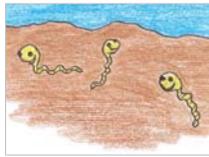


Hamilton Harbour Remedial Action Plan (HH RAP) Beneficial Uses

i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii	xiii	xiv
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**DEGRADATION OF BENTHOS**



**STATUS**

2002 Status	Impaired	Requires Further Assessment	Not Impaired
2012 Status	Impaired	Requires Further Assessment	Not Impaired

**APPROVED BY 2012 RAP STAKEHOLDER FORUM:**

- Beneficial Use vi status remain "impaired".
- Beneficial Use vi delisting objective wording be updated as follows:  
 Beneficial Use vi will be considered not impaired when remedial actions to address contaminated sediment have been implemented and follow-up monitoring demonstrates improved benthic community structure and a reduction in acute and chronic toxicity attributable to contaminants in Hamilton Harbour sediments relative to historical surveys.  
 Progress should continue to be made towards these desired outcomes:
  - Littoral Zone** (depth < upper limit of maximum extent of anoxic conditions)
    - Benthic community structure (BCS) is not different from that of appropriate reference conditions and BCS is not correlated to sediment contaminant levels among sites.
    - Acute and chronic sediment toxicity attributable to contaminants in sediments not different from appropriate reference conditions.
  - Profundal Zone** (depth > upper limit of maximum extent of anoxic conditions)
    - BCS is not correlated to sediment contaminant levels among sites.
    - Acute and chronic sediment toxicity attributable to contaminants in sediments not different from appropriate reference conditions.

**2002 HH RAP Delisting Objective:**

Using the BEAST (Benthic Assessment of Sediment) Methodology:

- Littoral Zone (depth < upper limit of maximum extent of anoxic conditions)
  - Benthic community structure (BCS) not different from that of appropriate reference sites in the Great Lakes (i.e., Hamilton Harbour sites determined as "equivalent to reference conditions" by BEAST methodology) and BCS not correlated to sediment contaminant levels among sites.
  - Absence of acute or chronic sediment toxicity attributable to contaminants in sediments.
- Profundal Zone (depth > upper limit of maximum extent of anoxic conditions)
  - BCS not correlated to sediment contaminant levels among sites.
  - Absence of acute or chronic sediment toxicity attributable to contaminants in sediments.

**Why Update the 2002 HH Wording?**

**Reasonable:** The primary goal of this Beneficial Use is to improve the benthic community numbers and diversity in comparison to historical records by completing sediment management plans for severely contaminated areas. The ultimate goal is to have populations across the whole Harbour similar to reference conditions which need to reflect HH's urban/industrial setting.

**Achievable:** Anticipate years of natural recovery after the last sediment project is completed before the desired outcomes are reached; however, the urban/industrial setting of HH will likely always show a stressed benthic community structure.

**Measurable:** BEAST is only one technique which can be used to evaluate benthos, so specific reference has been removed to focus on the endpoint, not the methodology used. EC scientists currently use a modified BEAST methodology which includes the division into littoral (shallow) and profundal (deep) zones to account for anoxia. External reference conditions representative of HH's urban/industrial setting will be challenging to find, so internal HH sites may potentially need to be used.

<b>BACKGROUND INFORMATION</b>	<p><b>What Was the Original Problem in Hamilton Harbour?</b></p> <p>The benthic communities in 1964 and 1984 were dominated by pollution-tolerant worms, but with improvements in the abundance and community composition over those 20 years (HHRAP 1992, p.85). Stress on the benthos was caused by toxic chemicals in the sediment and extended periods of low to no oxygen.</p>
	<p><b>Other AOC Comparisons:</b></p> <p>St. Clair River AOC, Detroit River AOC, Jackfish Bay AOC, St. Lawrence River AOC, and Niagara River AOC compare their site to reference site(s), but none directly refer to BEAST. A distinction between criteria for "dynamics of benthic populations"(i.e. field measurements) and "body burden of benthic populations" (laboratory tests) appears frequently.</p>

**IJC Listing Guideline (1991):**

When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment associated contaminants at a site is significantly higher than controls

**IJC Delisting Guideline (1991):**

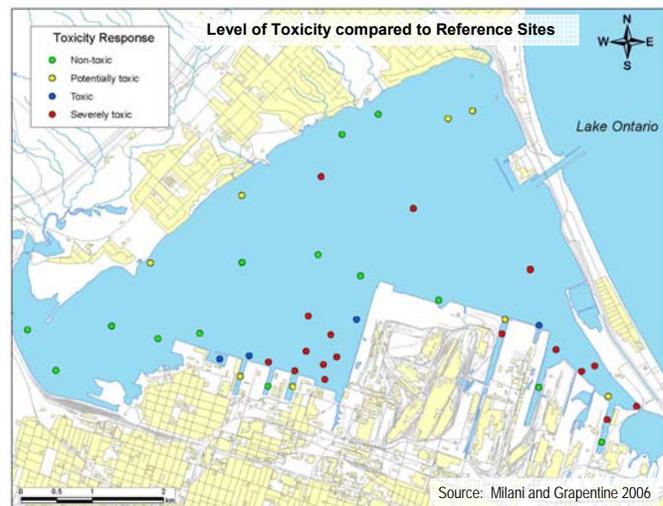
When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.

**What Has Been Done?**

- There have been no direct projects targeted at changing the sediment characteristics. Various projects have been undertaken to reduce toxic substances and phosphorus input to HH.
- BEAST assessments have been completed at different scales in HH. A full survey was completed in 2000 and a partial survey in 2002. Surveys focused on the Randle Reef Remediation were completed in 2005, 2006, and 2007.

**How Are Things Today?**

- BEAST is recommended as part of biological sediment guidelines adopted by COA (2007).
- From a 2000 BEAST survey, there is strong evidence of benthic community impairment at 27 of 44 sites with strong evidence of toxicity at 21 sites and in general, there is a tendency towards lower taxon diversity (Milani and Grapentine 2006). However, available Great Lakes reference sites are not well matched to HH sites due to site-specific conditions (low-energy bay), multiple stressors (seasonal anoxia at depth >7m), and confounding factors (physical disturbance from ships). Therefore, reference conditions may need to be modelled.

**What Still Needs To Happen?**

- A BEAST survey focused on the Randle Reef Remediation sites is planned for 2013.
- Complete ArcelorMittal Dofasco Boat Slip Sediment Remediation Project (targeted for 2015).
- Complete ongoing crackdown of the source of PCBs in Strathearne Slip and determine any management.
- Continue exploring causes for the "severely toxic" sites in Windermere Arm.
- Planned upgrades to the Woodward and Skyway WWTPs will reduce nutrient and sediment loadings.
- Complete in water work for the Randle Reef Sediment Remediation Project (targeted for 2019).
- Redo BEAST surveys after Randle Reef Remediation is completed (1 year and 5 years post remediation).

**When Will The Status Change?**

- A re-evaluation should be made when all scientifically feasible and economically reasonable actions have been implemented.
- Anticipate years of natural recovery after sediment projects are completed before the desired outcomes are reached.

**Where Can I Learn More?**

Dermott, R., and R. Bonnell. 2010. Benthic fauna in Hamilton Harbour and adjacent Lake Ontario 2002-2005 in comparison to 1964. *Aquatic Ecosystem Health & Management*, 13(4): 413-428.

COA Sediment Task Group. 2007. *Canada-Ontario Decision-Making Framework for Assessment of Great Lakes Contaminated Sediment*.

BARC. 2006. *Toward Safe Harbours: Progress Toward Delisting – Toxic Substances and Sediment Remediation*

Milani, D. and L.C. Grapentine. 2006. *The application of BEAST sediment quality guidelines to Hamilton Harbour, An Area of Concern*.

HHRAP. 2003. *Remedial Action Plan for Hamilton Harbour. Stage 2 Update 2002*.

HHRAP. 1992. *Remedial Action Plan for Hamilton Harbour. Environmental Conditions and Problem Definition. 2<sup>nd</sup> Edition of the Stage 1 Report*.

*Most references can be provided by the HH RAP Office as a PDF upon request*