UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

SEP 2 3 2019

Teresa Seidel, Director
Water Resources Division
Michigan Department of Environment, Great Lakes, and Energy
525 W Allegan St.
P.O. Box 30028
Lansing, MI 48909-7528

Dear Ms. Seidel:

Thank you for your September 16, 2019 request to remove the "Degradation of Fish and Wildlife Populations" and "Loss of Fish and Wildlife Habitat" Beneficial Use Impairments (BUIs) from the United States side of the St. Marys River Area of Concern (AOC). As you know, we share your desire to restore all the Great Lakes AOCs and to formally delist them.

Based upon a review of your submittal and the supporting data, the U.S. Environmental Protection Agency (EPA) approves your request to remove these BUIs from the St. Marys River AOC. EPA will notify the International Joint Commission (IJC) of this significant positive environmental change at this AOC.

We congratulate you and your staff as well as the many federal, state and local partners who have been instrumental in achieving this environmental improvement. Removal of these BUIs will benefit not only the people who live and work in the St. Marys River AOC, but all residents of Michigan and the Great Lakes Basin as well.

We look forward to the continuation of this important and productive relationship with your agency and the St. Marys River Binational Public Advisory Council as we work together to delist this AOC in the years to come. If you have any further questions, please contact me at (312) 353-8320 or your staff can contact Leah Medley at (312) 886-1307.

Sincerely,

Chris Korleski, Director
Great Lakes National Program Office

Printed on Recycled Paper

cc: Richard Hobrla, EGLE
John Riley, EGLE
Mike Ripley, St. Marys River BPAC
Raj Bejankiwar, IJC

GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
LANSING

LIESL EICHLER CLARK
DIRECTOR

September 16, 2019

VIA E-MAIL

Mr. Chris Korleski, Director
Great Lakes National Program Office
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (G-9J)
Chicago, Illinois 60604-3507

Dear Mr. Korleski:

I am writing to request the United States Environmental Protection Agency (USEPA), Great Lakes National Program Office's (GLNPO) concurrence with the removal of the Loss of Fish and Wildlife Habitat and the Degradation of Fish and Wildlife Populations Beneficial Use Impairments (BUI) from the United States side of the St. Marys River Area of Concern (AOC). The Michigan Department of Environment, Great Lakes, and Energy (EGLE) assessed the status of these BUIs in accordance with the *Guidance for Delisting Michigan's Great Lakes Areas of Concern* and recommends that the BUIs be removed from the list of impairments in the St. Marys River AOC.

Enclosed please find our BUI removal recommendation and associated documentation to support this action. Staff from the GLNPO, United States Fish and Wildlife Service, Environment Canada, and the Ontario Ministry of Environment's Conservation and Parks reviewed the documentation and provided their support for these BUI removals. The St. Marys River Binational Public Advisory Council provided a letter of support dated July 29, 2019, which is included as Appendix 5 to the removal recommendation.

Please note that a public comment period was held August 2-31, 2019. No input was received during the 30-day comment period.

We value our partnership in the AOC program and look forward to continuing to work with the GLNPO in the removal of other BUIs and the delisting of AOCs. If you need further information concerning this request, please contact Mr. John Riley, Great Lakes Management Unit, Surface Water Assessment Section, Water Resources Division, at 517-284-5045; RileyJ2@Michigan.gov; or EGLE, P.O. Box 30458, Lansing, Michigan 48909-7958; or you may contact me.

Sincerely,

Teresa Seidel, Director
Water Resources Division
517-284-5470

Enclosure

cc/enc: Mr. Mike Ripley, St. Marys River Binational Public Advisory Council
Mr. Marc Tuchman, USEPA
Ms. Heather Williams, USEPA
Ms. Leah Medley, USEPA
Mr. Rick Hobrla, EGLE
Mr. John Riley, EGLE

# Removal Recommendation
# Degradation of Fish and Wildlife Populations and
# Loss of Fish and Wildlife Habitat Beneficial Use Impairments
# St. Marys River Area of Concern

## Issue

The Michigan Department of Environment, Great Lakes, and Energy (EGLE), Areas of Concern (AOC) Program recommends removal of: (1) the Degradation of Fish and Wildlife Populations; and (2) the Loss of Fish and Wildlife Habitat Beneficial Use Impairments (BUI) from the U.S. side of the St. Marys River AOC. This recommendation is being made with the support of the St. Marys River Binational Public Advisory Council (BPAC) and U.S. Fish and Wildlife Service, in accordance with the process and criteria set forth in the *Guidance for Delisting Michigan's Great Lakes Areas of Concern* (Guidance) (Michigan Department of Natural Resources [MDNR], 2018).

## Background

The St. Marys River is a binational AOC, shared jointly between the U.S. and Canada. To date, five BUIs have been restored on the U.S. side of the St. Marys River AOC: Degradation of Aesthetics, in January 2014; Bird or Animal Deformities or Reproductive Problems, in March 2014; Beach Closings, in July 2016; Eutrophication or Undesirable Algae, in December 2016; and Restrictions on Dredging Activities, in November 2017. This removal recommendation pertains to the Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat BUIs. Three other beneficial uses remain impaired on the U.S. side of the AOC: Restrictions on Fish and Wildlife Consumption, Fish Tumors or Other Deformities, and Degradation of Benthos.

The 1992 Stage 1 Remedial Action Plan (RAP) for the St. Marys River, prepared jointly by the Ontario Ministry of the Environment (OMOE) and MDNR (1992), provides the following rationale for assessing which BUIs were assigned to the AOC:

> *A determination as to whether a specific use impairment exists in the St. Marys River AOC was made using the Listing/Delisting Guidelines for Great Lakes Areas of Concern in conjunction with applicable standards, guidelines, and objectives, where available. In the absence of standards, guidelines, or objectives, impairment status is based on best professional judgement from the evidence available.*

The Guidelines mentioned above refer to listing and delisting recommendations developed by the International Joint Commission (IJC) in 1991 to help establish a consistent set of measures to apply across the Great Lakes basin (IJC, 1991). More specifically, the Stage 1 RAP provided a rationale for including the Degradation of Fish and Wildlife Populations BUI, due to concerns over habitat loss, body burdens of contaminants, and impacts of sea lamprey on fish populations. Decreases in populations of lake herring and lake whitefish in the lower river were mentioned, but not attributed to a particular cause. It is important to note that degradation of fish and wildlife populations was not the central issue for listing the St. Marys River as an AOC. Contaminated sediments were the primary driver behind the AOC designation.

The issues related to chemical contaminants are more appropriately addressed through other BUIs, such as Restrictions on Fish Consumption, Fish Tumors or other Deformities, and Bird or Animal Deformities or Reproductive Problems. Because contamination issues are addressed under those BUIs, they are not addressed in this removal recommendation. Invasive species, such as sea lamprey, represent a Great Lakes-wide problem, which is not unique or specific to the St. Marys River AOC. For this reason, specific restoration criteria for the St. Marys River were not developed to address this issue, although efforts are ongoing to control sea lamprey populations in the AOC and throughout the Great Lakes basin.

According to the Stage 1 RAP, the Loss of Fish and Wildlife Habitat was originally listed as impaired in the St. Marys River AOC due to the construction of structures for navigation and power generation, particularly resulting in the loss of high-value rapids habitat; urban and industrial riparian development; and pollutant loadings from municipal and industrial discharges (OMOE and MDNR, 1992).

**Figure 1**. Location of the Little Rapids project site and Main Rapids, in the St. Marys River, Michigan, adjacent to the city of Sault Ste. Marie. The river flows from the Main Rapids toward the Little Rapids. (Image courtesy of A. Moerke, Lake Superior State University [LSSU])

## Restoration Criteria

The St. Marys River BPAC (2008) finalized its *St. Marys River Fish and Wildlife Restoration Plan* (Restoration Plan, Appendix 1), which established specific restoration criteria for the two fish and wildlife BUIs and was approved by the State of Michigan. Criteria specified in the restoration plan specifically called for the restoration of two rapids habitat areas located entirely

in Michigan waters, the Little Rapids and the Neebish Rock Cut. The projects were selected based on perceived feasibility at the time and the likelihood that they would be supported by natural resource agencies and other stakeholders. The relevant specific language follows:

> "The two fish and wildlife BUIs will be considered restored in the Michigan's [sic] portion of the St. Marys River AOC upon the completion of the two projects described below, which would restore approximately 100 acres of fish and wildlife habitat.
>
> BPAC does not specify numerical restoration targets in terms of fish populations or other indicator organisms. Restoration targets are instead specified in terms of acreage of habitat restored. We presume that restoration of the habitat will result in increased numbers of desired species. Post-implementation monitoring will be included in the workplans of the agencies responsible for the restoration activities (viz., MDNR and USACE)."

As state and federal agencies began coordinating efforts to undertake the two restoration projects, it was determined that the restoration of the Neebish Rock Cut would not be feasible, due primarily to the extremely high estimated cost of the project. Subsequently, the BPAC agreed to an addendum (2015; Appendix 2) of the Restoration Plan. In a letter from the BPAC dated February 15, 2015 (Appendix 3), the restoration criteria for the two BUIs were revised as follows:

> "This addendum modifies restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations Beneficial Use Impairments in the St. Marys River Fish and Wildlife Restoration Plan to read:
>
> - The two fish and wildlife BUIs will be considered restored in the Michigan portion of the St. Marys River AOC upon completion of the Little Rapids project at Sugar Island, which would restore approximately 50 to 70 acres of fish and wildlife habitat."

As noted above, the restoration criteria did not specify target organisms or population numbers to be achieved. Neither did they require specific habitat conditions, such as current velocity or substrate type to be verified. The restoration criteria only require the completion of the Little Rapids project and that rapids habitat be created by restoring flow through the Little Rapids area. Based on the general area of river under the influence of the existing causeway and the area expected to receive additional flow following bridge construction, it was assumed that 50 to 70 acres would be improved. Although not part of the restoration criteria, general indicators that high-quality restoration had occurred included: (1) increased velocity to approximately 0.24 meters per second (m/s) within nearly ten acres; (2) an increase in the abundance of larval and adult fish of desired species (e.g., walleye, salmon, sturgeon); (3) the presence of aquatic macroinvertebrate communities indicative of highly oxygenated water; and (4) substrate types and bathymetry demonstrating an increase in flow velocity.

## Fish and Wildlife BUI Restoration

The Little Rapids restoration project was constructed in 2015 and 2016. Prior to implementation, an earthen berm causeway connected Island Number 1 to Sugar Island in the St. Marys River, just east of Sault Ste. Marie, Michigan, Figure 1. The causeway provided critical infrastructure connecting Sugar Island to the ferry docks, which are located on Island Number 1, and provide the only connection from Sugar Island to the mainland. When constructed, the causeway cut through a once productive rapids habitat, separating it into Upper and Lower Little Rapids, effectively acting as a dam while severely restricting flow through two six-foot culverts.

The aim of the Little Rapids Project was to remove the causeway and replace it with a bridge structure to reestablish flowing rapids habitat and reconnect the area of the Upper and Lower Little Rapids. The project was intended to recreate the proper flow conditions and substrate suitable for foraging and spawning by a variety of fish species found in the St. Marys River. Funding through the Great Lakes Restoration Initiative supported the successful removal of the former causeway and construction of a bridge, allowing the river to flow freely through a span of approximately 600 feet. The total area restored by the project includes the Upper and Lower Little Rapids, on both sides of the bridge. Figure 2 shows the project under construction.

**Figure 2.** Little Rapids project during construction. Photo shows completed temporary road on upstream side, following the removal of the former road and causeway.

The established criteria described above set a range of 50 to 70 acres of habitat for restoration. Flow volumes and velocities increased throughout the area from the Upper Rapids, downstream through the Lower Rapids, to the main river channel after project construction. The acreage of restored habitat is based largely on the AOC Coordinator's best professional judgement and reflects all available information regarding pre- and post-restoration fish, aquatic macroinvertebrate community composition, velocity, bathymetry, and substrate observations. Because "restoration" was not defined in terms of any specific performance metrics, the exact boundary of the restored area is somewhat subjective. However, the boundary is a reasonable estimate based on the available information and general indicators of an ecologically meaningful increase in habitat quality in the Little Rapids area. Therefore, the assessment of restored area is a qualitative one that assumes increased flows approximately 150 feet upstream of the bridge (based on flow velocity monitoring described below), continuing downstream to the main river channel, while attempting to exclude obvious backwater areas that may not experience higher flows.

Figure 3 provides a Geographic Information System-generated calculation of the approximate area affected by the new flow regime through the Little Rapids. The entire area within the polygon is approximately 107 acres, as indicated in the inset on the figure. Note that the

polygon extends upstream of the bridge about 150 feet. The polygon was drawn in a conservative manner on both sides of the bridge, so as not to overestimate the area of improved flow upstream, and to exclude the most obvious backwater areas east and west of the bridge opening downstream. The polygon includes two islands, whose collective area is less than nine acres. Subtracting out the acreage of those islands leaves just under 100 acres assumed to be restored habitat area.

**Figure 3.** Approximate Little Rapids area restored by new flow regime after bridge construction, as calculated by ArcGIS. Islands within the polygon collectively total about nine acres.

Even if one disagrees with the exact location of the boundaries of the polygon that were drawn to calculate restored habitat area, one could reduce the area of the polygon in Figure 3 by almost half and still meet the target threshold of “approximately 50 to 70 acres.” More than 50 acres were positively impacted by the change in flow regime resulting from the removal of the causeway and construction of the bridge with 600 feet of free-flowing St. Marys River beneath it, as shown in Figure 3. The project has successfully achieved the target of restored habitat area acreage.

Although not required to verify the restoration target was achieved, preliminary monitoring results have been collected and are presented below to provide information to support this conclusion.

## Monitoring Results

Ecological monitoring in the Little Rapids project area has been a collective effort. Some of this work began prior to demolition of the causeway, and some is ongoing, more than two years following construction of the bridge. Project partners remain engaged in discussions regarding monitoring, hoping to continue assessing ecological impacts to the St. Marys River system over the long term.

The Michigan Department of Environmental Quality (MDEQ) performed bathymetric surveys at the site, in 2013 before and in 2017 after construction. The U.S. Geological Survey (USGS) measured flow velocities in the vicinity of the project area in 2014 before and in 2017 after construction. The MDEQ performed one brief electroshocking fish survey prior to construction in 2013, while the MDNR did one follow-up electrofishing survey in 2017 post construction, using similar methods. The MDNR also completed four rounds of expanded electrofishing surveys in 2018. LSSU staff and students have dedicated an immense amount of time to the project, assessing benthic macroinvertebrates, as well as larval and juvenile fish communities. The efforts of everyone involved are greatly appreciated. Dedicated monitoring is critical to a comprehensive understanding of the range of ecological impacts from this multimillion-dollar project.

### *Bathymetry*

Bathymetric survey results indicate minor changes to the river bed elevation following the opening of the river channel at the bridge. Changes in the flow regime undoubtedly shifted silts and light-weight sediment throughout the area, both upstream and downstream of the bridge. Due to changes in personnel and assessment techniques between surveys, the composition of substrate types (silt, sand, cobble, gravel, etc.) in the Little Rapids area was not characterized post-construction. There were areas of each of these substrates before project implementation and it is likely that areas of each remain following project completion. However, shifts in exact locations of each type were not documented quantitatively, but shifts from silt to gravel and cobble were visible upstream and downstream of the bridge from pre- to post-restoration.

The post-construction bathymetric survey, conducted in September 2017, indicates a slight decline in the overall elevation of the riverbed, downstream of the bridge, Figure 4. While there are certain areas that gained sediment volume, such as the channel in the southeast corner, most of the area lost sediment. However, because a few formerly deep spots appear to have filled in, the data indicates a net gain in overall sediment volume for the Little Rapids. Those net sediment gains are concentrated over about 27 acres, while about 35 acres ended up losing sediment volume (Eustice, pers. comm.).

By opening the Little Rapids to the unimpeded flow of the river, the expectation was that the energy of the currents would scour out the bed of the rapids. These data seem to indicate this

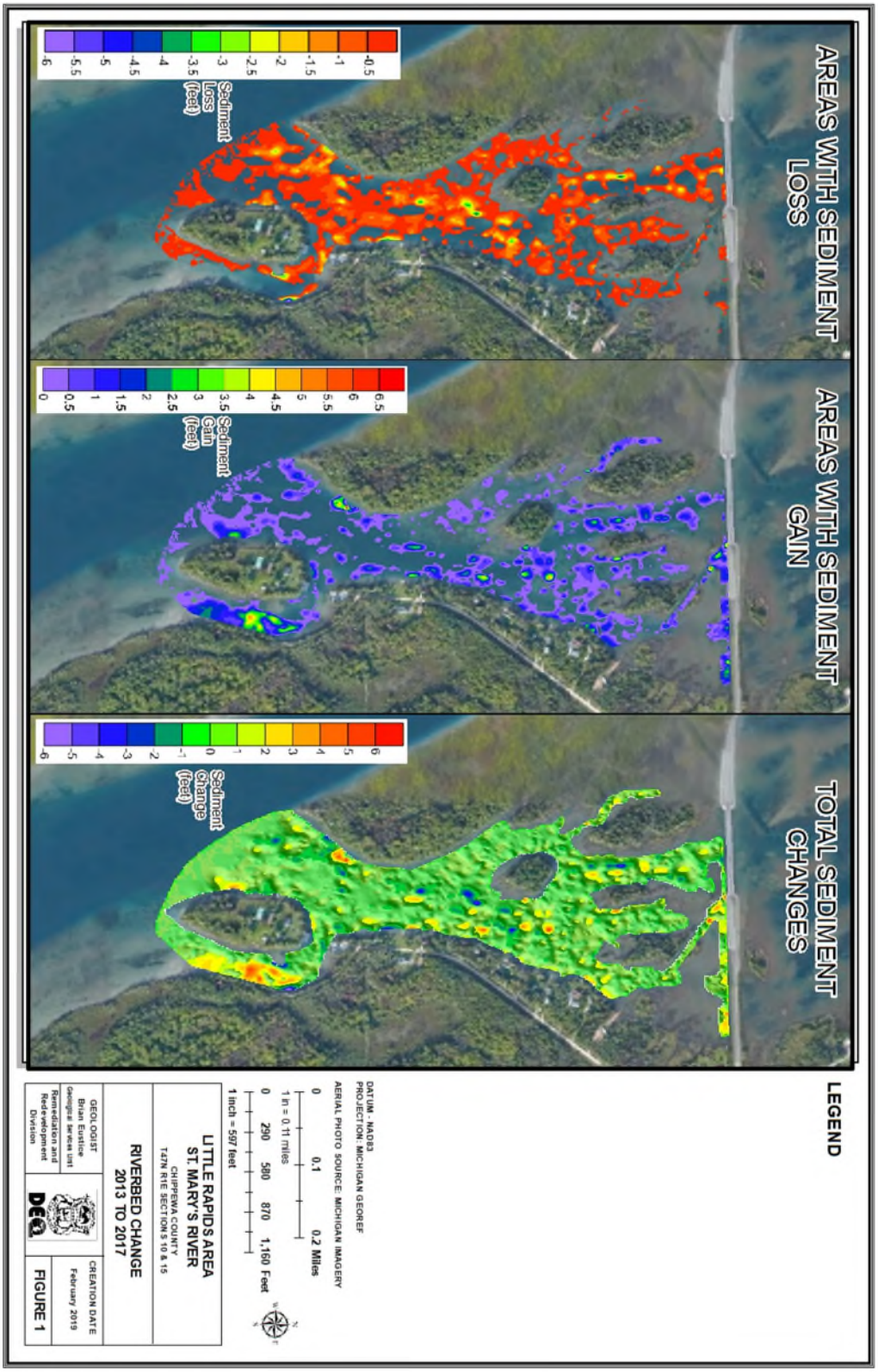


**Figure 4.** Bathymetric assessment of the sediment changes in the Little Rapids area, following construction of the bridge.

occurred in part, but not all, of the restored rapids area. Keep in mind that rock material was added around the bridge footings during construction. This may explain some of the increase in elevation. Further, each bathymetric survey was a snapshot of a single point in time. This is a dynamic system that may look different again today, should another survey be conducted. Great Lakes water levels have risen since the initial survey in June 2013. They are likely to drop again in the future. The compensating gates upstream of the Main Rapids are routinely manipulated to control flow in the river. These are only a couple of the variables that may be influencing Little Rapids currents, flow rates, and bathymetry. It is likely that sediments will continue to be scoured out of, and subsequently deposited into, areas of the Little Rapids as the system settles into a new and dynamic elevation range "equilibrium."

*Current Velocity*

Current velocities were measured in limited areas in 2014 before construction began, and again in 2017, following completion of the project. Measurements were taken along five transects, two upstream of the bridge and three downstream, indicated by thickened transect lines in Figure 5. The data indicate that flow velocities increased following removal of the causeway. It should be noted that water levels were generally higher in the St. Marys River in 2017 than in 2014.

**Figure 5.** Transects used for monitoring current velocities, fish using drift and fyke nets, total suspended solids (TSS) and macroinvertebrates. The thick lines indicate the locations of velocity measurements. The thin lines indicate macroinvertebrate and TSS sampling, while circles and triangles indicate locations of fish collection gear types. (Image courtesy of A. Moerke, LSSU)

A current velocity of 0.24 m/s or greater was identified prior to construction as being ideal for the creation of spawning habitat suitable for preferred fish species, such as walleye, salmon, sturgeon, and others. Hydraulic flow modeling suggested that about seven acres would meet the desired velocity, assuming construction of a 600-foot bridge span (URS Corporation, 2014). Prior to construction, all measured velocities in the project area were below 0.24 m/s. The USGS collected data, which were analyzed and interpreted by the LSSU, indicating that nearly ten acres out of 14.5 acres surveyed met or exceeded 0.24 m/s, following project construction (Moerke, 2018). In hindsight, assessing flow throughout more of the Little Rapids project area would have enabled a more thorough analysis of project impact, relative to the desired velocity. However, increased post-restoration velocity at the southernmost sampling transect suggests that the target velocity was met or exceeded for 96% of the sampled area farthest downstream (between transects 3 and 4) during post-restoration surveys. Thus, it is reasonable to assume that the area of restored flow extends well beyond the surveyed area, extending downstream to the main channel of the St. Marys River.

*Fish*

One round of electroshocking was undertaken by the MDEQ in 2013, to get an idea of the preconstruction fish community makeup. Success was limited, in terms of the number of fish captured. The survey was conducted one day in May, while water temperatures would have still been cold and likely to limit capture rates. Two sampling runs were conducted upstream of the causeway, while eight were conducted downstream. Each run lasted for ten minutes. In all, a total of nine white suckers were caught, ranging in size between 16 and 19 inches, plus one Atlantic salmon that measured 23 inches, for a total of ten individuals for the entire survey.

In May 2017, in an effort to compare post-construction sampling results with the 2013 preconstruction sampling effort, MDNR Fisheries Division staff duplicated the timing, locations, and methods of the previous survey. A total of 33 individual fish of seven different species were caught, 31 of which were three inches long or under. The last two individuals included a six-inch white sucker and a 19-inch northern pike. MDNR staff surmise that the cold water temperature ($40^{o}$ F) may be the reason for such a small catch (N. Godby, pers. comm.). Comparing before and after, ten fish representing two species were caught in 2013, while 33 fish from seven species were caught in 2017, using similar collection methods.

In 2018, MDNR Fisheries Division staff returned to the Little Rapids and revised their electroshocking locations and methods. Sampling locations included two transects upstream of the bridge, one meandering about 1.25 miles in a northerly direction from Island Number 1, around an island northwest of the bridge including shallow water habitat to the west of the bridge opening. The other upstream transect followed the shoreline north of Island Number 1 in an easterly direction along the upstream side of the bridge opening for about 1.62 miles to the northwest shore of Sugar Island.

Downstream of the bridge, three sampling transects were followed. One is about 0.96 miles long and followed along the eastern shore of Island Number 1 to the main St. Marys River channel. A second transect begins at the bridge and follows the western shoreline of the island located immediately downstream, then follows the west shoreline of Sugar Island for a total distance of about 1.35 miles to the main St. Marys River channel. The third downstream transect is about 0.8 miles long, circumnavigating the northeastern-most corner of the Little Rapids area between Sugar Island, the roadway east of the bridge, and a small island. The described sampling transects were all near shore and are not represented in Figure 5.

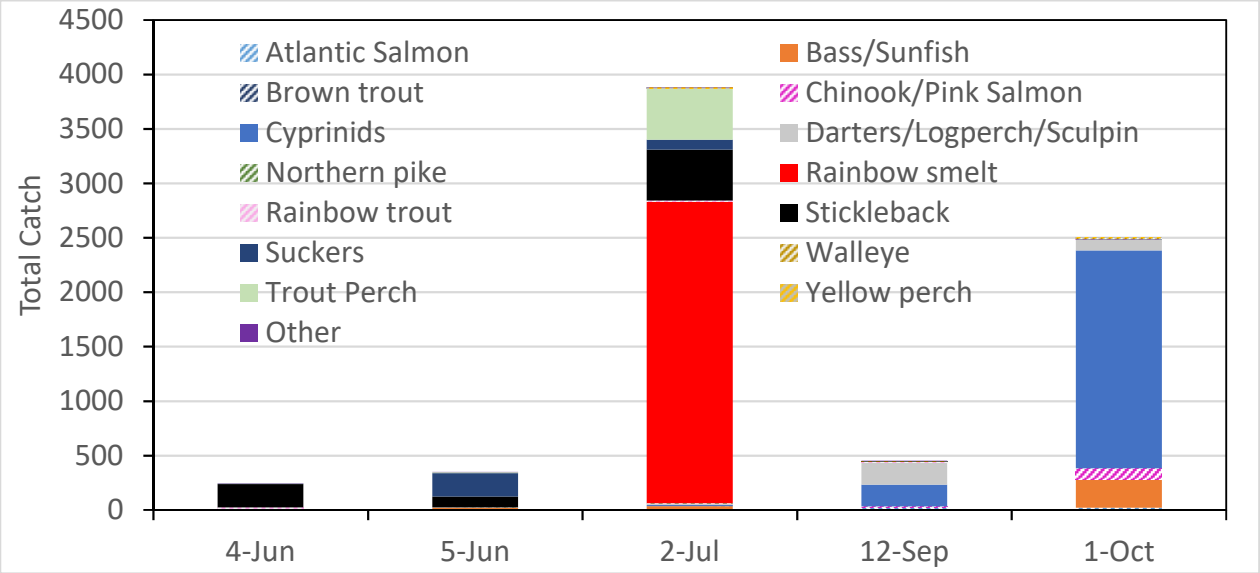


**Figure 6**. Total catch of all fish collected by the MDNR using boat electrofishing methods in June, July, September, and October 2018 after restoration. Catch was dominated by minnows (cyprinids), smelt, and stickleback. Large catches (usually over 100) were estimated (Graphic courtesy of A. Moerke, LSSU).

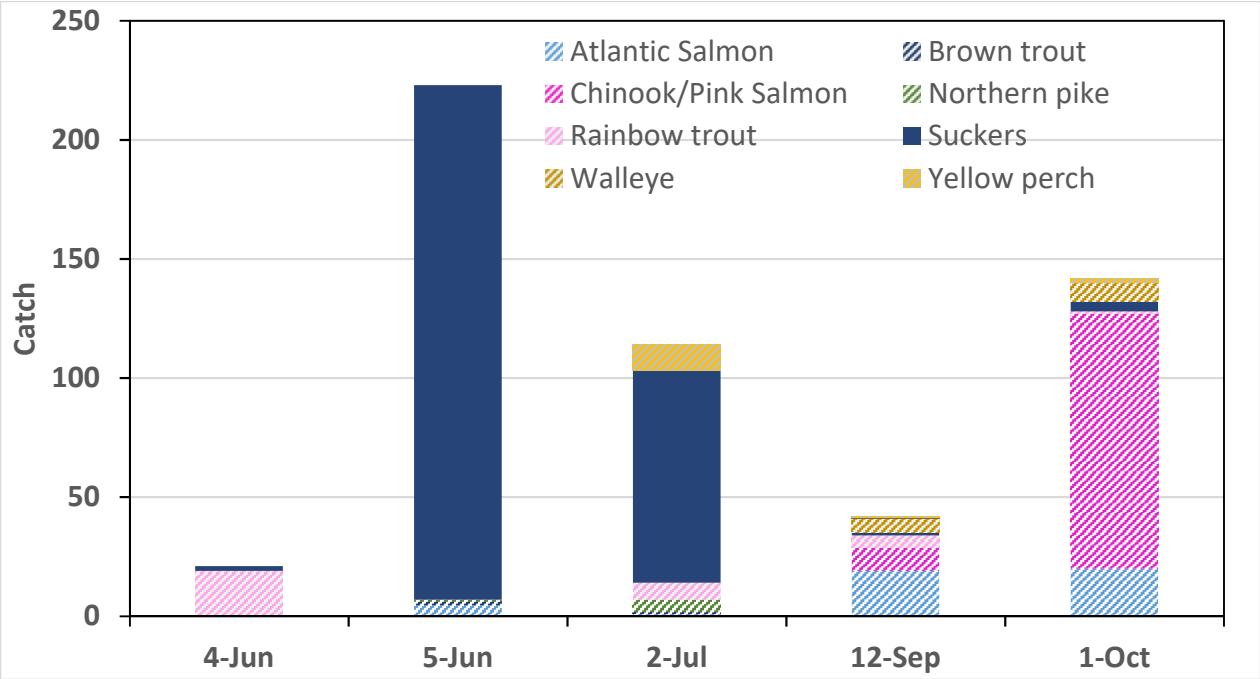


**Figure 7**. Catch of game fishes and other lithophilic spawners collected by the MDNR using electrofishing methods in June, July, September, and October 2018 after restoration. Catch was dominated by suckers in the early summer, smelt in July, and salmonids in the fall. Large catches were estimated. Smelt were removed from this figure to highlight other game fish (Graphic courtesy of A. Moerke, LSSU).

The MDNR's revised survey methods included night surveys, additional shallow water habitat, and an extended sampling season, through summer and fall. These changes were designed to increase gear capture efficiency and to see expanded species habitat usage over a longer part

of the year. Two locations upstream and three locations downstream of the bridge were sampled during each visit in June, July, September, and October. Except for the October effort, the number of species captured during each sampling event was between nine and 14. Just five species were caught in October. Sizes ranged from minnows (3-spine sticklebacks, rainbow smelt) to pike, walleye, trout, and salmon species well over 20 inches. One Atlantic salmon and one chinook salmon were caught in September that were over 30 inches long. Another chinook salmon was caught in October that was almost 34 inches long.

Overall, thousands of individual fish were caught through this effort in 2018, and thousands more were observed throughout the Little Rapids area. See Figures 6 and 7 for breakdowns by species and date. Due to the change in sampling methodology and timing, a direct comparison between fish collection results from 2013 and 2018 may not be entirely appropriate. However, both the number of individual fish caught and the number of species represented increased dramatically following construction of the bridge, indicating that fish community utilization of the restored rapids began almost immediately.

Fish communities in the Little Rapids were also sampled before and after restoration activities using three net survey types. Larval drift nets were used to capture larval and juvenile fish in the Little Rapids in spring and summer of 2017 and 2018. These efforts targeted larval fish emerging after winter or spring spawning, which provide evidence of natural reproduction. Fyke net surveys were conducted from July to September/October in 2017 to capture juvenile and adult fish in slower velocity, nearshore locations. Small seine surveys were also conducted weekly to sample juvenile and adult fish in shallow, nearshore areas. In both survey types, fish were identified, counted, and a subset was measured for total length.

Post-restoration drift net survey results from 2017 indicate that most of the larval fish were collected downstream of the bridge, which suggests that they were drifting out of the restored Little Rapids area. These larval catches were dominated by *Catostomidae* (suckers) and *Osmeridae* (rainbow smelt), along with some sculpin and salmonids. Fyke net sampling targeting juvenile and adult fish detected large numbers of Rainbow Smelt were found in the Little Rapids, along with smaller numbers of *Percidae* (mainly yellow perch), *Centrarchidae* (rock bass), and *Cyprinidae* (minnows). Although spawning salmon were not targeted by the types of net surveys used, large numbers of pink salmon and Atlantic salmon using and spawning in the Little Rapids were opportunistically observed during late summer/early fall site surveys. Data from 2018 is continuing to be processed, but preliminary larval fish data from 2018 indicate that larval fishes were abundant in the Little Rapids area and included *Cottidae* (sculpin), *Salmonidae* (salmon and trout), and *Osmeridae*. Despite lacking pre-restoration net survey information for comparison, these post-restoration results indicate that restoration activities have resulted in an area of high-quality fish habitat capable of supporting larval and spawning adult fish of desired species. See Appendix 4 for a summary of electrofishing and drift and fyke net monitoring efforts.

*Macroinvertebrates*

LSSU's data show that the benthic community changed between the pre-construction (2013 and 2014) and post-construction (2017 and 2018) surveys, which were conducted using the same transects as indicated in Figure 5. Taxonomic richness was reduced by two to three times following the reintroduction of flow through the area. However, percentage-wise, the dominance of groups indicating good water quality (Ephemeroptera, Plecoptera and Trichoptera) increased by four to six times between 2014 and 2017 (Moerke, 2018). Analysis of 2018 data is not yet complete, but they appear to show continued reductions in the benthic community population.

One potentially confounding finding of some of the biological monitoring work completed in the project area is the proliferation of the algae Didymo (*Didymosphenia geminata*), sometimes referred to as “rock snot,” a relatively new arrival in the St. Marys River system that does well in nutrient-poor conditions. Its ability to colonize substrate in fast-moving waters may be reducing the available habitat for macroinvertebrates. Reintroducing flow to the area may have provided opportunity for Didymo to gain a foothold. There is considerable uncertainty regarding how the presence of Didymo may impact the recovery of biota in the Little Rapids project area over time.

*Anecdotal Results*

One immediate social benefit to the construction of the bridge over the Little Rapids was the inclusion of fishing access, in the form of a cantilevered sidewalk platform on the downstream side, which runs the entire length of the structure (Figure 8). Almost immediately following construction, project partners began to see for themselves and hear reports of people using the platform to catch game fish (Figures 9 and 10). Reports of large salmon being caught have been common, along with eyewitness reports of schools of minnows and other fish.

Prior to construction, fishing access to the Little Rapids was limited without a boat. Anglers had to stand on uneven and potentially dangerous rip rap or don waders to stand in the water. Even then, flow was so minimal that popular game fish, such as salmon and trout, were so rare that it was not worth the effort. Now, it is common to see anglers making good use of the access platform.

**Figure 8.** Fishing access on the south (downstream) side of the bridge at the Little Rapids.

**Figures 9 and 10.** LSSU student Blake Hendrick shows off his catch from the bridge in November 2017. (Images courtesy of Blake Hendrick)

## Analysis

Often, nature's responses to human intervention are different than predicted. There can be countless reasons for those differences. Stakeholders might like to see more macroinvertebrates in the restored area today, but those numbers may change. Didymo may or may not continue to exert pressure on the benthic microhabitat. However, increased flow rates appear to be meeting expectations, as are fish community responses.

Several variables were evaluated, both pre- and post-construction. Largely, those results are positive and encouraging. The reality is that it may take several years of ecological monitoring to get a true picture of the impact of the Little Rapids project. Additional biological monitoring is being recommended for at least three-, five-, and ten-year intervals following project completion. This is likely to include surveys of fish communities and benthic macroinvertebrates, at a minimum. Only then can we truly be confident of the outcomes of the project.

Nonetheless, the question at hand is whether the Loss of Fish and Wildlife Habitat and the Degradation of Fish and Wildlife Populations BUI restoration criteria for the St. Marys River AOC have been met. The Little Rapids project at Sugar Island is complete, restoring a minimum of 50 acres of fish and wildlife habitat, as demonstrated above.

## Conclusion

As set forth in Annex 1 of the 2012 Amendments to the Great Lakes Water Quality Agreement (Government of the United States of America and the Government of Canada, 2012), the BUIs addressed in this document are: (1) Degradation of Fish and Wildlife Populations; and (2) Loss of Fish and Wildlife Habitat. The State of Michigan approved the BPAC's site-specific criteria as including all components required by the *Guidance*. This removal recommendation reiterates the local criteria and summarizes assessment data, concluding that the acreage of completed restoration and initial monitoring results indicate the successful restoration of the fish and wildlife habitat and population beneficial uses.

## Recommendation

Consistent with the consultation requirements under the Four Agency Letter of Commitment, this removal recommendation was reviewed by Environment and Climate Change Canada (ECC) and the Ontario Ministry of the Environment, Conservation and Parks (MECP). MECP offered no comments and ECC provided a statement of concurrence with the removal of the Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat BUIs on the U.S. side of the AOC.

The St. Marys River BPAC discussed the issue in detail at its June 5, 2019, meeting. Members voted to support removal of the BUI. The BPAC submitted a letter dated July 29, 2019, expressing support for this action (Appendix 5). A 30-day public comment period was announced via Mich-RAP, GLIN Announce, and the EGLE Calendar. No written comments were received during the comment period, which concluded on August 31, 2019.

Based on review of the data and technical input from LSSU, MDNR, EGLE, and the U.S. Fish and Wildlife Service staff, removal of the Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat BUIs from the St. Marys River AOC is recommended.

Prepared by: John Riley
Michigan Department of Environment, Great Lakes, and Energy
September 16, 2019

## References


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# APPENDIX 1
# ST. MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL
# 2008 FISH AND WILDLIFE RESTORATION PLAN

**St. Marys River Fish and Wildlife Restoration Plan**
**Prepared by St. Marys River BPAC Office Staff**
**FINAL draft as approved by BPAC December 2008**

Purpose of This Restoration Plan

This report provides a plan to restore fish and wildlife populations and fish and wildlife habitat identified as being impaired in the Stage I and Stage II St. Marys River Remedial Action Plans (RAP). The plan also highlights the significant achievements made by stakeholders to restore, protect, and preserve the St. Marys River aquatic resources. The priorities for restoration defined in this plan will serve to direct agencies working in Michigan on the restoration of the river and provide priorities for projects to be completed on the Michigan side of the river, as funding becomes available. Completion of these restoration projects will lead to the eventual removal of the fish and wildlife population and habitat beneficial use impairments (BUIs) on the Michigan side of the river.

Though this plan focuses on the Michigan portion of the St. Marys River Area of Concern (AOC), the agencies working under the Four Party Agreement (i.e., Michigan Department of Environment (MDEQ), Ontario Ministry of the Environment (MOE), US Environmental Protection Agency (USEPA), and Environment Canada (EC)), will continue to collaborate and coordinate their shared responsibilities under the Four Agency Letter of Commitment. Because the St. Marys River spans the international border, removal of each BUI for the river will require removal of that impairment on both the Canadian and US sides of the river. (The process of developing delisting criteria for the Canadian side is presently underway and should build on the delisting criteria suggested in the Stage II RAP report.) Each of these BUI removals will involve technical committee and stakeholder input. After all of the BUIs are removed from both the US and Canadian sides, the St. Marys River AOC will jointly delisted.

Beyond the coordination of efforts on both sides of the river, the efforts stated in this report should be seen as a minimum set of tasks that would need to be completed for removing the fish and wildlife populations and habitat BUIs, not as the final goal of restoration. Even after the removal of individual BUIs, the local government agencies, non-government organizations, educational institutions, other citizen groups, and the residents themselves will have to work together to continue in their vigilance and stewardship of the resources to ensure that they do not again become degraded. The Binational Public Advisory Council (BPAC), established in 1988, hopes to continue its outreach, education, and watchdog functions beyond the time when the St. Marys River is delisted as an AOC, since delisting is just one step towards achieving and maintaining the integrity of this shared resource.

**Background**

The St. Marys River AOC

In 1987, the St. Marys River was designated as one of 43 Great Lakes AOCs. RAP documents were developed to identify specific BUIs (Stage I), and to identify potential

remedial actions needed to restore those use impairments (Stage II). The St. Marys AOC boundary was defined as the entire river system, from the head of the river at Whitefish Bay (Point Iroquois - Gros Cap), downstream through the St. Joseph Channel to Humburg Point on the Ontario side, and to the straits of Detour on the Michigan side.. The following 10 BUIs are listed for the St. Marys River AOC: Fish consumption advisories, Fish tumors or other deformities, Bird or animal deformities or reproductive problems, Degradation of Benthos, Eutrophication or undesirable algae, Beach Closings, Degradation of Aesthetics, Restrictions on dredging, Degradation of fish and wildlife populations, Loss of fish and wildlife habitat.

The Development of This Plan

To consolidate progress toward delisting AOCs in Michigan, MDEQ published its *Guidance for Delisting Michigan's Great Lakes Areas of Concern* in 2006 (MDEQ 2006). That document, developed in consultation with the Statewide Public Advisory Council and other stakeholders, provides a standard set of restoration criteria Public Advisory Councils (PACs) can choose to use for all the BUIs except the Degradation of Fish and Wildlife Population and the Loss of Fish and Wildlife Habitat BUIs. In recognition of the unique nature of the fish and wildlife related BUIs in each AOC, MDEQ outlined a process for PACs to use to establish restoration criteria and develop a fish and wildlife restoration plan. Restoration criteria for the non-fish and wildlife BUIs are covered in another document titled, "St Marys River Delisting Criteria for Non-Fish and Wildlife Beneficial Use Impairments."

This document presents that restoration plan for the St. Marys River. It is based on information from the Stage I and Stage II RAPs along with information from other reports and projects addressing water quality issues. The restoration plan documents progress to date on addressing the fish and wildlife-related BUIs on the Michigan side of the AOC, and also brings in new information and projects not necessarily planned specifically for the AOC, but are thought to have, or will have, a positive impact on the St. Marys River fish and wildlife resources.

To develop the restoration plan, a technical committee was formed consisting of resource professionals that work in the river. Members were recruited from the St. Marys River Fisheries Task Group (SMRFTG), Lake Superior State University (LSSU), Chippewa/East Mackinac Conservation District, and other groups. The purpose of the initial technical committee meeting was to discuss the fish and wildlife impairments outline the RAPs and to identify potential restoration projects that would help address those key issues identified by the technical committee. Subsequent meetings focused on identifying specific projects for areas in need of restoration.

The recommendations in this report also reflect stakeholder input. Two stakeholder meetings were held over the winter and spring of 2007/8. The first meeting was to gage stakeholder concerns and to identify potential projects. The second meeting was to get stakeholder comments on the restoration projects identified in the draft plan. The final draft of the restoration plan [was presented and approved at the November 5, 2008], BPAC meeting, which stakeholders were invited to attend.

**The Impairments Regarding Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat**

*Degradation of Fish and Wildlife Populations*
As described in the Stage I and II RAPs, degraded fish and wildlife populations were listed mainly due to concerns over habitat loss, body burdens of contaminants, and impacts of sea lamprey on the fish populations (OMOE and MDNR, 1992; EC, USEPA, OMOE, and MDEQ, 2002). Whitefish and herring were two species specifically mentioned as species of concern because their numbers had declined in the lower river. The impact of sea lamprey on lake trout was also recognized. It is important to note that degradation of fish and wildlife populations was not the central issue of concern for the listing of the St. Marys River as an AOC. Contaminated sediments were and remain the major issue.

The issues related to body burdens of contaminants illustrate the overall concern with chemical contaminants in the RAPs. The RAP documents, for example, list chemical contaminants in herring gulls and terns as a concern. The issues related to chemical contaminants are more completely addressed in other BUIs, including fish consumption advisories, fish tumors or other deformities, and bird or animal deformities or reproductive problems. Because the contamination issues are better addressed under these BUIs, they are not further addressed in this document.

Invasive species represent a Great Lakes-wide problem, not an issue specific or unique to the St. Marys River AOC. As with practically any area in the Great Lakes, the St. Marys River has been subjected to numerous invasive species, including sea lamprey, spiny waterflea, zebra mussels, gobies, rusty crayfish, purple loosestrife, and Eurasian water milfoil. Property owners and government agencies continue to monitor and implement control measures. Because invasive species are a Great Lakes-wide problem, specific restoration criteria for the St. Marys River were not developed to address this issue. For more information about specific projects and programs regarding invasive species, such as the sea lamprey control program, see ”Recent and Ongoing Restoration Efforts,” page 11, below.

The Stage I RAP reported that a complex and diverse fish community exists in the river, providing dynamic, year around sport fishing (OMOE and MDNR, 1992). It also reported that an important tribal subsistence fishery exists for whitefish, walleye, and other fish species throughout the St Marys River. However, the RAP documents stressed the need for a comprehensive, binational effort to assess and monitor the health of the fish populations in the St. Marys River. Since that time, the SMRFTG was established under the Lake Huron Committee of the Great Lakes Fishery Commission. The Lake Huron Committee is reviewing fish community objectives for Lake Huron, which includes the St. Marys River. The Task Group and the Commission complements and supports the RAP process.

*Loss of Fish and Wildlife Habitat*

The Loss of Fish and Wildlife Habitat BUI was listed for the St. Marys River AOC for the following reasons, as described in the Stage II RAP Report (EC et al., 2002):

- Loss of the majority of the St. Marys River rapids due to construction of the compensating works in 1921 to control flow to the locks and existing hydro power plants, resulted in loss of rapids habitat and an unnatural flow regime through the remaining rapids;
- Loss of other rapids habitat due to road and river navigation projects;
- Loss of riparian habitat due to urban and industrial development;
- Additional habitat degradation due to invasive species;
- Increased nutrient and sediment loads from tributary streams due to inadequate watershed management.

The first three issues from the above list are the basis for the specific restoration projects called for by this plan. The latter three issues are general, Great Lakes-wide issues not unique or specific to the St. Marys River. Though specific targets and projects will not be further developed for these issues, the BPAC will continue to track progress made by programs, projects and plans in place to address these ongoing habitat-related concerns (see ”Recent and Ongoing Restoration Efforts,” page 11,, below.)

<u>Loss of St. Marys River Rapids Habitat</u>

Four significant rapids existed in the St. Marys River before the river was extensively modified for commercial shipping. (These modifications began as early as 1890s and continued through the 1930s.) The four rapids were: the St. Marys Rapids, the Little Rapids, a stretch of rapids between Sugar Island and Neebish Islands, and a rapids between the mainland and Neebish Island (the area now known as the Neebish Rock Cut). Development and operation of the locks and hydro power plants resulted in filling, dredging and diverting of significant water flow from the main St. Marys Rapids, reducing the surface area and water quantity within the rapids to a fraction of its original size and volume (US Army Corps of Engineers [USACE], 2005). Construction of the causeway from the Sugar Island Ferry dock to the island destroyed the Little Rapids by diverting flow away from the shallows. Channel excavation destroyed the other two rapids.

Further impacting the flow regime through the main rapids is the high priority for lock operations as set by the International Joint Commission. In 1978, the IJC established that the highest priority for water flow through the compensating works is shipping. But in recognition of the importance of the rapids for fish habitat, the second priority was protection of the rapids fishery. This secondary priority established a guaranteed minimum flow for the rapids under the current IJC operating plan (Regulation Plan 1977-A). Other approved uses including hydroelectric power generation were given third priority (EC et al., 2002), although even at third priority, power generation uses a large portion of the outflow from Lake Superior.

*St. Marys Rapids*
The construction of the hydroelectric plants and the navigation locks required installation of compensating works to channel the flow of the river through those projects. According to the Stage I RAP, an increase in demand for water in the 1960s resulted in the concern that water levels over the rapids were not sufficient to maintain the aquatic biota in the rapids (OMOE and MDNR, 1992). This loss of rapids habitat was a major issue documented in the Stage I RAP. The compensating works reduced flow (and at some times completely cut off flow) to the rapids, thus reducing the value of the rapids as habitat for a number of native fish species, especially whitefish. In 1985 Great Lakes Power in Ontario requested opportunity to build a new and larger capacity hydro power plant. A mitigation agreement to compensated for diversion of more water from the rapids resulted in construction of a fisheries remedial berm along the north shoreline to ensure that the flow along the north side of the rapids would remain and be sufficient for the protection of aquatic biota and organisms. When flows are at agreed to levels (see below) the structure is largely effective in keeping a wetted surface area, however, water depths and flow rates have been reduced. Present day, periodic dewatering and flooding of portions of the rapids still occur for maintenance and flow testing and the permanent loss of rapids habitat remain a concern.

According to the Stage II RAP, a hydrological study estimated the gains in rapids habitat that would result from various incremental increases in minimum flow volumes through the gates at the compensating works (EC et al., 2002). After considering various flow scenarios, the International Lake Superior Board of Control, the binational body governing the flow through the compensating gates, issued an order to have the northernmost gate (Gate 1) open to permit 15 cu m/sec to keep a flow of water along the north shore of the rapids, held in place by the fisheries remedial berm. The remainder of the rapids south of the berm is watered by the equivalent of ½ gate open. But even with this mitigation, the size of the St. Marys Rapids remains drastically reduced.

It has also been recognized that gravel to cobble-sized substrate in the lower St. Marys Rapids has been swept away by surges of water through the years. Suggestions for enhancement of the remaining rapids habitat have included the addition of gravel to increase benthic macroinvertebrate production in the lower rapids (Geiling, 1997). Other studies have pointed out that wetlands that existed at the foot of the rapids along the Canadian shoreline, probably served an important role as a nursery and staging area for many fish species. The combination of rapids flowing into wetlands would have provided prime habitat for fish production (Bray, 1993). Most of these wetlands have been lost to infilling for parking lots, building construction and industrial shoreline facilities. That loss of wetland suggests that conservation of the remaining wetlands is important to maintenance of natural fish reproduction and that creation or restoration of wetlands would improve it.

*Little Rapids at Sugar Island*
The Little Rapids at the head of Sugar Island, located between the Sugar Island ferry terminal and the island proper, was impacted by the construction of the causeway from

the Sugar Island Ferry dock to the island. This project blocked off most of the flow of water through that channel and the pre-existing rapids.

*Neebish Island Rapids and the Rock Cut*
The rapids located between Sugar Island and Neebish Island was destroyed during the construction of the navigation channel. Also, the construction of the navigation channel between Neebish Island and the mainland (i.e., the Neebish Rock Cut) removed substantial amounts of rock-rubble/cobble habitat, which was thought to be used as a spawning bed for walleye and sturgeon. The remaining watered rock-rubble/cobble habitat in this area was also compromised by placement of excavated materials and now only has intermittent water flow over it (USACE, 2005).

**Restoration Targets**
During the development of the Stage II RAP, a Flora and Fauna Task Team was formed to develop a strategic plan for the restoration of fish and wildlife related BUIs. Task team participants included state, federal and provincial agency and BPAC representatives. The task team examined a number of options for the remediation of rapids habitat and associated wetlands. Their findings and recommendation, summarized in Appendix 1, were designed to restore and rehabilitate habitat in order to enhance fish and wildlife populations in the AOC (EC et al., 2002). The Task Team recognized that implementation of some or all of these options would only partially compensate for historic losses to aquatic habitat in the AOC.

The Stage II RAP document also outlined a range of other types of restoration activities. In terms of the Degradation Fish and Wildlife Populations BUI, the major activities were to support the work of Sea Lamprey Control, the SMRFTG and other monitoring programs. These activities have been ongoing and are described in more detail under "Recent and Ongoing Restoration Efforts," page 11.

The delisting criteria specified in this restoration plan centers on the Loss of Fish and Wildlife Habitat BUI, specifically calling for the restoration of two rapids habitat areas located entirely in Michigan waters. These projects were selected based on feasibility and the likelihood that the project would be supported by natural resource agencies and other stakeholders.

- The two fish and wildlife BUIs will be considered restored in the Michigan's portion of the St. Marys River AOC upon the completion of the two projects described below, which would restore approximately 100 acres of fish and wildlife habitat.

BPAC does not specify numerical restoration targets in terms of fish populations or other indicator organisms. Restoration targets are instead specified in terms of acreage of habitat restored. We presume that restoration of the habitat will result in increased numbers of desired species. Post-implementation monitoring will be included in the workplans of the agencies responsible for the restoration activities (viz., MDNR and USACE).

Scope of Work

The two proposed projects will result in the restoration of approximately 100 acres of rapids habitat, including 28 acres in the Little Rapids at Sugar Island, 26 acres on the west side of the Neebish Rock Cut, and 42 acres on the east side of the Neebish Rock Cut. The projects would likely be completed by MDNR and USACE, respectively.

However, these proposed projects do not commit these agencies or other parties identified to complete the projects as described in this plan. The actual work to completed and the role to be played by the agencies and other stakeholders will be further developed in more detail once the sites are considered ready for implementation and/or when funding becomes available.

Proposed Activities

*Restoration of the Little Rapids at Sugar Island*

Twenty-eight acres of rapids habitat can be provided by the restoration of the Little Rapids at the head of Sugar Island (Acres International Corporation, 1997). This area of rapids habitat was filled in with the construction of causeway between the Sugar Island ferry terminal and the island proper. The project, as originally proposed by MDNR, would involve the installation of clear span bridges to permit a greater flow under the causeway. Rock and rubble remain in the former rapids area downstream of the causeway, however, water in this area is mainly stagnant. Restoration of this rapids habitat would greatly improve fish reproduction and foraging opportunities in the St. Marys River (Figure 1, Figure 2).

The MDNR had this project fully designed and ready for implementation in 1996, however, some local residents on Sugar Island, downstream of the causeway, objected due to the potential increase in fishing activity that it might bring. The BPAC, the AOC Fish and Wildlife Technical Committee, and other stakeholders recommend that this project be revisited, the residents' objections re-evaluated and a solution to those objections be found, such as establishing the area as a sanctuary focused on rehabilitation of the brook trout population.

***Figure 1. Location of the proposed Little Rapids project.***

***Figure 2. Closeup of the causeway. Presently, two, six-foot culverts, indicated by the arrows, are the only flow remaining.***

Project Details

- Timetable: Depends on funding availability to MDNR.
- Acres: 28 acres
- Funding: MDNR. Cost estimated in the 1996 document was $500,000 but that was without clear-span bridges.
- Responsible Entities: MDNR
- Indicator and Monitoring: The agencies associated with the SMRFTG (e.g., LSSU Aquatic Research Lab) would monitor the fish populations and the physical and biological aspects of the habitat periodically.
- Public Involvement: MDNR uses stakeholder processes in the planning and implementation of their projects.
- Project Reporting: All progress on project will be reported to MDEQ via the BPAC support staff or BPAC chair.

<u>Restoration of Rapids at the Neebish Rock Cut</u>

The USACE has proposed restoration of the rapids habitat in the Neebish Island Rock Cut (USACE, 2005). The proposed work includes a west and an east project site. According the Corps' plan, "The west project site would consist of removal of old building foundations, excavation of a channel and the installation of a culvert to allow water to flow behind the existing rock piles over the natural rock-rubble/cobble substrate. The east project site would require the modification of the eastern remnants of the upper dam. A portion of the upper dam would be removed and culverts placed under the existing roadway. A channel would then be excavated to allow water to flow behind the existing rock piles over the natural rock-rubble/cobble substrate" (USACE, 2005).

The project is expected to significantly improve habitat for fish, especially walleye and sturgeon, and invertebrate species. Approximately 26 acres of river habitat on the west side of the Rock Cut and 42 acres on the east would result. According to the proposal document "the proposed project would provide essential flow to areas adjacent to the Rock Cut that would support and enhance the aquatic ecosystem…[and] improve water quality" (USACE, 2005). The project would occur entirely on USACE land.

The project is considered one of the top priorities in the latest Water Resources Development Act (WRDA) funding request. Specific details related to the planning of the project, examination of design alternatives, clearance through necessary approvals would be the responsibility of the USACE. The MDNR has expressed their support for the project and may have an interest in cost sharing as part of the required local match.

- Timetable: Dependent on funding through WRDA and availability of the local match.
- Acres: 68 acres
- Funding: WRDA. Cost estimated in the Corps' Planning Document ranges from one to two million dollars, depending on restoration alternative selected.
- Responsible Entities: USACE

- Indicator and Monitoring: SMRFTG or agencies within that group (e.g., LSSU Aquatic Research Lab) will most likely monitor the fish populations, and the physical and biological aspects of the restored habitat.
- Public Involvement: Formal coordination with federal agencies, state agencies, and regional and local agencies would be initiated during the planning, design, and analysis phase if the project proceeds. Public comment will likely be sought by some or all of the agencies involved.

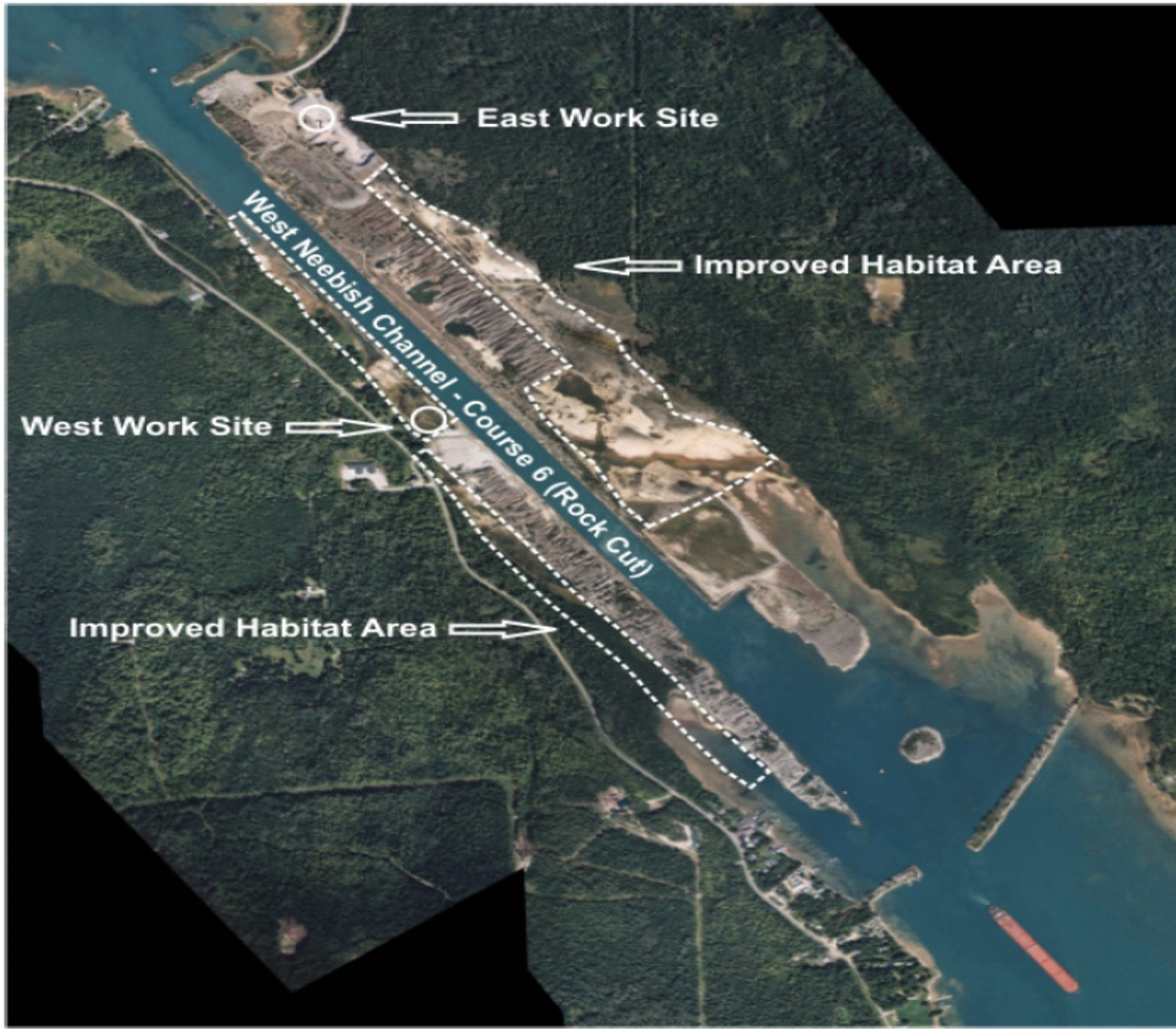


***Figure 3. Location of the proposed Neebish Rock Cut project (USACE, 2005).***

**Recent and On-Going Restoration Efforts**

The AOC Program and the ultimate delisting of the St. Marys River as an AOC is not the final word on restoration and conservation of this resource. A significant number of projects have been completed and/or are underway for managing the resources in the river and its watershed. BPAC and other organizations have been instrumental in educating the residents and visitors of the area about the importance of conserving the resources represented by the St. Marys River. Some were a direct result of the AOC Program, others arose due to concern from groups of residents and other stakeholders. The list below includes many of those projects. The list was not intended to be comprehensive but rather an example of excellent work done in recent years by a wide range of people with a concern for the resource. It is groups and projects such as these that will ensure the future integrity of the St. Marys River is protected, maintained, and preserved.

St. Marys River Fisheries Task Group

SMRFTG was formed as part of the Lake Huron Technical Committee in 1997. The group consists of representatives from MDNR, US Fish and Wildlife Service, Chippewa Ottawa Resource Authority, Sault Sainte Marie Tribe of Chippewa Indians, Bay Mills Indian Community, OMNR, and EC's Department of Fisheries and Oceans. Also participating in the work of the group are LSSU and Sault College. The group assesses the health of the fish populations in the St. Marys River and works to coordinate and partner in fish assessment efforts on the river. To date the SMRFTG has completed several projects that were identified in the Stage II RAP as being instrumental in monitoring and assessing the status of the fisheries in the St. Marys River, including:

- Conducting the first Fish Harvest Survey in 1999-2000 as a cooperative effort by provincial, state, and native fisheries management agencies in Ontario and Michigan. The goal was to determine the total fish extraction from the St. Marys River by all sources (i.e., angling, commercial and subsistence fishing).
- Completed the St. Marys River Assessment Plan in 2002 (Gebhardt, Fielder, Greenwood, Robbins, and Sutton, 2002), which provides a standardized approach for regular assessment of the river's fishery and aquatic resources. The plan includes approaches for activities such as fish community assessment, fish harvest estimates, habitat mapping and data collection.
- Since 2002, the SMRFTG has undertaken angler fish harvest surveys, a fish population gillnet surveys, and an annual young of the year walleye electrofishing survey, among other routine monitoring efforts completed by the individual agency.

MDEQ's Surface Water Assessment Section Watershed Monitoring Program

The State of Michigan assesses water bodies (within targeted watersheds), including the St. Marys River, on a 5-year basin rotation. One component of the monitoring effort is to monitor fish and benthic invertebrate community structure, nuisance aquatic plants, algae, and slimes, as well as assess physical habitat.

Sea Lamprey Control

Sea Lamprey Control is the Great Lakes Fishery Commission's primary program which is delivered by the US Fish and Wildlife Service and Fisheries and Oceans Canada as the lead control agencies and the US Geological Survey as the lead research agency. Other agencies (MDNR, OMNR) and academic institutions (University of Guelph and Michigan State University) support the program through research and joint projects. LSSU is a contractor for collection from lamprey traps in the St. Marys River. The Sea Lamprey Control facility is located at the St. Marys Canal National Historic Site in Sault Ste. Marie, Ontario.

The program includes three main control measures: trapping, sterile male release and application of lampricide. The trapping program involves capture of females to remove them from the spawning population. Under the sterile-male program, male lamprey are trapped, sterilized and released back into the population. They compete for spawning females, but don't successfully breed. The lampricide program involves application of granular Baylucide in areas with high larval lamprey abundance. The control program includes an ongoing assessment of sea lamprey abundance by deepwater electro fishing for larvae. According to the assessment data, the combination of approaches seems to be effective in reducing sea lamprey numbers, but it will not be possible to eliminate sea lamprey from the St. Marys River system.

Watershed Planning

A number of watershed planning programs and specific watershed management projects have been implemented since the completion of the Stage II document.

*The Sault Watershed Plan* was completed in 2007 by the Chippewa/East Mackinac Conservation District. MDEQ has accepted the plan and the project is now entering the implementation phase. A stakeholder group is in place and provides input into the plan and its implementation. The goal of the plan is to enhance and protect the quality of the St. Marys tributary streams that flow through the watershed area surrounding Sault Sainte Marie, Michigan. These tributary streams include Ashmun Creek, Mission Creek, and Frechette Creek. The watershed plan will also help to address concerns expressed in the RAP documents regarding the point source pollution (e.g., urban/stormwater runoff) and non-point source pollution (e.g., agricultural runoff).

*The Munuscong River Watershed Association* was formed in the late 1990s. The objective of the group is to restore the quality of the Munuscong River, specifically to reduce siltation and improve fish habitat quality and the recreational potential of the river. This group of residents was instrumental in restoring the Sterlingville Bridge Site, a specific site identified in the Stage II RAP as in need of stabilization to address sedimentation to the river and Munuscong Bay. In cooperation with Chippewa County Road Commission, the former bridge pilings and resultant logjams were removed, the shoreline reseeded to native plants, a canoe slide and improved road access were installed. The group also installed a set of interpretive signs along the river.

*The City of Sault Sainte Marie, Michigan* is completing the separation of sanitary and storm sewers. As well, regulations regarding stormwater management have been put in place (namely through the National Pollution Discharge Elimination System – NPDES). Prior to this regulation, property development did not have to plan for stormwater runoff. Older developments, such as Cascades Crossings, discharge large amounts of water into the local streams after rain and snowmelt. Formal adoption of the Sault Sainte Marie Area Watershed Management Plan by the City will ensure that best management practices are implemented for new developments within the city in order to reduce stormwater runoff and improve water quality in the urban tributaries to the St. Marys River.

Other Research and Monitoring

*LSSU Aquatic Research Lab and Department of Biological Sciences* conducts several research and outreach projects related to the fish and wildlife that inhabit the river. Current projects include a sturgeon survey in the St. Marys River, recommended stream remediation projects for Ashmun Creek and Frechette Creek, and a major research project on the ecological integrity of the St. Marys River coastal wetlands.

The ecological integrity study began in 2004 to determine the ecosystem health of the St. Marys River. The LSSU researchers are investigating coastal marshes to determine the status of habitat and the wildlife by collecting biological, sediment, and water samples, and performing various types of chemical analyses. All field studies have been completed and indices of biotic integrity are being developed. Further refinement and development of biotic and chemical integrity models is ongoing. A final report will be completed in the summer of 2008.

Walleye stocking

The importance of sustenance and commercial fishing by native people and recreational angling in the St. Marys River is widely recognized by residents, various economic interests, units of government and others. One indication of the level of resources applied to supporting and enhancing fishing opportunities is the walleye stocking done by US, Canadian and Tribes/First Nations.

Marsh Monitoring Program

A marsh monitoring program that records instances of birds and amphibians has been in place in the St. Marys River for many years, mainly on the Canadian side. Recently, Bird Studies Canada (BSC) has re-invigorated the program with additional volunteers and additional study sites. Part of BSC's work has been in direct support of monitoring for AOCs and especially remediation projects in the AOCs.

Habitat Conservation

A number of habitat conservation projects have been completed for the St. Marys River.

*Little Traverse Conservancy* has acquired deed or conservation easements on 17 miles in nine properties along the Michigan shoreline of the St. Marys River. Some of these

preserves were secured in collaboration with MDNR and through funding by the National Wetlands Conservation Act (NAWCA).

*The Nature Conservancy* (TNC) also has a number of project sites along the St. Marys River, especially on Drummond Island and in the neighboring Les Cheneaux area. TNC recently received USEPA funding (summer 2008) to assist the Lake Huron Binational Partnership in the development of a Lake Huron Biodiversity Strategy. Working with a multitude of partners, the development of the Strategy will focus on compiling and integrating information about aquatic ecological systems, natural communities and species in both Canada and the US into an international strategy for conserving the biodiversity of Lake Huron and its watershed (including the St. Marys River). A Conservation Action Plan process is also presently underway (summer 2008) to identify critical unmet needs for the St. Marys River where TNC can make a contribution, develop a set of conservation objectives for TNC projects in the river and watershed, and increase networking of professionals working in the river and its watershed. The initial meeting with partners for the plan was held in August, 2008 at LSSU.

*The City of Sault Sainte Marie, Michigan* is involved in a project that could result in improved habitat conservation. The city recently acquired the Ashmun Bay property from Edison Sault Electric Company, under a grant from Michigan Natural Resources Trust Fund. The City held a series of planning workshops with stakeholders and the resulting plan called for much of the park to be a natural area. Ashmun Bay includes coastal wetland habitats and the mouth of Ashmun Creek. The City is presently looking for further funding to implement the plan.

Wetlands mitigation

A large number of constructed wetlands have been put in place in the St. Marys River watershed over the past several years. These wetlands often represent a collaboration between private land owners and the US Department of Agriculture Natural Resources Conservation Service, Chippewa/East Mackinac Conservation District, and Ducks Unlimited. Some of the constructed wetlands represent mitigation for wetlands lost to development but others are constructed simply to increase wetlands habitat. One example of these construction projects is the Munuscong Potholes Complex (also known as the Munuscong Bay Waterfowl Sanctuary), located just west of Munuscong Bay, near Pickford, Michigan. These wetlands have provided improved habitat for waterfowl and aquatic organisms.

Enhanced fish access

According to the Stage II RAP, the Michigan Department of Natural Resources bulldozed openings into the Munuscong Bay Waterfowl Sanctuary dike, allowing free water and fish movement into the rich emergent wetland matrix, unattainable by many fish since 1963 (S. Greenwood, pers. comm., as cited in EC et al., 2002).

Protecting Biodiversity

At the 2000 State of the Lakes Ecosystem Conference (SOLEC), the St. Marys River was recognized as having the highest biodiversity rating in the Great Lakes (De Philip et al.,

2000). This rating emphasizes the pressing need to protect the River's uniquely important riparian environment and to successfully address the habitat loss problems identified in the Stage I RAP. To address the need to protect unique species habitat and/or populations along the Great Lakes shoreline, the State of Michigan has designated 275 linear miles of essential habitat as Environmental Areas, including several reaches along the St. Marys River. Environmental area designation sets up a review program where the affected property owner must make application to the MDEQ for any dredging, filling, grading or other alteration of the soil, natural drainage or vegetation, or placement of permanent structures. This recognition by SOLEC was part of the rationale for TNC program described above.

Point Source Cleanup Projects

Cleanup of the *Cannelton Industries (Tannery)* site on the St. Marys River in Sault Sainte Marie, Michigan was completed in 2007. In a two-phase cleanup, many tons of contaminated soil and sediment were removed. In addition to removal of a potential source of chemical contaminants, the project resulted in cleaner habitat for waterfowl, fish and other aquatic organisms. Long-term monitoring of sediments, soil, and surface water is taking place to ensure protectiveness of human health and the environment. This long-term monitoring was specifically requested in the Stage II RAP.

Installation of the new *East End Sewage Treatment Plant* in Sault Sainte Marie, Ontario will protect the water quality of the river. The project was not billed as a direct benefit to fish and wildlife populations or fish and wildlife habitat, but it was a major improvement called for in the St. Marys River RAP documents.

Invasive species management

Sea lamprey was a major concern in the listing of the river as an AOC. The St. Marys River has been identified as a major source of sea lamprey reproduction and a vigorous control program is in place by the Sea Lamprey Control Program.

In addition to sea lamprey, the St. Marys River has received a long list of invasive species similar to any other site in the Great Lakes system. And like other communities in the Great Lakes, property owners and agencies along the St. Marys River have undertaken some invasive species management efforts. Biocontrol agents (i.e., *Gallerucella* beetles) have been successfully applied to purple loosestrife infestations, including Potagannising Flooding on Drummond Island; Bellevue Marine Park in Sault Ste. Marie, Ontario; and Echo Bay, Ontario.

Invasive species management across our region will be enhanced with the creation of the Invasive Species Research Institute, planned for Sault Ste. Marie, Ontario. This facility, which has been planned by Science Enterprises Algoma, will encourage collaboration in research and control of invasive species by government agencies, non-government organization and property owners in the upper Great Lakes region. While the focus will be terrestrial invasives, the existence of the Institute will bring additional attention to invasive species in general.

Other water and resource quality projects
Work on the specific AOCs is also complemented by two other programs directed toward improving resource quality in the Great Lakes. The St. Marys River is also covered by the Lake Superior Lakewide Area Management Plan (LaMP) and the Lake Huron Binational Partnership. For example, one specific project called for in the Lake Superior LaMP is the restoration of Ashmun Creek in Sault Sainte Marie, Michigan.

Restoration of the Great Lakes is also being addressed by the Great Lakes Regional Collaboration, a Great Lakes basin-wide program in the US designed to focus funding and efforts toward restoration of the Great Lakes. Restoration of AOCs is a key component of this intiative.

**Other Habitat Related Issues Raised by the Technical Committee and Stakeholders**
Over the course of developing this restoration plan, a couple important issues were raised by members of the Technical Committee and other stakeholders. They are included in the plan to raise awareness, and if addressed, may have a positive impact on the habitat conditions in the St. Marys River.

Issues Relating to Navigation
Shipping continues to be a vector by which pathogens and invasive species enter the Great Lakes and connecting channels through the release of contaminated ballast water. Although several states, including Michigan, have enacted legislation prohibiting the release of untreated ballast water within their jurisdictions, efforts to enact federal legislation which would require the treatment of ballast water have failed. It is hoped that legislation currently pending in Congress will be approved and that this source of invasive species to the Great Lakes will be eliminated.

Other navigation issues include the effects of bow wakes on streamside habitat. LSSU's research project regarding ecological integrity of the coastal wetlands partly documents such effects. During the Technical Committee and stakeholder meetings conducted as part of the present project, the idea of speed limits was raised. We encourage resource management agencies to look further into the feasibility of working with the Lake Carriers Association to find a solution to the issues related to bow wakes.

The fact that concerns over resource quality can influence navigation is illustrated by the decision not to permit winter navigation in the late 1970's (OMOE and MDNR, 1992) and again in the late 1990's, partly as a result of studies that demonstrated the impacts of winter navigation on fisheries and other aquatic life (e.g., Kauss, 1991).

Issues Related to the Operation of the Compensating Gates
An ongoing issue raised by the Technical Committee for the present report was the fact that when settings are changed at the compensating gates, they are changed suddenly instead of gradually. When the settings are changed on the compensating gates, the flow of water into the river rapidly changes. Sudden increases in flow can flush fish and other animals from their habitats. Sudden decreases in flow can leave fish and other animals stranded. Such sudden changes in flow rates can be detrimental to reproduction of fish

and other animals if the changes occur during critical life stages. A gradual change in the flow over a protracted period of time would let fish and other animals move to protected locations.

The OMNR has been working with the International Lake Superior Board of Control and its operational representatives, Brookfield Power (formerly Great Lakes Power), and the USACE since 1994 to mitigate such effects by timing the changes in water level fluctuations more appropriately for critical life stages. However, adherence to this request is not always communicated well enough to those supervising the change in gate setting. Thus, there appears to be a need to provide targeted outreach/education to raise more awareness about this important issue.

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Appendix 1: Key recommendations by the Flora and Fauna Task Team to restore fish and wildlife habitat in the St. Marys River AOC, as outlined in the Stage II RAP (EC et al., 2002):

- Protect remnant rapids habitat from further reduction and degradation and maximize the productive capacity of the rapids area. In essence, this is a water quantity issue.

- Enhance remnant rapids habitat by placing additional spawning substrate in rapids area. This option would require the placement of additional substrate to potentially increase the size and productive capacity of the remnant rapids. The berm construction represents the first attempt to enhance the remnant rapids habitat.

- Create new rapids areas elsewhere in the St. Marys River, especially in the Little Rapids area.

- Create alternatives to rapids habitat such as artificial spawning substrate. A variety of methods are available to either create artificial spawning substrate or to cleanse existing habitat in order to enhance fishery production.

- Create wetlands downstream of Whitefish Island to connect wetland habitat to adjacent remnant rapids. This option would involve depositing suitable fill in the area between Whitefish Island and the channel leading to the former Canadian navigation lock.

- Create new wetland/rapids complexes. The Task Team believed that it may be possible to create riffle habitat along a series of islands and shoals that extend along the north shore of Sugar Island.

- Enhance habitat and water quality in tributary watersheds. Creating or enhancing wetlands in selected areas of tributary streams would provide a range of fish and wildlife habitats and would reduce sediment and nutrient inputs to the St. Marys River.

- Do nothing. The Task Team recognized that this option would maintain or increase dependence on hatcheries and stocking programs to enhance fish populations in the St. Marys River.

APPENDIX 2
MICHIGAN OFFICE OF THE GREAT LAKES
2014 ST. MARYS RIVER FISH AND WILDLIFE RESTORATION PLAN ADDENDUM

**St. Marys River Fish and Wildlife Restoration Plan Addendum**
**Prepared by the Michigan Office of the Great Lakes**
**October, 2014**

## Purpose of the Addendum

This addendum updates the St. Marys River Fish and Wildlife Restoration Plan prepared and approved by the St. Marys River Area of Concern Binational Public Advisory Council dated December, 2008. Specifically, it addresses restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Population Beneficial Use Impairments by removing the requirement for restoration of rapids habitat at the Neebish Rock Cut and increasing rapids habitat restoration of the Little Rapids at Sugar Island.

## Background

The original Fish and Wildlife Restoration Plan focused on two areas of potential increase in rapids habitat, the Little Rapids and the Neebish Rock Cut. The plan recognized the critical importance of high-energy rapids habitat to the river. In fact, high-energy rapids-type habitat is a limiting factor Great Lakes-wide and the St. Marys River is an outstanding location to restore that habitat lost through human modifications over the last century and a half.

The two recommended sites for restoration, totaling approximately 100 acres of new rapids habitat, were assessed for feasibility in 2009. It was determined that the Little Rapids project could be expanded to approximately 70 acres of rapids habitat improvements on its own, whereas the Neebish Rock Cut site was found to be financially infeasible. Subsequently, the federal and state agencies engaged in the AOC work made a commitment to complete the Little Rapids project in its expanded scope and made a decision to not conduct the Neebish Rock project.

This addendum modifies restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations Beneficial Use Impairments in the St. Marys River Fish and Wildlife Restoration Plan to read:

- The two fish and wildlife BUIs will be considered restored in the Michigan portion of the St. Marys River AOC upon completion of the project described below, which would restore approximately 70 acres of fish and wildlife habitat.

## Proposed Activities and Project Details

*Restoration of the Little Rapids at Sugar Island*

(Insert activities from the project workplan)

APPENDIX 3
ST. MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL
2015 LETTER OF SUPPORT FOR FISH AND WILDLIFE RESTORATION PLAN ADDENDUM

# ST. MARYS RIVER
# BINATIONAL PUBLIC ADVISORY COUNCIL

February 25, 2015

Mr. John Riley
Michigan Department of Environmental Quality
Office of the Great Lakes
P.O. Box 30473
Lansing Michigan

Dear Mr. Riley:

DRAFT St. Marys River Fish and Wildlife Restoration Plan Addendum
Prepared by the Michigan Office of the Great Lakes
November, 014

This acknowledges ST. MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL 's support on December 02, 2014 for the addendum outlined below.

Purpose of the Addendum

This addendum updates the St. Marys River Fish and Wildlife Restoration Plan prepared and approved by the St. Marys River Area of Concern Binational Public Advisory Council dated December, 2008. Specifically, it addresses restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Population Beneficial Use Impairments by removing the requirement for restoration of rapids habitat at the Neebish Rock Cut and increasing rapids habitat restoration of the Little Rapids at Sugar Island.

Justification for Revision

The original Fish and Wildlife Restoration Plan focused on two areas of potential increase in rapids habitat, the Little Rapids and the Neebish Rock Cut. The plan recognized the critical importance of high-energy rapids habitat to the river.

The 2008 Restoration Plan recommended two sites for restoration, totaling approximately 100 acres of improved rapids habitat. Of those 100 acres, it was estimated at the time that about 28 acres of habitat would be restored at the Little Rapids, and approximately 68 acres could be restored at the Neebish Rock Cut site.

When the project sites were assessed for feasibility, it was determined that the increased rapids habitat at the Little Rapids site could reasonably be estimated at approximately 50-70 acres of improved rapids habitat, depending on the final design specifications of the project. However, the proposed Neebish Rock Cut project was determined to be infeasible. Subsequently, the federal and state agencies engaged in the AOC work made a commitment to complete the Little Rapids project in its expanded scope and made a decision to not conduct the Neebish Rock Cut project.

Restoration Target

This addendum modifies restoration criteria for the Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations Beneficial Use Impairments in the St. Marys River Fish and Wildlife Restoration Plan to read:

- The two fish and wildlife BUIs will be considered restored in the Michigan portion of the St. Marys River AOC upon completion of the Little Rapids project at Sugar Island, which would restore approximately 50 to 70 acres of fish and wildlife habitat.

Donald L. Marles A.I.M.A.

Donald L Marles

Chairman
ST. MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL

APPENDIX 4
ASHLEY MOERKE, LAKE SUPERIOR STATE UNIVERSITY
2018 ECOLOGICAL MONITORING - FINAL REPORT

**Ecological Monitoring – Final Report**
December 10, 2018
Additional information on the changes in benthos and larval fish are expected to be complete in early 2019 and will be submitted to GLC/NOAA.

**Background**
The St. Marys River supports a diverse cool- and cold-water fish community, which includes Lake Sturgeon (*Acipenser fulvescens),* Walleye *(Sander vitreus),* Lake Whitefish (*Coregonus clupeaformis)*, and Atlantic and Pacific Salmon (*Salmo salar and Oncorhynchus* spp.) (Schaeffer et al. 2011). Many of these species (e.g. salmon) are considered lithophilic spawners, meaning that they require faster flowing water and coarse substrate for successful reproduction. Historically, diverse rapids habitat was present throughout the St. Marys River, including the Main Rapids and the Little Rapids areas. However, human alterations to river flow and morphology, along with intensive industrial and commercial use of the river over the past century, has resulted in degradation of critical fisheries habitat (Duffy et al. 1987). Consequently, the St. Marys River was listed as an AOC by both the United States and Canada in 1985, and has since had a Remedial Action Plan (RAP) developed to provide a framework for environmental improvements and ultimately delisting.

As part of the RAP, the St. Marys Little Rapids area was identified as a target for restoration to address Beneficial Use Impairments (BUI) identified by the Michigan Department of Environmental Quality. Three of the BUIs – loss of fish and wildlife habitat, degradation of fish populations, and degradation of benthos – were proposed to be addressed through a project that would restore hydrological connectivity and current velocities in the Little Rapids area. Historically this area possessed complex habitat with diverse water velocities, depths, and substrate; however, a causeway with two undersized culverts restricted water flow for the last several decades. The causeway resulted in reduced flows, increased temperatures and poor habitat for native and recreationally important fishes.

To address the historical loss of rapids habitat in the St. Marys River, restoration of flow and habitat in the Little Rapids area was determined a priority by local stakeholders. In 2016, the two culverts that were restricting flow were removed and replaced with a larger bridge spanning approximately 190 m (625 feet). The goal of the bridge replacement was to reconnect hydrology and restore rapids fisheries habitat in this area.

A monitoring program was initiated in 2013 to collect pre- and post-restoration monitoring of physical and biological parameters in response to the Little Rapids restoration.

**Methods**
Monitoring of the Little Rapids restoration was a collaborative effort led by Lake Superior State University's Center for Freshwater Research and Education (formerly Aquatic Research

Laboratory) but involved data collection by the Michigan Department of Environmental Quality, Michigan Department of Natural Resources, and U.S. Geological Survey.

*Study Design*

Figure 1. Location of the Little Rapids (project site) and Main Rapids (proposed reference), in the St. Marys River, MI. Pre-restoration monitoring was conducted in 2013 and 2014 and post-restoration monitoring in 2017 and 2018.

Monitoring was conducted in the Little Rapids prior to restoration during the summers of 2013 and 2014 to document baseline conditions in biological communities, water quality, and habitat (bathymetry and velocity), and in 2017 and 2018 after restoration was complete (Figure 1). According to modeling efforts prior to construction, the restoration at the Little Rapids site was expected to result in the majority of habitat changes occurring approximately 200 m upriver and 400 m downriver of the causeway. Therefore, standardized transects were established perpendicular to flow and spanning the entire channel width, upriver and downriver of the causeway (Figure 2). The majority of monitoring was conducted across these transects (e.g., benthos sampling stations, velocity).

Transects were established every 100 m beginning 10 m from the existing roadway and extending to the water's edge (Figure 2). Drift nets were limited to locations possessing flow

prior to restoration and therefore were placed closer to the Sugar Island Ferry but were then relocated towards the bridge after restoration.

Originally the Main Rapids was proposed as a reference site; however, high water levels, as a result of increased gate openings by mid-summer, created safety concerns in all sampling years and prohibited effective sampling. Only larval drift was conducted in spring/early summer of the Main Rapids in 2013, which was prior to increased gate openings. Sampling was attempted in 2014 but nets were irretrievable because of safety issues. Sampling in the Main Rapids was not conducted by LSSU in 2017 or 2018, but LSSU did partner with USGS to conduct additional sampling with multiple gear types.

Figure 2. Map of Little Rapids area including location of 100-m transects used for macroinvertebrate and habitat sampling, along with drift net and fyke net locations. Drift nets were limited to areas where flow was sufficient in 2013 and 2014, but they were moved adjacent to the single net on transect 6 after restoration (2017 and 2018) because suitable flow existed. Fyke nets were located in nearshore areas representative of site habitat. The thickened lines on transects 3-7 illustrate locations of current velocity measurements.

*Biological Data Collection – Larval Fish*

Larval drift nets (76.2 cm wide x 53.3 cm high) were used to capture larval and juvenile fish, as evidence of natural reproduction, in the Little Rapids and the Main Rapids (when possible). Larval drift nets were set by boat in areas behind gravel beds where there was sufficient flow for the nets to fish properly. Nets were anchored to the bottom substrate with large steel anchors having approximately 4-6 foot leads to the frame of the net (Kempinger 1988)**.** Nets were set overnight twice per week usually starting in May through July or August each year in an attempt to target larval fish emerging after winter or spring spawning. Water temperature at the onset of sampling ranged between 3.7$^{o}$C (in 2018) and 10$^{o}$C (in 2013).

A total of five to six nets were set prior to restoration—two to three nets were set on the upstream side of the causeway directly in front of the large culverts or near the ferry dock, and three nets were set downstream of the causeway directly below the culverts. Sampling locations in the Little Rapids area were limited because few areas possessed sufficient flow. Six to eight nets were set post-restoration, three upstream of the causeway, three downstream of the causeway, and two attached to the bridge. All nets fished overnight for approximately 12 hours. Samples were sorted in the field when able or returned to the lab for sorting from debris (largely mats of *Didymosphenia geminata*). Fish captured were identified, recorded, and measured (generally only salmonids). All specimens unidentified in the field were preserved and identified in the laboratory using larval fish keys by Auer (1982) and Fuiman et al. (1983), and photos were sent to the USGS GLERL lab for verification.

*Biological Data Collection – Juvenile & Adult Fish*

Fyke nets, a common passive sampling gear (Hubert et al. 2012), were set twice per week in the Little Rapids from July to September/October in 2013, 2014, and 2017 to capture juvenile and adult fish. Seven fyke nets were set in slower velocity, nearshore locations. Two nets (1 large, 1 mini-fyke) were set upstream of the causeway/bridge, and five nets (3 large, 2 mini-fykes) were set downstream of the causeway. The nets were set by tying the lead line to a tree near the water's edge and running the net perpendicular to the shoreline. The nets were held in place by a fyke net anchor with a float attached to the net to mark the location. The nets were set for 24 hours and then fish captured were identified and counted, and the first 25 individuals of each species were measured for total length (mm). All fish identified in the field were released. Unidentified fishes were preserved in ethanol and identified using dichotomous keys in the laboratory.

Small seines (9.75 m x 2.3 m; mesh = 0.32 cm) were used to sample shallow, nearshore areas in the Little Rapids once per week. Seining was conducted in 2013 from July to October at two representative sites upstream of the causeway and four sites downstream. Total length for the first 25 individuals of each species collected was measured before releasing all captured fish.

Unidentified fishes were preserved in ethanol and identified using dichotomous keys in the laboratory. Seining was attempted post-restoration but did not continue due to high water levels and flows in 2017 and 2018.

*Biological Data Collection – Macroinvertebrates*

Benthic invertebrates were collected using a modified version of the Large River Bioassessment Protocol for Benthic Macroinvertebrate Sampling (LR-BP; Flotemersch et al. 2006). The LR-BP method is semi-quantitative and samples multiple habitats in proportion to their availability. This method suggests sampling a reach length of 500 m, however due to the smaller site, only 200 m upstream and 400 m downstream of the causeway was sampled using this approach (Figure 2). Along each transect, the sampling zone extends 5 m on each side of the transect (10-m sampling zone). The zone extends from each bank to the mid-point of the river (or until depth >1m). A sample included three kicks or sweeps of the substrate using D-frame nets (500-μm mesh). Each kick/sweep was conducted along a 0.5 m path and covered approximately 0.15 $m^2$. The sample locations were distributed based on available habitat within the zone to ensure coverage of sub-habitats (rocks, logs, soft sediment, etc.). If water was >1 m deep at the water's edge, sweeps were collected from a boat when possible. Each transect had two zones (one on each bank) and samples from the entire zone were composited into a single sample; therefore each transect has two samples. When a transect encountered an island or shallow bar it was considered to be a separate transect and two additional zones were sampled, resulting in a total of 28 zones (n=10 upstream, n=18 downstream). Samples were washed into a 500-μm sieve to remove fine sediments and then transferred to sample bottles with 70% ethanol and both internal and external labels.

Macroinvertebrate samples were processed in the laboratory at LSSU. All samples were sorted under a Leica dissecting microscope (35x) and identified to genus when possible. Aquatic insect taxa were generally identified to genus (except *Chironomidae* was left at family level) when specimens were intact, but most non-insect taxa were only identified to Class (e.g., *Oligochaeta*) or Order (e.g. *Amphipoda*). A minimum of 15% of all samples were randomly selected and checked by a second person to verify identifications.

*Water Quality & Algal Data Collection*

Samples of Total Suspended Solids (TSS) were collected once in July 2014 to determine background levels of TSS, and then biweekly in summer 2016 during construction, followed by monthly sampling in 2017 post-restoration. Samples were collected along the established transects at the same sites sampled for benthos (n=28; see above). Downstream sites were sampled first followed by upstream transects. Additionally, all samples were collected off the bow of the boat to avoid possible disturbance of the sediment due to the sampling activity.

Water samples were collected for TSS analysis using an integrated water column PVC sampler. Each sample was emptied into an acid-washed carboy, mixed, and then a 2.5 L cubitainer was filled, labeled, and placed in a cooler on ice until returned to the lab for further processing. TSS samples were processed immediately upon return to the laboratory following EPA Method 160.2 (Gravimetric method). GF/F filters were pre-weighed in an aluminum pan on an analytical balance. Samples were mixed and then filtered using GF/F filters (Gelman A/E) on a vacuum filtration manifold. Total volume of water filtered was recorded. Filters were placed in a drying oven and dried to a constant weight (>24 hours) at 100$^{o}$C.

In 2017, benthic algal data was collected above and below the berm to provide a baseline on *Didymosphenia geminata* (Didymo) in the Little Rapids area. Clean clay tiles attached to cement blocks were placed in the Little Rapids area and allowed to colonize for at least 4 weeks. Individual tiles were removed monthly to quantify Didymo stalks and cells.

*Habitat Data Collection – Cross-sections and Current Velocity*

Four channel cross-sections were surveyed using a laser range finder by MDEQ staff in September 2013 and then in 2017 a bathymetric survey was completed using a BSS +3 System. One transect was located upstream of the causeway and the other three were located downstream (~80 m, 150 m, and 200 m downriver of causeway). Depth, sediment depth, and substrate type were recorded at approximately 20 intervals along each cross-section in 2013. Further details are outlined in the DEQ report submitted to John Riley, Office of the Great Lakes.

Current velocity was measured using an acoustic doppler current profiler (ADCP) following USGS Techniques and Methods 3-A22 (Mueller et al. 2013; Appendix D). Measurements were completed in July 2014 and 2017 to map variation in current velocities in the Little Rapids area. Six transects were surveyed, with three above and three below the causeway (Figure 2). Two to four passes were made across each transect. Operation of the ADCP system was conducted by USGS-trained ADCP staff that had conducted surveys previously. ADCP configurations were selected based on water depths and modeled velocities in the area. Data was processed using RD Instruments WinRiver2 software and then imported into USGS program Velocity Mapping Toolbox (VMT). Data for each transect were exported from WinRiver2 software using the ASCII Output Wizard and analyzed using R software. Any bins (or pixels) where velocity or depth data were missing were removed from the analysis. Bins that had velocity readings above 0.24 m/s were summed for each transect and divided by the total number of bins to determine the percentage of the water column meeting or exceeding the desired velocity. To estimate total area with velocities above 0.24 m/s in the study site, the percentages from the previous analyses were extrapolated to the entire study area by averaging values from the two nearest transects. For example, transect width transect 8 and transect 7 were averaged and then multiplied by the distance between the transects (usually 100 m) to calculate total surface area

between the two transects. Then, % Vcrit for transect 8 and transect 7 was averaged and multiplied by the total area to determine the total area that met or exceeded the critical velocity. Thus, the results reflect an estimate within the boundaries surveyed and are likely an underestimate of habitat created that meets the target velocity.

**Results**

*Water Quality & Habitat*

Total Suspended Solids levels remained low throughout construction and a year following construction (Figure 3), except for a single event when TSS approached 30 mg/L during a breach of the sediment curtain surrounding the construction site. Channel cross-section surveys indicated that upstream and downstream transects were generally dominated by fine sediments prior to restoration. Less than 25% of the substrate was course substrate suitable for lithophils in most pre-restoration transects. Changes in lake bottom depth were documented by MDEQ in their report submitted separately.

Pre-restoration channel cross-section surveys indicated that upstream (cross-section 7) and downstream (cross-sections 5, 4, 3) were generally dominated by fine sediments. Less than 25% of the substrate was coarse substrate suitable for lithophils in cross-sections 7 and 4. In contrast, the substrate in cross-section 5, the first transect downstream of the causeway and culverts, contained over 60% of gravel and cobble. This information was only determined pre-restoration by DEQ staff, comparable post-restoration data were not collected due to a change in personnel and methodology used by the MDEQ before and after restoration. The information collected used transects and grab samples so determining the area of substrate type was not possible.

The USGS completed velocity mapping in summer 2014 and 2017. Pre-restoration data indicated that all measured velocities were below desired levels (desired >0.24 m/s) (Figure 4). Post-restoration mapping illustrates substantial increases in velocity (to or beyond target velocities) throughout the restored area (Figure 5). Over 90% of the water column in downstream transects 3-5 and upstream transect 6 met or exceeded the desired velocities (Figure 6). The furthest upstream transects (8 & 7) had 18% and 50% of the water column, respectively, meeting the desired velocity. An approximate area of 58,717 $m^2$ (14.5 acres) was surveyed in the Little Rapids site, and of this area, approximately 40,000 $m^2$ (9.89 acres) met or exceeded the desired velocity (Table 1). Thus, nearly 70% of the surveyed habitat met the desired goal and exceeded the target area.

*Biological Responses*

Macroinvertebrate communities shifted from pre- to post-restoration and taxa richness declined 2-3-fold in upstream and downstream transects. In 2017 after restoration, richness averaged around 3 taxa in both reaches. In contrast, the % EPT (Ephemeroptera, Plecoptera, Trichoptera) increased by 4-6-fold in both upstream and downstream reaches immediately

after restoration (Figure 7). The 2018 data are still being analyzed but indicate continued low numbers in the restored area. Although fish appear to be using the Little Rapids area for spawning and foraging areas, macroinvertebrate abundance remains low throughout the area. *Didymosphenia geminata* blooms continue to occur throughout the rapids habitat and it is unknown how this may impact biological recovery in the long-term.

In 2017, larval fish catches were dominated by *Catostomidae* (suckers) and *Osmeridae* (Rainbow Smelt), along with some sculpin and salmonids. Most of the larval fish were collected downstream of the bridge, which suggests that they were drifting out of the newly created Little Rapids area. It was not surprising that we did not see larval fish of many fall/winter spawners (e.g., salmon and whitefish) because the habitat was not open until late fall 2017 and therefore it is unlikely that large numbers of fish spawned in this area. Fyke net sampling was conducted from late July through mid-September in 2017 in nearshore areas and large numbers of Rainbow Smelt were found in the Little Rapids, along with smaller numbers of *Percidae* (mainly Yellow Perch), *Centrarchidae* (Rock Bass), and *Cyprinidae* (minnows). Site surveys identified large numbers of Pink Salmon and Atlantic Salmon using and spawning in the Little Rapids in late summer/early fall, but these species are generally not effectively sampled using fyke nets. The larval data for 2018 is continuing to be processed, but preliminary analyses indicate that larval fishes were abundant in the Little Rapids area and included *Cottidae* (sculpin), *Salmonidae* (salmon and trout), and *Osmeridae*.

Earlier in the summer 2018, electrofishing surveys collected thousands of Rainbow Smelt, hundreds of adult White Suckers and Trout Perch, and fall surveys collected Atlantic Salmon, Chinook Salmon, and Pink Salmon spawners (Figures 8 and 9). Additionally, numerous adult Walleye and Yellow Perch were collected on multiple dates and a single adult Cisco (*Coregonus artedii)* was collected.

**Deviation from Proposed Methods**

As mentioned in the Methods section described above, this project did deviate from proposed methods several times due to field constraints. The first deviation was removal of the Main Rapids as a reference site due to increased flow through the compensating gates and conditions that did not allow effective or safe sampling using drift nets. We also changed drift net locations from pre to post-restoration due to location of flow necessary for the gear to fish effectively. Finally, electrofishing was originally conducted once by the MDNR in early summer most years due to their scheduling, but in 2018 the MDNR was able to complete sampling three times during the summer to increase their likelihood of collecting fall spawners.

**Achievements of Performance Metrics**

Fish abundance & composition, fish diversity, and water quality performance measures were all met within 1-year post-restoration. Benthos abundance and benthos diversity did not meet performance measures. Reduced benthos post-restoration may reflect changes to the habitat as a result of *Didymosphenia geminata* blooms, which began in 2016 and continue today.

Didymo blooms produce large stalks that form dense mats along the bottom substrate and have been shown in studies elsewhere to result in a shift to a community dominated by chironomids. Although we still observed other taxa, numbers and diversity have declined. Since Didymo immediately colonized substrate in the new area it is difficult to separate out the mechanism driving the decline. It is also possible that the modified Large River Bioassessment Protocol method used to sample benthos was less effective after the restoration due to higher water levels and velocities.

As mentioned above, we were unable to evaluate the substrate performance measure due to a change in personnel and methodology used by the MDEQ before and after restoration. Prior to restoration, the frequency of occurrence of sand and silt was high (>50% at all transects), and although it is not quantified, aerial photos illustrate high occurrence of exposed cobble downstream of the bridge.

Velocity data collected by the USGS and analyzed by LSSU indicated that the target to create >7 acres of habitat with velocities exceeding 0.24 m/s was achieved. Research findings have been presented by Moerke and her students at the Michigan Aquatic Restoration Conference (Boyne Mountain, MI), Midwest Fish and Wildlife Conference (Milwaukee, WI), and the Michigan American Fisheries Society Conference (Port Huron, MI).

**Lessons Learned**

Our main lessons learned during the monitoring portion of this project were related to logistical constraints associated with sampling in a large water level-controlled river system. The high-water levels in recent years resulted in increased gate openings at the compensating gates producing flows that exceeded our ability to access the rapids safely and retrieve our gear. We did not anticipate these large changes in flow and therefore were unable to accommodate them with the proposed sampling methods. A second lesson learned was that more research needs to be done on how to accurately compare data collected in environments where flow has changed significantly. For example, gear used to effectively sample stagnant habitats do not work well in flowing habitats, and vice versa. Thus, standardized approaches to analyze these types of data are needed to be able to compare pre and post-restoration data. A final lesson learned is that communication with monitoring partners is crucial to ensure that methodologies stay consistent and that outcomes reported are consistent with expectations. We often found that agencies were willing to contribute to collecting data, but data analysis and interpretation were generally not part of the outcome and therefore future monitoring programs should make sure to build these expectations into the monitoring plan with existing or additional partners to ensure that data are not just collected, but analyzed to inform understanding of the changes that can be attributed to the restoration.

**Future Plans**

Data analyses related to changes in benthos and larval fish (2018) are ongoing and will be complete by the end of January 2019. A manuscript summarizing the findings is in preparation

for submission to the Journal of Great Lakes Research. Additionally, summarized raw data will be provided to GLC in MSExcel spreadsheets so it can be made publicly available on the GLC's website within a year of the project completion as is specified in the data sharing plan.

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Table 1. Area surveyed and area exceeding desired velocity (Vcritical = 0.24 m/s) for the Little Rapids study area post-restoration, 2017.

| Transect No. | Transect width (m) | Avg Transect width (m) | Surveyed Area ($m^2$) | % > Vcrit | Avg >Vcrit | Total Area >Vcrit ($m^2$) |
|---|---|---|---|---|---|---|
| 8 | 279 | | | 18 | | |
| 7 | 139 | 209 | 20890 | 50 | 0.34 | 7041 |
| 6 | 179 | 159 | 15873 | 98 | 0.74 | 11715 |
| 5 | 146 | 162 | 4872 | 96 | 0.97 | 4713 |
| 4 | 69 | 108 | 10751 | 99 | 0.97 | 10445 |
| 3 | 57 | 63 | 6332 | 94 | 0.96 | 6095 |
| Total ($m^2$) | | | 58,717 | | | 40,010 |
| Total (acres) | | | 14.5 | | | 9.9 |

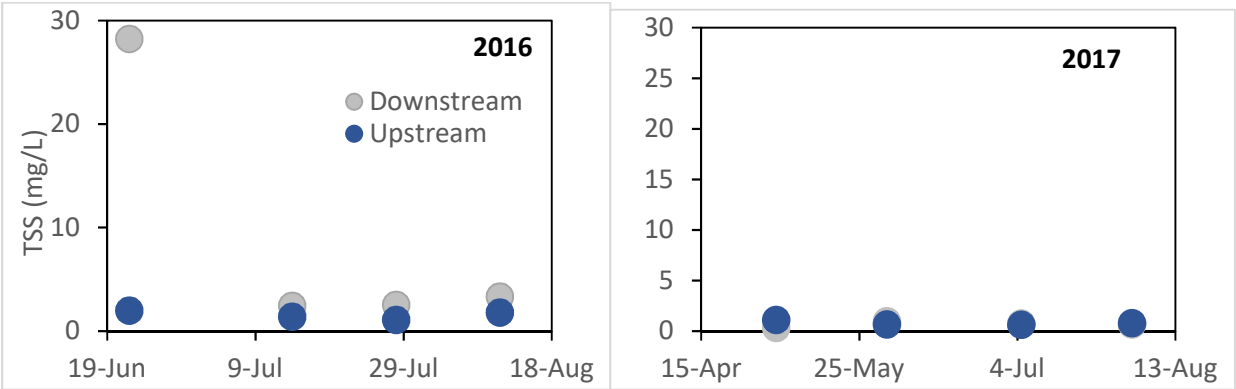


Figure 3. Total Suspended Solids downstream and upstream of the constructed bridge in 2016 (left) during construction and 2017 (right) after construction.

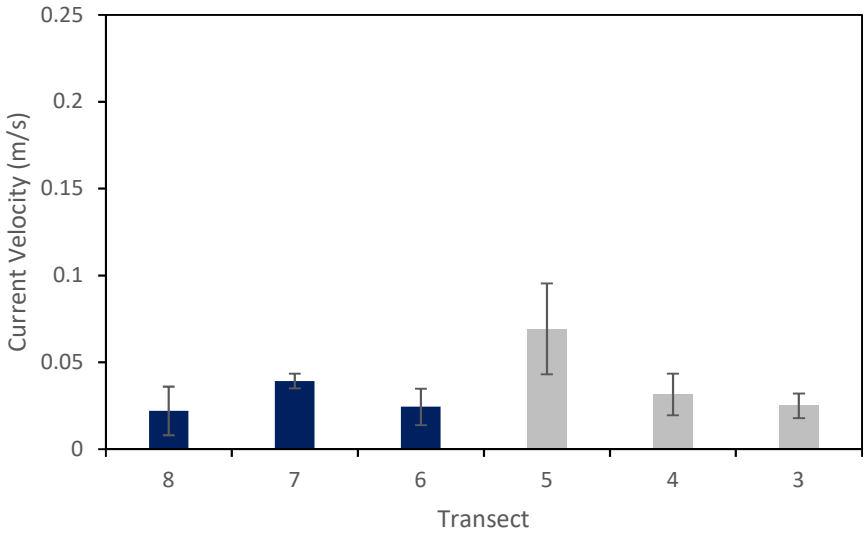


Figure 4. Mean current velocities in transects 6-8 (upstream) and 3-5 (downstream) of the causeway prior to restoration. All were below the desired velocity of 0.24 m/s.

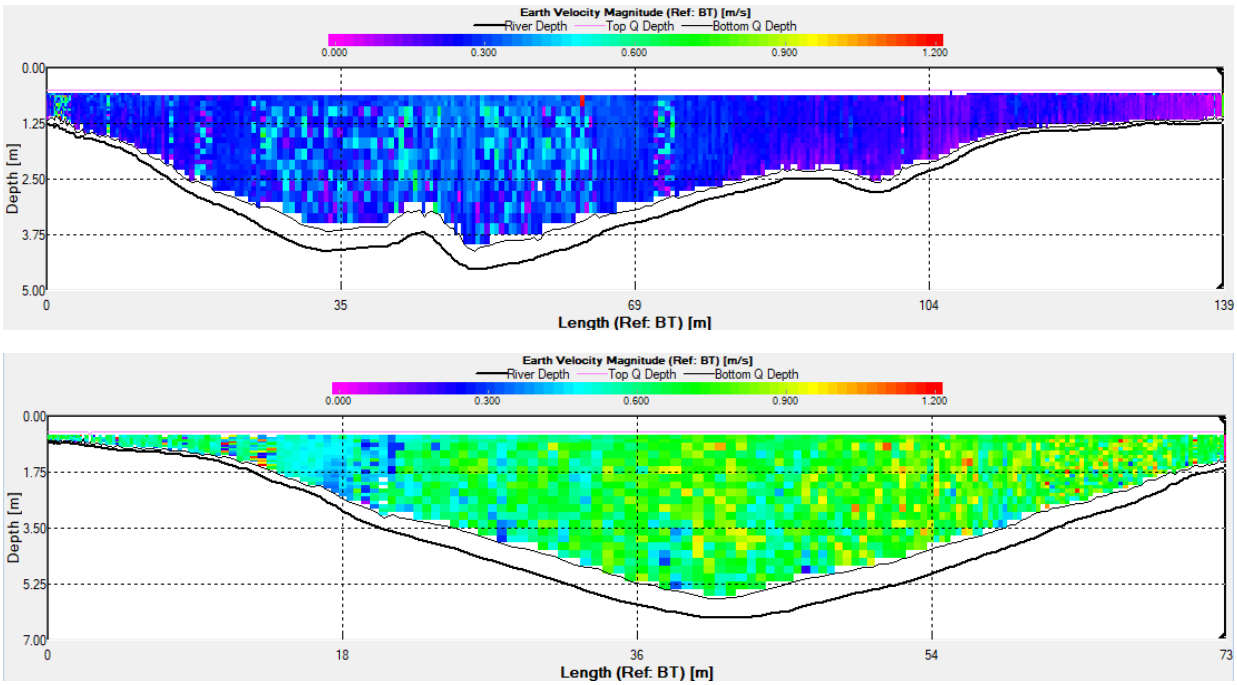


Figure 5. ADCP profiles illustrating current velocity (m/s) at an upstream transect (transect 7, top) and a downstream transect (transect 4, bottom) in 2017 post-restoration. Both demonstrate that velocities above the 0.24 m/s desired range were achieved.

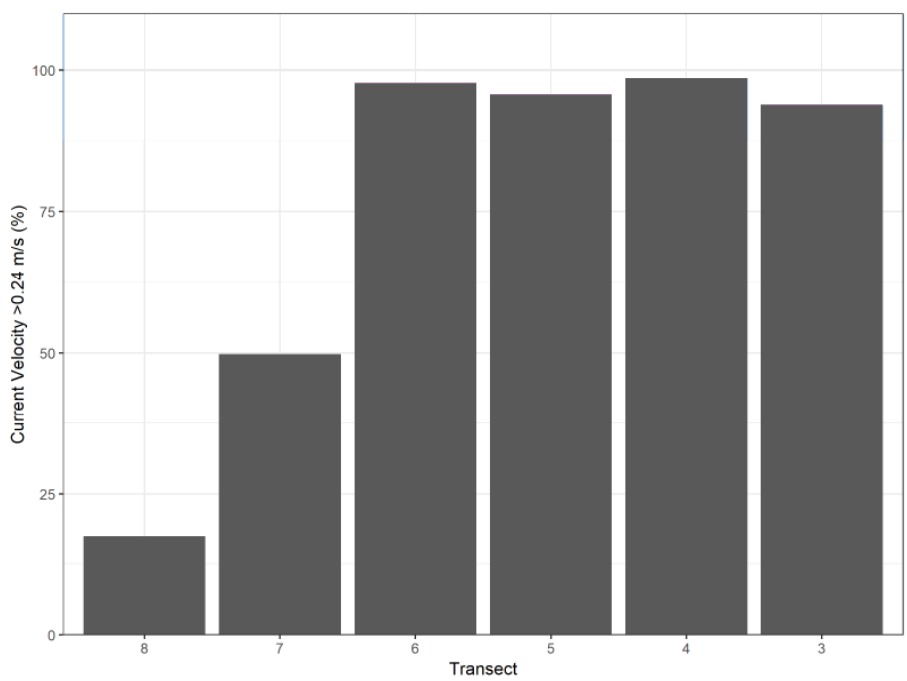


Figure 6. The percentage of the water column that had current velocities above 0.24 m/s during the USGS ADCP survey post-restoration. Transects 3-5 are downstream of the bridge and transects 6-8 are located upstream.

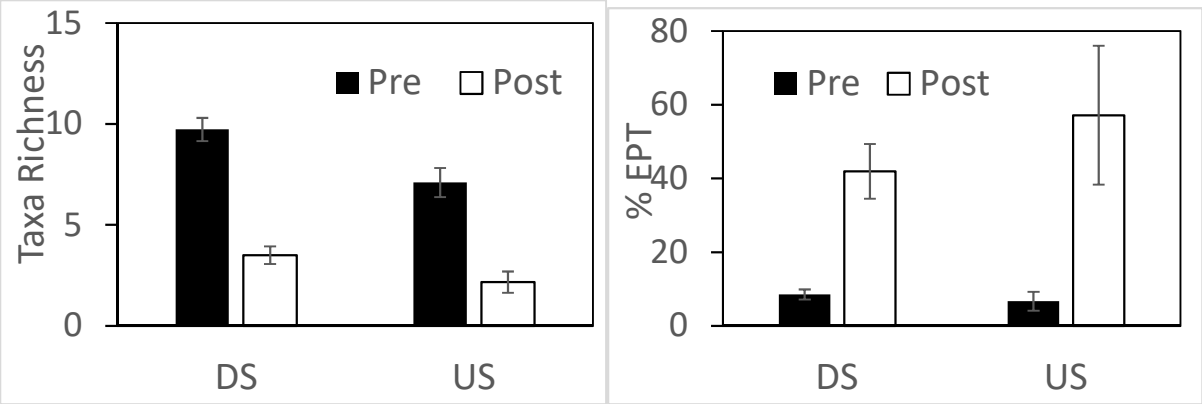


Figure 7. Mean macroinvertebrate taxa richness (left) and %EPT (right) upstream (US) and downstream (DS) of the causeway pre-and post-restoration. Although taxa richness declined, %EPT increased in both reaches after restoration.

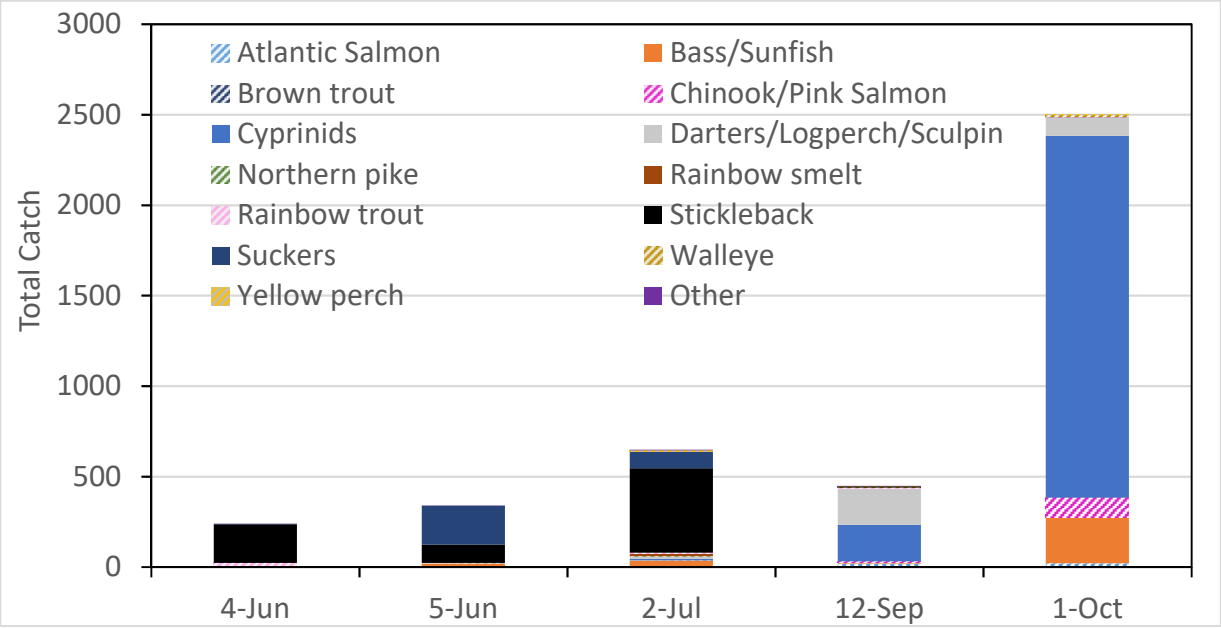


Figure 8. Total catch of all fishes collected using boat electrofishing methods in June, July, September and October 2018 after restoration. Catch was dominated by minnows (cyprinids) and stickleback.

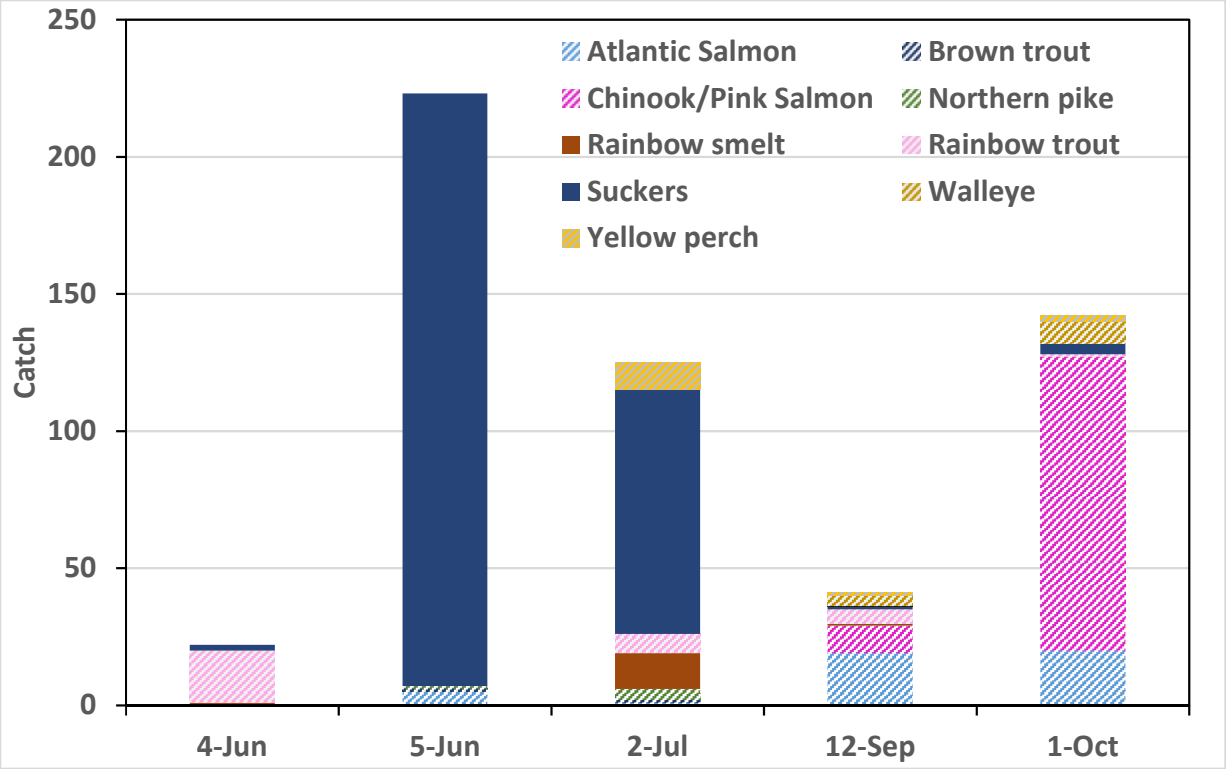


Figure 9. Catch of game fishes and other lithophillic spawners collected using boat electrofishing methods in June, July, September and October 2018 after restoration. Catch was dominated by suckers in the early summer and salmonids in the fall.

APPENDIX 5
ST. MARYS RIVER BINATIONAL PUBLIC ADVISORY COUNCIL
2019 LETTER OF SUPPORT FOR REMOVAL OF
LOSS OF FISH AND WILDLIFE HABITAT AND
DEGRADATION OF FISH AND WILDLIFE POPULATIONS
BENEFICIAL USE IMPAIRMENTS

ST. MARYS RIVER
BINATIONAL PUBLIC ADVISORY COUNCIL

July 29, 2019

Mr. Rick Hobrla
Water Resources Division
Michigan Department of Environment, Great Lakes, and Energy
P.O. Box 30473
Lansing, MI 48909

**RE: Michigan's 'Degradation of fish and wildlife populations' and 'Loss of fish and wildlife' BUIs.**

Dear Mr. Hobrla,

Members of the Bi-National Public Advisory Council (BPAC), who represent stakeholders on both the U.S. and Canadian sides of the St. Marys River, have reviewed the findings related to the 'Degradation of fish and wildlife populations' and the 'Loss of fish and wildlife' Beneficial Use Impairments (BUIs). A final draft of the report titled "Removal Recommendation: Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat Beneficial Use Impairments, St. Marys River Area of Concern" was submitted to the BPAC on May 29, 2019 and discussed at our June meeting.

Since the delisting criteria for these BUIs was predicated on completion of the Little Rapids restoration project and recent monitoring of fish diversity indicates improvements, BPAC supports MDEQ's recommendation to delist both the 'Degradation of fish and wildlife population' and 'Loss of fish and wildlife' BUIs on the U.S. side of the AOC.

BPAC encourages support for on-going monitoring of fish and invertebrates through Lake Superior State University and we look forward to hearing reports on that monitoring in the coming years. We also understand that EGLE will be soliciting public comments on the proposed removal of Fish and Wildlife BUIs and will look forward to hearing those comments.

Sincerely,

Mike Ripley, U.S. Chair
St. Marys River Binational Public Advisory Council

Cc: Lisa Derickx, St. Marys River Remedial Action Plan Coordinator
John Riley, RAP Coordinator, EGLE