

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
WATER RESOURCES DIVISION  
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STAFF REPORT

BIOLOGICAL AND WATER CHEMISTRY SURVEYS OF SELECTED STATIONS IN THE  
RUDDIMAN CREEK WATERSHED  
MUSKEGON COUNTY, MICHIGAN  
JUNE 2009

## **Introduction**

Biological, chemical, and physical habitat conditions of Ruddiman Creek in Muskegon County were assessed by staff of the Surface Water Assessment Section (SWAS) in June 2009. The primary objective of the assessment was to assess the current status and condition of Ruddiman Creek and determine if Michigan Water Quality Standards (WQS) are being met.

Water chemistry samples were collected and preserved from three stations (Table 1, Figure 1) according to the Michigan Department of Environmental Quality (MDEQ) protocol (MDEQ, 1994). The macroinvertebrate community and physical habitat were qualitatively assessed at two stations, using the SWAS Procedure 51 (MDEQ, 1990; Creal et al., 1996) for wadeable streams. The macroinvertebrate communities were assessed and scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered tending towards a poor rating, while positive scores in the acceptable range are tending towards an excellent rating. Habitat evaluations are based on 10 metrics, with a possible maximum total score of 200. A station habitat score of >154 is characterized as having excellent habitat, 105-154 is good, 56-104 is marginal, and <56 is poor.

## **Watershed Information**

Ruddiman Creek is located near the city of Muskegon on the west side of the lower peninsula of Michigan and is a tributary to Muskegon Lake. The watershed covers approximately 6.5 square miles. The Ruddiman Creek watershed lies within four municipalities; the city of Muskegon, Muskegon Heights, Roosevelt Park, and Norton Shores. The Ruddiman Creek watershed is highly urbanized (i.e., predominantly residential, industrial, and commercial land use) and stream flow is greatly impacted by storm water runoff. Sixty percent of the headwater area has been modified and flows below ground as part of the storm sewer system. Only about three percent of the entire watershed drains naturally to the creek without entering storm sewers (NOAA, 2008). The above-ground portion of Ruddiman Creek begins as a storm sewer outfall, just upstream of Barclay Avenue (Figure 1).

Historic timber harvest, industrialization, channelization, storm water and wastewater discharges, improper hazardous waste disposal, and contaminated groundwater inputs have impacted Ruddiman Creek. Between 2005 and 2006, Ruddiman Pond and seven sections of the main branch of Ruddiman Creek were dredged by removing 68,710 cubic meters of contaminated sediments. Limited hydrologic improvements were installed following dredging, including a storm water retention basin and channel braiding at two dredged sites.

The watershed is primarily within the Southern Lake Michigan Lake Plain ecosystem type, which is characterized by lacustrine clay and silt soils, and historically, white oak-white pine forest (Albert, 1995). Ruddiman Creek is designated as a warmwater stream.

### **Historical Sampling Efforts and Section 303(d) Listing Information**

Prior to 2009, Ruddiman Creek was surveyed in 1988 and 1989 (Wuycheck, 1990). In 1988, the macroinvertebrate community in Ruddiman Creek was qualitatively sampled at Barclay Street and Glenside Boulevard. In 1989, the macroinvertebrate community was qualitatively sampled in the unnamed tributary of Ruddiman Creek that flows from the southwest (West Branch) at McGraft Park Drive. Sediment samples were also collected at each of the above stations and at one additional station in the West Branch at Sherman Avenue. Several metals were found at elevated concentrations. The macroinvertebrate communities indicated severely degraded stream quality; however, Procedure 51 was not yet developed, so the streams were not rated. The 1990 report indicates that Ruddiman Creek failed to support the aquatic life and fish designated warmwater uses due to deep deposits of fine particulate, inorganic materials that eliminated habitat for biota, and that the sources of the solids were runoff from the highly urbanized and industrialized areas upstream of the drainage area.

The main branch of Ruddiman Creek is listed on the 2010 Michigan Section 303(d) list as not attaining the other indigenous aquatic life and wildlife, warmwater fisheries, fish consumption, and total and partial body contact designated uses (LeSage and Smith, 2010 draft). The wetland/pond portion is listed on the Section 303(d) list as not attaining the fish consumption designated use, but is listed as not assessed on the Section 305(b) list for the other designated uses. In the 2012 Michigan Section 303(d) list, the entire watershed will be listed as not meeting the total and partial body contact designated uses. A Total Maximum Daily Load (TMDL) for *E. coli* has been written and approved by the United States Environmental Protection Agency to address the total and partial body contact designated use nonattainment. Currently, a biota TMDL for the main branch of Ruddiman Creek is scheduled for development in 2013. The AUID numbers that correspond to Ruddiman Creek are noted in Table 2.

### **2009 Sampling Results**

The macroinvertebrate community, fish community, and habitat was surveyed upstream of Glenside Boulevard (Station 1; Figure 1). The glide/pool habitat scored marginal (95; moderately-impaired) (Table 3a). Epifaunal substrate was lacking and consisted of all sand and silt. Heavy deposits forming sandbars was evidence of sedimentation. The stream channel is fairly straight through this section as a result of historic channelization. The riparian area consisted of a wide flood plain and mix of shrubs and herbaceous plants, but there was a large amount of nonnative plants. Woody debris was minimal, and there was an extensive amount of trash in the stream. There were obvious signs of extreme fluctuations of flow at this station, including a large amount of trash caught in branches high above the water surface. The macroinvertebrate community scored at the very low end of acceptable (-4) and was only 1 point away from scoring poor (Tables 3b and 3c). Nearly 400 feet of stream (from Glenside Avenue upstream to Barclay Street) was sampled for more than 45 minutes, and only 33 fish (8 taxa) were found. This resulted in a poor fish community rating (Tables 3d and 3e). There was a whitish coloration to the water at the time of sampling and a slight petroleum smell to the water and sediment in spots. No sediment samples were taken.

The macroinvertebrate community and habitat was surveyed downstream of Barclay Street (Station 2; Figure 1). The riffle/run habitat scored at the low end of good (105; slightly impaired) (Table 3a). This score is 1 point from scoring marginal. Epifaunal substrate was lacking. The substrate was 50-75 percent embedded by silt and sand. There were obvious signs of extreme

fluctuations of flow at this station (as much as 48 inches). The riparian area consisted of a wide floodplain and a lot of nonnative vegetation. The macroinvertebrate community scored poor (-5) (Tables 3b and 3c). There was a whitish coloration to the water at the time of sampling and a slight petroleum smell to the water.

Water quality samples were taken at Stations 1 and 2 and upstream of Barclay where Ruddiman Creek first surfaces after being underground (Station 3). Parameters analyzed included metals, hardness, chemical oxygen demand, total organic carbon, nitrate+nitrites, ammonia, and total phosphorus. No WQS exceedances were found at the three stations for the parameters analyzed (Table 4).

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## Literature Cited

- Albert, Dennis A. 1995. Regional Landscape Ecosystems of Michigan, Minnesota, and Wisconsin: A Working Map and Classification. Gen. Tech. Rep. NC-178. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/habitat/rlandscp/index.htm> (Version 03JUN1998).
- Creal, W., S. Hanshue, S. Kosek, M. Oemke, and M. Walterhouse. 1996. Update of GLEAS Procedure 51 Metric Scoring and Interpretation. MDEQ Staff Report No. MI/DEQ/SWQ-96/068. Revised May 1998.
- LeSage, S. and J. Smith. 2010. Water Quality and Pollution Control in Michigan: 2010 Sections 303(d), 305(b), and 314 Integrated Report. DRAFT Report #MI/DEQ/WB-10/001.
- MDEQ. 1990. SWAS Procedure 51 - Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers, April 24, 1990. Revised June 1991, August 1996, January 1997, May 2002, and December 2008.
- MDEQ. 1994. Quality Assurance Manual for Water, Sediment, and Biological Sampling. Surface Water Quality Division, Lansing, Michigan. MI/DEQ/SWQ-98/083.
- NOAA. 2008. NOAA Coastal Change Analysis Program (C-CAP) Zone 51 (lower) 2006-Era Land Cover. Charleston, SC.
- Wuycheck, J. 1990. Biological and Sediment Contaminant Surveys of Ruddiman Creek and Unnamed Tributary, Muskegon County, Michigan, August 17, 1988 and August 1, 1989.



Figure 1. 2009 biosurveys of the Ruddiman Creek watershed, Muskegon County, Michigan.

Table 1. Biosurvey stations for Ruddiman Creek, Muskegon County, Michigan, June 2009.

Station #	Road Crossing	STORET #	Latitude	Longitude	<u>Habitat Evaluation</u>		<u>Macroinvertebrate</u>		<u>Fish</u>	AUID#
					Rating	Score	Rating	Score	Rating	
1	Glenside Boulevard	610767	43.2108	-86.2768	Marginal	95	Acceptable	-4	Poor	040601021004-04
2	Barclay Street	610768	43.2080	-86.2707	Good	105	Poor	-5	Poor	040601021004-04
3	Main Branch surfaces	610574	43.2072	-86.2687	NA	NA	NA	NA	NA	040601021004-04

**Habitat Scoring**

Poor < 56    Marginal 56-104    Good 105-154    Excellent >154

**Macroinvertebrate Scoring**

Poor < -4    Acceptable -4 to +4    Excellent > +4

Table 2. AUID numbers for Ruddiman Creek.

<b>Water Body</b>	<b>AUID</b>
Main Branch Ruddiman Creek	040601021004-04
Wetland/Pond Area at Mouth of Ruddiman Creek	04061021004-08

Table 3a. Habitat evaluation for selected stations on Ruddiman Creek, Muskegon MI, June 4, 2009.

	Station 1 Ruddiman Creek @ upstream Glenside Boulevard GLIDE/POOL	Station 2 Ruddiman Creek @ downstream Barclay Street RIFFLE/RUN
<b>HABITAT METRIC</b>		
<b>Substrate and Instream Cover</b>		
Epifaunal Substrate/ Avail Cover (20)	6	10
Embeddedness (20)*		6
Velocity/Depth Regime (20)*		13
Pool Substrate Characterization (20)**	6	
Pool Variability (20)**	13	
<b>Channel Morphology</b>		
Sediment Deposition (20)	7	6
Flow Status - Maint. Flow Volume (10)	8	9
Flow Status - Flashiness (10)	1	2
Channel Alteration (20)	6	8
Frequency of Riffles/Bends (20)*		15
Channel Sinuosity (20)**	6	
<b>Riparian and Bank Structure</b>		
Bank Stability (L) (10)	7	6
Bank Stability (R) (10)	7	6
Vegetative Protection (L) (10)	6	7
Vegetative Protection (R) (10)	6	7
Riparian Veg. Zone Width (L) (10)	8	5
Riparian Veg. Zone Width (R) (10)	8	5
<b>TOTAL SCORE (200):</b>	<b>95</b>	<b>105</b>
<b>HABITAT RATING:</b>	<b>MARGINAL (MODERATELY IMPAIRED)</b>	<b>GOOD (SLIGHTLY IMPAIRED)</b>

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Date:	6/4/2009	6/4/2009
Weather:	Sunny	Sunny
Air Temperature:	60 Deg. F.	70 Deg. F.
Water Temperature:	59 Deg. F.	62 Deg. F.
Ave. Stream Width:	13.5 Feet	11 Feet
Ave. Stream Depth:	0.78 Feet	0.5 Feet
Surface Velocity:	0.12 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	1.2636 CFS	5.5 CFS
Stream Modifications:	Canopy Removal	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	610767	610768
Stream Name:	Ruddiman Creek @	Ruddiman Creek @
Road Crossing/Location:	upstream Glenside Boulevard	downstream Barclay Street
County Code:	61	61
TRS:	10N17W36	10N17W36
Latitude (dd):	43.2108	43.20801
Longitude (dd):	-86.27675	-86.27073
Ecoregion:	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater
USGS Basin Code:	4060102	4060102

\* Applies only to Riffle/Run stream Surveys

\*\* Applies only to Glide/Pool stream Surveys

Table 3B. Qualitative macroinvertebrate sampling results for selected stations on Ruddiman Creek, Muskegon MI, June 4, 2009.

TAXA	Ruddiman Creek @ upstream Glenside Boulevard 6/4/2009 STATION 1	Ruddiman Creek @ Barclay Street 6/4/2009 STATION 2
PLATYHELMINTHES (flatworms)		
Turbellaria		31
ANNELIDA (segmented worms)		
Hirudinea (leeches)	1	1
Oligochaeta (worms)	83	59
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	12	12
Decapoda (crayfish)	1	
Isopoda (sowbugs)	2	
Insecta		
Odonata		
Zygoptera (damselflies)		
Coenagrionidae	2	
Hemiptera (true bugs)		
Gerridae	2	1
Veliidae	1	1
Coleoptera (beetles)		
Dytiscidae (total)	2	
Diptera (flies)		
Ceratopogonidae	3	46
Chironomidae	174	118
Simuliidae	8	
Stratiomyidae	1	
MOLLUSCA		
Pelecypoda (bivalves)		
Sphaeriidae (clams)	6	1
TOTAL INDIVIDUALS	298	270

Table 3C. Macroinvertebrate metric evaluation of selected stations in Ruddiman Creek, Muskegon, MI, June 4, 2009.

METRIC	Ruddiman Creek @ upstream Glenside Boulevard 6/4/2009 STATION 1		Ruddiman Creek @ Barclay Street 6/4/2009 STATION 2	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	14	0	9	-1
NUMBER OF MAYFLY TAXA	0	-1	0	-1
NUMBER OF CADDISFLY TAXA	0	-1	0	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	0.00	-1	0.00	-1
PERCENT CADDISFLY COMPOSITION	0.00	-1	0.00	-1
PERCENT DOMINANT TAXON	58.39	-1	43.70	-1
PERCENT ISOPOD, SNAIL, LEECH	1.01	1	0.37	1
PERCENT SURFACE AIR BREATHERS	2.01	1	0.74	1
TOTAL SCORE		-4		-5
MACROINVERTEBRATE COMMUNITY RATING	ACCEPTABLE		POOR	



Table 3D. Qualitative fish sampling results for one station in Ruddiman Creek, Muskegon, MI, June 4, 2009.

Ruddiman Creek @ upstream Glenside Boulevard 6/4/2009 STATION 1	
TAXA	
Umbridae (mudminnows)	
<i>Umbra limi</i> (Central mudminnow)	1
Cyprinidae (minnows and carps)	
<i>Semotilus atromaculatus</i> (Creek chub)	19
<i>Labidesthes sicculus</i> (Brook silverside)	
<i>Fundulus diaphanus</i> (Banded killifish)	1
Gasterosteidae (sticklebacks)	
<i>Culaea inconstans</i> (Brook stickleback)	4
Centrarchidae (sunfish)	
<i>Ambloplites rupestris</i> (Rock bass)	2
<i>Lepomis gibbosus</i> (Pumpkinseed sf)	2
Percidae (perch)	
<i>Perca flavescens</i> (Yellow perch)	2
Gobiidae (gobies)	
<i>Neogobius melanostomus</i> (Round goby)	2
TOTAL INDIVIDUALS	33
Number of hybrid sunfish	0
Number of anomalies	0
Percent anomalies	0.000
Percent salmonids	0.000
Reach sampled (ft)	400
Area sampled (sq ft)	5,400
Density (# fish/sq ft)	0.006
Gear	bps

Table 3E. Fish metric evaluation of one station in Ruddiman Creek, Muskegon, MI, June 4, 2009.

Ruddiman Creek @ upstream Glenside Boulevard 6/4/2009 STATION 1		
METRIC	Value	Score
TOTAL NUMBER OF TAXA	8	
NO. OF DARTER, SCULPIN, MADTOM TAXA	0	
NUMBER OF SUNFISH TAXA	2	
NUMBER OF SUCKER TAXA	0	
NUMBER OF INTOLERANT TAXA	2	
PERCENT TOLERANT	60.61	
PERCENT OMNIVOROUS TAXA	60.61	
PERCENT INSECTIVOROUS TAXA	27.27	
PERCENT PISCIVOROUS TAXA	6.06	
% SIMPLE LITHOPHILIC SPAWNER TAXA	0.00	
TOTAL SCORE		
FISH COMMUNITY RATING		POOR

Table 4. Water chemistry results for selected stations in Ruddiman Creek, Muskegon, Michigan, June 3, 2009.

		<b>Ruddiman @ upstream Glenside Avenue</b>	<b>Ruddiman @ downstream Barclay Street</b>	<b>Ruddiman @ where surfaces</b>
<b>Date</b>		<b>6/4/2009</b>	<b>6/4/2009</b>	<b>6/4/2009</b>
<b>Storet #</b>		<b>610767</b>	<b>610768</b>	<b>610574</b>
<b>Station #</b>		<b>1</b>	<b>2</b>	<b>3</b>
<b>Parameter</b>	<b>Units</b>			
Ammonia	mg N/L	0.05	0.04	0.06
TOC	mg/L	4.1	3.8	3.9
COD	mg/L	8.6	6.3	5.9
Nitrogen, Total Kjeldahl	mg N/L	0.4	0.38	0.42
Phosphorus, Total	mg/L	0.03	0.04	0.04
Nitrate + Nitrite	mg/L	1.66	2	2.4
Calcium	mg/L	69.5	68.5	67.7
Magnesium	mg/L	20.4	19.1	19.3
Potassium	mg/L	4.6	4.8	5
Sodium	mg/L	113	130	132
Hardness	mg/L	272	257	275
Arsenic	µg/L	<1.0	<1.0	<1.0
Barium	µg/L	56	54	60
Cadmium	µg/L	<0.20	0.22	0.24
Chromium	µg/L	1.5	1.5	1.7
Copper	µg/L	1.6	1.5	1.5
Lead	µg/L	<1.0	<1.0	<1.0
Selenium	µg/L	<1.0	1.1	1.1
Silver	µg/L	<0.2	<0.2	<0.2
Zinc	µg/L	<10	<10	<10
Iron	µg/L	220	260	240