MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
OCTOBER 2013

STAFF REPORT

BIOLOGICAL SURVEY OF THE TAWAS RIVER AND AU GRES RIVER WATERSHEDS ARENAC, IOSCO, AND OGEMAW COUNTIES, MICHIGAN JULY 12-15, AUGUST 9-11, AND AUGUST 23-25, 2011

Staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), conducted biological surveys of the Tawas River and Au Gres River watersheds located in Arenac, Iosco, and Ogemaw Counties on July 12-15, August 9-11, and August 23-25, 2011. Qualitative macroinvertebrate, habitat, and fish surveys were conducted throughout the watersheds (Figure 1; Table1) following the SWAS Procedure 51 (MDEQ, 1990) and the Macroinvertebrate Community Status and Trend Monitoring Procedure (MDEQ, Draft).

OBJECTIVES

The biological surveys were conducted to:

- Support water quality-based effluent limit development for National Pollutant Discharge Elimination System (NPDES) permits.
- Identify nonpoint sources (NPS) of water quality impairment.
- Evaluate the effectiveness of specific NPS water quality improvement projects.
- Assess the current status and condition of individual assessment units and determine whether Water Quality Standards (WQS) are being met.
- Evaluate macroinvertebrate community temporal trends.
- Satisfy water quality monitoring requests submitted by internal and external customers.
- Support Total Maximum Daily Load development for surface waters of nonattainment and address nonattainment listings described in the 2010 Integrated Report (LeSage and Smith, 2010).

BACKGROUND AND HISTORICAL SAMPLING EFFORTS

The Au Gres River watershed originates on the east side of Ogemaw County in South Dease and Johnson Lakes. The Au Gres River flows through Arenac and Iosco Counties where it makes its way through the town of Au Gres and flows into Lake Huron. There are ten point sources with NPDES permits within this watershed; Michigan Gypsum, National Gypsum (x2), United States Gypsum, Bessinger Pickle, Prescott Wastewater Treatment Plant (WWTP), Au Gres WWTP, Twining Wastewater Sewage Lagoon (WWSL), Iosco County Road Commission Quarry, and R.E. Glancy, Inc. (Figure 2; Table 2).

The Tawas River watershed is located within Iosco County, originating from several small tributaries. These tributaries converge at Tawas Lake where the river continues through Tawas City and empties into Lake Huron. Only one major NPDES permitted facility (Tawas Utility Authority [Tawas] WWTP) is located in the watershed, which discharges into the Tawas River just below the Tawas Lake outlet (Figure 2; Table 2).

Both the Tawas River and Au Gres River watersheds are located in the Northern Lakes and Forest ecoregion, which commonly has perennial streams that originate in lakes or wetlands. The predominant land use consists primarily of forested and agricultural use (Omernik and Gallant, 1988). Summaries of biological surveys conducted in these watersheds over the last 22 years are provided below.

Au Gres River

In September 1991, a biological survey of the Au Gres River and Johnson Creek was carried out to evaluate the impacts that agricultural NPS had on aquatic macroinvertebrate and fish community structure, physical habitat, and chemical water quality. A second priority was to evaluate the water quality of the Au Gres River prior to the startup of the new Au Gres WWTP. Fish and macroinvertebrate ratings indicated agricultural and NPS were impairing the biological integrity of the Au Gres River. The study also found that low physical habitat ratings may have been influenced by areas of poor bank stability, increased bottom deposition, and trampled banks due to livestock access. It was also determined that WQS were being met for both streams.

Johnson Creek, a small marginal coldwater stream, was surveyed in June 1995 to evaluate biological and physical conditions in the stream before the village of Prescott WWSL was built. Macroinvertebrate communities were moderately impaired, with upstream agricultural runoff cited as a likely cause. Nutrient concentrations supported algal growth throughout the reach and the author noted that future evaluations of water quality impacts by the Prescott WWSL would be difficult to quantify (Taft, 1995).

A chronic toxicity test was performed from November 29 through December 5, 1995, as part of the Great Lakes and Environmental Section effluent and screening test of United States Gypsum Company's outfalls 005 and 003. Both effluents did not meet the aquatic toxicity requirements of Rule 57 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 (Dimond, 1996).

A biological survey was conducted in June 1996 on the East Branch Au Gres River and selected tributaries to evaluate land use impacts on fish and macroinvertebrate communities as well as physical habitat conditions within each tributary. Poor fish communities and moderately impaired macroinvertebrate communities were found in Sand Creek with degraded physical habitat conditions, including channelization of the river, free access to livestock, poorly maintained road crossings, and extensive bank erosion. Fish and macroinvertebrate communities improved stepwise in an upstream progression with Brook Trout found at the furthest upstream site. All other sites rated acceptable for fish and acceptable to excellent for macroinvertebrate communities (Morse, 1996c).

A biological survey was conducted in June 1999 on the Au Gres River evaluating impacts of permitted dischargers, background water quality, and NPS impairments. This watershed survey found that sites generally lacked important in-stream habitat features such as gravel, cobble, large woody debris, or pool-riffle-run development required to support high quality macroinvertebrate communities. Except for several managed drains, the Au Gres River and associated branches and tributaries were judged to meet Michigan's WQS (Walsh, 2002).

In 2006, a biological survey was carried out to evaluate physical habitat and macroinvertebrate communities in the Au Gres River watershed. Habitat and macroinvertebrate communities rated

excellent to poor with scores higher in the headwater sections. Johnson Creek was targeted to address comments in the 2006 Integrated Report (Edly and Wuycheck, 2006) that further data was needed pertaining to nutrient-rich groundwater leaching to the creek from the Prescott WWSL. Johnson Creek rated poor for macroinvertebrates and marginal for habitat due to heavy siltation, bank scouring, and nuisance levels of algae. Water chemistry at these locations revealed high Total Dissolved Solids (TDS) with nutrient levels exceeding 1 milligram per liter (mg/L) total phosphorus concentrations from May through August, peaking at 6.7 mg/L in June. Intercounty Drain also displayed poor macroinvertebrate communities as well as the lowest habitat score in the watershed; two points short of a poor rating. It is notable that substrate appeared to be shallow with a firm clay bottom, but staff sank knee deep into a black, sulfur-smelling muck when entering the drain. Substrate was composed of a material thought to be gypsum (Roush, 2008).

Tawas River

A biological survey was conducted in July 1989 on the Tawas River in the vicinity of the Tawas WWTP to assess the impact of their discharge on the stream, which included aquatic plant growth and sediment contamination of metals and pesticides. Total phosphorus concentrations at Outfall 001 were not found in excess of the facility's NPDES permit, while aquatic plant growth was found to be somewhat enhanced immediately downstream of the WWTP. Pesticides were not detected in the sediments throughout the entire survey reach, but chromium was found at levels higher than typical background levels as defined by Jones and Gerard (1999) below the Tawas WWTP (Hull, 1990).

In August 1995, a biological survey was carried out to evaluate the impacts of the Multi-County Landfill on the macroinvertebrate community, physical habitat conditions, water chemistry, and sediment chemistry of Gray Creek; a tributary to the Tawas River. Macroinvertebrate communities and physical habitat were rated good with no differences determined between Station 1 (upstream of landfill) and Station 2 (downstream of landfill). No chemicals were detected in the water samples that exceeded their respective Rule 57(2), of the Part 4 Rules, allowable levels. However, sediment chemistry did indicate arsenic, iron, and manganese were present in higher concentrations below the groundwater seeps. These elevated concentrations did not exceed either the United States Environmental Protection Agency (USEPA) or the Ontario guidelines for these compounds (Morse, 1996a).

In July 1996, a biosurvey was carried out to evaluate the impact of the Tawas WWTP on the biological integrity of the Tawas River. Surveys were conducted upstream and downstream of the facility. Macroinvertebrate communities rated acceptable at both locations above and below the WWTP. However, taxa collected during the 1996 sampling, more than doubled the taxa collected during the 1989 collection at the same location. While habitat rated poor at both locations, no biological or water chemistry impacts from this point source discharge were identified. The impacts of various land use practices on fish and macroinvertebrate communities were also evaluated at selected tributaries during this survey. Habitat rated poor at two survey locations in Dead Creek and fish communities rated poor on Tuttle Drain, which was related to degraded physical habitat conditions including improper land use, free access for livestock, and poorly maintained road crossings (Morse, 1996b).

Biological surveys in 2001 indicated the Tawas River and its tributaries were attaining Michigan's WQS. Comparisons with biological surveys conducted by MDEQ biologists in 1995 and 1996 indicated little change in water quality in recent years. The limited fish data available indicated a mix of coldwater and warmwater streams that generally supported healthy fish

communities (with the exception of Tuttle Drain, based on 1996 data). Habitat quality in the Tawas River and its tributaries was adequate; however, all stations suffered from sedimentation and the resultant lack of riffles, pools, and solid substrate for benthic invertebrates. Sites on Proper and Dead Creeks were targeted to determine whether the benthic macroinvertebrate community and habitat quality had improved since 1996, but these scheduled surveys were not performed due to lack of water or flowing water, as was found in many headwater streams in this watershed (Kohlhepp, 2002). However, the presence of a creosote film on the water, and the associated odor, at two of the stations caused these locations to not meet the requirements of Rule 50 of the Part 4 Rules, prohibiting the presence of oil films at quantities which are or may become injurious to designated uses (Kohlhepp, 2001).

In 2006, a biological survey was carried out by Roush (2008) to evaluate watershed attainment. However, due to lack of flow at some locations, Procedure 51 surveys were deemed inappropriate and not carried out during the field season. Dead Creek at 2nd Street was also targeted to identify whether creosote from the bridge crossing was impacting the stream as reported by Kohlhepp (2002) and noted in the 2006 Integrated Report (Edly and Wuycheck, 2006). Staff did observe some creosote on rocks below the bridge, but no water quality samples were taken. It was found by Brooks (2000) that creosote impacts from bridges are minimal and isolated to the immediate area of exposure. Habitat and macroinvertebrate communities at Silver Creek rated excellent and acceptable, respectively. Algae was observed at this location, but was not present at levels that would impact the overall survey score. Water samples collected at this location met Michigan WQS.

METHODS

This survey was performed according to Procedure 51 (MDEQ, 1990) to measure habitat and macroinvertebrate community quality in the Au Gres River and Tawas River watersheds. Water chemistry samples were collected as appropriate and transported to the MDEQ's Environmental Laboratory for analysis.

Two site selection methods were used to assess the Au Gres River and Tawas River watersheds in 2011. These included targeted site selection and probabilistic site selection. Targeted site selection includes stations that are selected to fulfill specific monitoring requests, assess known or potential areas of concern where more information is needed, achieve assessment coverage of the watershed, and provide information for NPDES activities. A probabilistic monitoring approach using random site selection was carried out for the remaining river locations throughout both watersheds. This process was carried out by determining the total channel length within the Au Gres River and Tawas River watersheds using the Reach File 3 database to estimate the total stream miles. Based on this data and survey work from previous basin years, it was estimated that approximately 17 biological surveys would represent an achievable workload necessary to adequately assess the entire watershed. Alternate sites were selected to allow for contingencies in the field. Targeted sites were identified prior to random site selection. If targeted sites were subsequently chosen in the random draw, they were considered random. Targeted sites that were not selected in the random selection process were surveyed in addition to the 17 random sites; however, the results of these surveys were not considered for the probabilistic analysis. Thirteen targeted sites and 2 trend sites were also sampled totaling 32 (24 Au Gres River and 8 Tawas River) stations with water chemistry samples collected at 7 of these locations. Twenty-six macroinvertebrate community and 28 habitat assessments were performed during the survey (Table 1).

RESULTS

Au Gres River

HABITAT

Habitat conditions for the 21 stations sampled in the Au Gres River watershed rated from marginal to excellent (Tables 4a and 4b). Stations that were marginal were found to be concentrated near the lower sections of the Au Gres River from Station 22 down to the mouth (Station 5) with the exception of Station 11, which was located approximately 1,500 feet downstream of the outlet of Long Lake in the headwaters of Hale Creek.

Stations rating marginal generally displayed characteristics indicative of hydrologic instability including increased flashiness, homogenization/siltation of in-stream habitat, decreased bank stability and riparian cover, and increased sediment deposition. Additionally, most of these stations were located in the portion of the watershed with very little topographic slope and a predominance of clay and other fine sediment.

Stations rated as excellent and good generally displayed more protective, stable riparian bank areas, more stable flow and channel morphology, and a more diverse and stable instream substrate.

MACROINVERTEBRATES

Macroinvertebrate communities ranged in ratings from poor to acceptable with total taxa ranging from 16 to 36 (Tables 3a and 3b). Stations rating poor and very low acceptable were generally clustered around Elm Creek, Johnson Creek, and the Intercounty Drain in areas where land use was dominated by forage and row crops, pastures, and upland shrub with small pockets of forested areas.

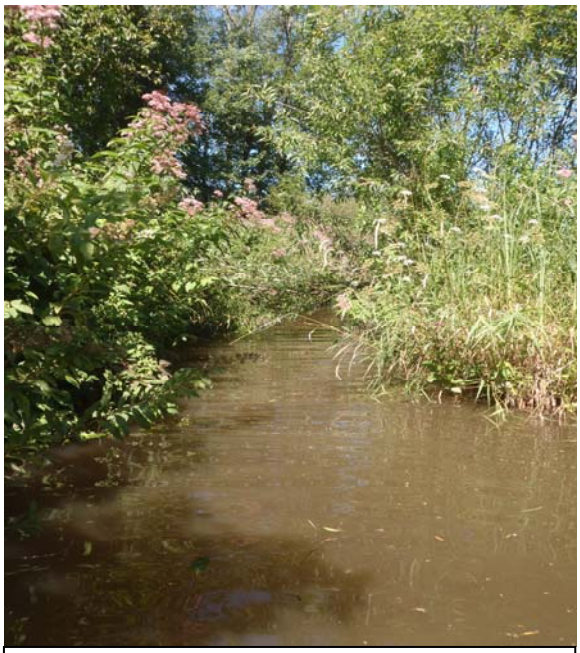

Figure 3. Elm Creek at National City Road.

There were two locations on Elm Creek sampled during this survey period. The National City Road crossing (Station 23; Figure 3) was approximately 1.3 miles downstream of Whittemore Road (Station 7) with macroinvertebrate communities rating as poor (-5) and acceptable (-3), respectively. Station 23 historically scored poor during the 1999 biosurvey (Walsh, 2002) due to reduced habitat quality associated with recent drain maintenance activity. Amphipods, Chironomidae, and a variety of surface breathers were the dominant taxa present at this location with a total of ten taxa collected with no Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichopera (caddisfly) taxa recorded at this site. Kohlhepp (2002) also found macroinvertebrate communities to be represented by ten taxa and rated as poor. Habitat was rated as fair as there was recent drain maintenance activity observed during the time of the survey. Roush (2008) found Procedure 51 inappropriate at this location due to lack of flow (<0.1 cubic feet per second). However, during

the current 2011 survey 23 taxa were found with the dominant organisms comprised of Calopterydids, Isopods, and Elmids. Habitat was rated as good but due to the use of Elm Creek as an active municipal drain, there is only marginal substrate and cover available for macroinvertebrate use, with heavy deposits of fine material affecting 80 percent or more of the bottom substrates. Upstream, at the Whittemore Road crossing, no prior biosurveys were completed. This survey found the macroinvertebrate communities on the low end of acceptable due to moderate erosional problems, canopy removal, and moderate depositional problems including greater than 75 percent embeddedness of sediment. Habitat at this location was rated on the low end of marginal.

Figure 4. Johnson Creek at Sage Lake Road.

Johnson Creek at Sage Lake Road (Station 20; Figure 4) was found to have poor macroinvertebrate communities and good habitat dominated by Amphipods, Chironomids, and Isopods with 16 total taxa identified. This location is upstream of the Prescott WWTP with very low flow with log jams almost stagnating water throughout the reach, which is questionable for use of Procedure 51. This reach looks to get major discharge episodes in the spring but loses its flow during the summer dry months. Structures available for colonization are sparse at this location with no undercut banks, overhanging vegetation, or aquatic macrophytes. Within the channel, only roughly 50 percent of the stream channel filled with water decreasing available habitat further.

Johnson Creek at Greenwood Road (Station 25) is another historical sampling location that has previously scored poor for habitat due to limited substrate and available cover, low bank stability, and limited streamside vegetative cover as well as the land being used as a cow pasture (Taft, 1995). During the 2011 survey the free range cattle had been removed from the pasture and the field had good vegetative growth eliminating the nutrient sources and erosional sediment concerns that were recorded in the 1995 report. However, this location was not surveyed in 2011 due to the lack of access to the stream, which is on private property and restricted with barbed wire. However, other sampling locations were completed within a mile in the upstream and downstream directions. The macroinvertebrate community at Black Road (Station 21), upstream of Station 25, scored acceptable with the habitat scoring good. Downstream of Station 25 (Drow Road; Station 8), the macroinvertebrate community also scored acceptable with the habitat scoring good.

Figure 5. Intercounty Drain at National City Road.

Intercounty Drain at National City Road (Station 22; Figure 5) was first survey by Roush (2008) and is downstream of Michigan Gypsum (Permit #MI0002453) (Figure 2; Table 2). Roush found the macroinvertebrate communities and habitat ratings to be poor and marginal, respectively. Nine macroinvertebrate taxa were found with no midges present and the location dominated by snails. Sediments were very soft and composed of gypsum and black muck, which were approximately 2 feet in depth in 2006. In 2011, the stream was very different with firm sandy sediments with no gypsum or soft black organic muck present throughout the channel (remnants of black organic material was still found under the bridge [Figure 6]). Sediment within the channel was suspected to have been dredged since the last survey and approximately 80 percent of the reach was covered with aquatic vegetation. Twenty-three taxa were identified during this survey with Amphipoda, Physidae, and Chironomidae dominating the reach resulting in a macroinvertebrate community still rating poor and habitats still rating marginal.

FISH

The 2011 fish survey on Sand Creek was initiated based on the poor rating received in the 1996 report (Morse, 1996c). Within that report, seven out of the eight taxa collected were identified as tolerant to pollution. During the 2011 survey at Sand Creek (Station 32) a total of eight taxa were collected in which five were classified as tolerant, one classified as intermediate, and two classified as intolerant to pollution. The overall fish community at this station rated acceptable (Table 5). It should be noted that Sand Creek is a designated trout stream approximately two miles upstream of the Sand Lake Road sampling location, but no salmonids were collected during this fish survey.

Tawas River

HABITAT

Habitat conditions for seven stations sampled (Stations 1, 9, 12, 17, 29, 30, and 31) rated from good to excellent (Tables 4a and 4b). These stations are generally more protective, have stable riparian bank areas, more stable flow and channel morphology, and a more diverse and stable instream substrate.

MACROINVERTEBRATES

Macroinvertebrate communities at all six stations sampled (Stations 1, 9, 12, 17, 30, and 31) rated acceptable with total taxa ranging from 14 to 36 (Tables 3a and 3b). Dead Creek at Lorenz Road (Station 9) was dominated by Amphipods and Chironomids composing 89 percent of the sample, resulting in a low acceptable rating with a total of 17 taxa identified at this location. The habitat was rated good with sparse riparian vegetation, moderately unstable banks, high erosion potential during floods, and sediments dominated by silt and clay. A second station on Dead Creek (Station 28) was scheduled to be surveyed; however, due to seiche effect from Lake Huron (1.1 miles downstream) it was determined that Procedure 51 was not appropriate for this location.

FISH

Historically, Tuttle Drain (Station 29) was found to have poor fish communities with seven taxa collected during the 1996 survey (Morse, 1996b). Of the seven taxa, three were tolerant and composed 60 percent of the sample. This rating was a result of degraded physical habitat conditions. The substrate cover was reduced along with improper land use practices including

poorly maintained road crossings, lack of riparian buffer zones, and livestock having free access to streams. In 2011, the fish community was again sampled at Tuttle Drain (Station 29; Table 5). Seven species were identified resulting in a community that rated as acceptable. Fish taxa present at this location shifted from tolerant in 1996 to intolerant in 2011. Four brook trout were collected at this station as well as longnose dace, pearl dace, and mottled sculpins. Finding brook trout should not be surprising since Silver Creek and all of its tributaries except Tuttle Drain are considered designated trout streams, including Indian and Loud Creeks, which feed Tuttle Drain. Lack of habitat variability, including moderate deposition of sand, sparse availability of large woody debris and submerged vegetation, as well as prevalent shallow pools within the section may effect trout populations within this water body.

VISUAL EVALUATIONS

Au Gres River

A Procedure 51 biosurvey was not conducted on Johnson Creek (Station 25) due to lack of access to the stream and biosurveys had already been conducted immediately upstream (Station 21) and downstream (Station 8) of this location both rating the macroinvertebrate community acceptable. Historically this location was found to have good fish populations, fair macroinvertebrate communities, and poor habitat (Taft, 1995). Observations during the 2011 survey showed a different stream than was surveyed in 1995; in 2011 no aquatic vegetation was apparent in the stream where in 1995 the stream was described as choked with algae. Also, no livestock were present in the pastures and the riparian vegetation was comprised of tall grasses.

Tawas River

Dead Creek (Station 28) was also targeted to identify whether creosote from the bridge crossing appeared to impact the creek. This location was originally observed by Kohlhepp (2001) and was noted in the 2006 Integrated Report (Edly and Wuycheck, 2006) as not meeting the requirements of Rule 50 of the Part 4 Rules, prohibiting the presence of oil films at quantities which are or may be injurious to designated uses. The creosote-laden bridge was visited again in 2006 by Roush (2008) in which some creosote was observed on the bridge and rocks below. It was also found through a library search that creosote impacts were found to be minimal and isolated to the immediate area of exposure (Brooks, 2000). The bridge was visited again during this biosurvey to further assess the presence and impact of creosote on the river. Minimal creosote was observed on the rocks and the creosote on the bridge was looking “weathered.” The location also lacked downstream flow due to seiche effect from Lake Huron creating an environment in which Procedure 51 should not be used.

WATER AND SEDIMENT CHEMISTRY

Water chemistry data were collected at stations when staff had inquiries regarding the conditions of the stream. For this survey, samples were taken at seven stations; five stations had water quality samples collected and analyzed by the MDEQ, Environmental Laboratory, and at two stations, the water quality was analyzed strictly with the YSI sonde. The Michigan WQS were met at all stations.

Au Gres River

Stations sampled on Johnson Creek upstream (Station 20) and downstream (Station 21) of the

Prescott WWTP (NPDES permit #MI0057529) (Table 2; Figure 2) showed a slight increase in TDS at the downstream location but neither of the samples resulted in levels that exceeded the 500 mg/L (monthly average) and 750 mg/L (maximum) WQS (Table 6). The remaining parameters met WQS.

Figure 6. Sediment Sample at Intercounty Drain.

Data from Intercounty Drain (Station 22) was indicative of the effluent quality of Michigan Gypsum whose effluent appears to drive the flow in the drain. Upstream of the effluent location, the drain has no flow and is choked with cattails. Median effluent levels of TDS, total suspended solids, chloride, conductance, copper, magnesium, potassium, sodium, and sulfate taken from the facilities monitoring records were similar to the grab sample data taken at Station 22 on August 24, 2011 (Table 6). However, WQS exceedances were determined for TDS and copper. Michigan Gypsum also has a selenium limit but during this sampling event the concentrations resulted in "not detected." Sediment samples were collected at Station 22 (Table 7; Figure 6) revealing detectable concentrations of arsenic, barium, chromium, cobalt, copper, manganese, nickel, potassium, selenium, sodium, vanadium, and zinc. However, the levels in which these chemicals were found indicate there is little adverse impact on the chemical integrity of the Au Gres River when compared to the USEPA, Region 5, Ecological Screening Levels for sediments. Elevated levels of calcium, magnesium, and iron were also found, which are normally present in the effluent from mines and quarries resulting in increased stream hardness (Table 6).

Mattison & Roberts Drain (Station 26) is located downstream of R.E. Glancy (NPDES permit #MIG490279) (Figure 2; Table 2) and was surveyed for TDS; however, no flow was present in the stream while we were at this location. The stream was shallow with depths around 2 inches and were covered with approximately 25 percent duckweed. Stream banks were steep, covered with herbaceous riparian vegetation, with few immature cottonwoods present. Basic water chemistry was collected with a YSI meter (Table 6).

Cedar Creek Drain (Station 27) was located 0.5 miles downstream of Twining WWSL (NPDES permit #MIG570000) (Figure 2; Table 2) and was surveyed to determine TDS and visual impacts during low flow periods. The stream was approximately 8 feet wide with flow under 1 cubic feet per second. The Twining WWSL has seasonal discharges suggesting present conditions were natural, nondischarge levels. Sediments were composed of gravel, cobble, and silt with some small riffles present 100 feet upstream of the bridge. Riparian zones were dominated by herbaceous grasses and shrubs with surrounding uplands dominated by pasture and row crops. Basic water chemistry was collected with a YSI meter (Table 6).

Tawas River

Water samples collected downstream (Station 31) of the Tawas WWTP (NPDES permit #MI0021091) (Figure 2; Table 2) showed exceedances (690 mg/l) of the 500 mg/l Chronic TDS WQS. All other parameters met WQS with a few parameters displaying concentration increases downstream of the WWTP. These included chlorides, nitrates, potassium, and sodium.

AREAS OF FURTHER INVESTIGATION

Au Gres River at National City Road (Station 4)

- Stability on the left bank was moderately unstable increasing to unstable during high water events. The thalweg of the river hits the banks directly as it passes under the National City Road bridge and creates a back eddy leading to more erosion of the bank.
- Influences from eroded sediment are moderate to heavy within this section with substrates composed of 95 percent silt and sand.

Intercounty Drain at National City Road (Station 22)

- Michigan Gypsum uses this drain as the primary effluent leaving the quarry. Flow from the drain is almost exclusively from the quarry.
- In 2006, “grayish” silt and black organic material covered the entire bottom of the drain and was extremely soft and deep with a sulfur-like smell. SWAS staff noted sinking to their knees within the drain.
- In 2011, the site looks to be dredged with a little of the black and grey material present. The only locations this previous material was found was along margins and under the bridge. Sediments were found to be firm and covered with vegetation.
- Water quality and stream sediments need further monitoring to determine if quarry effluents are impacting the drain.

WATERSHED ATTAINMENT STATUS

Based on the probabilistic monitoring aspect of this watershed survey, 100 percent of the randomly selected sites supported the other indigenous aquatic life and wildlife designated use component of R 323.1100(1)(e) of the Michigan WQS using Procedure 51. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations (17 / 17 = 100%).

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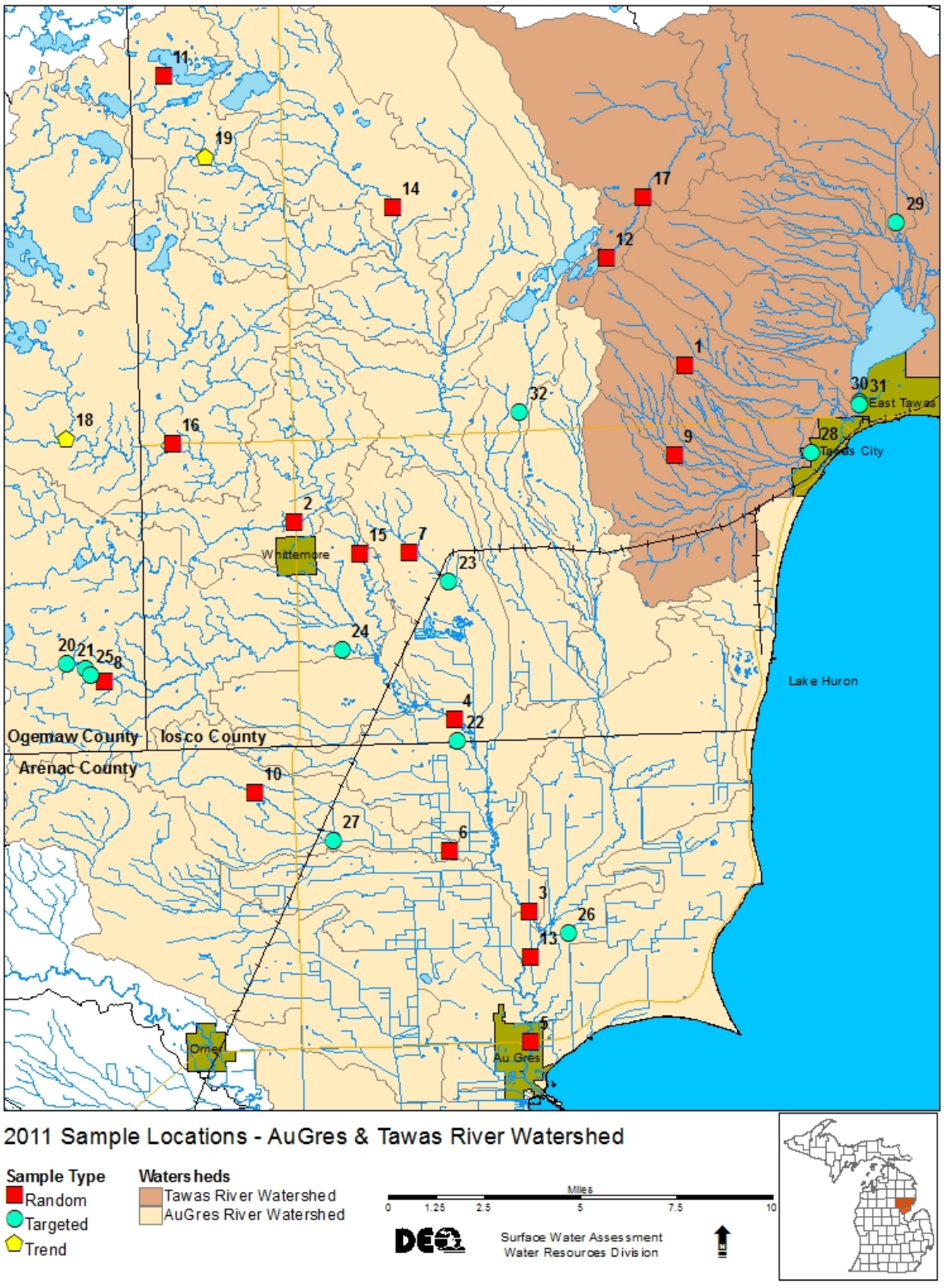

Figure 1. Selected 2011 random and targeted monitoring locations in the Au Gres and Tawas River watersheds located in Arenac, Iosco, and Ogemaw counties, June-August 2011.

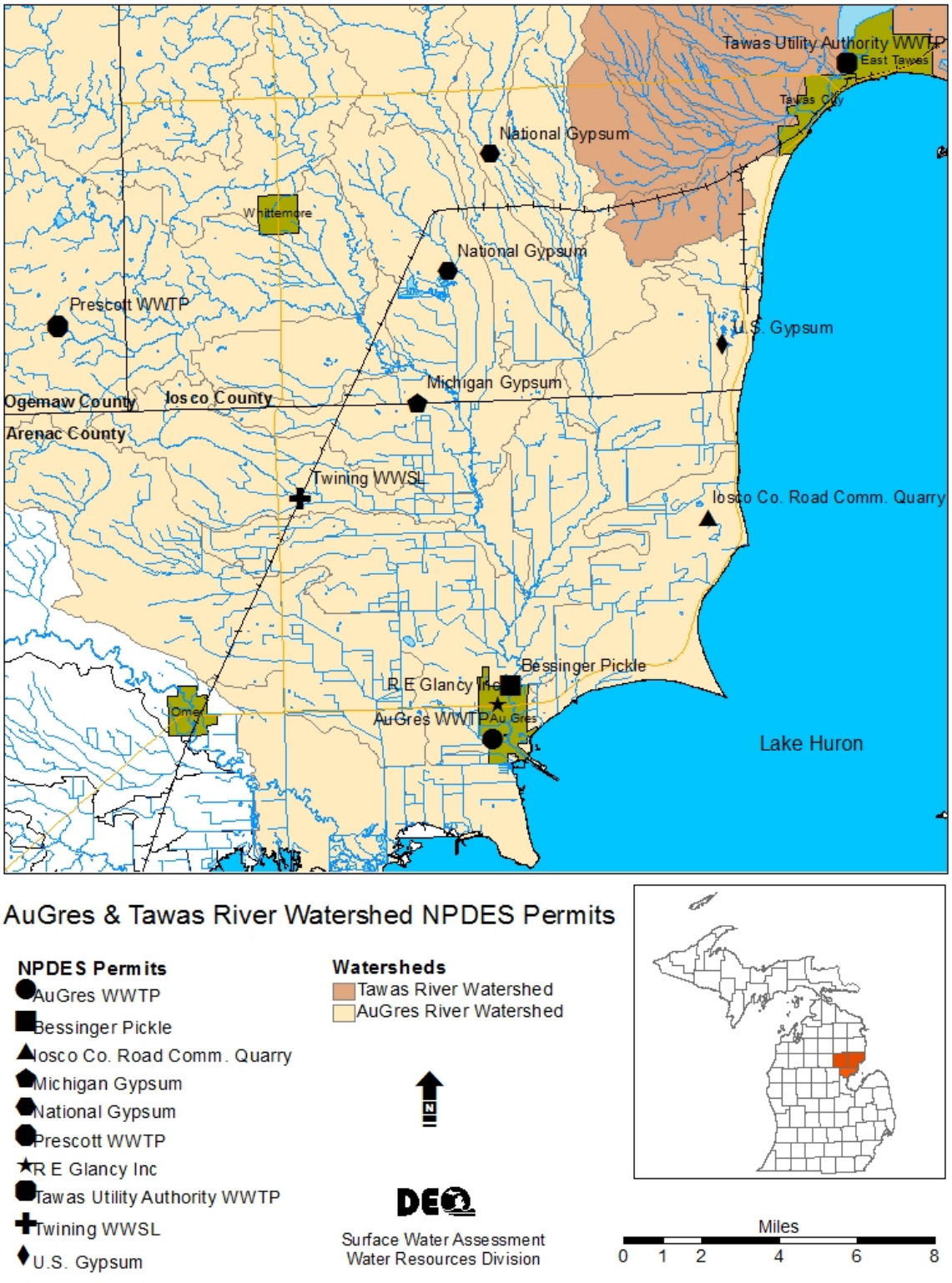

Figure 2. NPDES Permitted Discharge Sites in the Au Gres and Tawas River watersheds, 2011.

Table 1. Station summary for the Au Gres and Tawas River watersheds, July - August, 2011.

Site ID	Waterbody Name	Location	Latitude	Longitude	Macroinvertebrate		Fish		Habitat		Chem
Random Sites											
1	Cold Creek	Laidlaw Road	44.30109	-83.59643	Acceptable	0			Good	123	
2	Porterfield Creek	M-65	44.24618	-83.80309	Acceptable	2			Good	144	
3	Au Gres River	Mackinaw Road (north)	44.09721	-83.68584	Acceptable	4			Marginal	98	
4	Au Gres River	National City Road	44.17016	-83.72236	Acceptable	1			Good	109	
5	Au Gres River	US 23 (Huron Road)	44.04830	-83.68707	Acceptable	4			Marginal	71	
6	Cedar Creek Drain	Herr Road	44.12073	-83.72652	Acceptable	-3			Marginal	92	
7	Elm Creek	Whittemore Road	44.23383	-83.74332	Acceptable	-3			Good	108	
8	Johnson Creek	Drow Road	44.18798	-83.90457	Acceptable	-2			Good	142	
9	Dead Creek	Lorenz Road	44.26729	-83.60295	Acceptable	-3			Good	110	
10	Cedar Creek Drain	Lehman Road	44.14468	-83.82791	Acceptable	1			Good	129	
11	Hale Creek	Long Lake Road	44.41548	-83.86565	Acceptable	-1			Marginal	92	
12	Silver Creek	Essex Road	44.34266	-83.63599	Acceptable	0			Good	135	
13	Au Gres River	Mackinaw Road (south)	44.08024	-83.68590	Acceptable	3			Marginal	88	
14	Smith Creek	Curtis Road	44.36400	-83.74732	Acceptable	4			Excellent	171	
15	Au Gres River	Whittemore Road	44.23369	-83.76952	Acceptable	4			Good	153	
16	Au Gres River	M-55	44.27702	-83.86609	Acceptable	3			Good	139	
17	Silver Creek	Curtis Road	44.36500	-83.61540	Acceptable	3			Excellent	165	
Trend Sites											
18	Nester Creek	d/s S Sage Lake Rd	44.27987	-83.92157	Acceptable	-3			Good	148	
19	Hale Creek	Ora Lake Road	44.38488	-83.84468	Acceptable	-3			Good	132	
Targeted Sites											
20	Johnson Creek	Sage Lake Road	44.19516	-83.92472	Poor	-5			Good	125	W
21	Johnson Creek	Black Road	44.19292	-83.91476	Acceptable	-4			Good	118	W
22	Intercounty Drain	National City Road	44.16220	-83.72130	Poor	-5			Marginal	73	W,S
23	Elm Creek	National City Road	44.22243	-83.72322	Poor	-5			Good	137	
24	Johnson Creek	South Towerline Road	44.19780	-83.78028	Acceptable	3			Good	111	
25	Johnson Creek	Greenwood Road	44.19080	-83.91200	*						X
26	Mattison & Roberts Drain	Tonkey Road	44.08850	-83.66585							Y, X
27	Cedar Creek Drain	Crawford Road	44.12577	-83.78740							Y, X
28	Dead Creek	12th Street	44.26709	-83.53160	^						X
29	Tuttle Drain	Davidson/Swan Road	44.35236	-83.48312			Acceptable	-3	Good	130	W
30	Tawas River	u/s Nunn Road	44.28541	-83.50525	Acceptable	-1			Good	149	W
31	Tawas River	d/s Nunn Road	44.28442	-83.50525	Acceptable	0			Good	152	
32	Sand Creek	Sand Lake Road	44.24941	-83.68330			Acceptable	3	Good	116	

* No Access

^ No P-51 performed due to Seiche Effect from Lake Huron

W - Water Chemistry Collected

S - Sediment Sample Collected

X - Observations Only

Y - YSI Meter Readings

Table 2. NPDES permitted discharges in the AuGres & Tawas River Watersheds located in Arenac, Iosco & Ogemaw Counties, 2011.

Designated Name	Permit No.	Expiration Date	County	Latitude	Longitude	Receiving Water
AuGres River Watershed (HUC 04080101)						
Individual Permits						
National Gypsum	MI0003531	10/1/2012	Iosco	44.254166	-83.691666	Sand Creek
Michigan Gypsum	MI0002453	10/1/2012	Iosco	44.16194	-83.73333	Intercounty Drain & AuGres River
Bessinger Pickle	MI0048755	10/1/2012	Arenac	44.055277	-83.68888	AuGres River
U.S. Gypsum	MI0002437	10/1/2012	Iosco	44.18083	-83.57389	Alabaster-Whitney Drain-Lake Huron
Prescott WWTP	MI0057529	10/1/2013	Ogemaw	44.1944	-83.91861	Johnson Creek
General Permits						
National Gypsum	MIG580093	4/1/2014	Iosco	44.210833	-83.715555	Elm Creek
Twining WWSL	MIG570000	4/1/2015	Arenac	44.1275	-83.7952	Cedar Creek Drain
AuGres WWTP	MIG570000	4/1/2015	Arenac	44.035555	-83.698888	AuGres River
Iosco County Road Commission Quarry	MIG490000	4/1/2015	Iosco	44.116388	-83.58388	Hammel Creek
R E Glancy Inc	MIG490279	4/1/2015	Arenac	44.049	-83.696	Mattison (Outfall 001A) & Roberts Dr (Outfall 002A)
Designated Name	**Permit No.**	**Expiration Date**	**County**	**Latitude**	**Longitude**	**Receiving Water**
Tawas River Watershed (HUC 04080101)						
Individual Permits						
Tawas Utility Authority WWTP	MI0021091	10/1/2012	Iosco	44.283888	-83.505	Tawas River

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties 15, August 9-11 and August 23-25, 2011.

TAXA	Cold Creek Laidlaw Road 7/13/2011 STATION 1	Porterfield Creek d-s M65 7/14/2011 STATION 2	Au Gres River Mackinaw Road (north) 7/15/2011 STATION 3	Au Gres River National City Road 8/10/2011 STATION 4
ANNELIDA (segmented worms)				
Oligochaeta (worms)			1	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	36		21	31
Decapoda (crayfish)		3	1	
Isopoda (sowbugs)	3		16	2
Arachnoidea				
Hydracarina	1	2	1	
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				2
Baetidae	9	3	4	
Caenidae			1	14
Ephemerellidae	7	1	41	
Heptageniidae		11	17	2
Isonychiidae			2	
Tricorythidae				10
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	10
Cordulegastridae		6		
Gomphidae			7	10
Zygoptera (damselflies)				
Calopterygidae		6	2	2
Coenagrionidae			1	
Plecoptera (stoneflies)				
Nemouridae	13			
Perlidae			10	
Pteronarcyidae			1	
Hemiptera (true bugs)				
Belostomatidae				1
Corixidae			9	
Notonectidae				2
Megaloptera				
Sialidae (alder flies)	1	2	1	
Trichoptera (caddisflies)				
Brachycentridae	14		15	74
Glossosomatidae		22		
Hydropsychidae	6	32	5	1
Hydroptilidae		3		
Lepidostomatidae	10	3		
Leptoceridae			78	5
Limnephilidae	3		8	1
Molannidae		1		
Philopotamidae	8	11		
Polycentropodidae				4
Psychomyiidae		1		
Coleoptera (beetles)				
Dytiscidae (total)				1
Gyrinidae (adults)	1	1		
Haliplidae (adults)			1	
Hydrophilidae (total)		1		1
Dryopidae		3		2
Elmidae		53	5	28
Haliplidae (larvae)				1
Diptera (flies)				
Athericidae	2	2		1
Ceratopogonidae	1	1		1
Chironomidae	123	77	9	66

Culicidae		1		
Simuliidae	3			
Tabanidae	1	4		11
Tipulidae		10		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1		
Lymnaeidae	1			
Physidae		4		9
Pelecypoda (bivalves)				
Sphaeriidae (clams)		2		
TOTAL INDIVIDUALS	243	268	258	293

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Cold Creek Laidlaw Road 7/13/2011 STATION 1		Porterfield Creek d-s M65 7/14/2011 STATION 2		Au Gres River Mackinaw Road (north) 7/15/2011 STATION 3		Au Gres River National City Road 8/10/2011 STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	19	0	29	1	25	0	27	0
NUMBER OF MAYFLY TAXA	2	-1	3	0	5	1	4	0
NUMBER OF CADDISFLY TAXA	5	0	7	1	4	0	5	0
NUMBER OF STONEFLY TAXA	1	0	0	-1	2	1	0	-1
PERCENT MAYFLY COMP.	6.58	0	5.60	0	25.19	1	9.56	0
PERCENT CADDISFLY COMP.	16.87	0	27.24	0	41.09	1	29.01	0
PERCENT DOMINANT TAXON	50.62	-1	28.73	-1	30.23	-1	25.26	0
PERCENT ISOPOD, SNAIL, LEECH	1.65	1	1.87	1	6.20	0	3.75	1
PERCENT SURF. AIR BREATHERS	0.41	1	1.12	1	3.88	1	1.71	1
TOTAL SCORE		0		2		4		1
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Cou
12-15, August 9-11 and August 23-25, 2011.

TAXA	Au Gres River US 23 8/9/2011 STATION 5	Cedar Creek Drain u-s Herr Road 8/9/2011 STATION 6	Elm Creek Whittemore Road 8/10/2011 STATION 7	Johnson Creek Drow Road 8/24/2011 STATION 8
PORIFERA (sponges)				1
ANNELIDA (segmented worms)				
Hirudinea (leeches)				1
Oligochaeta (worms)		1	3	8
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	11	94	50	26
Decapoda (crayfish)	2	1	8	3
Isopoda (sowbugs)		26	65	214
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		1		
Baetidae		1		
Caenidae	4			
Ephemerellidae	2			
Ephemeridae	9	1		
Heptageniidae	5			21
Tricorythidae	1			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		4	2	1
Cordulegastridae			1	
Gomphidae	1	6		
Zygoptera (damselflies)				
Calopterygidae		3	23	26
Coenagrionidae	5			
Plecoptera (stoneflies)				
Perlidae	1			
Hemiptera (true bugs)				
Belostomatidae	1	1	1	
Gerridae			1	1
Mesoveliidae				5
Notonectidae			1	1
Pleidae	1			
Megaloptera				
Sialidae (alder flies)	1		5	
Trichoptera (caddisflies)				
Brachycentridae	4	5		
Glossosomatidae				1
Hydropsychidae	1	1		24
Leptoceridae	2	23	1	
Limnephilidae			3	2
Phryganeidae			1	
Coleoptera (beetles)				
Gyrinidae (adults)			2	1
Haliplidae (adults)	1			1
Hydrophilidae (total)			3	1
Dryopidae		3	1	
Elmidae	9	13	13	2
Diptera (flies)				
Ceratopogonidae			3	
Chironomidae	10		21	6
Culicidae	1			
Dixidae		1		
Simuliidae		1		
Tabanidae		10	2	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				3
Physidae	1	58	20	24

Planorbidae				1
Pelecypoda (bivalves)				
Sphaeriidae (clams)		18	20	
TOTAL INDIVIDUALS	73	272	250	374

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Au Gres River US 23 8/9/2011 STATION 5		Cedar Creek Drain u-s Herr Road 8/9/2011 STATION 6		Elm Creek Whittemore Road 8/10/2011 STATION 7		Johnson Creek Drow Road 8/24/2011 STATION 8	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	21	0	21	0	23	1	23	1
NUMBER OF MAYFLY TAXA	5	1	3	0	0	-1	1	-1
NUMBER OF CADDISFLY TAXA	3	0	3	0	3	0	3	0
NUMBER OF STONEFLY TAXA	1	0	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	28.77	1	1.10	-1	0.00	-1	5.61	0
PERCENT CADDISFLY COMP.	9.59	0	10.66	0	2.00	-1	7.22	0
PERCENT DOMINANT TAXON	15.07	1	34.56	-1	26.00	0	57.22	-1
PERCENT ISOPOD, SNAIL, LEECH	1.37	1	30.88	-1	34.00	-1	64.97	-1
PERCENT SURF. AIR BREATHERS	5.48	0	0.37	1	3.20	1	2.67	1
TOTAL SCORE		4		-3		-3		-2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Coun
12-15, August 9-11 and August 23-25, 2011.

TAXA	Dead Creek Lorenz Road 8/11/2011 STATION 9	Cedar Creek Drain Lehamn Road 8/10/2011 STATION 10	Hale Creek Long Lake Road 7/13/2011 STATION 11	Silver Creek d-s Essex Road 7/13/2011 STATION 12
NEMATOMORPHA (roundworms)			1	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		2	
Oligochaeta (worms)	1	2	4	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	147		4	1
Decapoda (crayfish)	6		2	
Isopoda (sowbugs)			115	
Arachnoidea				
Hydracarina		2	16	1
Insecta				
Ephemeroptera (mayflies)				
Baetidae		4	2	
Caenidae			3	
Ephemerellidae		2		
Ephemeridae		1	1	6
Heptageniidae		12		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	5	12		1
Cordulegastridae		9		
Gomphidae				1
Zygoptera (damselflies)				
Calopterygidae	1	17	3	
Coenagrionidae			2	
Hemiptera (true bugs)				
Gerridae	1	1	1	
Mesoveliidae		3		
Megaloptera				
Sialidae (alder flies)	3	2		
Trichoptera (caddisflies)				
Brachycentridae		9		1
Hydropsychidae		11	1	212
Lepidostomatidae		1		
Leptoceridae			5	
Limnephilidae	2	1	2	
Philopotamidae		4	1	
Psychomyiidae	1			
Coleoptera (beetles)				
Gyrinidae (adults)		1	1	
Haliplidae (adults)			1	
Hydrophilidae (total)		4		
Dryopidae	3	1		
Elmidae	6	1	3	4
Diptera (flies)				
Athericidae		3		
Ceratopogonidae		16	6	1
Chironomidae	182	28	75	10
Simuliidae	1			5
Tabanidae	2	3	2	
Tipulidae		15		
MOLLUSCA				
Gastropoda (snails)				
Physidae	5		4	
Planorbidae			1	
Viviparidae				1
Pelecypoda (bivalves)				
Dreissenidae			1	
Sphaeriidae (clams)	1	1	9	3

TOTAL INDIVIDUALS	368	166	268	248

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Dead Creek Lorenz Road 8/11/2011 STATION 9		Cedar Creek Drain Lehamn Road 8/10/2011 STATION 10		Hale Creek Long Lake Road 7/13/2011 STATION 11		Silver Creek d-s Essex Road 7/13/2011 STATION 12	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	17	1	27	0	27	1	14	1
NUMBER OF MAYFLY TAXA	0	-1	4	0	3	1	1	0
NUMBER OF CADDISFLY TAXA	2	-1	5	0	4	0	2	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.00	-1	11.45	0	2.24	-1	2.42	-1
PERCENT CADDISFLY COMP.	0.82	-1	15.66	0	3.36	0	85.89	1
PERCENT DOMINANT TAXON	49.46	-1	16.87	1	42.91	-1	85.48	-1
PERCENT ISOPOD, SNAIL, LEECH	1.63	1	0.00	1	45.52	-1	0.40	1
PERCENT SURF. AIR BREATHERS	0.27	1	5.42	0	1.12	1	0.00	1
TOTAL SCORE		-3		1		-1		0
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counti 15, August 9-11 and August 23-25, 2011.

TAXA	AuGres River Mackinaw Road (South) 8/9/2011 STATION 13	Smith Creek Curtis Road 7/13/2011 STATION 14	Au Gres River Whittemore Road 7/14/2011 STATION 15	Au Gres River M55 7/14/2011 STATION 16
ANNELIDA (segmented worms)				
Oligochaeta (worms)	13	34	3	6
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	54	1	1	
Decapoda (crayfish)			3	3
Isopoda (sowbugs)				5
Arachnoidea				
Hydracarina	1	1		1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	2	10	12	23
Caenidae	26		3	3
Ephemerellidae	8	10	12	21
Ephemeridae	2	3		
Heptageniidae	1	3	6	12
Tricorythidae	60		1	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	2	1
Cordulegastridae		1	1	
Gomphidae	1		1	7
Zygoptera (damselflies)				
Calopterygidae		1	1	2
Coenagrionidae	3			
Plecoptera (stoneflies)				
Perlidae	1		2	3
Pteronarcyidae	1			
Hemiptera (true bugs)				
Corixidae	1			
Gerridae		1		
Megaloptera				
Corydalidae (dobson flies)		1		1
Sialidae (alder flies)	2			
Trichoptera (caddisflies)				
Brachycentridae		63	1	2
Glossosomatidae		2	1	1
Helicopsychidae			1	4
Hydropsychidae		13	131	21
Hydroptilidae			2	1
Lepidostomatidae		43		
Leptoceridae	10		2	1
Limnephilidae	1	4	3	2
Molannidae		1		
Philopotamidae		33	1	
Uenoidae			1	
Coleoptera (beetles)				
Dytiscidae (total)	1		1	1
Gyrinidae (adults)	1	1	1	
Haliplidae (adults)		1		
Hydrophilidae (total)		1		
Elmidae	4	6	12	22
Psephenidae (larvae)			1	5
Diptera (flies)				
Athericidae		1	1	11
Ceratopogonidae	3	8	1	2
Chironomidae	35	74	29	45
Ptychopteridae		1		
Simuliidae		1	2	1
Tabanidae			2	

Tipulidae			1	1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				1
Bithyniidae	5		24	40
Physidae	13		10	
Pleuroceridae	18			
Pelecypoda (bivalves)				
Dreissenidae			1	
Sphaeriidae (clams)	1		6	4
TOTAL INDIVIDUALS	268	320	283	253

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	AuGres River Mackinaw Road (South) 8/9/2011 STATION 13		Smith Creek Curtis Road 7/13/2011 STATION 14		Au Gres River Whittemore Road 7/14/2011 STATION 15		Au Gres River M55 7/14/2011 STATION 16	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	26	0	28	1	36	1	31	1
NUMBER OF MAYFLY TAXA	6	1	4	0	5	1	4	0
NUMBER OF CADDISFLY TAXA	2	-1	7	1	9	1	7	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	1	0	1	0
PERCENT MAYFLY COMP.	36.94	1	8.13	0	12.01	0	23.32	1
PERCENT CADDISFLY COMP.	4.10	0	49.69	1	50.53	1	12.65	0
PERCENT DOMINANT TAXON	22.39	0	23.13	0	46.29	-1	17.79	0
PERCENT ISOPOD, SNAIL, LEECH	13.43	0	0.00	1	12.01	0	18.18	-1
PERCENT SURF. AIR BREATHERS	1.12	1	1.56	1	0.71	1	0.40	1
TOTAL SCORE		3		4		4		3
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Cou
12-15, August 9-11 and August 23-25, 2011.

TAXA	Silver Creek Curtis Road 7/14/2011 STATION 17	Nester Creek d-s Sage Lake Road 7/12/2011 STATION 18	Hale Creek Ora Lake Road 7/12/2011 STATION 19	Johnson Creek Sage Lake Road 8/23/2011 STATION 20
ANNELIDA (segmented worms)				
Hirudinea (leeches)				1
Oligochaeta (worms)	13	4	1	13
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	43		58	177
Decapoda (crayfish)		2	1	
Isopoda (sowbugs)		51	174	37
Arachnoidea				
Hydracarina	1	1		
Insecta				
Ephemeroptera (mayflies)				
Baetidae		1		
Caenidae	9			
Ephemeridae	5		2	
Heptageniidae	8	1	2	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	2		
Cordulegastridae	10			
Gomphidae		2		
Zygoptera (damselflies)				
Calopterygidae	24	4		
Coenagrionidae	2			1
Plecoptera (stoneflies)				
Leuctridae	21			
Perlidae			1	
Hemiptera (true bugs)				
Corixidae			1	
Gerridae			1	1
Megaloptera				
Corydalidae (dobson flies)	6			
Trichoptera (caddisflies)				
Glossosomatidae		1		
Helicopsychidae	1			
Hydropsychidae	12	21	4	
Lepidostomatidae	8			
Leptoceridae		2		1
Limnephilidae	4	2	6	1
Molannidae	1			
Philopotamidae	2			
Phryganeidae	1			5
Psychomyiidae		1		
Coleoptera (beetles)				
Dytiscidae (total)				3
Elmidae	2	16	3	10
Diptera (flies)				
Athericidae		1		
Ceratopogonidae	1			
Chironomidae	46	83	7	54
Simuliidae	7		1	
Tabanidae	9	1		2
Tipulidae	1			2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		2		2
Physidae		4		5
Valvatidae			1	
Viviparidae		10		
Pelecypoda (bivalves)				

Sphaeriidae (clams)		35	8	
TOTAL INDIVIDUALS	238	247	271	315

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Silver Creek Curtis Road 7/14/2011 STATION 17		Nester Creek d-s Sage Lake Road 7/12/2011 STATION 18		Hale Creek At Ora Lake Road 7/12/2011 STATION 19		Johnson Creek Sage Lake Road 8/23/2011 STATION 20	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	0	22	0	16	0	16	0
NUMBER OF MAYFLY TAXA	3	0	2	0	2	0	0	-1
NUMBER OF CADDISFLY TAXA	7	1	5	0	2	-1	3	0
NUMBER OF STONEFLY TAXA	1	0	0	-1	1	0	0	-1
PERCENT MAYFLY COMP.	9.24	0	0.81	-1	1.48	-1	0.00	-1
PERCENT CADDISFLY COMP.	12.18	0	10.93	0	3.69	0	2.22	-1
PERCENT DOMINANT TAXON	19.33	0	33.60	-1	64.21	-1	56.19	-1
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	27.13	-1	64.58	-1	14.29	-1
PERCENT SURF. AIR BREATHERS	0.00	1	0.00	1	0.74	1	1.27	1
TOTAL SCORE		3		-3		-3		-5
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		POOR

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

TAXA	Johnson Creek Black Road 8/23/2011 STATION 21	Intercounty Drain National City Road 8/24/2011 STATION 22	Elm Creek National City Road 8/11/2011 STATION 23	Johnson Creek South Towerline Road 8/24/2011 STATION 24
ANNELIDA (segmented worms)				
Oligochaeta (worms)	2	4		6
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	84	111	14	22
Decapoda (crayfish)			4	2
Isopoda (sowbugs)	76		20	25
Arachnoidea				
Hydracarina				4
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				2
Baetidae				4
Caenidae			4	
Ephemeridae				1
Heptageniidae	1			40
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	5	7
Cordulegastridae	1		1	
Gomphidae		2		2
Libellulidae		2		
Zygoptera (damselflies)				
Calopterygidae	3	25	21	17
Coenagrionidae		12	15	
Hemiptera (true bugs)				
Belostomatidae		2	2	1
Corixidae		1	1	1
Gerridae	1		2	1
Nepidae			2	
Notonectidae			10	
Megaloptera				
Corydalidae (dobson flies)				4
Sialidae (alder flies)			3	2
Trichoptera (caddisflies)				
Brachycentridae				7
Helicopsychidae				2
Hydropsychidae	1	1		7
Leptoceridae	1	1		
Limnephilidae				1
Philopotamidae				12
Phryganeidae	4	1		
Polycentropodidae				3
Lepidoptera (moths)				
Pyralidae	1			
Coleoptera (beetles)				
Dytiscidae (total)		3		5
Gyrinidae (adults)	1			
Haliplidae (adults)		2		
Hydrophilidae (total)		4		1
Dryopidae	2			
Elmidae	10	6	18	21
Gyrinidae (larvae)				1
Haliplidae (larvae)		4		
Scirtidae (larvae)				2
Diptera (flies)				
Ceratopogonidae	2	4		3
Chironomidae	97	26	5	37
Culicidae		1	2	
Sciomyzidae			1	

Stratiomyidae		9		
Tabanidae		12	2	20
Tipulidae	1			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			15	2
Bithyniidae				3
Hydrobiidae			1	
Lymnaeidae		3		
Physidae	1	46	8	3
Pelecypoda (bivalves)				
Sphaeriidae (clams)			11	6
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	290	283	167	277

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Johnson Creek Black Road 8/23/2011 STATION 21		Intercounty Drain National City Road 8/24/2011 STATION 22		Elm Creek National City Road 8/11/2011 STATION 23		Johnson Creek South Towerline Road 8/24/2011 STATION 24	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	19	1	23	1	23	0	35	1
NUMBER OF MAYFLY TAXA	1	-1	0	-1	1	-1	4	0
NUMBER OF CADDISFLY TAXA	3	0	3	0	0	-1	6	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.34	-1	0.00	-1	2.40	-1	16.97	0
PERCENT CADDISFLY COMP.	2.07	-1	1.06	-1	0.00	-1	11.55	0
PERCENT DOMINANT TAXON	33.45	-1	39.22	-1	12.57	1	14.44	1
PERCENT ISOPOD, SNAIL, LEECH	26.55	-1	17.31	-1	26.35	-1	11.91	0
PERCENT SURF. AIR BREATHERS	0.69	1	7.77	0	11.38	0	3.25	1
TOTAL SCORE		-4		-5		-5		3
MACROINV. COMMUNITY RATING		ACCEPT.		POOR		POOR		ACCEPT.

Table 3A. Qualitative macroinvertebrate sampling results for Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

TAXA	Tawas River Nunn Road u-s Tawas WWTP 8/23/2011 STATION 30	Tawas River Nunn Road d-s Tawas WWTP 8/23/2011 STATION 31
ANNELIDA (segmented worms)		
Hirudinea (leeches)	2	12
Oligochaeta (worms)	7	2
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	55	4
Decapoda (crayfish)	1	2
Isopoda (sowbugs)	32	7
Arachnoidea		
Hydracarina	25	9
Insecta		
Ephemeroptera (mayflies)		
Caenidae	22	18
Ephemeridae	3	
Heptageniidae	9	3
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	6	
Libellulidae	17	9
Zygoptera (damselflies)		
Calopterygidae	7	1
Coenagrionidae	76	49
Hemiptera (true bugs)		
Belostomatidae		1
Corixidae	2	
Gerridae	1	
Mesoveliidae		2
Nepidae	1	1
Pleidae		4
Megaloptera		
Sialidae (alder flies)	9	2
Trichoptera (caddisflies)		
Hydropsychidae		4
Hydroptilidae		2
Lepidostomatidae	8	2
Leptoceridae	1	1
Limnephilidae	3	3
Molannidae	4	1
Phryganeidae	2	1
Coleoptera (beetles)		
Gyrinidae (adults)	22	1
Haliplidae (adults)		1
Hydrophilidae (total)		1
Elmidae		1
Diptera (flies)		
Ceratopogonidae	2	3
Chironomidae	18	27
Tabanidae		1
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)		3
Physidae	24	35
Planorbidae	11	46
Pleuroceridae	30	3
Viviparidae	10	20
Pelecypoda (bivalves)		
Sphaeriidae (clams)	8	3
TOTAL INDIVIDUALS	418	285

Table 3B. Macroinvertebrate metric evaluation of Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

	Tawas River Nunn Road u-s Tawas WWTP 8/23/2011 STATION 30		Tawas River Nunn Road d-s Tawas WWTP 8/23/2011 STATION 31	
METRIC	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	30	1	36	1
NUMBER OF MAYFLY TAXA	3	0	2	-1
NUMBER OF CADDISFLY TAXA	5	0	7	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	8.13	0	7.37	0
PERCENT CADDISFLY COMP.	4.31	0	4.91	0
PERCENT DOMINANT TAXON	18.18	0	17.19	0
PERCENT ISOPOD, SNAIL, LEECH	26.08	-1	44.21	-1
PERCENT SURF. AIR BREATHERS	6.22	0	3.86	1
TOTAL SCORE		-1		0
MACROINV. COMMUNITY RATING	ACCEPT.		ACCEPT.	

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 201

HABITAT METRIC	Cold Creek Laidlaw Road RIFFLE/RUN Station 1	Porterfield Creek M65 RIFFLE/RUN Station 2	Au Gres River Mackinaw Road (north) GLIDE/POOL Station 3	Au Gres River National City Road GLIDE/POOL Station 4	Au Gres River US 23 GLIDE/POOL Station 5
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	5	15	6	7	8
Embeddedness (20)*	2	14			
Velocity/Depth Regime (20)*	14	14			
Pool Substrate Characterization (20)**			10	9	9
Pool Variability (20)**			13	15	2
Channel Morphology					
Sediment Deposition (20)	4	10	8	6	11
Flow Status - Maint. Flow Volume (10)	10	8	8	9	10
Flow Status - Flashiness (10)	8	3	1	3	1
Channel Alteration (20)	20	20	9	18	4
Frequency of Riffles/Bends (20)*	12	13			
Channel Sinuosity (20)**			11	13	6
Riparian and Bank Structure					
Bank Stability (L) (10)	10	3	7	3	8
Bank Stability (R) (10)	10	6	7	3	8
Vegetative Protection (L) (10)	7	9	6	7	1
Vegetative Protection (R) (10)	9	9	6	6	1
Riparian Veg. Zone Width (L) (10)	4	10	3	7	1
Riparian Veg. Zone Width (R) (10)	8	10	3	3	1
TOTAL SCORE (200):	123	144	98	109	71
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)

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

Date:	7/13/2011	7/14/2011	7/15/2011	8/10/2011	8/9/2011
Weather:	Sunny	Sunny	Sunny	Sunny	Sunny
Air Temperature:	72 Deg. F.	76 Deg. F.	70 Deg. F.	70 Deg. F.	70 Deg. F.
Water Temperature:	53 Deg. F.	64 Deg. F.	70 Deg. F.	72 Deg. F.	74 Deg. F.
Ave. Stream Width:	15 Feet	10 Feet	65 Feet	40 Feet	75 Feet
Ave. Stream Depth:	0.67 Feet	0.33 Feet	1.33 Feet	1.25 Feet	2.5 Feet
Surface Velocity:	1 Ft./Sec.	0.5 Ft./Sec.	0.2 Ft./Sec.	0.8 Ft./Sec.	0.1 Ft./Sec.
Estimated Flow:	10.05 CFS	1.65 CFS	17.29 CFS	40 CFS	18.75 CFS
Stream Modifications:	None	None	Dredged	Canopy Removal	
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	350252	350253	60153	350247	60033
Stream Name:	Cold Creek	Porterfield Creek	Au Gres River	Au Gres River	Au Gres River
Road Crossing/Location:	Laidlaw Road	M65	Mackinaw Road (north)	National City Road	US 23
County Code:	35	35	06	35	06
TRS:	22N07E16	21N05E2	20N06E36	21N06E32	19N06E13
Latitude (dd):	44.30109	44.24618	44.09721	44.17016	44.0483
Longitude (dd):	-83.59643	-83.80309	-83.68584	-83.72236	-83.68707
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4080101	4080101	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 201

HABITAT METRIC	Cedar Creek Drain Herr Road RIFFLE/RUN Station 6	Elm Creek Whittemore Road RIFFLE/RUN Station 7	Johnson Creek Drow Road GLIDE/POOL Station 8	Dead Creek Lorenz Road GLIDE/POOL Station 9	Cedar Creek Drain Lehman Road RIFFLE/RUN Station 10
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	6	8	7	16
Embeddedness (20)*	2	1			1
Velocity/Depth Regime (20)*	8	13			9
Pool Substrate Characterization (20)**			7	7	
Pool Variability (20)**			10	4	
Channel Morphology					
Sediment Deposition (20)	5	5	16	2	2
Flow Status - Maint. Flow Volume (10)	9	10	9	9	9
Flow Status - Flashiness (10)	4	6	8	3	8
Channel Alteration (20)	11	9	18	18	18
Frequency of Riffles/Bends (20)*	1	7			8
Channel Sinuosity (20)**			15	18	
Riparian and Bank Structure					
Bank Stability (L) (10)	8	8	9	3	9
Bank Stability (R) (10)	8	7	9	3	9
Vegetative Protection (L) (10)	9	8	9	9	10
Vegetative Protection (R) (10)	9	8	9	9	10
Riparian Veg. Zone Width (L) (10)	6	10	7	9	10
Riparian Veg. Zone Width (R) (10)	4	10	8	9	10
TOTAL SCORE (200):	92	108	142	110	129
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	8/9/2011	8/10/2011	8/24/2011	8/11/2011	8/10/2011
Weather:	Sunny	Sunny	Cloudy	Sunny	Partly Cloudy
Air Temperature:	72 Deg. F.	70 Deg. F.	70 Deg. F.	70 Deg. F.	70 Deg. F.
Water Temperature:	72 Deg. F.	64 Deg. F.	60 Deg. F.	53 Deg. F.	58 Deg. F.
Ave. Stream Width:	12 Feet	5 Feet	6 Feet	5 Feet	10 Feet
Ave. Stream Depth:	0.333 Feet	0.42 Feet	0.5 Feet	0.67 Feet	0.333 Feet
Surface Velocity:	0.75 Ft./Sec.	0.5 Ft./Sec.	0.7 Ft./Sec.	0.17 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	2.997 CFS	1.05 CFS	2.1 CFS	0.5695 CFS	3.33 CFS
Stream Modifications:	Dredged	Canopy Removal	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	60116	350142	650132	350246	60150
Stream Name:	Cedar Creek Drain	Elm Creek	Johnson Creek	Dead Creek	Cedar Creek Drain
Road Crossing/Location:	Herr Road	Whittemore Road	Drow Road	Lorenz Road	Lehman Road
County Code:	06	35	65	35	06
TRS:	20N06E22	21N06E06	21N04E26	22N07E29	20N05E12
Latitude (dd):	44.12085	44.23383	44.18798	44.26729	44.14468
Longitude (dd):	-83.72665	-83.74332	-83.90457	-83.60295	-83.82791
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Warmwater	Coldwater	Coldwater
USGS Basin Code:	4080101	4080101	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 201

HABITAT METRIC	Hale Creek Long Lake Road GLIDE/POOL Station 11	Silver Creek Essex Road RIFFLE/RUN Station 12	AuGres River Mackinaw Road (South) GLIDE/POOL Station 13	Smith Creek Curtis Road RIFFLE/RUN Station 14	Au Gres River Whittemore Road RIFFLE/RUN Station 15
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	3	7	8	19	12
Embeddedness (20)*		11		15	14
Velocity/Depth Regime (20)*		8		20	12
Pool Substrate Characterization (20)**	9		9		
Pool Variability (20)**	1		3		
Channel Morphology					
Sediment Deposition (20)	8	10	5	15	18
Flow Status - Maint. Flow Volume (10)	10	9	8	9	9
Flow Status - Flashiness (10)	4	7	6	8	1
Channel Alteration (20)	6	20	8	19	20
Frequency of Riffles/Bends (20)*		9		17	20
Channel Sinuosity (20)**	7		9		
Riparian and Bank Structure					
Bank Stability (L) (10)	9	7	8	8	5
Bank Stability (R) (10)	9	7	6	10	5
Vegetative Protection (L) (10)	7	10	6	8	10
Vegetative Protection (R) (10)	9	10	6	10	10
Riparian Veg. Zone Width (L) (10)	1	10	3	3	8
Riparian Veg. Zone Width (R) (10)	9	10	3	10	9
TOTAL SCORE (200):	92	135	88	171	153
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	7/13/2011	7/13/2011	8/9/2011	7/13/2011	7/14/2011
Weather:	Sunny	Partly Cloudy	Partly Cloudy	Partly Cloudy	Cloudy
Air Temperature:	72 Deg. F.	74 Deg. F.	76 Deg. F.	74 Deg. F.	72 Deg. F.
Water Temperature:	74 Deg. F.	78 Deg. F.	80 Deg. F.	56 Deg. F.	66 Deg. F.
Ave. Stream Width:	6 Feet	4 Feet	72 Feet	18 Feet	40 Feet
Ave. Stream Depth:	0.25 Feet	0.25 Feet	2 Feet	0.67 Feet	0.58 Feet
Surface Velocity:	0.5 Ft./Sec.	1 Ft./Sec.	0.1 Ft./Sec.	1 Ft./Sec.	0.8 Ft./Sec.
Estimated Flow:	0.75 CFS	1 CFS	14.4 CFS	12.06 CFS	18.56 CFS
Stream Modifications:	Dredged	None	Dredged	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	350249	350251	60069	350163	350136
Stream Name:	Hale Creek	Silver Creek	AuGres River	Smith Creek	Au Gres River
Road Crossing/Location:	Long Lake Road	Essex Road	Mackinaw Road (South)	Curtis Road	Whittemore Road
County Code:	35	35	06	35	35
TRS:	23N05E05	23N07E31	19N06E01	23N06E19	22N05E01
Latitude (dd):	44.41548	44.34266	44.08005	44.36389	44.23369
Longitude (dd):	-83.86565	-83.63599	-83.68613	-83.74735	-83.76952
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Warmwater	Warmwater	Warmwater	Coldwater	Warmwater
USGS Basin Code:	4080101	4080101	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 201

HABITAT METRIC	Au Gres River M55 RIFFLE/RUN Station 16	Silver Creek Curtis Road GLIDE/POOL Station 17	Nester Creek Sage Lake Road RIFFLE/RUN Station 18	Hale Creek Ora Lake Road RIFFLE/RUN Station 19	Johnson Creek Sage Lake Road RIFFLE/RUN Station 20
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	11	18	16	7	7
Embeddedness (20)*	15		18	11	15
Velocity/Depth Regime (20)*	15		10	13	7
Pool Substrate Characterization (20)**		15			
Pool Variability (20)**		4			
Channel Morphology					
Sediment Deposition (20)	16	19	13	13	11
Flow Status - Maint. Flow Volume (10)	10	10	7	7	4
Flow Status - Flashiness (10)	3	10	2	3	6
Channel Alteration (20)	15	20	20	20	18
Frequency of Riffles/Bends (20)*	12		17	7	11
Channel Sinuosity (20)**		15			
Riparian and Bank Structure					
Bank Stability (L) (10)	5	7	9	8	3
Bank Stability (R) (10)	5	7	8	7	3
Vegetative Protection (L) (10)	8	10	9	9	10
Vegetative Protection (R) (10)	8	10	9	9	10
Riparian Veg. Zone Width (L) (10)	8	10	6	9	10
Riparian Veg. Zone Width (R) (10)	8	10	4	9	10
TOTAL SCORE (200):	139	165	148	132	125
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	7/14/2011	7/14/2011	7/12/2011	7/12/2011	8/23/2011
Weather:	Sunny	Cloudy	Partly Cloudy	Sunny	Cloudy
Air Temperature:	70 Deg. F.	68 Deg. F.	80 Deg. F.	85 Deg. F.	73 Deg. F.
Water Temperature:	66 Deg. F.	61 Deg. F.	72 Deg. F.	70 Deg. F.	53 Deg. F.
Ave. Stream Width:	78 Feet	10 Feet	10 Feet	10 Feet	7 Feet
Ave. Stream Depth:	1 Feet	0.5 Feet	0.33 Feet	0.5 Feet	1.5 Feet
Surface Velocity:	0.8 Ft./Sec.	1 Ft./Sec.	0.3 Ft./Sec.	0.3 Ft./Sec.	0.1 Ft./Sec.
Estimated Flow:	62.4 CFS	5 CFS	0.99 CFS	1.5 CFS	1.05 CFS
Stream Modifications:	Canopy Removal	Habitat Improvement	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	350250	350212	650106	350206	650084
Stream Name:	Au Gres River	Silver Creek	Nester Creek	Hale Creek	Johnson Creek
Road Crossing/Location:	M55	Curtis Road	Sage Lake Road	Ora Lake Road	Sage Lake Road
County Code:	35	35	65	35	65
TRS:	22N05E30	23N07E29	22N04E23	23N05E17	21N04E22
Latitude (dd):	44.27702	44.36496	44.27987	44.3848	44.19516
Longitude (dd):	-83.86609	-83.61515	-83.92157	-83.84563	-83.92472
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Warmwater	Coldwater	Warmwater	Coldwater	Warmwater
USGS Basin Code:	4080101	4080101	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011.

HABITAT METRIC	Johnson Creek Black Road GLIDE/POOL Station 21	Intercounty Drain National City Road GLIDE/POOL Station 22	Elm Creek National City Road GLIDE/POOL Station 23	Johnson Creek South Towerline Road GLIDE/POOL Station 24	Tuttle Drain Davidson Road GLIDE/POOL Station 29
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	6	9	6	6	8
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	7	9	11	7	7
Pool Variability (20)**	6	0	11	11	7
Channel Morphology					
Sediment Deposition (20)	6	8	5	9	9
Flow Status - Maint. Flow Volume (10)	5	10	9	9	9
Flow Status - Flashiness (10)	4	3	6	6	6
Channel Alteration (20)	20	3	19	15	18
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	12	1	15	11	18
Riparian and Bank Structure					
Bank Stability (L) (10)	8	8	9	5	6
Bank Stability (R) (10)	8	8	9	5	6
Vegetative Protection (L) (10)	9	4	8	8	9
Vegetative Protection (R) (10)	9	4	9	8	9
Riparian Veg. Zone Width (L) (10)	9	3	10	7	9
Riparian Veg. Zone Width (R) (10)	9	3	10	4	9
TOTAL SCORE (200):	118	73	137	111	130
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY 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:	8/23/2011	8/24/2011	8/11/2011	8/24/2011	8/23/2011
Weather:	Partly Cloudy	Cloudy	Sunny	Cloudy	Partly Cloudy
Air Temperature:	78 Deg. F.	75 Deg. F.	71 Deg. F.	70 Deg. F.	74 Deg. F.
Water Temperature:	64 Deg. F.	Deg. F.	64 Deg. F.	63 Deg. F.	58 Deg. F.
Ave. Stream Width:	7 Feet	8 Feet	9 Feet	20 Feet	14 Feet
Ave. Stream Depth:	0.17 Feet	1 Feet	1.5 Feet	1.5 Feet	0.5 Feet
Surface Velocity:	0.3 Ft./Sec.	1 Ft./Sec.	0.1 Ft./Sec.	0.6 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	0.357 CFS	8 CFS	1.35 CFS	18 CFS	7 CFS
Stream Modifications:	None	Dredged	None	Dredged	None
Nuisance Plants (Y/N):	N	Y	N	N	N
Report Number:					
STORET No.:	350248	350207	350179	350208	350171
Stream Name:	Johnson Creek	Intercounty Drain	Elm Creek	Johnson Creek	Tuttle Drain
Road Crossing/Location:	Black Road	National City Road	National City Road	South Towerline Road	Davidson Road
County Code:	65	35	35	35	35
TRS:	21N04E23	21N06E33	21N06E08	21N05E24	23N08E29
Latitude (dd):	44.19292	44.1622	44.22243	44.1978	44.3525
Longitude (dd):	-83.91476	-83.7213	-83.72322	-83.78028	-83.483
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
USGS Basin Code:	4080101	4080101	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 4. Habitat evaluation for the Tawas River and Au Gres River Watersheds, Arenac, Iosco and Ogemaw Counties, July 12-15, August 9-11 and August 23-25, 2011

HABITAT METRIC	Tawas River u-s Nunn Road GLIDE/POOL Station 30	Tawas River d-s Nunn Road GLIDE/POOL Station 31	Sand Creek Sand Lake Road GLIDE/POOL Station 32
Substrate and Instream Cover			
Epifaunal Substrate/ Avail Cover (20)	8	9	8
Embeddedness (20)*			
Velocity/Depth Regime (20)*			
Pool Substrate Characterization (20)**	15	15	7
Pool Variability (20)**	12	17	5
Channel Morphology			
Sediment Deposition (20)	16	14	16
Flow Status - Maint. Flow Volume (10)	9	8	9
Flow Status - Flashiness (10)	9	8	6
Channel Alteration (20)	16	16	11
Frequency of Riffles/Bends (20)*			
Channel Sinuosity (20)**	14	13	6
Riparian and Bank Structure			
Bank Stability (L) (10)	9	9	9
Bank Stability (R) (10)	9	9	9
Vegetative Protection (L) (10)	7	9	9
Vegetative Protection (R) (10)	7	9	9
Riparian Veg. Zone Width (L) (10)	9	7	8
Riparian Veg. Zone Width (R) (10)	9	9	4
TOTAL SCORE (200):	149	152	116
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	8/23/2011	8/23/2011	8/23/2011
Weather:	Cloudy	Cloudy	Partly Cloudy
Air Temperature:	75 Deg. F.	75 Deg. F.	76 Deg. F.
Water Temperature:	74 Deg. F.	74 Deg. F.	66 Deg. F.
Ave. Stream Width:	55 Feet	45 Feet	7 Feet
Ave. Stream Depth:	3 Feet	2 Feet	0.42 Feet
Surface Velocity:	0.1 Ft./Sec.	0.1 Ft./Sec.	0.7 Ft./Sec.
Estimated Flow:	16.5 CFS	9 CFS	2.058 CFS
Stream Modifications:	Canopy Removal	Canopy Removal	Dredged
Nuisance Plants (Y/N):	N	N	N
Report Number:			
STORET No.:	350148	350147	350157
Stream Name:	Tawas River	Tawas River	Sand Creek
Road Crossing/Location:	u-s Nunn Road	d-s Nunn Road	Sand Lake Road
County Code:	35	35	35
TRS:	22N08E19	22N08E19	22N06E22
Latitude (dd):	44.285411	44.284419	44.28326
Longitude (dd):	-83.508676	-83.505247	-83.68374
Ecoregion:	NLAF	NLAF	NLAF
Stream Type:	Warmwater	Warmwater	Coldwater
USGS Basin Code:	4080101	4080101	4080101

* Applies only to Riffle/Run stream Surveys
** Applies only to Glide/Pool stream Surveys

COMMENTS:

Table 5A. Qualitative fish sampling results for streams in the Au Gres/Tawas River watershed, July and August, 2011.

TAXA	Tuttle Drain Davison Rd 8/23/2011 Station 29	Sand Creek Sand Lake Rd 8/23/2011 Station 32
Salmonidae (trouts)		
Salvelinus fontinalis (Brook trout)	4	
Umbridae (mudminnows)		
Umbra limi (Central mudminnow)	21	16
Cyprinidae (minnows and carps)		
Semotilus atromaculatus (Creek chub)		60
Cyprinella spilopterus (Spotfin shiner)		1
Rhinichthys atratulus (Blacknose dace)	34	16
Rhinichthys cataractae (Longnose dace)	2	14
Margariscus margarita (Pearl dace)	10	
Cottidae (sculpins)		
Cottus bairdii (Mottled sculpin)	47	
Catostomidae (suckers)		
Catostomus commersoni (White sucker)		5
Gasterosteidae (sticklebacks)		
Culaea inconstans (Brook stickleback)	8	
Centrarchidae (sunfish)		
Ambloplites rupestris (Rock bass)		3
Percidae (perch)		
Etheostoma nigrum (Johnny darter)		23
TOTAL INDIVIDUALS	126	138
Number of hybrid sunfish	0	0
Number of anomalies	0	0
Percent anomalies	0.000	0.000
Percent salmonids	3.175	0.000
Reach sampled (ft)	600	500
Area sampled (sq ft)	8,400	3,500
Density (# fish/sq ft)	0.015	0.039
Gear	bps	bps

Table 5B. Fish metric evaluation of streams in the Au Gres/Tawas River watershed, July and August, 2011.

METRIC	Tuttle Drain Davison Rd 8/23/2011 Station 29 Value	Score	Sand Creek Sand Lake Rd 8/23/2011 Station 32 Value	Score
TOTAL NUMBER OF TAXA	7	-1	8	0
NO. OF DARTER, SCULPIN, MADTOM TAXA	1	-1	1	0
NUMBER OF SUNFISH TAXA	0	-1	1	1
NUMBER OF SUCKER TAXA	0	-1	1	1
NUMBER OF INTOLERANT TAXA	4	1	2	1
PERCENT TOLERANT	43.65	0	86.96	0
PERCENT OMNIVOROUS TAXA	43.65	0	70.29	0
PERCENT INSECTIVOROUS TAXA	53.17	1	27.54	0
PERCENT PISCIVOROUS TAXA	0.00	-1	2.17	0
% SIMPLE LITHOPHILIC SPAWNER TAXA	36.51	0	25.36	0
TOTAL SCORE		-3		3
FISH COMMUNITY RATING		ACCEPT.		ACCEPT.

Table 6. Water quality analysis results for the AuGres and Tawas Rivers Watersheds, August, 2011.

Parameter	Units	Johnson Creek u/s Prescott WWTP (Sage Lk Rd) Station 20	Johnson Creek d/s Prescott WWTP (Black Rd) Station 21	Intercounty Drain National City Road Station 22	Tawas River u/s WWTP (Nunn Rd) Station 30	Tawas River d/s WWTP (Nunn Rd) Station 31	Mattison Drain Tonkey Rd Station 26 (YSI Only)	Cedar Creek Drain d-s Twining WWSL (Crawford Rd) Station 27 (YSI Only)
Alkalinity - Bicarbonate	mg/L	130	130	340	330	310		
Alkalinity - Carbonate	mg/L	ND	ND	ND	ND	ND		
Alkalinity (as $CaCO_3$)	mg/L	130	130	340	330	310		
Ammonia	mg N/L	ND	ND	ND	.03	.01		
Antimony - Total	µg/L			ND				
Arsenic - Total	µg/L			ND				
Barium - Total	µg/L			19				
Beryllium - Total	µg/L			ND				
Cadmium - Total	µg/L			ND				
Calcium - Total	mg/L	37.3	37.5	581	80.9	86.1		
Chloride	mg/L	3.9	6.5	850	27	94		
Chromium - Total	µg/L			ND				
Cobalt - Total	µg/L			ND				
COD	mg/L	22	21	12	14	14		
Conductance	umhos/cm	271	287	5210	721	102	608	597
Copper - Total	µg/L			3.8				
Dissolved Oxygen	mg/L						8.69	10.25
Hardness - Calculate	mg/L	129	130	1670	323	339		
Hexavalent Chromiu	µg/L	ND	ND	ND	ND	ND		
Iron - Total	µg/L			49				
Lead - Total	µg/L			ND				
Magnesium - Total	mg/L	8.7	8.7	52.9	29.4	30.0		
Manganese - Total	µg/L			ND				
Mercury - Total	µg/L			ND				
Molybdenum - Tota	µg/L			ND				
Nickel - Total	µg/L			14				
Nitrate - Calculated	mg N/L	ND	0.09	0.23	0.08	5.49		
Nitrate + Nitrite	mg N/L	ND	.09	.25	.08	5.5		
Nitrite	mg N/L	ND	ND	.02	ND	.01		
Ortho-phosphate	mg P/L	ND	.02	ND	.02	.04		
pH	pH	8.12	8.16	8.00	7.79	8.05	7.1	8.34
Potassium - Total	mg/L	0.2	0.4	5.9	2.0	5.8		
Selenium - Total	µg/L			ND				
Silver -Total	µg/L			ND				
Sodium - Total	mg/L	3.2	5.3	537	19.1	71.9		
Solids - Suspended	mg/L	ND	ND	ND	ND	ND		

Table 6 Continued. Water quality analysis results for the AuGres and Tawas Rivers Watersheds, August, 2011.

Parameter	Units	Johnson Creek (Sage Lk Rd) Station 20	Johnson Creek (Black Rd) Station 21	Intercounty Drain National City Road Station 22	Tawas River (Nunn Rd) Station 30	Tawas River (Nunn Rd) Station 31	Mattison Drain Tonkey Rd Station 26 (YSI Only)	Cedar Creek Drain (Crawford Rd) Station 27 (YSI Only)
Solids - Total Disso	mg/L	160	180	4000	420	690		
Sulfate	mg/L	11	12	1300	20	36		
Temperature	^{o}C	11.6	17.8	21.3	23.3	23.3	21.9	17
Thallium - Total	µg/L			ND				
TOC	mg/L	9.4	9.4	3.4	3.6	4.4		
Total Kjeldahl Nitro	mg N/L	.51	.52	.27	.31	.59		
Total Phosphorus	mg P/L	.010	.039	ND	.032	.057		
Turbidity	NTU	1.0	1.0	1.2	3.8	2.2		
Vanadium - Total	µg/L			ND				
Zinc - Total	µg/L			ND				

Table 7. Sediment chemistry analysis results for the AuGres River Watershed, August, 2011.

Parameters	Intercounty Drain National City Road Station 22
Metals (mg/kg)	
% Total	54.1
Antimony	ND
Arsenic	2.6
Barium	20
Beryllium	ND
Cadmium	ND
Calcium	81600
Chromium	7.9
Cobalt	2.8
Copper	7.0
Iron	8800
Lead	4.1
Magnesium	4660
Manganese	120
Mercury	ND
Molybdenum	ND
Nickel	11
Potassium	610
Selenium	0.48
Silver	ND
Sodium	1000
Thallium	ND
Vanadium	10
Zinc	81