CUMULATIVE ENVIRONMENTAL EFFECTS AND SCREENING UNDER THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT

WORKSHOP PROCEEDINGS
DEPARTMENT OF FISHERIES AND OCEANS
January 12, 1993
Ottawa, Ontario

Prepared For:
The Federal Environmental Assessment Review Office and
The Environmental Assessment Branch, Environment Canada

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1. INTRODUCTION

The Canadian Environmental Assessment Act received Royal Assent on June 23, 1992, and will be proclaimed in 1993. Amongst other things, the Act requires that:

> *"Every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors.**
>
> > *(a) the environmental effects of the project...and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;*
> >
> > *(b) the significance of the effects refered to in paragraph (a); "*
> >
> > (section 16(1)).

The Federal Environmental Assessment Review Office (FEARO) is currently preparing a Procedural Manual which provides guidance on how to conduct environmental assessments under the Act, including the assessment of cumulative environmental effects. As well, a more detailed Reference Guide on addressing cumulative environmental effects has been drafted as a supporting document to the Manual. However, FEAR0 recognises that approaches and methods for assessing cumulative environmental effects are evolving rapidly and that any guidance offered should reflect best current practice. The Reference 'Guide and the Procedural Manual will be revised and updated on an ongoing basis to take account of these and other relevant improvements in environmental assessment practice.

To complement its work to date and to provide the best practical advice possible, FEAR0 in cooperation with other federal departments and agencies is examining how cumulative environmental effects can be considered in screenings of projects during federal environmental assessments. The departments and agencies that are participating in this initiative are:

- Environment Canada;

- Transport Canada;
- The National Capital Commission (NCC);
- The Canadian International Development Agency (CIDA);
- The Department of Indian Affairs and Northern Development;
- Fisheries and Oceans;
- Energy, Mines and Resources; and
- Agriculture Canada.

The workshops focus on the assessment of cumulative environmental effects at the screening level of the environmental assessment process. Screening is the most routine of the four tracks of the environmental assessment process (the others are comprehensive study, mediation and panel review) and is required for most smaller projects or projects that are thought to be less likely to cause any significant adverse environmental effects. Class screening, in which the environmental effects of a class of projects is assessed, is part of the screening track. The vast majority of federal environmental assessments (more than 95%) are conducted at this level. Also, smaller projects that are subject to screening can be important contributors to cumulative environmental effects. In addition, there are special issues associated with addressing the cumulative environmental effects of small projects as opposed to larger ones.

Each participating department or agency selected several case studies of projects that have been subjected to screening under the Environmental Assessment and Review (EARP) Guidelines Order (1984). For each case study, brief written background materials are prepared (see Chapter 2). The case studies are then presented at a series of l-2 day workshops with staff from the department or agency involved. The case studies are used as a basis for discussing how the cumulative environmental effects of projects could be addressed in screening.

There is at least one workshop being held by each participating department or agency. The Schedule of Workshops is shown in Appendix A. Department of Fisheries and Oceans (DFO) was the fourth department to hold a workshop. DFO will be participating in four other regional workshops, with Environment Canada.

This draft report summarises the results of the DFO workshop, held in Ottawa on January **12, 1993.** It is intended to summarise the discussions, rather than to provide detailed minutes. The agenda and list of participants for the DFO workshop is shown in Appendix B. As well as the draft report, a set of 'consolidated proceedings' will be prepared.

At the conclusion of this initiative, the final 'consolidated proceedings' will be distributed to all participants from all workshops. As well, a final interdepartmental workshop will be organised to discuss common themes in assessing cumulative environmental effects in screenings, as well as inter-departmental collaboration and co-operation on this subject. This will probably be in April or May, 1993. Subsequently, FEARO's Procedural Manual and Reference Guide will be revised to take account of the outcome of this initiative.

2. CASE STUDIES

Each department or agency participating in this initiative was asked to select several recent examples of projects subjected to screening under the EARP Guidelines Order (1984). In most cases, these case studies represented the range of different types of projects screened by the department or agency, as well as different-sized projects and projects in different types of ecosystems.

For each case study, brief written background materials were prepared by each participating department or agency summarising:

- The project;
- The project's environmental effects;
- The screening decision reached; and
- How, and to what extent could any cumulative environmental effects be addressed.

To assist in the preparation of the background materials and to familiarise the workshop participants with the subject of assessing cumulative environmental effects in environmental assessments, copies of a background paper on cumulative environmental effects and the draft Reference Guide prepared by FEAR0 were distributed to all workshop participants in advance.

The following case studies were presented at the DFO Ottawa workshop:

- Biological waste from fish hatcheries; and
- Maintenance dredging.

The background materials prepared by DFO are shown in Appendix C. Some of the main issues discussed following the presentation of each case study are outlined below.

Biological Waste from Fish Hatcheries

This case study dealt with the cumulative environmental effects of biological wastes from fish hatcheries. Biological wastes from hatcheries affect downstream water quality and fish habitat. This can be an issue when there are several hatcheries releasing biological wastes into the same waterbody or river, and/or when there are other sources of sewage or waste discharging into the same watercourse.

Biological wastes affect water quality by changing the nutrient status, possibly adding drugs and antibiotics to the water, and sometimes introducing new species or diseases. As well, the volumes of water used and discharged by hatcheries can affect flow patterns. One of the most important net environmental effects is changes in downstream fish habitats. It was noted that although increased nutrient loadings are normally detrimental to aquatic ecosystems, nutrient additions can be beneficial to a receiving waterbody in certain cases. Mitigation measures proposed to deal with this potential problem normally include settling ponds for discharged waste.

The BC government has prepared a draft regulation on this matter and there is some concern in west coast fish hatcheries about the cumulative effects of hatchery wastes. In east coast fish hatcheries, there is a consensus that biological wastes from fish hatcheries is not normally a significant problem.

Discussion of this case study raised several issues including:

- The need to improve baseline environmental data and information, particularly with regard to information on the nature of the receiving water body (e.g., water quality and fish habitat) for fish hatcheries;
- The potential for using the results of environmental audits of hatchery operations in assessments of cumulative environmental effects;
- The need to characterise waste effluents better;
- The need to consider developing loading limits for receiving waterbodies (this is already done in some waterbodies in the U.S.); and
- Identifying who is responsible for monitoring the cumulative environmental effects of hatchery wastes on a receiving waterbody.

Maintenance Dredging

This case study focussed on the cumulative environmental effects of maintenance dredging activities. At present, DFO has a $7 million (per year) program of maintenance dredging at about fifty locations in Canada, mostly in New Brunswick, Nova Scotia and Quebec. The volumes handled vary. The dredgeate is either ocean dumped or disposed of on land. Public Works Canada is usually contracted to conduct the dredging.

Every maintenance dredging project undergoes an environmental assessment screening, focussing on the site to be dredged. Normally there is no assessment carried out for the deposit activities under ocean dumping. Samples from the site are analysed for the presence of contaminants. Dredging only proceeds if the material to be dredged is uncontaminated. Dredgeate dumping is regulated by Environment Canada. DFO must get an ocean dumping permit to dispose of dredgeate in water. One dumping site may receive dredgeate from several different dredging operations. If the dredgeate is contaminated, it is usually disposed of on land, in confined disposal areas that have appropriate engineering and technical measure for containing the material and treating any run-off wastes. In general, dumping sites are not as closely monitored as dredging sites.

The nature and extent of the environmental effects associated with dredging operations depend on the volume of dredgeate removed, the frequency of dredging and the environmental conditions in the area of the dredge site. The use of explosives can have certain environmental effects.

The most important cumulative environmental effects associated with maintenance dredging include:

- Effects on vegetation and fish habitat;
- Effects on water quality; and
- The potential for effects on slope and bank stability.

Mitigation measures may be necessary.

There are several issues that should be considered in relation to this case study:

- Repeated dredging (i.e., temporal crowding) so that habitat cannot recover between dredging operations;

- Multiple dredging projects in a given area (i.e., spatial crowding), for example there are 10- 12 dredging projects in Lake Winnipeg;

- Interactions between different dredging projects;

- Interactions between the environmental effects of dredging projects and other types of activities, such as the disposal of effluents, resulting in sediment contamination; and

- Increased number of dumping sites in a given area.

3. USING THE APPROACH DESCRIBED IN THE DRAFT REFERENCE GUIDE TO ADDRESS CUMULATIVE ENVIRONMENTAL EFFECTS

After a discussion of the two case studies, the workshop participants used the approach described in the draft Reference Guide as a basis for assessing the cumulative environmental effects associated with two hypothetical screenings:

- Screening a project consisting of the construction and operation of a new fish hatchery located on a receiving waterbody where there are existing hatcheries and other sources of biological wastes (e.g., municipal sewage treatment plant, dairy farming); and

- Screening a project consisting of annual maintenance dredging in a waterbody where there are other maintenance dredging activities and other types of activities associated with a small craft harbour.

The workshop participants discussed how the different steps outlined in the proposed approach could be achieved. The steps discussed were:

- Scoping;

- Assessing the interactions between the environmental effects of the project;
- Identifying past projects and activities and their environmental effects;
- Identifying future projects and activities and their environmental effects;
- Assessing the interactions between the environmental effects of the project and past and future projects and activities;
- Establishing appropriate mitigation measures for the cumulative environmental effects, as well as determining the needs for and requirements of a follow-up program for the cumulative environmental effects; and
- Determining if the project is likely to cause significant adverse cumulative environmental effects.

Scoping

There was general agreement that the boundaries would depend on the size of the project. The boundaries would also depend on the nature of the environmental effects to be assessed. For both of the hypothetical projects, boundaries based on the aquatic ecosystem would be most relevant.

The general types of environmental issues associated with each hypothetical project were identified (see Section 2 above).

Assessing Interactions Between &Environmental Effects of a Project

The workshop participants were of the opinion that, in general, environmental assessments do not explicitly address the interactions between the environmental effects of a project, except that they usually contain a statement summarising the potential environmental effects. In most cases, a qualitative approach will be the only way of assessing the interactions. This can be facilitated by having environmental assessments prepared by multi-disciplinary teams.

In some cases, it may be possible to use the net effects on fish habitat (quality/quantity) as a means of assessing the cumulative environmental effects of a project.

Identifying Past Projects and Activities and Their Environmental Effects

It can be difficult to identify past projects and activities. In many cases, there simply isn't enough time to collect all the relevant information. Resource constraints are another problem. GISs could be used to display information on past projects. The public registry that will be established under the new Act will provide information on other projects subjected to a federal environmental assessment in the area.

Identifying Future Projects and Activities and Their Environmental Effects

The comments about time and resource constraints (see above) also apply to the identification of future projects and activities and their environmental effects. Also, it is difficult, if not impossible, to predict the environmental effects of future projects and activities.

Assessing; the Interactions Between the Environmental Effects of the Project and Past and Future Projects and Activities

See earlier comments about assessing interactions. If the environmental effects of past and future projects and activities are not known precisely, it will be difficult to determine how they are likely to interact with the environmental effects of the project in question.

Mitigation Measures and Follow-Up

Mitigation measures must be technically feasible. Proponents should only be required to implement measures to mitigate the proportion of the cumulative environmental effect that can be attributed to their project.

For repetitious projects, such as annual maintenance dredging, environmental monitoring conducted every three or four years can provide a baseline from which the cumulative environmental effects can be assessed.

Determining Significance

The workshop participants did not discuss this step in detail. However, FEAR0 has prepared a draft Reference Guide on determining whether a project is likely to cause significant adverse environmental effects.

4. FUTURE DIRECTIONS

The workshop participants discussed several strategies, approaches and methods that could be used to improve the way that cumulative environmental effects are addressed in screenings conducted under the new Act. These included:

- The use of geographic information systems (GIS) to map past projects as well as environmental data, information and knowledge on an area. This would make it easier to assess the cumulative environmental effects of a new project in the area.

- The use of ‘expert systems’, such as SCREENER. Although SCREENER does not explicitly address cumulative environmental effects, SPEARS (its successor) includes a GIS. The possibility of expanding SCREENER/SPEARS to address cumulative environmental effects should be explored.

- The need for better interdepartmental coordination on assessing cumulative environmental effects to encourage the exchange of relevant environmental data, information and knowledge. It was noted that the establishment of the public registry under the new Act should facilitate this.

- The need to encourage private proponents (i.e., non federal government proponents who are required to comply with the requirements of the new Act) to become more familiar with the approaches for addressing cumulative environmental effects in environmental assessments through education and training.

5. RECOMMENDATIONS TO FEAR0 AND ENVIRONMENT CANADA

Towards the end of the workshop, the participants discussed recommendations to FEAR0 and Environment Canada on activities and initiatives that would facilitate the assessment of cumulative environmental effects in screening. These recommendations included:

- The need to provide specific advice on how to assess the cumulative environmental effects of different types of projects. One way of doing this would be to encourage the inclusion of a section on cumulative environmental effects in class screening reports. If class screening reports could identify the types of cumulative environmental effects associated with different classes of projects, then the assessment of the cumulative environmental effects of an individual project within the class would probably be more comprehensive. Thus, FEAR0 and Environment Canada should promote the inclusion of a section identifying cumulative environmental effects in all class screening reports prepared under the new Act. It was also noted that class screening reports will be forwarded to FEARO. FEAR0 will maintain information on class screening reports that have been prepared. This could be in the public registry or separately.

- The need for advice on addressing cumulative environmental effects in environmental assessments at two distinct levels:

  - How to assess cumulative environmental effects as part of an environmental assessment (advice for proponents); and

  - How to review assessments of cumulative environmental effects that are part of an environmental assessment (advice for regulators).

  Both types of advice are needed.

- The draft Reference Guide is adequate, but it could be made even more practical. This could be done by reorganising it and explaining how the proposed approach fits with environmental assessment, as currently practised, i.e., emphasising what's new and how environmental assessment processes should be revised to take account of cumulative environmental effects.

- The need for more education and training within the federal government and for private proponents on how to address cumulative environmental effects in environmental assessment; and

- The need for further research on methods for addressing cumulative effects as part of environmental assessment.

APPENDWA

SCHEDULE OF WORKSHOPS

DEPARTMENT	LOCATION	DATE
Transport Canada	Ottawa	November 10
National Capital Commission	Ottawa	November 26-27
Canadian International Development Agency	Ottawa	December 8-9
Department of Fisheries and Oceans	Ottawa	January 12
Department of the Environment/Department of Fisheries and Oceans	Dartmouth Vancouver	January 14-15 January 25-26
Department of Indian Affairs and Northern Development	Vancouver	January 28-29
Energy, Mines and Resources	Ottawa	February 4-5
Department of the Environment	Quebec	February 15-16
Department of the Environment/Department of Fisheries and Oceans	Burlington	February 18-19
Agriculture Canada	TO BE DETERMINED	

APPENDIX B

DEPARTMENT OF FISHERIES AND OCEANS

WORKSHOP AGENDA AND LIST OF PARTICIPANTS

WORKSHOP AGENDA

CUMULATIVE ENVIRONMENTAL EFFECTS AND SCREENING UNDER THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT

Tuesday, January 12, 1993
8:30 am - 4:30 pm
Minto Place Hotel
Salon Monck-B
Ottawa, Ontario

DAYN E

830 am	Welcome, Overview of Agenda and Purpose of Workshop
840 am	Introductions
8:45 am	Update on CEAA • Regulations • Procedural Manual
9:oo am	Cumulative Environmental Effects and the CEAA
9:10 am	Review of Previous Workshops
9:20 am - 10:30 am	Presentation and Discussion of Case Studies (10 minutes presentation each with 5 minutes for questions of clarification, to be followed by 30 minutes group discussion) 1. Maintenance Dredging Projects (Small Craft Harbours) 2. Discharge of Hatchery Wastes (Capital Assets)
10:30 am	Coffee
10:45 am	Resume Case Studies
Noon	Lunch

1:00 pm	Procedures and Methods for Assessing Cumulative Environmental Effects • Setting Boundaries • Examining Interactions • Identifying Past and Future Projects
2:15 pm	Coffee
2:30 pm	Future Directions
4:15 pm	Recommendations to FEAR0 and Environment Canada
4:30 pm	Adjourn

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APPENDIX C

DEPARTMENT OF FISHERIES AND OCEANS - OTTAWA

CASE STUDIES

1. DISCHARGE OF HATCHERY WASTES

MACTAQUAC GENERAL FEATURES OF FACILITY

This facility is different in concept to all others studies in that this facility is primarily a fish rearing and transfer facility, rather than an experimental research facility, and is located in a rural setting adjacent to the Saint John River approximately 10 miles (16 kilometres) west of Fredericton, New Brunswick. The building complexity is minimal compared to other facilities but the water flow rates and fish hatching capabilities exceed all other facilities. The hatchery facility is located on 2 sites; one the original hatchery site and the other a much more recently installed accelerated rearing facility immediately downstream of the Mactaquac Dam. The hatchery building and piping services are generally original and were build approximately 22 years ago. Atlantic salmon are the only species raised at this facility.

The Mactaquac facilities are comprised of:

- A fish collection facility incorporated in the Mactaquac Dam to permit the collection and transportation of adult fish of all species attempting to migrate upstream;

- An accelerated rearing facility (located adjacent to the Mactaquac Hydroelectric Generating Station) where warm water from the cooling systems of the hydro station's six generators is used to accelerate egg incubation, and early rearing of salmon;

- The main salmon hatchery (situated downstream and on the other side of the river) where advanced young salmon are grown out to smolts (a 15 cm silvery salmon capable of surviving transition to the sea) and adult salmon captured here in the migration channel and at the fish collection facility are sorted for hatchery broodstock and for transportation up-river where they are released for angling and natural spawning.

The accelerated rearing facility and main salmon hatchery are collectively referred to as the Mactaquac fish culture station.

The fish collection facility and the main salmon hatchery were constructed in conjunction with the Mactaquac Hydro Station during the late 1960s by the New Brunswick Electric Power Commission. The main salmon hatchery was originally designed to produce smolts in two years. The accelerated rearing facility has, since its construction in the early 1980s, reduced the time required to produce smolts to one year. The construction of the accelerated rearing facility was jointly funded by the New Brunswick Electric Power Commission and the federal Departments of Fisheries and Oceans and Employment and Immigration. All three facilities are operated by the Department of Fisheries and Oceans. Operations at the fish collection facility and the accelerated rearing facility are seasonal.

Adult Atlantic salmon return each year to collection facilities incorporated in the Mactaquac Dam, or the result from smolts reared at the hatchery and released in the hatchery migration channel. Adults collected during June and July for broodstock purposes are referred to as early-run salmon and those collected during September and October as late-run salmon. Small numbers of adult salmon are also collected in Saint John River tributaries located below the Mactaquac Dam for enhancement of salmon stocks in those rivers. Most of the salmon selected for broodstock purposes will have spent two years at sea and weigh between 3.5 kg to 6.0 kg.

The adult salmon are held in broodstock ponds at the main salmon hatchery until late October when they are spawned. Each large salmon female provides about 7,600 eggs which are laid down in the fibreglass troughs supplied with a combination of well and river water. The eggs are eyed (eyes of embryo visible) by late-December. About one million eyed eggs are moved to the accelerated rearing facility during mid-January and deposited in upwelling incubation boxes. The boxes contain layers of ASTROTURF plastic material which acts as a substrate for the 50,000 eggs deposited in each box. Warm water from the cooling systems of the Mactaquac Hydro Station's generators is supplied to each of the incubation boxes. The water temperature is maintained at about 6°C and the eggs hatched during February. The newly hatched salmon, called alevins, are relatively inactive in the plastic substrate and efficiently utilize their yolk material for growth. The yolk is fully absorbed by early April when the young salmon, now weighing an average of 0.17g each, are removed from the boxes and transferred to 10 ft. x 10 ft. (3m x 3m) rearing tanks located in four large greenhouse-type buildings called aquadomes. Water temperature is increased to the 13°C - 15°C range at this time and the parr are provided with a commercially-prepared diet at half-hour intervals during daylight. Without the warm water from the Hydro Station, the parr would not commence feeding until June.

Of the one million eggs which are deposited in the incubation boxes, approximately 750,000 survive until the middle of June when they weigh about two (2) g each. At this time, they are transferred to larger rearing ponds located at the main salmon hatchery. The parr are fed at hourly intervals during daylight and attain a mean weight of 15 g by early-September. At this time the parr are graded and the smallest forty percent of the population, numbering 300,000, are distributed to various tributaries of the Saint John River. The smaller parr, retained at the station, attain an average weight of 50 g by the following spring when they become smolts. During May approximately 245,000 smolts are released from the main salmon hatchery to the Saint John River by the migration channel. An additional 45,000 smolts are released in tributaries located below Mactaquac, and 110,000 are sold to the New Brunswick aquaculture industry.

About 10% of the smolts released into the Saint John River are marked with a small plastic tag bearing a unique identification number on one side and a return address on the other. Except for tags recovered from smolts caught in the river, an $8.00 reward is paid for each tag returned and for information on where, how and when the tagged salmon was caught. The return of tags from captured salmon provides information on the route and timing of salmon migrations as well as an assessment of the performance of the different smolt-release groups. The information from these tagging experiments is used to improve the effectiveness of future hatchery stocking programs.

Of the 290,000 smolts released annually into the Saint John River, about 14,000 survive beyond the first twelve months after entering the sea. As well, from the 300,000 underyearling parr released into tributaries of the right, 3,000 salmon survive to a sea age of one year. The sea fisheries, situated mainly along the west Greenland and Newfoundland-Labrador coasts, annually harvest in nets about 3,000 of the 17,000 salmon which originate from smolt and parr releases. The majority of the salmon taken in the sea fisheries are in their second summer at sea and generally weight 2 kg to 3.5 kg when captured. The 14,000 salmon which escape the sea fisheries return to the river where some are harvested in commercial, angling and Indian food fisheries. Those not caught in the fisheries spawn naturally in tributaries of the Saint John River, except for a smaller number which are collected and used for hatchery broodstock. About half of the salmon entering the river return as grilse, having spent only one winter at sea, which the remaining salmon return after spending two or three winters at sea.

The 110,000 smolts sold to the aquaculture industry are reared in net cages situated in the western Bay of Fundy. After 18-24 months in the cages the salmon weigh 3 kg to 5 kg and are marketed for food. The provision of smolts to the aquaculture industry from the Mactaquac facilities will be reduced in the coming years as production from private hatcheries increases and the industry evolves to self-sufficiency.

WASTEWATER SYSTEMS

All fish wastewater from the original hatchery site and the Mactaquac Dam accelerated rearing facility discharges directly to the Saint John River. Level control in the tanks at the original hatchery site is accomplished by simple adjustable and removable standpipe arrangements, which then discharges wastewater to the river. Level control in the tanks at the accelerated rearing facility is accomplished by the same method as described above for half the tanks and for the remaining tanks by a swinging elbow with a length of pipe attached such that the maximum water level in the tanks is attained when the standpipe is in a vertical position.

There has apparently been recent discussion to install settling ponds immediately downstream of the original hatchery building as a primary form of wastewater treatment prior to discharge of fish waste to the river.

2. MAINTENANCE DREDGING AT SMALL CRAFT HARBOURS

Maintenance dredging is carried out annually at approximately 5 1 small craft harbours throughout Canada, mainly in Nova Scotia, New Brunswick and Quebec. The dredged volume and associated costs vary from site to site.

The following Table gives a general summary of our proposed dredging program for 93-94.

Province	No. of Projects	Averaged Dredged Volume per Project	cost
Nova Scotia	(13)	2000 to 6000 cu.m.	($2110 K)
New Brunswick	(09)	2000 to 5000 cu.m.	($1580 K)
Quebec	(16)	500 to 4000 cu.m. (1)	($1150 K)
British Columbia	(04)	4000 to 16000 cu.m	($ 695 K)
Newfoundland	(01)	12000 cu.m.	($ 600 K)
Prince Edward Island	(05)	2000 to 5000 cum.	($ 400 K)
Manitoba	(01)	25000 cu.m. (2)	($ 250 K)

(1) With the exception of one 1300 cu.m. project (Millerand)
(2) Approximately 10 sites on Lake Winnipeg

Dredging of channels and/or basins is necessary to ensure safe harbour access during all tidal periods. Two types of dredging operations can be envisaged depending on the site i.e., land based dredging or floating plant.

Preliminary environmental assessment of the dredge material must be carried out before any dredging operation can take place. Such testing would include sampling of the -dredged material to verify the presence of contaminants and determine the suitability for ocean dumping and/or land disposal. The sampling and testing are done in conformity with Environment Canada’s rules and regulations.

An environmental impact evaluation is then prepared and submitted to Environment Canada for approval and issuance of the ocean dumping permit. In cases where the ocean dumping regulation does not apply, the environmental study is submitted to Fisheries and Ocean's Habitat Management Division.

Environmental concerns usually addressed in the environmental study are listed below:

- Area and volume to be dredged
- Frequency of dredging
- Level of contamination of the dredge area (samplings) and disposal site
- Degree of turbidity caused by material in suspension and settling rate
- Presence of spawning, nursery, migration, rearing, aquaculture or fishing areas or other areas of other exploitable resources in the vicinity of the dredge area and/or dumpsite
- Odour
- Presence of vegetation at the bottom of the dredge area
- Dredging method
- Alteration of the land and upland development: occurrence of sedimentation, change in drainage characteristics, presence of acidity in the dredge material, removal of terrestrial vegetation
- Alteration of bottom substrate
- Change of water flow characteristics
- Physical oceanographic features (currents, tides or wind)
- Physical or chemical water characteristics (temperature, salinity, stratification, nutrients, suspended particulate matter)
- Bottom characteristics at the dump site (topography, geochemical and geotechnical characteristics, biological productivity)
- Use of explosives
- Proposed dredging dates (and ocean dumping dates if applicable)
- Volume of dumped material per dumping operation
- Geographical coordinates of dumping site
- Depth of water at dumping site
- Others

Mitigation measures applicable to dredging projects having an adverse effect on the environment may include:

- Confinement of the dredged material (dyke or underwater burial)
- Alternate dredge site and/or disposal site
- Decontamination
- Alternate dredging period
- Reduction of volume to be dredged and dredging frequency

Generally, environmental studies are completed by Public Works Canada (PWC) on behalf of the Department of Fisheries and Oceans. PWC is fully knowledgeable of Environment Canada's rules and regulations concerning dredging projects.

CUMULATIVE EFFECTS ASSESSMENT

In most small craft harbour dredging projects, annual maintenance dredging and disposal of dredged material are generally not considered to be a significant threat to the environment as the quantities involved are usually not very high and that each project is very closely monitored in compliance with Environment Canada's standards.

It is possibly more dangerous, environmentally speaking, to dredge a site less frequently (say every 5 or 10 years) than to do it every year because of the potential of re-creation of a new functional biological community during this time.

Disposal of the dredged material is likely to have more adverse effect on the environment than the dredging itself. Monitoring of the disposal site is probably just as important (or more) than that of the dredging site.

Nevertheless, the assessment of cumulative effects (sum total of all potential environment effects caused by maintenance dredging and/or the interaction between the environmental effects resulting from maintenance dredging in combination with the environment effects of other projects or activities) should be analysed on a case by case basis.