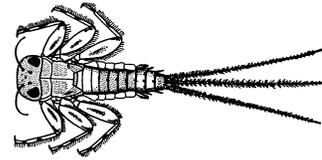
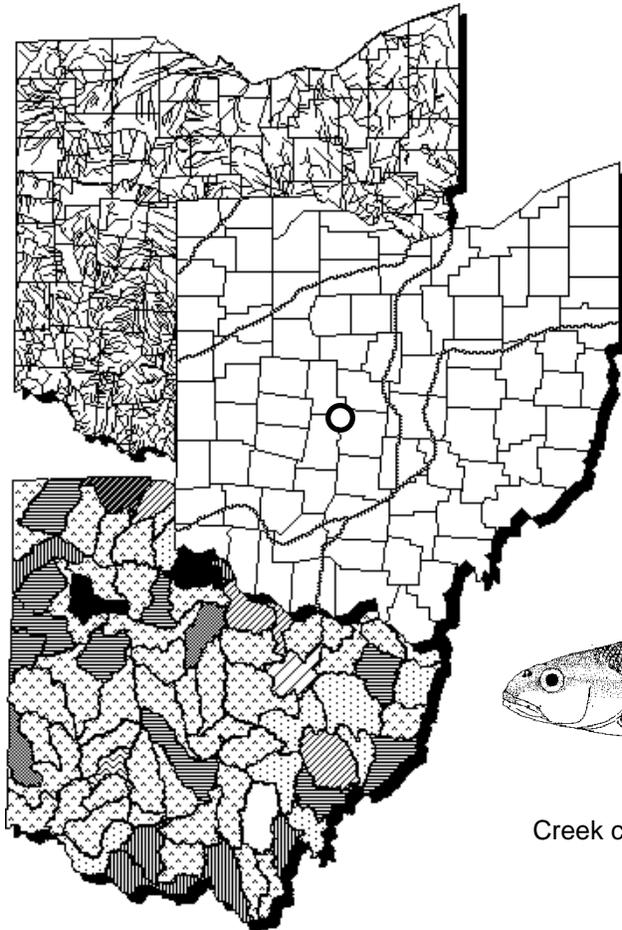


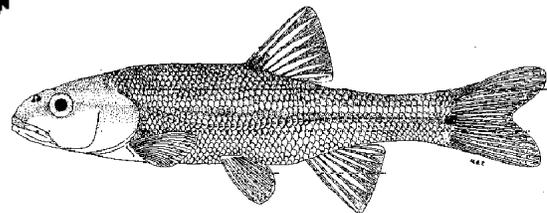
Biological and Habitat Study of Sugar Run

Hershberger Landfill

Union and Madison Counties, Ohio



Mayfly (*Stenonema*)



Creek chub (*Semotilus atromaculatus*)

June 14, 1996

Biological Study of Sugar Run 1995

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Introduction and Methods

Macroinvertebrate and fish communities were sampled during the summer and fall of 1995 at six locations in Sugar Run from river mile (RM) 7.9 to RM 0.5 (Table 1, Figure 1 - 3). Fish collections were made at each site between September 13 and October 12 using pulsed DC electrofishing gear, with sampling distances varying between 160 and 200 meters. Sampling was conducted to assess ecological conditions of biological communities in Sugar Run at sites located upstream and downstream from the Hershberger landfill north tributary. In addition, biological impacts associated with wastewater effluent discharged from New California were evaluated in Sugar Run. Fish and macroinvertebrate field work, laboratory, data processing and data analysis methods and procedures conducted by Ohio EPA were consistent with those specified in Ohio EPA manuals (1987, 1989a, 1989b). Qualitative macroinvertebrate sampling consisted of an inventory of taxa at a sampling station with an attempt to field estimate predominant populations. An assessment of the status of the designated aquatic life use was made based on best professional judgement utilizing sample attributes such as taxa richness and EPT (Ephemeroptera - mayfly, Plecoptera - stonefly, and Trichoptera -caddisfly) richness - an indication of the prevalence of pollution sensitive organisms. Evaluation of aquatic life uses was determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-17. The Index of Biotic Integrity (IBI) was used to evaluate the performance of the fish community. The IBI is a multi-metric index patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984).

Condition of the physical habitat was evaluated by Ohio EPA using the Qualitative Habitat Evaluation Index (QHEI) developed by Ohio EPA for streams and rivers in Ohio (Rankin 1989, Rankin 1995). Various attributes of the available habitat were 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 to determine the QHEI score which generally ranges from 20 to 100. The QHEI is used to evaluate the characteristics of a stream segment, as opposed to 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 greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 frequently typify habitat conditions which have the ability to support exceptional warmwater faunas.

Sugar Run, a tributary of Big Darby Creek, is located in the Eastern Corn Belt Plains ecoregion and is currently assigned the Warmwater Habitat (WWH) aquatic life use designation.

Table 1. Biological sampling locations in Sugar Run, 1995.

<i>Stream/ River Mile</i>	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
<i>Sugar Run</i>					
7.9	40°10'16"	83°15'42"	Ust. Hershberger Landfill North Tributary	Union	Marysville, OH
7.7	40°10'11"	83°15'33"	Dst. Hershberger Landfill North Tributary	Union	Marysville, OH
7.0	40°09'35"	83°15'15"	Taylor Rd.	Union	Marysville, OH
5.4	40°08'34"	83°14'54"	US 42	Union	Shawnee Hills, OH
2.8	40°07'08"	83°14'12"	Adj. Currier Rd.	Union	Hilliard, OH
0.5	40°05'38"	83°15'01"	Cemetary Pike	Madison	Plain City, OH Hilliard, OH

Summary/ Conclusions

- Qualitative Habitat Evaluation Index scores, channel modification and on-going ditch maintenance support the appropriateness of recommending the Modified Warmwater Habitat (MWH) use designation for Sugar Run from the headwaters (RM 10.2) to near Taylor Road (RM 6.7).
- Aquatic biological communities were in non-attainment of the Modified Warmwater Habitat aquatic life use designation at the two uppermost sampling locations and were in non-attainment of the Warmwater Habitat (WWH) use designation at two midsection sampling locations (Table 2). Full biological attainment of the WWH use occurred near the mouth of Sugar Run. Overall 1995 biological results for Sugar Run indicate that approximately 8.5 miles of stream were not meeting the aquatic life use designations of the stream, 0.6 miles were in partial attainment of the MWH use designation, and 1.7 miles were fully attaining the WWH use designation.
- The aquatic biological communities in the upstream channelized section of Sugar Run were reflective of poor to very poor water resource conditions. These poor conditions occurred in Sugar Run upstream and downstream from the Hershberger landfill tributaries, and were associated with the modified channel, maintenance of a degraded riparian corridor, nutrient enriched conditions, potential toxic stresses due to land application of fertilizer and manure, and gray water septic discharges.
- Improved stream habitat occurred in Sugar Creek downstream from Taylor Road to the mouth. In the area of New California, significant degradation of biological communities was documented (U.S. Rt. 42), as evidenced by severely impaired fish communities and poor macroinvertebrates. This degradation occurred in an area within two miles downstream from the Kimberly Woods WWTP, a facility which discharges to an unnamed tributary to Sugar Run.
- Significant improvement of biological resources was noted near the mouth of Sugar Run, with fish and macroinvertebrate populations representative of good to very good water quality and in full attainment of WWH.
- Cadmium, copper, iron, lead, mercury, manganese, and nickel were measured in sediment from Sugar Run at or above a Lowest Effect Level, a measure of contamination that can be tolerated by a majority of benthic organisms. These elevated concentrations were documented both upstream and downstream from Hershberger landfill tributaries to Sugar Run.
- Fish and macroinvertebrate communities near the mouth of Sugar Run have shown a substantial improvement in quality to good conditions over the past six years. However, a decline in biological community condition was documented in the upper five miles of Sugar Run over the same time period.
- Based on aquatic biological sampling results from 1995 and surface water and sediment data from 1992, the Hershberger landfill did not have a detectable influence on Sugar Run. The prevailing conditions of channel modification, sewage discharges, and poor riparian quality in the upper section of Sugar Run are the predominant influences on the aquatic communities and the attainment of designated uses.

Table 2. Aquatic life use attainment status for Sugar Run based upon sampling conducted in September and October, 1995. Attainment status of existing or recommended aquatic life uses is based on biocriteria for the Eastern Corn Belt Plains ecoregion of Ohio (OAC Chapter 3745-1-07, Table 7-17).

RIVER MILE Fish/ Invert.	IBI	ICI^a	QHEI	Attainment Status	Comment
<i>Sugar Run</i>					
<i>Eastern Corn Belt Plains Ecoregion - WWH Use Designation Existing (RM 6.7-0.0)</i>					
<i>Eastern Corn Belt Plains Ecoregion - MWH Use Designation Proposed (RM 10.2-6.7)</i>					
7.9	<u>20</u> *	<u>VP</u> *	40.0	NON	Channel modified
7.7	<u>22</u> *	<u>P</u> *	38.0	NON	Channel modified, dst. landfill
7.0	<u>24</u>	<u>P</u> *	50.5	PARTIAL	Channel modified, some habitat recovery
5.4/5.5	<u>16</u> *	<u>P</u> *	61.0	NON	Dst. New California WWTPs
2.8	<u>27</u> *	MG ^{ns}	69.5	NON	
0.5	41	VG	71.0	FULL	Near mouth

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)

INDEX	WWH	EWB	MWH^b
IBI - Headwaters	40	50	24
ICI	36	46	22

* Significant departure from ecoregion biocriterion (>4 IBI units); poor and very poor results are underlined.

^a Narrative evaluation used in lieu of ICI (E=Exceptional, V=Very good, G=Good, MG=Marginally good, F=Fair, P=Poor, VP=Very poor).

^b Modified Warmwater Habitat biocriteria for channel modified areas.

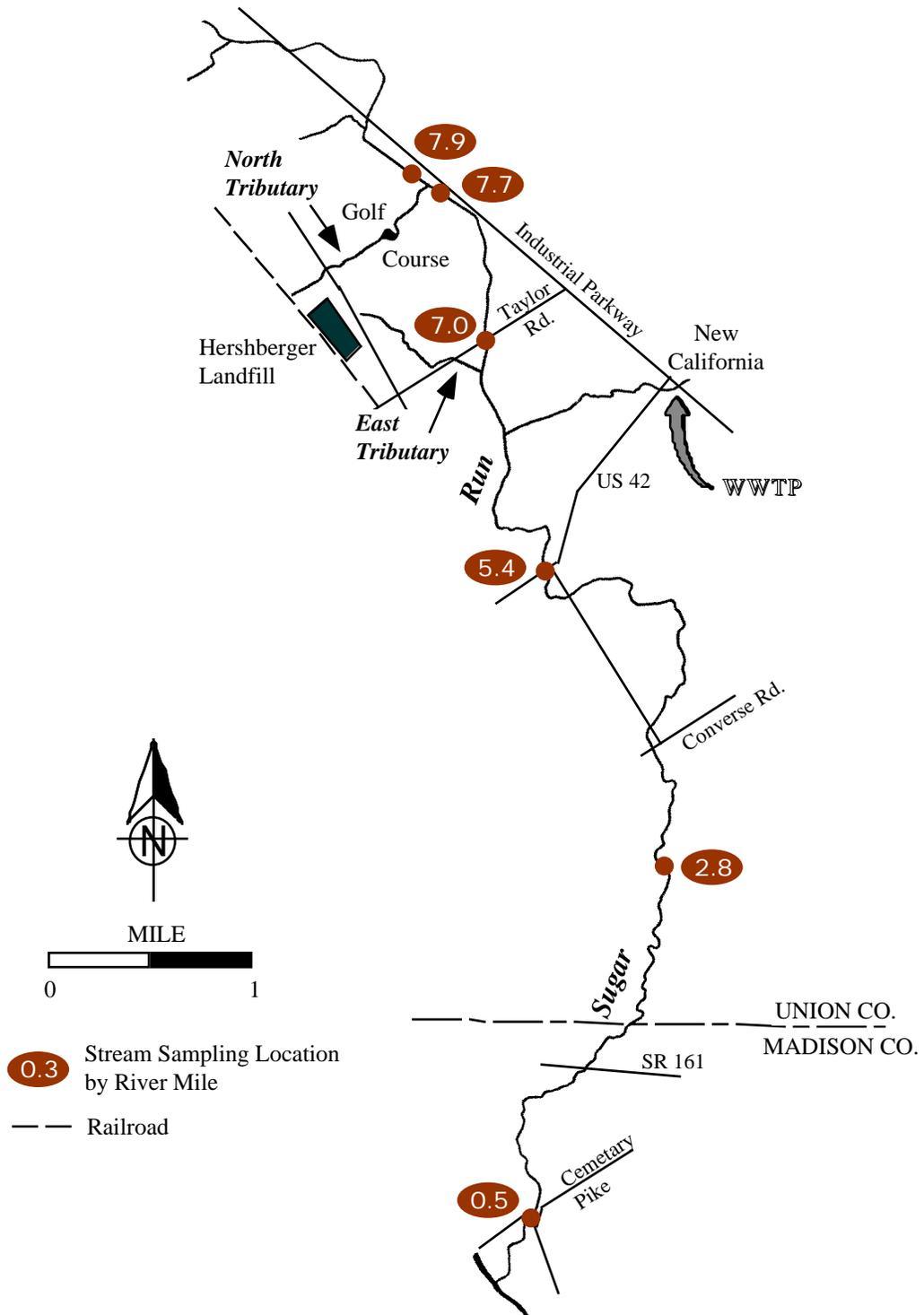


Figure 1. Map of Sugar Run showing principal streams, landmarks, wastewater treatment plants, Hershberger landfill and Ohio EPA biological sampling locations, 1995.

Physical Habitat for Aquatic Life

Physical habitat was evaluated at each 1995 biological sampling location. Qualitative Habitat Evaluation Index (QHEI) scores are detailed in Table 3.

Sugar Run

- The headwater section of Sugar Run is currently under ditch maintenance by the Union County Engineer. The segment of stream which has been previously channel modified extends from RM 6.7 to RM 10.2 (uppermost part of Sugar Run). This section of Sugar Run is composed of grassed banks (some areas with extensive bank slumping), gravel, sand, and muck substrates, shallow riffles and the lack of shade-providing trees. Three sites (RMs 7.0, 7.7, and 7.9) were sampled in the channel modified section of Sugar Run, with QHEI scores ranging from 38.0 to 50.5 (mean = 42.8). Modified habitat attributes predominated at each of these sampling locations, with the modified:warmwater attributes ratio exceeding 2.75. Although moderate amounts of instream cover were noted between RMs 7.0 and 7.9, it was largely composed of undercut banks and overhanging grasses. QHEI scores and prevalent habitat attributes were indicative of poor to fair stream habitat. The QHEI scores, channel modification, and active ditch maintenance support the appropriateness of recommending the MWH use designation for Sugar Run from the headwaters (RM 10.2) to near Taylor Road (RM 6.7).
- Sugar Run downstream from the channel modified section was evaluated at three locations (RMs 5.4, 2.8, and 0.5). These three locations were characterized by bottom substrates predominated by gravel and sand, moderate amounts of instream cover, a predominantly natural stream channel, and a narrow to moderate riparian tree canopy. The QHEI scores at RMs 5.4, 2.8, and 0.5 were 61.0, 69.5, and 71.0, respectively, (mean = 67.2) and were indicative of good instream habitat. Based on physical habitat conditions, the lower 6.7 miles of Sugar Run should retain the existing WWH aquatic life use designation.

Macroinvertebrate Community

Macroinvertebrate communities were qualitatively sampled during September, 1995 at six locations in Sugar Run. Summarized results from the 1995 macroinvertebrate sampling are compiled in Table 4. Macroinvertebrate taxa identified at each sampling location are detailed in Appendix Table 1.

- The macroinvertebrate communities at the three upper sites (RMs 7.0, 7.7, and 7.9) in Sugar Run ranged from very poor to poor. The upstream section of Sugar Run has previously been channelized, which along with the maintenance of a degraded and treeless riparian corridor, has contributed to the reduced macroinvertebrate community. In addition, nutrient enriched conditions (and at times toxic conditions) have been noted in the headwaters of Sugar Run associated with land application of fertilizer and manure, and gray water septic conditions were observed at one location in the upper headwaters adjacent to a dairy farm operation. The land area adjacent to RM 7.9 and RM 7.7 sampling locations was mostly bare dirt as a result of constructing a golf course. The most upstream sampling site (RM 7.9) supported a macroinvertebrate community in the very poor range. Ten total taxa were collected at RM 7.9 and the site was predominated by the leech *Erpobdella punctata punctata* and high numbers of the pollution tolerant snail genus *Physella*. EPT taxa, a measure of the presence of relatively pollution sensitive members of the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), were not present at RM 7.9. Macroinvertebrate sampling at RM 7.7, downstream from the north ditch draining part of Hershberger landfill, had a community in the poor range. The total taxa collected was 18, predominated by high numbers of the pollution tolerant snail genus *Physella*. In addition, three other pollution tolerant taxa collected included the midges *Cricotopus (Isocladius) sylvestris* group and *Polypedilum (P.) illinoense* and aquatic worms. No EPT taxa were collected. The lower site in the channel modified reach (RM 7.0) supported a macroinvertebrate community in the poor range. The total number of taxa collected at RM 7.0 increased to 24, and the EPT taxa richness was two (caddisflies of the genus *Cheumatopsyche* and *Hydropsyche depravata* group were collected in a riffle formed under the bridge on Taylor Road). The predominant taxa were midges and blackflies. The degraded macroinvertebrate communities in the upper reach (RMs 7.0 - 7.9) of Sugar Run are likely due to a combination of impacts from agricultural nonpoint runoff (particularly dairy farms), the work to develop the golf course, and poor habitat conditions associated with ditch maintenance.
- The macroinvertebrate community at U.S. Route 42 (RM 5.5) indicated poor biological conditions. Although the stream was in a more natural state with good physical habitat conditions it lacked the gradient to provide good current velocity. This site was downstream from the Kimberly Woods WWTP discharge and had a sewage smell and green scum on the water surface in the pools. The total taxa collected was 16 and the community was predominated by the pollution tolerant midge *Polypedilum (P.) illinoense* and flatworms. There were no EPT taxa collected.
- The site at RM 2.8 (off Currier Road) supported a macroinvertebrate community indicative of marginally good biological conditions. Thirty-seven (37) total taxa were collected and the EPT taxa richness was 6. The predominant taxa were midges and blackflies. Although the macroinvertebrate community is much improved, relative to upstream sites, the results showed a persistent impact from nutrients and a heavy silt load.
- The sample location near the confluence with Big Darby Creek (RM 0.5) supported a macroinvertebrate community in the very good range. The total taxa collected was 51, and the site was predominated by caddisflies and midges. The EPT taxa richness was 15. The site had improved habitat conditions and a lighter silt load. The improved water quality and habitat conditions and the close proximity of this site to Big Darby Creek contributed to the marked improvement in the macroinvertebrate community.

Table 4. Summary of macroinvertebrate data collected from natural substrates (qualitative sampling) in Sugar Run, 1995.

Qualitative Macroinvertebrate Evaluation						
Stream/ River Mile	No. Qual. Taxa	QCTV ^b	Qual. EPT ^a	Relative Density	Predominant Organisms	Narrative Evaluation ^c
<i>Sugar Run</i>						
7.9	10	NA	0	Low	leeches, snails	Very Poor
7.7	18	17.6	0	Moderately Low	snails, beetles	Poor
7.0	24	30.8	2	Low	blackflies	Poor
5.5	16	24.6	0	Low	midges, flatworms	Poor
2.8	37	33.0	6	Low	midges, blackflies	Marginally Good
0.5	51	35.6	15	Moderate	caddisflies, midges	Very Good

^a EPT= total Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa richness.

^b Qualitative Community Tolerance Value (QCTV) derived as the median of the tolerance values calculated for each qualitative taxon present.

^c The qualitative narrative evaluation is based on best professional judgement utilizing sample attributes such as taxa richness, EPT richness, and QCTV score and is used when quantitative data is not available to calculate the Invertebrate Community Index (ICI) scores.

NA Too few taxa collected to calculate the QCTV.

Fish Community

A total of 1,558 fish representing 29 species and one hybrid were collected from Sugar Run between September and October, 1995. The sampling effort included a cumulative distance electrofished of 2.22 km at six locations. IBI metrics and scores and relative numbers and species collected per location are presented in Appendix Tables 2 and 3, respectively.

- Creek chub (24.9%), green sunfish (20.2%), and bluntnose minnow (11.6%), three pollution tolerant species, predominated the catch numerically. Sunfish species (4) made up 33.9% of the catch and darter species (7) comprised 9.7% of the fish collected in Sugar Run.
- The fish communities at the three upstream sites (RMs 7.0, 7.7, and 7.9) in Sugar Run were evaluated as poor, with a large proportion of pollution tolerant species present. The upstream section of Sugar Run has previously been channelized, which along with the maintenance of a degraded riparian corridor, has contributed to the reduced fish community. In addition, nutrient enriched conditions (and at times toxic conditions) have been noted in the headwaters of Sugar Run associated with land application of fertilizer and manure, and gray water septic conditions were observed at one location in the upper headwaters adjacent to a dairy farm operation. The IBI scores of 20 and 22 which were recorded at RMs 7.9 and 7.7, respectively, do not meet the MWH ecoregional biocriterion. At RM 7.0 (Taylor Rd.), the IBI score was 24 and met the MWH biocriterion.
- The fish community at RM 5.4 (U.S. Rt. 42) was severely degraded. The IBI score of 16 was in the very poor range, showing substantial departure from the WWH ecoregional biocriterion. Sampling results suggested toxic conditions have occurred in the stream, as evidenced by a substantial reduction in fish species present and dominance of highly pollution tolerant fish (96% of the catch). The site at RM 5.4 is located within two miles downstream from the Kimberly Woods WWTP, a facility which discharges to an unnamed tributary to Sugar Run.
- Improved conditions in the fish community occurred at RM 2.8, in comparison to upstream locations. Although highly pollution tolerant fish predominated at this site, the appearance of moderately intolerant species (northern hog sucker, longear sunfish, rainbow darter) suggested some improvement in biological condition. The IBI score of 27 was in the poor range, and not achieving the WWH ecoregional biocriterion.
- A substantial improvement in the fish community was documented at the most downstream sampling location (RM 0.5, Cemetary Pike). The number of fish species collected was the highest of any of the Sugar Run sites (24 cumulative species). Seven darter species were collected at RM 0.5, comprising 24% of the catch. The IBI score of 41 was representative of good water quality conditions and achieved the WWH ecoregional biocriterion.

Table 5. Fish community indices from Sugar Run, 1995 based on pulsed D.C. electrofishing at sites sampled by Ohio EPA. Sites were sampled using wading methods.

Stream/ River Mile	Mean Number of Species	Cumulative Species	Relative Number (No./0.3 km)	QHEI	Index of Biotic Integrity	Narrative Evaluation ^a
<i>Sugar Run</i>						
7.9	8	10	75.0	40.0	<u>20</u> *	Poor
7.7	6	8	131.9	38.0	<u>22</u> *	Poor
7.0	12.5	14	364.5	50.5	<u>24</u>	Poor
5.4	3.5	5	75.0	61.0	<u>16</u> *	Very Poor
2.8	13.5	17	255.0	69.5	<u>27</u> *	Poor
0.5	21	24	309.7	71.0	41	Good

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)

INDEX	WWH	EWH	MWH^b
IBI - Headwaters	$\frac{\quad}{40}$	$\frac{\quad}{50}$	$\frac{\quad}{24}$

* Significant departure from ecoregional biocriterion (>4 IBI units); poor and very poor results are underlined.

ns Nonsignificant departure from ecoregional biocriterion (≤4 IBI units).

^a Narrative evaluation is based on IBI scores.

^b Modified Warmwater Habitat for channel modified areas.

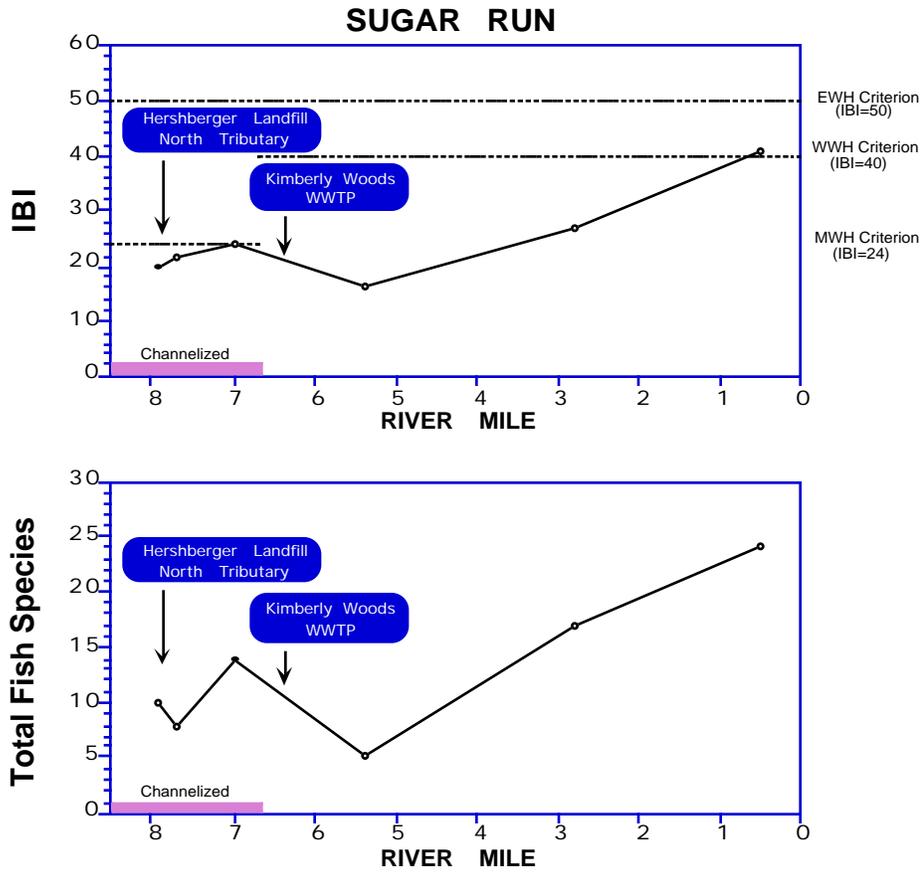


Figure 2. Longitudinal performance of the Index of Biotic Integrity (IBI) and total number of fish species in Sugar Run, 1995.

Trend Assessment

Changes in Macroinvertebrate Community Performance: 1990-1995

- Three locations in Sugar Run were previously sampled by Ohio EPA in 1990 (RMs 0.5 and 6.9) and 1992 (RMs 5.5 and 6.8). The trend in the macroinvertebrate community between 1990 and 1995 from RMs 6.8 -7.0 revealed a significant decline from exceptional/good (ICI = 46/38) in 1990, to fair (ICI = 28) in 1992, to poor in 1995. Trends at RM 5.5 (U.S. Rt. 42) revealed a macroinvertebrate community in the fair range during 1992 (ICI = 14) which declined to poor condition during 1995. Sampling results from 1995 suggested that toxic conditions exist in Sugar Run in the vicinity of U.S. Rt. 42 (RM 5.5). Sugar Run was sampled near the mouth during 1990 (RM 0.5) to assess biological conditions prior to entering Big Darby Creek. Results from 1990 revealed a marginally good macroinvertebrate community (ICI = 34). Macroinvertebrate community condition improved at RM 0.5 during 1995 into the very good range.

Changes in Fish Community Performance: 1990-1995

- Three fish locations in Sugar Run were previously sampled by Ohio EPA in 1990 (RMs 0.5 and 5.5) and 1992 (RMs 5.4 and 7.0). Index of Biotic Integrity scores from RM 7.0 showed a small decline from 1992 to 1995 (28 versus 24). Trends at RM 5.4/5.5 (U.S. Rt. 42) revealed a fish community in the poor range during 1990 (IBI=19), substantial improvement to fair conditions during 1992 (IBI=30), and a considerable decline to very poor quality during 1995 (IBI=16). Sampling results from 1995 suggested that toxic conditions exist in Sugar Run in the vicinity of U.S. Rt. 42 (RM 5.4). Sugar Run was sampled near the mouth during 1990 (RM 0.5) to assess biological conditions prior to entering Big Darby Creek. Results from 1990 revealed an IBI score of 31, indicative of fair water resource condition. A substantial improvement in the fish community occurred at RM 0.5 during 1995, with an IBI score of 41. The site at RM 0.5 is the only sampling location in Sugar Run which has met the Warmwater Habitat IBI biocriterion during the last five years.

Surface Water/ Sediment

Surface water and sediment chemical analyses were reported in the Hershberger Landfill Remedial Investigation report (Blaslund, Bouck and Lee 1994). Surface water and sediment samples were collected during 1992 in Sugar Run upstream and downstream from the North Tributary and East Tributary. Results of the remedial investigation study are detailed in Tables 6 and 7.

- Fifteen (15) exceedences of Ohio Water Quality criteria were documented in eight surface water samples from Sugar Run (Table 6). These exceedences occurred both upstream and downstream from the Hershberger landfill tributaries. None of the values exceeding water quality criteria were at levels considered acutely toxic to aquatic life. No clear association of surface water chemistry in Sugar Run and chemicals of concern from Hershberger landfill was evident.
- Sediment samples for several metal and organic parameters were evaluated using guidelines established by the Ontario Ministry of the Environment (Persaud *et al.* 1993). The guidelines define two levels of ecotoxic effects and are based on the chronic, long-term effects of contaminants on benthic organisms. A *Lowest Effect Level* is a level of sediment contamination that can be tolerated by the majority of benthic organisms, and a *Severe Effect Level* indicates a level at which pronounced disturbance of the sediment-dwelling benthic community can be expected. When any parameters are at or above the Severe Effect Level guideline, the material tested is considered highly contaminated (Persaud *et al.* 1993).
- Seven metal parameters (cadmium, copper, iron, lead, mercury, manganese, and nickel) were measured in sediment from Sugar Run at or above the Lowest Effect Level (Table 7). These elevated metal concentrations were documented both upstream and downstream from Hershberger landfill tributaries to Sugar Run. None of the chemical parameters tested in the sediments were at or above the Severe Effect Level.

Chemical Spills/Wildlife Kills

- Chemical spills and wild animal kills are indications of impacts due to excessive pollutant loadings. Reviews were conducted for discharges and kills in Sugar Run for Union and Madison Counties as reported by the Ohio EPA Division of Emergency and Remedial Response and the Ohio DNR Division of Wildlife. Spills and kills results are listed in Tables 8 and 9, respectively. Five spills were reported in Sugar Run or a tributary to Sugar Run from 1990 to 1995; none were reported during 1995. In most of the reported spills, the amount and type of material discharged into Sugar Run was unknown. One Ohio DNR investigation of pollution was reported during 1993, when 1,884 wild animals were killed by a release of fertilizer waste into Sugar Run from a farm.

Table 6. Surface water chemical sampling results from Sugar Run collected in March and August, 1992, and reported in the Hershberger Landfill Remedial Investigation, 1994. Exceedences of applicable Ohio Water Quality Criteria are indicated with asterisks. ND = not detected. Exceedences or values outside of criterion ranges are bold typed.

Parameter	Surface Water Concentration							
	Upstream N. Trib.		Downstream N. Trib.		Upstream E. Trib.		Downstream E. Trib.	
	RM 7.9 Mar. 92	RM 7.9 Aug. 92	RM 7.8 Mar. 92	RM 7.8 Aug. 92	RM 6.8 Mar. 92	RM 6.8 Aug. 92	RM 6.7 Mar. 92	RM 6.7 Aug. 92
Temperature °F	44.2	63.0	44.2	61.1	41.5	65.4	42.2	65.3
pH (SU)	6.81	7.41	6.21#	7.03	5.53#	6.73	5.59#	6.75
Aluminum, T (ug/l)	447	269	176	1490	112	468	264	381
Antimony, T (ug/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic, T (ug/l)	<1.0	28	3.7	12	<1.0	6	<1.0	<1.0
Barium, T (ug/l)	50	50	50	160	50	70	50	80
Beryllium, T (ug/l)	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Cadmium, T. (ug/l)	<1.0	2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calcium, T (mg/l)	82.8	66.6	80.6	85.2	90.0	82.5	86.4	93.2
Chromium, T. (ug/l)	5	<1.0	5	<1.0	<1.0	<1.0	<1.0	<1.0
Copper, T. (ug/l)	15	44*	15	16	21	<10	11	<10
Iron, T. (mg/l)	0.44	0.74	0.50	2.76*	0.92	0.98	0.77	0.86
Lead, T. (ug/l)	30.6*	46*	9.5	28	8.4	40*	13.5	42
Mercury, T. (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Magnesium, T. (mg/l)	22.2	33.2	23.1	38.6	25.8	36.5	25.9	42.5
Manganese, T. (mg/l)	0.02	0.06	0.02	0.74	0.04	0.14	0.04	0.13
Nickel, T. (ug/l)	<40	47	<40	62	<40	50	<40	<40
Potassium, T. (mg/l)	15.0	18.4	5.12	17.9	5.12	16.1	5.34	28.2
Selenium, T. (ug/l)	5.2*	18*	<1.0	10*	<1.0	<1.0	1.9	<1.0
Sodium, T. (mg/l)	23.5	45.4	21.8	43.4	34.2	132	32.6	191
Thallium, T. (ug/l)	6	<1.0	<1.0	<1.0	7	<1.0	<1.0	<1.0
Zinc, T. (ug/l)	44	144	21	<10	30	<10	23	<10
Hardness, T. (mg/l)	298	303	296	372	331	356	322	408
Cyanide, T. (ug/l)	<5	<10	<5	<10	<5	12	<5	13
PCBs (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds - ug/l (detected)								
- O Xylenes	<2	<10	2	<2	<2	<2	2	<2
Semivolatile Organic Compounds - ug/l (detected)								
- Bis(2-ethylhexyl) phthalate	<1	7	74*	<6	4	4	63*	21*
- Di-n-octyl phthalate	<1	4	<1	<6	<1	<2	6	<2
- Di-n-butyl phthalate	<1	<1	<1	<6	1	<2	<1	<2
- 4-Methylphenol	-	10*	-	419R	-	<20	-	<20

* - exceedence of warmwater habitat, modified warmwater habitat outside mixing zone 30-day average criterion

- outside of the warmwater habitat criterion.

R - Sample results were rejected by the lab due to serious deficiencies in the ability to analyze the sample and meet quality control criteria.

Table 7. Sediment sampling results from Sugar Run collected in March, 1992, and reported in the Hershberger Landfill Remedial Investigation, 1994. Measurements in **bold** exceed the Lowest Effect Level as detailed in Persaud *et al.* 1993. Parameters exceeding the Severe Effect Level are indicated by underlined **bold** numbers. Non-italicized parameters do not have review guidelines established in Persaud *et al.* 1993. ND = not detected.

Parameter	Upstream of North Tributary			Downstream of North Tributary		
	RM 7.9	RM 7.9	RM 7.9	RM 7.8	RM 7.8	RM 7.8
Aluminum, T (mg/kg)	15,400	5,380	5,860	5,120	4,930	4,330
Antimony, T (mg/kg)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium, T (mg/kg)	82.7	47.7	37.3	53.2	55.7	51.8
Beryllium, T (mg/kg)	0.61	0.51	0.49	0.55	0.58	0.48
<i>Cadmium, T. (mg/kg)</i>	1.20	0.78	0.65	0.78	0.91	0.79
Calcium, T (mg/kg)	9,640	9,450	8,660	10,400	9,100	8,930
<i>Chromium, T. (mg/kg)</i>	10.1	9.2	6.0	8.8	9.6	9.3
<i>Copper, T. (mg/kg)</i>	25.6	17.5	14.8	16.8	20.1	16.4
<i>Iron, T. (mg/kg)</i>	17,700	20,100	18,800	21,300	22,500	18,700
<i>Lead, T. (mg/kg)</i>	35.3	26.1	25.6	27.1	30.7	26.3
<i>Mercury, T. (ug/kg)</i>	<100	280	<100	<100	258	<100
Magnesium, T. (mg/kg)	4,410	4,230	3,170	4,600	3,850	3,620
<i>Manganese, T. (mg/l)</i>	781	421	409	600	556	469
<i>Nickel, T. (mg/kg)</i>	36.1	25.7	22.5	26.4	27.9	25.6
Potassium, T. (mg/kg)	1,080	893	593	696	806	785
Selenium, T. (mg/kg)	14.6	9.8	8.5	10.1	8.5	8.2
Sodium, T. (mg/kg)	110	144	77.0	112	96.3	120
Thallium, T. (mg/kg)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
<i>Zinc, T. (mg/kg)</i>	92.6	66.0	50.8	54.8	71.3	56.2
Cyanide, T. (mg/kg)	0.24	0.31	0.26	0.47	0.22	0.20
<i>PCBs (ug/kg)</i>	ND	ND	ND	ND	ND	ND
<i>Pesticides (ug/kg)</i>	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds - ug/kg	ND	ND	ND	ND	ND	ND
- O Xylenes						
Semivolatile Organic Compounds - ug/kg (detected)						
- Bis(2-ethylhexyl) phthalate	<1.0	<1.0	<1.0	<1.0	4	24
- Di-n-octyl phthalate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Table 7. Continued.

Parameter	Upstream of East Tributary			Downstream of East Tributary		
	RM 6.8	RM 6.8	RM 6.8	RM 6.7	RM 6.7	RM 6.7
Aluminum, T (mg/kg)	11,300	7,260	7,780	5,490	5,390	8,050
Antimony, T (mg/kg)	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Barium, T (mg/kg)	51.6	59.9	75.0	57.9	55.4	87.4
Beryllium, T (mg/kg)	0.46	0.76	0.66	0.59	0.66	0.77
Cadmium, T. (mg/kg)	0.59	0.97	0.96	0.76	1.04	1.90
Calcium, T (mg/kg)	5,320	19,500	11,600	56,600	19,900	8,1300
Chromium, T. (mg/kg)	10.4	14.1	14.6	9.3	11.2	17.6
Copper, T. (mg/kg)	26.6	26.9	27.4	16.2	21.7	26.6
Iron, T. (mg/kg)	12,100	25,700	24,300	24,200	23,000	23,800
Lead, T. (mg/kg)	22.1	34.8	32.8	25.6	32.0	47.2
Mercury, T. (ug/kg)	<100	<100	113	<100	<100	<100
Magnesium, T. (mg/kg)	3,200	11,600	7,970	22,300	8,570	4,180
Manganese, T. (mg/l)	702	385	458	598	453	612
Nickel, T. (mg/kg)	31.8	37.1	35.9	23.9	28.3	29.3
Potassium, T. (mg/kg)	974	1,560	1,370	957	1,230	1,940
Selenium, T. (mg/kg)	8.7	9.9	14.0	12.1	10.2	10.6
Sodium, T. (mg/kg)	441	551	553	367	505	439
Thallium, T. (mg/kg)	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Zinc, T. (mg/kg)	79.0	81.6	93.5	51.0	65.2	80.1
Cyanide, T. (mg/kg)	0.16	0.20	<0.10	0.30	0.27	0.96
PCBs (ug/kg)	ND	ND	ND	ND	ND	ND
Pesticides (ug/kg)	ND	ND	ND	ND	ND	ND
Volatile Organic Compounds - ug/kg	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds - ug/kg (detected)						
- Bis(2-ethylhexyl) phthalate	72	<1.0	<1.0	<1.0	<1.0	<1.0
- Di-n-octyl phthalate	5	<1.0	<1.0	<1.0	<1.0	<1.0

Table 8. Summary of pollutant discharges to Sugar Run reported to the Ohio EPA, Division of Emergency and Remedial Response from January 1990 - December 1995.

Date	Stream	Entity	Material	Amount
07/21/93	Sugar Run	Farm	Fertilizer waste	Unknown
08/03/90	Sugar Run	Unknown	-	Unknown
07/23/90	Sugar Run	Mitchell Construction	-	Unknown
05/31/90	Trib. to Sugar Run	Hershberger Landfill	-	Unknown
04/30/90	Sugar Run	Champaigne Landmark	-	Unknown

Table 9. Summary of wildlife kills and water pollution investigations for Sugar Run between 1990 and 1995, as reported by the Ohio DNR, Division of Wildlife.

Date	Stream	County	Number Reported Killed	Cause
07/21/93	Sugar Run	Union	1884	Fertilizer waste

References

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Appendix Table 1. Raw macroinvertebrate data by river mile for Sugar Run, 1995.

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/13/95 River Code:02-206 River: Sugar Run

RM: 7.90

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03600	<i>Oligochaeta</i>	0 +			
04935	<i>Erpobdella punctata punctata</i>	0 +			
28810	<i>Pantala flavescens</i>	0 +			
42700	<i>Belostoma sp</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
95100	<i>Physella sp</i>	0 +			
96200	<i>Planorbella sp</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 10
 No. Qualitative Taxa: 10 ICI:
 Number of Organisms: 0 Qual EPT:

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/13/95 River Code: 02-206 River: Sugar Run

RM: 7.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03600	<i>Oligochaeta</i>	0 +			
04964	<i>Mooreobdella microstoma</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
45501	<i>Notonectidae</i>	0 +			
60800	<i>Haliphus sp</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
62800	<i>Dytiscus sp</i>	0 +			
63900	<i>Laccophilus sp</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
80510	<i>Cricotopus (Isocladius) sylvestris group</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
95100	<i>Physella sp</i>	0 +			
95501	<i>Planorbidae</i>	0 +			
98600	<i>Sphaerium sp</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 18
 No. Qualitative Taxa: 18 ICI:
 Number of Organisms: 0 Qual EPT:

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/13/95 River Code: 02-206 River: Sugar Run

RM: 7.00

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03360	<i>Plumatella sp</i>	0 +			
03600	<i>Oligochaeta</i>	0 +			
04664	<i>Helobdella stagnalis</i>	0 +			
04964	<i>Mooreobdella microstoma</i>	0 +			
28810	<i>Pantala flavescens</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
65800	<i>Berosus sp</i>	0 +			
66500	<i>Enochrus sp</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
83300	<i>Glyptotendipes (Phytotendipes) sp</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
86200	<i>Tabanus sp</i>	0 +			
87540	<i>Hemerodromia sp</i>	0 +			
95100	<i>Physella sp</i>	0 +			
95501	<i>Planorbidae</i>	0 +			
98600	<i>Sphaerium sp</i>	0 +			

No. Quantitative Taxa: 0 Total Taxa: 24

No. Qualitative Taxa: 24 ICI:

Number of Organisms: 0 Qual EPT:

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/12/95 River Code: 02-206 River: Sugar Run

RM: 5.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
03600	<i>Oligochaeta</i>	0 +			
05800	<i>Caecidotea sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
28810	<i>Pantala flavescens</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
67700	<i>Paracymus sp</i>	0 +			
67800	<i>Tropisternus sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77140	<i>Ablabesmyia peleensis</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
95100	<i>Physella sp</i>	0 +			
97601	<i>Corbicula fluminea</i>	0 +			
98600	<i>Sphaerium sp</i>	0 +			

No. Quantitative Taxa: 0	Total Taxa: 16
No. Qualitative Taxa: 16	ICI:
Number of Organisms: 0	Qual EPT:

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/12/95 River Code: 02-206 River: Sugar Run

RM: 2.80

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +			
03600	<i>Oligochaeta</i>	0 +	No. Quantitative Taxa:	0	Total Taxa: 37
04685	<i>Placobdella ornata</i>	0 +	No. Qualitative Taxa:	37	ICI:
04935	<i>Erpobdella punctata punctata</i>	0 +	Number of Organisms:	0	Qual EPT:
05800	<i>Caecidotea sp</i>	0 +			
06700	<i>Crangonyx sp</i>	0 +			
08250	<i>Orconectes (Procericambarus) rusticus</i>	0 +			
11120	<i>Baetis flavistriga</i>	0 +			
11130	<i>Baetis intercalaris</i>	0 +			
13400	<i>Stenacron sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
27500	<i>Somatochlora sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
45900	<i>Notonecta sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
50315	<i>Chimarra obscura</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
67000	<i>Helophorus sp</i>	0 +			
68708	<i>Dubiraphia vittata group</i>	0 +			
68901	<i>Macronychus glabratus</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
80420	<i>Cricotopus (C.) bicinctus</i>	0 +			
82141	<i>Thienemanniella xena</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
84210	<i>Paratendipes albimanus or P. duplicatus</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			
84470	<i>Polypedilum (P.) illinoense</i>	0 +			
84750	<i>Stictochironomus sp</i>	0 +			
85625	<i>Rheotanytarsus exiguus group</i>	0 +			
87540	<i>Hemerodromia sp</i>	0 +			
95100	<i>Physella sp</i>	0 +			
96900	<i>Ferrissia sp</i>	0 +			
97601	<i>Corbicula fluminea</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/12/95 River Code: 02-206 River: Sugar Run

RM: 0.50

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
03600	<i>Oligochaeta</i>	0 +	84460	<i>Polypedilum (P.) fallax group</i>	0 +
04685	<i>Placobdella ornata</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
05800	<i>Caecidotea sp</i>	0 +	84750	<i>Stictochironomus sp</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	85500	<i>Paratanytarsus sp</i>	0 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	0 +
11020	<i>Acerpenna pygmaeus</i>	0 +	87540	<i>Hemerodromia sp</i>	0 +
11120	<i>Baetis flavistriga</i>	0 +	93900	<i>Elimia sp</i>	0 +
11130	<i>Baetis intercalaris</i>	0 +	95100	<i>Physella sp</i>	0 +
11200	<i>Callibaetis sp</i>	0 +	96900	<i>Ferrissia sp</i>	0 +
11651	<i>Procloeon sp (w/o hindwing pads)</i>	0 +	98600	<i>Sphaerium sp</i>	0 +
13000	<i>Leucrocuta sp</i>	0 +			
13400	<i>Stenacron sp</i>	0 +	No. Quantitative Taxa:	0	Total Taxa: 51
13570	<i>Stenonema terminatum</i>	0 +	No. Qualitative Taxa:	51	ICI:
17200	<i>Caenis sp</i>	0 +	Number of Organisms:	0	Qual EPT:
18700	<i>Hexagenia sp</i>	0 +			
22001	<i>Coenagrionidae</i>	0 +			
23909	<i>Boyeria vinosa</i>	0 +			
28955	<i>Libellula lydia</i>	0 +			
42700	<i>Belostoma sp</i>	0 +			
43300	<i>Ranatra sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
50315	<i>Chimarra obscura</i>	0 +			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
53800	<i>Hydroptila sp</i>	0 +			
60400	<i>Gyrinus sp</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
63300	<i>Hydroporus sp</i>	0 +			
69400	<i>Stenelmis sp</i>	0 +			
72700	<i>Anopheles sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	0 +			
77500	<i>Conchapelopia sp</i>	0 +			
77800	<i>Helopelopia sp</i>	0 +			
80740	<i>Eukiefferiella claripennis group</i>	0 +			
81270	<i>Nanocladius (N.) spinipennis</i>	0 +			
82141	<i>Thienemanniella xena</i>	0 +			
82820	<i>Cryptochironomus sp</i>	0 +			
84450	<i>Polypedilum (P.) convictum</i>	0 +			

Appendix Table 2. IBI scores and metric values for fish sampling locations in Sugar Run, 1995.

IBI scores and IBI metric values for sites sampled on Sugar Run, 1995

River Mile	Type	Date	Drainage area (sq mi)	Number of						Percent of Individuals					Rel.No. minus tolerants /(0.3km)	IBI
				Total species	Minnow species	Headwater species	Sensitive species	Darter & Sculpin species	Simple Lithophils	Tolerant fishes	Omnivores	Pioneering fishes	Insectivores	DELT anomalies		
Sugar Run - (02-206)																
Year: 95																
7.90	E	10/12/95	3.9	9(3)	3(3)	0(1)	0(1)	0(1)	0(1)	63(1)	15(1)	56(1)	60(3)	0.0(5)	30(1)*	22
7.90	E	09/13/95	3.9	5(1)	2(1)	0(1)	0(1)	0(1)	0(1)	98(1)	7(1)	71(1)	41(3)	0.0(5)	2(1)*	18
7.70	E	10/12/95	4.3	4(1)	1(1)	0(1)	0(1)	0(1)	0(1)	31(1)	3(3)	27(3)	89(5)	0.0(5)	96(1)*	24
7.70	E	09/13/95	4.3	7(3)	2(1)	0(1)	0(1)	0(1)	0(1)	91(1)	3(1)	67(1)	55(3)	0.0(5)	12(1)*	20
7.00	E	10/12/95	9.5	12(3)	6(3)	0(1)	0(1)	0(1)	2(1)	80(1)	23(3)	73(1)	51(5)	0.5(3)	65(1)	24
7.00	E	09/13/95	9.5	11(3)	5(3)	0(1)	0(1)	0(1)	2(1)	88(1)	8(5)	83(1)	36(3)	0.4(3)	48(1)	24
5.40	E	09/14/95	11.0	3(1)	0(1)	0(1)	0(1)	0(1)	0(1)	87(1)	6(1)	79(1)	87(1)	0.0(5)	13(1)*	16
5.40	E	10/12/95	11.0	3(1)	1(1)	0(1)	0(1)	0(1)	0(1)	100(1)	11(1)	93(1)	89(1)	0.0(5)	0(1)*	16
2.80	E	10/12/95	13.6	12(3)	4(3)	0(1)	2(1)	3(3)	5(3)	70(1)	26(3)	77(1)	32(3)	0.5(3)	83(1)	26
2.80	E	09/13/95	13.6	15(3)	4(3)	0(1)	3(3)	3(3)	5(3)	75(1)	24(3)	74(1)	37(3)	0.6(3)	59(1)	28
0.50	E	10/12/95	19.4	21(5)	5(3)	1(1)	6(3)	7(5)	11(5)	38(3)	12(5)	43(3)	80(5)	0.6(3)	167(1)	42
0.50	E	09/13/95	19.4	20(5)	5(3)	0(1)	6(3)	5(5)	9(5)	52(3)	26(3)	51(3)	60(5)	0.9(3)	170(1)	40

Appendix Table 3. Relative numbers of fish and species collected in Sugar Run, 1995.

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 7.90	Basin: Scioto River	Date Range: 09/13/95
Data Source: 01	Time Fished: 3013 sec Drain Area: 3.9 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.36 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GRASS PICKEREL (C)		P	M	P	1	0.83	1.11			
COMMON CARP (C)	G	O	M	T	3	2.50	3.33			
CREEK CHUB (C)	N	G	N	T	32	26.67	35.56			
FATHEAD MINNOW (C)	N	O	C	T	6	5.00	6.67			
BLUNTNOSE MINNOW (C)	N	O	C	T	1	0.83	1.11			
YELLOW BULLHEAD (C)		I	C	T	11	9.17	12.22			
BL'KSTRIPE TOPMINNOW (C)		I	M		2	1.67	2.22			
GREEN SUNFISH (C)	S	I	C	T	18	15.00	20.00			
BLUEGILL SUNFISH (C)	S	I	C	P	14	11.67	15.56			
PUMPKINSEED SUNFISH (C)	S	I	C	P	1	0.83	1.11			
GREEN SF X BLUEGILL (C)					1	0.83	1.11			
		<i>Mile Total</i>			90	75.00				
		<i>Number of Species</i>			10					
		<i>Number of Hybrids</i>			1					

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 7.70	Basin: Scioto River	Date Range: 09/13/95
Data Source: 01	Time Fished: 3932 sec Drain Area: 4.3 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.34 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
COMMON CARP (C)	G	O	M	T	2	1.88	1.42			
CREEK CHUB (C)	N	G	N	T	36	30.63	23.22			
BLUNTNOSE MINNOW (C)	N	O	C	T	2	1.67	1.26			
YELLOW BULLHEAD (C)		I	C	T	19	15.94	12.09			
BLACK BULLHEAD (C)		I	C	P	1	0.83	0.63			
LARGEMOUTH BASS (B)	F	C	C		2	1.67	1.26			
GREEN SUNFISH (C)	S	I	C	T	32	28.13	21.33			
BLUEGILL SUNFISH (C)	S	I	C	P	55	51.15	38.78			
<i>Mile Total</i>					149	131.88				
<i>Number of Species</i>					8					
<i>Number of Hybrids</i>					0					

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 7.00	Basin: Scioto River	Date Range: 09/13/95
Data Source: 01	Time Fished: 4898 sec Drain Area: 9.5 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
SPOTTED SUCKER (C)	R	I	S		2	1.50	0.41			
COMMON CARP (C)	G	O	M	T	10	7.50	2.06			
GOLDEN SHINER (C)	N	I	M	T	9	6.75	1.85			
CREEK CHUB (C)	N	G	N	T	195	146.25	40.12			
STRIPED SHINER (C)	N	I	S		15	11.25	3.09			
FATHEAD MINNOW (C)	N	O	C	T	3	2.25	0.62			
BLUNTNOSE MINNOW (C)	N	O	C	T	57	42.75	11.73			
CENTRAL STONEROLLER (C)	N	H	N		7	5.25	1.44			
YELLOW BULLHEAD (C)		I	C	T	12	9.00	2.47			
BLACK BULLHEAD (C)		I	C	P	7	5.25	1.44			
BL'KSTRIPE TOPMINNOW (C)		I	M		4	3.00	0.82			
LARGEMOUTH BASS (B)	F	C	C		2	1.50	0.41			
GREEN SUNFISH (C)	S	I	C	T	125	93.75	25.72			
BLUEGILL SUNFISH (C)	S	I	C	P	33	24.75	6.79			
GREEN SF X BLUEGILL (C)					5	3.75	1.03			
	<i>Mile Total</i>				486	364.50				
	<i>Number of Species</i>				14					
	<i>Number of Hybrids</i>				1					

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 5.40	Basin: Scioto River	Date Range: 09/14/95
Data Source: 01	Time Fished: 3268 sec Drain Area: 11.0 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.32 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
COMMON CARP (C)	G	O	M	T	3	2.81	3.75			
BLUNTNOSE MINNOW (C)	N	O	C	T	3	2.81	3.75			
YELLOW BULLHEAD (C)		I	C	T	3	2.81	3.75			
GREEN SUNFISH (C)	S	I	C	T	64	60.00	80.00			
BLUEGILL SUNFISH (C)	S	I	C	P	3	2.81	3.75			
GREEN SF X BLUEGILL (C)					4	3.75	5.00			
	<i>Mile Total</i>				80	75.00				
	<i>Number of Species</i>				5					
	<i>Number of Hybrids</i>				1					

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 2.80	Basin: Scioto River	Date Range: 09/13/95
Data Source: 01	Time Fished: 4331 sec Drain Area: 13.6 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GRASS PICKEREL (A)		P	M	P	13	9.75	3.82			
GRASS PICKEREL (B)		P	M	P	4	3.00	1.18			
NORTHERN HOG SUCKER (C)	R	I	S	M	4	3.00	1.18			
WHITE SUCKER (C)	W	O	S	T	30	22.50	8.82			
GOLDEN SHINER (C)	N	I	M	T	2	1.50	0.59			
CREEK CHUB (C)	N	G	N	T	117	87.75	34.41			
STRIPED SHINER (C)	N	I	S		8	6.00	2.35			
BLUNTNOSE MINNOW (C)	N	O	C	T	55	41.25	16.18			
CENTRAL STONEROLLER (C)	N	H	N		4	3.00	1.18			
YELLOW BULLHEAD (C)		I	C	T	1	0.75	0.29			
BL'KSTRIPE TOPMINNOW (C)		I	M		1	0.75	0.29			
LARGEMOUTH BASS (B)	F	C	C		2	1.50	0.59			
GREEN SUNFISH (C)	S	I	C	T	41	30.75	12.06			
BLUEGILL SUNFISH (C)	S	I	C	P	1	0.75	0.29			
LONGEAR SUNFISH (C)	S	I	C	M	1	0.75	0.29			
JOHNNY DARTER (C)	D	I	C		37	27.75	10.88			
RAINBOW DARTER (C)	D	I	S	M	12	9.00	3.53			
ORANGETHROAT DARTER (C)	D	I	S		7	5.25	2.06			
<i>Mile Total</i>					340	255.00				
<i>Number of Species</i>					17					
<i>Number of Hybrids</i>					0					

Species List

River Code: 02-206	Stream: Sugar Run	Sample Date: 1995
River Mile: 0.50	Basin: Scioto River	Date Range: 09/13/95
Data Source: 01	Time Fished: 4976 sec Drain Area: 19.4 sq mi	Thru: 10/12/95
Purpose:	Dist Fished: 0.40 km No of Passes: 2	Sampler Type: E

Species Name / Stage / ODNR Status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GRASS PICKEREL (A)		P	M	P	2	1.50	0.48			
GRASS PICKEREL (B)		P	M	P	1	0.75	0.24			
GRASS PICKEREL (C)		P	M	P	8	6.00	1.94			
GOLDEN REDHORSE (C)	R	I	S	M	8	6.00	1.94			
NORTHERN HOG SUCKER (C)	R	I	S	M	26	19.50	6.30			
WHITE SUCKER (C)	W	O	S	T	11	8.25	2.66			
SPOTTED SUCKER (C)	R	I	S		1	0.75	0.24			
COMMON CARP (C)	G	O	M	T	3	2.25	0.73			
CREEK CHUB (C)	N	G	N	T	14	10.50	3.39			
SILVER SHINER (C)	N	I	S	I	2	1.50	0.48			
STRIPED SHINER (C)	N	I	S		29	21.75	7.02			
BLUNTNOSE MINNOW (C)	N	O	C	T	69	51.75	16.71			
CENTRAL STONEROLLER (C)	N	H	N		12	9.00	2.91			
YELLOW BULLHEAD (C)		I	C	T	4	3.00	0.97			
BL'KSTRIPE TOPMINNOW (C)		I	M		4	3.00	0.97			
ROCK BASS (B)	S	C	C		1	0.75	0.24			
LARGEMOUTH BASS (A)	F	C	C		4	3.00	0.97			
LARGEMOUTH BASS (B)	F	C	C		4	3.00	0.97			
GREEN SUNFISH (C)	S	I	C	T	88	66.00	21.31			
BLUEGILL SUNFISH (C)	S	I	C	P	19	14.25	4.60			
GREEN SF X BLUEGILL (C)					2	1.50	0.48			
BLACKSIDE DARTER (C)	D	I	S		2	1.50	0.48			
LOGPERCH (C)	D	I	S	M	6	4.50	1.45			
JOHNNY DARTER (C)	D	I	C		19	14.25	4.60			
GREENSIDE DARTER (C)	D	I	S	M	9	6.75	2.18			
RAINBOW DARTER (C)	D	I	S	M	58	43.50	14.04			
ORANGETHROAT DARTER (C)	D	I	S		6	4.50	1.45			
FANTAIL DARTER (C)	D	I	C		1	0.75	0.24			
<i>Mile Total</i>					413	309.75				
<i>Number of Species</i>					24					
<i>Number of Hybrids</i>					1					