ST. MARYS RIVER

AQUATIC HABITAT FEASIBILITY STUDY

March 17, 2015

Government Gouvernement of Canada du Canada









The Study Team

Morrison Hershfield (MH) was the lead consultant for the St. Marys River Aquatic Habitat Feasibility Study, filling the roles of Project Manager and Senior Fisheries Biologist.

PARISH Aquatic Services, a division of Matrix Solutions Inc., led the geomorphic and hydraulic assessments for the study.

R & M Construction served as the specialized watercourse construction Contractor who provided constructability reviews as well as costing for the various enhancement/restoration options.



Additional study team support:





Environment Canada





Garden River First Nation



Batchewanwa First Nation

Batchewana First Nation of Ojibways



Feasibility Study Goals



Physical Feasibility

Ecological Feasibility

Economic Feasibility

Creating New Habitats

Augmenting Existing Habitats

St. Marys River

St. Marys River Rapids

St. Marys River Tributaries



Study Area

St. Marys River Sites

SMR Rapids

Whitefish Island

Brookfield Tailrace & Fort Creek Confluence

SSM Waterfront & St Joseph Island

St. Marys River Tributary Sites

Big and Little Carp River West Davignon Diversion Channel

Fort Creek

Root River

Garden River

Echo River

Bar River







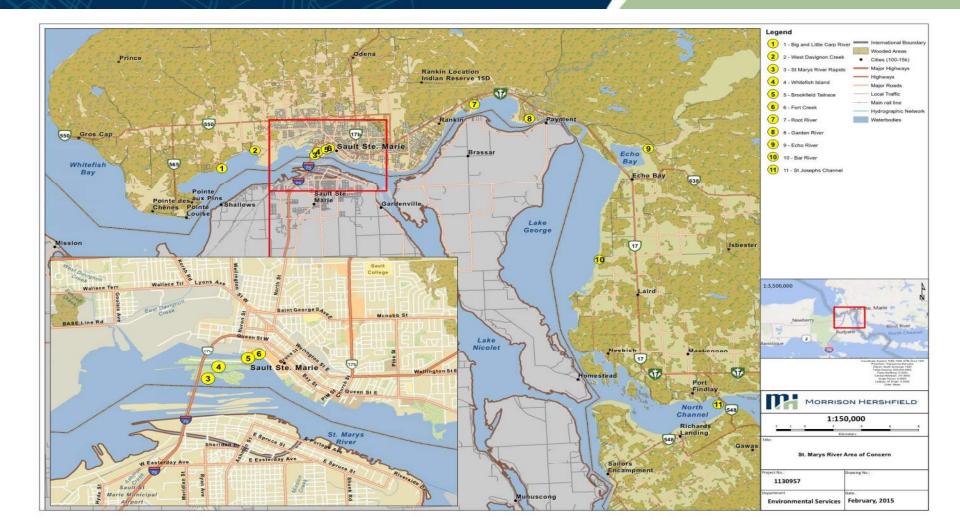






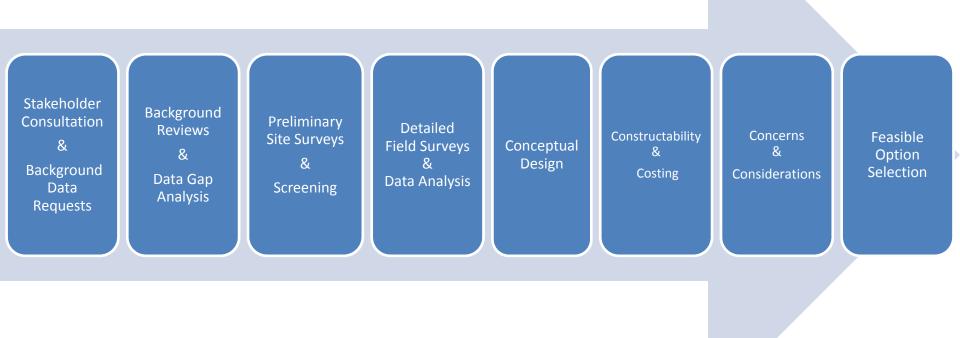


Study Area





Methodology





Stakeholder Consultation

Environment Canada led consultations with the following stakeholders in an effort to collect any new or notable information on the SMR/AOC

Ministry of Natural Resources and Forestry (MNRF)

Fisheries and Oceans Canada (DFO)

Environment Canada (EC)

Sault Ste. Marie Region Conservation Authority (SSMRCA)

City of Sault Ste. Marie

U.S. Army Corps of Engineers (USACE)

Batchewana First Nation

Garden River First Nation



Background Data Analysis





Data Gaps

Data gaps which may require further research or field based studies to properly address habitat restoration/enhancements within the SMR.

Limited topographic mapping

Lack of specific fisheries data

Lack of fish habitat mapping

Limited detailed bathymetry data/mapping

Lack of studies to support the link between wetlands and the rapids

Understanding of impacts from compensating gate configuration

Incomplete reports/data/studies

Lack of flow pattern data, velocity and depth information for the rapids

Sediment, rock and boulder movement data does not exist

Preliminary Site Screening

Each site was evaluated in terms of a general approach of enhancing aquatic habitat through the development of a stable, self-maintaining system with hydraulic variability and appropriate structure.



Ecological Parameters (Ecological)

- Fish Community
- Fisheries Dependence on Habitats
- Water Quality



Geomorphic Parameters (Physical)

- Flow Regime
- Reach Slope



Habitat Enhancement Potential



Proximity of Reach and Benefit to SMR AOC



Preliminary Site Screening

Highly representative of criteria

Moderately representative of criteria / More data required to determine

Not suitable for criteria

	GEOMORPHOLGCAL		F	ISH AND FISH HABITA	т	Habitat	Proximity of Reach	CARRY FORWARD	
SMR AREA OF STUDY	Flow Regime	Slope of Reach	Fish Community Fisheries Dependence on Habitat Present		Water Quality Enhancement Potential		& Direct Benefit to SMR AOC	ASSESSMENTS YES / NO	
Big Rapids (north of Fish Berm)	•	•	•	•	•	0	•	YES	
Whitefish Island	•	•	۲		•	•	٠	YES	
Brookfield Tailrace/Fort Creek Confluence	•		•	0	•	0	•	YES	
St. Joseph Channel	0	0	•	0	0		0	®	
SMR Tributaries									
Big and Little Carp Rivers	•		•	0	\bigcirc		0	1	
West Davignon Creek (between SMR and Baseline Rd)	•	0	•	•	•	•	0	YES	
Fort Creek (between SMR and Queen St)		0	0	0	\bigcirc	•	•	YES	
Root River (between SMR and Highway 17B)				0	\bigcirc		0	®	
Garden River (between SMR and Highway 17B)	•			•	•	0		YES	
Echo River	•	•	•	0	\bigcirc			N	
Bar River			•	•	0		0	®	

Detailed Field Investigations & Analysis







Fish

Community



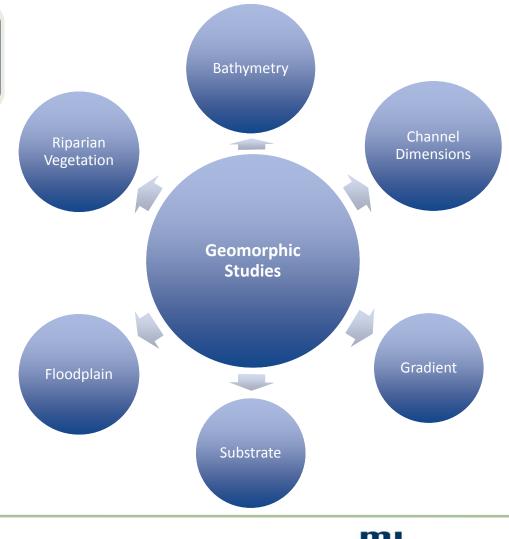




Detailed Field Investigations & Analysis

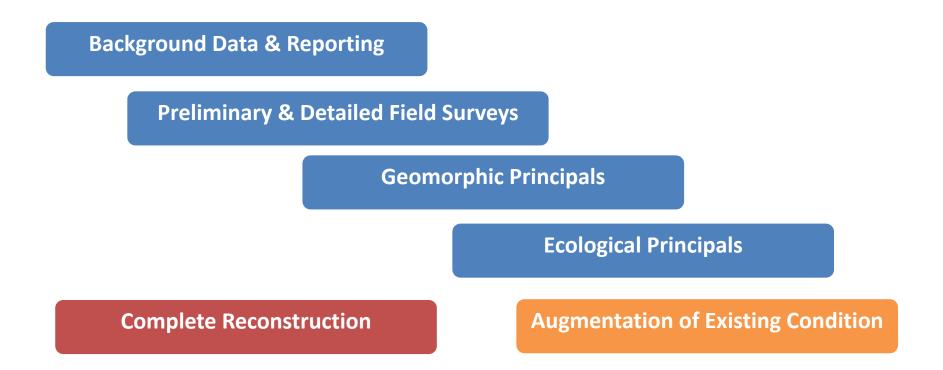
Physical Field Surveys Studied 6 Major Components





Conceptual Designs

Conceptual Designs were developed using:





Conceptual Designs

Conceptual Design Considerations:

Developed for Consideration & Planning Discussions

In-depth Field Investigations Required

Property and Site Access Permissions

Social and Community Impacts

Stakeholder Concerns

Funding



Big Rapids

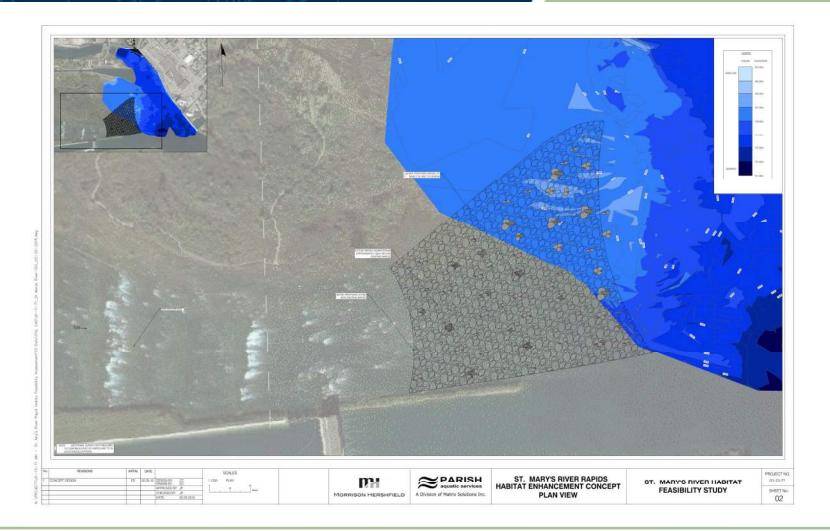
The approach was to augment the existing rapids to increase the available area for spawning and other habitat uses and enhance productivity and distribution of benthic invertebrates.

Conceptual Design Details

- Existing rapids would be extended at its downstream limits
- Graded to concentrate flows to middle of structure
- Stone mix would vary in size
- Large stone to act as structural component
- The mid to lower sized stone have suitable void ratio to limit through flow (piping) and provide spawning habitat
- To avoid excessive piping and enhance habitat availability for benthic invertebrates, the voids would be filled with smaller stone material (coarse gravels and small cobbles)



Big Rapids





Brookfield Tailrace & Fort Creek Confluence

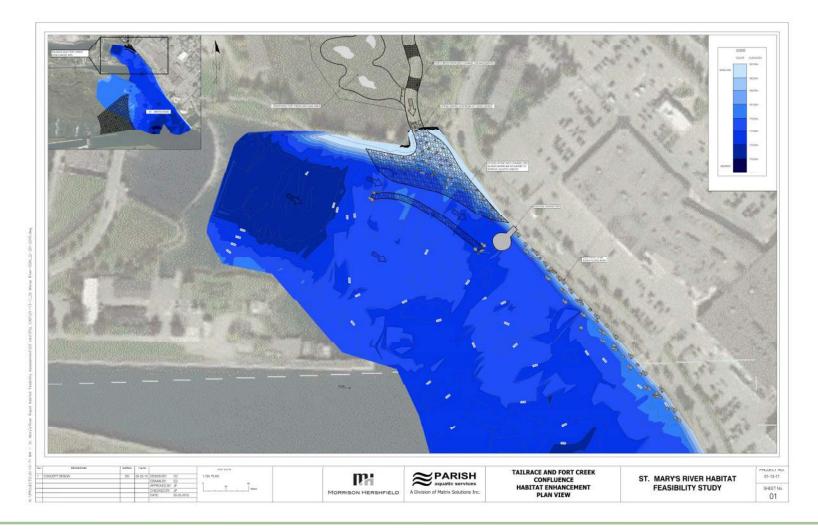
True rapids habitats not possible within tailrace due to high velocities, substantial water depths and fluctuating ramping rates from hydro facility Shallow backwater area at Fort Creek confluence provides opportunity to install stone on channel bed to mimic rapids-like substrate

Conceptual Design Details

- A stone berm would be created near the confluence to direct flows.
- Boulder clusters/rock piles would provide additional roughness, habitat cover opportunities and habitat variability for both fish and other aquatic organisms.
- Stone mix in nearshore areas would provide roughness and habitat for fish and also serve to reduce the scour potential along boardwalk.
- Stone mix installed so thickness and width varies to ensure increased variability of the treatment.
- Due to flow disturbance during placement of rock, natural variability in shape and thickness would naturally occur.
- Broader mix of stone sizes (likely 0.3 -1.0 m plus), variability would be achieved.



Brookfield Tailrace & Fort Creek Confluence





Whitefish Island & Channel

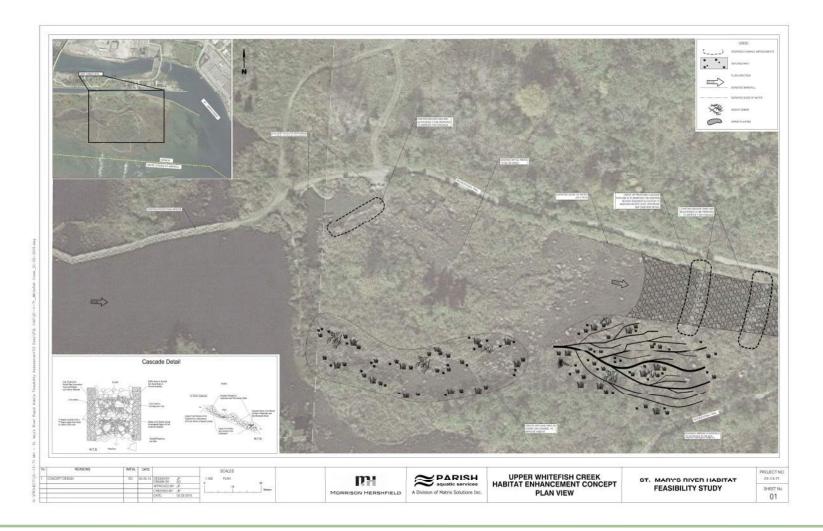
Whitefish Island can be segmented into two sections: (1) The downstream (east) section, the single channel, and (2) the upper (west) section which has braided wetland/channel features.

Conceptual Design Details

- Modification of the beaver dam/weir structures to improve fish passage and sediment transport.
- Channel bed and bank areas would be restored to a more natural condition including grading existing materials and seeding and planting to create a more natural transition area and provide additional aquatic habitat.
- Existing concrete/rock berms used to define the lower portion of the channel would be replaced with a soil berm with a stony core, planted with native shrubs and vegetation that would overhang the channel.
- Woody debris would be incorporated along the banks to provide additional cover habitat
- Wetland features would be created/enhanced on the east end of the island.
- Wetland creation would increase water retention, improve water quality, add nutrient rich soils which would result in a more diverse aquatic vegetation community to improve fish, benthic invertebrate and wildlife habitat.

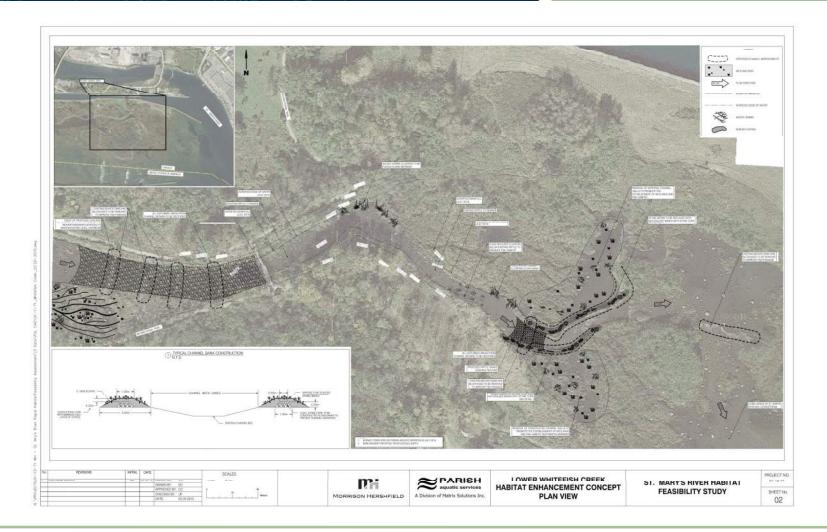


Whitefish Island & Channel





Whitefish Island & Channel





Fort Creek

The conceptual design proposed for Fort Creek is limited to a short reach between the railway crossing immediately south of Bay Street and the confluence with the SMR.

Conceptual Design Details

- Re-alignment of channel to improve channel sinuosity, improve geomorphic function, diversify habitats, create variability in flow depth and velocity and increase dissolved oxygen.
- Bank treatments to promote dense overhanging vegetation growth to provide nearshore foraging and cover opportunities as well as to stabilize channel banks.
- At the confluence of Fort Creek and SMR, a rocky feature which would mimic a natural rapids area is proposed.
- Creation of a wetland complex connected to the channel via a series of overflow points that would act as flood control.
- Wetland graded to have a broad, hummocky profile to provide variability for supporting a broad range of vegetation types and support spawning activity of northern pike and bass species.
- Wetland and surrounding lands planted with trees, shrubs and aquatic herbaceous species that would provide additional benefits to the currently abandoned land.
- Further enhancements could include public accessibility through the creation of pathways.

Fort Creek





West Davignon Diversion Channel

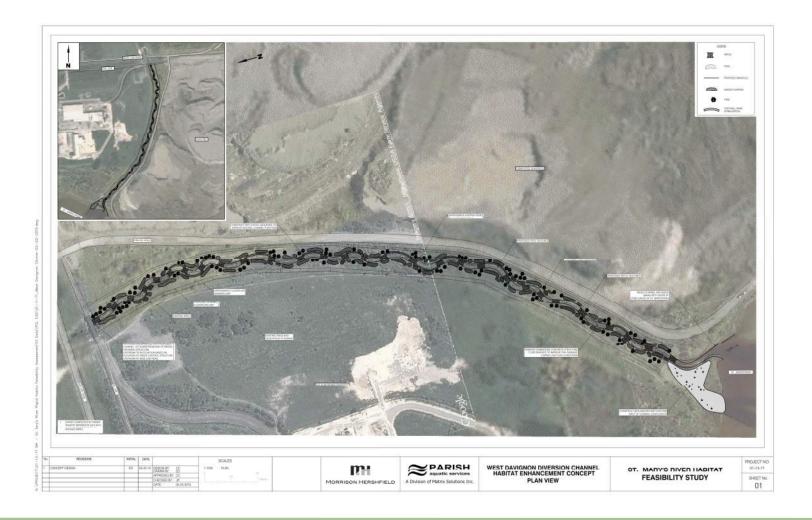
The overall strategy with the conceptual design is to improve the channel by restoring some of the natural functions lost when the channel was straightened and hardened.

Conceptual Design Details

- Natural channel design implemented from railway downstream to SMR.
- Due to the low gradient the bed would be raised gradually to the height of the grade control structure upstream of Baseline Road to increase energy and sediment transport.
- Riffles, pools, and improved cross-sectional form and capacity would promote more natural sediment transport.
- The improved bedforms would create pools for nursery and overwintering habitat and riffles for spawning and benthic invertebrate productivity.
- Bank treatments including Live Cribwalls and Brush Layering would provide long term bank stability and habitat opportunities.
- Planting of native species of trees, shrubs and forbs would provide stability, shading, nutrient and nearshore cover.
- Barriers (beaver dam/apron) would be removed to provide unobstructed fish passage.



West Davignon Diversion Channel





Garden River

Little opportunity for significant aquatic enhancement and/or restoration in lower Garden River

A/OFRC is entering the third year of a multi-year on-going study to determine distribution, spawning activity and habitat usage of lake sturgeon populations within the Garden River.

To date, important findings on the numbers and distribution of this species have been found including dispersal of larval lake sturgeon within lower Garden River.

This option was carried forward as a means to flag its importance for future considerations to both the SMR AOC, status of a threatened population of lake sturgeon and traditional importance of this fish species to the Garden River First Nation.



Economic Feasibility and Constructability

Constructability Review

- Determination if concept designs are constructible
- Insight into construction costs
- General feasibly of undertakings

General Assumptions

- Estimates of excavations
- Fill and stone quantities
- Proposed channel / treatment dimensions
- Limits of bank and bed treatments
- Access and permissions
- In-water timing restrictions

General Limitations

- Challenges of small vs. large scale projects
- Protection and mitigation measures
- Supply and delivery of materials
- Disposal facilities
- Experience of contactor undertaking work
- Unknown soil conditions



SMR AREA OF STUDY	Constructability Effort 1 – Low Effort 2 – Moderate Effort 3 - Challenging	Time to Construct Project*			Estimated Project Cost*				
		< 2 Months	2 - 6 Months	6 + Months	< \$100,000	\$100,000 to \$350,000	\$350,000 to \$750,000	\$750,000 to \$1.5 mil	\$1.5 mil +
Big Rapids	2		•						
Whitefish Island	3								
Brookfield Tailrace/Fort Creek Confluence	2	•						•	
West <u>Davignon</u> Creek (between SMR and Baseline Rd)	1	•						•	
Fort Creek (between SMR and Queen St)	1		•						٠



Big Rapids

- Very challenging site
- Significant amount of rock
- Material storage & delivery
- Barge access
- Substantial in-water works
- In-water timing restrictions
- High uncertainty
- Estimated cost between \$17M and \$19M









Whitefish Island

- Access questionable
- Disturbance to public areas
- Material storage areas
- Smaller equipment
- Archaeological surveys
- Community and BFN involvement
- Estimated cost between \$700K and \$900K









Brookfield Tailrace / Fort Creek Confluence

- Significant amount of rock
- Access dependent on permissions
- Depths and flows
- Use of barges
- Project overlap
- Flow fluctuations (hydro)
- In-water timing restrictions
- Disruption to recreational pursuits (fishing, pathways)
- Estimated cost between \$1M and \$1.4M









Fort Creek

- Complex project
- Flow control/management
- Good access
- Highly disturbed
- Significant excavations
- Community involvement
- Recreational development
- Possible soil contamination
- Estimated cost
 - No Soil Contamination \$2M to \$2.5M
 - Chemical/Hydrocarbon contamination \$8M to \$10M
 - PCB contamination \$25M to \$30M









West Davignon Diversion Channel

- Typical of natural channel design project
- Good site access (if permitted)
- Quality of sub-soils
- Soil contamination
- Flow control/management
- Existing flow controls (dams) may be an advantage
- Stakeholder approval/buy-in
- Low community benefit (isolated and inaccessible)
- Estimated cost between \$1M and \$1.2M







Concerns & Considerations

Potential challenges and limiting factors that may arise during implementation for the options being investigated:

Stakeholder concerns / Property

Substantial field studies required over a variety of disciplines

Site access for construction

Contamination of soils & water quality impairments

Disruption to recreational fishery and recreational pursuits

Hydrological considerations (compensating gates, hydro)

Difficulty in quantifying success of installed habitats for some designs

Increase in Sea Lamprey treatment areas

In-water work restrictions/timing

Creation of wetlands may lead to more ideal conditions for invasive species

Beaver activity may continue to alter and degrade habitats



Feasible Option Selection

The key to identifying a feasible option is finding a sound balance between all considerations in which:

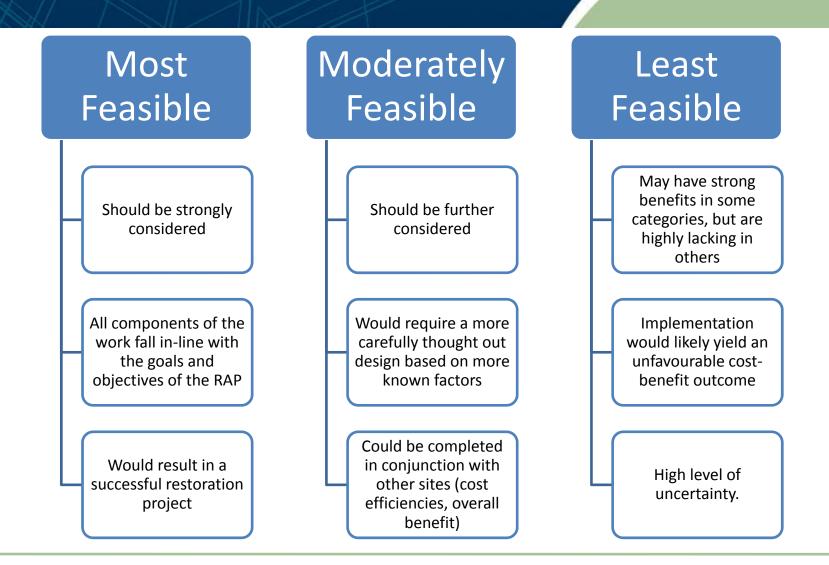
-ideal conditions exist;

-there will be a measurable benefit to the fishery and habitats with the SMR; and

-that the project cost is reflective of the anticipated results and overall goals within the RAP and AOC.



Feasible Option Selection





Results of Feasibility Analysis

CONCEPTUAL DESIGN	FE	ASIBLITY SELECTION F	OVERALL BENEFIT TO THE SMR AOC	OVERALL SCORE	
	Physical 1 - Marginal Benefit 2 - Improvement 3 - Significant Benefit	Ecological 1 - Marginal Benefit 2 - Improvement 3 - Significant Benefit	Economical* 1 - Not Cost Effective 2 - Moderately Cost Effective 3 - Cost Effective	1 – Low 2- Moderate 3- High	< 8 : Least Feasible 8 & 9 : Moderately Feasible 10 + : Most Feasible
Big Rapids – Creation of New Rapids Area at base of existing rapids (north of Fish Berm)	2	2	1	2	7
Whitefish Island Channel Modifications and Wetland Creation	2	3	3	3	11
Brookfield Tailrace/Fort Creek Confluence Rapids Habitat Creation	1	2	2	2	7
West Davignon Diversion Channel Reconstruction and Habitat Enhancements	3	2	2	1	8
Fort Creek Wetland Creation, Channel Realignment and Habitat Enhancements	3	3	1**	3	10

*Based on cost to construct as well as physical and ecological feasibility scoring **Cost analysis uncertain due to unknown factors (i.e. contamination)



Conclusion

Most Feasible Options is:

> Channel modification and enhancements, and wetland creation on Whitefish Island

> > Wetland creation, channel realignment, and habitat enhancements on Fort Creek.



Conclusion

The Whitefish Island project presents a unique situation within the study area.

Ability to build on historical enhancements and modifications to help restore natural function

Target species present, opportunity to increase overall health and productivity through low impact enhancements

Opportunity for multiple project and funding partners

Opportunity to enhance trails, viewing locations and trail signage for First Nation and public use Many opportunities to restore access to habitats and increase opportunities for fish and benthic invertebrates

Benefits of partnership with First Nations for traditional knowledge, land access and joining of goals and visions for Whitefish Island

Highly visible with excellent public exposure for AOC enhancements within a National Historic Site

In-line with goals outline in the RAP



THANK YOU

QUESTIONS?

morrisonhershfield.com





