

Little Rapids Habitat Restoration Project
Chippewa County, Michigan
Aquatic Habitat Restoration Narrative

Purpose

The primary goal of the Little Rapids Habitat Restoration feasibility project is to develop the engineering design necessary to modify the Sugar Island causeway to increase flow and velocities over historic rapids. The project specifically addresses the goals of the Remedial Action Plans for the St. Marys River Area of Concern (AOC), the Lake Superior Lakewide Management Plan, and the Lake Huron Binational Partnership Action Plan. This project will directly address the goals and objectives of the AOC and Habitat and Wildlife Protection and Restoration Focus Areas of the Great Lakes Restoration Initiative Action Plan. Ultimately, enhancements and improvements to the Little Rapids should increase populations of desirable fish species in the St. Marys River Area of Concern and contribute to the removal of the Degradation of Fish and Wildlife Populations and Loss of Fish and Wildlife Beneficial Use Impairments (BUIs).

Aquatic Habitat Restoration

Modification to the causeway will allow for greater movement of fish and other aquatic organisms through this section of the St. Marys River, as well as provide spawning and nursery habitat for migratory fish populations. To maximize the benefits of habitat restoration, suitable substrate, water depth, and water velocity must be available after modification to the causeway. Attainable high quality habitat will have some of the following characteristics: rough substrate; high water velocity; and adequate depths. According to various modeling scenarios, the water depth and substrate will not change significantly from their current state when restoration activities are implemented. The substrate will remain cobble/gravel and water depths will stay at 1 to 5 meters. Project alternatives will impact water velocity in the upper and lower Little Rapids through the number, size, and placement of culverts, arch structures, or bridge spans. The design goal is to maximize the acreage of rapids that contain a water velocity suitable for a maximum number of fish species to spawn.

Figure 1 portrays the water velocity ranges for fish species that could use the rapid habitat to spawn and are commonly found in the St. Marys River. Based on data available for the species present in the St. Marys River the optimal water velocity to restore to Little Rapids would be approximately 1.5 feet/second. This velocity would incorporate the optimal ranges for a large number of fish species. However, due to engineering and environmental constraints it may not be possible to achieve this velocity. A slightly slower velocity should also be suitable for a large number of the fish species. An attainable goal for restoration design should attempt to provide a minimum of 0.8 feet/second of current within the majority of the restored rapids. With an average water velocity of 0.8 feet/second, the spawning requirements for a majority of fish species will be met and other species requiring slower or faster current should be able to find

microhabitats within the Little Rapids suitable for spawning. Additionally, water velocity ranges for individual fish species depicted in **Table 4** and **Figure 1** are conservative values based off of 75% on the optimal spawning conditions. Fish species can successfully spawn in non-optimal habitat. A water velocity of at least 0.8 feet/second will allow for close to optimal spawning conditions for a variety of fish species and should be the target water velocity for restoration design.

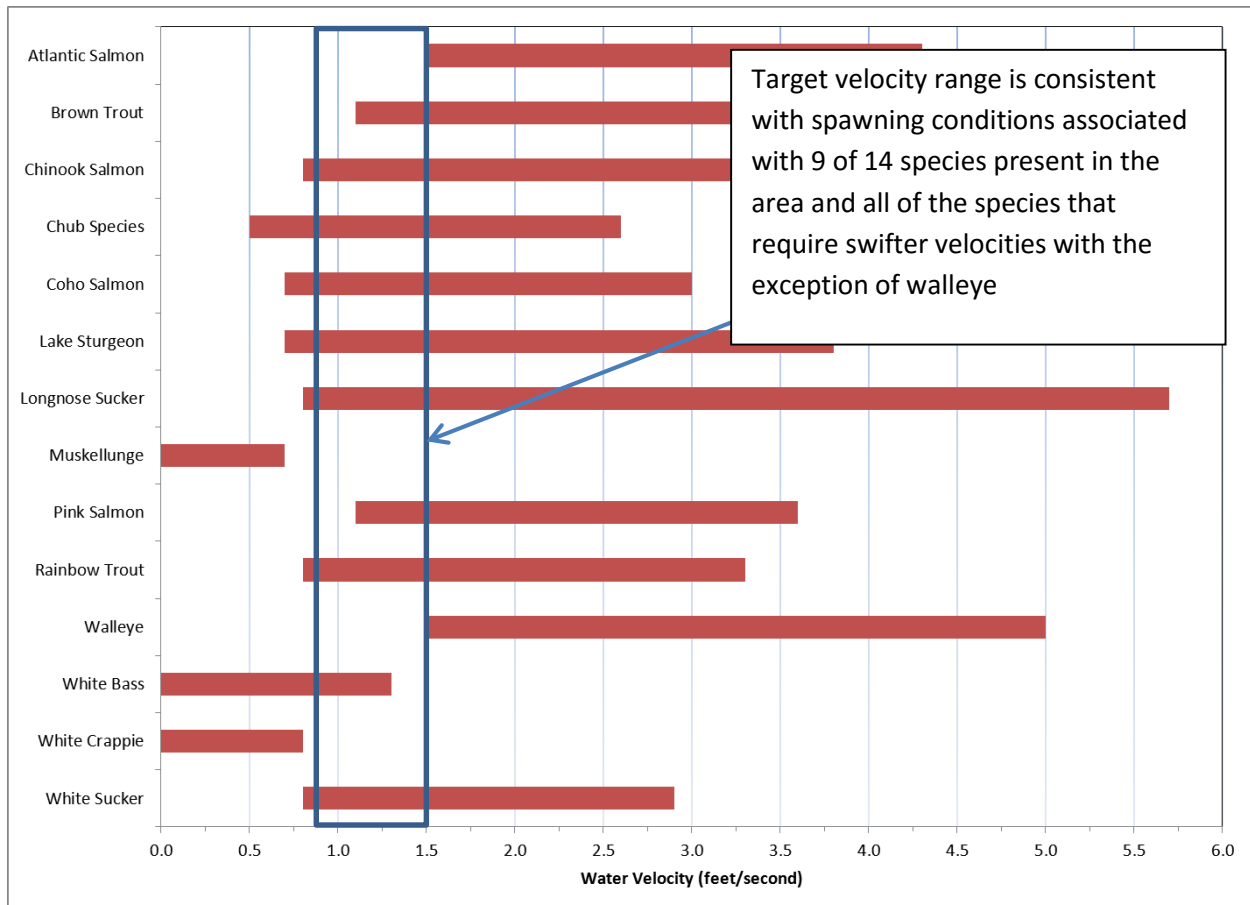


Figure 1: Water Velocities for Spawning St. Marys River Fish

St. Marys River Fisheries and Aquatic Organisms

As part of the Little Rapids Habitat Restoration feasibility project, data was collected from a variety of sources to generate lists of fish, benthic invertebrates, and herptiles (reptiles and amphibians) and determine whether these species could potentially be impacted by restoration activities. Sources included population assessments, past feasibility studies, and biological reports from the Michigan Department of Natural Resources (MDNR), U.S. Fish and Wildlife Service (USFWS), and Great Lakes Fishery Commission (GLFC). **Table 1** details the primary sources of data for completion of the preliminary aquatic habitat restoration design.

Table 1: Reference Documents		
Title	Author	Date
Atlas of the Spawning and Nursery Areas of the Great Lakes Fishes	USFWS	September 1982
The St. Marys River, Michigan: An Ecological Profile	USFWS	May 1987
Little Rapids Restoration Project Feasibility Study	Edison Sault Electric Company	July 1997
Fish Population Surveys of St. Marys River, 1975-95, and Recommendations for Management	MDNR	October 1998
St. Marys River Fisheries Assessment Plan	GLFC	March 2002
Population Dynamics of the St. Marys River Fish Community 1975-2002	GLFC	2002
Development of a GIS Model to Predict Muskellunge Spawning Habitat in Northern Wisconsin Lakes	Joel Nohner	April 2009
Screen Level Analysis of Velocity & Stage in the St. Marys River at Little Rapids Causeway	USFWS	January 2011
Habitat Suitability Index Models (for various fish species)	USFWS	Various
Spawning Habitat Suitability for Walleye and Lake Sturgeon in the Missisquoi River	USFWS	-

Table 2 depicts herptiles potentially existing within the Little Rapids area and indicates which species may be impacted when the slow-moving, backwater area is restored to a swift current, rapids habitat. Similarly, **Table 3** lists common benthic macroinvertebrates found within the St. Marys River and there associated habitats.

Table 2: Herptiles of the Little Rapids Area		
Common Name	Scientific Name	Potential Impact
Snapping Turtle	<i>Chelydra serpentina</i>	X
Wood Turtle	<i>Glyptemys insculpta</i>	X
Painted Turtle	<i>Chrysemys picta</i>	X
Northern Water Snake	<i>Nerodia sipedon</i>	
Eastern Garter Snake	<i>Thamnophis sirtalis</i>	
Northern Ribbon Snake	<i>Thamnophis sauritus septentrionalis</i>	

Table 2: Herptiles of the Little Rapids Area		
Common Name	Scientific Name	Potential Impact
Red-bellied Snake	<i>Storeria occipitomaculata occipitomaculata</i>	
Brown Snake	<i>Storeria dekayi</i>	
Ringneck Snake	<i>Diadophis punctatus edwardii</i>	
Smooth-green Snake	<i>Liochlorophis vernalis</i>	
Eastern Milk Snake	<i>Lampropeltis triangulum triangulum</i>	
Eastern Massasauga	<i>Sistrurus catenatus catenatus</i>	
Mudpuppy	<i>Necturus maculosus</i>	X
Eastern Newt	<i>Notophthalmus viridescens</i>	X
Blue-spotted Salamander	<i>Ambystoma laterale</i>	
Spotted Salamander	<i>Ambystoma maculatum</i>	
Red-backed Salamander	<i>Plethodon cinereus</i>	
Four-toed Salamander	<i>Hemidactylium scutatum</i>	
Eastern American Toad	<i>Bufo americanus</i>	
Northern Spring Peeper	<i>Pseudacris crucifer</i>	
Gray Treefrog	<i>Hyla versicolor</i> and <i>H. chrysoscelis</i>	
Green Frog	<i>Rana clamitans</i>	
Bull Frog	<i>Rana catesbeiana</i>	X
Northern Leopard Frog	<i>Rana pipiens</i>	
Pickerel Frog	<i>Rana palustris</i>	
Mink Frog	<i>Rana septentrionalis</i>	X
Wood Frog	<i>Rana sylvatica</i>	

Table 3: Benthic Macroinvertebrates of the Little Rapids Area			
Common Name	Scientific Name	Soft-Bottomed Habitat	Rapids
Oligochaete	<i>Ophidonais serpentina</i>	X	

Table 3: Benthic Macroinvertebrates of the Little Rapids Area

Common Name	Scientific Name	Soft-Bottomed Habitat	Rapids
Oligochaete	<i>Limnodrilus</i> sp.	X	
Oligochaete	<i>Pelosclex ferox</i>	X	
Amphipod	<i>Gammarus fasciatus</i>	X	
Amphipod	<i>Hyalella azteca</i>	X	X
Mayfly	<i>Hexagenia limbata</i>	X	
Mayfly	<i>Stenonema tripunctatum</i>		X
Mayfly	<i>Leptophlebia</i> sp.		X
Caddisfly	<i>Cheumatopsyche</i> sp.		X
Caddisfly	<i>Helicopsyche borealis</i>		X
Caddisfly	<i>Hydropsyche bifida</i>		X
Sand Fly	Ceratopogonidae	X	
Bloodworm/Midge	<i>Cryptochironomus</i> sp.	X	
Bloodworm/Midge	<i>Dicrotendipes</i> sp.	X	
Bloodworm/Midge	<i>Epoicocladius</i> sp.	X	
Bloodworm/Midge	<i>Larsia</i> sp.	X	X
Bloodworm/Midge	<i>Paratanytarsus</i> sp.	X	
Bloodworm/Midge	<i>Polypedilum</i> sp.	X	
Bloodworm/Midge	<i>Procladius</i> sp.	X	
Bloodworm/Midge	<i>Stictochironomus</i> sp.	X	
Bloodworm/Midge	<i>Tanytarsus</i> sp.	X	
Black Fly	<i>Simulium</i> sp.		X
Snail	<i>Amnicola</i> sp.	X	
Snail	<i>Physa</i> sp.	X	
Pea Clam	<i>Pisidium</i> sp.	X	
Fingernail Clam	<i>Sphaerium</i> sp.	X	

* Table includes only the most common invertebrates that occurred at > 50% of the habitat sampling locations.

A list of fish species compiled from the MDNR's *Population Dynamics of the St. Marys River Fish Community 1975-2002*, MDNR's *Fish Population Surveys of St. Marys River, 1975-95*, and *Recommendations for Management*, and the GLFC's *St. Marys River Fish Assessment Plan (2002)* is shown in **Table 4**. The table also includes suitable spawning conditions for each fish species including substrate, water depth, and water velocity. Information for spawning habitat was taken from the USFWS's Habitat Suitability Index (HSI) Models for each individual fish species. Spawning conditions were recorded for only species of interest and those with available HSI models. Additionally, all spawning habitat parameters are conservative and depict 75% of optimal conditions, species can spawn in non-optimal habitat.

Table 4: Fish Species of the St. Marys River

Common Name	Scientific Name	Spawning Substrate	Spawning Current	Spawning Depth
Alewife	<i>Alosa pseudoharengus</i>	mud, silt, or soft material containing detritus or vegetation	sluggish	15 cm - 3 m (5.9 in - 9.8 ft)
Atlantic Salmon	<i>Salmo salar</i>	gravel, cobble	47 - 85 cm/s (1.5 - 2.8 ft/s)	0.15 - 0.5 m (0.49 - 1.6 ft)
Black Crappie	<i>Pomoxis nigromaculatus</i>	soft mud, vegetation, sand, gravel	< 15 cm/s (0.5 f/s)	shallow
Bloater	<i>Coregonus hoyi</i>			
Bowfin	<i>Amia calva</i>			
Brook Trout	<i>Salvelinus fontinalis</i>	gravel, rubble, boulders	22.5 - 67.5 cm/s (0.7 - 2.2 ft/s)	> 33 cm (1.1 ft)
Brown Bullhead	<i>Ictalurus nebulosus</i>			
Brown Trout	<i>Salmo trutta</i>	rubble, boulders, vegetation	35 - 75 cm/s (1.1 - 2.5 ft/s)	12.2 - 91.4 cm (0.4 - 3.0 ft)
Burbot	<i>Lota lota</i>			
Channel Catfish	<i>Ictalurus punctatus</i>	rubble, gravel, boulders	< 20 cm/s (0.66 ft/s)	≤ 5 m
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	gravel	0.25 - 0.9 m/s (0.8 - 3.0 ft/s)	≥ 0.2 m - ≤ 7 m (0.66 ft - 23.0 ft)
Chub spp.	<i>Coregonus</i> sp.	gravel, rubble, boulders	15 - 65 cm/s (0.50 - 2.1 ft/s)	0.25 - 1.1 m (0.8 - 3.6 ft)
Coho Salmon	<i>Oncorhynchus kisutch</i>	gravel and rubble	21 - 70 cm/s (0.7 - 2.3 ft/s)	> 15 cm (0.5 ft)
Common Carp	<i>Cyprinus carpio</i>	mud, silt, vegetation	≤ 20 cm/s (0.65 ft/s)	0.45 - 1.3 m (1.5 - 4.3 ft)
Freshwater Drum	<i>Aplodinotus grunniens</i>			
Gizzard Shad	<i>Dorosoma cepedianum</i>	vegetation, rocks	≤ 2.5 cm/s (0.1 ft/s)	0.3 - 1.6 m (1.0 to 5.2 ft)
Johnny Darter	<i>Etheostoma nigrum</i>			
Lake Herring	<i>Coregonus artedii</i>	gravel, stone	moderate water velocity	0.9 - 12.2 m (3 - 40 ft)
Lake Sturgeon	<i>Acipenser fulvescens</i>	gravel, cobble, boulder	22.5 - 95 cm/s (0.7 - 3.1 ft/s)	0.6 - 4.6 m (2 to 15 ft)
Lake Trout	<i>Salvelinus namaycush</i>	cobble, gravel	Not usually found in rivers, except for tributaries of Lake Superior	0.5 m - 55 m (1.6 - 180 ft)

Table 4: Fish Species of the St. Marys River

Common Name	Scientific Name	Spawning Substrate	Spawning Current	Spawning Depth
Lake Whitefish	<i>Coregonus clupeaformis</i>	sand, gravel, cobble, stone	can spawn with and without current	est. 2.0 - 2.5 m (6.6 to 8.3)
Longnose Gar	<i>Lepisosteus osseus</i>			
Longnose Sucker	<i>Catostomus catostomus</i>	gravel, rocks	0.25 - 1.5 m/s (0.8 - 4.9 ft/s)	7 - 42 cm (0.2 - 1.4 ft)
Menominee	<i>Prosopium cylindraceum</i>	sand, gravel, cobble, stone	slow to fast current	0.7 - 2.5 m (2.3 - 8.3 ft)
Mottled Sculpin	<i>Cottus bairdi</i>			
Muskellunge	<i>Esox masquinongy</i>	sand with vegetation	21 cm/s (0.7 f/s)	0.9 - 1.8 m (3 - 6 ft)
Ninespine Stickleback	<i>Pungitius pungitius</i>			
Northern Hogsucker	<i>Hypentelium nigricans</i>			
Northern Pike	<i>Esox lucius</i>	vegetation	< 5 cm/s (0.2 ft/s)	< 0.5 m (1.6 ft)
Pink Salmon	<i>Oncorhynchus gorbuscha</i>	gravel	35 - 75 cm/s (1.1 - 2.5 ft/s)	0.2 - 0.7 m (0.65 - 2.3 ft)
Pinook	<i>Oncorhynchus tshawytscha</i> x <i>Oncorhynchus gorbuscha</i>			
Rainbow Smelt	<i>Osmerus mordax</i>			
Rainbow Trout	<i>Oncorhynchus mykiss</i>	gravel	25 - 75 cm/s (0.8 - 2.5 ft/s)	approx. 15 cm (0.5 ft)
Redhorse spp.	<i>Moxostomaspp.</i>			
Rock Bass	<i>Ambloplites rupestris</i>			
Round Goby	<i>Neogobius melanostomus</i>			
Sea Lamprey	<i>Petromyzon marinus</i>	sand, gravel, rock	0.6 - 1.5 m/s (2.0 - 5 ft/s)	≥ 3.7 m (12 ft)
Slimy Sculpin	<i>Cottus cognatus</i>			
Smallmouth Bass	<i>Micropterus dolomieu</i>	stone, rock, and gravel	very slow current	0.3 - 0.9 m (1.0 - 3.0 ft)
Splake	<i>Salvelinus fontinalis</i> x <i>Salvelinus namaycush</i>			
Spottail Shiner	<i>Notropis hudsonius</i>			
Sunfish spp.	<i>Lepomis spp.</i>			

Table 4: Fish Species of the St. Marys River

Common Name	Scientific Name	Spawning Substrate	Spawning Current	Spawning Depth
Tiger Musky	<i>Esox lucius x Esox masquinongy</i>			
Trout-perch	<i>Percopsis omiscomaycus</i>			
Walleye	<i>Stizostedion vitreum</i>	gravel, rubble	0.5 - 1.1 m/s (1.5 - 3.5 ft/sec)	0.3 m - 1.5 m (1.0 - 4.9 ft)
White Bass	<i>Morone chrysops</i>	rock, gravel, firm sand, vegetation	≤ 0.4 m/s (1.3 ft/s)	0.3 - 3.0 m (1.0 - 9.8 ft)
White Crappie	<i>Pomoxis annularis</i>	clay, dirt, or gravel	≤ 24 cm/s (0.8 ft/s)	10 - 420 cm (0.3 - 13.8 ft)
White Perch	<i>Morone americana</i>			
White Sucker	<i>Catostomus commersoni</i>	coarse sand, gravel	25 - 65 cm/s (0.8 - 2.1 ft/s)	10 - 30 cm (0.3 - 1.0 ft)
Yellow Perch	<i>Perca flavescens</i>	vegetation	< 5 cm/s (0.2 ft/s)	1.0 m - 3.7 m (3.3 - 12.1 ft)