MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
JULY 2017

STAFF REPORT

Biological and water chemistry surveys in the Pentwater River watershed in Oceana County, Michigan, June-July 2015

Introduction

Biological and physical habitat conditions of selected water bodies in the Pentwater River watershed in Oceana County, were assessed by staff of the Michigan Department of Environmental Quality (MDEQ), Water Resources Division (WRD), Surface Water Assessment Section (SWAS), in June and July 2015. The primary objectives of the assessments were to:

1) Assess the current status and condition of individual water bodies and determine if Michigan Water Quality Standards (WQS) are being met.
2) Address monitoring requests submitted by internal and external customers.
3) Identify nonpoint sources (NPS) of water quality impairment.
4) Evaluate biological community temporal trends.

Watershed Information

The Pentwater River is a coldwater designated stream (Michigan Department of Natural Resources [MDNR], 1997) that originates approximately 95 miles upstream from its confluence with Lake Michigan. There are three listed warmwater tributaries in the Pentwater River watershed: Hart Lake, Unnamed Creeks, and Leavitt Lake Outlet. The watershed has an area of approximately 170 square miles.

The Pentwater River watershed is located in the Newaygo Outwash Plain subsection ecosystem, which consists of several outwash plains with excessively well drained, sand soils (Albert, 1995). All stations are located in the Southern Michigan and Northern Indiana Till Plains ecoregion (Omernik and Gallant, 2010). Land use within the Pentwater River watershed consists primarily of natural and agricultural uses (Table 1).

Table 1. Land use summary for the Pentwater River watershed.

	Natural	Agriculture	Developed	Pasture	Other	Water
Pentwater Watershed	53.4%	30.5%	8.9%	4.2%	1.6%	1.5%

Historical Sampling Efforts and Information

Biological, chemical, and physical habitat conditions of the Pentwater River watershed were monitored at ten sites by the MDEQ, WRD, SWAS, in 2010 (Lipsey, 2012). In 2010, macroinvertebrate ratings were acceptable (7) or excellent (3) and habitat ratings were marginal (1), good (7), or excellent (2). Chippewa Creek is a small coldwater designated tributary that had a dry stream bed in 2010 and could not be assessed using the SWAS Procedure 51

(Creal et al., 1996; MDEQ, 1990). In 2006, Chippewa Creek was not meeting coldwater standards due to a lack of salmonids from 88th Avenue to the Hart Lake Impoundment (Lipsey, 2007). In addition, reaches of the creek have excessive sand deposition over clay, flashy flow conditions due to stormwater runoff from Oceana Drive, and connectivity issues with the Pentwater River. Donaldson Creek is a small coldwater designated tributary to Huftile Creek with an emergency outfall from the Hart Wastewater Treatment Plant (WWTP) south of Polk Road and east of 88th Avenue. This outfall is occasionally used.

Prior surveys include Lipsey, 2012, 2007, and 2006; and Walker, 2001.

Methods

The macroinvertebrate community and physical habitat were qualitatively assessed at seven stations (Table 2; Figure 1) using Procedure 51 for wadeable streams. If a station is at a road crossing, it is sampled upstream unless otherwise noted. The macroinvertebrate communities were assessed and scored with metrics that rate water bodies excellent (+5 to +9), acceptable (-4 to +4), or poor (-5 to -9). The fish communities were assessed and scored with metrics that rate water bodies excellent (+5 to +10), acceptable (-4 to +4), or poor (-5 to -10). 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 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. Where available, macroinvertebrate community scores are used to determine attainment of the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use and fish community scores are used to assess attainment of the relevant fish designated use. Habitat scores and individual metrics are used to help better understand the biological community scores.

Site Selection

Two site-selection methods were used to assess the Pentwater River watershed in 2015: (1) stratified random; and (2) targeted. Four randomly selected sites were assigned to support the SWAS Status (3 sites) and Trend (1 site) Program. These sites will be used to estimate the watershed attainment status for the OIALW designated use component of Rule 100 (R 323.1100(e)) of the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and will be used as baseline data to facilitate a measurement of biological community temporal trends (MDEQ, 2015).

Three stations within the Pentwater River watershed were selected for targeted monitoring to answer stakeholder and staff concerns.

2015 Sampling Results

Table 2. Summary of the aquatic habitat and macroinvertebrate community evaluations for the Pentwater River watershed, 2015.

Station #	Stream Name	Road Crossing	STORET #	County	Township	Latitude	Longitude	Habitat Evaluation		Macroinvertebrate Community		S/T/Tr	AUID#
								Rating	Score	Rating	Score		
1	Huftile Creek	Polk Rd	640189	Oceana	Hart	43.68709	-86.30037	Good	135	Acceptable	4	S	040601010602-01
2	South Branch Pentwater River	136th Ave	640347	Oceana	Elbridge	43.70589	-86.21774	Good	135	Acceptable	2	S	040601010603-01
3	Dorrance Creek	Water Rd	640329	Oceana	Shelby	43.57622	-86.36918	Good	128	Acceptable	-1	S	040601011006-04
4	North Branch Pentwater River	Hammett Rd	640207	Oceana	Weare	43.78210	-86.38655	Good	141	Acceptable	0	Tr	040601010604-01
5	Donaldson Creek	Polk Rd	640191	Oceana	Hart	43.68766	-86.32680	Good	153	Acceptable	-1	T	040601010602-01
6	Unnamed Tributary to Chippewa Creek	Griswold St	640346	Oceana	Hart	43.69285	-86.35747	Good	122	Poor	-5	T	040601010605-04
7	Chippewa Creek	d/s Oceana Dr	640291	Oceana	Hart	43.69828	-86.35464	Good	120	Acceptable	-1	T	040601010605-04

S/T/Tr = status, targeted, trend station
SV = site visit only station
NW = non-wadeable
NA = Not Applicable

Habitat Scoring Wadeable Stations
Poor < 56 Marginal 56-104 Good 105-154 Excellent >154

Macroinvertebrate Scoring Wadeable Stations
Poor < -4 Acceptable -4 to +4 Excellent > +4

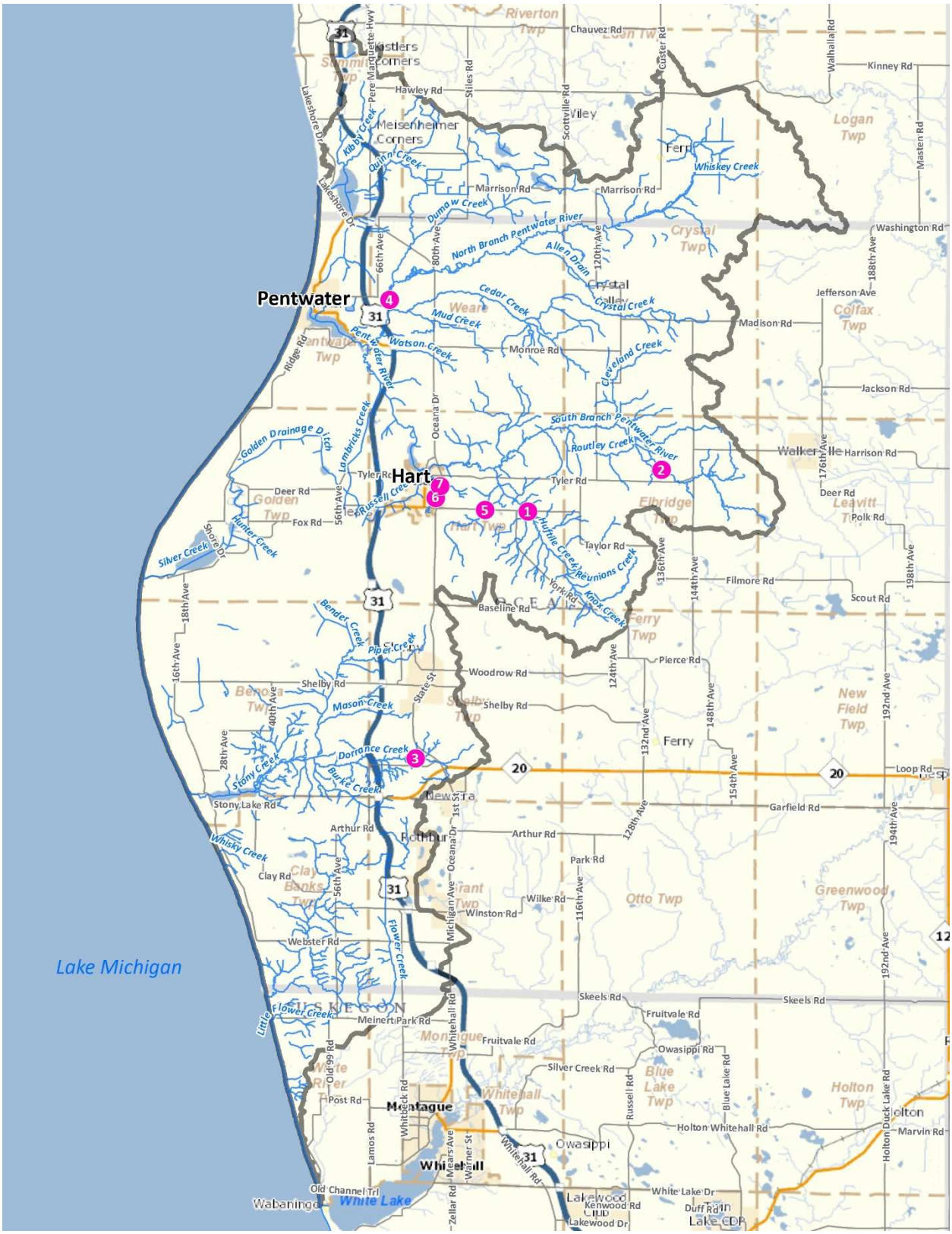

Figure 1. Pentwater River watershed 2015 sampling locations.

Summary of Findings by Monitoring Objective

Objective 1: Assess the current status and condition of individual waters of the state and determine whether Michigan WQS are being met.

In 2015, 14 randomly selected sites within the Pere Marquette/Pentwater watershed group were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed group survey, 100 +/- 19.3 percent of the randomly selected sites supported the OIALW designated use using biological monitoring procedures. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations ((14 / 14)100 = 100 percent). This value is coupled with a 95 percent confidence interval to provide our estimation of certainty, meaning there is 95 percent certainty that the true proportion of attainment in the northwest Michigan watershed group is between 78 and 100 percent (MDEQ, 2015).

In 2015, aquatic macroinvertebrate community and habitat assessments were conducted at a total of four status and trend stations in the Pentwater River watershed. The OIALW designated use was being met at all status sites.

HUFTILE CREEK

Huftile Creek was sampled at Polk Road (Station 1; Table 2). The glide/pool habitat was rated good (135; Table 4). This portion of the river was flashy showing an additional 2 feet of depth the day prior to sampling. The stretch is primarily shaded at 80% cover and consists of heavy levels of rootwads with moderate levels of undercut banks and large woody debris. The substrate is sand with small pockets of silt. The banks were stable with vegetative protection. The macroinvertebrate community scored at the high end of acceptable (4; Table 6). The four most prevalent taxa were baetids, brachycentrids, hydropsychids, and simuliids. Twenty-four taxa were present, the highest value of the status sites.

SOUTH BRANCH OF THE PENTWATER RIVER

The South Branch of the Pentwater River was sampled downstream of 136th Avenue (Station 2; Table 2). The downstream segment of stream was sampled due to barbed wire across the stream preventing access to the upstream segment. The glide/pool habitat was rated good (135; Table 4). This stretch of the river is flashy, showing an additional 1.5 foot of water level the previous day. The canopy is thick at 90% coverage with moderate rootwads and large woody debris in the river. The substrate consists of mostly sand with some clay. The banks showed signs of high erosion from flooding, especially along the right bank. The macroinvertebrate community scored at the high end of acceptable (2, Table 6). Chironomids, baetids, and amphipods were most prevalent with a total of 22 taxa.

DORRANCE CREEK

Dorrance Creek was sampled at Water Road (Station 3, Table 2). The glide/pool habitat was rated good (128; Table 4). Just downstream of Water Road, there was a large washout with uprooted trees showing that the road crossing is constricting the river, increasing river flow and causing erosion downstream of the crossing. The upstream section had heavy amounts of overhanging vegetation along with a sandy bottom. The stream bed had sparse large woody

debris and aquatic macrophytes. The macroinvertebrate community scored acceptable (-1, Table 6). There were 16 taxa present, but 79% of the sample was amphipods.

Objective 2: Satisfy monitoring requests submitted by internal and external customers.

A biologist from the MDEQ, Permits Section, requested two reaches on Chippewa Creek and one reach on Donaldson Creek with sampling of Procedure 51 fish, macroinvertebrates, and habitat as well as water chemistry analysis and YSI grab samples. These requests provided updated information on the condition of the streams in relation to the Hart WWTP.

Donaldson Creek is a coldwater tributary that has a discharge from the Hart WWTP. The outfall has not been used for several years, but may resume seasonal use. Nutrients have been the main issue in Donaldson Creek, but more importantly the discharge from the Hart WWTP. Donaldson Creek is a coldwater trout stream and should be protected to every extent possible. Fish, bugs, and habitat are critical as well as water chemistry, to understand conditions prior to the discharge resumption. Chippewa Creek and the Unnamed Tributary to Chippewa Creek are coldwater streams that have one permittee, Indian Summer, discharging infrequently to Chippewa Creek along with lagoons from the Hart WWTP that could be venting into the creek. Nutrients are the primary issue from these discharges.

DONALDSON CREEK

Donaldson Creek was sampled at Polk Road (Station 5; Table 2). The glide/pool habitat was rated good (153; Table 5). This stretch has heavy undercut banks and overhanging vegetation. The substrate is primarily sand with small patches of silt and gravel. This stretch of stream is surrounded by wetlands, has downed trees across the stream in a few locations, and has heavy amounts of coarse plant material. The macroinvertebrates scored acceptable (-1, Table 7). There were 20 taxa with a majority of amphipods. The fish survey counted seven taxa with a dominance of brown trout and brook trout. Other species identified were silver lamprey, central mudminnow, creek chub, white sucker, and bluegill. Coldwater streams are not scored; however, at least 1% salmonids should be present. Donaldson Creek had 69% salmonids in this stretch.

Grab samples were taken with a YSI to provide basic readings on the creek including dissolved oxygen at 10.10 milligrams per liter (mg/L), temperature at 59.06˚F, conductivity at 0.424 micro-Siemens per centimeter (µs/cm), and pH at 7.80. In 2005, nitrate+nitrite (2.79 mg/L), Kjeldahl Nitrogen (0.58 mg/L), Total Phosphorus (0.069 mg/L), and Total Suspended Solids (47 mg/L) were measured. In 2015, nitrate+nitrite stayed similar, Kjeldahl Nitrogen decreased, Total Phosphorus decreased, and Total Suspended Solids decreased (Table 3).

UNNAMED TRIBUTARY TO CHIPPEWA CREEK

This unnamed tributary to Chippewa Creek was sampled at Griswold Street (Station 6; Table 2). The riffle/run habitat rated good (122; Table 5). The stretch had a mostly sand bottom with geotextile fabric viewed at the riffles. The stretch had well vegetated banks along with wetland shoreline at the downstream end of the reach. This site had a petroleum odor from the water and sediments along with a slight oil sheen on the water leading to the collection of a water sample for metals. The macroinvertebrates scored poor (-5, Table 7). Seven taxa were identified from this stretch with no sensitive taxa present. The main taxa were oligochaetes, ceratopogonids, and chironomids. The creek was highly manipulated with the addition of

geotextile fabric and heavy deposits of sand forming bars. The fish survey produced only two green sunfish. No salmonids were identified in this stretch. The unnamed tributary was sampled for only 15 minutes for a length of 60 meters. A grated culvert and private property prevented any further sampling.

The grab sample YSI readings showed dissolved oxygen at 10.64 mg/L, temperature at 59.21˚F, conductivity at 1.023 µs/cm, and pH at 7.60. In 2005, the unnamed tributary to Chippewa Creek downstream of Mason Co. Fruit Packers was sampled with the following results: barium 41 micrograms per liter (µg/L), copper <1.0 µg/L, and zinc <10 µg/L. In addition, nitrate+nitrite (0.8 mg/L), Kjeldahl Nitrogen (0.58 mg/L), Total Phosphorus (0.089 mg/L), and Total Suspended Solids (67 mg/L) were measured. The 2015 data show that barium levels increased to 64 µg/L, copper increased to 5.2 µg/L, and zinc was generally the same. Barium, copper, and zinc were detected; however, all metals were meeting WQS. The current data also show that all other parameters decreased since 2005 (Table 3).

CHIPPEWA CREEK

Chippewa Creek was sampled downstream of Oceana Drive (Station 7; Table 2). The riffle/run habitat rated good (120; Table 5). The stretch consisted mostly of sand with some silt. Vegetation was present along the banks and large woody debris was moderate in the stream. Several gullies were passed that looked like dry stream beds before this creek was reached. The macroinvertebrate community scored acceptable (-1; Table 7). Chironomids and oligochaetes were the dominant taxa with a total of 17 taxa identified. The fish survey produced 8 individual fish including brook stickleback, white sucker, and fathead minnow. No salmonids were identified in this stretch after 45 minutes of sampling along 225 meters.

YSI readings showed dissolved oxygen at 11.12 mg/L, temperature at 61.04˚F, conductivity at 0.987 µs/cm, and pH at 7.78. In 2006, Chippewa Creek was sampled upstream of Oceana Drive for Kjeldahl Nitrogen (0.34 mg/L) and Total Phosphorus (0.051 mg/L). In 2005, Chippewa Creek at Oceana Drive water chemistry was sampled for nitrate+nitrite (1.51 mg/L), Kjeldahl Nitrogen (0.529 mg/L), Total Phosphorus (0.046 mg/L), and Total Suspended Solids (8 mg/L). The 2015 data show that Kjeldahl Nitrogen increased to 0.69 mg/L, Total Phosphorus stayed generally the same, and TSS increased to 12 mg/L (Table 3).

Table 3. Water Chemistry of the Targeted Monitoring Sites.

		Station 5 Donaldson Creek at Polk Road	Station 6 Unnamed Tributary to Chippewa Creek at Griswold Street	Station 7 Chippewa Creek d/s Oceana Drive
		June 17, 2015	June 17, 2015	June 17, 2015
Parameter	Units			
Ammonia	mg/L	0.01	0.17	0.18
Kjeldahl Nitrogen	mg/L	0.40	0.58	0.69
Nitrate/Nitrite	mg/L	2.7	0.70	0.74
Total Phosphorus	mg/L	0.029	0.044	0.048
Ortho Phosphate	mg/L	0.011	0.015	0.020
Total Suspended Solids	mg/L	9	4	12
Arsenic	µg/L		ND	
Barium	µg/L		64	
Cadmium	µg/L		ND	
Chromium	µg/L		ND	
Copper	µg/L		5.2	
Lead	µg/L		ND	
Mercury	µg/L		ND	
Selenium	µg/L		ND	
Silver	µg/L		ND	
Zinc	µg/L		5.9	

Objective 3: Identify NPS of water quality impairment.

Crystal Creek at 120th Avenue had a new culvert installed in 2010. The culvert was not installed at the proper angle, which will lead to erosion on the upstream side of the culvert. The stream must make a turn where the culvert starts, which will increase sedimentation and disturb habitat downstream. This site should be monitored to document if water flow is degrading the culvert and to review any sedimentation occurring downstream of the culvert for impacts to stable habitat.

The Unnamed Tributary to Huftile Creek downstream of 112th Avenue has a two-foot perched culvert on the downstream end that has created a plunge pool widening and deepening this

portion of the stream. In addition, the culvert was placed at an improper angle for the stream flow and has caused extensive erosion along the road. 112th Avenue has orange flags marking eroded areas to avoid as you drive down the road. This site would benefit from a properly installed culvert at the correct depth, angle, and diameter for this stream. The proper placement of the culvert would allow connectivity for fish and would prevent erosion issues at the creek. The site should be repaired and monitored within the watershed year.

The Unnamed Tributary to Huftile Creek at 116th Avenue has a perched culvert on the downstream end with wingwalls on the sides. The culvert is too small and too high to properly connect this tributary. The upstream end shows the improper angle of culvert installation with a 90 degree turn for the stream. In addition, it is clear that the culvert size and alignment are not adequate for this stream. This culvert should be removed and replaced with a culvert at least twice the diameter along with aligning to the natural direction of the stream. The increased culvert size would allow connectivity of the stream for fish and would restore the site to its normal flow. This site should be monitored again in five years.

Objective 4: Evaluate biological community temporal trends.

One station (Station 4; Table 2), the North Branch of the Pentwater River was selected as a trend station and is sampled every five years. Station 4 is located off of Hammett Road. The glide/pool habitat was rated good (141). The substrate was mostly sand with some silty/mucky edges. The stretch had a moderate amount of overhanging vegetation and aquatic macrophytes. This site is the put-in location for the Pentwater River Outfitters. The macroinvertebrate community scored acceptable (0) (Table 2). Twenty-two taxa were identified with the majority consisting of baetids. Trends can not be assessed until 2021, when a sufficient amount of data have been collected.

Conclusions and Future Monitoring Recommendations

The unnamed tributary to Chippewa Creek showed a poor (-5) macroinvertebrate score as well as a fish survey that does not meet a coldwater designation due to grated culverts that restricted fish passage and flow. This stretch of creek has been highly manipulated due to disturbed sediments, including the installation of geotextile fabric, grated culverts that prevent fish access, and petroleum odors and sheens present in the water and soil. It is recommended that the grated culvert be removed, the geotextile fabric be removed, and large woody debris be added to promote stable habitat. Additional sampling is not suggested at this site unless improvements are made to improve fish and macroinvertebrate scores.

Chippewa Creek showed adequate macroinvertebrates, but we did not collect enough fish for this site to meet its coldwater fish designation. Unlike the Unnamed Tributary to Chippewa Creek, access was sufficient to sample for the appropriate time and an adequate stretch of the creek, but no salmonids were collected. Additional sampling should be completed at Chippewa Creek in five years.

Huftile Creek, the South Branch of the Pentwater River, and Dorrance Creek all showed themselves to be flashy systems. Eroded stream banks and exposed tree roots along the shoreline are prevalent. Any future sampling should be completed during base level conditions to assure proper habitat assessments. These streams would benefit from more stable flow and decreased erosion.

Crystal Creek at 120th Avenue, the Unnamed Tributary to Huftile Creek at 112th Avenue, and the Unnamed Tributary to Huftile Creek at 116th Avenue all have improperly sized and installed culverts. The culverts should be replaced for proper size and alignment with the natural stream flow. These sites should be monitored during the next watershed year.

Field Work By: Marcy Knoll Wilmes, Aquatic Biologist
Tamara Lipsey, Aquatic Biologist
Sam Noffke, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

Report By: Marcy Knoll Wilmes, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

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Table 4. Habitat evaluation for selected stations in the Pentwater River watershed, Oceana County, 2015.

	Huftile Creek		South Branch Pentwater River		Dorrance Creek		North Branch Pentwater River	
	Polk Road		136th Avenue		Water Road		Hammet Road	
	GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL	
	STATION 1		STATION 2		STATION 3		STATION 4	
HABITAT METRIC								
Substrate and Instream Cover								
Epifaunal Substrate/ Avail Cover (20)	12		8		12		8	
Embeddedness (20)*								
Velocity/Depth Regime (20)*								
Pool Substrate Characterization (20)**	12		8		9		13	
Pool Variability (20)**	8		13		3		6	
Channel Morphology								
Sediment Deposition (20)	10		15		13		9	
Flow Status - Maint. Flow Volume (10)	10		10		10		10	
Flow Status - Flashiness (10)	4		3		1		8	
Channel Alteration (20)	20		19		18		19	
Frequency of Riffles/Bends (20)*								
Channel Sinuosity (20)**	10		13		8		8	
Riparian and Bank Structure								
Bank Stability (L) (10)	7		7		9		10	
Bank Stability (R) (10)	8		5		9		10	
Vegetative Protection (L) (10)	9		7		9		10	
Vegetative Protection (R) (10)	8		7		9		10	
Riparian Veg. Zone Width (L) (10)	10		10		9		10	
Riparian Veg. Zone Width (R) (10)	7		10		9		10	
TOTAL SCORE (200):	135		135		128		141	
HABITAT RATING:	GOOD		GOOD		GOOD		GOOD	
	(SLIGHTLY		(SLIGHTLY		(SLIGHTLY		(SLIGHTLY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)	
	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:	7/8/2015		7/8/2015		7/7/2015		7/7/2015	
Weather:	Sunny		Sunny		Sunny		Sunny	
Air Temperature:	70	Deg. F.	65	Deg. F.	70	Deg. F.	70	Deg. F.
Water Temperature:	59	Deg. F.	58	Deg. F.	69	Deg. F.	68	Deg. F.
Ave. Stream Width:	20	Feet	20	Feet	8	Feet	45	Feet
Ave. Stream Depth:	1.5	Feet	1.5	Feet	1	Feet	1.7	Feet
Surface Velocity:	1.44	Ft./Sec.	0.89	Ft./Sec.	1.38	Ft./Sec.	2.14	Ft./Sec.
Estimated Flow:	43.2	CFS	26.7	CFS	11.04	CFS	163.71	CFS
Stream Modifications:	None		None		None		None	
Nuisance Plants (Y/N):	N		N		N		N	
Report Number:								
STORET No.:	640189		640347		640329		640207	
Stream Name:	Huftile Creek		South Branch Pentwater River		Dorrance Creek		North Branch Pentwater River	
Road Crossing/Location:	Polk Road		136th Avenue		Water Road		Hammet Road	
County Code:	64		64		64		64	
TRS:	15N17W23		15N16W10		14N17W29		16N17W18	
Latitude (dd):	43.6868735		43.70589		43.57622		43.7821	
Longitude (dd):	-86.3001815		-86.21774		-86.36919		-86.38655	
Ecoregion:	SMNITP		SMNITP		SMNITP		SMNITP	
Stream Type:	Coldwater		Coldwater		Warmwater		Coldwater	
USGS Basin Code:	4060101		4060101		4060101		4060101	
* Applies only to Riffle/Run stream Surveys								
** Applies only to Glide/Pool stream Surveys								

Table 5. Habitat evaluation for targeted stations in the Pentwater River watershed, Oceana County, 2015.

	Donaldson Creek		Unnamed Tributary to Chippewa Creek		Chippewa Creek	
	Polk Road		Griswold Street		Oceana Dr (downstream)	
	GLIDE/POOL		RIFFLE/RUN		RIFFLE/RUN	
	STATION 5		STATION 6		STATION 7	
HABITAT METRIC						
Substrate and Instream Cover						
Epifaunal Substrate/ Avail Cover (20)	14		13		12	
Embeddedness (20)*			10		2	
Velocity/Depth Regime (20)*			11		13	
Pool Substrate Characterization (20)**	10					
Pool Variability (20)**	15					
Channel Morphology						
Sediment Deposition (20)	10		4		1	
Flow Status - Maint. Flow Volume (10)	9		8		7	
Flow Status - Flashiness (10)	9		5		4	
Channel Alteration (20)	17		13		16	
Frequency of Riffles/Bends (20)*			11		13	
Channel Sinuosity (20)**	17					
Riparian and Bank Structure						
Bank Stability (L) (10)	9		8		8	
Bank Stability (R) (10)	9		8		8	
Vegetative Protection (L) (10)	7		7		8	
Vegetative Protection (R) (10)	9		7		8	
Riparian Veg. Zone Width (L) (10)	9		8		10	
Riparian Veg. Zone Width (R) (10)	9		9		10	
TOTAL SCORE (200):	153		122		120	
HABITAT RATING:	GOOD		GOOD		GOOD	
	(SLIGHTLY		(SLIGHTLY		(SLIGHTLY	
	IMPAIRED)		IMPAIRED)		IMPAIRED)	
	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:	6/17/2015		6/16/2015		6/16/2015	
Weather:	Sunny		Partly Cloudy		Sunny	
Air Temperature:	79	Deg. F.	78	Deg. F.	73	Deg. F.
Water Temperature:	58	Deg. F.	62	Deg. F.	59	Deg. F.
Ave. Stream Width:	5	Feet	7	Feet	3	Feet
Ave. Stream Depth:	1	Feet	0.42	Feet	0.5	Feet
Surface Velocity:	1.17	Ft./Sec.	0.77	Ft./Sec.	0.75	Ft./Sec.
Estimated Flow:	5.85	CFS	2.2638	CFS	1.125	CFS
Stream Modifications:	None				None	
Nuisance Plants (Y/N):	N		N		N	
Report Number:						
STORET No.:	640191		640346		640291	
Stream Name:	Donaldson Creek		Unnamed Tributary to Chippewa Creek		Chippewa Creek	
Road Crossing/Location:	Polk Road		Griswold Street		Oceana Dr (downstream)	
County Code:	64		64		64	
TRS:	15N17W15		15N17W17		15N17W16	
Latitude (dd):	43.6880794		43.69285		43.6981626	
Longitude (dd):	-86.3264929		-86.35747		-86.3518108	
Ecoregion:	SMNITP		SMNITP		SMNITP	
Stream Type:	Coldwater				Coldwater	
USGS Basin Code:	4060101		4060101		4060101	
* Applies only to Riffle/Run stream Surveys						
** Applies only to Glide/Pool stream Surveys						

Table 6. Macroinvertebrate community for selected stations in the Pentwater River watershed, Oceana County, 2015.

	Huftile Creek		South Branch Pentwater River		Dorrance Creek		North Branch Pentwater River	
	Polk Road		136th Avenue		Water Road		Hammet Road	
	7/8/2015		7/8/2015		7/7/2015		7/7/2015	
TAXA	STATION 1		STATION 2		STATION 3		STATION 4	
ANNELIDA (segmented worms)								
Hirudinea (leeches)					1		1	
Oligochaeta (worms)	3				25		4	
ARTHROPODA								
Crustacea								
Amphipoda (scuds)	6		49		249		73	
Decapoda (crayfish)	5		1		1		1	
Isopoda (sowbugs)	1				2		100	
Arachnoidea								
Hydracarina	1		6		1			
Insecta								
Ephemeroptera (mayflies)								
Baetidae	45		47		18		208	
Caenidae							1	
Heptageniidae	8		1					
Isonychiidae	9				1			
Tricorythidae	1							
Odonata								
Anisoptera (dragonflies)								
Aeshnidae	2				1		1	
Zygoptera (damselflies)								
Calopterygidae	1		1				1	
Plecoptera (stoneflies)								
Perlidae							4	
Hemiptera (true bugs)								
Belostomatidae							1	
Corixidae							5	
Gerridae	1		1		1			
Mesoveliidae	2							
Veliidae			4					
Megaloptera								
Corydalidae (dobson flies)	1							
Trichoptera (caddisflies)								
Brachycentridae	48		41		1		5	
Hydropsychidae	50		5		9		7	
Hydroptilidae			1					
Leptoceridae			1					
Limnephilidae	5		2				1	
Polycentropodidae							1	
Coleoptera (beetles)								
Gyrinidae (adults)			1				1	
Hydrophilidae (total)	2		5		1			
Dryopidae			1					
Elmidae	3		2					
Diptera (flies)								
Ceratopogonidae	1		1					
Chironomidae	6		64				23	
Dixidae	6							
Simuliidae	68		45				89	
Tabanidae			2		3		3	
Tipulidae			1				2	
MOLLUSCA								
Gastropoda (snails)								
Physidae	1				1		5	
Planorbidae					1			
TOTAL INDIVIDUALS	276		282		316		537	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	24	0	22	0	16	0	22	0
NUMBER OF MAYFLY TAXA	4	1	2	0	2	0	2	0
NUMBER OF CADDISFLY TAXA	3	0	5	1	2	0	4	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	1	1
PERCENT MAYFLY COMP.	22.83	1	17.02	0	6.01	0	38.92	1
PERCENT CADDISFLY COMP.	37.32	1	17.73	0	3.16	-1	2.61	-1
PERCENT DOMINANT TAXON	24.64	0	22.70	0	78.80	-1	38.73	-1
PERCENT ISOPOD, SNAIL, LEECH	0.72	1	0.00	1	1.58	1	19.74	-1
PERCENT SURF. AIR BREATHERS	1.81	1	3.90	1	0.63	1	1.30	1
TOTAL SCORE		4		2		-1		0
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 7. Macroinvertebrate community for targeted stations in the Pentwater River watershed, Oceana County, 2015.

	Donaldson Creek		Unnamed Tributary to Chippewa Creek		Chippewa Creek	
	Polk Road		Griswold Street		Oceana Dr (downstream)	
	6/17/2015		6/16/2015		6/16/2015	
TAXA	STATION 5		STATION 6		STATION 7	
PLATYHELMINTHES (flatworms)						
Turbellaria	1					
ANNELIDA (segmented worms)						
Hirudinea (leeches)					2	
Oligochaeta (worms)			132		56	
ARTHROPODA						
Crustacea						
Amphipoda (scuds)	155		1		8	
Decapoda (crayfish)					1	
Isopoda (sowbugs)	1		2		3	
Arachnoidea						
Hydracarina	1					
Insecta						
Ephemeroptera (mayflies)						
Baetidae					13	
Caenidae					1	
Isonychiidae					1	
Odonata						
Anisoptera (dragonflies)						
Aeshnidae	2				1	
Hemiptera (true bugs)						
Corixidae	1					
Gerridae	6					
Mesoveliidae	3				2	
Megaloptera						
Corydalidae (dobson flies)					1	
Trichoptera (caddisflies)						
Brachycentridae	21					
Hydropsychidae	2					
Limnephilidae	1					
Coleoptera (beetles)						
Dytiscidae (total)			3		22	
Hydrophilidae (total)	3		1			
Elmidae	1				3	
Diptera (flies)						
Ceratopogonidae	10		160		1	
Chironomidae	62		126		162	
Dixidae	1				5	
Simuliidae	5					
Stratiomyidae	1					
Tipulidae	1					
MOLLUSCA						
Gastropoda (snails)						
Planorbidae	6				1	
TOTAL INDIVIDUALS	284		425		283	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	20	1	7	-1	17	1
NUMBER OF MAYFLY TAXA	0	-1	0	-1	3	1
NUMBER OF CADDISFLY TAXA	3	0	0	-1	0	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.00	-1	0.00	-1	5.30	0
PERCENT CADDISFLY COMP.	8.45	0	0.00	-1	0.00	-1
PERCENT DOMINANT TAXON	54.58	-1	37.65	-1	57.24	-1
PERCENT ISOPOD, SNAIL, LEECH	2.46	1	0.47	1	2.12	1
PERCENT SURF. AIR BREATHERS	4.93	1	0.94	1	8.48	0
TOTAL SCORE		-1		-5		-1
MACROINV. COMMUNITY RATING		ACCEPT.		POOR		ACCEPT.

Table 8. Fish community for targeted stations in the Pentwater River watershed, Oceana County, 2015.

	Donaldson Creek		Unnamed Tributary to Chippewa Creek		Chippewa Creek	
	Polk Road		Griswold Street		Oceana Dr (downstream)	
	6/17/2015		6/16/2015		6/16/2015	
TAXA	STATION 5		STATION 6		STATION 7	
Petromyzontidae (lampreys)						
Ichthyomyzon unicuspis (Silver lamprey)	1					
Salmonidae (trouts)						
Salmo trutta (Brown trout)	15					
Salvelinus fontinalis (Brook trout)	7					
Umbridae (mudminnows)						
Umbra limi (Central mudminnow)	6					
Cyprinidae (minnows and carps)						
Semotilus atromaculatus (Creek chub)	1					
Pimephales promelas (Fathead minnow)					1	
Catostomidae (suckers)						
Catostomus commersoni (White sucker)	1				1	
Gasterosteidae (sticklebacks)						
Culaea inconstans (Brook stickleback)					6	
Centrarchidae (sunfish)						
Lepomis cyanellus (Green sunfish)			2			
Lepomis macrochirus (Bluegill sf)	1					
TOTAL INDIVIDUALS	32		2		8	
Number of hybrid sunfish	0		0		0	
Number of anomalies	0		0		0	
Percent anomalies	0.000		0.000		0.000	
Percent salmonids	68.750		0.000		0.000	
Reach sampled (ft)	600		197		738	
Area sampled (sq ft)						
Density (# fish/sq ft)						
Gear	bps					
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	7		1		3	
NO. OF DARTER, SCULPIN, MADTOM TAXA	0		0		0	
NUMBER OF SUNFISH TAXA	1		1		0	
NUMBER OF SUCKER TAXA	1		0		1	
NUMBER OF INTOLERANT TAXA	3		0		0	
PERCENT TOLERANT	25.00		100.00		25.00	
PERCENT OMNIVOROUS TAXA	25.00		0.00		25.00	
PERCENT INSECTIVOROUS TAXA	3.13		100.00		75.00	
PERCENT PISCIVOROUS TAXA	0.00		0.00		0.00	
% SIMPLE LITHOPHILIC SPAWNER TAXA	3.13		0.00		12.50	