MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
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STAFF REPORT

BIOLOGICAL SURVEY OF THE KEWEENAW WATERSHED GROUP IN BARAGA, HOUGHTON, KEWEENAW, MARQUETTE AND ONTONAGON COUNTIES JUNE AND AUGUST, 2011

As part of the five-year watershed monitoring cycle, staff from the Surface Water Assessment Section (SWAS) conducted biological sampling within the Keweenaw Peninsula, Sturgeon River and Dead-Kelsey River Watersheds located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon counties in June and August, 2011. Qualitative macroinvertebrate and habitat surveys were conducted throughout the watersheds (Figure 1, Table 1) following the SWAS Procedure 51 (MDEQ, 1990; Creal et al., 1996), and the status and trend procedure (MDEQ, 2011a).

OBJECTIVES

The biological surveys were conducted to:

- Support water quality-based effluent limit development for National Pollutant Discharge Elimination System permits.
- Identify nonpoint sources of water quality impairment.
- Evaluate the effectiveness of specific nonpoint source 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 biological integrity temporal trends.
- Satisfy water quality monitoring requests submitted by internal and external customers.
- Support total maximum daily load (TMDL) development for surface waters of nonattainment and address nonattainment listings described in the 2010 Integrated Report (LeSage and Smith, 2010).

WATERSHED DESCRIPTION

These watersheds all fall within the Northern Lakes and Forests ecoregion (Omernik and Gallant, 1988) which are heavily forested and made up of steep, rolling hills interspersed with pockets of wetlands, bogs, lakes and ponds. Lakes are typically deep and clear, with good game fish populations. These lakes are very sensitive to damage from atmospheric deposition of pollutants, storm water runoff from logging operations, urban and shoreland development, mining, inadequate wastewater treatment, and failing septic systems. Agriculture is somewhat limited by the hilly terrain and lack of nutrients in the soil, though there are some beef and dairy cattle farms.
The geology of the Keweenaw Peninsula Watershed Group is composed of a unique mixture of basaltic bedrock outcrops and sandstone deposits that are covered by thin glacial till soils. Soils in the southwestern portion of the basin are dominated by lacustrine clays (Albert, 1995). Seasonal snowfall totals can be very high, up to 390 inches, resulting in exceptional spring runoff events. Most streams begin as forested wetlands but form wide alluvial channel beds that are mostly dry

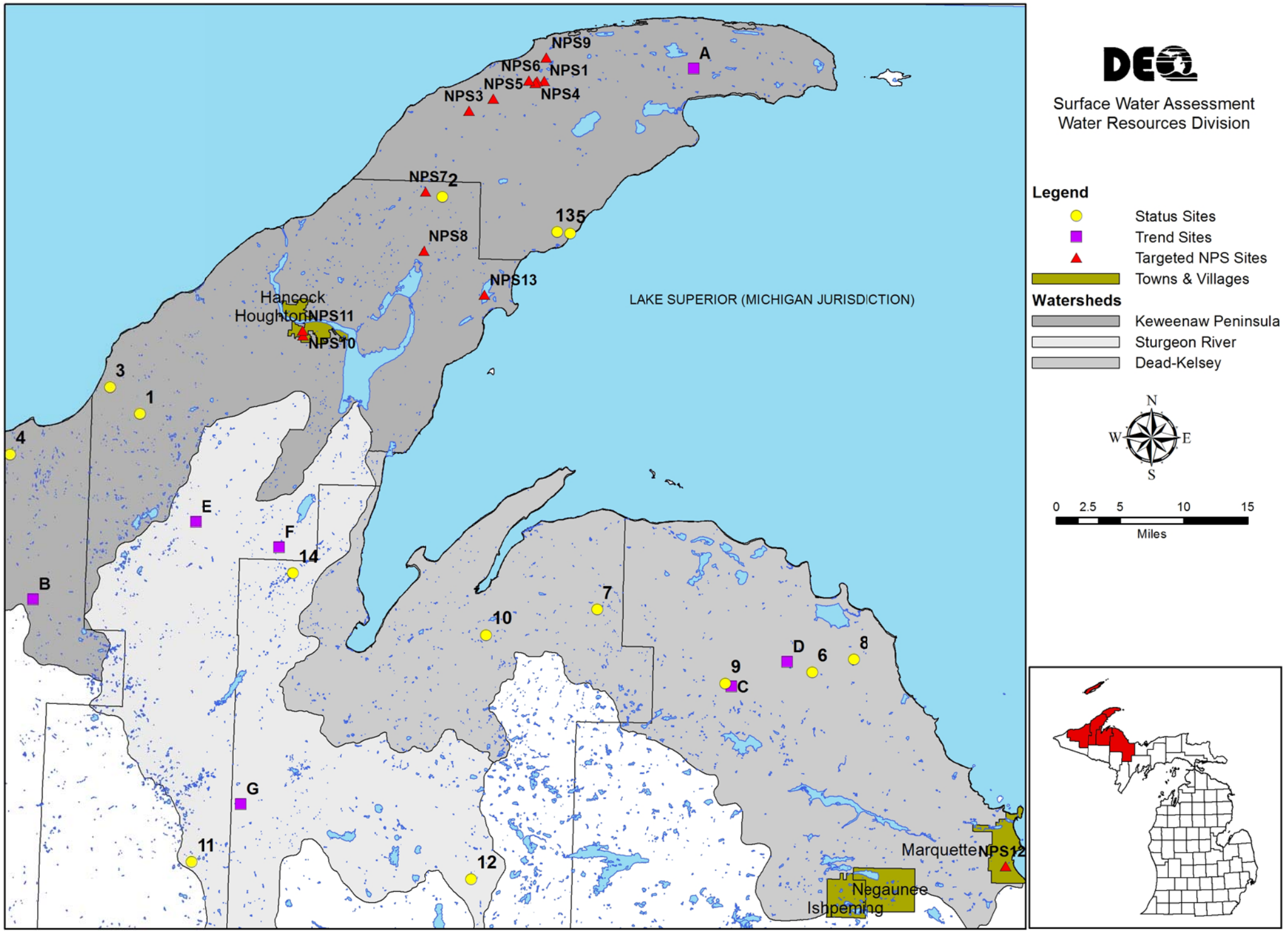

Figure 1. Status, Targeted & Trend Sampling Locations - Keweenaw Peninsula Watershed Group, 2011.

following spring runoff. Consequently, spring runoff is a significant influence to the physical and biological characteristics for many of the sub-basins in the group.

The Keweenaw Peninsula is a geologic site of substantial elemental and amygdaloidal copper deposits. Historic mining processes including stamp mills produced huge deposits of stamp sands that continue to leach copper ions into surrounding soils and waterways with a detrimental impact to aquatic biota (Dorr and Eschman, 1970). Stamp sands are commonly found throughout the Keweenaw area and continue to impact plant and animal communities.

BACKGROUND AND HISTORICAL SAMPLING EFFORTS

In September 1988, the Montreal River was surveyed to evaluate the effects of the Gogebic-Iron Wastewater Treatment Plant (WWTP) discharge on water quality. An overall reduction in total number of organisms was found downstream with a 50 percent decline in the number of macroinvertebrate taxa when compared to the upstream location (Sayles, 1988).

The Trap Rock River and its tributaries (Slaughterhouse, Scales and Kearsarge Creeks) were surveyed in July 1991 as part of a nonpoint source surveillance project due to the nearby historic copper mining operations near the towns of Kearsarge, Copper City and Centennial Heights. Two sites were surveyed on the Trap Rock River in which both were rated good for fish and macroinvertebrate communities with two taxa of trout (rainbow and brook) and one taxon of salmon (coho) were found at the lower station. Habitat was rated as excellent. Total copper concentrations showed an eight–fold increase between the two stations and exceeded the Rule 57 aquatic life protection value at the lower station. However, the presence of the elevated copper concentrations did not appear to adversely impact the biological integrity of the river (Taft, 1992).

In August 1993, biological surveys were conducted on the Montreal River to evaluate the Gogebic/Iron WWTP on fish and macroinvertebrate communities. Both the macroinvertebrate and fish communities rated good and the habitat quality rated excellent. The water chemistry data demonstrated there were no measureable adverse impacts attributable to the Gogebic/Iron WWTP outfall which were reported by Sayles (1988) except for elevated copper and phosphorus concentrations (Taft, 1994).

In July 1996, as part of the nonpoint source surveillance activity, biological surveys were conducted on the East and West Branch Eagle Rivers. The East Branch did not have a fish survey conducted due to low stream conductivity but the macroinvertebrate communities rated acceptable with Baetid mayflies dominating the site. The West Branch Eagle River survey rated fish as acceptable and macroinvertebrate communities as poor. Intolerant invertebrate taxa were notably absent from the location which was dominated by large quantities of fine copper stamp sands. Water quality at these locations were both found to exceed the Rule 57 aquatic chronic and final acute values for copper (Taft, 1997).

During the 2001 field season, a biological survey was conducted on selected water bodies located on the Keweenaw Peninsula to evaluate biological, chemical and physical habitat conditions. All of the Keweenaw streams monitored during this study attained WQS, except Huron Creek and the East Branch Sleeping River. These streams had elevated total copper concentrations due to historic mining activities or local geological characteristics. Huron Creek also possessed poor macroinvertebrate communities and showed some evidence of being negatively impacted by venting groundwater from a buried landfill (Taft, 2002a).

In 2000 and 2001 biological surveys were conducted on selected tributaries located north of the Portage Ship Canal which runs along the Keweenaw Peninsula. Most of the streams monitored during the study met water quality standards even though several (Boston Creek, Hammel Creek, Kearsarge Creek, Scales Creek, East Branch Eagle River, Montreal River, Little Gratiot River and Kingston Mine Drainage)were impacted by elevated levels of copper due to the historic mining activities which took place in this region. Except for copper and mercury, no chemicals were detected that exceeded the Rule 57 Water Quality value. Total mercury exceeded its Rule 57 WQS in Hammel Creek and in Kingston Mine Discharge (Taft, 2002b).

Biological surveys were carried out on the Yellow Dog River at two locations (County Road 550 and Section 3) during July 2001 to evaluate nonpoint source impairments and water quality improvement projects. Habitat rated excellent and good respectively with sediment deposition and bank stability inhibiting the rating for Section 3. Macroinvertebrate communities rated excellent and acceptable for the County Road 550 and Section 3 locations. County Road 550 was dominated by Glossosomatids and Ephemerellids with 19 total taxa identified and over 62 percent composed of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa. Section 3 identified 25 taxa, dominated by Brachycentrids with over 35 percent composed of EPT taxa (Godby, 2002).

A biological survey was carried out in 2001 within the Sturgeon River watershed to evaluate physical habitat and biological integrity. Good habitat, fish and macroinvertebrate community scores combined with the water chemistry analysis indicate the Sturgeon river and the other nine coastal watersheds were meeting Michigan WQS. It was noted that even with the good biological and physical integrity of the area watersheds implementation of best management practices could possibly reduce the impacts of sediment in these systems (Walsh, 2001).

Two stations were surveyed during the 2004 baseline limnological study conducted by White Water Associates within the Yellow Dog River. Both locations (County Road 510 and AAA Road) were rated good for physical habitat and excellent for macroinvertebrate communities. Even though the habitat was rated good, these locations scored high, just a few numbers shy of an excellent rating. The County Road 550 location displayed some embedded gravel with the formations of new sand bars which were impacting some available habitat. Habitat limitations at the AAA Road locations consisted of marginal availability of cover with sediments frequently disturbed due to the sandy composition of the sediments. Macroinvertebrate communities at both locations were dominated by EPT taxa which composed over 30 percent of the samples. Identified taxa ranged from 25 to 34 respectively. Fish were surveyed but Procedure 51metrics were not used to categorize the surveys. Fish present at the County Road 550 site included brown and rainbow trout, sculpin and white suckers, while at the AAA Road location, fish taxa consisted of: brook trout, sculpin, blacknose dace, creek chubs and brook sticklebacks (Premo, et. al., 2005).

In 2006, biological surveys were conducted on several tributaries from the Keweenaw Peninsula to the Carp River to evaluate biological, physical and habitat conditions from these watersheds. Among the 38 probabilistic sites visited in 2006, all (100 percent) were supporting the other indigenous aquatic life and wildlife designated use of the Michigan WQS. The lower 95 percent confidence limit is 92 percent attainment. The mean Procedure 51 metric score for benthic macroinvertebrates was 2.91, and most sites had many sensitive EPT taxa. Instream habitat also was quite good, with 18 sites rating excellent, 18 sites rating good, and only 2 sites rating marginal. Among 29 targeted sites assessed for benthic macroinvertebrates, nine scored excellent and 19 rated acceptable (only four of which had a metric score < 0). Only one location (Huron Creek, Station 54) was not supporting the other indigenous aquatic life designated use

of the Michigan WQS. This site has been severely impacted by channel alteration resulting from construction activity. Copper levels in the water also exceed the Rule 57 aquatic life protection value at this station. A total of 32 targeted sites were assessed for habitat, with 14 rating excellent, 12 good, 5 marginal, and 1 poor. The East Branch Eagle River (Station 45) had poor habitat due to the presence of stamp sands, bank erosion, and limited riparian vegetation (Kohlhepp, Edly & Taft, 2007)

During June of 2007 and 2008, biological surveys were conducted on Huron Creek in Houghton County to evaluate the current biological and physical habitat conditions after the installation of a leachate collection system adjacent to Sharon Road as well as to evaluate effects of channel reconstruction on the biological communities downstream. Macroinvertebrate communities continue to be poor due to contaminated landfill leachate that had coated the substrates with iron hydroxide (yellow boy). Also, total copper levels exceeded the Rule 57 WQS at both locations on the Huron River due to extensive copper stamp sand deposits located upstream of the Razorback Road location. Based on these findings, Huron Creek is not attaining WQS from its headwaters to its mouth (Taft and VanDusen, 2009).

Between the years 2007 and 2009, pre-remediation monitoring activities were intended to be combined with later post-remediation to assess the effectiveness of the remediation activities on the biological, physical and chemical components within the East Branch Eagle River. Macroinvertebrate communities within the stamp sand areas were far less abundant in the East Branch than in the reference, which were located in the headwaters of the West Branch Eagle River. Macroinvertebrate communities were found to be acceptable within the stamp sand areas with most of the organisms inhabiting the hard structures of the stream such as woody debris and small gravel, while the shifting sands contained almost no organisms (Rathbun, 2010).

METHODS

This survey was performed as described in SWAS Procedure 51 (MDEQ, 1990) or Procedure 91 (MDEQ, 2011b) at nonwadeable sites to measure habitat and macroinvertebrate community quality in the Keweenaw Watershed group. Water quality samples were collected at Rice Lake, preserved, and transported according to procedures contained in the Michigan Department of Environmental Quailty (MDEQ), Water Resouces Division's Quality Assurance Manual, unless otherwise indicated. All chemical analyses was conducted at the MDEQ Environmental Lab while the Cholorphyll a analysis was conducted by White Water Associates, Inc.

Two site selection methods were used to assess the Keweenaw Watershed group 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, show 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 the watershed group. This process was carried out by determining the total channel length within the Keweenaw Watershed group 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 14 surveys sites would represent an achievable work load 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 are considered random. Targeted sites that were not selected in the random selection process were surveyed in addition to the 14 random sites; however the results of these surveys

were not considered for the probabilistic analysis. Thirteen targeted sites and seven trend sites were also sampled totaling 34 total stations (Table 1).

SUMMARY

Stations used for the biological and habitat evaluations are shown in Figure 1 and Table 1. The macroinvertebrate community and habitat assessments were performed at 33 locations and the results are presented in Tables 2 and 3, respectively. Water chemistry monitoring data can be found in Table 4 for Huron Creek and Table 5 for Rice Lake water chemistries.

RANDOMLY SELECTED WADEABLE SITES

KEWEENAW PENINSULA WATERSHED

The Elm River was surveyed at Misery Bay Road (Station 1) during the 2011 field season with habitat quality rating excellent. Stream flashiness was rated as poor with bank scouring greater than 20 inches with little woody material present in the active channel. Sediment deposition was also determined to be marginal at this location with sand impacting the site at obstructions, constrictions and bends. The stream was approximately 20 feet wide with an average stream depth of 6 inches. The macroinvertebrate community rated acceptable with 26 taxa identified including 3 mayfly, 5 caddisfly and 2 stonefly taxa. These taxa comprised 69 percent of the total number of individuals counted.

Figure 2. Trap Rock River below Lincoln School Road.

In 2011, the Trap Rock River was surveyed at Lincoln School Road (Station 2, Figure 2). Habitat quality rated excellent with all individual metrics ranking between good and excellent except channel flow status-flashiness which rated poor. This flashiness has obviously been a problem at this location since there was recent bank stabilization activity at the road crossing. Undercut banks, large woody debris and aquatic macrophytes were sparse with the absence of root wads within this reach. However there was a moderate amount of overhanging vegetation which was available for macroinvertebrate colonization which rated excellent at this location. There were 29 macroinvertebrate taxa identified of which 53 percent of the total individuals were made up of the taxa EPT.

South Branch Elm River at Agate Beach Road (Station 3) was sampled in 2011 with no previous data collected within this sub-watershed. Habitat quality rated good and the macroinvertebrate communities rate excellent. Three out of eleven habitat parameters rated marginal and flashiness rated poor with few retention devices in the active channel. Substrate at this location was dominated by gravel and cobble with very little embeddedness. Only 2 out of 4 velocity/depth regimes were present (slow-deep and fast-shallow) and greater than 25 percent of the riffle substrates were exposed in some areas. The left bank was also moderately unstable with areas of erosion evident particularly during high water events. A total of 24 macroinvertebrate taxa were identified within this reach composed mainly of mayflies, caddisflies and stoneflies.

East Branch Sleeping River at Camp 18 Road (Station 4), which was the known as the Ford Crossing in 2001, was surveyed again in 2011. Habitat quality rated good and all metrics except flashiness rated good or above. Bank scour along the stream channel was large and retention devices within the channel were generally absent from the active channel. Structure available for macroinvertebrate colonization was sparse with no undercut banks present at the reach surveyed. Even with this sparse habitat, macroinvertebrate communities were rated as excellent with 28 total taxa and 62 percent of the total individuals composed of the EPT orders.

Figure 3. Tobacco River at Gay/Lac La Belle Road.

The Tobacco River was surveyed at Gay/Lac La Belle Road (Station 5, Figure 3) and was found to have excellent habitat assessment. All habitat parameters rated between excellent and good except for flashiness which rated poor due to bank scouring and lack of channel retention devices in the river. Overhanging vegetation and aquatic macrophytes were sparse within this reach with no undercut banks, large woody debris or rootwads to aid in macroinvertebrate colonization. The substrate at this location was dominated by bedrock with roughly 25 percent of the remaining substrates composed of boulder, cobble, gravel and sand. Macroinvertebrate communities were rated acceptable with 25 total taxa identified with the dominate orders composed of mayflies and caddisflies consisting of over 63 percent of the total individuals in the sample.

DEAD-KELSEY WATERSHED

The habitat quality of Lost Creek at County Road 510 (Station 6, Figure 4) rated good even though a majority (6 of 11) of the metrics rated marginal and poor. Sediments were dominated by sand which was significantly increasing the formation of sand bars and substantially filling in all pools within this reach. During low water periods, the stream does not fill the available channel due to the heavy deposition of sediments. However, during high water events, the bank is moderately unstable presenting areas of high erosion potential and bedload transport downstream. In spite of these limitations and the sparse availability of undercut banks, aquatic macrophytes and absence of overhanging vegetation and rootwads, the macroinvertebrate community rated excellent. Excellent bank protection and depth regimes aided in the presence of 31 total taxa along with the extensive availability of large woody debris. Orders of EPT comprise 47 percent of the total individuals identified.

Figure 4. Lost Creek at County Road 510.

The 2011 survey on the West Branch Huron River was conducted at Black Creek Road (Station 7, Figure 5) where the habitat quality rated excellent with all habitat parameters ranking in the excellent range. Large woody debris and aquatic macrophytes were sparse within this section with no undercut banks, overhanging vegetation or rootwads to add additional structure for macroinvertebrate colonization. The

macroinvertebrate community was also rated excellent at this site with 35 total taxa identified, including 5 mayfly, 8 caddisfly and 1 stonefly taxa.

Two stations were sampled on the Yellow Dog River during the 2011 survey, the Yellow Dog at County Road 550 (Station 8) and at Burma Trail #5/AAA Road (Station 9). The Yellow Dog River at County Road 550 (Station 8) had a habitat quality rating of good with some bank stabilization which had taken place in some sections of the reach. Habitat metrics for epifaunal substrate/available cover and frequency of riffles scored marginal with sediment deposition scoring poor. The substrates were dominated with sand, with no macrophyte growth or undercut banks due to sediment deposition within this reach. Macroinvertebrate communities were rated acceptable within this reach partially due to the sparse availability of macroinvertebrate colonization structures including: overhanging vegetation, large woody debris and rootwads. A total of 33 taxa were identified during the survey with the dominant orders comprised of the EPT orders which made up 46 percent of the total individuals identified in the sample.

Figure 5. West Branch Huron River at Black Road.

Figure 6. Yellow Dog River at Burma Trail #5/AAA Road.

The second site located at Burma Trail #5/AAA Road (Station 9, Figure 6) is several miles upstream from Station 6 and within the Kennecott Mine road construction area that was taking place throughout the summer. Habitat quality at this site rated good as metrics for epifaunal substrate/cover, pool substrate characterization, flashiness and channel sinuosity scored marginal. The reach was shaded mainly by alders along the riparian zone and the sediments were composed of sand and silt. Macroinvertebrate communities rated acceptable with no stoneflies identified at this location. However, over 52 percent of the total individuals were composed of caddisflies and mayflies. Twenty-three total taxa were found inhabiting the extensive overhanging vegetation, moderate undercut banks and sparse availability of large woody debris and aquatic macrophytes.

Pages Creek at Arvon Road (Station 10) had a habitat quality rating of good. The only habitat parameter to rank marginal or lower was maintained flow volume due to the exposure of the riffle substrates throughout this reach, all other parameters ranked good or excellent. Sediments were composed of mainly sand and silt with roughly 30 percent of the remaining substrates composed of gravel and cobble. Large woody debris was present moderately throughout this reach for macroinvertebrate colonization but undercut banks, overhanging vegetation and aquatic macrophytes were only available sparsely with no rootwads present. Overall, macroinvertebrate communities were rated excellent with 31 percent of the total individuals composed of EPT taxa and a total taxa of 41 identified.

STURGEON RIVER WATERSHED

In 2011, Sidnaw Creek at M-28 (Station 11) was surveyed about 1.3 miles west of the village of Sidnaw. The habitat quality rated excellent as all metrics scored in the excellent or good range except for sediment deposition which scored marginal due to the moderate deposition of sand at obstructions, constrictions and bends. The limitations of the habitat were evident in the macroinvertebrate community which rated acceptable. In spite of the acceptable rating, 35 taxa were identified indicating a very diverse community present at this location. This location was also dominated by organisms within the EPT orders which composed over 52 percent of the total individual organisms identified at this site.

The 2011 survey of Tioga River off Nestoria Road (Station 12) was conducted downstream of the bridge due to beaver activity above the bridge. Habitat quality was rated excellent with all habitat parameters rating excellent except for velocity/depth regime which was ranked as marginal due to the presence of only two habitat regimes (fast-shallow and slow-shallow). This location was almost exclusively a riffle section with a small portion determined to be depositional. Overhanging vegetation, large woody debris and aquatic macrophytes were sparse with the absence of any undercut banks or rootwads throughout the reach. Macroinvertebrate communities rated excellent with 31 total taxa identified during the survey. Dominant orders were the EPT taxa which made up 54 percent of the total individuals identified.

RANDOMLY SELECTED NONWADEABLE SITES

Two sites were found which exceed the channel depth limitations for Procedure 51, Tobacco River off Mohawk-Gay Road (Station 13) and Sturgeon River at Froberg Road (Station 14). Both of these sites were assessed using the rapid bioassessment procedure for nonwadeable rivers (MDEQ, 2011b).

The reach surveyed off of Mohawk-Gay Road on the Tobacco River (Station 13) was generally found to have stable banks but had with very little riparian vegetation, due perhaps to the beaver activity throughout this section. Human activities have also impacted this site with a riparian width less than 30 feet. Thirty-two taxa were identified within this predominately sandy section with the macroinvertebrate community rating good. This location was dominated by Corixids, Elmids and Hydrobiids which composed 39 percent of the total taxa identified.

Sturgeon River at Froberg Road (Station 14) was the second nonwadeable site to be surveyed, however, it is suggested that this site may be wadeable if visited after the dry summer season. Riparian width on the left bank was limited, upstream of the bridge, due to Froberg Road running parallel to the river for approximately 700 feet and a residential/farm on the right bank. Sediments were composed mainly of sand throughout this reach but banks were stable with very little potential for future erosional problems. Macroinvertebrate colonization structures were present throughout the reach consisting of macrophytes, large woody debris and overhanging vegetation which supported an excellent macroinvertebrate community. Taxa richness was high with 36 taxa identified. The dominant taxa were Baetids, Leptocerids, Chironomids and Simulliids making up 53 percent of collected individuals.

TREND SITES

KEWEENAW PENINSULA WATERSHED

Figure 7. Montreal River off Mandan Road.

The Montreal River was surveyed off Mandan Road (Station A, Figure 7). The habitat rated excellent with only one parameter rating marginal, the remaining parameters ranged from excellent to good. Habitat availability was less than desirable with frequently disturbed substrates, additional structures which were available for colonization included moderate amounts of large woody debris; sparse undercut banks, overhanging vegetation and aquatic macrophytes with no rootwads present. Macroinvertebrate communities within this reach were rated acceptable with 25 total taxa identified at this location and dominated by EPT orders and chironomids, which made up 36 percent and 32 percent each of the total organisms identified, respectively.

The habitat assessment for the East Branch Firesteel River upstream of M-26 (Station B) was rated good. Eight habitat parameters rated between excellent and good with two of the remaining parameters rating marginal and one poor. Sediment deposition was moderate at this reach showing areas of high bank scour along the stream banks and sparseness of large woody debris in the stream channel, suggesting a flashy system. Thirty-two total macroinvertebrate taxa were identified and rated excellent even though available structure for colonization was generally sparse. Over 50 percent of the total individuals identified at this location could be classified into the Orders EPT.

DEAD-KELSEY WATERSHED

This Yellow Dog River location was surveyed upstream of Wylie Falls on County Road AAB (Station C) and found to have good habitat quality. Sinuosity and epifaunal substrates were rated marginal at this location with sediments composed of sand and silt throughout this slow glide area. Structures available for macroinvertebrate colonization included moderate levels of undercut banks, overhanging vegetation and aquatic macrophytes. Large woody debris was sparse in this section which had a macroinvertebrate community rating of excellent. This location was dominated by EPT and had 34 total taxa identified within this reach during the survey.

The headwaters of Lost Creek (Station D) were surveyed 2.8 miles upstream from the status site (Station 6). Habitat quality rated excellent with all metrics rating good to excellent. This riffle section was composed of gravel, sand and silt. The pool and depositional areas had fair amount of detrital material (coarse particulate organic matter [CPOM]) and muck (fine particulate organic matter[FPOM]) with moderate to extensive macroinvertebrate structures with the exception of aquatic macrophytes which were absent from this reach. The macroinvertebrate community rated excellent with 28 taxa identified including 4 taxa of mayflies, 3 taxa of stoneflies and 8 taxa of caddisflies.

STURGEON RIVER WATERSHED

The West Branch Bear Creek was surveyed upstream of the Unknown Road crossing (Station E). The habitat rated good with eight out of eleven metric rating good or excellent. Sediment deposition within this reach was noted as affecting the instream habitat with sand depositing on obstructions and in the pools. Water did not fill the entire channel exposing some sediment. The left bank showed some erosion potential with marginally vegetated and moderately unstable banks which erode during high water events. Extensive large woody debris was available for macroinvertebrate colonization with all other structures sparse or absent. The macroinvertebrate assessment rating was acceptable. A total of 27 taxa were collected at this location including 4 mayflies, 7 caddisflies and one stonefly. These orders dominated this reach with 66 percent of the total individuals identified as EPT.

The Otter River at Johnson and Cabbage Roads (Station F, Figure 8) habitat assessment rated good. Four out of eleven parameters rated marginal or poor. Substrates were composed of sand and silt with sediment deposition assessed as the major problem at this location. Sparse to absent habitat availability and heavy deposits of fine material which have increased bar development has led to an acceptable macroinvertebrate community. Thirty-one macroinvertebrate taxa were collected of which 43 percent where composed of Brachycentrids.

Figure 8. Otter Creek at Johnson & Cabbage Roads.

Sturgeon River upstream Sidnaw at FF 2200 (Station G) had a habitat assessment of excellent. All metrics rated excellent to good except for flashiness which rated poor due to height of visual bank scour and lack of large woody debris and other available habitat in the stream channel. Sediments were primarily boulder, cobble and gravel with some sand present within this reach suggesting high velocities and flow during the early part of the year. Macroinvertebrate communities rated excellent. Out of 420 total individuals identified within the sample, over 75 percent were identified as EPT with a total taxa of 30.

NONPOINT SOURCE BIOLOGICAL SURVEYS

A key objective of the 2011 biological survey of the Keweenaw Peninsula watershed was to evaluate locations identified by the Nonpoint Source Program due to the presence of stamp sands throughout the Keweenaw Watershed which continue to leach copper to surface waters throughout the region. These historic copper mining operations in Michigan's Keweenaw Peninsula discharged 500 million tons of finely pulverized rock or stamp sands into Lake Superior and its tributaries in the mid to late 1800s. These fine grained stamp sands erode into streams and wetlands and degrade fish and macroinvertebrate communities by smothering aquatic habitat features and leaching copper into the water column (Rathbun, 2010). Nonpoint source staff has installed Best Management Practices (BMPs) to reduce aqueous copper concentrations, but post-BMP sampling to-date indicates that water quality standards for total copper are not being met.

KEWEENAW PENINSULA WATERSHED

Eagle River Watershed

The Eagle River Watershed was surveyed in six locations, three on the East Branch Eagle River (Stations NPS1, NPS2 & NPS6) one on the West Branch Eagle River (Station NPS3) and one location each on Buffalo (Station NPS4) and Brodie Creeks (Station NPS5).

Figure 9. East Branch Eagle River at Gratiot Lake Road.

The first location was at Gratiot Lake Road (Station NPS1, Figure 9) where obvious stream modifications were observed including canopy removal, bank stabilization and areas of habitat improvement were observed, attributing to the habitat assessment which rated good. Seven out of eleven habitat metric rated excellent to good with the remaining metrics; velocity/depth regime, channel alteration, vegetative protection and riparian zone width, rating marginal. Sediments were primarily composed of gravel and sand but all substrate types were present at this location. Aquatic macrophytes were moderately abundant with large woody debris, undercut banks and overhanging vegetation sparse. No rootwads were present within this reach. The macroinvertebrate communities rated acceptable with 16 total taxa identified. One mayfly, four caddisfly and one stonefly taxa were identified within this reach but was dominated by Chironomids which composed 28 percent of the 75 individuals collected in this survey. These reduced overall numbers still suggest this location is being negatively impacted by leachate from copper stamp sands.

The second location on the East Branch Eagle River was surveyed off of US-41 (downstream of Central Mine 3) at the confluence of Central Creek (Station NPS2, Figure 10). This location displayed canopy removed from the left bank where large expanses of stamp sand material had been deposited. The upper portion of this reach was deep and slow and impounded by a beaver dam. The habitat quality rated good but marginal bank stability and vegetative protection along the left bank displayed areas of high erosion potential during high water events areas of bare soil/sand with very little vegetation to stabilize it. The riparian vegetative zone width was also impacted with less than 10 feet of riparian zone on the left bank and between 10-75 feet on the right bank due to US-41 skirting the stream at this location. Sediments were composed mainly of sand and silt with moderate overhanging vegetation and large woody debris within the stream for macroinvertebrate colonization. Undercut banks, aquatic macrophytes and rootwads were present, but sparse, resulting in a macroinvertebrate community rating of acceptable. The total number of taxa was identified at ten including one stonefly taxa, one mayfly taxa and four caddisfly taxa comprising 80 percent of the sample.

Figure 10. East Branch Eagle River off of US-41, downstream of Central Mine 3.

The third East Branch Eagle River location was surveyed at US-41 (Station NPS6). The left bank was inhibited by the vegetative zone width and vegetative protection due to obvious disruption of

the streambank, exposing bare soils and the close proximity of the stream to US-41. The habitat quality rated good with areas of the reach lacking deep pools, vegetative protection and a poor riparian zone width along the left bank. All substrate types except bedrock were present but was dominated by boulder, cobble and sand. Within this reach there was moderate overhanging vegetation and large woody debris but undercut banks, aquatic macrophytes and rootwads were sparse. The macroinvertebrate community rated acceptable even though individual organisms totaled 28 with 9 total taxa identified. Of these 28 individuals collected, 12 were caddisflies, 10 were diptera and 5 were mayflies.

The West Branch Eagle River was surveyed off of Cliff Road (Station NPS3). The habitat quality was rated as good. Four parameters rated marginal to poor with the remaining metrics ranging between excellent and good. Habitat availability was less than desirable with sediments composed primarily of sand and silt which are frequently disturbed and deposits moderately at obstructions, constrictions and bends. Stream bank vegetation grows naturally and covers close to 100 percent of the banks thus providing extensive overhanging vegetation in the stream itself. Undercut banks and large woody debris were moderate with no aquatic macrophytes or rootwads present at this location. The macroinvertebrate community rated acceptable with 20 total taxa identified. Dominant taxa were caddisflies and diptera which composed 47 percent and 39 percent of the total organisms collected respectively.

Buffalo Creek was surveyed at the snowmobile trail (Station NPS4) which parallels US-41, west of the village of Phoenix. Both the habitat quality and the macroinvertebrate communities of Buffalo Creek rated excellent. Habitat metrics ranged from good to excellent for all parameters except flashiness which scored marginal due to presence of bank scour above the waters surface and sparse large woody debris within the channel. Overhanging vegetation was extensively available for macroinvertebrate colonization but undercut banks, aquatic macrophytes and rootwads were sparse at this reach which supported 24 different taxa. Dominant macroinvertebrate taxa were mayflies and caddisflies which composed 65 percent of individuals sampled.

Brodie Creek was also surveyed along the snowmobile trail (Station NPS5) west of the village of Phoenix and was given a habitat assessment quality rating of excellent, with 9 of the 11 habitat parameters ranking good to excellent. The final two parameters (velocity/depth regime and flashiness) rated marginal and poor, respectively. Overhanging vegetation was moderately available for macroinvertebrate colonization with all plants allowed to grow naturally along the banks. Undercut banks, large woody debris and rootwads were sparse throughout this reach with aquatic macrophytes absent due to the high percentage of the canopy which covers this location. Macroinvertebrate communities were rated excellent with 25 taxa identified, including 3 mayflies, 8 caddisflies and 2 stonefly taxa. These taxa composed 83 percent of the total number of individuals counted during this survey.

Figure 11. Kearsarge Creek upstream of the Slaughterhouse Creek confluence.

Trap Rock River Watershed

Kearsarge Creek was surveyed upstream of the confluence with Slaughterhouse Creek (Station NPS7, Figure 11). The habitat rated marginal with only two out of eleven metric rating good or better. Sediment deposition within this reach was moderate as most of the sediments were composed of silt and sand with

20 percent to 30 percent of the reach composed of CPOM and FPOM. The stream within this section was classified as flashy and unstable with many eroded "raw" areas along the straight sections with obvious bank sloughing near bends. Macroinvertebrate colonization structures were moderate to sparse throughout this reach with the absence of aquatic macrophytes and rootwad structures. Macroinvertebrate communities were still rated acceptable even with the marginal habitat within this reach. A total of 12 taxa were collected at this location including one mayfly, three caddisflies and one stonefly. However, Chironomids dominated this reach with 57 percent of the individuals identified.

The habitat assessment for the Trap Rock River off of Rimfetti Road (Station NPS8, Figure 12) was rated good with 9 out of 11 parameters rating good or excellent. Bank scour and stability of both banks was poor contributing to the many unstable, eroded areas throughout the reach. Substrates were primarily composed of gravel, cobble and boulder with small areas of sand and silt. Large woody debris, undercut banks and overhanging vegetation was moderately available at this location with sparse aquatic macrophytes and rootwads. The macroinvertebrate assessment was rated excellent with a total of 30 taxa collected. Four mayfly taxa, nine caddisfly taxa and one stonefly taxa were identified making up approximately 61 percent of the total individuals.

Figure 12. Trap Rock River off of Rimfetti Road.

Tributaries to Lake Superior & Connecting Waters

Figure 13. Owl Creek at Loop Road.

The habitat assessment at Owl Creek at Loop Road (Station NPS9, Figure 13) was rated as excellent. Habitat parameters were rated excellent to good for 10 out of the 11 total parameters measureable. The velocity/depth regime metric rated marginal with only two of the four habitat regimes (shallow fast and slow) present at this reach. Structures available for macroinvertebrate colonization within this reach are limited with a moderate amount of large woody debris but all other structures (undercut banks, overhanging vegetation, aquatic macrophytes and rootwads) absent. Macroinvertebrate communities were found to be acceptable which may be correlated to the lack of habitat throughout this reach. Sixteen taxa were collected, made up of 5 caddisfly taxa and 1 stonefly taxa. The dominant taxa consisted of Chrionomidae and Simuliidae which consisted of over 75 percent of the total individuals collectively.

Huron Creek was surveyed at 2 locations in the town of Houghton. The first location was behind the Ming Gardens Oriental Restaurant (Station NPS10). The habitat quality rated good with seven out of eleven parameters rating good or excellent. Three metrics rated marginal (velocity/depth regime, channel alteration and riparian zone width) and one metric (flashiness) rated poor. This reach of the Huron River flows through the urbanized business section of town and has been channelized to allow for new construction. Substrates were a good mix of

boulder, cobble, gravel, sand and silt with extensive overhanging vegetation immediately along the stream banks. This riparian zone was narrow due to past construction and urbanization of the surrounding areas. Other macroinvertebrate colonization structures were sparse with no rootwads present throughout this reach. Macroinvertebrate assessments scored poor with 13 taxa present. No mayflies or stoneflies were present at this location. One individual caddisfly was found but the site was dominated by Chironomidae and Simuliidae which composed 78 percent of the total individuals collected at this location.

The second location (Station NPS11) on the Huron River was surveyed approximately 0.4 miles downstream of Station NPS10, upstream of the Sharon Road crossing. The habitat quality rated good with six metrics scoring good to excellent. This reach had been historically altered with only occasional riffles present within the reach. Sediments were composed mainly of cobble, gravel and sand with patches of boulder and silt. The stream banks were sparsely covered with overhanging vegetation which was mostly composed of small shrubs and grasses and the riparian width was minimal for both banks. The right stream bank scored slightly higher due to increased riparian zone width and greater vegetative protection. This reach is mostly unshaded due to the removal of the canopy during channel relocation. Macroinvertebrate structures were absent except for some moderately distributed aquatic macrophytes throughout the reach. The macroinvertebrate community was rated acceptable with 16 taxa identified, which were composed of one taxa of caddisfly and dominated by Chironomidae, which comprised 45 percent of the total identified.

NONPOINT SOURCE WATER CHEMISTRY

Presented in Table 4, are results of water chemistry samples collected from 25 stream sites including eight sites sampled for biota (Stations NPS1, NPS2, NPS4, NPS7, NPS8, NPS9, NPS10 and NPS11) from Keweenaw, Houghton, and Ontonagon Counties, Michigan during this study. Monthly samples were collected from June 2011 through September 2011. Total copper, total organic carbon, dissolved organic carbon, and total hardness (as measured by total calcium and total magnesium ions) were measured in water samples. The water bodies sampled are currently included on the 2010 303(d) list due to non-attainment of the water quality standards for the “other indigenous aquatic life and wildlife” designated use, due to exceedances of the total copper WQS. These exceedances are most often due caused by historic copper mining wastes known as stamp sands. As a result of these stamp sands, there are increased water column copper concentrations in several water bodies that have low hardness and low pH values. However, the macroinvertebrate communities in these water bodies are meeting the biological integrity requirements of the Michigan WQS. The water chemistry information in Table 4 will be used to: (1) develop site-specific water-effect ratios that will be used to calculate new site-specific WQS for total copper, (2) make non-attainment listing decisions for the water bodies, and (3) develop TMDLs for water bodies not meeting the new site-specific WQS. The site specific water effect ratio decision making procedure and new site specific WQS that will be applied to the sites listed in Table 4 will be discussed in a separate report expected later this year.

OTHER NONPOINT SOURCE SUPPORT

As part of the nonpoint source surveillance activity, SWAS staff also conducted qualitative biological surveys on Billy Butcher Creek to evaluate water quality impairments due to the potential solid waste landfill leachate the into stream and water quality analysis on Rice Lake to evaluate nutrient inputs from local farm runoff.

Billy Butcher Creek

Habitat assessment was rated good at Billy Butcher Creek at Division Street/CR-553 (Station NPS12, Figure 14). Four habitat parameters rated from marginal to poor with the remaining metrics ranging from good to excellent. Sediments were soft, composed of sand and silt covering gravel and cobble with 30 percent to 60 percent of the reach composed of FPOM and CPOM. The stream was consistently 4 feet wide and shallow with the occasional riffle or bend, deep water regimes were absent along this entire reach. Colonization structures, including undercut banks and large woody debris, were extensive along with a moderate amount of overhanging vegetation. However, aquatic macrophytes and rootwads were sparse. The macroinvertebrate community rated acceptable with a total of 20 taxa collected. One mayfly taxa, four caddisfly taxa and one stonefly taxa were identified making up approximately 26 percent of the total individuals. However, Chironomidae were the dominant taxa composing 37 percent of the total individuals collected.

Figure 14. Billy Butcher Creek running parallel to Division Street/CR-553.

Rice Lake

Rice Lake is located in northeast Houghton County in the Keweenaw Peninsula, 5.1 miles east of the village of Lake Linden. Local riparian residents reported excessive aquatic weed growth and a sudden decrease in fishing success. Grab samples were collected on June 16, 2011, at the deepest point within the lake (Station NPS13), grab samples were also collected by district staff at three inlets. Results from the June 16, 2011 sampling suggest there are no nutrient exceedances (Table 5). Phosphorus concentrations were under the Water Quality Standard of 1 mg/L and chlorophyll a concentrations were reported as not detected which only suggests that more samples be collected.

Some historic data does exist for Rice Lake. In April 2001, depth profile was collected at the deepest point of the lake showing normal oxygen and temperature profiles (Table 6) while later that summer in August 2001 the dissolved oxygen profile appears unusual with oxygen concentrations increasing slightly with depth (Table 6). This late summer profile is not characteristic of normal dissolved oxygen profiles for shallow eutrophic lakes and should be investigated further.

Some potential causes relating to the excessive weed growth in the lake include; potential manmade phosphorus load due to inadequate septage systems and/or inadequate setback of drain field locations from the shoreline, excessive lawn fertilization, or increased loading from commercial activities. Increases in vegetation growth could also be due to natural conditions, increased atmospheric temperature and lower lake levels which allows sunlight to penetrate deeper into the lake. However, more information is needed to determine potential causes and if there are further impacts to Rice Lake.

AREAS OF FURTHER INVESTIGATION

Kearsarge Creek at confluence with Slaughterhouse Creek (Station NPS7)

- Bank stability – both banks need help, left bank is unstable with many eroded "raw" areas with bank sloughing. Right bank is moderately unstable with high erosion potential during high water events.
- Flashiness – bank scour along stream channel was noticed at greater than 20" with little woody debris in the active channel.
- Epifaunal substrate/available cover – very little stable habitat present within this stream with sediments composed of sand and silt that are frequently disturbed.

Trap Rock River off Rimfetti Road (Station NPS8)

- Bank stability – both banks rated poor exposing "raw" unstable areas with bank sloughing.
- Flashiness – Bank scour along stream channel was noticed at greater than 20" with little woody debris in the active channel.

Rice Lake

- Need more nutrient export data from the tributary near the northeast culvert area which empties into Rice Lake and transports potential nutrients from the Blueberry Farm upstream.
- Determine how often the drain flows and how often the drain is dry.
- Estimate septic inputs from the residential areas surrounding Rice Lake.
- Continue with spring, summer and fall sampling to determine nutrient inputs and impacts on macrophyte communities.
- Discharge measurements at locations with potential/suspected nutrient inputs.

CONCLUSION

The macroinvertebrate and habitat quality data collected during the 2011 biological survey in the Keweenaw Peninsula Watershed Group indicate that most sites (32 of 33) rated acceptable or excellent for macroinvertebrate community quality, even though many continue to be impacted by leachate from copper stamp sands. These locations have shown to have low diversities and few individuals present even though habitat within these sections generally rated good to excellent. Within areas unimpacted by copper leachate diversities tend to be higher and individual organisms more abundant. Habitat problems throughout the watershed tend to be sediment driven with flashy flows that impedes colonization and erodes stream banks. One nonpoint source location (Station NPS10) rated poor for macroinvertebrate communities due to copper stamp sand and landfill leachate and one nonpoint source location rated marginal for habitat quality (Station NPS7) due to heavy sand loads within the stream decreasing habitat stability as well as flashiness during rain events which impacts the exposed, unstable banks.

WATERSHED ATTAINMENT STATUS

Summary statistics were calculated from the probabilistic monitoring results to address regional attainment status for the Keweenaw Peninsula River watersheds. Based on 14 randomly assigned status stations, all sites were attaining the Other Indigenous Aquatic Life and Wildlife Designated Use water quality standard.

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Table 1. Station summary for the Keweenaw Watershed Group sampled from June & August, 2011 in Keweenaw, Houghton and Ontonagon Counties.

Site ID	Waterbody Name	Location	Latitude	Longitude	Macroinvertebrate		Habitat		Chem
Random Sites									
1	Elm River	Misery Bay Road	47.01140	-88.85334	Acceptable	4	Excellent	159	
2	Trap Rock River	Lincoln School Road	47.26880	-88.36219	Excellent	7	Excellent	169	
3	S. Br. Elm River	Agate Beach Road (S71D)	47.04041	-88.90449	Excellent	5	Good	142	
4	East Br. Sleeping River	Camp 18 Road (Snowmobile/Logging Rd)	46.95999	-89.06537	Excellent	7	Good	153	
5	Tobacco River	Gay Lac La Belle Road	47.23129	-88.14851	Acceptable	4	Excellent	168	
6	Lost Creek	County Road 510	46.74135	-87.73011	Excellent	6	Good	119	
7	W. Br. Huron River	Black Creek Road	46.80613	-88.08717	Excellent	5	Excellent	186	
8	Yellow Dog River	Big Bay Road (County Road 550)	46.75681	-87.66164	Acceptable	4	Good	127	
9	Upper Yellow Dog River	Burma Trail #5 (AAA Road)	46.72643	-87.87207	Acceptable	2	Good	130	
10	Pages Creek	Arvon Road	46.77416	-88.26843	Excellent	5	Good	151	
11	Sidnaw Creek	M28	46.50637	-88.74166	Acceptable	3	Excellent	163	
12	Tioga River	two track S off Nestoria Road	46.49712	-88.28169	Excellent	7	Excellent	186	
13	Tobacco River	off Mohawk Gay Road*	47.23260	-88.16983	Good	75	N/A	--	
14	Sturgeon River	Froberg Road*	46.83705	-88.59082	Excellent	82	N/A	--	
Trend Sites									
A	Montreal River	OFF S. Mandan Rd	47.42212	-87.94950	Acceptable	2	Excellent	157	
B	E. Br. Firesteel River	U/S M-26 (Unknown two-track)	46.79693	-89.01805	Excellent	6	Good	147	
C	Yellow Dog River	U/S Wylie Falls (OFF Co Rd Aab)	46.72331	-87.86247	Excellent	5	Good	153	
D	Lost Creek	Headwaters (OFF Co Rd 510)	46.75262	-87.77150	Excellent	7	Excellent	177	
E	W. Br. Bear Creek	U/S Unknown Rd (unknown two-track)	46.89147	-88.75407	Acceptable	3	Good	146	
F	Otter River	Johnson and Cabbage Roads	46.86570	-88.61461	Acceptable	4	Good	132	
G	Sturgeon River	U/S Sidnaw at FF2200	46.57384	-88.66375	Excellent	8	Excellent	166	
Nonpoint Source Sites									
NPS1	E. Br. Eagle River	Gratiot Lake Road	47.40320	-88.19810	Acceptable	-2	Good	128	W
NPS2	E. Br. Eagle River	US-41 (Site F)	47.40280	-88.21080	Acceptable	0	Good	129	W
NPS3	W. Br. Eagle River	off Cliff Road	47.36687	-88.32181	Acceptable	4	Good	142	
NPS4	Buffalo Creek	Snowmobile Trail	47.40060	-88.21290	Excellent	6	Excellent	178	W
NPS5	Brodie Creek	Snowmobile Trail	47.38141	-88.28236	Excellent	5	Excellent	172	
NPS6	E. Br. Eagle River	off US-41	47.40340	-88.22410	Acceptable	1	Good	152	
NPS7	Kearsarge Creek	u-s confluence with Slaughterhouse Cr	47.27438	-88.39074	Acceptable	2	Marginal	99	W
NPS8	Trap Rock River	Rimfetti Road	47.20708	-88.39062	Excellent	6	Good	139	W
NPS9	Owl Creek	Loop Road (Copper Falls-W)	47.42988	-88.19606	Acceptable	0	Excellent	181	W
NPS10	Huron Creek	behind Chinese Restaurant	47.10659	-88.58710	Poor	-5	Good	141	W
NPS11	Huron Creek	Sharon Road	47.11232	-88.58774	Acceptable	-4	Good	120	W
NPS12	Billy Butcher Creek	Division Street	46.52571	-87.40438	Acceptable	3	Good	138	
Lakes									
NPS13	Rice Lake	Houghton County	47.15643	-88.28399					W

* Non-wadeable site

W-Water Chemistry Collected
S - Sediment Sample Collected
X- Observations Only
Y - YSI Meter Readings

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Elm River Misery Bay Road 6/18/2011 **STATION 1**	Trap Rock River Lincoln School Road 6/17/2011 **STATION 2**	South Branch Elm River Agate Beach Road 6/18/2011 **STATION 3**	East Branch Sleeping River Ford Crossing 6/18/2011 **STATION 4**
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			
Oligochaeta (worms)	3	3	1	2
ARTHROPODA				
Crustacea				
Decapoda (crayfish)		1		1
Isopoda (sowbugs)		2		
Arachnoidea				
Hydracarina			1	5
Insecta				
Ephemeroptera (mayflies)				
Baetidae	33	25	13	20
Caenidae		6		45
Ephemerellidae	40	27	30	1
Heptageniidae	8	30	24	44
Isonychiidae				2
Leptophlebiidae		5	10	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		4	3	6
Cordulegastridae	5			
Gomphidae		15		14
Macromiidae			4	2
Zygoptera (damselflies)				
Calopterygidae		5		
Plecoptera (stoneflies)				
Leuctridae			1	
Perlidae		1		10
Perlodidae	1	2	4	
Pteronarcyidae	3		1	
Hemiptera (true bugs)				
Corixidae		1		
Gerridae	1	1	1	1
Veliidae				1
Megaloptera				
Corydalidae (dobson flies)				8
Sialidae (alder flies)	1	1	4	
Trichoptera (caddisflies)				
Glossosomatidae			3	
Helicopsychidae				4
Hydropsychidae	15	21	2	31
Hydroptilidae	2			1
Lepidostomatidae	12	5	6	
Leptoceridae		1		4
Limnephilidae	77	3	32	2
Molannidae	1		1	
Philopotamidae		23	5	1
Coleoptera (beetles)				
Dytiscidae (total)	1			
Dryopidae	1			
Elmidae	5	18	7	9
Diptera (flies)				
Athericidae	22	2	7	2
Ceratopogonidae	3	1		4
Chironomidae	21	43	11	41
Simuliidae	10	26	11	2
Tabanidae	6	3		2
Tipulidae	1	3	1	1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1		
Physidae	3			
Valvatidae	2			
TOTAL INDIVIDUALS	278	279	183	266

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Elm River Misery Bay Road 6/18/2011 **STATION 1**		Trap Rock River Lincoln School Road 6/17/2011 **STATION 2**		South Branch Elm River Agate Beach Road 6/18/2011 **STATION 3**		East Branch Sleeping River Ford Crossing 6/18/2011 **STATION 4**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	26	0	29	1	24	0	28	1
NUMBER OF MAYFLY TAXA	3	0	5	1	4	0	5	1
NUMBER OF CADDISFLY TAXA	5	0	5	0	6	1	6	1
NUMBER OF STONEFLY TAXA	2	1	2	1	3	1	1	0
PERCENT MAYFLY COMP.	29.14	1	33.33	1	42.08	1	42.11	1
PERCENT CADDISFLY COMP.	38.49	1	19.00	0	26.78	0	16.17	0
PERCENT DOMINANT TAXON	27.70	-1	15.41	1	17.49	0	16.92	1
PERCENT ISOPOD, SNAIL, LEECH	2.16	1	1.08	1	0.00	1	0.00	1
PERCENT SURF. AIR BREATHERS	0.72	1	0.72	1	0.55	1	0.75	1
TOTAL SCORE		4		7		5		7
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		EXCELLENT		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Tobacco River Gay Road 6/16/2011 **STATION 5**	Lost Creek off County Road 510 8/17/2011 **STATION 6**	West Branch Huron River Letherby and Black Creek Rd 8/15/2011 **STATION 7**	Yellow Dog River County Road 550 8/17/2011 **STATION 8**
ANNELIDA (segmented worms)				
Hirudinea (leeches)			2	
Oligochaeta (worms)	2	2	66	12
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	3			
Arachnoidea				
Hydracarina		1	1	
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				1
Baetidae	22	19	16	12
Caenidae	8			
Ephemerellidae	24	24	3	3
Heptageniidae	2	6	16	13
Leptophlebiidae	3	7	1	
Tricorythidae			7	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	3
Cordulegastridae		9	31	4
Gomphidae				1
Macromiidae	1			
Zygoptera (damselflies)				
Calopterygidae				1
Plecoptera (stoneflies)				
Leuctridae		3		
Perlidae		5	3	10
Pteronarcyidae				12
Hemiptera (true bugs)				
Corixidae	1			2
Gerridae		1	1	
Mesoveliidae		2	1	1
Megaloptera				
Corydalidae (dobson flies)			1	1
Sialidae (alder flies)		1	1	
Trichoptera (caddisflies)				
Brachycentridae				46
Glossosomatidae		10	2	20
Helicopsychidae	7			
Hydropsychidae	7	14	16	6
Hydroptilidae	2			1
Lepidostomatidae	5		2	1
Leptoceridae	3		9	
Limnephilidae	11	10	1	1
Molannidae	1		8	
Philopotamidae		6	16	
Phryganeidae		17		1
Polycentropodidae		1		8
Rhyacophilidae			3	
Uenoidae		1		1
Lepidoptera (moths)				
Pyralidae			1	
Coleoptera (beetles)				
Dryopidae		1		
Elmidae	9	2	1	35
Diptera (flies)				
Athericidae		4	1	6
Ceratopogonidae	2	13	2	2
Chironomidae	14	59	43	52
Dixidae		2	1	
Dolichopodidae			3	
Simuliidae	4	11	2	5
Tabanidae		2	1	5
Tipulidae		25		1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1		1	7
Hydrobiidae	13			
Lymnaeidae		1		
Physidae			1	13
Planorbidae	2			
Valvatidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	4	1	7
TOTAL INDIVIDUALS	149	264	266	294

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Tobacco River Gay Road 6/16/2011 **STATION 5**		Lost Creek off County Road 510 8/17/2011 **STATION 6**		West Branch Huron River Letherby and Black Creek Rd 8/15/2011 **STATION 7**		Yellow Dog River County Road 550 8/17/2011 **STATION 8**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	0	31	1	35	1	33	1
NUMBER OF MAYFLY TAXA	5	1	4	1	5	1	4	0
NUMBER OF CADDISFLY TAXA	7	1	7	1	8	1	9	1
NUMBER OF STONEFLY TAXA	0	-1	2	1	1	0	2	1
PERCENT MAYFLY COMP.	39.60	1	21.21	0	16.17	0	9.86	0
PERCENT CADDISFLY COMP.	24.16	0	22.35	0	21.43	0	28.91	0
PERCENT DOMINANT TAXON	16.11	1	22.35	0	24.81	0	17.69	0
PERCENT ISOPOD, SNAIL, LEECH	11.41	0	0.38	1	1.50	1	6.80	0
PERCENT SURF. AIR BREATHERS	0.67	1	1.14	1	1.88	1	1.02	1
TOTAL SCORE		4		6		5		4
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		EXCELLENT		ACCEPT.

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Upper Yellow Dog River AAA 6/20/2011 **STATION 9**	Pages Creek Arvon Road 8/15/2011 **STATION 10**	Sidnaw Creek M28 8/14/2011 **STATION 11**	Tioga River two-track off Nestoria Road 8/16/2011 **STATION 12**
PORIFERA (sponges)				1
PLATYHELMINTHES (flatworms)				
Turbellaria		1		1
ANNELIDA (segmented worms)				
Oligochaeta (worms)	6	3	5	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	2		1	
Decapoda (crayfish)				1
Arachnoidea				
Hydracarina	1	2	1	1
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1			
Baetidae	4	3	9	1
Caenidae	33		1	
Ephemerellidae	1	9		
Ephemeridae	1	1		
Heptageniidae	4	5	3	18
Isonychiidae				1
Leptophlebiidae		25	3	1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	3	1	3	3
Cordulegastridae		32	6	11
Gomphidae	10		2	1
Libellulidae			1	
Zygoptera (damselflies)				
Calopterygidae		9	4	14
Plecoptera (stoneflies)				
Leuctridae		2		
Perlidae		3	1	11
Pteronarcyidae				1
Hemiptera (true bugs)				
Gerridae		3	1	1
Mesoveliidae		2		1
Veliidae			2	
Megaloptera				
Corydalidae (dobson flies)		1	2	5
Sialidae (alder flies)	4	7	3	
Trichoptera (caddisflies)				
Glossosomatidae		1		20
Hydropsychidae		7	13	37
Hydroptilidae		1		
Lepidostomatidae	4		3	
Leptoceridae	10	14	119	9
Limnephilidae	50	7	5	1
Molannidae	15	3		
Philopotamidae		9		45
Phryganeidae		1	1	2
Polycentropodidae		1	1	
Lepidoptera (moths)				
Noctuidae		1		
Coleoptera (beetles)				
Dytiscidae (total)			1	
Gyrinidae (adults)				1
Hydrophilidae (total)		5		1
Dryopidae		4	1	
Elmidae	2	9	10	3
Diptera (flies)				
Athericidae		3	2	8
Ceratopogonidae	1	25	7	
Chironomidae	79	61	54	21
Culicidae		3		
Dixidae		7	1	
Simuliidae			2	48
Tabanidae	1	2	14	
Tipulidae	1	7		1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1	2	
Physidae	2	10	15	
Planorbidae		1	1	
Valvatidae	2			
Pelecypoda (bivalves)				
Sphaeriidae (clams)		1		
TOTAL INDIVIDUALS	237	293	300	271

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Upper Yellow Dog River AAA 6/20/2011 **STATION 9**		Pages Creek Arvon Road 8/15/2011 **STATION 10**		Sidnaw Creek M28 8/14/2011 **STATION 11**		Tioga River two-track off Nestoria Road 8/16/2011 **STATION 12**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	41	1	35	1	31	1
NUMBER OF MAYFLY TAXA	6	1	5	1	4	0	4	0
NUMBER OF CADDISFLY TAXA	4	0	9	1	6	1	6	1
NUMBER OF STONEFLY TAXA	0	-1	2	1	1	0	2	1
PERCENT MAYFLY COMP.	18.57	0	14.68	0	5.33	0	7.75	0
PERCENT CADDISFLY COMP.	33.33	1	15.02	0	47.33	1	42.07	1
PERCENT DOMINANT TAXON	33.33	-1	20.82	0	39.67	-1	17.71	0
PERCENT ISOPOD, SNAIL, LEECH	1.69	1	4.10	0	6.00	0	0.00	1
PERCENT SURF. AIR BREATHERS	0.00	1	4.44	1	1.33	1	1.48	1
TOTAL SCORE		2		5		3		6
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Tobacco River off Mohawk-Gay Road 9/12/2011 **STATION 13**	Sturgeon River Froberg Road 9/12/2011 **STATION 14**
PLATYHELMINTHES (flatworms)		
Turbellaria		2
ANNELIDA (segmented worms)		
Hirudinea (leeches)	1	
Oligochaeta (worms)	2	1
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	19	49
Decapoda (crayfish)		1
Isopoda (sowbugs)		4
Arachnoidea		
Hydracarina	28	6
Insecta		
Ephemeroptera (mayflies)		
Baetiscidae		3
Baetidae		95
Caenidae	18	
Heptageniidae		24
Isonychiidae	15	4
Leptophlebiidae	1	7
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	2	6
Corduliidae	1	
Gomphidae	11	3
Zygoptera (damselflies)		
Calopterygidae	12	9
Coenagrionidae	7	9
Plecoptera (stoneflies)		
Perlidae		1
Perlodidae		3
Hemiptera (true bugs)		
Belostomatidae	1	5
Corixidae	30	8
Mesoveliidae		1
Naucoridae		
Nepidae	1	1
Megaloptera		
Sialidae (alder flies)	1	
Trichoptera (caddisflies)		
Hydropsychidae	2	28
Leptoceridae	4	67
Limnephilidae	25	
Molannidae	1	
Phryganeidae	1	
Polycentropodidae		3
Coleoptera (beetles)		
Dytiscidae (total)	1	
Gyrinidae (adults)	1	1
Hydrophilidae (total)		2
Elmidae (total)	31	15
Diptera (flies)		
Ceratopogonidae	4	13
Chironomidae	25	62
Culicidae	1	1
Simuliidae		57
Tabanidae	1	1
Tipulidae	1	1
MOLLUSCA		
Gastropoda (snails)		
Hydrobiidae	59	1
Physidae		31
Planorbidae	1	
Pelecypoda (bivalves)		
Sphaeriidae (fingernail clams)	2	6
TOTAL INDIVIDUALS	310	531

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

METRIC	**STATION 13** off Mohawk-Gay Road Value		**STATION 14** Froberg Road Value	
TOTAL ABUNDANCETOTAL ABUNDANCE	310		531	
TOTAL RICHNESS	32		36	
NUMBER OF EPHEMEROPTERA FAMILIES	3		5	
NUMBER OF PLECOPTERA FAMILIES	0		2	
NUMBER OF TRICHOPTERA FAMILIES	5		3	
NUMBER OF DIPTERA TAXA	5		6	
TRICHOPTERA ABUNDANCE	33		98	
ABUNDANCE OF DOMINANT TAXON	59		95	
SHREDDER ABUNDANCE	49		120	
SCRAPER ABUNDANCE	61		56	
COLL-FILTERER ABUNDANCE	20		96	
COLL-GATH ABUNDANCE	108		195	
PREDATOR ABUNDANCE	72		64	

METRIC	Metric Score		Metric Score	
FFG Diversity (25)	25		25	
Habitat Stability FFG Surrogate (25)	8		8	
% Trichoptera (20)	20		20	
EPT Richness (8)	6		8	
Total Richness (7)	7		7	
Diptera Richness (5)	4		5	
Plecoptera Richness (5)	0		4	
% Dominance (5)	5		5	
TOTAL SCORE (100)	75		82	
MACROINVERTEBRATE COMMUNITY RATING	**GOOD**		**EXCELLENT**	

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Montreal River Mandan Road 6/13/2011 **STATION A**	East Branch Firesteel River M-26 6/19/2011 **STATION B**	Yellow Dog River County Road AAB 8/17/2011 **STATION C**	Lost Creek off County Road 510 6/20/2011 **STATION D**
ANNELIDA (segmented worms)				
Hirudinea (leeches)			3	
Oligochaeta (worms)	1	10	13	12
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	4		1	
Decapoda (crayfish)	5			
Arachnoidea				
Hydracarina		2	2	
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae			29	
Baetidae	7	15	21	33
Caenidae		31	3	
Ephemerellidae	2	33		50
Ephemeridae			1	
Heptageniidae	8	12	7	1
Leptophlebiidae				12
Tricorythidae	5			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	3	7	2	3
Cordulegastridae	1		1	1
Gomphidae	1	10	7	
Libellulidae			1	
Macromiidae		12		
Zygoptera (damselflies)				
Calopterygidae	14	9	10	
Plecoptera (stoneflies)				
Leuctridae				5
Nemouridae	1			
Perlidae		3		
Perlodidae				1
Pteronarcyidae	4			10
Hemiptera (true bugs)				
Corixidae			3	
Gerridae	1	1	1	1
Mesoveliidae			2	
Veliidae		1		1
Megaloptera				
Corydalidae (dobson flies)		2		
Sialidae (alder flies)			2	3
Trichoptera (caddisflies)				
Brachycentridae			1	7
Glossosomatidae		2		1
Hydropsychidae	2	20		5
Hydroptilidae		1	1	2
Lepidostomatidae				2
Leptoceridae	11	17	4	5
Limnephilidae	2	5	53	12
Molannidae		18	10	
Philopotamidae	10	1		27
Phryganeidae			11	
Polycentropodidae			1	
Coleoptera (beetles)				
Dytiscidae (total)				2
Dryopidae		1		
Elmidae	1	12	6	
Diptera (flies)				
Athericidae	2	1		8
Ceratopogonidae	7		4	5
Chironomidae	46	43	32	41
Dixidae			2	
Simuliidae	4	1		16
Tabanidae	1	1	7	1
Tipulidae	3	2		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		3		
Lymnaeidae			2	
Physidae		5	4	
Planorbidae		2	12	
Pelecypoda (bivalves)				
Sphaeriidae (clams)		5	6	1
TOTAL INDIVIDUALS	146	288	265	268

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Montreal River Mandan Road 6/13/2011 **STATION A**		East Branch Firesteel River M-26 6/19/2011 **STATION B**		Yellow Dog River County Road AAB 8/17/2011 **STATION C**		Lost Creek off County Road 510 6/20/2011 **STATION D**	
METRIC	Value	Scor	Value	Score	Value	Scor	Value	Score
TOTAL NUMBER OF TAXA	25	0	32	1	34	1	28	1
NUMBER OF MAYFLY TAXA	4	0	4	0	5	1	4	1
NUMBER OF CADDISFLY TAXA	4	0	7	1	7	1	8	1
NUMBER OF STONEFLY TAXA	2	1	1	0	0	-1	3	1
PERCENT MAYFLY COMP.	15.07	0	31.60	1	23.02	1	35.82	1
PERCENT CADDISFLY COMP.	17.12	0	22.22	0	30.57	1	22.76	0
PERCENT DOMINANT TAXON	31.51	-1	14.93	1	20.00	0	18.66	0
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	3.47	1	7.92	0	0.00	1
PERCENT SURF. AIR BREATHERS	0.68	1	0.69	1	2.26	1	1.49	1
TOTAL SCORE		2		6		5		7
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		EXCELLENT		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	West Branch Bear Creek unknown two-track 6/17/2011 **STATION E**	Otter River Johnson & Cabbage Roads 8/15/2011 **STATION F**	Sturgeon River u-s Sidnaw at FF 2200 6/19/2011 **STATION G**
PLATYHELMINTHES (flatworms)			
Turbellaria		1	
ANNELIDA (segmented worms)			
Oligochaeta (worms)	2	5	2
ARTHROPODA			
Crustacea			
Decapoda (crayfish)		1	
Arachnoidea			
Hydracarina	2	1	
Insecta			
Ephemeroptera (mayflies)			
Baetiscidae		2	
Baetidae	12	20	53
Caenidae			25
Ephemerellidae	26		41
Heptageniidae	13	9	33
Isonychiidae		1	1
Leptophlebiidae	1		5
Tricorythidae		1	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	7	1	2
Cordulegastridae	1	1	2
Gomphidae		1	16
Macromiidae	1		5
Zygoptera (damselflies)			
Calopterygidae		2	1
Plecoptera (stoneflies)			
Nemouridae	7		
Perlidae		10	12
Pteronarcyidae		15	
Hemiptera (true bugs)			
Corixidae		25	1
Gerridae	1	1	
Mesoveliidae		1	
Veliidae			1
Megaloptera			
Corydalidae (dobson flies)			1
Sialidae (alder flies)	1		
Trichoptera (caddisflies)			
Brachycentridae		131	
Glossosomatidae	9		5
Helicopsychidae			14
Hydropsychidae	2	20	68
Lepidostomatidae	1		3
Leptoceridae	2	3	60
Limnephilidae	114	7	1
Molannidae	9		2
Philopotamidae	8		7
Polycentropodidae		3	
Lepidoptera (moths)			
Pyralidae	1		
Coleoptera (beetles)			
Elmidae	13	15	27
Diptera (flies)			
Athericidae	13	5	
Ceratopogonidae	3		2
Chironomidae	30	6	19
Simuliidae	29	5	
Tabanidae		2	8
Tipulidae	1		
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)		1	2
Lymnaeidae	1		
Physidae		2	1
Pelecypoda (bivalves)			
Sphaeriidae (clams)		7	
TOTAL INDIVIDUALS	310	305	420

Table 2B. Macroinvertebrate metric evaluation of selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	West Branch Bear Creek unknown two-track 6/17/2011 **STATION E**		Otter River Johnson & Cabbage Roads 8/15/2011 **STATION F**		Sturgeon River u-s Sidnaw at FF 2200 6/19/2011 **STATION G**	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	0	31	1	30	1
NUMBER OF MAYFLY TAXA	4	0	5	1	6	1
NUMBER OF CADDISFLY TAXA	7	1	5	0	8	1
NUMBER OF STONEFLY TAXA	1	0	2	1	1	0
PERCENT MAYFLY COMP.	16.77	0	10.82	0	37.62	1
PERCENT CADDISFLY COMP.	46.77	1	53.77	1	38.10	1
PERCENT DOMINANT TAXON	36.77	-1	42.95	-1	16.19	1
PERCENT ISOPOD, SNAIL, LEECH	0.32	1	0.98	1	0.71	1
PERCENT SURF. AIR BREATHERS	0.32	1	8.85	0	0.48	1
TOTAL SCORE		3		4		8
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	East Branch Eagle River u-s Gratiot Lake Road 6/13/2011 **STATION NPS1**	East Branch Eagle River d-s end on Central Mine 3 6/14/2011 **STATION NPS2**	West Branch Eagle River off Cliff Road 6/15/2011 **STATION NPS3**	Buffalo Creek u-s snowmobile bridge 6/13/2011 **STATION NPS4**
ANNELIDA (segmented worms)				
Oligochaeta (worms)			19	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	5		1	1
Arachnoidea				
Hydracarina	3	1	3	1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	2	5	7	4
Caenidae				7
Ephemerellidae				58
Heptageniidae				9
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	2	1		
Cordulegastridae	7		1	
Gomphidae				5
Plecoptera (stoneflies)				
Perlidae	1			1
Perlodidae		2	7	11
Hemiptera (true bugs)				
Corixidae	6			
Gerridae		1	1	1
Veliidae				1
Megaloptera				
Corydalidae (dobson flies)				4
Sialidae (alder flies)			5	2
Trichoptera (caddisflies)				
Glossosomatidae			4	7
Hydropsychidae	11		1	47
Hydroptilidae		42	79	1
Lepidostomatidae	2	2	50	
Leptoceridae	1	10		13
Limnephilidae	1	10	14	16
Molannidae			1	
Philopotamidae			1	20
Coleoptera (beetles)				
Dytiscidae (total)			1	
Haliplidae (adults)	4			
Elmidae	2			25
Diptera (flies)				
Athericidae				3
Ceratopogonidae	3		7	7
Chironomidae	21	14	80	34
Simuliidae	4		26	
Tabanidae			11	
TOTAL INDIVIDUALS	75	88	319	281

Table 2B. Macroinvertebrate metric evaluation for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	East Branch Eagle River u-s Gratiot Lake Road 6/13/2011 **STATION NPS1**		East Branch Eagle River d-s end on Central Mine 3 6/14/2011 **STATION NPS2**		West Branch Eagle River off Cliff Road 6/15/2011 **STATION NPS3**		Buffalo Creek u-s snowmobile bridge 6/13/2011 **STATION NPS4**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	16	0	10	-1	20	1	24	0
NUMBER OF MAYFLY TAXA	1	-1	1	-1	1	-1	4	0
NUMBER OF CADDISFLY TAXA	4	0	4	0	7	1	6	1
NUMBER OF STONEFLY TAXA	1	0	1	0	1	1	2	1
PERCENT MAYFLY COMP.	2.67	-1	5.68	0	2.19	-1	27.76	1
PERCENT CADDISFLY COMP.	20.00	0	72.73	1	47.02	1	37.01	1
PERCENT DOMINANT TAXON	28.00	-1	47.73	-1	25.08	0	20.64	0
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	0.00	1	0.00	1	0.00	1
PERCENT SURF. AIR BREATHERS	13.33	0	1.14	1	0.63	1	0.71	1
TOTAL SCORE		-2		0		4		6
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		EXCELLENT

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Brodie Creek ORV Crossing East of Phoenix 6/15/2011 **STATION NPS5**	East Branch Eagle River South off U.S. 41 6/13/2011 **STATION NPS6**	Kearsarge Creek confluence with Slaughterhouse Cr 6/16/2011 **STATION NPS7**	Trap Rock River off Rimfetti Road 6/15/2011 **STATION NPS8**
ANNELIDA (segmented worms)				
Oligochaeta (worms)	3		1	1
ARTHROPODA				
Crustacea				
Isopoda (sowbugs)				1
Arachnoidea				
Hydracarina			3	2
Insecta				
Ephemeroptera (mayflies)				
Baetidae	15	3		44
Caenidae				2
Ephemerellidae	40	2	1	11
Heptageniidae	32			4
Odonata				
Anisoptera (dragonflies)				
Cordulegastridae	9		5	2
Gomphidae				2
Zygoptera (damselflies)				
Calopterygidae				26
Plecoptera (stoneflies)				
Perlidae	1			
Perlodidae	11		5	3
Hemiptera (true bugs)				
Corixidae				1
Gerridae	1		1	
Megaloptera				
Sialidae (alder flies)	7			
Trichoptera (caddisflies)				
Brachycentridae				1
Glossosomatidae	37			1
Hydropsychidae	11	8		9
Hydroptilidae	1	2		13
Lepidostomatidae	1		1	6
Leptoceridae	2	2		35
Limnephilidae	112		5	12
Molannidae	5			1
Philopotamidae	7		3	2
Coleoptera (beetles)				
Dytiscidae (total)			6	1
Haliplidae (adults)		1		1
Elmidae	5			8
Diptera (flies)				
Athericidae	4			5
Ceratopogonidae		1		1
Chironomidae	10	8	43	26
Simuliidae	15	1		7
Tabanidae	1		1	9
Tipulidae				1
MOLLUSCA				
Gastropoda (snails)				
Physidae	1			
TOTAL INDIVIDUALS	331	28	75	238

Table 2B. Macroinvertebrate metric evaluation for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Brodie Creek ORV Crossing East of Phoenix 6/15/2011 **STATION NPS5**		East Branch Eagle River South off U.S. 41 6/13/2011 **STATION NPS6**		Kearsarge Creek confl with Slaughterhouse Cr 6/16/2011 **STATION NPS7**		Trap Rock River off Rimfetti Road 6/15/2011 **STATION NPS8**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	0	9	0	12	1	30	1
NUMBER OF MAYFLY TAXA	3	0	2	0	1	1	4	0
NUMBER OF CADDISFLY TAXA	8	1	3	0	3	0	9	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	1	1	1	0
PERCENT MAYFLY COMP.	26.28	1	17.86	0	1.33	-1	25.63	1
PERCENT CADDISFLY COMP.	53.17	1	42.86	1	12.00	0	33.61	1
PERCENT DOMINANT TAXON	33.84	-1	28.57	-1	57.33	-1	18.49	0
PERCENT ISOPOD, SNAIL, LEECH	0.30	1	0.00	1	0.00	1	0.42	1
PERCENT SURF. AIR BREATHERS	0.30	1	3.57	1	9.33	0	1.26	1
TOTAL SCORE		5		1		2		6
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		EXCELLEN

Table 2A. Qualitative macroinvertebrate sampling results for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

TAXA	Owl Creek Loop Road 6/14/2011 **STATION NPS9**	Huron Creek d-s WalMart (Ming location) 6/17/2011 **STATION NPS 10**	Huron Creek Sharon Road 6/17/2011 **STATION NPS11**	Billy Butcher Creek County Road 553 6/20/2011 **STATION NPS12**
ANNELIDA (segmented worms)				
Hirudinea (leeches)				1
Oligochaeta (worms)	7		5	8
ARTHROPODA				
Crustacea				
Amphipoda (scuds)			1	42
Arachnoidea				
Hydracarina	4	4	4	7
Insecta				
Ephemeroptera (mayflies)				
Baetidae				15
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1		
Cordulegastridae			1	
Macromiidae		5	12	
Zygoptera (damselflies)				
Calopterygidae			3	
Coenagrionidae		2		
Plecoptera (stoneflies)				
Perlodidae	8			5
Hemiptera (true bugs)				
Corixidae			1	
Gerridae	2	6	4	1
Saldidae	1			
Veliidae		2	1	
Megaloptera				
Sialidae (alder flies)			7	9
Trichoptera (caddisflies)				
Hydropsychidae	3	1	1	
Lepidostomatidae	1			23
Leptoceridae				2
Limnephilidae	2			15
Philopotamidae	7			3
Polycentropodidae	3			
Coleoptera (beetles)				
Dytiscidae (total)	6	5		9
Gyrinidae (adults)	1			
Hydrophilidae (total)	1			1
Diptera (flies)				
Athericidae				2
Ceratopogonidae		5		
Chironomidae	75	63	44	91
Simuliidae	73	68	7	2
Tabanidae		4	5	1
Tipulidae	3	2	1	1
MOLLUSCA				
Gastropoda (snails)				
Lymnaeidae			1	
Physidae				7
TOTAL INDIVIDUALS	197	168	98	245

Table 2B. Macroinvertebrate metric evaluation for selected streams in the Keweenaw Peninsula watershed located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

	Owl Creek Loop Road 6/14/2011 **STATION NPS9**		Huron Creek d-s WalMart (Ming location) 6/17/2011 **STATION NPS10**		Huron Creek Sharon Road 6/17/2011 **STATION NPS11**		Billy Butcher Creek County Road 553 6/20/2011 **STATION NPS12**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	16	1	13	0	16	1	20	1
NUMBER OF MAYFLY TAXA	0	-1	0	-1	0	-1	1	0
NUMBER OF CADDISFLY TAXA	5	0	1	-1	1	-1	4	0
NUMBER OF STONEFLY TAXA	1	1	0	-1	0	-1	1	1
PERCENT MAYFLY COMP.	0.00	-1	0.00	-1	0.00	-1	6.12	0
PERCENT CADDISFLY COMP.	8.12	0	0.60	-1	1.02	-1	17.55	0
PERCENT DOMINANT TAXON	38.07	-1	40.48	-1	44.90	-1	37.14	-1
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	0.00	1	1.02	1	3.27	1
PERCENT SURF. AIR BREATHERS	5.58	0	7.74	0	6.12	0	4.49	1
TOTAL SCORE		0		-5		-4		3
MACROINV. COMMUNITY RATING		ACCEPT.		POOR		ACCEPT.		ACCEPT.

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonago Counties, June and August, 2011.

HABITAT METRIC	Elm River Misery Bay Road RIFFLE/RUN **STATION 1**	Trap Rock River Lincoln School Road RIFFLE/RUN **STATION 2**	South Branch Elm River Agate Beach Road RIFFLE/RUN **STATION 3**	East Branch Sleeping River Ford Crossing RIFFLE/RUN **STATION 4**	Tobacco River Gay Road RIFFLE/RUN **STATION 5**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	20	18	19	12	12
Embeddedness (20)*	12	19	18	17	20
Velocity/Depth Regime (20)*	14	17	8	14	14
Pool Substrate Characterization (20)**					
Pool Variability (20)**					
Channel Morphology					
Sediment Deposition (20)	7	19	17	13	20
Flow Status - Maint. Flow Volume (10)	7	10	4	6	10
Flow Status - Flashiness (10)	1	2	0	0	1
Channel Alteration (20)	20	18	18	20	20
Frequency of Riffles/Bends (20)*	20	17	17	15	16
Channel Sinuosity (20)**					
Riparian and Bank Structure					
Bank Stability (L) (10)	9	7	3	7	9
Bank Stability (R) (10)	9	9	6	9	9
Vegetative Protection (L) (10)	10	9	6	10	10
Vegetative Protection (R) (10)	10	9	6	10	10
Riparian Veg. Zone Width (L) (10)	10	6	10	10	9
Riparian Veg. Zone Width (R) (10)	10	9	10	10	8
TOTAL SCORE (200):	159	169	142	153	168
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-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:	6/18/2011	6/17/2011	6/18/2011	6/18/2011	6/16/2011
Weather:	Cloudy	Sunny	Cloudy	Cloudy	Cloudy
Air Temperature:	60 Deg. F.	65 Deg. F.	60 Deg. F.	65 Deg. F.	50 Deg. F.
Water Temperature:	54 Deg. F.	56 Deg. F.	57 Deg. F.	67 Deg. F.	62 Deg. F.
Ave. Stream Width:	20 Feet	70 Feet	20 Feet	30 Feet	50 Feet
Ave. Stream Depth:	0.5 Feet	1.25 Feet	0.33 Feet	2 Feet	0.75 Feet
Surface Velocity:	1.5 Ft./Sec.	1.5 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.	2 Ft./Sec.
Estimated Flow:	15 CFS	131.25 CFS	6.6 CFS	60 CFS	75 CFS
Stream Modifications:	None	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	310373	310510	310511	660113	420006
Stream Name:	Elm River	Trap Rock River	South Branch Elm River	East Branch Sleeping River	Tobacco River
Road Crossing/Location:	Misery Bay Road	Lincoln School Road	Agate Beach Road	Ford Crossing	Gay Road
County Code:	31	31	31	66	42
TRS:	53N36W10	56N32W10	54N36W29	53N38W25	56N30W20
Latitude (dd):	47.01106	47.2688	47.04041	46.96006	47.23129
Longitude (dd):	-88.85305	-88.36219	-88.90449	-89.065316	-88.14851
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4020103	4020103	4020103	4020103	4020103

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonago Counties, June and August, 2011.

HABITAT METRIC	Lost Creek off County Road 510 RIFFLE/RUN **STATION 6**	West Branch Huron River Letherby and Black Creek Road RIFFLE/RUN **STATION 7**	Yellow Dog River County Road 550 RIFFLE/RUN **STATION 8**	Upper Yellow Dog River AAA GLIDE/POOL **STATION 9**	Pages Creek Arvon Road RIFFLE/RUN **STATION 10**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	9	20	7	8	13
Embeddedness (20)*	6	16	11		16
Velocity/Depth Regime (20)*	16	16	15		13
Pool Substrate Characterization (20)**				7	
Pool Variability (20)**				11	
Channel Morphology					
Sediment Deposition (20)	2	18	2	13	12
Flow Status - Maint. Flow Volume (10)	4	9	10	10	5
Flow Status - Flashiness (10)	6	9	7	5	9
Channel Alteration (20)	20	20	18	15	16
Frequency of Riffles/Bends (20)*	10	20	9		17
Channel Sinuosity (20)**				6	
Riparian and Bank Structure					
Bank Stability (L) (10)	3	9	8	9	6
Bank Stability (R) (10)	3	9	6	9	6
Vegetative Protection (L) (10)	10	10	9	9	9
Vegetative Protection (R) (10)	10	10	9	9	9
Riparian Veg. Zone Width (L) (10)	10	10	9	9	10
Riparian Veg. Zone Width (R) (10)	10	10	7	10	10
TOTAL SCORE (200):	119	186	127	130	151
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 Ratin describes the general riverine environment at the site(s)

Date:	8/17/2011	8/15/2011	8/17/2011	6/20/2011	8/15/2011
Weather:	Sunny	Sunny	Sunny	Cloudy	Partly Cloudy
Air Temperature:	78 Deg. F.	72 Deg. F.	80 Deg. F.	55 Deg. F.	75 Deg. F.
Water Temperature:	64 Deg. F.	63 Deg. F.	67 Deg. F.	55 Deg. F.	70 Deg. F.
Ave. Stream Width:	6 Feet	20 Feet	35 Feet	20 Feet	6 Feet
Ave. Stream Depth:	0.25 Feet	0.5 Feet	0.5 Feet	2.5 Feet	0.3 Feet
Surface Velocity:	0.2 Ft./Sec.	1 Ft./Sec.	1.5 Ft./Sec.	0.75 Ft./Sec.	0.1 Ft./Sec.
Estimated Flow:	0.3 CFS	10 CFS	26.25 CFS	37.5 CFS	0.18 CFS
Stream Modifications:	None	None	Bank Stabilization		None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	520442	70110	520239	520317	70137
Stream Name:	Lost Creek	West Branch Huron River	Yellow Dog River	Upper Yellow Dog River	Pages Creek
Road Crossing/Location:	off County Road 510	Letherby Road and Black (	County Road 550	AAA	Arvon Road
County Code:	52	07	52	52	07
TRS:	50N28W01	51N30W22	50N27W03	50N24W13	51N31W32
Latitude (dd):	46.75407	46.80672	46.76522	46.73652	46.77416
Longitude (dd):	-87.7522	-88.08706	-87.66007	-87.86189	-88.26843
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4020105	4020105	4020105	4020105	4020105

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

HABITAT METRIC	Sidnaw Creek M28 GLIDE/POOL **STATION 11**	Tioga River two-track off Nestoria Road RIFFLE/RUN **STATION 12**
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	12	18
Embeddedness (20)*		19
Velocity/Depth Regime (20)*		10
Pool Substrate Characterization (20)**	18	
Pool Variability (20)**	18	
Channel Morphology		
Sediment Deposition (20)	9	19
Flow Status - Maint. Flow Volume (10)	9	10
Flow Status - Flashiness (10)	8	10
Channel Alteration (20)	20	20
Frequency of Riffles/Bends (20)*		20
Channel Sinuosity (20)**	17	
Riparian and Bank Structure		
Bank Stability (L) (10)	7	10
Bank Stability (R) (10)	7	10
Vegetative Protection (L) (10)	10	10
Vegetative Protection (R) (10)	10	10
Riparian Veg. Zone Width (L) (10)	9	10
Riparian Veg. Zone Width (R) (10)	9	10
TOTAL SCORE (200):	163	186
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	EXCELLENT (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:	8/14/2011	8/16/2011
Weather:	Sunny	Partly Cloudy
Air Temperature:	72 Deg. F.	73 Deg. F.
Water Temperature:	66 Deg. F.	68 Deg. F.
Ave. Stream Width:	12 Feet	8 Feet
Ave. Stream Depth:	1 Feet	0.3 Feet
Surface Velocity:	0.1 Ft./Sec.	1.5 Ft./Sec.
Estimated Flow:	1.2 CFS	3.6 CFS
Stream Modifications:	None	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	310512	70138
Stream Name:	Sidnaw Creek	Tioga River
Road Crossing/Location:	M28	two-track off Nestoria Road
County Code:	31	07
TRS:	47N36W01	47N32W02
Latitude (dd):	46.50637	46.49712
Longitude (dd):	-88.74166	-88.28169
Ecoregion:	NLAF	NLAF
Stream Type:	Coldwater	Warmwater
USGS Basin Code:	4020104	4020104

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonag Counties, June and August, 2011.

HABITAT METRIC	Montreal River Mandan Road GLIDE/POOL **STATION A**	East Branch Firesteel River M-26 GLIDE/POOL **STATION B**	Yellow Dog River County Road AAB GLIDE/POOL **STATION C**	Lost Creek off County Road 510 RIFFLE/RUN **STATION D**	West Branch Bear Creek unknown two-track RIFFLE/RUN **STATION E**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	9	13	10	16	19
Embeddedness (20)*				12	16
Velocity/Depth Regime (20)*				18	14
Pool Substrate Characterization (20)**	14	14	12		
Pool Variability (20)**	13	16	5		
Channel Morphology					
Sediment Deposition (20)	15	8	16	13	9
Flow Status - Maint. Flow Volume (10)	9	9	10	10	5
Flow Status - Flashiness (10)	8	0	10	9	1
Channel Alteration (20)	20	18	20	20	19
Frequency of Riffles/Bends (20)*				19	19
Channel Sinuosity (20)**	12	10	10		
Riparian and Bank Structure					
Bank Stability (L) (10)	10	10	10	10	5
Bank Stability (R) (10)	8	9	10	10	6
Vegetative Protection (L) (10)	10	10	10	10	5
Vegetative Protection (R) (10)	10	10	10	10	8
Riparian Veg. Zone Width (L) (10)	10	10	10	10	10
Riparian Veg. Zone Width (R) (10)	9	10	10	10	10
TOTAL SCORE (200):	157	147	153	177	146
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY 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:	6/13/2011	6/19/2011	8/17/2011	6/20/2011	6/17/2011
Weather:	Sunny	Rainy	Sunny	Partly Cloudy	Sunny
Air Temperature:	63 Deg. F.	35 Deg. F.	75 Deg. F.	60 Deg. F.	70 Deg. F.
Water Temperature:	56 Deg. F.	57 Deg. F.	69 Deg. F.	Deg. F.	64 Deg. F.
Ave. Stream Width:	22 Feet	40 Feet	20 Feet	4 Feet	20 Feet
Ave. Stream Depth:	2.5 Feet	2 Feet	1.5 Feet	0.75 Feet	0.67 Feet
Surface Velocity:	0.5 Ft./Sec.	0.5 Ft./Sec.	0.3 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	27.5 CFS	40 CFS	9 CFS	3 CFS	13.4 CFS
Stream Modifications:	None	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	420140	660008	520510	520442	310434
Stream Name:	Montreal River	East Branch Firesteel River	Yellow Dog River	Lost Creek	West Branch Bear Creek
Road Crossing/Location:	Mandan Road, 4.9 miles fr	M-26	County Road AAB, upstre	off County Road 510	unknown two-track
County Code:	42	66	52	52	31
TRS:	58N29W14	51N37W21	50N28W18	50N28W01	52N35W21
Latitude (dd):	47.4215	46.79693	46.72331	46.75407	46.89147
Longitude (dd):	-87.949	-89.01805	-87.86247	-87.7522	-88.75407
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4020103	4020103	4020105	4020105	4020104

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonag Counties, June and August, 2011.

HABITAT METRIC	Otter River Johnson & Cabbage Roads GLIDE/POOL **STATION F**	Sturgeon River upstream Sidnaw at FF 2200 RIFFLE/RUN **STATION G**
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	7	18
Embeddedness (20)*		18
Velocity/Depth Regime (20)*		12
Pool Substrate Characterization (20)**	10	
Pool Variability (20)**	6	
Channel Morphology		
Sediment Deposition (20)	5	17
Flow Status - Maint. Flow Volume (10)	10	9
Flow Status - Flashiness (10)	6	2
Channel Alteration (20)	20	19
Frequency of Riffles/Bends (20)*		17
Channel Sinuosity (20)**	18	
Riparian and Bank Structure		
Bank Stability (L) (10)	6	9
Bank Stability (R) (10)	6	7
Vegetative Protection (L) (10)	9	9
Vegetative Protection (R) (10)	9	9
Riparian Veg. Zone Width (L) (10)	10	10
Riparian Veg. Zone Width (R) (10)	10	10
TOTAL SCORE (200):	132	166
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-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:	8/15/2011	6/19/2011
Weather:	Sunny	Rainy
Air Temperature:	62 Deg. F.	60 Deg. F.
Water Temperature:	Deg. F.	61 Deg. F.
Ave. Stream Width:	66 Feet	65 Feet
Ave. Stream Depth:	1.3 Feet	Feet
Surface Velocity:	1.5 Ft./Sec.	2 Ft./Sec.
Estimated Flow:	128.7 CFS	CFS
Stream Modifications:	None	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	310432	70109
Stream Name:	Otter River	Sturgeon River
Road Crossing/Location:	Johnson & Cabbage Roads	upstream Sidnaw at FF 2200
County Code:	31	07
TRS:	52N34W34	48N35W10
Latitude (dd):	46.866	46.57384
Longitude (dd):	-88.615	-88.66375
Ecoregion:	NLAF	NLAF
Stream Type:	Coldwater	Coldwater
USGS Basin Code:	4020104	4020104

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonagor Counties, June and August, 2011.

HABITAT METRIC	**STATION NPS 1** East Branch Eagle River u-s Gratiot Lake Road RIFFLE/RUN	**STATION NPS 2** East Branch Eagle River d-s end on Central Mine 3 GLIDE/POOL	**STATION NPS 3** West Branch Eagle River off Cliff Road GLIDE/POOL	**STATION NPS 4** Buffalo Creek u-s snowmobile bridge, u-s old railroad RIFFLE/RUN	**STATION NPS 5** Brodie Creek ORV Crossing East of Phoenix RIFFLE/RUN
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	12	12	8	20	20
Embeddedness (20)*	18			19	20
Velocity/Depth Regime (20)*	9			16	10
Pool Substrate Characterization (20)**		11	10		
Pool Variability (20)**		13	4		
Channel Morphology					
Sediment Deposition (20)	18	14	8	19	18
Flow Status - Maint. Flow Volume (10)	9	10	8	9	7
Flow Status - Flashiness (10)	9	8	8	4	2
Channel Alteration (20)	8	18	20	20	20
Frequency of Riffles/Bends (20)*	12			16	20
Channel Sinuosity (20)**		10	16		
Riparian and Bank Structure					
Bank Stability (L) (10)	9	4	10	7	7
Bank Stability (R) (10)	10	10	10	9	8
Vegetative Protection (L) (10)	4	3	10	10	10
Vegetative Protection (R) (10)	4	10	10	10	10
Riparian Veg. Zone Width (L) (10)	3	2	10	9	10
Riparian Veg. Zone Width (R) (10)	3	4	10	10	10
TOTAL SCORE (200):	128	129	142	178	172
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)

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:	6/13/2011		6/14/2011		6/15/2011		6/13/2011		6/15/2011	
Weather:	Sunny		Sunny		Sunny		Sunny		Partly Cloudy	
Air Temperature:	70	Deg. F.	70	Deg. F.	70	Deg. F.	70	Deg. F.	60	Deg. F.
Water Temperature:	66	Deg. F.	61	Deg. F.	56	Deg. F.	70	Deg. F.	55	Deg. F.
Ave. Stream Width:	10	Feet	22	Feet	6.5	Feet	10	Feet	10	Feet
Ave. Stream Depth:	0.75	Feet	3	Feet	0.67	Feet	1	Feet	0.25	Feet
Surface Velocity:	0.75	Ft./Sec.	0.25	Ft./Sec.	0.25	Ft./Sec.	1.25	Ft./Sec.	1.5	Ft./Sec.
Estimated Flow:	5.625	CFS	16.5	CFS	1.08875	CFS	12.5	CFS	3.75	CFS
Stream Modifications:	Canopy Removal		Canopy Removal		None		None		None	
Nuisance Plants (Y/N):	N		N		N		N		N	
Report Number:										
STORET No.:	420136		420207		420201		420131		420173	
Stream Name:	t Branch Eagle River		East Branch Eagle River		West Branch Eagle River		Buffalo Creek		Brodie Creek	
Road Crossing/Location:	eam Gratiot Lake Rd		downstream end on Central Mine 3		off Cliff Road		pstream snowmobile bridge, upstream old railroad		ORV Crossing East of Phoenix	
County Code:	42		42		42		42		42	
TRS:	59N31W31		58N31W23		57N32W2		58N31W23		58N31W31	
Latitude (dd):	47.4032		47.4034		47.36687		47.4006		47.38141	
Longitude (dd):	-88.1981		-88.2241		-88.32181		-88.2129		-88.28236	
Ecoregion:	NLAF		NLAF		NLAF		NLAF		NLAF	
Stream Type:	Coldwater		Warmwater		Coldwater		Coldwater		Coldwater	
USGS Basin Code:	4020103		4020103		4020103		4020103		4020103	

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonagon Counties, June and August, 2011.

HABITAT METRIC	**STATION NPS 6** E B Eagle River-Site F South off U.S. 41 GLIDE/POOL	**STATION NPS 7** Kearsarge Creek confluence with Slaughterhouse Cr GLIDE/POOL	**STATION NPS 8** Trap Rock River off Rimfetti Road RIFFLE/RUN	**STATION NPS 9** Owl Creek Loop Road RIFFLE/RUN	**STATION NPS 10** Huron Creek d-s WalMart (Ming location) RIFFLE/RUN
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	16	8	14	18	17
Embeddedness (20)*			16	20	14
Velocity/Depth Regime (20)*			18	10	9
Pool Substrate Characterization (20)**	17	8			
Pool Variability (20)**	10	8			
Channel Morphology					
Sediment Deposition (20)	14	10	11	20	16
Flow Status - Maint. Flow Volume (10)	10	9	9	8	9
Flow Status - Flashiness (10)	10	2	1	8	2
Channel Alteration (20)	19	19	19	20	8
Frequency of Riffles/Bends (20)*			11	19	19
Channel Sinuosity (20)**	12	10			
Riparian and Bank Structure					
Bank Stability (L) (10)	8	2	2	10	9
Bank Stability (R) (10)	9	3	1	10	9
Vegetative Protection (L) (10)	5	5	9	9	10
Vegetative Protection (R) (10)	10	4	9	9	10
Riparian Veg. Zone Width (L) (10)	2	4	9	10	4
Riparian Veg. Zone Width (R) (10)	10	7	10	10	5
TOTAL SCORE (200):	152	99	139	181	141
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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

Date:	6/13/2011		6/16/2011		6/15/2011		6/14/2011		6/17/2011	
Weather:	Sunny		Cloudy		Sunny		Sunny		Sunny	
Air Temperature:	70	Deg. F.	65	Deg. F.	70	Deg. F.	60	Deg. F.	70	Deg. F.
Water Temperature:	73	Deg. F.	54	Deg. F.	62	Deg. F.	49	Deg. F.	69	Deg. F.
Ave. Stream Width:	8	Feet	2.5	Feet	40	Feet	2	Feet	10	Feet
Ave. Stream Depth:	1	Feet	0.5	Feet	2	Feet	0.25	Feet	0.25	Feet
Surface Velocity:	1	Ft./Sec.	0.75	Ft./Sec.	0.75	Ft./Sec.	1.5	Ft./Sec.	1	Ft./Sec.
Estimated Flow:	8	CFS	0.9375	CFS	60	CFS	0.75	CFS	2.5	CFS
Stream Modifications:	Canopy Removal		Canopy Removal		None		None		Canopy Removal	
Nuisance Plants (Y/N):	N		N		N		N		N	
Report Number:										
STORET No.:	420168		310354		310415		420164		310410	
Stream Name:	e River-Site F (aka Central Cr		Kearsarge Creek		Trap Rock River		Owl Creek		Huron Creek	
Road Crossing/Location:	South off U.S. 41		fluence of Kearsarge and Slaughterhouse C		off Rimfetti Road		Loop Road		Downstream WalMart (Ming location	
County Code:	42		31		31		42		31	
TRS:	58N31W23		56N32W05		56N32W32		58N31W14		54N34W2	
Latitude (dd):	47.4028		47.27438		42.20708		47.4298		47.10659	
Longitude (dd):	-88.2105		-88.39074		-88.39062		-88.196		-88.5871	
Ecoregion:	NLAF		NLAF		NLAF		NLAF		NLAF	
Stream Type:	Warmwater		Coldwater		S		Coldwater		Warmwater	
USGS Basin Code:	4020103		4020103		4020103		4020103		4020103	

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

COMMENTS:

Table 3. Habitat evaluation for selected streams located within the Keweenaw Peninsula watershed, located in Baraga, Houghton, Keweenaw, Marquette and Ontonag
Counties, June and August, 2011.

HABITAT METRIC	**STATION NPS 11** Huron Creek Sharon Road RIFFLE/RUN	**STATION NPS 12** Billy Butcher Creek County Road 553 RIFFLE/RUN
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	16	10
Embeddedness (20)*	17	4
Velocity/Depth Regime (20)*	14	9
Pool Substrate Characterization (20)**		
Pool Variability (20)**		
Channel Morphology		
Sediment Deposition (20)	16	13
Flow Status - Maint. Flow Volume (10)	9	10
Flow Status - Flashiness (10)	1	8
Channel Alteration (20)	7	20
Frequency of Riffles/Bends (20)*	8	8
Channel Sinuosity (20)**		
Riparian and Bank Structure		
Bank Stability (L) (10)	8	10
Bank Stability (R) (10)	9	10
Vegetative Protection (L) (10)	3	10
Vegetative Protection (R) (10)	7	10
Riparian Veg. Zone Width (L) (10)	0	10
Riparian Veg. Zone Width (R) (10)	5	6
TOTAL SCORE (200):	120	138
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

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:	6/17/2011		6/20/2011	
Weather:	Sunny		Sunny	
Air Temperature:	70	Deg. F.	65	Deg. F.
Water Temperature:	59	Deg. F.	52	Deg. F.
Ave. Stream Width:	2	Feet	4	Feet
Ave. Stream Depth:	0.75	Feet	0.33	Feet
Surface Velocity:	1	Ft./Sec.	1	Ft./Sec.
Estimated Flow:	1.5	CFS	1.32	CFS
Stream Modifications:	Canopy Removal		None	
Nuisance Plants (Y/N):	N		N	
Report Number:				
STORET No.:	310411		520509	
Stream Name:	Huron Creek		Billy Butcher Creek	
Road Crossing/Location:	Sharon Road		County Road 553	
County Code:	31		52	
TRS:	55N34W35		48N25W26	
Latitude (dd):	47.11232		46.52571	
Longitude (dd):	-88.58774		-87.40438	
Ecoregion:	NLAF		NLAF	
Stream Type:	Warmwater		Coldwater	
USGS Basin Code:	4020103		4020105	

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

COMMENTS:

Table 4. Water chemistry results for 25 stream sites impacted by Copper in Keweenaw, Houghton County and Ontonagon Counties from June through September 2011.

AUID #	Waterbody	Location	Latitude	Longitude	County	Storet	Date	Hardness (mg/L)	DOC (mg/L)	TOC (mg/L)	Copper (µg/L)
040201030303-03	Slaughterhouse Creek	Calumet Lake Outlet	47.25950	-88.43680	Houghton	310463	6/21/2011	94.8	9.7	11	23.4
040201030303-03	Slaughterhouse Creek	Calumet Lake Outlet	47.25950	-88.43680	Houghton	310463	7/22/2011	118	13.7	15.4	19
040201030303-03	Slaughterhouse Creek	Calumet Lake Outlet	47.25950	-88.43680	Houghton	310463	8/16/2011	108	15.5	17.2	4.8
040201030303-03	Slaughterhouse Creek	Calumet Lake Outlet	47.25950	-88.43680	Houghton	310463	9/19/2011	106	11.8	48.3	76.9
040201030303-11	Slaugtherhouse Creek	upstream of Fulton Creek	47.28230	-88.39450	Houghton	310464	6/21/2011	65.5	7.1	8.2	14.3
040201030303-11	Slaugtherhouse Creek	upstream of Fulton Creek	47.28230	-88.39450	Houghton	310464	7/22/2011	74.2	6.2	6.9	17.8
040201030303-11	Slaugtherhouse Creek	upstream of Fulton Creek	47.28230	-88.39450	Houghton	310464	8/16/2011	31.5	3.8	4.1	22
040201030303-11	Slaugtherhouse Creek	upstream of Fulton Creek	47.28230	-88.39450	Houghton	310464	9/19/2011	26.4	3.3	3.4	27.1
040201030303-08	Slaughterhouse Creek	below Queen Ann Falls	47.27470	-88.39070	Houghton	310466	6/21/2011	64.2	7.5	8.8	12.1
040201030303-08	Slaughterhouse Creek	below Queen Ann Falls	47.27470	-88.39070	Houghton	310466	7/22/2011	91.6	6.9	7.3	9.8
040201030303-08	Slaughterhouse Creek	below Queen Ann Falls	47.27470	-88.39070	Houghton	310466	8/16/2011	60.3	5.5	5.9	9.9
040201030303-08	Slaughterhouse Creek	below Queen Ann Falls	47.27470	-88.39070	Houghton	310466	9/19/2011	52.7	5.2	5.6	9.2
040201030303-08	Kearsarge Creek	u/s Slaughterhouse Creek	47.27500	-88.39100	Houghton	310354	6/21/2011	66.3	5	6.2	64.4
040201030303-08	Kearsarge Creek	u/s Slaughterhouse Creek	47.27500	-88.39100	Houghton	310354	7/22/2011	91.8	4.4	4.7	45
040201030303-08	Kearsarge Creek	u/s Slaughterhouse Creek	47.27500	-88.39100	Houghton	310354	8/16/2011	94.5	3.8	4.2	24
040201030303-08	Kearsarge Creek	u/s Slaughterhouse Creek	47.27500	-88.39100	Houghton	310354	9/19/2011	88.6	4.2	4.6	40.5
040201030303-12	Scales Creek	u/s Slaughterhouse Creek	47.27170	-88.39050	Houghton	310467	6/21/2011	51.4	12	14	<1.1
040201030303-12	Scales Creek	u/s Slaughterhouse Creek	47.27170	-88.39050	Houghton	310467	7/22/2011	95	7.4	8	4
040201030303-12	Scales Creek	u/s Slaughterhouse Creek	47.27170	-88.39050	Houghton	310467	8/16/2011	100	3.8	4.1	3.4
040201030303-12	Scales Creek	u/s Slaughterhouse Creek	47.27170	-88.39050	Houghton	310467	9/19/2011	86.4	3.3	3.6	2.3
040201030303-08	Scales Creek	u/s Valley Road crossing	47.26720	-88.36980	Houghton	310338	6/21/2011	56.4	9.2	9.1	21.7
040201030303-08	Scales Creek	u/s Valley Road crossing	47.26720	-88.36980	Houghton	310338	7/22/2011	79.7	6.3	5.9	20.3
040201030303-08	Scales Creek	u/s Valley Road crossing	47.26720	-88.36980	Houghton	310338	8/16/2011	70.1	4.2	4.7	15.6
040201030303-08	Scales Creek	u/s Valley Road crossing	47.26720	-88.36980	Houghton	310338	9/19/2011	67.6	4	4.3	15.3
040201030303-05	Trap Rock River	Valley Road crossing (W)	47.24990	-88.37120	Houghton	310341	6/21/2011	48	10	11	16
040201030303-05	Trap Rock River	Valley Road crossing (W)	47.24990	-88.37120	Houghton	310341	7/22/2011	74.6	6.2	6.7	14.4
040201030303-05	Trap Rock River	Valley Road crossing (W)	47.24990	-88.37120	Houghton	310341	7/22/2011	76.3	6.1	6.9	14.2

Table 4. Water chemistry results for 25 stream sites impacted by Copper in Keweenaw, Houghton County and Ontonagon Counties from June through September 2011.

AUID #	Waterbody	Location	Latitude	Longitude	County	Storet	Date	Hardness (mg/L)	DOC (mg/L)	TOC (mg/L)	Copper (µg/L)
040201030303-05	Trap Rock River	Valley Road crossing (W)	47.24990	-88.37120	Houghton	310341	8/16/2011	67.9	3.9	4.4	11.4
040201030303-05	Trap Rock River	Valley Road crossing (W)	47.24990	-88.37120	Houghton	310341	9/19/2011	64.6	3.1	3.4	9.4
040201030303-05	Trap Rock River	Angman Road	47.23000	-88.38276	Houghton	310382	6/21/2011	49	9.7	10	16.5
040201030303-05	Trap Rock River	Angman Road	47.23000	-88.38276	Houghton	310382	7/22/2011	46.6	5.1	5.3	12.6
040201030303-05	Trap Rock River	Angman Road	47.23000	-88.38276	Houghton	310382	8/16/2011	73	3.4	3.7	9.9
040201030303-05	Trap Rock River	Angman Road	47.23000	-88.38276	Houghton	310382	9/19/2011	67.3	2.8	3	7.9
040201030303-05	Trap Rock River	Angman Road	47.23000	-88.38276	Houghton	310382	9/19/2011	68	2.9	3.2	8.1
040201030303-05	Trap Rock River	Rimfetti	47.20708	-88.39062	Houghton	310415	6/21/2011	47.1	10	11	21.2
040201030303-05	Trap Rock River	Rimfetti	47.20708	-88.39062	Houghton	310415	7/22/2011	76.7	5	5.2	15.3
040201030303-05	Trap Rock River	Rimfetti	47.20708	-88.39062	Houghton	310415	8/16/2011	65.9	3.4	3.7	11.8
040201030303-05	Trap Rock River	Rimfetti	47.20708	-88.39062	Houghton	310415	9/19/2011	67.7	2.9	3.2	11.5
040201030405-06	Owl Creek	Copper Falls-(W)	47.42980	-88.19600	Keweenaw	420164	6/20/2011	71.8	4.2	4.4	28.2
040201030405-06	Owl Creek	Copper Falls-(W)	47.42980	-88.19600	Keweenaw	420164	7/20/2011	61.6	4.4	4.1	19.2
040201030405-06	Owl Creek	Copper Falls-(W)	47.42980	-88.19600	Keweenaw	420164	8/15/2011	88.2	4	3.7	12.7
040201030405-06	Owl Creek	Copper Falls-(W)	47.42980	-88.19600	Keweenaw	420164	8/15/2011	92.5	4	3.7	12.8
040201030405-06	Owl Creek	Copper Falls-(W)	47.42980	-88.19600	Keweenaw	420164	9/14/2011	65.9	4.6	4.2	21.4
040201030405-06	Owl Creek	u/s Stamp sands	47.43780	-88.19670	Keweenaw	420143	6/20/2011	49.6	9.9	11	106
040201030405-06	Owl Creek	u/s Stamp sands	47.43780	-88.19670	Keweenaw	420143	6/20/2011	49.6	11	11	105
040201030405-06	Owl Creek	u/s Stamp sands	47.43780	-88.19670	Keweenaw	420143	7/20/2011	49.6	11	11	135
040201030405-06	Owl Creek	u/s Stamp sands	47.43780	-88.19670	Keweenaw	420143	8/15/2011	73.9	8.6	8.5	76.4
040201030405-06	Owl Creek	u/s Stamp sands	47.43780	-88.19670	Keweenaw	420143	9/14/2011	51.6	8.4	7.7	73.3
040201030405-06	Owl Creek	stamp sands	47.43870	-88.19940	Keweenaw	420137	6/20/2011	58.4	9.4	10	115
040201030405-06	Owl Creek	stamp sands	47.43870	-88.19940	Keweenaw	420137	7/20/2011	59.8	10	10	140
040201030405-06	Owl Creek	stamp sands	47.43870	-88.19940	Keweenaw	420137	8/15/2011	90.7	7.4	7.4	92.9
040201030405-06	Owl Creek	stamp sands	47.43870	-88.19940	Keweenaw	420137	9/14/2011	71.2	6.8	6.5	80
040201030405-06	Owl Creek	stamp sands	47.43870	-88.19940	Keweenaw	420137	9/14/2011	92.3	7	6.5	80.8
040201030107-02	East Branch Sleeping River	above Red Creek	46.86710	-88.93000	Ontonogan	310407	6/22/2011	61.3	6.5	7.2	2.6
040201030107-02	East Branch Sleeping River	above Red Creek	46.86710	-88.93000	Ontonogan	310407	7/29/2011	71.3	3.8	4.2	0.87
040201030107-02	East Branch Sleeping River	above Red Creek	46.86710	-88.93000	Ontonogan	310407	8/16/2011	68.8	3.5	3.9	8.9
040201030107-02	East Branch Sleeping River	above Red Creek	46.86710	-88.93000	Ontonogan	310407	9/19/2011	65.2	3.3	3.7	0.98
040201030107-03	Sleepy Creek	below Red Creek	46.88050	-88.94360	Ontonogan	660126	6/22/2011	56.2	11	11	175
040201030107-03	Sleepy Creek	below Red Creek	46.88050	-88.94360	Ontonogan	660126	7/29/2011	83.7	3.6	3.5	11.4
040201030107-03	Sleepy Creek	below Red Creek	46.88050	-88.94360	Ontonogan	660126	8/16/2011	87.6	3.2	3.5	8.6
040201030107-03	Sleepy Creek	below Red Creek	46.88050	-88.94360	Ontonogan	660126	9/19/2011	68.9	3.7	4.2	47
040201030107-01	East Branch Sleeping River	Snowmobile Trail	46.96000	-89.06530	Ontonogan	660113	6/22/2011	77.1	8.4	8.9	15.2

Table 4. Water chemistry results for 25 stream sites impacted by Copper in Keweenaw, Houghton County and Ontonagon Counties from June through September 2011.

AUID #	Waterbody	Location	Latitude	Longitude	County	Storet	Date	Hardness (mg/L)	DOC (mg/L)	TOC (mg/L)	Copper (µg/L)
040201030107-01	East Branch Sleeping River	Snowmobile Trail	46.96000	-89.06530	Ontonogan	660113	7/29/2011	88.8	6.5	6.8	13.6
040201030107-01	East Branch Sleeping River	Snowmobile Trail	46.96000	-89.06530	Ontonogan	660113	8/17/2011	95.4	5.6	5.3	10.6
040201030107-01	East Branch Sleeping River	Snowmobile Trail	46.96000	-89.06530	Ontonogan	660113	8/17/2011	95.9	5.6	5.4	10.3
040201030107-01	East Branch Sleeping River	Snowmobile Trail	46.96000	-89.06530	Ontonogan	660113	9/27/2011	85.9	6.2	6.1	11.9
040201030307-10	Huron Creek	Ming Garden	47.10650	-88.58710	Houghton	310513	6/21/2011	75.1	10	11	9.5
040201030307-10	Huron Creek	Ming Garden	47.10650	-88.58710	Houghton	310513	7/20/2011	96.3	12	12	14.7
040201030307-10	Huron Creek	Ming Garden	47.10650	-88.58710	Houghton	310513	8/15/2011	167	9.2	9.4	7.6
040201030307-10	Huron Creek	Ming Garden	47.10650	-88.58710	Houghton	310513	9/14/2011	189	7.5	7.8	17.3
040201030307-10	Huron Creek	Sharon Road	47.11230	-88.58770	Houghton	310411	6/21/2011	81.5	9.4	9.9	26.6
040201030307-10	Huron Creek	Sharon Road	47.11230	-88.58770	Houghton	310411	7/20/2011	89.3	7.9	7.5	35.9
040201030307-10	Huron Creek	Sharon Road	47.11230	-88.58770	Houghton	310411	8/15/2011	311	4.9	5.2	69.3
040201030307-10	Huron Creek	Sharon Road	47.11230	-88.58770	Houghton	310411	9/14/2011	243	5.7	5.4	33.6
040201010107-02	Portal Creek	Upper road crossing near tailings basin	46.78146	-89.55910	Ontonogan	660162	6/22/2011	120	13	14	55.1
040201010107-02	Portal Creek	Upper road crossing near tailings basin	46.78146	-89.55910	Ontonogan	660162	7/29/2011	241	14.6	16.1	6.3
040201010107-02	Portal Creek	Upper road crossing near tailings basin	46.78146	-89.55910	Ontonogan	660162	8/17/2011	208	15	15.2	29.6
040201010107-02	Portal Creek	Upper road crossing near tailings basin	46.78146	-89.55910	Ontonogan	660162	9/27/2011	250	13.1	13.9	19.1
040201010107-02	Portal Creek	CC1 (confluence with Mineral River)	46.7951	-89.5597	Ontonogan	660107	6/22/2011	124	12	13	33.4
040201010107-02	Portal Creek	CC1 (confluence with Mineral River)	46.7951	-89.5597	Ontonogan	660107	6/22/2011	117	12	13	35.3
040201010107-02	Portal Creek	CC1 (confluence with Mineral River)	46.7951	-89.5597	Ontonogan	660107	7/29/2011	166	15.4	16.7	19.7
040201010107-02	Portal Creek	CC1 (confluence with Mineral River)	46.7951	-89.5597	Ontonogan	660107	8/17/2011	418	11.7	191	11.7
040201010107-02	Portal Creek	CC1 (confluence with Mineral River)	46.7951	-89.5597	Ontonogan	660107	9/27/2011	137	9.6	15.8	32.6
040201010108-NA	Pine Creek	LP Walsh Road	46.73678	-89.51472	Ontonogan	660163	6/22/2011	43.7	11	12	10.4
040201010108-NA	Pine Creek	LP Walsh Road	46.73678	-89.51472	Ontonogan	660163	7/29/2011	156	10.5	10.9	2.9
040201010108-NA	Pine Creek	LP Walsh Road	46.73678	-89.51472	Ontonogan	660163	8/17/2011	217	10.1	12	1.4
040201010108-NA	Pine Creek	LP Walsh Road	46.73678	-89.51472	Ontonogan	660163	9/27/2011	117	9.4	9.5	9.1
040201010109-NA	Duck Creek	Logging Road Crossing	46.82770	-89.46940	Ontonogan	660164	6/22/2011	41.8	11	12	7.5
040201010109-NA	Duck Creek	Logging Road Crossing	46.82770	-89.46940	Ontonogan	660164	7/29/2011	59.1	8.7	8.9	3.3

Table 4. Water chemistry results for 25 stream sites impacted by Copper in Keweenaw, Houghton County and Ontonagon Counties from June through September 2011.

AUID #	Waterbody	Location	Latitude	Longitude	County	Storet	Date	Hardness (mg/L)	DOC (mg/L)	TOC (mg/L)	Copper (µg/L)
040201010109-NA	Duck Creek	Logging Road Crossing	46.82770	-89.46940	Ontonogan	660164	8/17/2011	60.4	8.4	8.5	3.1
040201010109-NA	Duck Creek	Logging Road Crossing	46.82770	-89.46940	Ontonogan	660164	9/27/2011	30.5	12.9	13	4
040201030404-01	Eagle River, East Branch	u/s of Central #1 (SS6)	47.40270	-88.19480	Keweenaw	420114	6/20/2011	36.9	18	19	7.2
040201030404-01	Eagle River, East Branch	u/s of Central #1 (SS6)	47.40270	-88.19480	Keweenaw	420114	7/20/2011	45.7	20.6	25.2	2.8*
040201030404-01	Eagle River, East Branch	u/s of Central #1 (SS6)	47.40270	-88.19480	Keweenaw	420114	8/15/2011	56.2	16	16.6	1.2
040201030404-01	Eagle River, East Branch	u/s of Central #1 (SS6)	47.40270	-88.19480	Keweenaw	420114	9/14/2011	57.3	13.1	13.8	1.1
040201030404-01	Eagle River, East Branch	Gratiot Lake Road (ER-C)	47.40306	-88.19861	Keweenaw	420182	6/20/2011	56.9	13	14	12.1
040201030404-01	Eagle River, East Branch	Gratiot Lake Road (ER-C)	47.40306	-88.19861	Keweenaw	420182	7/20/2011	75.6	15	16	16.7
040201030404-01	Eagle River, East Branch	Gratiot Lake Road (ER-C)	47.40306	-88.19861	Keweenaw	420182	7/20/2011	65.5	16	16	17.8
040201030404-01	Eagle River, East Branch	Gratiot Lake Road (ER-C)	47.40306	-88.19861	Keweenaw	420182	8/15/2011	100	10.8	11.4	22.2
040201030404-01	Eagle River, East Branch	Gratiot Lake Road (ER-C)	47.40306	-88.19861	Keweenaw	420182	9/14/2011	96.6	10.1	9.2	18.9
040201030404-01	Eagle River, East Branch	Site F(ER-F) (SS 4)	47.40280	-88.21080	Keweenaw	420168	6/20/2011	56.5	13	14	60.5
040201030404-01	Eagle River, East Branch	Site F(ER-F) (SS 4)	47.40280	-88.21080	Keweenaw	420168	7/20/2011	77.5	13	13	101
040201030404-01	Eagle River, East Branch	Site F(ER-F) (SS 4)	47.40280	-88.21080	Keweenaw	420168	8/15/2011	105	8.5	8.8	70.2
040201030404-01	Eagle River, East Branch	Site F(ER-F) (SS 4)	47.40280	-88.21080	Keweenaw	420168	8/15/2011	109	8.9	9.2	87.1
040201030404-01	Eagle River, East Branch	Site F(ER-F) (SS 4)	47.40280	-88.21080	Keweenaw	420168	9/14/2011	101	8.7	8.9	79.9
040201030404-02	Buffalo Cr.	Snowmobile Trail	47.40060	-88.21290	Keweenaw	420131	6/20/2011	37	12	12	1.9*
040201030404-02	Buffalo Cr.	Snowmobile Trail	47.40060	-88.21290	Keweenaw	420131	7/20/2011	49.5	12	12	<1.1
040201030404-02	Buffalo Cr.	Snowmobile Trail	47.40060	-88.21290	Keweenaw	420131	8/15/2011	70.3	7.4	7.6	1.1
040201030404-02	Buffalo Cr.	Snowmobile Trail	47.40060	-88.21290	Keweenaw	420131	9/14/2011	50.4	6.7	6.8	1

Table 5. Water Chemistry results for Rice Lake, Houghton County, June 2011.

					Rice Lake Sample Locations			
Parameter	Unit	Reporting Limit	MDL	MQL	W-NW	W-SW	NE Culvert	Center of Lake
KN TP - Digestion		--------	--------	--------	Completed	Completed	Completed	Completed
Total Phosphorus	mg P/L	0.005	--------	--------	0.049	0.032	0.100	0.022
Ammonia	mg N/L	0.010	--------	--------	0.039	0.037	0.032	0.028
Nitrate + Nitrite	mg N/L	0.010	--------	--------	0.020	0.010	ND	ND
Chlorophyll a	mg/m3	--------	1.000	1.000				ND

ND=Non Detect MDL=Method Detection Limit MQL=Method Quanititation Limit

Table 6. 2001 Lake profile results for Rice Lake, Houghton County.

Date	Depth feet	D.O. mg/L	pH	Specific Conductivity uS/cm	Temperature oC	Secchi / Total Depth feet
30-Apr-01						
	2	10.2	6.78	37	13.0	5.5/9
	3	10.3	6.79	37	13.0	
	4	10.3	6.76	38	13.0	
	5	10.3	6.78	38	13.0	
	6	10.3	6.80	38	13.0	
	7	10.3	6.82	38	13.0	
	8	10.3	6.82	38	13.0	
8-Aug-01						
	2	7.4	7.37	38	27.3	9/9
	3	7.4	7.38	39	27.3	
	4	7.4	7.36	39	27.3	
	5	7.5	7.36	39	27.0	
	6	7.8	7.39	38	25.7	
	7	8.1	7.28	38	23.6	
	8	7.2	6.97	39	22.9	