

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
WATER RESOURCES DIVISION  
SEPTEMBER 2015

STAFF REPORT

BIOLOGICAL SURVEYS OF THE TAHQUAMENON RIVER AND  
TWO HEARTED RIVER WATERSHEDS  
ALGER, LUCE, CHIPPEWA, AND MACKINAC COUNTIES, MICHIGAN  
SEPTEMBER 2014

## INTRODUCTION

Biological surveys of the Tahquamenon River (Hydrologic Unit Code [HUC] 04020202) and Two Hearted River (HUC 04020201) watersheds were conducted in September 2014 as part of the Surface Water Assessment Section's (SWAS) five-year rotating basin monitoring design. Macroinvertebrate and habitat surveys were completed at nine sites (six status, three trend) following the SWAS Procedure 51 (Michigan Department of Environmental Quality [MDEQ], 1990).

Specific monitoring objectives were to:

- Identify nonpoint sources of water quality impairment.
- Assess the current status and condition of individual water bodies and determine whether Michigan Water Quality Standards (WQS) are being met.
- Evaluate biological integrity temporal trends.

## STUDY AREA

The Tahquamenon River and Two Hearted River watersheds are located in the eastern-central Upper Peninsula, Michigan. Both are situated in the Northern Lakes and Forest ecoregion (United States Environmental Protection Agency [USEPA] Level III) and land use is predominately coniferous and northern hardwood forests (USEPA, 2007). Both watersheds were extensively logged in the late 1800s and early 1900s and the rivers were often used to transport wood downstream to mills near Lake Superior (Taft, 2000). Remnants of Michigan's logging era remain within these watersheds. The soil and vegetative cover of heavily logged (and often subsequently burned) areas was permanently altered by logging practices, influencing the hydrology and stability of parts of both the Tahquamenon River and Two Hearted River watersheds (Taft, 2000).

### Tahquamenon River Watershed

The Tahquamenon River is a coldwater river that originates in southwest Luce County and flows northeast for approximately 87 miles before emptying into Whitefish Bay five miles south of Paradise, Michigan. Part of the Tahquamenon River (East Branch) is a nationally designated Wild River under the National Wild and Scenic Rivers Act (1968). The river experiences high spring runoff and stable base flows (United States Geological Survey [USGS], 2014). The Tahquamenon River watershed encompasses nearly 589,600 acres (HUC\_8) and is made up of 28 subwatersheds (HUC\_12). Much of the river flows through the Seney-Tahquamenon Sand

Plains (USEPA Level IV), characterized by abundant wetlands and bogs, sandy soils, acidic muck or mucky peat soils, and a relatively short growing season (USEPA, 2007).

### Two Hearted River Watershed

The Two Hearted River is a coldwater river that originates in western-central Luce County and flows northeast for approximately 35 miles before emptying into Lake Superior (Michigan Department of Natural Resources [MDNR], 1973). The Two Hearted River is state-listed as a Natural River (Part 305, Natural Rivers, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended). The river is primarily driven by snowmelt with high flows in the spring and stable base flows in the summer months (Fongers, 2007). The Two Hearted River watershed encompasses 282,667 acres (HUC\_8) and is made up of 17 subwatersheds (HUC\_12). The watershed is primarily within the Grand Marais Lakeshore USEPA Level IV ecoregion, characterized by lake-moderated climatic conditions, dry outwash plains, sandy moraines, and poorly-drained wetlands (USEPA, 2007).

### HISTORICAL SAMPLING EFFORTS

#### Tahquamenon River Watershed

The MDEQ's Water Resources Division (WRD) conducted biological surveys following Procedure 51 within the Tahquamenon River watershed three times prior to 2014.

- In 1999, surveys were conducted at nine sites within the Tahquamenon River watershed by SWAS Staff (Goodwin, 2000). Qualitative macroinvertebrate surveys were conducted at six sites and physical habitat surveys at eight sites. Water chemistry surveys were also conducted at all nine sites. Macroinvertebrates were characterized as Acceptable in all six sites sampled, while habitat was characterized as Fair in four sites, and Good in four sites (Goodwin, 2000). Water chemistry parameters for all sites were within the Michigan WQS (Goodwin, 2000).
- In 2004, ten sites within the Tahquamenon River watershed were sampled by SWAS Staff (Holden, 2005). Macroinvertebrates and habitat conditions were assessed at 8 sites, while water chemistry was assessed at 6 of these sites. Water chemistry was also assessed at an additional two sites near the Newberry Wastewater Treatment Plant in support of the National Pollutant Discharge Elimination System (NPDES) Program. Macroinvertebrates were characterized as Acceptable in all eight sites sampled, while habitat was characterized as Good in seven sites and Excellent in one site. Water chemistry samples did not exceed Michigan WQS in any of the sites (Holden, 2005).
- In 2009, six sites within the Tahquamenon River watershed were sampled by SWAS staff (Edly and Taft, 2010). Macroinvertebrates and habitat were assessed at four sites, while water chemistry was assessed at an additional two sites. Macroinvertebrates were characterized as Acceptable in all four sites, while habitat was characterized as Good in two sites and Excellent in two sites. To support the NPDES Program, two sites were also sampled for water chemistry on the Tahquamenon River near the Newberry Wastewater Treatment Plant (one upstream and one downstream); however, no chemical concentrations exceeded Michigan WQS (Edly and Taft, 2010).

## Two Hearted River Watershed

The MDEQ's WRD conducted biological surveys following Procedure 51 within the Two Hearted River watershed five times prior to 2014.

- In 1999, 12 sites within the Two Hearted River watershed were sampled by SWAS staff (Taft, 2000; includes 3 sites outside of 2014 watershed boundary). Macroinvertebrates, habitat, and water chemistry were assessed at 10 sites, while water chemistry was assessed at an additional 2 sites. Macroinvertebrates were characterized as Acceptable in nine sites and Excellent in one site. Habitat was characterized as Good in six sites, Fair in two sites, and Excellent in two sites. Water chemistry samples did not exceed Michigan WQS in any of the sites (Taft, 2000).
- In 2004, 14 sites within the Two Hearted River watershed were sampled by SWAS staff (Holden, 2005). Macroinvertebrates and habitat were sampled at 9 sites, while water chemistry was sampled at five of these sites and an additional five sites. Macroinvertebrates were characterized as Acceptable in seven sites and Excellent in two sites. Habitat was characterized as Good in three sites and Excellent in six sites. Water chemistry samples did not exceed Michigan WQS in any of the sites (Holden, 2005).
- In 2009, four sites within the Two Hearted River watershed were sampled by SWAS staff (Edly and Taft, 2010). Macroinvertebrates and habitat conditions were assessed at all four sites. Macroinvertebrates were characterized as Acceptable in all sites, while habitat was characterized as Good in two sites and Excellent in two sites (Edly and Taft, 2010).
- Four sites within the Two Hearted River watershed were sampled in 2012, 2013, and 2014 as part of the Duck Lake Fire Ecological Study (two of which were status sites in 2014 – STORET numbers 480069 and 480072). In 2012 and 2013, macroinvertebrates were classified as either Acceptable or Excellent in all four sites. Habitat conditions were characterized as Good or Excellent in all four sites as well.

## METHODS

Five sites in the Tahquamenon River watershed and four sites in the Two Hearted River watershed were sampled according to SWAS Procedure 51 in 2014 (Table 1, Figure 1). Four sites within the Tahquamenon River and two sites within the Two Hearted River were randomly selected using a stratified random site selection method to address statewide and watershed-specific questions following the SWAS's Biological Monitoring Status and Trend Procedure WRD-SWAS-027 (MDEQ, 2015). One additional trend site in the Tahquamenon River watershed and two additional trend sites in the Two Hearted River watershed were chosen to track temporal trends in biological and habitat data (MDEQ, 2015).

Procedure 51 assigns a score to macroinvertebrate communities and habitat conditions using metrics that rate macroinvertebrates as Excellent ( $> 4$ ), Acceptable (+ 4 to - 4), or Poor ( $< 4$ ) based on the macroinvertebrate community composition and structure, and habitat as Excellent ( $> 154$ ), Good (105 to 154), Marginal (56 to 104), or Poor ( $< 56$ ) based on several parameters that describe in-stream and riparian conditions (Creal et al., 1996).

## RESULTS

### Tahquamenon River Watershed (HUC 04020202)

#### *Tahquamenon River (480074)*

The Tahquamenon River originates from springs in southwest Luce County northwest of the town of McMillan. In this area, the Tahquamenon River is a fairly small riffle/run stream with Excellent instream habitat and a high density of macroinvertebrates (Figure 2). The section of the river that was sampled in 2014 (480074) had an average width of 37 feet and an average depth of 0.85 feet. It also contained large amounts of cobble and large woody debris, and had the highest possible score in all habitat parameters assessed (Table 2). The macroinvertebrate community was typical of coldwater riffle/runs streams and was comprised of 34 taxa, 27% ephemeroptera, 42% tricoptera, and 24% dominant taxa (Table 3).



Figure 2. Tahquamenon River (480074).

#### *Syphon Creek (480038)*

As the Tahquamenon River winds its way first south and then east, several small tributaries flow into the mainstem. Syphon Creek is a small, glide/run headwater stream that flows southeast through tag alder swamp surrounded by hemlocks and enters the Tahquamenon River northeast of the town of Laketon (Figure 3). This stream scored Excellent for the majority of habitat parameters assessed, and scored no lower than Good in all categories (Table 4). The macroinvertebrate community in Syphon Creek was similar to that in the headwaters of the Tahquamenon River and was comprised of 27 taxa, 25% ephemeroptera, 22% tricoptera, and 17% dominant taxa. Overall, the macroinvertebrate community was rated as Excellent in this section of the stream (Table 5).

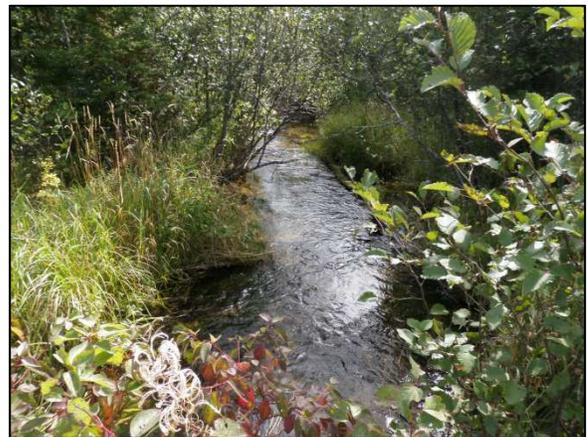


Figure 3. Syphon Creek (480038).

Syphon Creek is also a trend site and had been previously sampled in 1999 and 2009. In 1999, a different habitat scoring system was used; however, the site did meet the other indigenous aquatic life and wildlife designated use component of the Michigan WQS based on the macroinvertebrate community. In 2009, Syphon Creek habitat was considered Good (134) and the macroinvertebrate community was considered Acceptable (3) following the same version of Procedure 51 used in 2014. In 2014, substrate and in-stream cover metrics scored much higher than in 2009, and the macroinvertebrate community scored higher due to greater percent

ephemeroptera composition, two additional plecoptera taxa (only one individual of each), and lower percent surface air breathers. However, these differences may be attributed to seasonal differences in communities within this stream as these surveys did not occur at the same time of year (2014-September, 2009-July).

#### *Silver Creek (480073)*

Silver Creek is another small, glide/pool headwater stream that enters the Tahquamenon River northeast of McMillan (Figure 4). The site sampled in 2014 was approximately 2.5 miles upstream of the confluence. The surrounding riparian area was predominately tag alder and cedar swamp and riparian habitat was rated as Excellent. In-stream habitat conditions were also Excellent for the majority of parameters assessed and scored no lower than Good for all parameters (Table 2). The macroinvertebrate community also rated Excellent with 27 taxa present, 23% ephemeroptera, 25% tricoptera, and 17% dominant taxa (Table 3).



Figure 4. Silver Creek (480073).

#### *West Branch Sage River (480035)*

The West Branch Sage River originates from several smaller tributaries southeast of Newberry before flowing northeast into the Sage River, a major tributary to the Tahquamenon River. The West Branch Sage River is a narrow, deep, glide/pool stream with riparian vegetation consisting of primarily tag alder. Habitat parameters in this stream (sampled at M-28 crossing) were Good or Excellent, with channel sinuosity being the only parameter scored as Marginal (Table 2). Although sinuosity was Marginal, the channel does not appear to be channelized and naturally flows straight in this section. The macroinvertebrate community in this site was characterized as Acceptable and was comprised of 38 taxa, 41% of which were ephemeroptera and 20% of which were tricoptera. West Branch Sage River had a slightly higher percentage of dominant taxa (35%) and surface air breathers (5%) than upstream tributaries (Table 3).

#### *Murphy Creek (480075)*

Downstream of the confluence of the Sage River with the Tahquamenon River, the east branch of the Tahquamenon River joins the mainstem Tahquamenon River near the Luce-Chippewa County line. Murphy Creek is a moderately sized tributary that flows east into the Tahquamenon River just downstream of this confluence. Murphy Creek was sampled approximately ten miles upstream of the Tahquamenon River at the M-123 crossing in 2014 (Figure 5). This site was characterized as a glide/pool stream with a deep and narrow channel. Habitat was characterized as Excellent



Figure 5. Murphy Creek (480075).

overall with all individual parameters scoring Good or Excellent (Table 2). The macroinvertebrate community in Murphy Creek was rated as Acceptable with 36 taxa present, 49% of which were ephemeroptera, and 11% of which were tricoptera (Table 3).

No sites downstream of Murphy creek in the Tahquamenon River watershed were sampled in 2014.

### Two Hearted River Watershed (HUC 04020201)

#### *Sucker River (020160)*

The Two Hearted River watershed contains the mainstem Two Hearted River, Little Two Hearted River, and their tributaries, as well as several direct tributaries to Lake Superior. The Sucker River is a Lake Superior tributary that originates in western Alger County and flows north before entering Lake Superior near Grand Marais. Historically, the Sucker River flowed further east to what is today the Blind Sucker River before entering Lake Superior. The river was re-routed to its present day location around 1880 to allow loggers faster transport of timber to Grand Marais harbor (Taft, 2000). The site sampled in 2014 was near the Grand Marais Truck Trail east of Grand Marais (Figure 6). This glide/pool section of the river



Figure 6. Sucker River (020160).

flows through mixed hardwood stands, contains a fair amount of large woody debris, and has mostly sand and gravel substrate. Overall, habitat was characterized as Good with lower ratings for bank stability, vegetative protection of banks, and flashiness (Table 4). The macroinvertebrate community was characterized as Acceptable overall, and consisted of 22 taxa, 24% ephemeroptera, 57% tricoptera, and 32% dominant taxa (Table 5).

The Sucker River is also a trend site and was surveyed in 2009. In 2009, the Sucker River was found to have Good (136) habitat as it was in 2014. The macroinvertebrate community was also scored as Acceptable in both 2009 and 2014.

#### *West Branch Two Hearted River (480067)*

Five major tributaries flow into the mainstem Two Hearted River: the South Branch, West Branch, North Branch, and East Branch Two Hearted River, and Dawson Creek. The West Branch begins in western Luce County and flows east before converging with the South Branch and then the mainstem Two Hearted River. This section of the river is a glide/pool stream with deep holes and is bordered by tag alders and lowland areas. Habitat in this site was characterized as Good with most individual parameters scoring Good or Excellent. However, pool substrate and sediment deposition were Marginal (Table 4). The macroinvertebrate community in West Branch was Excellent overall with 5% ephemeroptera and 30% tricoptera (Table 5).

The West Branch Two Hearted River was also a trend site and was sampled in 1999 and 2009. In 1999, a different habitat scoring system was used; however, the site did meet the other

indigenous aquatic life and wildlife designated use component of the Michigan WQS based on macroinvertebrate scores. In 2009, habitat scores were similar to those recorded in 2014 with an overall rating of Good in both years. The macroinvertebrate community scored much higher in 2014 (6) than in 2009 (1). Major differences included two additional tricoptera taxa, a greater percentage of tricoptera (~20% difference), one additional plecoptera taxa, lower percentage of isopod, snails, leeches (~4% difference), and lower percentage surface air breathers (~5% difference) in 2014. However, these differences may be attributed to seasonal differences in communities within this stream as these surveys did not occur at the same time of year (2014-September, 2009-July).

#### *Two Hearted River (480069)*

The Two Hearted River flows northeast into Lake Superior roughly 30 miles east of Grand Marais. The watershed is predominately coniferous and northern hardwood forests with dry outwash plains, sandy moraines, and poorly-drained wetlands. In 2012, a lightning-ignited wildfire (Duck Lake Fire) burned over 21,000 acres within the Two Hearted River watershed. Concerns about the potential impact of this fire on the Two Hearted River and its biological community resulted in a three-year study by MDEQ and MDNR staff. Four stations within the watershed, two on the Two Hearted River and two on the Little Two Hearted River, were monitored for three years following the fire. One of these sites on the Two Hearted River mainstem near the mouth was selected as part of the probabilistic biological monitoring for the watershed in 2014. Therefore, it is included in this report as a status site. A separate report will detail the temporal changes in this site following the fire.

In 2014, the Two Hearted River contained a fair amount of woody debris, several deep holes, and many unstable banks. Habitat in this section was characterized as Good with individual parameters ranging from Marginal to Excellent (Table 2). The macroinvertebrate community was scored as Acceptable overall with 14% ephemeroptera and 32% tricoptera (Table 3).

#### *Little Two Hearted River (480072)*

The Little Two Hearted River begins near Little Two Hearted Lakes in northeastern Luce County and is situated to the east of the Two Hearted River. In 2014, a site off of County Road 412 was selected as a random site (also within the Duck Lake burn area). Habitat was characterized as Good in this site and individual parameters ranged from Marginal to Excellent (Table 2). The macroinvertebrate community scored Excellent overall and was comprised of 44% ephemeroptera, 17% tricoptera, and 4% surface air breathers (Table 3).

### WATERSHED ATTAINMENT

#### Tahquamenon River Watershed

In 2014, five randomly selected sites within the Tahquamenon River Watershed were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed survey, 100% ± 45% of the randomly selected sites supported the other indigenous aquatic life and wildlife designated use using biological monitoring procedures (MDEQ, 2015). Percent attainment was calculated by dividing the number of random sites that meet WQS by the total number of random locations ((5/5)100=100%). This value is coupled with a 95% confidence interval to provide our estimation of certainty (MDEQ, 2015), meaning there is 95% certainty that the true proportion of attainment in the Tahquamenon River watershed is between 55% and 100%.

## Two Hearted River Watershed

In 2014, four randomly selected sites within the Two Hearted River watershed were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed survey,  $100\% \pm 53\%$  of the randomly selected sites supported the other indigenous aquatic life and wildlife designated use using biological monitoring procedures (MDEQ, 2015). Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations  $((4/4)100=100\%)$ . This value is coupled with a 95% confidence interval to provide our estimation of certainty (MDEQ, 2015), meaning there is 95% certainty that the true proportion of attainment in the Two Hearted River watershed is between 47% and 100%.

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Figure 1. Status and trend site locations during the 2014 biological survey of the Tahquamenon River and Two Hearted River Watersheds, Alger, Luce, Chippewa, and Mackinac Counties.

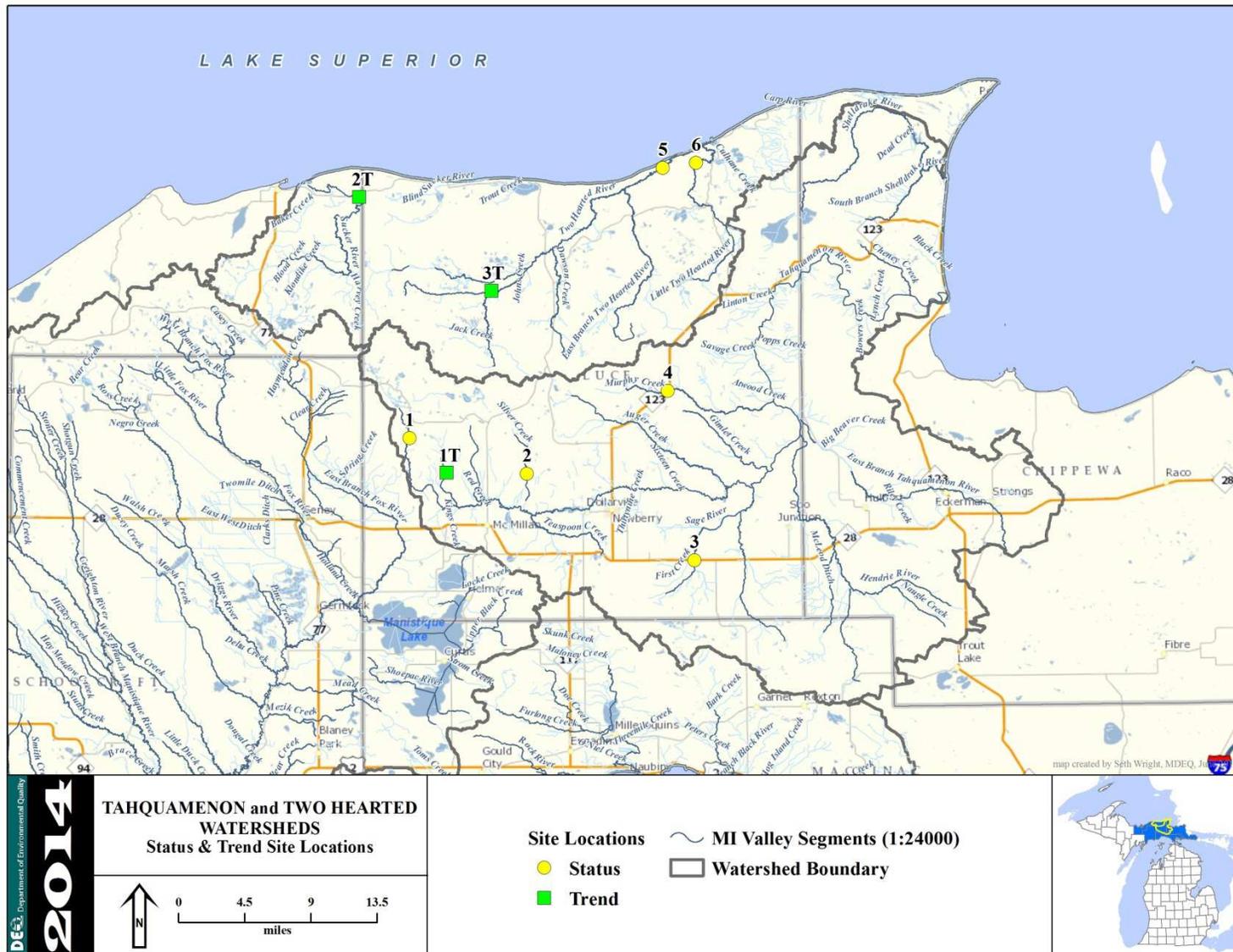


Table 1. Status and trend site locations during the 2014 biological survey of the Tahquamenon River and Two Hearted River watersheds.

STATUS SITES													
SITE ID	WATERBODY NAME	LOCATION	WATERSHED	LATTITUDE	LONGITUDE	COUNTY	AUID	STORET	STREAM TYPE	MACROINVERTEBRATES	SCORE	HABITAT	SCORE
1	Tahquamenon River	Two track at Log Cabin w/red roof	Tahquamenon	46.42482	-85.79771	Luce	040202020101-01	480074	Coldwater	Excellent	8	Excellent	200
2	Silver Creek	Camp Six Road	Tahquamenon	46.38955	-85.63131	Luce	040202020106-02	480073	Coldwater	Excellent	6	Excellent	186
3	West Branch Sage River	M28	Tahquamenon	46.30347	-85.39343	Luce	040202020202-01	480035	Coldwater	Acceptable	3	Excellent	156
4	Murphy Creek	M123	Tahquamenon	46.47021	-85.42962	Luce	040202020503-01	480075	Coldwater	Acceptable	4	Excellent	176
5	Two Hearted River	Off Mouth of Two Hearted Rd.	Two Hearted	46.68921	-85.43447	Luce	040202010306-NA	480069	Coldwater	Acceptable	4	Good	142
6	Little Two Hearted River	Off County Road 412	Two Hearted	46.69381	-85.38714	Luce	040202010402-03	480072	Coldwater	Excellent	5	Good	145
TREND SITES													
SITE ID	WATERBODY NAME	LOCATION	WATERSHED	LATTITUDE	LONGITUDE	COUNTY	AUID	STORET	STREAM TYPE	MACROINVERTEBRATES	SCORE	HABITAT	SCORE
1T	Syphon Creek	County Road 442	Tahquamenon	46.39071	-85.74531	Luce	040202020101-03	480038	Coldwater	Excellent	5	Excellent	189
2T	Sucker River	Grand Marais Truck Trail	Two Hearted	46.66203	-85.86893	Alger	040202010208-01	20160	Coldwater	Acceptable	4	Good	152
3T	W B Two-Hearted River	County Road 418	Two Hearted	46.56936	-85.68010	Luce	040202010306-01	480067	Warmwater	Excellent	6	Good	154

Table 2. Habitat evaluation for the Tahquamenon River and Two Hearted River watershed probabilistic sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

	Tahquamenon River	Silver Creek	West Branch Sage River	Murphy Creek
	Log Cabin with red roof	Camp Six Road	M-28	M123
	RIFFLE/RUN	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL
<b>HABITAT METRIC</b>				
<b>Substrate and Instream Cover</b>				
Epifaunal Substrate/ Avail Cover (20)	20	15	13	12
Embeddedness (20)*	20			
Velocity/Depth Regime (20)*	20			
Pool Substrate Characterization (20)**		18	12	14
Pool Variability (20)**		18	15	15
<b>Channel Morphology</b>				
Sediment Deposition (20)	20	16	15	17
Flow Status - Maint. Flow Volume (10)	10	10	10	10
Flow Status - Flashiness (10)	10	10	10	10
Channel Alteration (20)	20	20	18	20
Frequency of Riffles/Bends (20)*	20			
Channel Sinuosity (20)**		19	7	18
<b>Riparian and Bank Structure</b>				
Bank Stability (L) (10)	10	10	9	10
Bank Stability (R) (10)	10	10	9	10
Vegetative Protection (L) (10)	10	10	9	10
Vegetative Protection (R) (10)	10	10	9	10
Riparian Veg. Zone Width (L) (10)	10	10	10	10
Riparian Veg. Zone Width (R) (10)	10	10	10	10
<b>TOTAL SCORE (200):</b>	<b>200</b>	<b>186</b>	<b>156</b>	<b>176</b>
<b>HABITAT RATING:</b>	<b>EXCELLENT</b>	<b>EXCELLENT</b>	<b>EXCELLENT</b>	<b>EXCELLENT</b>
	(NON-IMPAIRED)	(NON-IMPAIRED)	(NON-IMPAIRED)	(NON-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:	9/18/2014	9/18/2014	9/17/2014	9/17/2014
Weather:	Sunny	Sunny	Cloudy	Cloudy
Air Temperature:	45 Deg. F.	45 Deg. F.	45 Deg. F.	50 Deg. F.
Water Temperature:	50 Deg. F.	50 Deg. F.	54 Deg. F.	53 Deg. F.
Ave. Stream Width:	37.18 Feet	12.83 Feet	20 Feet	12.24 Feet
Ave. Stream Depth:	0.853 Feet	1.67 Feet	2.08 Feet	2.106 Feet
Surface Velocity:	1.52 Ft./Sec.	1.79 Ft./Sec.	0.387 Ft./Sec.	0.82 Ft./Sec.
Estimated Flow:	48.2061008 CFS	38.352719 CFS	16.0992 CFS	21.1375008 CFS
Stream Modifications:	None	None	Impounded	None
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	480074	480073	480035	480075
Stream Name:	Tahquamenon River	Silver Creek	West Branch Sage River	Murphy Creek
Road Crossing/Location:	Log Cabin with red roof	Camp Six Road	M-28	M123
County Code:	48	48	48	48
TRS:	47N12W27	46N11W13	45N09W14	47N09W16
Latitude (dd):	46.43442	46.38955	46.30306	46.47021
Longitude (dd):	-85.79972	-85.63131	-85.39305	-85.42962
Ecoregion:	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	
USGS Basin Code:	4020202	4020202	4020202	4020202
* Applies only to Riffle/Run stream Surveys				
** Applies only to Glide/Pool stream Surveys				
COMMENTS:				

Table 2 cont. Habitat evaluation for the Tahquamenon River and Two Hearted River watershed probabilistic sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

	Two Hearted River Off Mouth of Two Hearted Rd GLIDE/POOL	Little Two Hearted River Off County Rd 412 GLIDE/POOL
<b>HABITAT METRIC</b>		
<b>Substrate and Instream Cover</b>		
Epifaunal Substrate/ Avail Cover (20)	13	10
Embeddedness (20)*		
Velocity/Depth Regime (20)*		
Pool Substrate Characterization (20)**	10	10
Pool Variability (20)**	15	15
<b>Channel Morphology</b>		
Sediment Deposition (20)	11	13
Flow Status - Maint. Flow Volume (10)	9	9
Flow Status - Flashiness (10)	6	9
Channel Alteration (20)	16	18
Frequency of Rifles/Bends (20)*		
Channel Sinuosity (20)**	20	16
<b>Riparian and Bank Structure</b>		
Bank Stability (L) (10)	5	9
Bank Stability (R) (10)	5	9
Vegetative Protection (L) (10)	8	6
Vegetative Protection (R) (10)	6	6
Riparian Veg. Zone Width (L) (10)	9	6
Riparian Veg. Zone Width (R) (10)	9	9
<b>TOTAL SCORE (200):</b>	<b>142</b>	<b>145</b>
<b>HABITAT RATING:</b>	<b>GOOD (SLIGHTLY 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:	9/4/2014	9/4/2014
Weather:	Partly Cloudy	Rainy
Air Temperature:	60 Deg. F.	60 Deg. F.
Water Temperature:	61 Deg. F.	62 Deg. F.
Ave. Stream Width:	40 Feet	28 Feet
Ave. Stream Depth:	2.5 Feet	2 Feet
Surface Velocity:	0.8 Ft./Sec.	0.7 Ft./Sec.
Estimated Flow:	80 CFS	39.2 CFS
Stream Modifications:	None	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	480069	480072
Stream Name:	Two Hearted River	Little Two Hearted River
Road Crossing/Location:	Off Mouth of Two Hearted Rd	Off County Rd 412
County Code:	48	48
TRS:	50N09W 33	50N09W 35
Latitude (dd):	46.689208	46.69381
Longitude (dd):	-85.434471	-85.38714
Ecoregion:	NLAF	NLAF
Stream Type:	Coldwater	Coldwater
USGS Basin Code:	4020201	4020201
* Applies only to Riffle/Run stream Surveys		
** Applies only to Glide/Pool stream Surveys		
COMMENTS:		

Table 3. Qualitative macroinvertebrate sampling results for the Tahquamenon River and Two Hearted River watershed probabilistic sampling sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

TAXA	Tahquamenon River Two track at Log Cabin with red roof 9/18/2014 STATION 1	Silver Creek Camp Six Road 9/18/2014 STATION 2	West Branch Sage River M-28 9/17/2014 STATION 3	Murphy Creek M123 9/17/2014 STATION 4
<b>ANNELIDA (segmented worms)</b>				
Hirudinea (leeches)			1	1
Oligochaeta (worms)	1			5
<b>ARTHROPODA</b>				
<b>Crustacea</b>				
Amphipoda (scuds)	1	2	22	1
Decapoda (crayfish)			1	1
Isopoda (sowbugs)		1		
<b>Arachnoidea</b>				
Hydracarina		11	28	9
<b>Insecta</b>				
<b>Ephemeroptera (mayflies)</b>				
Baetiscidae			1	
Baetidae	24	48	3	
Caenidae				6
Ephemerellidae	39	30	1	7
Ephemeridae			1	2
Heptageniidae	10		4	
Leptophlebiidae	23		120	111
Siphonuridae	1	1	9	8
Tricorythidae	4			8
<b>Odonata</b>				
<b>Anisoptera (dragonflies)</b>				
Aeshnidae	2		4	2
Cordulegastridae	1		1	1
Gomphidae	13		1	
<b>Zygoptera (damselflies)</b>				
Calopterygidae	3		9	1
<b>Plecoptera (stoneflies)</b>				
Nemouridae		29		2
Perlidae	41			
Perlodidae	1			
Pteronarcyidae	1	8		
Taeniopterygidae		5		
<b>Hemiptera (true bugs)</b>				
Belostomatidae			1	
Corixidae			8	1
Gerridae	1	1	1	
Mesoveliidae				2
Nepidae			1	
Notonectidae			1	
Pleidae			1	
<b>Megaloptera</b>				
Corydalidae (dobson flies)	4			1
Sialidae (alder flies)			5	1
<b>Trichoptera (caddisflies)</b>				
Brachycentridae	9	30		
Glossosomatidae	1			
Hydropsychidae	90	22		
Hydroptilidae			6	1
Leptoceridae	1	1	4	7
Limnephilidae	2	1	51	17

Molannidae			1	1
Philopotamidae	38	29		
Phryganeidae		2	4	
Polycentropodidae	4		2	7
Rhyacophilidae	6			
Uenoidae	2			
Lepidoptera (moths)				
Pyralidae				1
Coleoptera (beetles)				
Dytiscidae (total)		1		2
Gyrinidae (adults)				4
Elmidae	23		16	1
Diptera (flies)				
Athericidae	1			2
Ceratopogonidae	2	4	2	10
Chironomidae	5	52	10	50
Culicidae			3	1
Dixidae		1	5	1
Empididae		4		
Ptychopteridae	1	1		
Simuliidae	10	57	1	13
Tabanidae		1		1
Tipulidae	1	1		2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			2	
Hydrobiidae			4	
Lymnaeidae			4	
Physidae	2			
Planorbidae			3	
Pelecypoda (bivalves)				
Pisidiidae		1		
Sphaeriidae (clams)		1		
<b>TOTAL INDIVIDUALS</b>	<b>368</b>	<b>345</b>	<b>342</b>	<b>291</b>

METRIC	Tahquamenon River Two track at Log Cabin 9/18/2014 STATION 1		Silver Creek Camp Six Road 9/18/2014 STATION 2		West Branch Sage River M-28 9/17/2014 STATION 3		Murphy Creek M123 9/17/2014 STATION 4	
	Value	Score	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	34	1	27	0	38	1	36
NUMBER OF MAYFLY TAXA	6	1	3	0	7	1	6	1
NUMBER OF CADDISFLY TAXA	9	1	6	1	6	1	5	0
NUMBER OF STONEFLY TAXA	3	1	3	1	0	-1	1	0
PERCENT MAYFLY COMP.	27.45	1	22.90	1	40.64	1	48.80	1
PERCENT CADDISFLY COMP.	41.58	1	24.64	0	19.88	0	11.34	0
PERCENT DOMINANT TAXON	24.46	0	16.52	1	35.09	-1	38.14	-1
PERCENT ISOPOD, SNAIL, LEECH	0.54	1	0.29	1	4.09	0	0.34	1
PERCENT SURF. AIR BREATHERS	0.54	1	0.87	1	4.68	1	3.44	1
<b>TOTAL SCORE</b>		<b>8</b>		<b>6</b>		<b>3</b>		<b>4</b>
MACROINV. COMMUNITY RATING		EXCELLENT		EXCELLENT		ACCEPT.		ACCEPT.

Table 3 cont. Qualitative macroinvertebrate sampling results for the Tahquamenon River and Two Hearted River watershed probabilistic sampling sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

TAXA	Two Hearted River	Little Two Hearted River
	Off Mouth of Two Hearted Rd 9/4/2014 STATION 1	Off County Rd 412 9/4/2014 STATION 2
<b>ANNELIDA (segmented worms)</b>		
Oligochaeta (worms)	3	1
<b>ARTHROPODA</b>		
<b>Crustacea</b>		
Amphipoda (scuds)		2
Decapoda (crayfish)		1
<b>Arachnoidea</b>		
Hydracarina	1	2
<b>Insecta</b>		
<b>Ephemeroptera (mayflies)</b>		
Baetiscidae	26	12
Baetidae	7	80
Caenidae	3	
Ephemerellidae	2	8
Ephemeridae		3
Heptageniidae	3	8
Leptophlebiidae	5	6
<b>Odonata</b>		
<b>Anisoptera (dragonflies)</b>		
Aeshnidae	2	1
Gomphidae	4	11
<b>Zygoptera (damselflies)</b>		
Calopterygidae	1	2
<b>Plecoptera (stoneflies)</b>		
Perlidae	4	4
Pteronarcyidae	22	1
<b>Hemiptera (true bugs)</b>		
<b>Belostomatidae</b>		
Corixidae	1	
Gerridae	1	2
Velidae		2
<b>Megaloptera</b>		
Sialidae (alder flies)		2
<b>Trichoptera (caddisflies)</b>		
Brachycentridae	72	21
Glossosomatidae		1
Hydropsychidae	17	12
Lepidostomatidae	1	
Leptoceridae	2	1
Limnephilidae	9	6
Molannidae	1	1
Phryganeidae	1	1
Polycentropodidae	1	1
<b>Coleoptera (beetles)</b>		
Dytiscidae (total)	1	1
Gyrinidae (adults)	26	4
Hydrophilidae (total)		1
Dryopidae	1	
Elmidae	6	

Diptera (flies)		
Athericidae	1	3
Ceratopogonidae		1
Chironomidae	28	33
Simuliidae	1	11
Tabanidae	1	1
Tipulidae	1	1
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	2	
Physidae	68	16
Planorbidae	2	
Pelecypoda (bivalves)		
Sphaeriidae (clams)	1	
<b>TOTAL INDIVIDUALS</b>	<b>328</b>	<b>265</b>

Table 2B. Macroinvertebrate metric evaluation of

METRIC	Two Hearted River		Little Two Hearted River	
	Off Mouth of Two Hearted Rd		Off County Rd 412	
	9/4/2014		9/4/2014	
	STATION 1		STATION 2	
	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	36	1	37	1
NUMBER OF MAYFLY TAXA	6	1	6	1
NUMBER OF CADDISFLY TAXA	8	1	8	1
NUMBER OF STONEFLY TAXA	2	1	2	1
PERCENT MAYFLY COMP.	14.02	0	44.15	1
PERCENT CADDISFLY COMP.	31.71	1	16.60	0
PERCENT DOMINANT TAXON	21.95	0	30.19	-1
PERCENT ISOPOD, SNAIL, LEECH	21.95	-1	6.04	0
PERCENT SURF. AIR BREATHER	8.84	0	4.15	1
<b>TOTAL SCORE</b>			<b>4</b>	<b>5</b>
<b>MACROINV. COMMUNITY RATING</b>		<b>ACCEPT.</b>		<b>EXCELLENT</b>

Table 4. Habitat evaluation for the Tahquamenon River and Two Hearted River watershed trend sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

	Syphon Creek	Sucker River	West Branch Two Hearted River
	M-442	Grand Marais Truck Trail	County Road 418
	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL
<b>HABITAT METRIC</b>			
<b>Substrate and Instream Cover</b>			
Epifaunal Substrate/ Avail Cover (20)	15	19	15
Embeddedness (20)*			
Velocity/Depth Regime (20)*			
Pool Substrate Characterization (20)**	19	15	10
Pool Variability (20)**	17	19	14
<b>Channel Morphology</b>			
Sediment Deposition (20)	19	13	10
Flow Status - Maint. Flow Volume (10)	10	9	9
Flow Status - Flashiness (10)	10	3	8
Channel Alteration (20)	20	20	20
Frequency of Riffles/Bends (20)*			
Channel Sinuosity (20)**	19	19	16
<b>Riparian and Bank Structure</b>			
Bank Stability (L) (10)	10	5	8
Bank Stability (R) (10)	10	5	9
Vegetative Protection (L) (10)	10	5	8
Vegetative Protection (R) (10)	10	5	9
Riparian Veg. Zone Width (L) (10)	10	10	8
Riparian Veg. Zone Width (R) (10)	10	5	10
<b>TOTAL SCORE (200):</b>	<b>189</b>	<b>152</b>	<b>154</b>
<b>HABITAT RATING:</b>	<b>EXCELLENT (NON- IMPAIRED)</b>	<b>GOOD (SLIGHTLY 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:	9/18/2014	9/18/2014	9/5/2014
Weather:	Sunny	Partly Cloudy	Rainy
Air Temperature:	50 Deg. F.	40 Deg. F.	60 Deg. F.
Water Temperature:	48 Deg. F.	50 Deg. F.	58 Deg. F.
Ave. Stream Width:	9.744 Feet	31.7 Feet	38 Feet
Ave. Stream Depth:	1.11 Feet	1.85 Feet	2.5 Feet
Surface Velocity:	1.7 Ft./Sec.	1.77 Ft./Sec.	1.2 Ft./Sec.
Estimated Flow:	18.386928 CFS	103.80165 CFS	114 CFS
Stream Modifications:	None	None	None
Nuisance Plants (Y/N):	N	N	N
Report Number:			
STORET No.:	480038	20160	480067
Stream Name:	Syphon Creek	Sucker River	West Branch Two Hearted River
Road Crossing/Location:	M-442	Grand Marais Truck Trail	County Road 418
County Code:	48	02	48
TRS:	46N12W12	49N13W12	48N11W09
Latitude (dd):	46.39083	46.66203	46.56948
Longitude (dd):	-85.74472	-85.86893	-85.68017
Ecoregion:	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Warmwater
USGS Basin Code:	4020202	4020201	4020201
* Applies only to Riffle/Run stream Surveys			
** Applies only to Glide/Pool stream Surveys			
<b>COMMENTS:</b>			

Table 5. Qualitative macroinvertebrate sampling results for the Tahquamenon River and Two Hearted River watershed trend sampling sites, Alger, Luce, Chippewa, and Mackinac Counties, September 2014.

TAXA	Syphon Creek M-442 9/18/2014 STATION 1	Sucker River Grand Marais Truck Trail 9/18/2014 STATION 2	West Branch Two Hearted River County Road 418 9/5/2014 STATION 3
<b>ANNELIDA (segmented worms)</b>			
Hirudinea (leeches)	1		
Oligochaeta (worms)	26		2
<b>ARTHROPODA</b>			
<b>Crustacea</b>			
Amphipoda (scuds)			2
<b>Arachnoidea</b>			
Hydracarina	40	4	1
<b>Insecta</b>			
<b>Ephemeroptera (mayflies)</b>			
Baetidae	33	49	4
Ephemerellidae	52	18	8
Heptageniidae		13	1
Leptophlebiidae		4	5
Siphonuridae	1		1
<b>Odonata</b>			
<b>Anisoptera (dragonflies)</b>			
Aeshnidae		3	
Cordulegastridae			1
Gomphidae		3	
<b>Zygoptera (damselflies)</b>			
Calopterygidae		2	
<b>Plecoptera (stoneflies)</b>			
Nemouridae	11		
Perlidae	1	11	1
Perlodidae	1		
Pteronarcyidae		20	5
<b>Hemiptera (true bugs)</b>			
Corixidae	1	1	
Gerridae		1	1
<b>Megaloptera</b>			
Corydalidae (dobson flies)			1
Sialidae (alder flies)			1
<b>Trichoptera (caddisflies)</b>			
Brachycentridae	18	112	29
Hydropsychidae	41	83	87
Limnephilidae	14	2	1
Molannidae	1		
Philopotamidae	1	3	5
Phryganeidae	1		
Polycentropodidae			1
Rhyacophilidae			1
<b>Coleoptera (beetles)</b>			
Dytiscidae (total)	1		
Gyrinidae (adults)		1	1
Haliplidae (adults)			1
Gyrinidae (larvae)			1

Diptera (flies)			
Athericidae	2	3	7
Ceratopogonidae	8	1	2
Chironomidae	58	10	222
Dixidae	7		
Ptychopteridae	4		
Simuliidae	10	5	5
Tabanidae			1
Tipulidae	4		4
MOLLUSCA			
Gastropoda (snails)			
Lymnaeidae	1		1
Physidae	1	1	1
Pelecypoda (bivalves)			
Sphaeriidae (clams)	1		9
<b>TOTAL INDIVIDUALS</b>	<b>340</b>	<b>350</b>	<b>413</b>

METRIC	Syphon Creek M-442 9/18/2014 STATION 1		Sucker River Grand Marais Truck Trail 9/18/2014 STATION 2		West Branch Two Hearted County Road 418 9/5/2014 STATION 3	
	Value	Score	Value	Score	Value	Score
	TOTAL NUMBER OF TAXA	27	0	22	0	31
NUMBER OF MAYFLY TAXA	3	0	4	0	5	1
NUMBER OF CADDISFLY TAXA	6	1	4	0	6	1
NUMBER OF STONEFLY TAXA	3	1	2	1	2	1
PERCENT MAYFLY COMP.	25.29	1	24.00	1	4.60	0
PERCENT CADDISFLY COMP.	22.35	0	57.14	1	30.02	1
PERCENT DOMINANT TAXON	17.06	0	32.00	-1	53.75	-1
PERCENT ISOPOD, SNAIL, LEECH	0.88	1	0.29	1	0.48	1
PERCENT SURF. AIR BREATHERS	1.76	1	0.86	1	0.73	1
<b>TOTAL SCORE</b>		<b>5</b>		<b>4</b>		<b>6</b>
MACROINV. COMMUNITY RATING		<b>EXCELLENT</b>		<b>ACCEPT.</b>		<b>EXCELLENT</b>