710	<623	NA	NA
N-Nitrosodiphenylamine	<132	<178	<156	NA	NA
4-Bromophenyl-phenylether	<132	<178	<156	NA	NA
Hexachlorobenzene	<132	<178	<156	NA	NA
Pentachlorophenol	<527	<710	<623	NA	NA
Phenanthrene	<132	<178	**574**	NA	204
Anthracene	<132	<178	<156	NA	57.2
Di-N-butylphthalate	<132	<178	<156	NA	NA
Fluoranthene	<132	**264J**	**937**	NA	423
Pyrene	<132	**208J**	**682**	NA	195
Butylbenzylphthalate	<132	<178	<156	NA	NA
3,3'-Dichlorobenzidine	<263	<355	<312	NA	NA
Benzo(a)anthracene	<132	<178	**338**	NA	108
Chrysene	<132	<178	**341**	NA	166
bis(2-Ethylhexyl) phthalate	<132	<178	<156	NA	NA
Di-n-octylphthalate	<132	<178	<156	NA	NA
Benzo(b)fluoranthene	<132	<178	**271J**	NA	NA
Benzo(k)fluoranthene	<132	<178	**279J**	NA	NA
Benzo(a)pyrene	<132	<178	**283J**	NA	150
Indeno(1,2,3-cd)pyrene	<132	<178	<156	NA	NA
Dibenzo(a,h)anthracene	<132	<178	<156	NA	33
Benzo(g,h,i)perylene	<132	<178	<156	NA	NA
Pesticides (ug/kg)					
4,4'-DDD	<10.4	<14.6	<12.8	NA	4.88
4,4'-DDE	<10.4	<14.6	<12.8	NA	3.16
4,4'-DDT	<10.4	<14.6	<12.8	NA	4.16
Aldrin	<10.4	<14.6	<12.8	NA	NA
alpha-BHC	<10.4	<14.6	<12.8	NA	NA
beta-BHC	<10.4	<14.6	<12.8	NA	NA
delta-BHC	<10.4	<14.6	<12.8	NA	NA
Dieldrin	<10.4	<14.6	<12.8	NA	1.9
Endosulfan I	<10.4	<14.6	<12.8	NA	NA
Endosulfan II	<10.4	<14.6	<12.8	NA	NA
Endosulfan Sulfate	<10.4	<14.6	<12.8	NA	NA
Endrin	<10.4	<14.6	<12.8	NA	2.22
Endrin aldehyde	<10.4	<14.6	<12.8	NA	NA
gamma-BHC (Lindane)	<10.4	<14.6	<12.8	NA	2.37
Heptachlor	<10.4	<14.6	<12.8	NA	NA
Heptachlor Epoxide	<10.4	<14.6	<12.8	NA	2.47
Methoxychlor	<10.4	<14.6	<12.8	NA	NA
Endrin ketone	<10.4	<14.6	<12.8	NA	NA
alpha Chlordane	<10.4	<14.6	<12.8	NA	3.24
gamma Chlordane	<10.4	<14.6	<12.8	NA	3.24
Toxaphene	<526	<741	<649	NA	NA

Appendix Table 3. Continued.

Stream	**Chapman Creek**	**Chapman Creek**	**Chapman Creek**		
River Mile	**2.6**	**2.1**	**1.6**	Sediment	MacDonald
Date Sampled	9/26/2007	9/26/2007	9/26/2007	Reference	2000
Time Sampled	9:20 AM	1:00 PM	4:00 PM	Values (SRV)	TEC
PCBs (ug/kg)					
Aroclor 1016	<13	<18.3	<16.0	NA	59.8a
Aroclor 1221	<13	<18.3	<16.0	NA	59.8a
Aroclor 1232	<13	<18.3	<16.0	NA	59.8a
Aroclor 1242	<13	<18.3	<16.0	NA	59.8a
Aroclor 1248	<13	<18.3	<16.0	NA	59.8a
Aroclor 1254	<13	<18.3	<16.0	NA	59.8a
Aroclor 1260	<13	<18.3	<16.0	NA	59.8a
Other					
Percent Solids	73.0	54.0	60.9	NA	NA

J - The analyte was positively identified, but the quantitation was below the reporting limit.

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

a - Guideline is based on total PCBs.

Appendix Table 4. Index of Biotic Integrity (IBI) and Modified Index of well-being (MIwb) scores and metrics for Chapman Creek, 2007.

River Mile	Type	Date	Drainage area (sq mi)	Number of: Total species	Number of: Sunfish species	Number of: Sucker species	Number of: Intolerant species	Number of: Darter species	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	Percent of Individuals: DELT anomalies	Rel.No. minus tolerants /(0.3km)	IBI	Modified Iwb
Chapman Creek - (14120)																	
Year: 2007																	
2.60	E	08/15/2007	21	16(3)	2(3)	2(3)	1(1)	2(3)	46(5)	45(3)	2(5)	0.1(1)	32(3)	0.0(5)	2143(5)	40	8.6
2.60	E	09/26/2007	21	15(3)	1(1)	2(3)	1(1)	2(3)	42(5)	32(3)	3(5)	0.0(1)	32(3)	0.0(5)	2745(5)	38	8.9
2.10	E	08/15/2007	22	15(3)	2(3)	2(3)	1(1)	1(1)	37(5)	36(3)	2(5)	0.1(1)	36(3)	0.0(5)	2658(5)	38	8.8
2.10	E	09/26/2007	22	15(3)	2(3)	2(3)	1(1)	2(3)	42(5)	31(3)	3(5)	0.1(1)	33(3)	0.0(5)	2480(5)	40	8.6
1.60	E	08/15/2007	22	19(5)	1(1)	2(3)	2(3)	4(5)	37(5)	31(3)	4(5)	0.3(1)	41(3)	0.0(5)	2009(5)	44	9.0
1.60	E	10/03/2007	22	18(5)	3(3)	2(3)	2(3)	3(3)	41(5)	38(3)	5(5)	0.1(1)	40(3)	0.0(5)	1661(5)	44	9.0

na - Qualitative data, Modified Iwb not applicable.
♦ - IBI is low end adjusted.
* - < 200 Total individuals in sample
** - < 50 Total individuals in sample
● - One or more species excluded from IBI calculation.

Appendix Table 5. Ohio EPA fish results from Chapman Creek, Tremont City Landfill area, 2007.

River Code: **14-120**	Stream: **Chapman Creek**	Sample Date: **2007**
River Mile: **2.60**	Location: Willowdale Rd.	Date Range: 08/15/2007
Time Fished: 4534 sec	Drainage: 21.5 sq mi	Thru: 09/26/2007
Dist Fished: 0.39 km	Basin: Great Miami River No of Passes: 2	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	26	19.86	0.50	1.34	7.73	67.21
White Sucker	W	O	S	T	111	84.91	2.13	3.15	18.13	37.16
Golden Shiner	N	I	M	T	1	0.75	0.02	0.00	0.03	6.00
Western Blacknose Dace	N	G	S	T	1,425	1,100.61	27.66	2.08	12.00	1.91
Creek Chub	N	G	N	T	426	329.49	8.28	3.40	19.61	10.41
South. Redbelly Dace	N	H	S		3	2.37	0.06	0.01	0.06	4.33
Redside Dace	N	I	S	I	340	258.91	6.51	0.47	2.70	1.81
Striped Shiner	N	I	S		147	112.58	2.83	0.54	3.11	4.80
Fathead Minnow	N	O	C	T	2	1.54	0.04	0.01	0.03	3.00
Bluntnose Minnow	N	O	C	T	23	17.53	0.44	0.07	0.42	4.13
Central Stoneroller	N	H	N		1,514	1,157.41	29.08	3.87	22.31	3.35
Largemouth Bass	F	C	C		3	2.33	0.06	0.05	0.28	21.00
Green Sunfish	S	I	C	T	1	0.79	0.02	0.00	0.02	5.00
Bluegill Sunfish	S	I	C	P	8	6.20	0.16	0.06	0.37	10.38
Greenside Darter	D	I	S	M	4	3.12	0.08	0.01	0.08	4.50
Rainbow Darter	D	I	S	M	217	166.74	4.19	0.23	1.33	1.38
Mottled Sculpin		I	C		925	714.32	17.95	2.05	11.80	2.88
	Mile Total				5,176	3,979.42		17.35		
	Number of Species				17					
	Number of Hybrids				0					

Species List

River Code: **14-120**	Stream: **Chapman Creek**	Sample Date: **2007**
River Mile: **2.10**	Location: adj. Tremont City Landfill	Date Range: 08/15/2007
Time Fished: 6101 sec	Drainage: 22.0 sq mi	Thru: 09/26/2007
Dist Fished: 0.40 km	Basin: Great Miami River No of Passes: 2	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	11	8.25	0.21	0.51	3.26	62.39
White Sucker	W	O	S	T	110	82.50	2.13	2.10	13.34	25.49
Golden Shiner	N	I	M	T	2	1.50	0.04	0.01	0.04	4.00
Western Blacknose Dace	N	G	S	T	1,196	897.00	23.16	1.80	11.40	2.00
Creek Chub	N	G	N	T	423	317.25	8.19	3.29	20.86	10.36
South. Redbelly Dace	N	H	S		24	18.00	0.46	0.07	0.46	4.01
Redside Dace	N	I	S	I	291	218.25	5.64	0.79	5.01	3.62
Striped Shiner	N	I	S		114	85.50	2.21	0.35	2.25	4.14
Bluntnose Minnow	N	O	C	T	4	3.00	0.08	0.02	0.11	5.75
Central Stoneroller	N	H	N		1,630	1,222.50	31.57	4.82	30.58	3.94
Largemouth Bass	F	C	C		5	3.75	0.10	0.04	0.26	11.00
Green Sunfish	S	I	C	T	3	2.25	0.06	0.04	0.28	19.67
Bluegill Sunfish	S	I	C	P	3	2.25	0.06	0.02	0.13	9.00
Greenside Darter	D	I	S	M	1	0.75	0.02	0.00	0.02	4.00
Rainbow Darter	D	I	S	M	276	207.00	5.35	0.28	1.76	1.34
Mottled Sculpin		I	C		1,070	802.50	20.72	1.62	10.26	2.02
Mile Total					5,163	3,872.25		15.77		
Number of Species					16					
Number of Hybrids					0					

Species List

River Code: **14-120**	Stream: **Chapman Creek**	Sample Date: **2007**
River Mile: **1.60**	Location: upst. Hominy Ridge Rd.	Date Range: 08/15/2007
Time Fished: 7260 sec	Drainage: 22.3 sq mi	Thru: 10/03/2007
Dist Fished: 0.40 km	Basin: Great Miami River No of Passes: 2	Sampler Type: E

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Northern Hog Sucker	R	I	S	M	18	13.50	0.48	0.75	4.13	55.39
White Sucker	W	O	S	T	142	106.50	3.81	2.31	12.72	21.65
Golden Shiner	N	I	M	T	1	0.75	0.03	0.00	0.01	3.00
Western Blacknose Dace	N	G	S	T	689	516.75	18.50	1.69	9.30	3.26
Creek Chub	N	G	N	T	429	321.75	11.52	3.42	18.86	10.62
South. Redbelly Dace	N	H	S		53	39.75	1.42	0.16	0.89	4.03
Redside Dace	N	I	S	I	223	167.25	5.99	0.90	4.95	5.36
Rosyface Shiner	N	I	S	I	8	6.00	0.21	0.02	0.09	2.75
Striped Shiner	N	I	S		179	134.25	4.81	1.49	8.21	11.08
Fathead Minnow	N	O	C	T	2	1.50	0.05	0.01	0.04	4.00
Bluntnose Minnow	N	O	C	T	15	11.25	0.40	0.09	0.48	7.67
Central Stoneroller	N	H	N		874	655.50	23.47	4.68	25.80	7.13
Rock Bass	S	C	C		2	1.50	0.05	0.04	0.22	27.00
Largemouth Bass	F	C	C		4	3.00	0.11	0.02	0.11	6.50
Bluegill Sunfish	S	I	C	P	3	2.25	0.08	0.04	0.21	16.67
Longear Sunfish	S	I	C	M	1	0.75	0.03	0.04	0.21	50.00
Greenside Darter	D	I	S	M	4	3.00	0.11	0.01	0.06	3.75
Rainbow Darter	D	I	S	M	128	96.00	3.44	0.26	1.42	2.67
Orangethroat Darter	D	I	S		6	4.50	0.16	0.01	0.08	3.17
Fantail Darter	D	I	C		1	0.75	0.03	0.00	0.01	2.00
Mottled Sculpin		I	C		942	706.50	25.30	2.22	12.24	3.14
Mile Total					3,724	2,793.00		18.13		
Number of Species					21					
Number of Hybrids					0					

Appendix Table 6. Invertebrate Community Index (ICI) metrics and scores for sites sampled in Chapman Creek, 2007.

River Mile	Drainage Area (sq mi)	Number of: Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Percent: Mayflies	Caddis-flies	Tany-tarsini	Other Dipt/NI	Tolerant Organisms	Qual. EPT	Eco-region	ICI
Chapman Creek (14-120)													
Year: 2007													
2.60	21.5	51(6)	10(6)	9(6)	22(6)	21.1(4)	20.5(6)	32.4(6)	25.2(6)	4.4(6)	19(6)	5	58
2.10	22.0	37(4)	8(6)	5(6)	15(4)	31.5(6)	3.2(4)	30.4(6)	34.6(4)	15.6(4)	19(6)	5	50
1.60	22.3	48(6)	9(6)	9(6)	23(6)	23.9(4)	10.9(6)	29.8(6)	34.9(4)	6.9(6)	16(6)	5	56

Appendix Table 7. Ohio EPA macroinvertebrate results from Chapman Creek, Tremont City Landfill area, 2007.

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Collection Date: 09/26/2007 River Code: 14-120 RM: 2.60

Site: Chapman Creek
Willowdale Rd.

Taxa Code	Taxa	Quant	Qual
01320	*Hydra sp*	33	
01801	*Turbellaria*	2	
03600	*Oligochaeta*	8	+
05900	*Lirceus sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*	9	+
11014	*Acentrella turbida*	8	+
11018	*Acerpenna macdunnoughi*		+
11020	*Acerpenna pygmaea*	1	
11120	*Baetis flavistriga*	8	+
11130	*Baetis intercalaris*	17	+
11430	*Diphetor hageni*	8	+
13400	*Stenacron sp*	79	+
13521	*Stenonema femoratum*	3	
13590	*Maccaffertium vicarium*	87	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	9	+
17200	*Caenis sp*	398	+
21200	*Calopteryx sp*	12	+
24501	*Gomphidae*		+
47600	*Sialis sp*		+
50301	*Chimarra aterrima*	3	+
50315	*Chimarra obscura*	2	
51600	*Polycentropus sp*		+
52200	*Cheumatopsyche sp*	214	+
52430	*Ceratopsyche morosa group*	60	+
52440	*Ceratopsyche slossonae*	118	+
52450	*Ceratopsyche sparna*	134	+
52530	*Hydropsyche depravata group*	3	+
58505	*Helicopsyche borealis*	26	+
59310	*Mystacides sepulchralis*		+
59500	*Oecetis sp*	41	+
68075	*Psephenus herricki*		+
68901	*Macronychus glabratus*	1	
69210	*Optioservus ampliatus*	10	+
70600	*Antocha sp*	18	+
70700	*Dicranota sp*		+
71100	*Hexatoma sp*		+
74501	*Ceratopogonidae*	9	
77500	*Conchapelopia sp*	163	+
78350	*Meropelopia sp*	14	+
78655	*Procladius (Holotanypus) sp*		+
80370	*Corynoneura lobata*	144	
80410	*Cricotopus (C.) sp*	54	+
80420	*Cricotopus (C.) bicinctus*		+
81530	*Orthocladius (Symposiocladius) lignicola*		+
81650	*Parametriocnemus sp*	41	
81825	*Rheocricotopus (Psilocricotopus) robacki*	27	+
82101	*Thienemanniella taurocapita*	8	
82141	*Thienemanniella xena*	8	
82200	*Tvetenia bavarica group*	14	
83840	*Microtendipes pedellus group*	27	+
84210	*Paratendipes albimanus or P. duplicatus*		+
84440	*Polypedilum (Uresipedilum) aviceps*	14	+
84450	*Polypedilum (Uresipedilum) flavum*	14	+
84460	*Polypedilum (P.) fallax group*		+
84700	*Stenochironomus sp*		+
85500	*Paratanytarsus sp*	27	
85501	*Paratanytarsus n.sp 1*	503	
85625	*Rheotanytarsus sp*	41	+
85720	*Stempellinella fimbriata*	14	+
85752	*Sublettea coffmani*	27	
85800	*Tanytarsus sp*	313	+
85821	*Tanytarsus glabrescens group sp 7*	27	
87540	*Hemerodromia sp*	11	
94400	*Fossaria sp*	1	
95100	*Physella sp*	119	+
96002	*Helisoma anceps anceps*		+
96900	*Ferrissia sp*	3	+

No. Quantitative Taxa: 51 Total Taxa: 68

No. Qualitative Taxa: 50 ICI: **58**

Number of Organisms: 2935 Qual EPT: 19

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chapman Creek
adj. Tremont City Landfill

Collection Date: 09/26/2007 River Code: 14-120 RM: 2.10

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	13	
01801	*Turbellaria*	6	+
01900	*Nemertea*	28	
03600	*Oligochaeta*		+
05900	*Lirceus sp*	1	+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*		+
11120	*Baetis flavistriga*	1	+
11130	*Baetis intercalaris*	1	+
11250	*Centroptilum sp (w/o hindwing pads)*		+
11430	*Diphetor hageni*	2	+
13400	*Stenacron sp*	78	+
13521	*Stenonema femoratum*	16	+
13590	*Maccaffertium vicarium*	72	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	26	+
17200	*Caenis sp*	517	+
21200	*Calopteryx sp*	5	+
23909	*Boyeria vinosa*		+
24501	*Gomphidae*		+
50301	*Chimarra aterrima*		+
50315	*Chimarra obscura*		+
51600	*Polycentropus sp*	1	
52200	*Cheumatopsyche sp*	5	+
52430	*Ceratopsyche morosa group*		+
52440	*Ceratopsyche slossonae*	1	+
52450	*Ceratopsyche sparna*	2	+
52530	*Hydropsyche depravata group*		+
58505	*Helicopsyche borealis*		+
59310	*Mystacides sepulchralis*		+
59500	*Oecetis sp*	63	+
65800	*Berosus sp*	1	
68130	*Helichus sp*		+
68708	*Dubiraphia vittata group*	1	+
69200	*Optioservus sp*		+
69400	*Stenelmis sp*		+
70600	*Antocha sp*		+
71100	*Hexatoma sp*		+
71900	*Tipula sp*		+
77500	*Conchapelopia sp*	87	+
77800	*Helopelopia sp*	58	
80370	*Corynoneura lobata*	152	
81530	*Orthocladius (Symposiocladius) lignicola*		+
81650	*Parametriocnemus sp*		+
81825	*Rheocricotopus (Psilocricotopus) robacki*	19	+
82141	*Thienemanniella xena*	8	
82220	*Tvetenia discoloripes group*		+
83840	*Microtendipes pedellus group*	29	
84210	*Paratendipes albimanus or P. duplicatus*	19	
84440	*Polypedilum (Uresipedilum) aviceps*		+
84460	*Polypedilum (P.) fallax group*	19	
85500	*Paratanytarsus sp*	10	
85501	*Paratanytarsus n.sp 1*	291	+
85625	*Rheotanytarsus sp*	77	
85752	*Sublettea coffmani*		+
85800	*Tanytarsus sp*	174	
85802	*Tanytarsus curticornis*	58	
85821	*Tanytarsus glabrescens group sp 7*	77	
87540	*Hemerodromia sp*	6	
95100	*Physella sp*	333	+
95900	*Gyraulus sp*	3	
96900	*Ferrissia sp*		+

No. Quantitative Taxa: 37 Total Taxa: 61

No. Qualitative Taxa: 44 ICI: **50**

Number of Organisms: 2260 Qual EPT: 19

Ohio EPA/DSW Ecological Assessment Section
Macroinvertebrate Collection

Site: Chapman Creek
upst. Hominy Ridge Rd.

Collection Date: 09/26/2007 River Code: 14-120 RM: 1.60

Taxa Code	Taxa	Quant/Qual	
01320	*Hydra sp*	16	+
01801	*Turbellaria*		+
03360	*Plumatella sp*		+
03600	*Oligochaeta*	8	
05900	*Lirceus sp*		+
08250	*Orconectes (Procericambarus) rusticus*		+
08601	*Hydrachnidia*		+
11018	*Acerpenna macdunnoughi*	10	
11115	*Baetis tricaudatus*		+
11120	*Baetis flavistriga*	25	
11130	*Baetis intercalaris*		+
11430	*Diphetor hageni*	5	+
13400	*Stenacron sp*	135	+
13521	*Stenonema femoratum*	2	
13590	*Maccaffertium vicarium*	88	+
14950	*Leptophlebia sp or Paraleptophlebia sp*	6	+
15501	*Ephemerellidae*	4	
17200	*Caenis sp*	261	+
21200	*Calopteryx sp*	2	+
22300	*Argia sp*		+
23909	*Boyeria vinosa*	1	
24501	*Gomphidae*		+
50301	*Chimarra aterrima*		+
50804	*Lype diversa*	4	
51400	*Nyctiophylax sp*	4	
51600	*Polycentropus sp*		+
52200	*Cheumatopsyche sp*	44	+
52430	*Ceratopsyche morosa group*	78	+
52440	*Ceratopsyche slossonae*	16	+
52450	*Ceratopsyche sparna*	64	+
52530	*Hydropsyche depravata group*	3	+
58505	*Helicopsyche borealis*	2	+
59580	*Oecetis persimilis*	30	+
63300	*Hydroporus sp*		+
67800	*Tropisternus sp*		+
68708	*Dubiraphia vittata group*		+
69210	*Optioservus ampliatus*	8	+
70600	*Antocha sp*	13	
71100	*Hexatoma sp*	1	+
77500	*Conchapelopia sp*	179	
77800	*Helopelopia sp*	19	+
78450	*Nilotanypus fimbriatus*	9	
80204	*Brillia flavifrons group*	9	
80370	*Corynoneura lobata*	252	
81650	*Parametriocnemus sp*	9	
81825	*Rheocricotopus (Psilocricotopus) robacki*	38	
82101	*Thienemanniella taurocapita*	16	
82200	*Tvetenia bavarica group*	9	+
83820	*Microtendipes "caelum" (sensu Simpson & Bode, 1980)*	19	
83840	*Microtendipes pedellus group*	9	
84210	*Paratendipes albimanus or P. duplicatus*	19	
84460	*Polypedilum (P.) fallax group*	47	
85501	*Paratanytarsus n.sp 1*	160	
85625	*Rheotanytarsus sp*	254	+
85720	*Stempellinella fimbriata*	19	
85752	*Sublettea coffmani*	28	
85800	*Tanytarsus sp*	9	
85802	*Tanytarsus curticornis*	179	
85821	*Tanytarsus glabrescens group sp 7*	19	
87540	*Hemerodromia sp*	9	
94400	*Fossaria sp*		+
95100	*Physella sp*	100	+
96002	*Helisoma anceps anceps*	1	

No. Quantitative Taxa: 48 Total Taxa: 63
No. Qualitative Taxa: 35 ICI: **56**
Number of Organisms: 2242 Qual EPT: 16