

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
SURFACE WATER QUALITY DIVISION
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STAFF REPORT

BIOLOGICAL ASSESSMENT OF HICKORY CREEK
BERRIEN COUNTY
AUGUST 6, 1996

Staff of the Great Lakes Environmental Assessment Section (GLEAS) conducted qualitative biological sampling of Hickory Creek on August 6, 1996. This study was performed to evaluate the general water quality of Hickory Creek and the discharge from Allied Signaw-Bendix, a brake manufacturer in Glen Lord. Sampling was conducted following methods described in GLEAS Procedure #51 (MDEQ, 1997).

Hickory Creek originates in central Berrien County, near Hills Corner, and flows through Baroda into the St. Joseph River west of Fair Plain. The creek is approximately 15 miles in length and is located in the Southern Michigan Northern Indiana Till Plains ecoregion (Omernik and Gallant, 1988). Headwaters of Hickory Creek are both lake habitat and agricultural ditches. Land use in the first half of the creek is predominately agriculture while residential areas dominate the remainder of the stream.

Two stations were sampled. The upstream station (H-1) was located south of Stevensville on Baroda Avenue. The downstream station (H-2) was on Maiden Lane north of Glen Lord, just downstream of the Allied Signaw-Bendix outfall. Stations H-1 and H-2 were approximately five river miles apart (Figure 1).

SUMMARY

1. Locations of the biological sampling stations on Hickory Creek for the August 6, 1996 survey are shown in Figure 1.
2. The results of the fish sampling are provided in Table 1. More than 1% of the fish communities at both stations were salmonids; thereby Hickory Creek meets its designated use as coldwater stream.
3. Multi-metric evaluations of macroinvertebrate communities are provided in Table 2. Macroinvertebrates scores were fair at both stations.
4. Habitat information is summarized in Table 3. Habitat was rated moderately impaired at H-1 and good at H-2.
5. Water chemistry data were collected at both stations. All water chemistry results for Hickory Creek met water quality standards (Table 4).
6. Sediment data were collected at both stations (Table 5). All sediment results at H-2, the downstream station, were below reference sediment data. Elevated levels of arsenic, barium, manganese, and vanadium were found in sediments at H-1.
7. Allied Signaw-Bendix had no apparent impact on the water quality of Hickory Creek.

BIOLOGICAL SAMPLING RESULTS

Fish. The fish community at station H-1 was dominated by mottled sculpin, *Cottus bairdi* (59% of total number of fish sampled). This reach had an average width of 18 feet and a surface velocity of 1 cubic feet per second (cfs). In H-2, the fish community was more evenly distributed, with mottled sculpin and white sucker, *Castostomus commersoni*, comprising 26.9% and 16.7% of the total number of fish, respectively. This reach had an average width of 32 feet and a surface velocity of 1 cfs. Sunfish were found at both stations, which was expected since some headwaters originate from lakes. The salmonid composition at both stations was 2.1% and 6.4%, respectively, thereby meeting designated use as a coldwater stream.

Macroinvertebrates. Macroinvertebrate communities rated fair at both stations. The banks and bend areas provided a large amount of the available habitat. Many taxa found were associated with erosional and depositional areas, such as Hemiptera and Odonata. Surface dependent taxa were also identified. Simuliidae comprised 16% of the macroinvertebrate community sampled at H-2. Although habitat was limited in riffle areas, the available substrate supported Elmidae, Hydropsychidae, and Heptageniidae.

Habitat. Habitat quality rated fair (moderately impaired) at H-1 and good (slightly impaired) at H-2. At both stations, available substrate was limited, embedded and covered with silt. The channel appeared historically ditched, so habitat was provided primarily by bends or occasional riffles, although undercut banks were present at H-1. Flows were facilitated by a point source discharge at H-2. The banks at both stations were stable and covered with vegetation.

Water chemistry values at both stations met water quality standards. Sediment data at H-1, however, revealed elevated levels of arsenic, barium, manganese, and vanadium. According to sediment quality guidelines by MacDonald et al., 2000, arsenic concentrations at H-1 were above the threshold effect level (*i.e.*, a level below which harmful effects are unlikely to occur) but lower than the probable effect level (*i.e.*, a level above which harmful effects will likely occur); concentrations of barium, manganese, and vanadium were elevated compared to reference site sediment chemistry (Gerard, 1999).

DISCUSSION

The Hickory Creek survey showed moderate levels of degradation at both upstream and downstream stations. The stream is relatively straight and runs along city streets, so periodic high flows from channelization and surrounding impervious substrates may limit stable habitat. All water chemistry results were below levels of concern compared to water quality standards. The point source, Allied Signaw-Bendix, had no apparent impact on the water quality of Hickory Creek.

REFERENCES

- Gerard, K. 1999. Reference site sediment chemistry report for wadable streams, 1994, 1997, and 1998. Michigan Department of Environmental Quality, Surface Water Quality Division, Lansing, Michigan, MI/DEQ/SWQ-99/060.
- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation on consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31.

MDEQ. 1997. Qualitative biological and habitat survey protocols for wadable streams and rivers. GLEAS Procedure Number 51. Michigan Department of Environmental Quality, Surface Water Quality Division, Lansing, Michigan.

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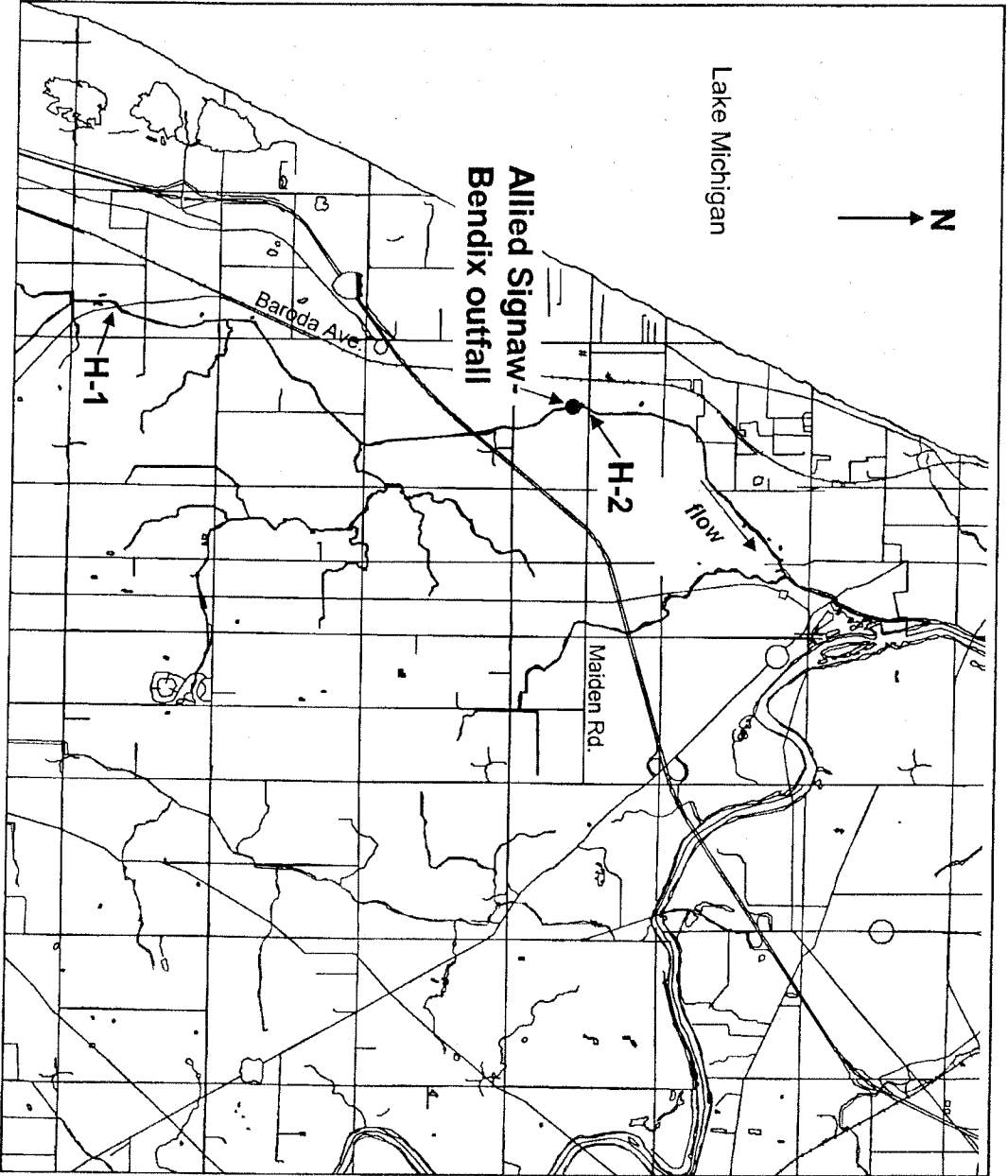


Figure 1. Station locations on Hickory Creek, August 6, 1996.

Table 1A. Qualitative fish sampling results for Hickory Creek, August 6, 1996.

Taxa	STATION 1		STATION 2	
	Hickory Ck Baroda Road		Hickory Ck Maiden Road	
Salmonidae (trouts)				
<i>Oncorhynchus mykiss</i> (Rainbow tr.)	1		4	
<i>Salmo trutta</i> (Brown trout)	1		1	
Umbridae (mudminnows)				
<i>Umbra limi</i> (Central mudminnow)	2		1	
Esocidae (pikes)				
<i>Esox americanus</i> (Grass Pike)	1			
Cyprinidae (minnows and carps)				
<i>Cyprinus carpio</i> (Carp)				1
<i>Cyprinella spilopterus</i> (Spotfin sh.)				10
<i>Pimephales notatus</i> (Bluntnose m.)				3
Cottidae (sculpins)				
<i>Cottus bairdii</i> (Mottled sculpin)	57		21	
Catostomidae (suckers)				
<i>Catostomus commersoni</i> (W. sucker)	13		13	
Ictaluridae (Bullhead, Catfish)				
<i>Ameiurus melas</i> (Black bullhead)	1			
Centrarchidae (sunfish)				
<i>Ambloplites rupestris</i> (Rock bass)				4
<i>Lepomis cyanellus</i> (Green sunfish)	2			9
<i>Lepomis gibbosus</i> (Pumpkinseed)				2
<i>Lepomis macrochirus</i> (Bluegill)	6			1
<i>Micropterus dolomieu</i> (Sm. bass)				2
Percidae (perch)				
<i>Etheostoma caeruleum</i> (Rainbow d.)	10			5
<i>Etheostoma nigrum</i> (Johnny darter)	1			
<i>Percina caprodes</i> (Logperch)	1			
<i>Percina maculata</i> (Blackside darter)				1
TOTAL INDIVIDUALS	96		78	
Number of hybrid sunfish	0		0	
Number of anomalies	0		0	
Percent anomalies	0.000		0.000	
Percent salmonids	2.083		6.410	
Reach sampled (ft)	450		410	
Area sampled (sq ft)	8,100		13,120	
Density (# fish/sq ft)	0.012		0.006	
Gear				

Table 1B. Fish metric evaluation of Hickory Creek, August 6, 1996.

METRIC	STATION 1		STATION 2	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	13		16	
NO. OF DARTER, SCULPIN, MADTOM TAXA	4		3	
NUMBER OF SUNFISH TAXA	2		4	
NUMBER OF SUCKER TAXA	1		1	
NUMBER OF INTOLERANT TAXA	4		6	
PERCENT TOLERANT	18.75		34.62	
PERCENT OMNIVOROUS TAXA	16.67		23.08	
PERCENT INSECTIVOROUS TAXA	80.21		62.82	
PERCENT PISCIVOROUS TAXA	1.04		7.69	
% SIMPLE LITHOPHILIC SPAWNER TAXA	25.00		24.36	

Table 2A. Qualitative macroinvertebrate sampling results for Hickory Creek, August 8, 1996.

TAXA	STATION H-1 Hickory Creek Baroda Rd.	STATION H-2 Hickory Creek Maiden Rd.
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	25	12
Decapoda (crayfish)	8	8
Isopoda (sowbugs)	1	30
Insecta		
Ephemeroptera (mayflies)		
Baetidae	8	6
Caenidae	1	
Heptageniidae	8	1
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	2	3
Zygoptera (damselflies)		
Calopterygidae	5	10
Hemiptera (true bugs)		
Corixidae	2	2
Gerridae	3	2
Pleidae		3
Megaloptera		
Sialidae (alder flies)	1	
Trichoptera (caddisflies)		
Hydropsychidae	10	5
Limnephilidae	2	
Coleoptera (beetles)		
Gyrinidae (larvae)		2
Hydrophilidae (total)	3	
Elmidae	8	4
Diptera (flies)		
Chironomidae	20	18
Simuliidae	6	20
Tipulidae	1	
TOTAL INDIVIDUALS	116	126

Table 2B. Macroinvertebrate metric evaluation of Hickory Creek, August 8, 1996.

METRIC	STATION H-1 Hickory Creek		STATION H-2 Hickory Creek	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	19	0	15	0
NUMBER OF MAYFLY TAXA	3	0	2	0
NUMBER OF CADDISFLY TAXA	2	0	1	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	14.66	0	5.56	0
PERCENT CADDISFLY COMP.	10.34	0	3.97	-1
PERCENT CONTR. DOM. TAXON	21.55	0	23.81	0
PERCENT ISOPOD, SNAIL, LEECH	2.59	1	23.81	-1
PERCENT SURF. AIR BREATHERS	6.90	1	7.14	0
TOTAL SCORE		1		-4
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.

Table 3. Habitat evaluation for Hickory Creek, Berrien County, August 6, 1996.

HABITAT METRIC	H-1 Stevensville Rd	H-2 Maiden Rd
Bottom Substrate		
Avail. Cover (20):	7	10
Embeddedness (20):	5	7
Velocity:Depth (20):	10	10
Flow Stability (15):	9	9
Bottom Depos. (15):	4	6
Pools-Riffles- Runs-Bends (15):	7	7
Bank Stability (10):	7	9
Bank Vegetative Stability (10):	8	9
Stream Cover (10):	8	9
TOTAL SCORE (135)	65	76
HABITAT CONDITION CATEGORY	FAIR (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Date:	8/6/96	8/6/96
Stream Type:	Coldwater	Coldwater
Weather:	Sunny	Sunny
Ecoregion:	SMNITP	SMNITP
Air Temperature:	80 Deg. F.	80 Deg. F.
Water Temperature:	66 Deg. F.	68 Deg. F.
Ave. Stream Width:	18 Feet	32 Feet
Ave. Stream Depth:	0.83 Feet	0.83 Feet
Surface Velocity:	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	14.94 CFS	26.56 CFS
Stream Modifications:		
Nuisance Plants (Y/N):	N	N
Basin Code:		
Report Number:		
COMMENTS:		

Table 4. Water chemistry data for Hickory Creek, August 6, 1998.

Parameter	H-1	outfall	H-2	Units
Alkalinity	268	110	233	mg CaCO ₃ /L
Carbonate Alkalinity	<0.5	<0.5	<0.5	mg CaCO ₃ /L
Bicarbonate Alkalinity	268	110	233	mg CaCO ₃ /L
pH	8.12	8.18	8.19	s.u.
Hardness	320	141	285	mg/L
Conductivity	627	341	613	umho/cm
Nitrite	0.013	0.001	0.008	mg N/L
Nitrate + Nitrite	0.66	0.33	0.65	mg N/L
Ammonia	0.021	0.001	0.018	mg N/L
Kjeldahl Nitrogen	0.45	0.15	0.35	mg N/L
Ortho Phosphate	0.007	0.003	0.023	mg P/L
Total Phosphorus	0.041	0.007	0.049	mg P/L
Suspended Solids	11	<4	15	mg/L
Total Dissolved Solids	440	196	400	mg/L
Chemical Oxygen Demand	13	<5	10	mg/L
Total Organic Carbon	4.4	2	3.8	mg/L
Chloride	19	15	23	mg/L
Sulfate	58	28	51	mg/L
Arsenic	2.3	<1	1.5	ug/L
Barium	104	76	79	ug/L
Calcium	75.3	36	67.3	ug/L
Cadmium	<0.2	<0.2	<0.2	ug/L
Hexavalent Chromium	<5	<5	<5	ug/L
Chromium	<1	<1	<1	ug/L
Copper	<1	1.9	1.1	ug/L
Lead	<1	1.1	1	ug/L
Magnesium	32.5	12.3	28.7	mg/L
Mercury	<0.2	<0.2	<0.2	ug/L
Selenium	<1	<1	<1	ug/L
Silver	<0.5	<0.5	<0.5	ug/L
Zinc	<4	8	<4.0	ug/L

Table 5. Sediment data for Hickory Creek, August 6, 1998. All data for organics were less than levels of quantification.

Parameter	H-1	H-2	Units
Arsenic	14	6.5	mg/kg (dry)
Barium	119	55	mg/kg (dry)
Beryllium	0.37	0.22	mg/kg (dry)
Calcium	29000	13000	mg/kg (dry)
Cadmium	<2	<2	mg/kg (dry)
Chromium	11	10	mg/kg (dry)
Cobalt	5	<5	mg/kg (dry)
Copper	14	11	mg/kg (dry)
Iron	24500	12100	mg/kg (dry)
Lead	15	11	mg/kg (dry)
Lithium	8	4	mg/kg (dry)
Magnesium	11800	4900	mg/kg (dry)
Manganese	1500	500	mg/kg (dry)
Mercury	<0.1	<0.05	mg/kg (dry)
Molybdenum	<5	<5	mg/kg (dry)
Nickel	11	6.5	mg/kg (dry)
Potassium	695	370	mg/kg (dry)
Selenium	<0.5	<0.5	mg/kg (dry)
Silver	<0.25	0.3	mg/kg (dry)
Sodium	150	170	mg/kg (dry)
Strontium	40	18	mg/kg (dry)
Thalium	<1	<1	mg/kg (dry)
Titanium	56	52	mg/kg (dry)
Vanadium	17	9	mg/kg (dry)
Zinc	<4	<4.0	mg/kg (dry)
Total Inorganic Solids	33.7	59	%TS