

ONGOING DEVELOPMENT OF AN ENVIRONMENTAL DREDGING PROJECT ST. CLAIR RIVER, ONTARIO, CANADA

S. Hayter, R. Joyner, R. Santiago, L. Brown



June 2014



Environment
Canada

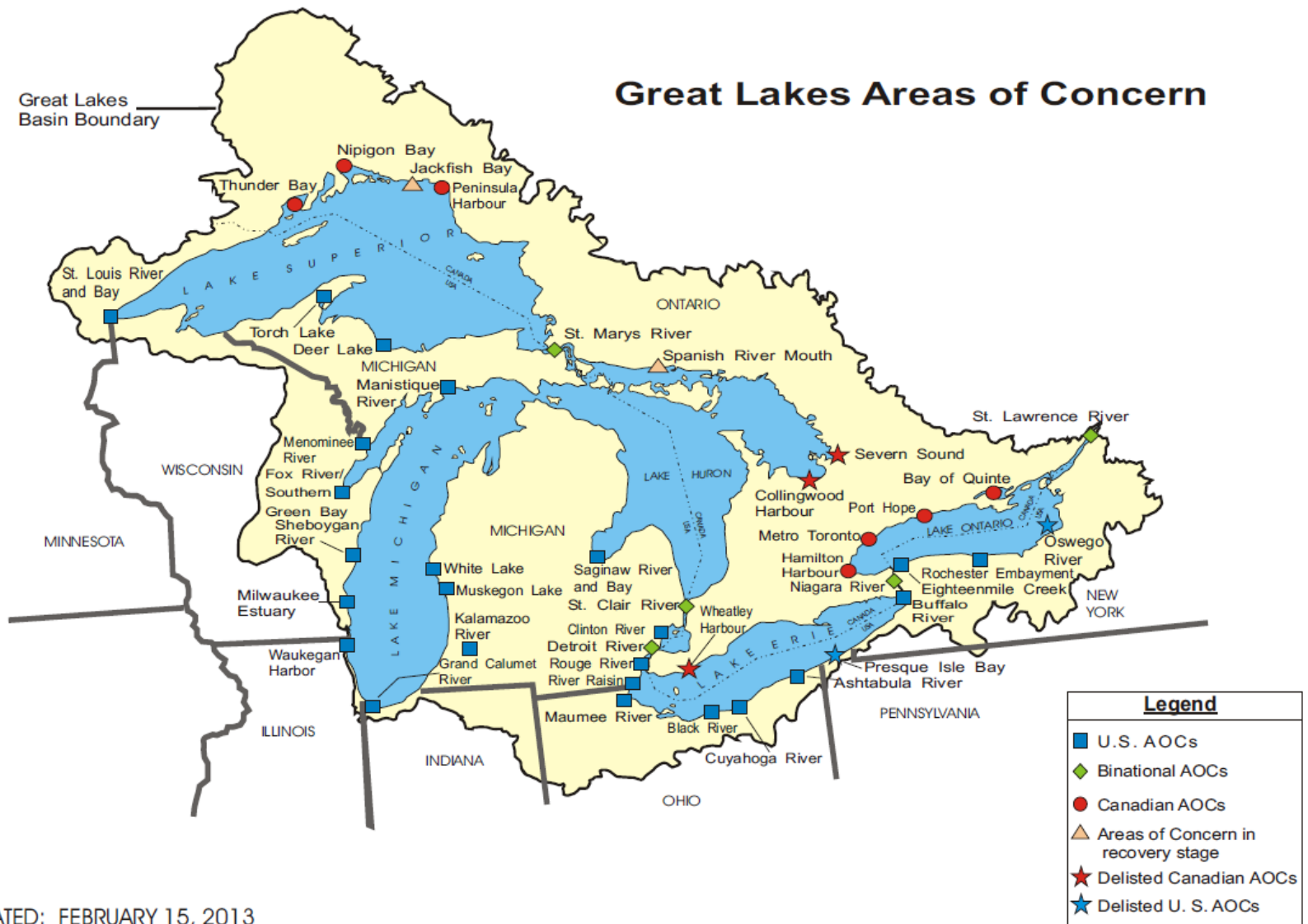


Presentation Overview

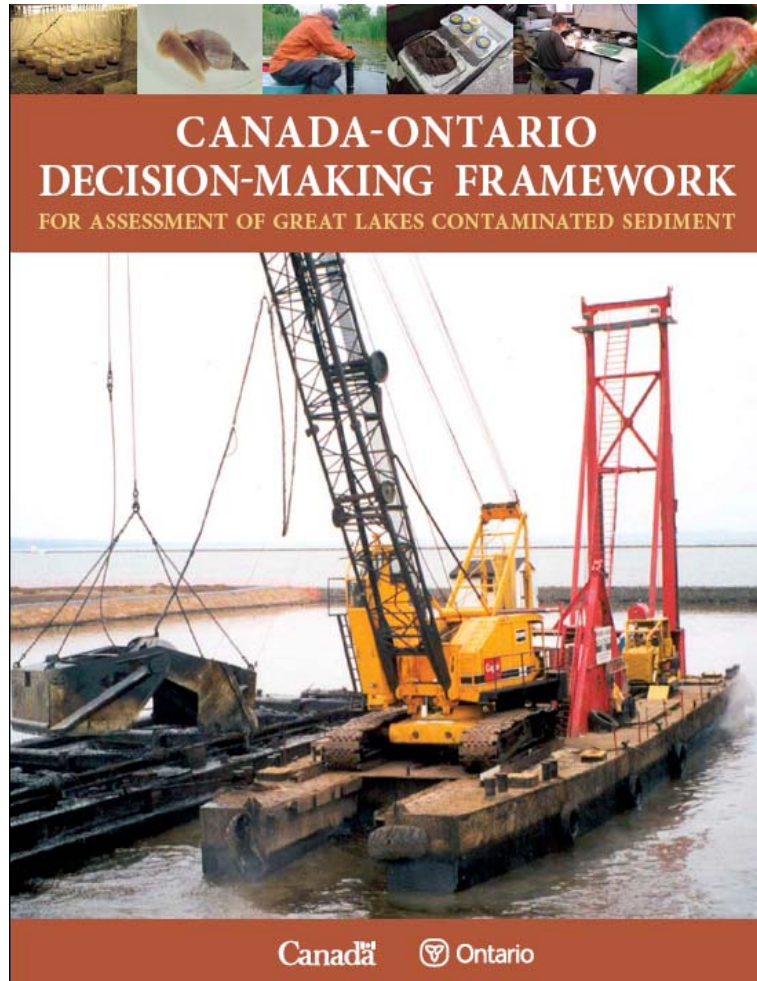
- St. Clair Area of Concern
- Risk Based Evaluation
- Priority Areas for Sediment Management
- Sediment Management Options
- Technical Considerations
- Decision Process
- Results of Sediment Management Options Evaluation



Areas of Concern

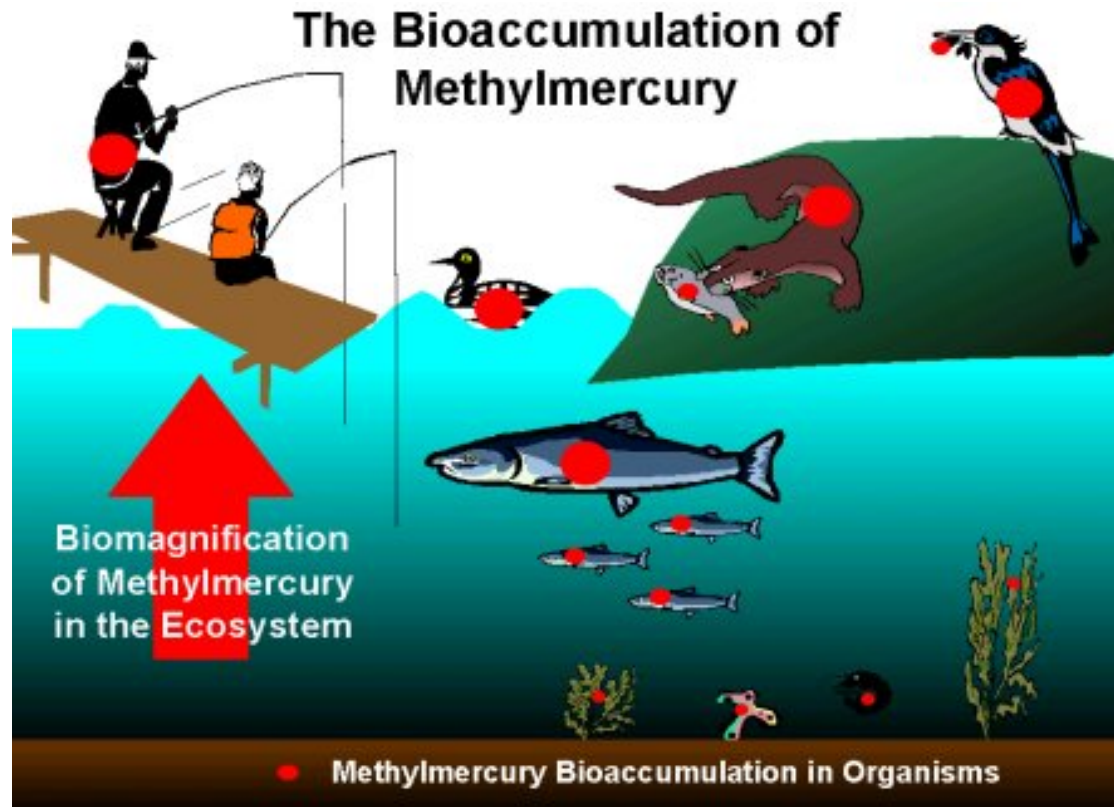


COA Sediment Assessment Decision Making Framework



- Standard approach to the decision-making process taking into account site specific considerations
- Uses four lines of evidence:
 - Chemistry
 - Toxicity
 - Community Structure
 - Biomagnification
- Results showed high sediment chemistry and risk of **biomagnification** in fish

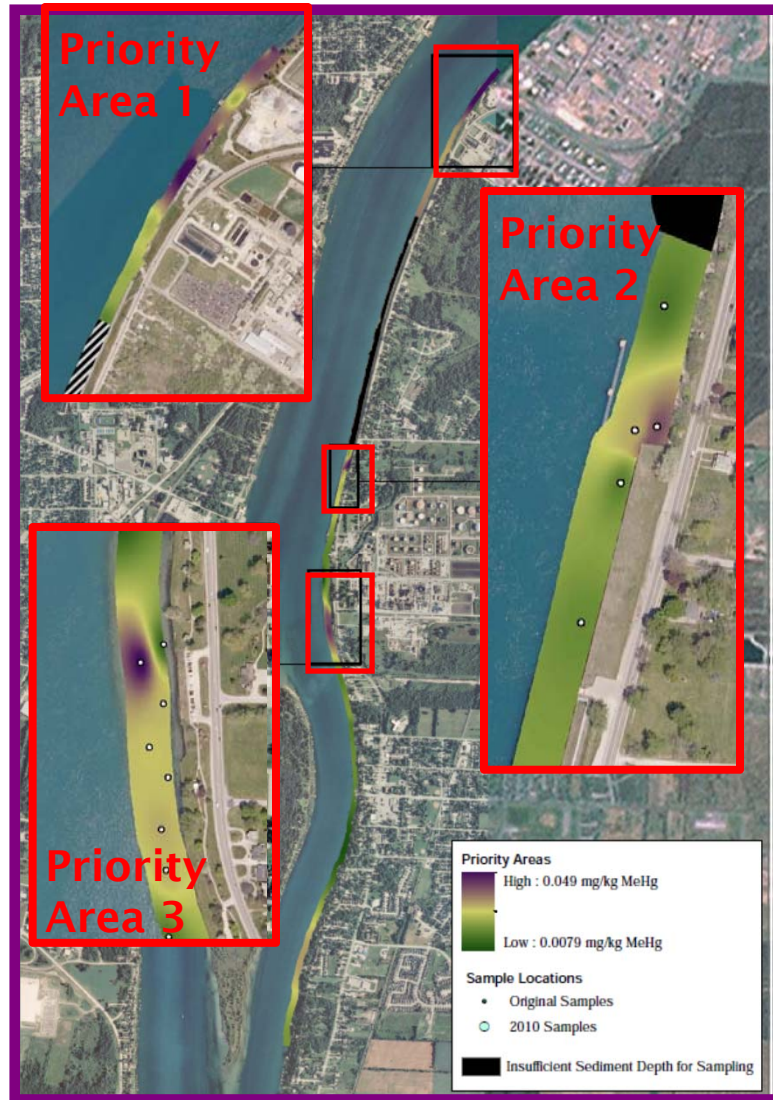
Methylmercury Biomagnification in Organisms



Priority Areas for Sediment Management

- Highest concentrations of mercury are in near shore locations where sediment has historically accumulated in deposits
- Deposits are located in quiet water areas behind dock structures and/or in shallow water
- Deposits are located down river from the historic source area
- Deposits are typically less than one meter thick
- Mercury impacted sediment deposits have been identified as priority areas for management

Priority Areas for Sediment Management



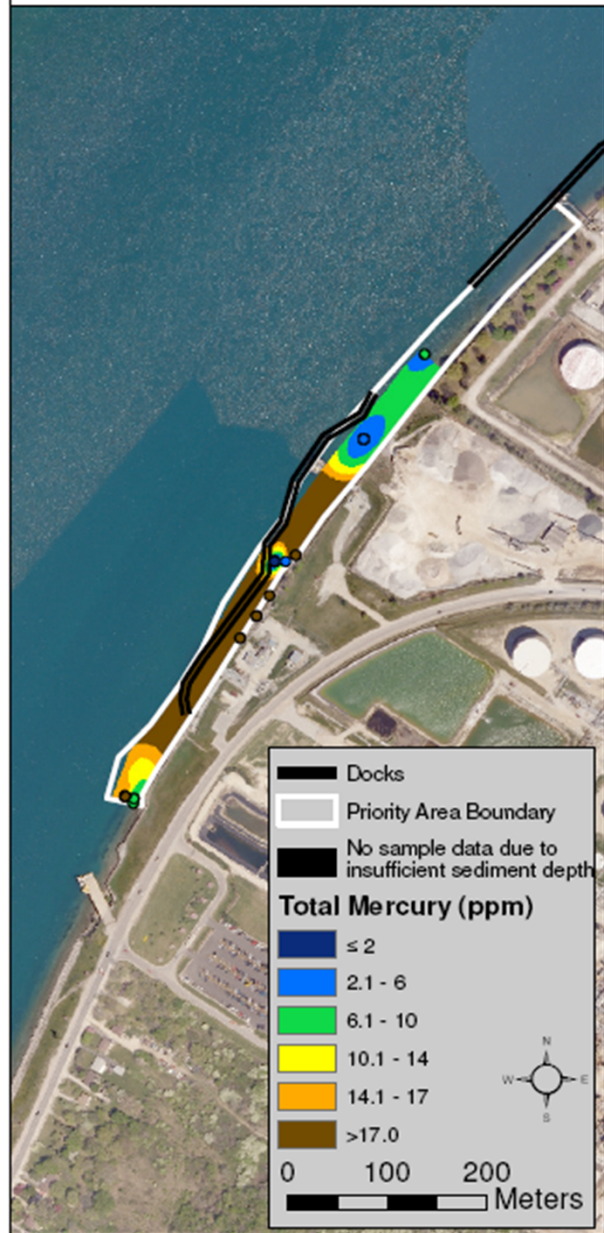
Three priority areas for management;

1. Priority Area 1 (26,400 m², 10,300 m³)
2. Priority Area 2 (8,900 m², 3,900 m³)
3. Priority Area 3 (32,600 m², 10,500 m³)

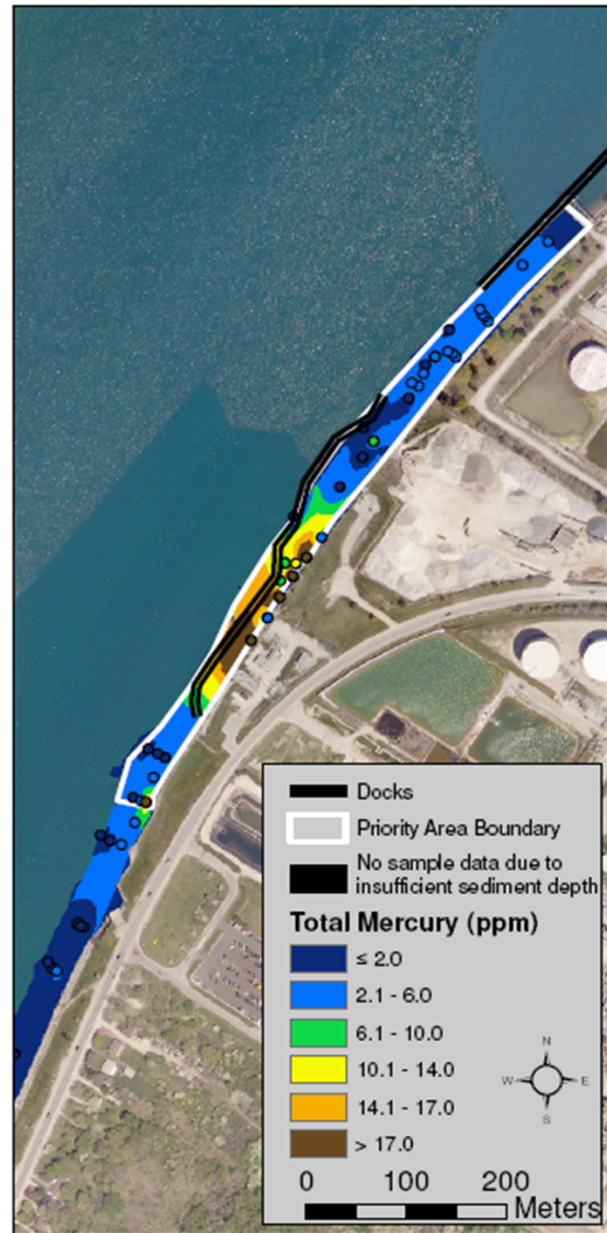
The total estimated area and volume to be managed are ~68,000 m², and ~25,000 m³

Priority Area 1

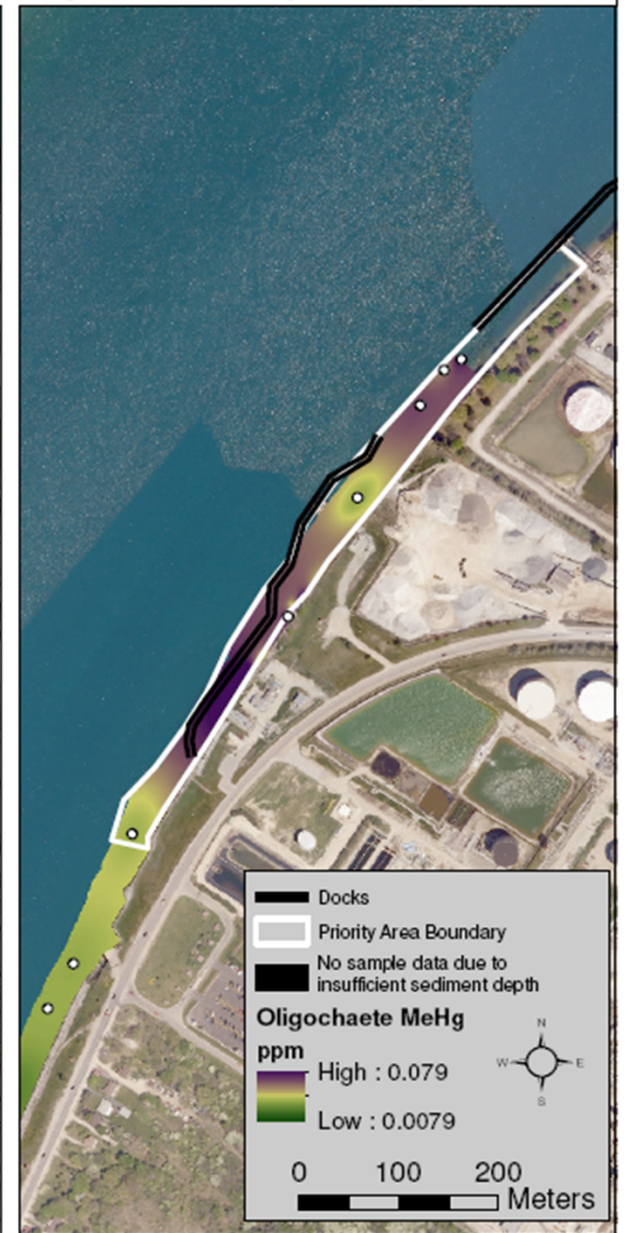
Subsurface Total Mercury



Surface Total Mercury

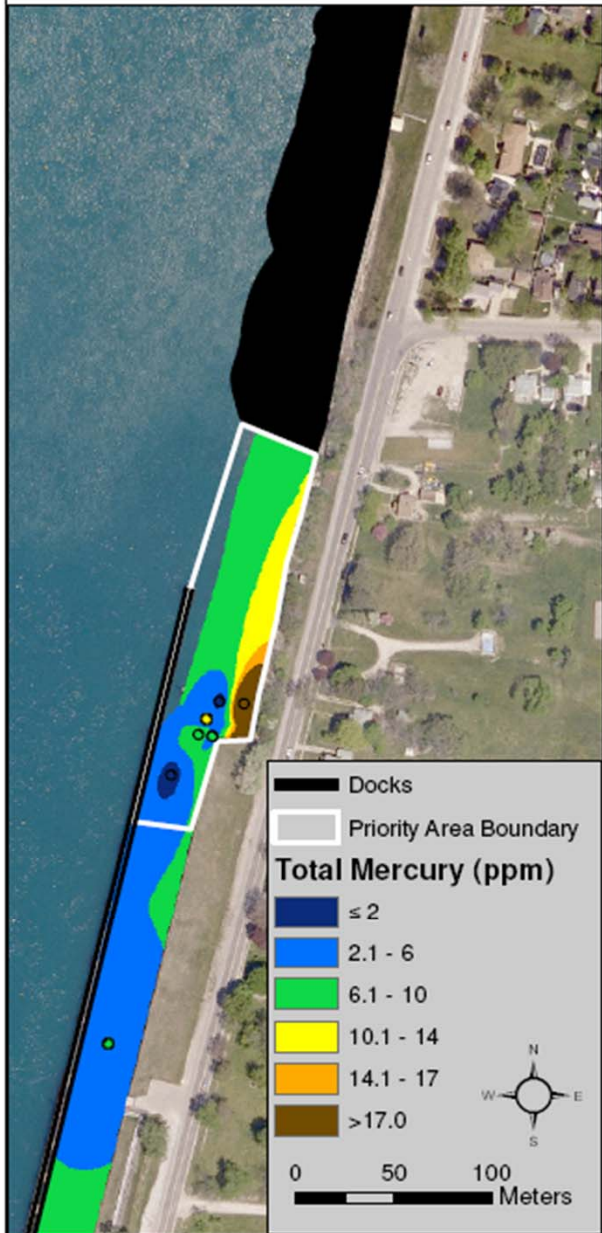


Oligochaete Methylmercury

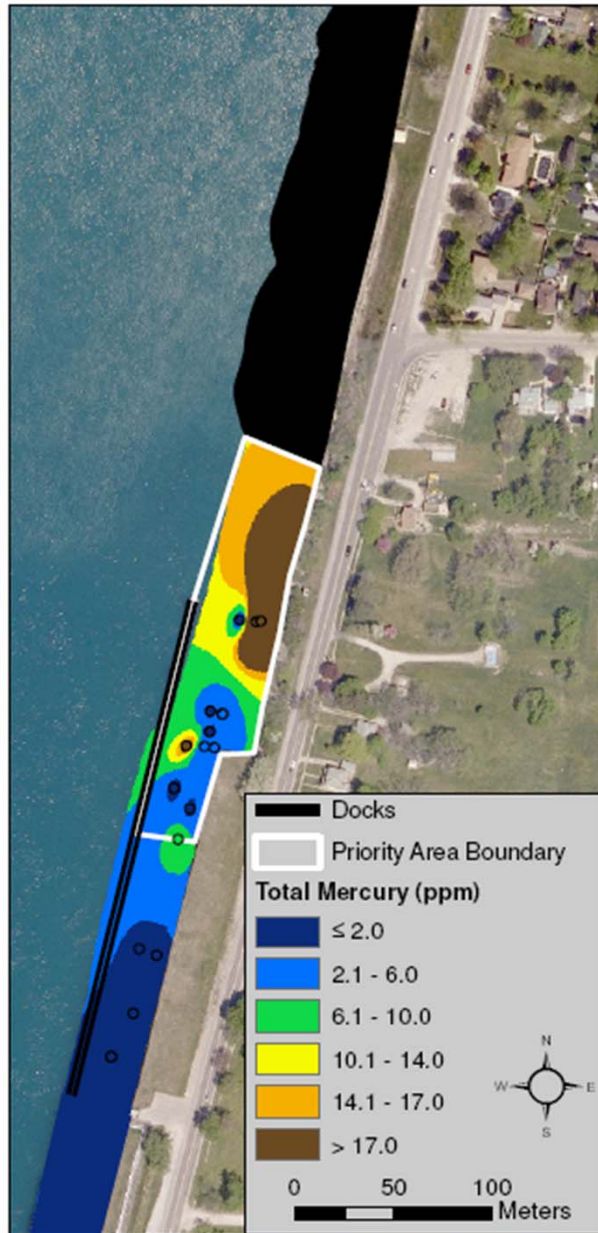


Priority Area 2

Subsurface Total Mercury



Surface Total Mercury

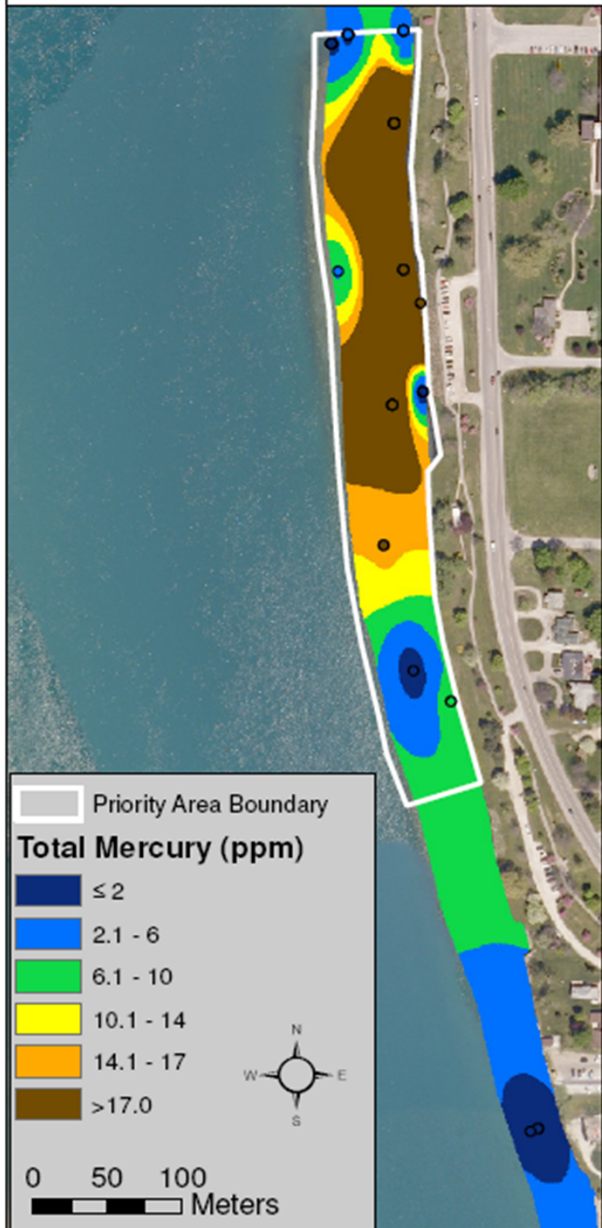


Oligochaete MeHg

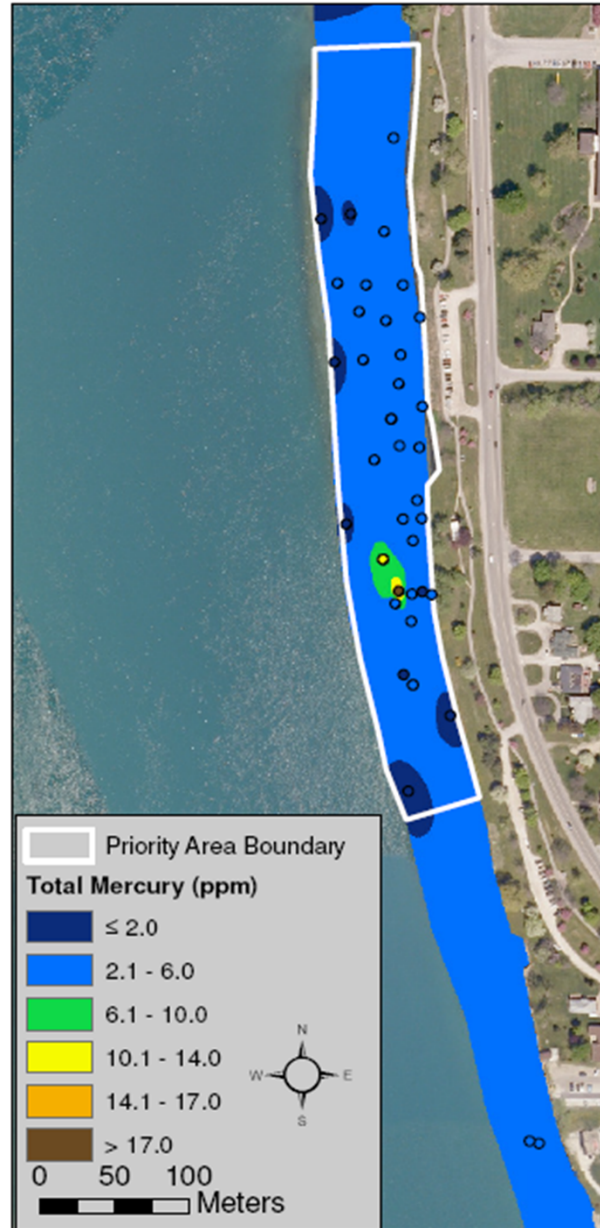


Priority Area 3

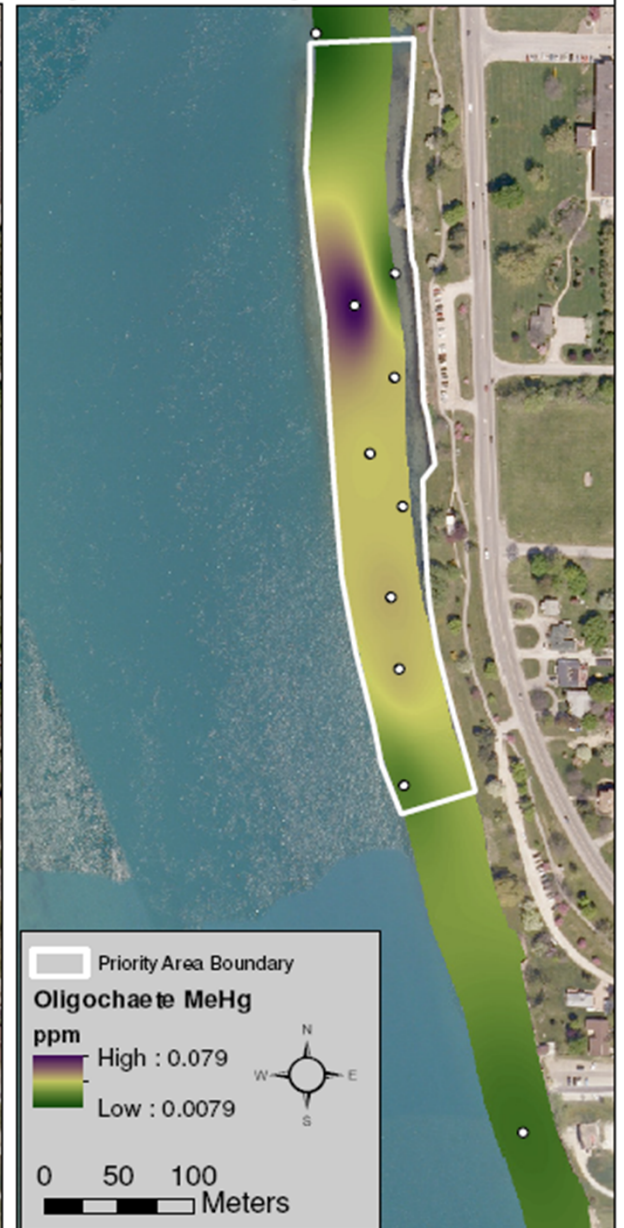
Subsurface Total Mercury



Surface Total Mercury



Oligochaete MeHg



Sediment Management Options

Monitored
Natural
Recovery

“Let Nature Do
Its Work”

Thin Layer
Capping



Isolation
Capping



Removal
(Dredging)



Sediment Management Option Process

- Identify and screen sediment management options
- Monitored Natural Recovery and Mechanical Dredging options screened out
- Hydraulic Dredging to include Post Dredging Thin Layer Backfill
- Evaluate and compare short-list of alternatives relative to selection criteria (effectiveness, feasibility and cost)
- Develop conceptual designs and costs for alternatives

What are the Pros and Cons of Each Option?

	Pros	Cons
Thin Layer Capping	<ul style="list-style-type: none"> ▪ Easy to perform ▪ Reduces exposure by burying & diluting ▪ Equivalent to years of natural sedimentation and mixing 	<ul style="list-style-type: none"> • Chemicals are not removed • Elevated concentrations may migrate to the surface
Isolation Capping	<ul style="list-style-type: none"> • Easy to perform • Permanently eliminates exposure • Immediate benefit to benthic community 	<ul style="list-style-type: none"> • Chemicals are not removed • Monitoring required • Reduces water depth • Requires a stable sediment bed to support cap
Hydraulic Dredging and Thin Layer Backfill	<ul style="list-style-type: none"> • Highest levels of chemicals are removed • Residuals are buried/diluted with a thin layer cap 	<ul style="list-style-type: none"> • Expensive • Implementation costs are uncertain • Dredged sediment needs to be dewatered, transported and disposed of

Sediment Management Options

Priority Area 1

- Isolation capping
- Hydraulic dredging followed by post-dredge thin layer backfill
- Blended Remedy - Dredging and Thin Layer Capping

Priority Area 2

- Isolation capping
- Hydraulic dredging followed by post-dredge thin layer backfill

Priority Area 3

- Isolation capping
- Hydraulic dredging followed by post-dredge thin layer backfill
- Blended Remedy - Dredging and Thin Layer Capping

Technical Considerations

Geographic Distance

- 3 priority areas located in different depositional zones of the river

High Flow

- High water flow due to the combined outlet of the upper and lower Great Lakes

Debris and Buried Utilities

- Highly developed industrial area and shipping corridor with buried debris and utilities

Access

- Limited area for staging, sediment handling, dewatering, and water treatment

Technical Considerations

Existing Infrastructure

- Steel docks in Priority Areas 1 and 2 with significant footprints

Local Weather Conditions

- Extended periods of ice cover/flow

Heavy Ship Traffic

- Delays and standby time for ship traffic and use of the docks

Permitting Restrictions

- In-water construction timing restrictions to protect fish spawning areas and egg incubation periods

Criteria Used to Select Sediment Management Options

1. Ability to achieve the sediment management goals with defined targets
2. Technical feasibility (reliability, timeline, and construction and operation requirements)
3. Community Preference
4. Environmental impacts and human health implications
5. Need for measures to control and address residual contamination
6. Requirements for chemical, biological, and/or physical monitoring
7. Compliance with regulatory requirements
8. Overall project costs

Decision Matrix for Technical Committee

Criteria	Description	Weight	Explanation for Weight	Priority Area 1			Priority Area 2		Priority Area 3			Comments
				Isolation Capping	Hydraulic Dredging	Blended Remedy	Isolation Capping	Hydraulic Dredging	Isolation Capping	Hydraulic Dredging	Blended Remedy	
1	Ability to achieve the sediment management goals with defined targets		The goals are to minimize methyl mercury biomagnification in fish, limit transport and re-exposure of mercury contaminated sediment, and remove mass sediment mercury contamination	2	Highest weight assigned since the ability to achieve the sediment management goals is not equivalent among the options and because achievement of these goals is most critical to the success of the project.							
2	Technical feasibility (reliability, timeline, and construction and operation requirements)		Timeline, and construction and operation requirements are expected to be equivalent for all options. The reliability of each option is expected to vary and should be the focus for this criteria.	1	Weight of 1 assigned since reliability is an important criteria, yet all options are expected to be reasonably reliable.							
3	Community Preference		To be based on verbal and written comments from public, including stakeholders	1.5	A higher than 1 weighting was assigned to reflect the importance of the community's preference.							
4	Environmental impacts and human health implications		The focus of this criteria is on the short-term negative environmental and human health impacts that may occur during remedy implementation	0.5	Lower weight assigned since the criteria focus is on short term impacts.							
5	Need for measures to control and address residual contamination		The focus of this criteria is on residual contamination remaining in the sediment after implementation	0.25	Lower weight assigned since all options mitigate residual contamination.							
6a	Requirements for chemical, biological, and/or physical monitoring		The focus of this criteria is on the cost and burden of responsibility for long term monitoring. Some options (e.g. dredging) have lower long term monitoring requirements	1	Lower weight assigned since the monitoring requirements, although perpetual, are not significant.							
6b	Requirements for maintenance		The focus of this criteria is on the cost and burden of responsibility for long term maintenance. Some options (e.g. dredging) have lower long term maintenance requirements	2	Highest weight assigned due to the potentially perpetual and significant requirements for maintenance.							
7	Compliance with regulatory requirements		Compliance with national, provincial, and local regulatory requirements. Neutral scores have been assumed since all options would be compliant with regulatory requirements	0.25	Lowest weight assigned since all options are expected to comply with regulatory requirements.							
8	Overall Project Costs		Cost of implementation and monitoring. Score pre-determined based on relative cost	1.5	A higher than 1 weighting was assigned to reflect the importance of the costs since the project will be publicly funded.							
Total Score												

Sediment Management Options Areas, Volumes, and Costs

	Priority Area 1	Priority Area 2	Priority Area 3
Area – square metres (m ²)	26,400	8,900	32,600
Volume – cubic metres (m ³)	10,300	3,900	10,500
Isolation Cap Cost	\$5,887,700	\$2,288,000	\$5,267,600
Hydraulic Dredge Option Cost	\$10,764,000	\$7,550,400	\$10,353,200
Blended Remedy – Hydraulic Dredging and Thin Layer Capping*	\$9,171,500	Not Applicable	\$9,419,800

Recommended remedy for all Priority Areas



QUESTIONS?