BINATIONAL PUBLIC ADVISORY COUNCIL
Friends of the St. Clair River

Cleaning Up Pollution at the Bottom of the River

Sediments

Sediment is material that, because of its weight, settles at the bottom of a liquid. Commonly, the word is used to describe the dirt, silt, soil, or polluted material that settles at the bottom of a lake, river, or stream.

The Issue

Sediments are the habitat for macroinvertebrates or bottom-dwelling species (benthos) at the lower end of the aquatic food web. When sediment becomes polluted, it contaminates macroinvertebrates, fish, birds, and mammals, including humans, who consume fish and waterfowl. Sediment pollution in one area can also be a continuing source of further pollution downstream unless it is cleaned, removed, or controlled.

Condition of Concern

The condition of the St. Clair River has been documented since the 1950s. Studies in 1968, 1977, and the mid-1980s revealed highest concentrations of polluted sediments are within 100 meters (328 feet) of the Ontario shore near industrial discharges. Evidence indicated that sediment-contaminating substances originated in both Ontario and Michigan

Evidence of Concern

Studies in 1957 showed that bottom sediments along the Ontario shoreline were moderately to severely contaminated with a variety of chemicals, which were attributable to industrial activity. The zone of sediment contamination decreased from the entire length of the St. Clair River 64 kilometers (40 miles) in 1968 to about 20 kilometers (12.4 miles) in 1977, 12 kilometers (7.4 miles) in 1985, and 6 kilometers (3.75 miles) in 1990. These improvements are attributed to fewer discharges and natural remediation, which includes biodegradation (biological decomposition), being covered by new sediment from upstream, or movement of polluted sediments to downstream locations.

Studies along the Michigan shore in the 1980s showed sediments with:

- Excessive arsenic, chromium, iron, nickel, and manganese downstream from Pine River;
- Moderate concentrations of oil and grease adjacent to Port Huron and Marine City;
- Heavy concentrations of copper and iron in 23 sampling locations; and
- Heavy pollution at two sites immediately downstream of the Canadian National Railroad tunnel.

Sources in the St. Clair River have contributed to elevated sediment concentrations of hexachlorobenzene, octachlorostyrene, PCBs, and mercury in Lake St. Clair.

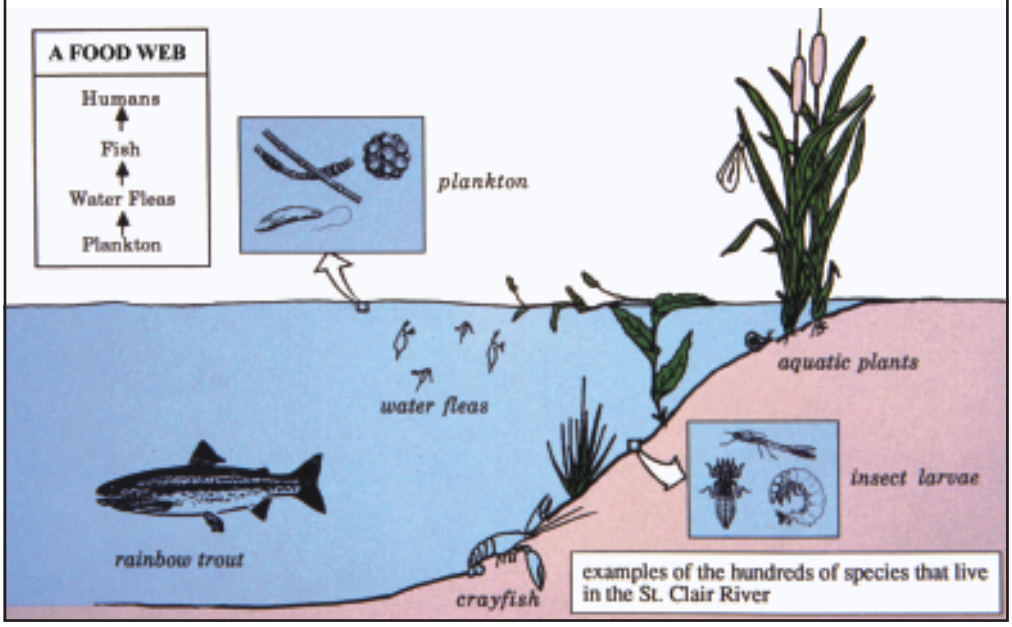
Sediment sampling provides government and industry with a snapshot of the health of the benthic community on the river bottom.

Goals and Strategies

Using information from these studies, BPAC identified six goals and strategies for sediment remediation:

- Identify and control contamination sources
- Delineate type and extent of contamination (that is, concentration and total volume)
- Evaluate potential for natural restoration
- Determine costs, funding sources, and permits required to remove and dispose of sediments
- Determine the physical and chemical conditions of cleanup areas relative to available remediation options
- Monitor areas before and after cleanup to evaluate cleanup effectiveness

Natural Monitors of Sediment Quality



While each of these six steps is critical, the first – identification and control of contamination sources – is most critical. Failure to eliminate the source of pollution before initiating a clean-up program could result in recontamination.

Remedial Measures

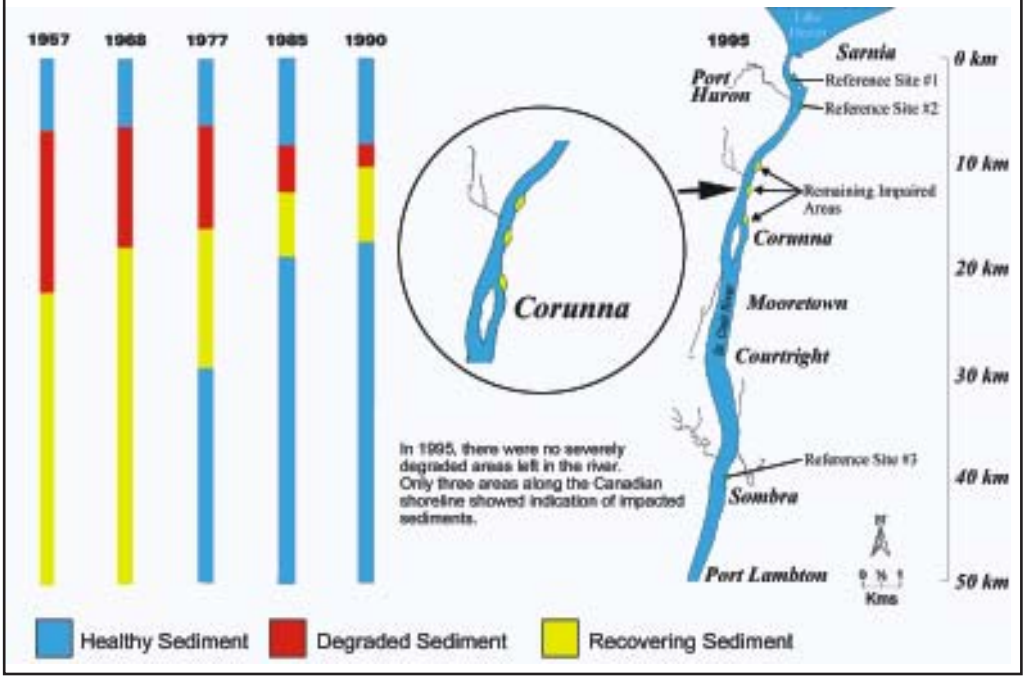
Four remediation options or technologies are typically available to clean up contaminated sediments:

1. **Natural Remediation** ***(No Action)*** – Allow time and natural river processes – decay, biological decomposition, coverage by clean sediments, and downstream transport – to reduce negative environmental effects.
2. **Contain Sediment In-Place** ***(Capping)*** – Use cleaner sediments or a synthetic cap to cover moderately contaminated sediments and prevent contact with aquatic organisms and further movement of contaminated particles.
3. **In-Situ Treatment** – Inject chemicals into contaminated sediments to stimulate biodegradation of contaminants, converting them to a less toxic form, and solidify or stabilize the sediment.
4. **Removal** ***(Dredging)*** – Physically remove the contaminated sediment by means of mechanical buckets, centrifugal pumps, or entrained air or water. Dredged contaminated sediments must be disposed in a specially constructed Confined Disposal Facility (CDF) or other suitable treatment.

Accomplishments

Studies in the 1990s indicate that concentrations of contaminants in sediments have decreased over the past 20 to 30 years. Significant reductions in mercury, lead, oil, grease, and PCBs are the result of changes in industrial processes, additional wastewater treatment, improved housekeeping operations, and spill prevention initiatives. The natural processes within the river have also led to improvement of its sediment.

Benthic Recovery in St. Clair River Sediment



In Spring 2002, Dow Canada's Sarnia (Ontario) Site began a multi-phase program using the latest in hydraulic dredging technology (unit pictured) to remove historically contaminated sediment from the bottom of the St. Clair River adjacent to the company's site.

Two other priority sediment zones, located in the upper St. Clair River, will be subject to a risk assessment to determine the need for remediation.

Current Conditions

As a result of ongoing efforts and naturally occurring changes, contaminated sediments are now limited to locations in the upper part of the St. Clair River adjacent to historical industrial discharge points.

A remedial project at the Dow Scott Road landfill and the Scott Road and Cutoff drains eliminated this discharge point of contamination to the St. Clair River. This project was a prerequisite for subsequent sediment remediation.

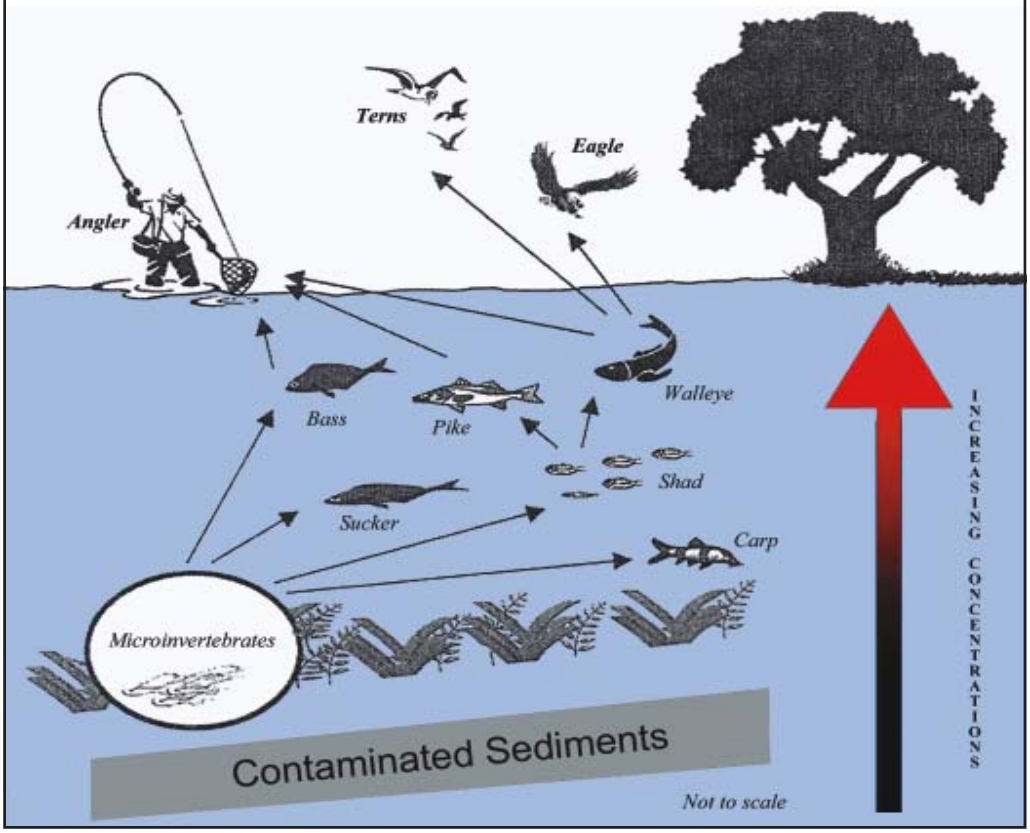
Studies by the Ministry of the Environment (MOE), Environment Canada (DOE), and the Sarnia Lambton Environmental Association (SLEA) (formerly the Lambton Industrial Society) from 1994 to the present, identified the most contaminated sediments as being located in three priority zones (represented as yellow areas north of Corunna on the map at left).

In June 2000, as a result of historical discharges from their facilities, Dow Chemical Canada Inc. engaged MOE and DOE to develop a plan to remediate contaminated sediments adjacent to their manufacturing complex on the banks of the St. Clair River. Based on detailed sediment sampling and evaluation of remedial technologies, Dow Chemical determined that it would hydraulically dredge approximately 28,000 cubic meters of sediments in an area 3,000 feet (925 m) long and 125 feet (39 m) wide. This activity is occurring in three phases:

- Phase 1 – A pilot project to assess the removal and treatment technology was completed in June 2002.
- Phases 2 and 3 will occur pending evaluation of Phase 1.

In addition to these remedial measures in the upper St. Clair River, sediments in the lower St. Clair River are periodically dredged for navigation purposes and then confined in Confined Disposal Facilities (CDFs) as a precautionary measure.

Simplified Example of Bioaccumulation



Predators at the top of the food chain, including humans, consume all or most of the pollutants ingested by smaller creatures.

Future Endeavors

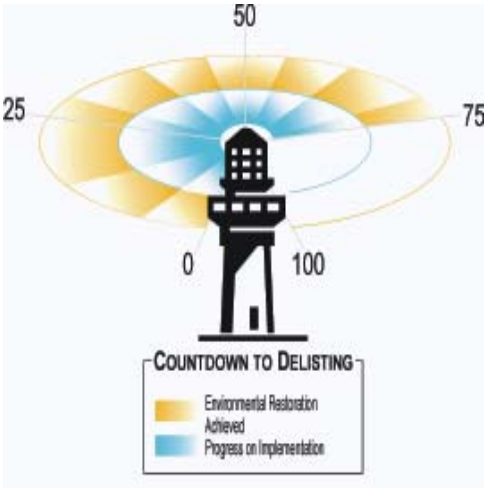
Successful management of historically contaminated sediments is a key remaining priority in the St. Clair River Remedial Action Plan (RAP). This action will result in improved water quality and progress toward achievement of RAP goals.

Remedial Options - Advantages and Disadvantages

	Pros	Cons
Natural Remediation	No cost for remediation. * Does not disturb sediment.	Does not isolate contaminated sediments. Potential for continued entry into the food chain and dispersion.
In-situ treatment	Intermediate cost. Selective for specific compounds.	Not proven to be effective for combination of metals and organic contaminants.
Capping	Intermediate cost. Effective isolation of contaminated sediments.	Requires perpetual care. Cap may be subject to breach or lifting. Limited knowledge for long-term use in high flow environment. Potential for re-suspension.
Dredging	Effective, permanent solution. Proven technology. Removes contamination from system.	Relatively high cost. Potential for re-suspension. Temporary damage to aquatic habitat.

** All options include costs for studies and monitoring.*

Progress Indicator



This fact sheet was created by the St. Clair River Binational Public Advisory Council (BPAC). BPAC is a dedicated group of individuals who represent a cross section of society in both Ontario and Michigan. BPAC provides a channel for informed and continuous public participation regarding the health and environmental quality of the St. Clair River and its nearby surrounding lands. BPAC works in conjunction with Friends of the St. Clair River, Ontario, and Friends of the St. Clair River, Michigan, non-profit organizations dedicated to achieving improvements in the environmental quality of the St. Clair River.
For more information, visit the Friends website at www.friendsofstclair.ca

This fact sheet is part of a series on such topics as BPAC Overview, Water Quality and Spills, Sediments, Habitat, and Pollution Source Control, all of which were created and published in March, 2003. Fact sheets on other topics may have been created and published since.

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