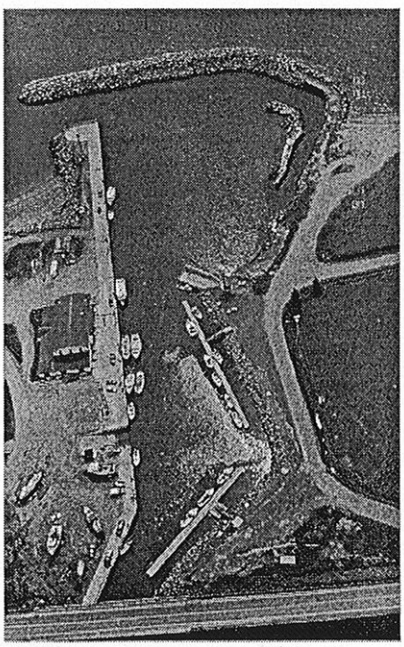
AQUATIC ENVIRONMENT PROTECTION

ARE THERE ANY ENVIRONMENTAL IMPACTS FROM OCEAN DISPOSAL IN L'ANSE-À-BEAUFILS ?



L'Anse-à-Beaufils harbour

Every year after ice break-up, maintenance dredging is carried out at L'Anse-à-Beaufils harbour in the Gaspé region. The ports in the gulf of St. Lawrence are subjected to the continual movement of water masses, generating sediment transport which gradually reduces water depth within the harbour area. Ports and navigation channels have to be dredged, and the dredged material, or spoil, is disposed of at sites a few kilometres offshore. Although dredge spoil is generally composed of sand or silt, which poses no threat to the environment, ocean disposal of these materials raises concern about such potential impacts as the destruction of marine animal habitats or the disturbance of sensitive areas. Another concern is that the dredged material could cause chemical contamination of edible fish, molluscs and crustaceans, with adverse effects on the fisheries.

Regulatory Framework

Canada has the longest shoreline of all the world 's maritime countries; hence, the preservation of marine environmental quality is an important challenge here. By international standards, Canada's marine environment is relatively uncontaminated; however, stringent monitoring is required in harbours, estuaries and littoral zones to prevent pollution problems. In order to protect marine ecosystems, Environment Canada has set up an ocean disposal permit system for the region east of Anticosti Island. Ocean disposal is governed by the *Canadian Environmental Protection Act* (CEPA), which authorizes disposal at sea solely for non-hazardous materials that cannot be recycled, reused or treated. In Quebec, the substances discharged in the sea consist primarily of spoil from port and harbour maintenance dredging operations. Environnement Canada is responsible for conducting environmental monitoring at ocean disposal

PUBLISHED BY ENVIRONMENTAL PROTECTION BRANCH

Canada

Environment Canada Québec Region
Environnement Canada Région du Québec

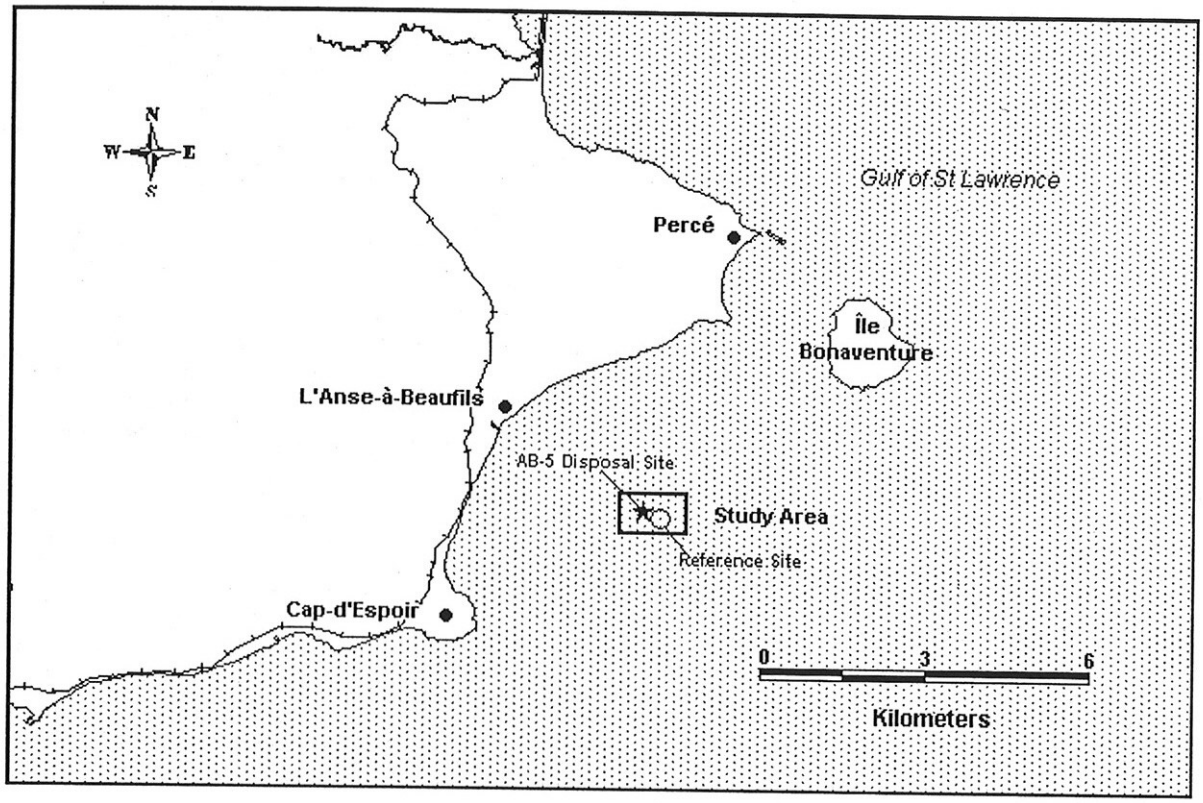


Figure 1. Location of the study area at disposal site AB-5

sites. More specifically, this involves carrying out a study to ensure that the sediments disposed of there do not pose a risk for the environment. In 1994, an environmental monitoring study was done at the disposal site used for dredged material from L'Anse-à-Beaufils harbour. It is identified as AB-5 in Figure 1.

Environmental Monitoring Study

In addition to ensuring that ocean disposal does not have any adverse effects on the marine environment, the monitoring activities provide important feedback for the disposal permit review process. The study conducted off L'Anse-à-Beaufils made it possible to:

- identify the contaminants and assess the toxicity of sediments at the disposal site;
- compare the state of the environment at the disposal site with the reference site, where no disposal occurred;
- check for pollution by analysing seabed-dwelling invertebrates (benthos) ;
- identify the ecological impact of the disposal activities;
- determine whether site AB-5 can continue to be used for dredge spoil disposal without endangering the receiving environment.

The Site and Dredging and Disposal Operations

Ocean disposal site AB-5 is located about 5 km southeast of L'Anse-à-Beaufils harbour, in water approximately 55 m deep. Between 1990 and 1993, from 3300 to 7900 cubic metres of dredged material were disposed of at the site annually, or the equivalent of 50 to 120 tandem truckloads. The disposal site was compared with a reference site not used for spoil disposal. This site is situated about 800 m southeast of site AB-5 (Figure 1). Disposal site AB-5 was selected for an environmental monitoring study because it is representative of most of the ocean disposal sites located along the Gaspé coast in Quebec. These sites are used for the disposal of small volumes of uncontaminated sediments generated by maintenance dredging of harbours and navigation channels.

Methods Used

To conduct an environmental monitoring study on the disposal site, sampling was first carried out during the summer of 1994, at 12 well-defined locations within the disposal site and within the reference site. The sediments collected at those sampling stations were transported to the laboratory for the following analyses:

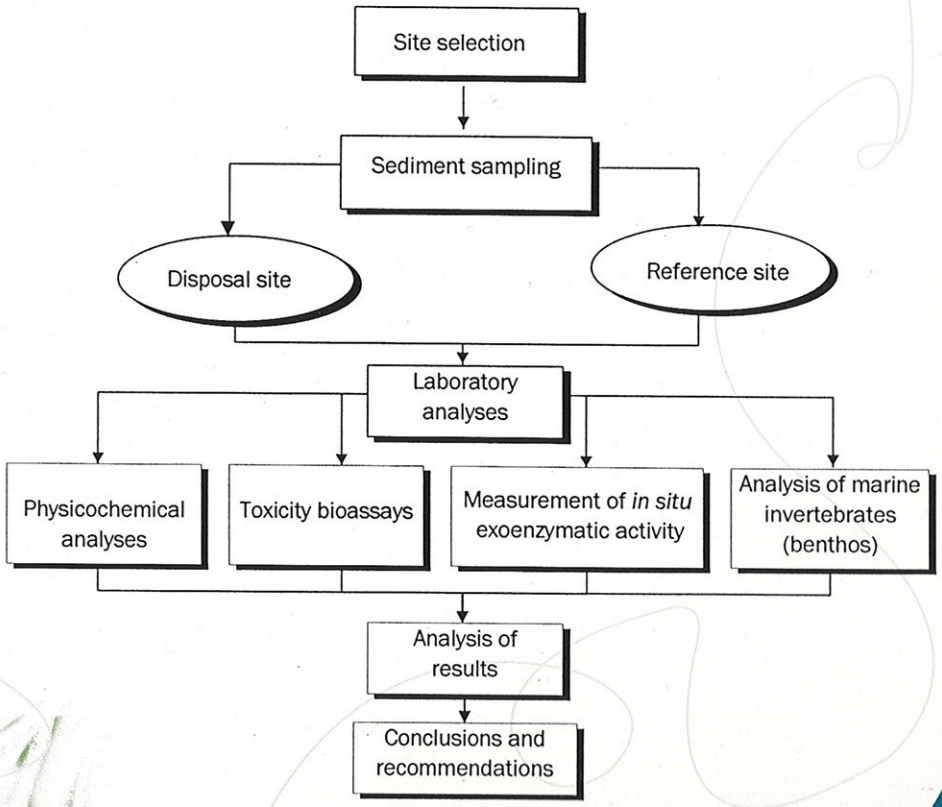
1 – Physicochemical analysis:
measurement of the physical and chemical composition of sediments using variables such as sediment particle size, organic matter, nitrogen, sulphides, phosphate and mercury to assess the nature and quality of the sediments. Of these parameters, mercury is the only one that can be compared against a Canadian quality standard; the other variables were used to interpret biological measurements;

2 – Toxicity tests:

- Microtox™ bioassay: method using bacteria to detect the presence of toxic substances in and on the surface of sediment particles;
- Bioassay measuring percent fertilization in the white sea urchin (*Lytechinus pictus*) following 20 minutes of exposure to water contained in test sediments;
- Bioassay measuring the survival of the tiny crustacean *Amphiporeia virginiana*, following 10 days of exposure to test sediments;

3 - In situ exoenzymatic analysis:
measures the metabolism of bacteria contained in the sediments to evaluate the state of the environment at this site. In the

Figure 2. Main steps in an environmental monitoring study at a disposal site



present study, this method was used on an experimental basis. Further research is required to determine how it can be used to assess sediment quality and the impact of dredge spoil;

4- Benthic community analysis:
evaluation of benthic invertebrate density and diversity.

Figure 2 provides a schematic diagram of the approach used.

Reassuring Results

The study showed that sediment disposal at site AB-5 has no negative impacts on the marine environment. The section below explains why.

1 - The sediments are not deleterious from the standpoint of their mercury content, because the concentrations measured at the disposal site were below the Canadian standard of 0.75 milligram per kilogram.

2 - According to Environment Canada criteria, no toxicity was observed in the sediments in two of the three bioassays. Only in one test, the sea urchin fertilization assay, most of the samples were found to be toxic, including the sediments from the reference site. However, this toxicity was found to be linked to aqueous ammonia, sulphides and other factors not related to the dredge spoil disposed of at site AB-5.

3 - The *in situ* exoenzymatic activity at the reference site was nearly twice that at the disposal site. While these results indicate that dredge spoil has an effect on the activity of bacteria in the sediments, they do not necessarily show a disturbance or negative impact on the environment.

4 - The benthic invertebrate community at the disposal site was similar to the reference site community, except with respect to the abundance of some groups of animals (marine worms and small crustaceans); however, the latter situation was not indicative of a pollution-caused disturbance. The differences appear to be due to a physical impact. Since the disposal site substrate was covered with a sediment layer containing more organic matter than at the reference site, the pattern of colonization by benthic animals differs slightly. Furthermore, the benthic community composition was in the process of returning to its original state (i.e., similar to that of the reference site) two years after the disposal operation.

Outcome of the Study

The environmental monitoring study of L'Anse-à-Beaufils harbour indicates that disposal site AB-5 is not contaminated, that the sediments are not toxic and that ocean disposal has few negative effects on the benthic invertebrate community. It therefore appears that site AB-5 can continue to be used for the disposal of dredge spoil from L'Anse-à-Beaufils harbour without endangering the receiving environment or the organisms living there. The results of this study confirm the hypothesis that benthic communities recover gradually following sediment disposal. In addition, the methods used to monitor the discharge of substances at sea appear to be appropriate for protecting the marine environment.

Aquatic Environment Protection is a series of fact sheets on the activities of the Aquatic Environment Protection Section, Environmental Protection Branch, Environment Canada - Quebec Region. This publication is aimed at stakeholders within the field, decision-makers and anyone interested in environmental protection.

For more information :
Environment Canada
105 McGill Street, 4th floor
Montreal, Quebec
H2Y 2E7
1-800-463-4311
Web Site:
www.qc.ec.gc.ca/protect/english/water/water_home.htm

Published by Authority of the Minister of the Environment

ISSN 1488-8718

November 1999

Printed on recycled paper
with vegetable ink