PARTIAL DIVERSION OF THE PORTNEUF RIVER

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

COMPREHENSIVE STUDY REPORT

PREPARED BY

DEPARTMENT OF FISHERIES AND OCEANS CANADA
QUÉBEC REGION

APRIL 2002

Pêches et Océans Canada | Fisheries and Oceans Canada

Canada

General Information

Date:	April 2nd 2002
Proponent:	Hydro-Québec
Project type:	Partial diversion of a river
Trigger:	*Fisheries Act*, subsection 35(2) and *Navigable Waters Protection Act*, subsection 5(1)
Responsible Authority:	Department of Fisheries and Oceans Canada
Study Type:	Comprehensive study pursuant to the "Comprehensive Study List Regulations", section 9.

Summary

Hydro-Québec intends to partially divert the Portneuf River to the Bersimis Complex, which includes the Pipmuacan Reservoir as well as the Bersimis-1 and Bersimis-2 power stations. The mean annual flow of the Portneuf River, at the outflow of Portneuf Lake, would decrease from 14.7 m^3/s to 5.2 m^3/s following the cutoff. Thus the percentage of the reduction of the mean annual flow would be 65% at the headwaters, and 15% at the river mouth. This project involves, among other things, the construction of a dam between the Itomamo and Portneuf lakes and the construction of a riprap sill equipped with a regulating structure at the outlet of Portneuf Lake. The rehabilitation and the construction of access roads would also be required.

The water diverted to the Pipmuacan Reservoir would be more productive when it is turbined in the two power stations of the Bersimis Complex than when it is turbined in the three power stations of the Portneuf River as is currently the case, because the heights of the turbined water heads are different. The mean annual generation of the Bersimis Complex would increase by 262 GWH, whereas the generation of the Portneuf River power stations would decrease by approximately 15 GWH, which would permit Hydro-Québec to realize a net gain of 247 GWH after compensating the Innergex company, owner of the power stations on the Portneuf River, for their losses equivalent to 15 GWH.

The partial diversion of the Portneuf River would result in the decline in water levels and in exposures of the riverbed in certain locations. The total aquatic areas lost would be nearly 38.5 hectares (ha) over the total river, namely 20.6 ha in the lower reaches (km 0 to 106) and 17.9 ha in the upper reaches (km 106 to 169), during summer low water, with the implementation of the proposed mitigation measures. These aquatic area losses would cause habitat losses for the brook trout, the species most highly prized by users of the environment, as well as additional limitations on navigation in certain segments of the river. The fish production losses that would be induced by this project have been estimated at 370 kg of brook trout annually. This estimate as been provided using the POTSAFO 2^{21} method, based on data gathered by electric fishing in the Portneuf River, spread over two years, namely 2000 and 2001, and through the precautionary factor added by the Department of Fisheries and Oceans.

Under the *Canadian Environmental Assessment Act* (CEAA), an environmental assessment of the project must be conducted since the project will incur a loss of fish habitat productive capacity, which requires authorization under subsection 35(2) of the *Fisheries Act* (FA). Certain facilities proposed as part of this project are also subject to the issuing of formal approval under section 5.1 of the *Navigable Waters Protection Act* (NWPA), which is also a trigger of the *Canadian Environmental Assessment Act* (CEAA) under the Law List Regulations.

This report fulfills the Department of Fisheries and Oceans' (DFO) obligation as a responsible authority established under the CEAA, to conduct an assessment of the project's environmental effects in consultation with other federal authorities who have the appropriate expertise.

Taking into account the proposed mitigation measures and the follow-up programs as well as the proponent's commitments to compensate residual losses of habitats, the DFO has

determined that the proposed project, as defined by the scope of the assessment, is not likely to have significant negative effects on the environment.

This a preliminary conclusion that will be reconsidered following the analysis of the comments received during the public consultation period.

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1 Introduction

The Department of Fisheries and Oceans (DFO) prepared this comprehensive study report for the partial diversion of the Portneuf River proposed by Hydro-Québec, the proponent. This report fulfills DFO's obligation as a responsible authority, established under the *Canadian Environmental Assessment Act* (CEAA), to conduct an environmental assessment of the project's effects, in consultation with other federal authorities who have the appropriate expertise.

This document includes a summary of the project and the environment in which it will be conducted, the results of public consultations conducted by the proponent, the results of public consultations conducted by the Bureau des audiences publiques en environnement du Québec (BAPE), a summary of the main environmental effects, the cumulative effects and the effects caused by accidents or malfunctions that might occur, an outline of the associated mitigation and follow-up measures, the determination of the significance of the effects, approval conditions and a preliminary conclusion on the environmental acceptability of the project.

The documents listed below are also part of the comprehensive study report and were used in the writing of this document. They contain more detailed information pertaining to the above-mentioned elements, as well as the proponent's answers to questions raised during the validity analysis, established under Québec environmental procedure, as well as supplemental elements required to fulfill the requirements of an environmental assessment under the CEAA.

- InteRives Ltée (April 1998). Avis scientifique sur la dynamique sédimentaire dans l'estuaire de la rivière Portneuf. Rapport d'étude présenté à Hydro-Québec [Scientific advice on the sediment dynamics of the Portneuf River, study report submitted to Hydro-Québec.] 50 pp. + appendices.
- Hydro-Québec (August 1999). Dérivation partielle de la rivière Portneuf. Rapport d'avant-projet [Partial diversion of the Portneuf River. Preliminary project report.], volume 1, 399 pp.
- Hydro-Québec (August 1999). Dérivation partielle de la rivière Portneuf. Rapport d'avant-projet [Partial diversion of the Portneuf River. Preliminary project report.], volume 2, appendices, 260 pp.
- Hydro-Québec (February 2000). Dérivation partielle de la rivière Portneuf. Résumé du rapport d'avant-projet [Partial diversion of the Portneuf River. Preliminary project report summary.] 54 pp.
- Hydro-Québec (February 2000). Dérivation partielle de la rivière Portneuf. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires du ministère de l'Environnement du Québec [Partial diversion of the Portneuf River. Supplement to the preliminary project report, responses to questions and comments from the ministère de l'Environnement du Québec.] 197 pp. + appendices.
- Hydro-Québec (November 2000). Dérivation partielle de la rivière Portneuf. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires du

ministère de l'Environnement du Québec [Partial diversion of the Portneuf River. Supplement to the preliminary project report, responses to questions and comments from the ministère de l'Environnement du Québec. Second edition.] 39 pp. + appendices.

- Hydro-Québec (February 2000). Dérivation partielle de la rivière Portneuf. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant-projet [Partial diversion of the Portneuf River. Supplement to the preliminary project report, responses to questions and comments from federal authorities on the preliminary project report.] 176 pp. + appendices.
- Hydro-Québec (October 2000). Dérivation partielle de la rivière Portneuf. Complément du rapport d'avant-projet. Réponses aux questions et aux commentaires des autorités fédérales concernant le rapport d'avant-projet [Partial diversion of the Portneuf River. Supplement to the preliminary project report, responses to questions and comments from federal authorities on the preliminary project report. Second edition.] 74 pp.
- Bélisle F. et C. Théberge (November 2000). Dérivation partielle des rivières Portneuf et du Sault aux Cochons; programme de compensation de l'habitat du poisson, acquisition de connaissances complémentaires et identification des avenues d'intervention. Rapport présenté à Hydro-Québec par Naturam Environnement [Partial diversion of the Portneuf and the Sault aux Cochons rivers; fish habitat compensation program, acquisition of supplementary information and identification of intervention methods. Report of Naturam Environnement submitted to Hydro-Québec.] 110 pp. + appendices.
- Hydro-Québec (March 2001). Dérivation partielle de la rivière Portneuf, réponse aux questions complémentaires formulées par Pêches et Océans Canada [Partial diversion of the Portneuf River, responses to supplementary questions formulated by Fisheries and Oceans Canada.] 11 pp.
- Hydro-Québec (March 2001). Projets de dérivation partielle des rivières Portneuf et Sault aux Cochons. Proposition de programme de compensation pour perte de capacité de production de l'habitat du poisson [Portneuf and Sault aux Cochons rivers partial diversion projects, proposed compensation program for loss of fish habitat production capacity.] 4 pp.
- Department of Fisheries and Oceans, (March 2002). Programme de compensation de l'habitat du poisson. [Partial diversion of the Portneuf River, fish habitat compensation program.] 7pp

2 Project description

This section summarizes information pertaining to the context and the rationale of the project, the proposed alternative means and facilities and a description of the chosen facility, which are contained in chapters 1 and 2 of Volume 1 of the preliminary project report.[9] It is to be noted that the order in council for the project, issued by the Quebec environment department in July 2001, requires that a minimum flow of 1 m^3/sec between lakes Itomamo and Portneuf be maintained, which was not planned in the preliminary project report.

2.1 Project context and rationale

The project consists of diverting the waters of the Portneuf River to the Pipmuacan Reservoir. Conducting the project will permit increasing the intake of the Pipmuacan, Reservoir, the main reservoir of the Bersimis Complex on the Betsiamites River.

The water diverted to the Pipmuacan Reservoir will be more productive when it is turbined in the two power stations of the Bersimis Complex than when it is turbined in the three power stations of the Portneuf River as is currently the case, because of the height difference in the turbined water heads (379.5 m for the Bersimis Complex compared to 62.3 m for the three Portneuf River power stations). The mean annual generation of the Bersimis Complex will increase by 262 GWH, whereas the generation of the Portneuf River power stations will decrease by approximately 15 GWH, which will permit Hydro-Québec to realize a net gain of 247 GWH after compensating the Innergex company, the owner of the power stations on the Portneuf River, for their losses, equivalent to 15 GWH.[9]

The rationale for the partial diverting of the Portneuf River is based on the initiatives of Hydro-Québec's 2000–2004 Strategic Plan. According to this plan, increased demand for electricity in Québec will result in additional sales of 17.4 TWH by 2004, compared to 1999. The energy required for these additional sales will come from new energy supply sources and a reduction in net sales to external markets.

2.1.1 Hydroelectric facility alternatives

The Portneuf River takes its source in Itomamo Lake, at the northern extremity of the watershed. Under natural conditions, Itomamo Lake flows both to the Pipmuacan Reservoir (via the Sables River, in the north) and to Portneuf Lake, in the east.

The proponent assessed two alternatives, namely the Itomamo alternative, which had planned for the construction of the dam between the Itomamo and Portneuf lakes, and the Portneuf alternative, which had planned for the construction of the dam at the outlet of Portneuf Lake, thereby diverting the entire drainage basin of Portneuf Lake in addition to that of Itomamo Lake. These two alternatives differ above all in terms of the location of the dam, the quantity of diverted water and the area of flooding. The chosen alternative, namely the Itomamo Lake facility, is more technically advantageous, presents fewer impacts from an environmental standpoint, provides more opportunities to mitigate the impacts, and it is the alternative preferred by the community stakeholders. Indeed, this alternative allows for maintaining a greater flow at the headwaters of the Portneuf River. It permits preventing the loss of 440 ha of productive forest land through significant flooding of the surface land area surrounding Portneuf Lake as well as preserving the quality of the landscape and the non-Aboriginal environment and maintaining use of the territory by Aboriginals as nearly as possible to current conditions.

2.2 Project definition

The project consists of partially closing the effluent of Itomamo Lake toward Portneuf Lake, where it flows naturally at an mean annual discharge of 10.7 m^3/sec, facilitated by a dam to divert approximately 91% of the Itomamo Lake inflow to the Pipmuacan Reservoir via the Sables River. Thus, mean annual discharge of approximately 9.7 m^3/s will be diverted from

the Portneuf River to the Sables River. In fact, a minimum flow of approximately 1 m^3/sec will continue to flow to the Portneuf River to mitigate the impacts of the diversion on the entire Portneuf River.

Note that this minimum flow is a requirement of the Ministère de l'Environnement du Québec, included as a condition for the order in council issued in July 2001. It was not planned in the proponent's initial project and thus does not appear in the preliminary project report.

2.2.1 Diversion structure

The diversion structure will consist of an overflow dam. It will be equipped with a gate that will allow flows of up to 10 m^3/s to be restored to Portneuf Lake. The structure's spillway will be made of an embankment composed of a downstream wall and concrete-block wing walls, and a summital concrete slab (7.2 m wide and 72 m long), at an elevation of 478.5 m. The non-flowing sections on the left and right banks will consist of a core till and of a riprap shoulder. A layer of pitching will protect the upstream slope of these sections. The crest of the dam is 6 m in width and will be placed 1.5 m above the level reached during maximum probable flood (MPF) of 481.5 m.

The conduit for the minimum flow will be incorporated in the structure's spillway and deep enough to be operable at all times. A gate will allow for controlling the flow according to the conditions stipulated by the provincial order in council and the level differential between the two lakes. A housing will protect this gate from the cold and vandalism.

The construction of the dam between Itomamo Lake and Portneuf Lake will be done without temporary diversion, and the lowering of the flows in the Portneuf River will occur upon the installation of the cofferdams. At that time, new hydrological conditions will prevail over the entire Portneuf River. Following the construction of the dam, the cofferdams will be removed.

Access to the Itomamo dam site will require the construction of a new road of approximately 2 km. This will allow for tying into an existing secondary network (which will have to be improved over a distance of 19 km), which will then provide access to forest roads that reach Saint-Fulgence, 107 km further west, or to a forest road that reaches Labrieville, 83 km further east. Neither the installation of new culverts nor the replacement of existing culverts is planned.

2.2.2 Regulating structure

The regulating structure will be composed of two distinct parts, namely a rockfill spillway crest 50 m in length that will block off the outlet of Portneuf Lake and a concrete structure composed of two gates. The elevation of the sill crest will be 475 m. It will mainly serve to regulate the flow at the outflow of Portneuf Lake, allowing for the storage of a part of the spring flood and its release during summer low water and thereby maintain the discharges at levels comparable to natural summer minimum flows in the Portneuf River after completion of the project.

2.3 Construction cost and schedule

According to the preliminary project reports, the cost of carrying out the partial diversion of the Portneuf River is estimated to be $5.6 million. Of this sum, $2.8 million was allocated to the preliminary project report. This cost excludes any sums intended for Aboriginal communities for corrective work and programs. The construction period of approximately 4 months is set for the end of June to October 2002.[9]

3 Environmental assessment and applicable regulations

The project requires an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) since it will cause a loss of fish habitat, which requires a permit issued under subsection 35(2) of the *Fisheries Act* (FA). This permit triggers the CEAA under the Law List Regulations. The project also requires formal approval under section 5.1 of the *Navigable Waters Protection Act* (NWPA), which also triggers the CEAA.

Before such a permit is issued, the proponent has to propose a compensation plan in compliance with the principle of no net loss in fish habitat productive capacity, as set out in the DFO's Policy for the Management of Fish Habitat.[27] This plan must be subject to the legal obligations of the compensation agreement binding the proponent and the DFO.

As specified by section 9 of the "Comprehensive Study List Regulations", the proposed construction, decommissioning or abandonment of a structure for the diversion of 10,000,000 m^3/a or more of water from a natural water body into another natural water body or an expansion of such a structure that would result in an increase in diversion capacity of more than 35 per cent, requires a comprehensive study-type environmental assessment.

A comprehensive study conducted under the CEAA is a self-assessment approach in which the responsible federal authority looks at a project's environmental effects before making any irrevocable decisions.

Within the meaning of the CEAA, DFO, through the Fish Habitat Management Division (FHMD) and Navigable Waters Protection (NWP), is the only responsible federal authority for this project. DFO has ensured that the environmental assessment process and the comprehensive study are in compliance with CEAA requirements.

Other federal departments have also been consulted to determine whether they have trusts with regard to this project, and to obtain their comments on their respective requirements concerning the environmental assessment under the CEAA. These are the Department of Indian and Northern Affairs Canada (DINAC), Environment Canada (EC), Natural Resources Canada (NRCan), and Health and Welfare Canada. The Canadian Environmental Assessment Agency (CEAA) has also worked on this file on matters of interpretation of the CEAA and methodology.

In terms of the provincial procedure, this project was subject to section 31.1 of Québec's *Environmental Quality Act,* which requires an environmental impact assessment and study. The Department of Fisheries and Oceans (DFO) and Environment Canada (EC) took part in reviewing the admissibility of the project study carried out as part of this procedure. Comments deemed pertinent were forwarded to the proponent by the Ministère de l'Environnement du Québec (MENV) under the same cover as those from the various other

Quebec departments and agencies involved. The comments of the two federal agencies involved were the same as those produced under the CEAA.

4 Scope of the project and of the environmental assessment

The scope of the project includes the construction and operation of water diversion and regulation structures, the construction of access roads, as well as the effects of diverting the Portneuf River flow on Portneuf Lake, the Portneuf, Sables and Betsiamites rivers and on the Pipmuacan Reservoir.

The environmental assessment includes study of the project's environmental effects including those caused by potential accidents or malfunctions and the cumulative effects that the project, combined with the existence of other structures or other projects or activities, is likely to cause to the environment.

Environmental impacts as defined by subsection 2(1) of the CEAA are the changes caused by the project to the biophysical environment and the direct effects of these changes on human health, socio-economic conditions, natural and cultural heritage (historical, archaeological, paleontological and architectural) as well as the current use of lands and natural resources for traditional purposes by Aboriginals.

The study also deals with the following:

the project rationale;
facility alternatives;
the significance of environmental effects;
the effects of the environment on the project;
public comments;
mitigation measures;
the need for a follow-up program and its requirements; and
assessment of the capacity of renewable resources that may be significantly affected by the project to meet the needs of present and future generations.

The environmental assessment of the project is also based on the Ministère de l'Environnement et de la Faune du Québec (MEF) guidelines, issued in 1997, specifying the nature, scope and extent of the environmental impact study, along with specific requirements set forth by federal authorities, such as DFO's Policy for the Management of Fish Habitat concerning compliance with the no net loss principle for fish habitat and the Federal Policy on Wetland Conservation.

5 Public consultation program

5.1 Hydro-Québec communications program

Hydro-Québec implemented a communications and community relations program in order to disseminate, as widely as possible, information on the Portneuf River partial diversion project, to learn about the concerns and expectations of the public directly affected and to respond to the questions and comments of various stakeholders. This program is described in detail in chapter 15 of the preliminary project report.[9]

The same communications program addressed the Portneuf and Sault aux Cochons rivers diversion projects since these projects, for the most part, affect the same stakeholders. The communications and community relations program was held in three stages, namely:

1. general information meetings (June and July 1997);
2. information and exchange table meetings, workshops on the project, meetings of a scientific committeee as well as information and consultation meetings (July 1997 to May 1998); and
3. a follow-up on community relations (May 1998 to June 1999).

At the first stage, the four partial diversion projects for the Portneuf, Sault aux Cochon, Manouane and Boucher rivers were the subject of a joint presentation. This stage consisted of 14 meetings with 33 different agencies including county regional municipalities (MRC) and municipalities, departments, media and tourism and recreational groups, as well as business meetings with private producers affected by the project, namely, Innergex, RSP Hydro and Alcan.

During the second stage, the public groups encountered voiced fears about their ability and their opportunity to influence the study procedure in progress, before its completion. This gave rise to 24 meetings including four information and exchange sessions (tool for assessing the project's degree of acceptability in the host community), for both the Sault aux Cochons and Portneuf projects, one meeting with the departments, five workshops on the Portneuf project alone and fifteen information meetings.

The third stage was the framework for meetings of a more private nature to discuss several of the public's questions about the impacts and the proposed mitigation measures. Parallel discussions continued with the Aboriginal communities of Betsiamites and Essipit. On June 21, 1999, they led to the signing of an agreement in principle with the Betsiamites Band Council, indicating the support of this Montagnais community for the Portneuf River partial diversion project.

5.2 Public hearings

As part of the Ministère de l'Environnement du Québec's environmental assessment procedure, the project was submitted to the Bureau d'audiences publiques sur l'environnement (BAPE) for public examination and consultation. A joint commission of inquiry was held from September 18, 2000 to January 18, 2001, for the Portneuf River and the Sault aux Cochons River projects. Hearings were held in Sainte-Anne-de-Portneuf, Forestville and Betsiamites. In all, some 500 people took part in the commission work, and the public filed 23 briefs. BAPE released its inquiry and public hearings report[5] on February 8, 2001.

5.2.1 Concerns and issues raised by the community

BAPE's public consultation allowed for defining several issues and concerns of the various agencies consulted, such as partnership agreements, the project's rationale, the dewatering of segments of the river, fish habitat, navigation, cumulative effects on the Betsiamites River, economic spin-offs for the region, the compensation for lost fish habitats and environmental procedure.

In addition, the public raised a number of aspects specific to the Portneuf project, such as the calculation and the maintenance of the minimum flow, the risks of introducing lake chub into the Portneuf River drainage basin, the project's impact on the sandbank located at the river mouth, the project's impact at the level of Patien Lake with regard to the nature of the structure (spur) that is planned to maintain the water level there, as well as the project's construction deadlines.

5.2.2 Position of groups and agencies

Most of the briefs originate with agencies, companies and citizens of the North Shore. The President of the Comité de survie des travailleurs de la Côte-Nord questioned the Ministère de l'Environnement du Québec spokesperson several times about the one-month period between the two mandates for processing the Portneuf River and the Sault aux Cochons partial diversion files. In sum, the Committee official wished to stress the importance of carrying out these projects for the communities and the workers of the North Shore and that he wondered about the way in which authorization of the projects could be accelerated.

The Betsiamites Band Council, the Association de l'industrie électrique du Québec (AIEQ), the county regional municipality (MRC) of the Haute Côte-Nord, as well as the municipality of Sainte-Anne-de-Portneuf expressed support for the Portneuf project, mainly because of the regional economic issues this project represents, job creation, increased demand for energy, as well as the associated partnership agreements. The Fédération des Pourvoyeurs du Québec (FPQ, a federation of Quebec outfitters) and the outfitters who will be affected by the project also supported the project during the hearings, as long as the dam between the Itomamo and Portneuf lakes is completely impervious, to prevent the propagation of lake chub (*Couesius plumbeus*), in the Portneuf River drainage basin, a species present in the Sables River basin. This propagation would in all likelihood naturally occur sooner or later.

However, since the condition stipulated by the provincial order in council issued in July 2001, requiring the installation of a gate in the dam and the restoration of a minimum flow, the outfitters would now oppose the project (Jean-François Dumont, FPQ, personal communication. January 2002).

Several citizens and agencies such as the Fédération Québécoise du canot et du kayak (FQCK, an association of Quebec canoeing and kayaking), the Mouvement Au courant, the regroupement des villégiateurs de la rivière Portneuf (a group representing Portneuf River cottager and vacation facility operators), the Conseil Régional de l'Environnement de la Côte-Nord (CRECN, a regional environmental board for the North Shore) as well as the Amis de la rivière Portneuf (friends of the Portneuf River) voiced their opposition to the project. This stems mainly from future uncertainty, after completion of the project, concerning the sandbar at the mouth of the Portneuf River, which acts as a shield against the erosion of the municipality's riparian land. As well, these groups question the rationale for this relatively small-scale energy project, as compared with the value of a heritage river that is highly used by the local communities, rich wildlife habitats and the risks of limiting navigation conditions on the river and tourism development.

The Amis de la rivière Portneuf organization presented the BAPE hearings with a petition signed by more than 290 people who oppose the project,[22] as addenda and in support for the brief they had previously filed, representing about 30% of the population. According to this agency, the petition was available for five days, from November 2–6, 2000 in four public

places in the municipality. Volunteers also went door-to-door in certain neighbourhoods. According to this same agency, approximately 90% of the persons encountered signed the petition.

5.3 Public consultations under the *Navigable Waters Protection Act* (NWPA)

As required by the *Navigable Waters Protection Act*, the proponent places a notice in the *Canada Gazette* and two local newspapers to apprise the public of its project and invite people to share their concerns about navigation.

5.4 Public consultations under the CEAA

A public notice period is provided when the comprehensive study report is filed with the Canadian Environmental Assessment Agency (CEAA). During this period, people may consult the document and voice their opinions and concerns about the project's environmental effects. In addition, there were 14 requests for documents from the public registry and under the *Access to Information Act* from 1998 to 2002.

6 Current state of the environment

Chapters 4, 5, 6 and 7 of the preliminary project report (Hydro-Québec communication program)[9] provide a detailed description of the general components and environmental issues involving natural and human environments. The following sections summarize this information.

6.1 Physical environment

6.1.1 Hydrography, sedimentary regime and water quality

Portneuf River

The watershed of the Portneuf River covers a total area of 3,101 km^2, which gives it an estimated mean annual discharge assessed at 63.5 m^3/s at the river mouth. Flowing in a south-east direction, this river issues from Itomamo Lake, located some 190 km from its confluence with the St. Lawrence River. Itomamo Lake, covering an area of 20 km^2, has two effluents. The first effluent, located at the north of the lake, is the Sables River, from which the waters flow on to the Pipmuacan Reservoir at a mean annual discharge of 42.6 m^3/s. The second effluent, located at the south-east of the lake, flows to Portneuf Lake and the Portneuf River at a mean annual discharge of 10.9 m^3/s.

The main reach of the Portneuf River, downstream of the lake of the same name, is characterized by a string of five lakes, namely Lake Bacon (km 162 to 165), Dégelis Lake (km 149 to 153), Chailly Lake (km 145 to 149), Emmuraillé Lake (km 138 to 141) and Patien Lake (km 134 to 137). Three private hydroelectric generating stations are located on the downstream reach of the river, between km 4 and 30, namely PN-1 station (km 4.4), PN-2 (km 10.5) and PN-3 (km 29). These are all managed by the Innergex company.

The estuary of the Portneuf River is a typical estuary of the North Shore of the St. Lawrence River, triangular in shape and 4 km in length. It extends from the mouth to the PN-1 station, located at the Quatre Milles falls. A single main channel, shallow and fairly uniform, runs

through the estuary, ending in a rapidly evolving sand spit that partially closes off the mouth from the left bank toward the right bank.[19] At the river mouth, this estuary forms an external, highly mobile delta diverting to the right. During spring tides, the fresh/saltwater interface likely reaches as far as the upstream tip of Île de Bois, located approximately 500 m downstream of the Quatre Milles falls.

For the most part, the development of Saint-Anne-de-Portneuf has been associated with the activity of forestry companies. The harvesting, floating, sawmilling and transshipment of lumber have strongly influenced the sediment dynamics of the Portneuf River, acting both on sediment input from the watershed, and on the flow through the construction of piers and dredging. The evolution of current sedimentary structures is the result of human-caused changes and also natural events such as storms, estuarine flows (streamflow and tidal flow) and longshore drift in the St. Lawrence River.

This sediment dynamics created and modified several sand spits in the estuary of the Portneuf River and at its mouth, of which the two main ones are the sand spit of the Portneuf bank and the Pointe des Fortin sand spit.[19]

Sables River

The Sables River is the main tributary and effluent of Itomamo Lake. It directs the main outflow of Itomamo Lake over a distance of approximately 25 km, to Baie des Sables in the Pipmuacan Reservoir. The flow within this segment alternates between subcritical flow and supercritical flow as far as a few kilometres upstream of its mouth in the bay, where the river broadens and deepens.

Betsiamites River

The Betsiamites River is characterized by the presence of two reservoirs, Pipmuacan and Bersimis-2, which are managed to supply two hydroelectric generating stations, Bersimis-1 and 2. The river's mean discharge at Bersimis-1 is 274 m^3/s, at Bersimis-2, 324 m^3/s and is 402 m^3/s at the river's mouth in the St. Lawrence River. Because of the management of the Bersimis-2 generating station, the river flow downstream of the station is subject to sudden and frequent variations. On a daily basis, the flow may vary by 150 m^3/s above and below the mean. Under normal operating conditions, the flow varies between 600 and 130 m^3/s, this latter threshold having been established as a protection criterion for biological and human use.

The estuary of the Betsiamites River extends to the first sill located 25 km from the river mouth. The salinity penetrates no further upstream than the most extreme point of slack tide occurence, near the route 138 bridge, that is, 8.5 km from the river mouth.

The Pipmuacan Reservoir has active storage of 725,200 m^3 and its water level varies between operating levels of 388.62 and 398.60 m.

There is little recent data available concerning the water quality of the lakes, rivers and reservoirs under study. However, the available data indicate that the waters of the overall territory under study are generally of low conductivity and their pH generally falls within 6.4 and 7.5, values that do not raise concerns about the survival of aquatic organisms. As well, this territory does not present any sources of significant pollution likely to reduce water quality.[9]

6.1.2 Thermal regime and ice regime

The thermal regime of Itomamo and Portneuf lakes are not currently subject to direct observations. Their thermal regime depends on their respective main tributaries and it has therefore been assessed qualitatively with respect to the tributaries and the water residence time. In the normal state, freeze-up begins near the end of November and ends toward the end of May on the region's deep lakes, such as Itomamo and Portneuf lakes.

According to the proponent, the summer water temperature of the Portneuf River frequently surpasses the optimal temperatures required for brook trout growth, namely a range between 11 and 20°C.[9] However, it appears that temperatures rarely reach the maximum value of 24°C tolerated by this species. As a general rule, summer water temperatures in the Portneuf River usually remain below 22°C. In the cold season, freeze-up on the Portneuf River usually occurs toward the end of November and break-up occurs toward the end of April. On the river's upstream segment, ice-cover forms everywhere on the lakes except at their outlet, where water flows freely.

The Pipmuacan Reservoir dictates the water level at the mouth of the Sables River. In summer the water flow is lacustrine, whereas in autumn it is subcritical. Under current conditions, the thermal pattern of the water of this section of the Sables River can be stratifed and can fluctuate with the affect of the wind. The ice-cover forms everywhere in basins in which water flow is slow, whereas in more rapid current segments, such as the Itomamo Lake outlet, water areas remain ice-free.

6.2 Biological environment

6.2.1 Ichthyological fauna and fish habitat

Portneuf River

Ten fish species have been recorded in the entire course of the Portneuf River, that is, between Itomamo Lake (approximately 190 km) and its mouth in the St. Lawrence River. Among species of interest for sportfishing are brook trout and sea trout (*Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*), rainbow smelt (*Osmerus mordax*) and Atlantic tomcod (*Microgadus tomcod*). There are also American eel (*Anguilla rostrata*), an important species for commercial fisheries. The brook trout is the most highly prized, abundant and important species for users and the six outfitters whose territory covers the Portneuf River upstream from km 4.

The estuary of the Portneuf River is surrounded by recent and very extensive marshes that are notably located on the left bank between the river mouth and km 2. The sand spit of the bank of the Portneuf River and its marsh form coastal habitats used by several fish species for feeding and reproduction, such as stickleback and plaice. Capelin (*Mallotus villosus*) spawn on the beaches of spits in May. The southernmost point of the Portneuf also presents a habitat conducive to the softshell clam (*Mya arenaria*), since concentrations of this shellfish have been reported there. Further offshore, various fish species are harvested; notably Atlantic sturgeon (*Acipenser oxyrynchus -oxyrhynchus*), Atlantic halibut (*Hippoglossus hippoglossus*) and Atlantic cod (*Gadus morhua*). The most prized invertebrates are Stimpson's surfclam (*Mactromeris polynyma*), waved whelk (*Buccinum undatum*), green sea urchin (*Strongylocentrotus droebachiensis*) and snow crab (*Chionoecetes opilio*).

The rainbow smelt uses the Portneuf River estuary in winter, probably as a thermal refuge and wintering area, as well as during spawning season, usually in the month of June. According to the proponent, a confirmed smelt spawning area of approximately 1,200 m^2 was identified downstream of the PN-1 generating station, in the Île de Cran area. This spawning area corresponds to a well-cleared high gravel bed that is fed freshwater by the turbine water of the PN-1 station.[11]

Atlantic salmon, sea trout and American eel are migratory species likely to be located in the sector under study, even though the Portneuf River presents, over its first 40 kilometres, a series of five major obstacles that, according to several studies, considerably limit the migration of these diadromous species. In fact, Quatre Milles Falls, located 4.4 km from the river mouth, is an impassable obstacle for rainbow smelt. These falls, and the falls located further on at 8.9 km from the river mouth are now also considered to be impassable for Atlantic salmon and sea trout because of the construction of the PN-1 generating station and dam.

The American eel is now the only species able to clear Quatre Milles Falls. The migration of the eels seems restricted, however, to a point 10.5 km from the river mouth at Phillias Falls, at the PN-2 generating station, since no sampling campaign has enabled the capture of young specimens of this species upstream of this obstacle.

Two other impassable obstacles are present upstream from Phillias Falls, namely the rapids at Crans Serrés (PN-3 generating station) and the falls at Boulé, located at km 29 and km 39 respectively. These obstacles therefore condition the composition of the piscifauna in the various segments that they delimit. They also prevent migratory species from accessing the river segment upstream from km 40 of the Portneuf River. By virtue of this fact, only four species have been recorded upstream of Phillias Falls, namely brook trout, white sucker *(Catostomus commersoni)*, longnose sucker (*Catostomus catostomus*) and threespined stickleback (*Gasterosteus aculeatus*). Moreover, inventories taken in the lakes located at the headwaters of the watershed (Itomamo, Portneuf, du Dégelis and Emmuraillé lakes) indicate that only brook trout and white sucker are present in the upper reach of the Portneuf River.

According to the proponent, the lower reach of the Portneuf River (km 1 to km 106), offers average development potential for brook trout and American eel populations. In fact, the quality of the areas available for rearing young brook trout and elvers is limited by the dominance of sand and silt substrate or by the presence of very steep slopes and rapid flow in certain segments. However, in the upper reach of the Portneuf River, that is, upstream of km 106, brook trout-rearing potential is much higher, since most of the rearing habitats are considered to be of excellent or average potential. Given that this segment contains spawning grounds of excellent quality and large area, it is considered to have high potential for the recruitment of brook trout.

Portneuf Lake, a large water body that will be most affected by the cutoff, contains three known sources of brook trout recruitment, namely the spawning grounds of the outflows of lakes Toqué and Bayeuville that flow into the northeast segment of Portneuf Lake, the confirmed spawning ground of the Tagi River that flows quite close to Portneuf Lake into the Itomamo-Portneuf passage, and the segment of the Portneuf River between the outlet of Portneuf Lake and Dégelis Lake. Several shoreline spawning beds most likely exist on the

edges of this large lake indented by numerous bays, but no inventory has been made to determine whether this is a certainty.

Sables River

No information is available concerning the distribution of fish species in the Sables River downstream of Itomamo Lake. However, the presence of two falls considered to be impassable, located at km 10 and at km 14 respectively, limits access to this river for the species present in the Pipmuacan Reservoir. These species are the lake whitefish (*Coregonus clupeaformis*), the northern pike (*Esox lucius*), the burbot (*Lota lota*), the lake trout (*Salvelinus namaycush*), the brook trout, the longnose sucker and the white sucker. According to the proponent, upstream of these falls, the Sables River undoubtedly contains the same species as Itomamo Lake, that is, brook trout and white sucker.

No recognized or potential spawning beds have been recorded by the FAPAQ in the segment of the Sables River located downstream of Itomamo Lake. Following photointerpretation analysis of this segment, the proponent indicates that two (2) sills, located between km 20 and km 23 and representing a total area of approximately 10,000 m^2, might be a potential reproduction site for brook trout. However, field verification conducted by the proponent in autumn 2000 confirmed the presence of several spawning sites utilized in tributaries, but none in the river (Louise Émond, HQ, personal communication, 2001).

The presence of lake chub (*Couesius plumbeus*) was reported more than ten years ago in the subwatershed of Itouk, Abondance and Boucle lakes, a subwatershed that flows into the Sables River at approximately 10 km upstream of Itomamo Lake. The presence of this species in this subwatershed is most likely attributable to the accidental, human-caused introduction of bait fish. Field campaigns to verify the presence of this species have been conducted recently and the results have not shown any evidence that this species has actually colonized the segment of the Sables River upstream of Itomamo Lake or Itomamo Lake itself as well as Portneuf Lake.

Betsiamites River

A total of 17 species are present in the Betsiamites River in the segment downstream of the Bersimis-2 generating station. Of these, the Atlantic salmon, whose population status is considered to be at risk, is one of the most important species harvested by the Aboriginal community of Betsiamites, located at the river mouth. It is estimated that from 100 to 500 adult salmon currently make an upriver run annually. The salmon population consists mostly of 2-sea-winter and 1-sea-winter salmon.[9] In addition, the historical fishing data show that approximately 4,000 salmon were fished at the beginning of the century. This roughly corresponds to an estimated productive capacity of 7,500 salmons for this river, taking into consideration that approximately 2,700 spawners must be conserved to ensure recruitment.[4]

The main spawning grounds utilized are located in the upstream part of the river at kilometres 67, 65, 52 and 42. The tributaries are more marginally used for spawning (redds were identified only in the Boucher River). The available fry-rearing sites remain stable at flows varying between 60 and 200 m^3/s, whereas the optimal flow for parr is 175 m^3/s.

Among the other species present in the Betsiamites River are brook trout, eel and rainbow smelt. Generally speaking, the Betsiamites River has a relatively low eel population density. The most beneficial habitat for the feeding and growth of eels (lakes) is completely absent in

the easily accessible part of the Betsiamites basin. Finally, it is possible that the eels use the Betsiamites estuary for summer feeding and that they swim up the river in the fall to overwinter.[12]

In the Betsiamites, salt water can penetrate the estuary through the bottom up to 10 km from the river mouth. Given the substrate's characteristics, the smelt could spawn upstream of the maximal area of influence for the penetration of salt water, as far as the facilities of the Bersimis-2 complex. Potential smelt spawning sites therefore appear to be abundant beyond the salinity intrusion limit and do not constitute a limiting factor for this species in the Betsiamites River.[12]

The total juvenile brook trout population in particular appears to be sparse in the Betsiamites and its tributaries. This sparseness can be explained by the sudden, frequent variations in flow as well as by the presence of several predatory and competing species.

The species identified in the river mouth and in the adjacent coastal area are diverse. Capelin utilize the estuary beaches as far as km 5 in addition to the beaches at Pointe à Michel and the sand spit at Betsiamites. Plaice appear to occupy the entire channel as far as the route 138 bridge (km 8.5). Atlantic sturgeon are reported the length of the shoreline between Pointe à Michel and Îlets Jérémie, further west. Atlantic cod and Atlantic halibut are encountered further offshore. Atlantic herring (*Clupea harengus*) and lumpfish (*Cyclopterus lumpus*) also frequent the estuary of the Betsiamites River.

In addition, a seal haulout has been reported less than 1 km offshore from Pointe à Michel. Significant concentrations of soft shell clams are present in the estuarine shoals, on the banks that face the village of Betsiamites and all the beaches from Pointe à Michel to the Îlets Jérémie.[11]

6.2.2 Riparian and aquatic vegetation

The Portneuf River mainly flows through balsam fir and black spruce feather moss association. Generally speaking, the semi-aquatic ecosystems form a narrow shrub strip dominated by sweet gale (*Myrica gale*) and speckled alder (*Alnus rugosa*). In the river, the aquatic and riparian vegetation form a thin strip parallel to the bank. This riparian ecotone is composed of submerged (*Potatmogeton spp.*), floating (*Nuphar variegatum*) and emergent (*Eleocharis spp., Carex spp.*) herbaceous communities, preceded by low shrub generally consisting of speckled alder, sweet gale and leatherleaf (*Chamaedaphne calyculata*).

The riparian ecotones of the Portneuf River are considered sparse in the part bounded by km 4 and km 40. However, between km 4 and km 8 there are shrub and grass habitats covering just over 4 ha. From km 40 to km 105, the riparian vegetation is concentrated in the convex areas of oxbows, in gently sloping sheltered areas as well as on islets. This segment represents about 11 ha of riparian ecotones colonized by willow and alder and mainly concentrated between km 42 and km 82.

The riparian habitats of the Sables River are sparse, discontinuous and of limited area. In total there are about 3 ha of wetlands bordering this river, in the segment located between Itomamo Lake and the Pipmuacan Reservoir.

The riparian habitats of the Betsiamites River are not well documented. In 1997, an inventory conducted by Hydro-Québec around the Bersimis-2 Reservoir showed that the shrub stratum

is sparsely developed over approximately 4% of the banks. This particularly consists of green alder (*Alnus crispa*) and sweet gale.

6.2.3 Avifauna

A total of 117 bird species were recorded in the Portneuf River basin during the preparation of the *The Atlas of the Breeding Birds of Québec s.*[6] Of this number, 65 species have been confirmed as breeders, 22 species as probable breeders, 26 species as possible breeders (without signs of nidification) and 4 species are considered as non-breeders.

The greatest diversity of the area under study was observed in the square of the Atlas (100 km) that covers the St. Lawrence River, the estuary and the first 4 km of the Portneuf River. The sand spit of the Portneuf bank and a large marsh mainly account for this wealth and diversity. Seventy-six species were identified, including species usually associated with the St. Lawrence River, such as the common eider (*Somateria mollissima*), the great black-backed gull (*Larus marinus*), but also migratory species such as the snow goose *(Chen caerulescens*) and several shorebird species.

The Portneuf sand spit is utilized as a staging area by tens of thousands of shorebirds in the autumn, which makes this a special site. Steps are currently being taken by the Canadian Wildlife Service (CWS) to incorporate this site into the Western Hemisphere Shorebird Reserve Network (WHSRN). According to Environment Canada experts, in addition to the Portneuf sand spit, there are only five other sites in Quebec that can be characterized as shorebird reserves.

The estuary of the Portneuf River and particularly the adjacent wetlands are also highly utilized as staging and resting areas by species that breed inland or by migratory species.

6.2.3.1 Water birds

In spring 1999, a helicopter aerial inventory identified 12 species of water birds between the mouth of the Portneuf River and the Sables River, including Portneuf and Itomamo lakes.[11] Anatidae species were the most strongly represented group with 8 species, and the most abundant population of 145 individuals. American black duck (*Anas rubripes*) was the most abundant species in the basin with 69 individuals, followed by the common merganser (*Mergus merganser*), the common goldeneye (*Bucephala clangula*) and the ring-necked duck (*Aythya collaris*). Although present in the area under study at the time of the inventory, the snowgeese utilize the mouth of the Portneuf River as a staging area before reaching their breeding area much further north.

Following Environment Canada's recommendations, the aerial inventory was also supposed to make it possible to document the presence of Barrow's goldeneye (*Bucephala islandica*) in the area under study. Since Barrow's goldeneye has a low total population, concerns have been raised over its status in Eastern Canada. It nests on small lakes of higher altitude in the inland of the upper and mid North Shore. No Barrow's goldeneye have been observed over the course of the Portneuf River or the tributaries and the lakes that will be affected by the project.

Among the other water birds inventoried are the common loon (*Gavia immer*), the great blue heron *(Ardea herodias*), the spotted sandpiper (*Actitis macularia*) and the black-crowned night heron (*Nycticorax nycticorax).*

6.2.3.2 Ground-dwelling birds

The description of ground-dwelling birds is basically derived from the data of *The Atlas of the Breeding Birds of Québec*.[6] The square of the Atlas that corresponds to the segment covering km 36 to km 55 on the Portneuf River is noteworthy with a total of 66 species, most of which are forest passerine birds. The species inventoried are typical of Quebec coniferous forests, particularly balsam fir stands.

6.2.3.3 Species at risk

In addition to Barrow's goldeneye whose status raises concerns, three species have been classified as threatened or vulnerable by the Centre de données sur le patrimoine naturel du Québec (CDPNQ), namely, the red-shouldered hawk (*Buteo lineatus*), Le Conte's sparrow (*Ammodramus leconteii*), and the sharp-tailed sparrow (*Ammodramus caudacutus*). The two sparrow species have been sighted near the mouth of the Portneuf River where they frequent the large marsh. A recognized and protected heron colony area is also present on one of the islands of Portneuf Lake.

6.3 Human environment

6.3.1 Socio-economic and socio-demographic profile

The land area under study is mainly located on public lands under the jurisdiction of the Ministère des Ressources Naturelles du Québec (MRN). It straddles the administrative region Saguenay-Lac-Saint-Jean to the west, which includes one Indian reserve and four MRC, and the North Shore region to the east, which includes nine Indian reserves and five MRC. The border of the two regions cuts across the Portneuf River at km 112. This land thus extends into the MRC of Fjord-du-Saguenay and Haute-Côte-Nord.

The regional economy of the North Shore is based mainly on resource harvest and transformation. Mines, forests, hydraulic energy and fishing are the principle economic activities. Two Aboriginal communities, at Essipit and Betsiamites, will be affected by the project.

The economy of the Saguenay-Lac-Saint-Jean region is also based on natural resources. Exploitation of significant hydroelectric potential gives a comparative advantage to the region in aluminum and pulp and paper production. The region's only Aboriginal community, Mashteuiatsh, will not be affected by this project.

6.3.2 Land use

The urbanized area included in the area of influence is mainly represented by the municipality of Sainte-Anne-de-Portneuf. Located on the right bank of the Portneuf River, this municipality extends over a strip of approximately 5 km along the shore. This land is characterized by residential, commercial and industrial sectors used for activities such as the transformation of seafood. The rest of the area of influence is rather of forest type, and is used for forestry and recreational activity.

This forest land is publicly owned and is currently subject to ten timber supply and forest management agreements (TSFMA) under the *Forest Act.* The annual volumes allocated in

this sector are 733,300 m^3 of forest biomass, and are mainly distributed among facilities located in Saguenay-Lac-Saint-Jean region.

6.3.3 Recreation and tourism

Located directly within the project's area of influence are outfitters which constitute the major tourist attractions. The following six outfitters with exclusive rights are established there: they are, proceeding upstream-downstream, Club Homamo et Épinette rouge, Québec Nature, Clauparo, Lac Dégelis, Domaine du Lac des Cœurs and La Rocheuse. The location of these outfitters is shown in Appendix BB of volume 2 of the preliminary project report.[10] The activities there are mainly linked to the harvesting of wildlife resources, namely, given the high potential, summer sport fishing for brook trout and small and big game hunting. In addition to harvesting activities, a number of outfitters offer canoeing, hiking, and nature observation and interpretation.

There is no concentrated core of vacation facilities on the municipal land of the area of influence. In contrast, there are about forty cottages on the Portneuf River, whose owners use the river for hunting, fishing, boating and other related activities.

The Association pour la Sauvegarde du Chemin Forestier de la Rivière Portneuf [an association for the preservation of the Portneuf River forestry road], founded in 1992, has proceeded with the development of a dozen sites for wilderness camping and other outdoor activities along this road. Association members carry out a wide range of activities on the Portneuf River and along its banks. Among these are vacationing, summer fishing, ice fishing, small and big game hunting, snowmobiling, camping, hiking and climbing.

Ice fishing for rainbow smelt is practised in the reach of the mouth of the Portneuf River, which extends for a dozen kilometres. About thirty cabins are established on this segment of the river from the end of December through the end of March. No harvesting data exist concerning this type of fishing in the Portneuf River.

6.3.3.1 Navigation

Boating on the Portneuf River is above all characterized by the utilization of rowboats and canoes, with or without motors. Outfitter customers and vacationers owning cottages bordering the river engage in boating on a number of segments for pleasure or fishing. A few boaters and kayakers use the river downstream from Innergex's PN-1 generating station.

The Fédération québécoise du canot et du kayak (FQCK) recognizes the entire course of the Portneuf River as passable. Canoe ramps have been built at kilometres 25, 39, 54 and 69. According to the proponent, the Portneuf River is relatively seldom used by canoers due to the difficulty of its course. However, the FQCK's brief submitted to the BAPE commission demonstrates the Portneuf River to be a canoe route of great interest, offering impressive, varied landscape and sections of varying levels of difficulty, making it accessible to everyone.

Boating other than canoeing is practised notably in the lacustrine segments of the river, for the purposes of fishing or pleasure boating. Finally, shallowness in the Portneuf River estuary impedes the passage of pleasure and fishing boats that come alongside the municipal pier and the federal wharf. In the past, such limitations have made repeated dredging in the channel and the approaches to the municipal pier necessary. According to the proponent,

over the last ten years, boating on the Portneuf River has not notably been affected by any project or measures. Innergex's three generating stations do not really constitute an additional difficulty for boating, since they were built on sites with falls or impassable rapids.

6.3.4 Archaeology and heritage

The edges of Lake Portneuf encompass 74 areas deemed conducive to the discovery of an archaeological site, six of which are located downstream from the outlet, but the inventories have revealed no remains.

6.4 Current use of lands and resources for traditional purposes by Aboriginals

The area of influence cuts across two trapping lots belonging to the Montagnais community of Betsiamites, namely lot 152, in the sector of Itomamo Lake and the Sables River, and lot 163, in the upper watershed of the Portneuf River upstream of km 145. In addition, the Montagnais community at Essipit owns the Domaine du Lac des Cœurs outfitter, whose territory ranges approximately from km 102 to km 122 on the Portneuf River, as well as two trapping areas cutting across the area of influence. Most of the activities carried on by the Montagnais on the Portneuf River are distributed upstream of km 106.

The use of the lands by Aboriginal communities is diversified. It includes trapping (beaver, marten, otter, and mink), big game hunting (moose, bear and caribou), small game and waterfowl hunting, as well as brook trout fishing. Recently, logging has significantly disturbed the use of this land, often up to the edge of the Portneuf River.

7 Anticipated effects, their significance and mitigation measures

Chapter 10 of the preliminary project report[9] describes the project's impacts on the general elements of the natural and human environments, whereas the impacts for issues of environmental concern, namely piscifauna, the use of resources by non-Aboriginal and Aboriginal communities as well as vacation, recreational and tourist activities and infrastructures are presented in Chapter 11. The impact assessment method used by the proponent is presented in Chapter 8 and in appendix R of Volume 2 of the preliminary project report.[10] In addition, all documents cited in Section 1 of this report contain additional information pertaining to the project's effects on the environment.

The following sections summarize the main environmental effects that would be caused by the project, including those caused by accidents and malfunctions as well as the cumulative effects. Mention is also made of the principal mitigation measures.

It is important to note that only the main concerns are described in this report. For more details as well as for the complete assessment of the impacts, the reader should refer to the documents cited in the introduction.

7.1 Impact assessment methodology

The assessment method used by the responsible authority consists in identifying the project's effects on the different valued environmental components (VECs) and in determining their significance. The identification of the project's effects and the determination of their significance are based on the information provided by the proponent and the expertise of the

various federal authorities. As well, it takes into account the application of mitigation measures proposed by the proponent or recommended by the federal authorities as well as the implementation of a follow-up program.

The selection of the valued environmental components takes into account the mandates and the fields of expertise of the various federal experts, scientific knowledge, and the concerns expressed by the public either directly to the proponent, to the province or to the federal government.

The following VECs have been selected to be part of the present project:

- Piscifauna and fish habitat;
- Riparian, aquatic and wetlands vegetation;
- avifauna;
- Portneuf bank sand spit;
- Physical and cultural heritage;
- Human health;
- Socio-economic situation; and
- Current use of lands and resources for traditional purposes by Aboriginals.

7.1.1 Significance of effects

The assessment method used by the proponent consists of identifying the project's impacts and of determining their significance. The identification of the project's impacts is carried out based on information gathered relating to the project's technical aspects, basic data for the receiving environment, experience and information gained from similar projects and the scientific literature. The analysis of this information allows for the identification of the project's impacts by specifying the interconnections among the various physical, biological and human components of the receiving environment for the project. This analysis takes into account all the implemented structures and the various phases of the project, from construction through operation. The impact assessment takes into account the systematic application of current mitigation measures. Moreover, a number of mitigation measures that have been incorporated into the project's design, such as spurs, are taken into account during the assessment.

The proponent determines the significance of the impacts, described as major, moderate or minor, on the basis of four criteria, namely the value of the affected component, the intensity of the disturbance, the spatial scope of the impact and its duration. The proponent has chosen to use an asymetrical classification of the impacts in order to establish a more balanced assessment scale containing 37 minor impacts, 33 moderate impacts and 11 major impacts.

This classification differs from the one used to define the environmental effects of projects under the *Canadian Environmental Assessment Act* (CEAA), where a negative impact has to be defined as significant, not significant or uncertain.

The Department of Fisheries and Oceans (DFO) feels that a major impact corresponds to a significant effect as defined in the language of the CEAA, whereas a moderate or minor impact corresponds to non-significant effect.

However, under the *Canadian Environmental Assessment Act*, the responsible authority is not bound by the proponent's conclusions concerning the significance of the effects, and is ultimately bound to arrive at its own conclusions, which would take into account not only the proponent's opinion, but also its own expertise, the expertise of other federal authorities and any other information at its disposal.

The following sections contain DFO's comments relating to these assessments. A number of environmental elements for which the project causes merely non-significant effects have not been repeated in the summary presented below (air quality, ambient sound, etc.).

7.2 Project's effects on the valued environmental components

7.2.1 Piscifauna and fish habitat

The analysis of the project's effects on piscifauna and the fish habitat is based on the information provided by the proponent and is supported by the *Policy for the Management of Fish Habitat* (PMFH), *A Decision Framework for the Determination and Authorization of Harmful Alteration Disturbance or Destruction of Fish Habitat* as well as by the Department of Fisheries and Oceans (DFO)'s *Habitat Conservation and Protection Guidelines*.

Under the *Fisheries Act*, the DFO may authorize modifications to the fish habitat under subsection 35(2) of said legislation. However, the residual losses of fish habitat, following the application of adequate mitigation measures, must be acceptable. In addition, under the PMFH's no net loss guiding principle, said authorization may only be issued if the habitat losses are adequately compensated.

The determination of the significance of the project's effects on the fish habitat thus takes into consideration the proposed mitigation and compensation measures as well as the follow-up program.

7.2.1.1 Piscifauna and fish habitat of the Portneuf River

The main impacts of the project on fish habitat productivity would be caused by modifications to hydrological conditions. The mean annual discharge of the Portneuf River, at the Portneuf Lake outlet, would change from 14.7 m^3/s to 5.2 m^3/s. Thus the percentage of the reduction of the mean annual discharge would be approximately 65% at the cutoff point and 15% at the river mouth.

Construction phase

The construction phase for the diversion structure and certain mitigation measures would only have a minor effect on the aquatic fauna and the fish habitat. In fact, the construction work would be minor in scope and it could be spread over a period from mid-June to mid-October, which constitutes, in part, the summer low water period, when the aquatic areas and flows are reduced. The end of the construction period could, nevertheless, overlap a part of the usual breeding period for brook trout. To that effect, the following mitigation measures should be applied:

- Take advantage of the low water period to carry out work in the aquatic environment;
- Carry out work in the river's approaches and most sensitive areas outside the brook trout's breeding periods, which generally extend from September to November; and

- Prohibit any machinery from fording the river;

In light of the following information and given that the proponent would respect these mitigation measures in addition to those described in chapter 9 of the preliminary project report,[9] the DFO is of the opinion that the construction of the diversion structure and the construction or the implementation of certain mitigation measures would not cause any significant negative effects on the aquatic fauna or the fish habitat.

Operation phase

In the assessment of the impacts of the project's operation phase on piscifauna, the proponent took into account the various parameters that might become limitative for fish species in the estuary and in the main reach of the Portneuf River following the cutoff of flow. Among these, it seems that it is the flooding of aquatic areas, the quality and the availability of spawning and rearing habitats as well as the intensification of competition with white sucker that would cause loss of fish production for the brook trout, the species most prized by users of the environment. Certain security factors have been applied by the DFO in such a way as to cautiously include a number of parameters that had not been included in the assessment of fish production losses.

The main mitigation measures recommended by the proponent and aiming to diminish loss of fish production capacity in the Portneuf River are listed below. A recent complete list of these, provided by the proponent appears in Appendix 1.

- The installation of a gate with a spillway capacity of 10 m^3/s into the dam to be constructed between Itomamo and Portneuf lakes, in such a way that a minimum flow of 1 m^3/s can flow at all times when hydrological conditions permit, as well as a flow higher than 1 m^3/s if necessary;
- The construction of a flow regulation structure at the outlet of Portneuf Lake to conserve the current lake area and the reproduction habitats on the shore. This structure would also be used to absorb a portion of the spring flood and release it in the Portneuf River during summer low water;
- The integration of a fish-pass into the regulating structure, to allow adequate passage for young and adult brook trout from the Portneuf River toward Portneuf Lake and vice versa, and this for the purpose of maintaining recruitment of brook trout in Portneuf Lake as well as access to the lake as a wintering site for brook trout from the river and its tributaries;
- The excavation of the main outlet of Itomamo Lake (Sables River) in such a way as to maintain the current level of the latter, despite the increase in flow and thereby prevent flooding of areas of forest lands and cottage and vacation facilities;
- The building of baffles or of rapid-flow conduit areas to clean the substrate and to conserve as far as possible the lotic habitats, conducive to brook trout and not conducive to white sucker;
- The building of spurs at the outlets of Sage, Patien, Emmuraillé and Bacon lakes, to maintain the water level in these water bodies as well as in the Portneuf River as nearly as possible to current conditions and thereby preserve the aquatic habitats and navigation conditions; and

- The recovery of unwatered gravel and the cleaning of fine sediments accumulated on the bed of existing spawning grounds.

Despite these mitigation measures, residual losses of brook trout production are anticipated following the partial diversion of the Portneuf River and these must be compensated.

7.2.1.1.1 Increase of interspecific competition with white and longnose suckers on the Portneuf River water course

The effect of reduced flow velocity would favor the white sucker to the detriment of the brook trout. In fact, white sucker generally better adapts to and thrives in slower waters. As indicated in the preliminary project report,[9] white and longnose suckers constitute species that compete with brook trout and from the standpoint of fisheries, they lead to the diminishment of the brook trout's productive capacity and of fishing quality.

The proponent considered that the proliferation of white suckers, the only sucker's specie present (see Section 6.2.1) between kilometer 106 and 169, would be more pronounced in the upper reach of the river than in the lower reach, because white and longnose sucker are already abundant in the lower reach and the flow velocities there would be scarcely altered. This overall increase of the white sucker population should translate into a potential brook trout production loss of approximately 30% in the fluvial environment, in the upper reach of the river (km 106 to km 169) and a loss of approximately 10% to 20% between km 91 and km 106. In the downstream segment, between km 0 and km 91, the proponent deems that the conditions are currently conducive to longnose sucker and that the slight flow and current decrease in this segment would have a minimal effect on the brook trout productive capacity. The DFO concurs with this assessment.

7.2.1.1.2 Decreases in water level and loss of aquatic areas on the Portneuf River water course

Main reach

In the preliminary project report, the proponent estimated that the unwatering of wet areas would be on the order of approximately 9% in the riverine environment and from 2% to 5% in the lacustrine environment in the upper reach of the river (km 106 to 169), as well as on the order of 5% in the lower reach (km 0 to 106), following the diversion as proposed at that time, namely without the minimum flow of 1 m^3/s, required as a condition for authorization by the provincial order-in-council[8] issued in July 2001. All the same, this unwatering, equivalent to a loss of aquatic area of approximately 38.5 hectares (ha) over the entire course of the river (20.6 ha in the lower reach and 17.9 ha in the upper reach), has been maintained to evaluate the assessed loss of fish production, despite the minimum flow requirement which contributes to diminishing the unwatering, in order to add a precautionary factor.

As a result, the loss of brook trout productive capacity associated with the unwatering has been established in a theoretical and conservative manner, respectively at 9% and 5% for the upper and lower reaches of the Portneuf River. The calculation of the Portneuf River's productive capacity as well as the fish production losses resulting from the project, was made by the proponent and based on two electrical fishing campaigns in the Portneuf River, a number of its tributaries as well as in the Sables River, conducted in 2000 and 2001.[18] The results of this evaluation were transmitted to DFO on december 2001. The numbers presented in the following paragraph represent an average for the two years.

The proponent has estimated the residual total production loss for brook trout in the upper reach of the Portneuf River to be approximately 240 kg/year. This number does not, however, include Itomamo Lake, but given that no alteration of level is planned there and that access to spawning grounds of high quality will be maintained there, no loss of fish production is anticipated there. The total residual loss of production in the lower reach of the river has been estimated to be approximately 111 kg/year.

It should be noted that this production estimate refers to the harvestable biomass, the quantity of fish that can be harvested annually while allowing the maintenance of the population, and not to the total fish production.

The overall assessment of residual losses, estimated by the proponent and based on 2 years of fishing in the field, is thus approximately 351 kg of brook trout per year for the entire Portneuf River.[18] Assessment from which the proponent subtracts the fish production gain of approximately 41 kg/year of brook trout that is anticipated in the Sables River because of the increase in aquatic areas and the improvement of habitat conditions for the brook trout to the detriment of white sucker (see Section 7.2.1.3), for a total residual loss of approximately 310 kg/year.

However, the losses of aquatic areas used as the basis for the estimate of fish production losses were calculated during the summer low water period, because according to the method used, it is this period that is considered to be the most limiting for brook trout and that as a result, it is this period that constitutes the "bottleneck" for the development and the growth of brook trout populations in a river. In this regard, the Fish Habitat Management Branch (FHM) of the DFO is of the opinion that the dynamics and the sustainability of a fluvial ecosystem such as the Portneuf River are based on a set of more elaborate factors such as the scope of flow fluctuations, the quantity of shelters, the quantity of food (benthos, drift, external input, etc). In certain rivers, the winter low flow, generally more severe than the summer low flow, may prove to be more limiting than the latter for brook trout. Thus, summer low water is not automatically the most critical period for fish.

It will be understood that conducting a practical assessment of the fish production of a water body requires reliance on calculation methods that take into account a number of intrinsic and local factors influencing the production and that eliminate several other factors in order to retain only those considered the most decisive. For instance, POTSAFO,[21] the method used in this case, considers the physical characteristics of a body of water, the biological characteristics of the population (fertility, mortality rate, proportion of mature females, etc.) as well as certain environmental variables that limit population density, in this case the presence of other species, the maximum summer temperature and sensitivity to acid precipitation. Although this method does not incorporate all the factors influencing production, the calculations derived from the field data are in fact more representative of the real productive capacity of the environment than a theoretical estimate and above all, they allow for the verification during the follow-up of the initial hypothesized loss estimates.

However, the DFO, as well as several other researchers consulted, stress the importance of adopting a cautious approach to the assessment of a water body's productive capacity and especially when assessing the fish productive capacity, using these methods, in the case of a water body whose natural hydrological characteristics will be altered following any development project, as is the case with this project.

The DFO thus expresses reservations regarding the identified limiting factor for the calculation of brook trout production loss, characterized as the summer low water period in this case. It is true that the aquatic areas of the summer low water period are the most reduced for the entire growth season for adult and juvenile brook trout. It is also true that this is usually a critical stage for the rearing of juveniles, because the number of territories that can be used by young territorial brook trout is at its lowest level, which in theory limits the brook trout production in fluvial segments and causes mortality and emigration. However, this method likely tends to under-estimate the significance of all the other periods of the year and all the other factors that influence the dynamics and the production of fish populations of a river.

In the case of the Portneuf River, in order to maintain the level of Portneuf Lake and mainly to prevent the low water period from being still more critical for navigation on the river, the proponent proposes installing a regulating structure that would store the spring flood to redistribute it into the river during the summer low water period. This would be done in such a way as to ensure that the minimum flows following project completion remain at similar or slightly higher levels than the natural flows during very dry years. Another effect of this mitigation measure would be to maintain the rearing areas available to young brook trout during this period and would reduce by as much those fish habitat losses determined by the assessment based on the summer low water rearing area. On the other hand, this measure would result in eliminating or diminishing to a great extent, the spring flood flow and subsidence, as well as the aquatic areas, during these periods in the upstream sector of the Portneuf River, particularly in the segment immediately near the cutoff, namely the segment located between Portneuf Lake (km 169) and Dégelis Lake (km 154).

The summer low water period would therefore be accelerated, extended and would gain in intensity during the spring period in the upstream sector of the river, particularly in the segment between Portneuf and Dégelis lakes which is currently well supplied in spawning grounds and rearing areas of high quality for brook trout. In fact, the tributaries that flow into this segment are relatively small and would not permit recreating hydraulic conditions similar to floods and therefore, comparable aquatic areas, given that the main water inflow during this period is the basin of Portneuf Lake.

These significant losses of aquatic areas during the fry-emergence period (May-June) would reduce the number of territories that could be colonized by emerging fry. It is certain, although difficult to quantify, that this reduction of areas available to emerging fry would have an impact, given that brook trout fry begin to defend territories very soon after their emergence from the gravel,[25] and that the dispersion of individuals causes a high mortality rate. This impact would likely be more significant in the segment located between Portneuf Lake and Dégelis Lake, and in the upstream reach of the Portneuf River in general, where the impact of the diversion would be the most pronounced.

The DFO is of the opinion that the effects on the survival of brook trout, the disappearance of significant aquatic areas as well as future flow conditions that would be inferior to current minimum water flows, during the fry-emergence and rearing periods, are not clearly assessed. As well, the DFO considers that the losses in biomass that would be triggered by these reductions in emergence areas are not included in the assessment of losses established by the proponent using the current method.

In the same way, much less pronounced flooding in the upstream sector of the river would eliminate or limit the time and the scope of spring overflow in this sector and thus the contacts between water and the bank. According to Junk W.J. (1989), the flooding caused by the overflow in flood-plain water body systems constitutes the main factor determining the nature and the productivity of the dominant biota as well as the interactions among organisms and among the latter and their environment. This effect is not included in the calculation of the losses in harvestable biomass. In addition, the dynamic of substrate cleaning and reshaping induced by the spring flood would be much less significant in the upper segment of the river, following the storage of the spring flood in Portneuf Lake.

The DFO is thus of the opinion that the method used to determine river's productive capacity is adequate from the standpoint of cautious stock management in rivers in which the flow cycles will not be altered or hardly altered, but that it is insufficient for determining losses in fish biomass (harvestable or total), produced by a number of river segments in which flow cycles will be greatly altered during different periods of the year, as is the case for the Portneuf River project. In fact, flow conditions over the entire river and particularly in the segment immediately downstream from the Portneuf Lake outlet, would be greatly reduced from April to July, which would bring significant permanent losses of aquatic areas during this crucial period for fish.

For example, the level of Dégelis, Chailly and Emmuraillé lakes would remain identical or rise slightly compared with current levels during the entire period without ice cover. However, the level of Bacon, Patien and Sage lakes would drop respectively by 75 cm (Bacon) and by 50 cm (Patien and Sage), during the spring flood and subsidence period. These losses in aquatic areas are not included in the method used for calculating losses of harvestable biomass. They would cause, however, the unwatering of the most productive part of the littoral zone,[9] particularly during the growth season of aquatic invertebrates and the peak feeding period for brook trout, which can extend from May to August.

Under the circumstances, DFO is responsible for applying a precautionary approach and has therefore increased the theoretical estimate for losses in the upper and lower segments of the river, with respect to the previously listed factors, and whose effects on fish production have not been calculated nor taken into account in the overall summary of impacts. This increase is explained in the document produced by Fisheries and Oceans 2001,[28] and raises the total losses in harvestable fish production to 370 kg of brook trout per year. This stems mainly from an increase allowed for the loss of significant aquatic areas during the fry-emergence period and during the intense feeding period for brook trout of all sizes in the upper segment and the loss of contact with riparian ecotones. From this total, the production gains of approximately 41 kg[18] anticipated by the proponent in the Sables River stemming from an increase in aquatic areas, and which is discussed in Section 7.2.1.3, have been subtracted. As well, the fact that a minimum flow of 1 m^3/s, not anticipated in the theoretical calculation of fish production losses, would now be added to the residual flow of the Portneuf River, without lowering the estimate of these losses, constitutes a reasonable security factor, and thereby reinforces the precautionary approach.

Estuary

According to the proponent, the water levels in the estuary area would be lowered by less than 2 cm, except in May, when the decrease would be more significant. In the ice-free

period, the reduced streamflow would cause the thinning of the fresh water surface layer in this area as well as an increase in the frequency and the extent of saltwater intrusion into the estuary.

The main impacts likely to be caused by the reduced streamflows concern the winter habitat of marine fish species and the recognized spawning ground of rainbow smelt. The proponent considers that the thinning of the fresh water surface layer in the estuary would not likely to impact the integrity of the rainbow smelt wintering sites because the latter appears to frequent fresh and brackish water indiscriminately in winter.[11] However, since the significance of this factor for the physiology and the survival of the smelt is not well understood, this element should be considered in the development and the interpretation of the follow-up for this species.

Lastly, no loss of area is anticipated for this species' spawning ground, located at the return point for the waters of the PN-1 complex and described in Section 6, during the month of June, the usual spawning period for the smelt in this area. The quality of the site would also remain identical to its current state. So as to validate these affirmations, the proponent has committed to conducting additional readings in the estuary relating to the integrity of the smelt spawning ground at the time of the follow-up.[11]

7.2.1.1.3 Modifications in the thermal regime of the Portneuf River

Following the partial diversion, the water of the Portneuf River downstream from the divertion point would react more quickly to weather variations.[9] As a result, the spring warming and the autumn cooling of the water would occur earlier, as would the freeze-up and the break-up. According to the proponent, these modifications would have limited impact on the reproduction of brook trout because the spawning period would occur slightly earlier in the autumn, as would the hatching and the emergence of fry in the spring. The duration of the incubation period would therefore remain identical to the current conditions. The cutoff of flow would also cause the occasional rise in water temperature during heat waves, near the divertion point, estimated by the proponent to be approximately 1.5 or 2.0 °C.

As mentioned in Section 6.1.2, the current summer temperature conditions in the Portneuf River, generally below 22°C, are considered to be conducive to the development of brook trout, although not optimal throughout the entire summer. By virtue of this fact, the effect of the occasional warming of summer temperatures anticipated following the diversion would be to extend the period of the year in which the temperature of the Portneuf River would not be optimal for the development of brook trout, namely, values over 20°C.[9] The proponent, relying on the temperature data for the Montmorency River, which shows maximum summer temperatures of 21.1°C, also feels that this temperature increase would not lead to more frequent attainment of the critical lethal temperature of 24°C for this species and would not affect the production of brook trout in the river.

From this perspective, according to the proponent, the anticipated increase in summer temperatures following flow reductions in the Portneuf River would not likely constitute a limiting factor for brook trout production. However, in order to verify this affirmation, the proponent expects to conduct a follow-up of the evolution of the thermal regime. Four thermographs have already been installed at kilometre points 10.5, 68, 155 and 165 in the Portneuf River.

In the opinion of the DFO, the follow-up of the Portneuf River's thermal regime proposed by the proponent would be adequate to verify whether the water temperature would be a limiting factor for the survival and the development of brook trout fountains in the Portneuf River as well as the aquatic wildlife in general and would allow for taking any necessary corrective measures as needed.

7.2.1.1.4 Free movement of fish and recruitment in Portneuf Lake

The construction of the dam between Itomamo and Portneuf lakes would block the access of fish coming from Portneuf Lake to Itomamo Lake. Thus, the spawners from Portneuf Lake would no longer have access to the recognized spawning ground of the Tagi River, one of the three known sources of recruitment of trout for Portneuf Lake. This loss of recruitment was estimated by the proponent as a production loss equivalent to 80 kg of brook trout annually in the overall losses,[18] which the DFO deems to be cautious and satisfactory.

However, with the loss of this source of recruitment, the DFO deems it crucial that the two other known sources of recruitment be maintained. The proponent also mentioned the importance of maintaining these sources of recruitment to Portneuf Lake[9, 11, 17] because, according to the proponent, the intake of juvenile trout from the Portneuf River largely contributes to the brook trout population that inhabits Portneuf Lake. The proponent also states that the effluents of Toqué and Bayeuville lakes are good reproduction sites and likely contribute to the recruitment for the northern part of Portneuf Lake.[17]

However, the installation of the regulating structure at the outlet of Portneuf Lake to maintain the level of Portneuf Lake and minimum flows would restrict the movement of adult trout and especially juveniles wishing to swim up the river toward Portneuf Lake. In fact, the proponent's and local outfitters' observation that the spawning ground at the effluent of Portneuf Lake is important for recruitment to Portneuf Lake points to the necessity of maintaining free movement for fish in this location. Following numerous discussions between Hydro-Québec and the DFO concerning the significantly reduced possibility for juvenile trout (under one year old) and adult trout attempting to migrate from the Portneuf River toward the lake to clear the regulating structure, it has been agreed to integrate a fish-pass into the regulating structure.

In December 2001, Hydro-Québec presented a preliminary proposal for the design of a fish-pass to the DFO. The details and the final design of the fish-pass are not yet finalized, but in the opinion of the DFO, this fish-pass would ensure adequate clearance for juvenile and adult brook trout, thereby allowing the preservation of this source of recruitment for Portneuf Lake for trout seeking growing areas. It would also allow for maintaining access to Portneuf Lake as a wintering site for juvenile and adult trout from the Portneuf River or even as a reproductive site (spawning ground at the lake outlet or other), thereby preventing a cleavage in the trout population in this sector

The characteristics of the fish-pass, the final design and the anticipated pass criteria will have to be discussed and accepted by the DFO before the necessary authorizations for carrying out this diversion project are issued. These conditions will have to be met and will be included in the follow-up in order to validate the assessment of the anticipated impacts on the free movement of fish and to implement any necessary corrective measures, as the need arises.

7.2.1.2 Other structures

Other activities, such as the construction or the patching of access roads could have impacts on the fish habitat. However, according to the proponent, the planned road-development work would be of limited scope. Essentially it would involve removing stumps, adding granular material and allowing for lateral drainage of the road surface. An additional road segment of approximately 2 km will have to be built to connect the existing road to the dam site. No construction of additional culverts or replacement of outdated culverts is planned.

7.2.1.3 Piscifauna and fish habitat in the Sables River

The mean annual flow of the Sables River would rise from 42.6 m^3/s to 52.5 m^3/s following the diversion. Thus, the percentage of increased flow would be approximately 24%. This flow increase would cause a permanent increase in water levels and flow velocities, as well as flooding of land areas by the banks, thereby causing a gain in aquatic area on the order of approximately 1 ha. This additional area would be usable by fish and aquatic fauna in general.

The potential source of impact on the piscifauna of the Sables River is the increase in flows and flow velocities, as well as the quantity of suspended matter in the water, linked to increased bank erosion. These increases should bring about temporary deterioration of the quality of a number of current habitats and the displacement of fish toward habitats that offer more favourable conditions for their development. The fish would thus be more confined to certain habitats, mainly during the flooding period and during the years immediately following the diversion.

In the segments constituted by meanders, where the materials are sandy, the riverbed would be overdeepened and there would be increased lateral displacement of the main river channel toward concave areas and greater accumulation of sand in the convex areas. On the banks, the permanent increase of water levels and velocities would cause the erosion of sensitive materials in locations exposed to flows. Rock, till and thin till banks (km 0 to 11) would quickly stablize. Moderately sloped and steep sand and gravel banks, located between km 11 and km 25, would be particularly subject to erosion. According to the proponent, the lifted sediment would be deposited in the Baie aux Sables of the Pipmuacan Reservoir, causing the enlargement of the river delta, which would represent a potential gain in feeding areas for fish species present in this area as well as in reproduction areas of the northern pike, on the condition that these deposits are colonized by aquatic vegetation.

In total, nearly 10 km of banks would be affected, and it would take several decades before these areas are able to attain an equilibrium slope and stabilize. The increased erosion of the banks of the Sables River would contribute to increasing the concentration of suspended matter in the water and turbidity, particularly during periods of flooding. In contrast, according to the proponent, the values of these parameters would remain below thresholds harmful to aquatic life. Since no confirmed brook trout spawning ground has been inventoried in the segment contained between Itomamo Lake and the Pipmuacan Reservoir, no loss of utilized spawning ground should be caused by the increased flow and suspended matter through increased sedimentation.

Thereafter, according to the proponent's estimate, the attainment of a new geomorphological equilibrium in the riverbed would produce a gain of 1 ha in brook trout rearing habitat due to

the increase in wet areas. In addition, on the whole, the increase in flow velocities would improve the quality of the habitat for the trout, by creating more lotic conditions, less favourable to white sucker and thereby diminish the interspecific competition with the latter. The proponent's estimate is a possible gain of approximately 41 kg /year of brook trout,[18] expressed in harvestable biomass and considering that spawning grounds currently deemed to be non-limiting would remain so after the project.

In the opinion of the DFO, despite the temporary deterioration of certain habitats, the longer term improvement of habitat conditions favouring brook trout as well as the gain in aquatic areas that can be utilized by fish represent a positive impact of the project on brook trout populations in this segment of the Sables River. As well, the potential gain in feeding and reproductive habitat for the northern pike and the other species of fish in this sector of the Pipmuacan Reservoir, caused by the enlargement of the Sables River delta, can be considered to be a positive impact.

7.2.1.4 Piscifauna and fish habitat in the Betsiamites River

The mean annual flow of the Betsiamites River exiting from the Bersimis-1 and Bersimis-2 complexes would rise from 289 m^3/s to 306 m^3/s and 341 m^3/s to 358 m^3/s respectively, with the joint diversion of the Portneuf and Sault aux Cochons rivers (another partial diversion anticipated by the proponent), namely an average increase of 5%. At the mouth of the river, the flow would rise from 402 m^3/s to 418 m^3/s, an increase of 4%. In terms of management, the main changes would occur from December to April, months during which the mean flow would rise from 335 to 373 m^3/s.

The Pipmuacan Reservoir level would be lowered by approximately 1 m compared with current conditions in winter. However, the operating levels of the reservoir would not be altered and the minimum and maximum levels would remain at 388.62 m and 398.98 m respectively.

The diversion projects for the Portneuf and Sault aux Cochons rivers would have few impacts on the habitat and fish resources of the Betsiamites River. In fact, since the current hydrological management of the river is state-of-the-art, involving fast and frequent flow variations, and since the minimum and maximum flows would not be altered, the anticipated slight flow increase would have few negative effects.

As for marine species, the flow alterations are deemed too slight to have an effect on habitats and the resource.

7.2.1.5 Follow-up program on the project's effects on piscifauna and fish habitat

If the project is carried out, the proponent will have to implement an environmental follow-up that will permit the monitoring of the evolution of the environment during and following the work. This follow-up, whose main elements are described in Chapter 14 of the preliminary project report,[9] as well as in the second response document to the questions of federal authorities,[12] will also have to permit the verification of the effectiveness of the mitigation measures and the determination of necessary adjustments.

In summary, the follow-up program on the project's effects on the piscifauna would discuss the following elements:

- the effectiveness of the mitigation measures (spurs, spawning grounds, rearing areas);

- the density of juvenile brook trout and white sucker (Portneuf River and redeveloped tributaries);
- fish populations (Portneuf Lake, Dégelis Lake, Patien and Sage Lake);
- the stability, the integrity and the utilization of redeveloped spawning grounds;
- the preservation of access to tributaries for spawners of the entire course of the Portneuf River; and
- the preservation of the quality smelt spawning ground in the Portneuf River estuary as well as the quality of the wintering habitat in the estuary for this same species.

Since the other significant elements for piscifauna and fish habitat, such as water quality, the thermal regime and the sedimentary regime would also be a part of the follow-up program, the DFO is of the opinion that the elements included in the program are adequate.

7.2.1.6 Compensation program for fish habitat losses

The anticipated impacts of the project's construction and operation on the fish habitat require the issuing of authorization under subsection 35(2) of the *Fisheries Act* (FA). In accordance with the no net loss principle of the DFO's Policy for the Management of Fish Habitat, said authorization cannot be issued unless habitat losses are adequately compensated.

The compensation measure anticipated by the proponent consists of redeveloping the maximum number of habitats conducive to the development and the survival of brook trout over the course of the Portneuf River (km 0 to km 169) as well as in Portneuf Lake and in their tributaries, taking into account the support capacity of the environment, as well as the completion of fish management redevelopment aimed at improving the brook trout habitat in the watershed of the Portneuf River. These facilities will have to enable the increase of the productive capacity of the receiving environment by a minimum of 370 kg of brook trout, expressed in harvestable biomass.

In summary, the compensation program[29] would include the following elements:

- the redevelopment of certain existing spawning grounds with the obligation of result (utilization by brook trout) for spawning grounds confirmed as lost and redeveloped;
- the creation of new spawning grounds and the improvement of rearing habitats in tributaries and in certain lakes, taking into account the support capacity of the environment; and
- the development and the stocking of virgin lakes or lakes supported by stocking, in the Portneuf River watershed, in such a way as to introduce or to naturally maintain self-sufficient brook trout populations and thereby offer greater potential for fishing in certain sectors of this watershed.

The proponent's original proposal[2, 16] to compensate fish production losses suggested that brook trout be stocked in certain lakes not currently containing fish in the Haute Côte-Nord and in the Monts Vallins region in the Saguenay, as well as the development of these lakes so that the stocked trout populations could be maintained in a natural manner. According to the experts of the Canadian Wildlife Service (CWS) of Environment Canada, this part of the project was likely to have an impact on the preferred nesting habitat of Barrow's Goldeneye, migratory duck designated as a species of special concern, and for which CWS has the management mandate.

This part of the project was thus subjected to a more detailed analysis and from the standpoint of conservation, the stocking of four virgin lakes located in the preferred habitat of Barrow's Goldeneye was abandoned. In fact, the CWS's work completed to date shows that the individuals of the Barrow's Goldeneye in Quebec reproduce mainly on the virgin lakes targeted for the developments. As well, the significant research work on virgin lakes of this sector, conducted by the proponent with a view to proposing the compensation program, shows that the lakes without fish are rare in the basin of the Portneuf and Sault aux Cochons rivers. That makes them more important ecosystems, according to CWS and Environment Canada experts.

Two other virgin lakes that do not have so-called ideal or preferential characteristics for this bird species have been preserved in the stocking and development program, on the condition that the benthic, plankton communities, avian and amphibian populations are studied before and after the introduction of fish. The purpose of this study is to document the effects of introducing new predators (fish) on the benthic and plankton communities of virgin lakes, necessary for the rearing of Barrow's Goldeneye and common goldeneye ducklings, amphibia and all other animal species, since the virgin lakes constitute important ecosystems in terms of biodiversity. However, this alternative was also abandoned in favour of simpler, less costly developments for the proponent and thus prevents the disturbance of these ecosystems that can be described as rare in this region.

The effectiveness of the compensation program would be assessed by a follow-up of at least ten years that would address the integrity and the utilization of fish developments as well as the productivity of brook trout and the dynamics of fish populations on the entire set of developed sites in the basin of the Portneuf River or connected basins.

7.2.1.7 Conclusion

The DFO deems that the impact of the project on the piscifauna and the fish habitat of area under study would not be significant, to the extent that the proponent complies with the planned and recommended mitigation measures, and in consideration of the fact that losses in fish habitat will be entirely compensated.

7.2.2 Riparian and aquatic vegetation and wetlands

Generally speaking, the reduced flow would cause, in the Portneuf River, the displacement of the riparian ecotone toward the new waterline. In this way, according to the information gained during the follow-up to the projects to divert the Vincelotte, Eastmain and Opinaca rivers for La Grande Complex, the unwatered shore platform would be quickly colonized by herbaceous vegetation, then in the longer term by shrub vegetation.

In the Sables River, the rise in the water level would cause the submergence of 2.4 ha of riparian ecotones scattered over the course of the river. As previously stated, currently, the riparian vegetation of the Sables River is spotty and sparse between Itomamo Lake and the Pipmuacan Reservoir. According to the proponent, the riparian ecotones would gradually replenish themselves above the new waterline and would help to stablize the banks subject to erosion in this sector.

The project to partially divert the Portneuf River would have no effect on the riparian and aquatic vegetation of the Pipmuacan Reservoir and the Betsiamites River.

The follow-up of the riparian ecotones would be concerned with the modifications and the significance of new habitats in the Sables River and in the Portneuf River. A mapping of these wetlands, conducted in summer 2001, would serve as a reference state.

7.2.2.1 Federal Policy on Wetland Conservation

The main objective of the Federal Policy on Wetland Conservation (FPWC)[7] is to promote the conservation of wetlands to sustain their ecological and socio-economic functions, now and in the future. The policy stipulates that there should be no net loss of wetland functions: 1) on federal waters and lands, 2) in areas influenced by the implementation of federal policies where the loss or the degradation of wetlands has reached critical levels; and 3) in areas where federal activities influence wetlands designated to have ecological or socio-economic significance for a region.

The wetlands affected by the partial diversion of the Portneuf River project do not meet any of the above-mentioned conditions. However, on the whole, the proponent complies with the spirit of the Policy because the anticipated mitigation measures for preventing or limiting habitat losses for aquatic wildlife would also limit losses of riparian and wetland habitats in the overall zone of influence. In addition, the follow-up program for the riparian ecotones in the Sables River would permit assessing the scope of the project's effects on these environments of ecological significance and redressing the situation where necessary.

7.2.2.2 Conclusion

Due to the relatively limited impact on the aquatic and riparian vegetation in the project's zone of influence as well as the adequate follow-up measures, the DFO deems that the project's impact on the riparian and aquatic vegetation would not be significant.

7.2.3 Avifauna

7.2.3.1 Portneuf River

Impacts on the avifauna are expected both during the construction phase and the operating phase. In fact, the construction of diversion facilities, access roads, the development of the work site area and the slight raising of Portneuf Lake would be sources of disturbances and would cause losses of terrestrial habitats that are potentially used by avifauna. However, according to Environment Canada experts, such losses may be deemed negligible and point-to-point. This would be true to the extent that the proponent carries out deforestation work before construction, between August 15 and April 15.

As for the operations phase, fluctuations in flow and water levels in the river would also be cause of disturbances to avifauna habitat.

Flow reduction

The habitats most highly valued by avifauna are located in the tidal area of the estuary of the St. Lawrence River, at the mouth of the Portneuf River. The reduction of flow at this location would be 15% on average with respect to currently measured flows. According to the proponent, the marshes located in the enclave formed by the sand spit of the Portneuf bank would in no way be threatened by the partial diversion project.

The reduction of flow in the Portneuf River estuary should not cause any significant impact for the birds that frequent the sand spit and the marshes. However, since the sand spit of the Portneuf bank is an exceptional site for shorebirds in Quebec, a series of inventories would be conducted as part of the environmental follow-up program. These inventories would permit monitoring the evolution of the sand spit and frequentation of it by shorebirds.

Again, according to the proponent, the reduction of flow in the other segments of the Portneuf River should cause the displacement of the ecotone toward the new waterline and would not cause harmful effects for avifauna. Following the reduction of flow in the Portneuf River, the application of mitigation measures would permit the preservation of most of the habitats that are attractive to avifauna on the main reach of the Portneuf River. The unwatering of the shore platform in the most conducive habitats would attract shorebirds and water birds in the short term. In the longer term, the extension of the shrub stratum would provide shelter and cover for the nesting of riverine birds.

The utilization of the unwatered zones and of the river by waterfowl would be integrated into the follow-up program for riparian ecotones, whose reference state was completed in spring 2001 through an inventory of indices of waterfowl presence. The standard inventory methods of the Canadian Wildlife Service (CWS) and of the Ministère de l'Environnement du Québec were used to survey waterfowl.

Raising of water level

The impacts on avifauna are deemed to be negligible in the area of Itomamo and Portneuf lakes, given the anticipated mitigation measures, which would help conserve the current water levels most of the time for these water bodies.

The presence of the regulating structure at the outlet of Portneuf Lake should not incur significant impacts on avifauna. In fact, the maximum flood level of the lake would be located at the altimetric point of 475 m, corresponding regulating structure's spillway. Currently, the mean flood level for the spring flood in this location is 475.5 m. As a result, the conditions that would prevail during the spring filling of the reservoir should not differ from the conditions observed to date in Portneuf Lake.[9] In the opinion of Environment Canada experts, no new impact would be anticipated on bird nesting at the edge of the reservoir, and this even during years of low hydraulicity and delayed filling of the lake.

The scrublands submerged in Portneuf Lake could serve as shelters during the rearing period of ducklings, whereas the impounding of herbaceous vegetation could sporadically enhance the food productivity of banks for waterfowl and herons. No degradation of the recognized heron colony area, on an island of Portneuf Lake is anticipated.

7.2.3.2 Sables River

In the short term, the submergence of riparian ecotones would give rise to the displacement and relocation of nesting birds likely to utilize these environments. In the longer term, new ecotones could replenish themselves and receive birds in the sections of lentic flow, given that the river would continue to follow a natural hydrologic cycle.

7.2.3.3 Betsiamites River

The undertaking of the project would permit the use of a greater water resource but without altering the operating levels of the Pimuacan Reservoir. This increase of the water resource

would involve an extension of the maximum flow turbined at the Bersimis-2 Complex and an increase of flows turbined during winter months, namely from December to March. Given that these alterations in the management mode of the Bersimis-1 and Bersimis-2 complexes would occur mainly in winter, they would have little effect on the avifauna likely to use the Betsiamites River.

7.2.3.4 Conclusion

The DFO thus deems the global impact of the project on the avifauna of the overall zone of influence to be not significant to the extent that the proponent complies with the mitigation measures and the follow-up program that it has proposed.

7.2.4 Sand spit of the Portneuf bank

In the opinion of experts, the sedimentary dynamics of the Portneuf River estuary is shaped by the equilibrium between the fluvio-tidal regime and the long-shore drift of the St. Lawrence River. According to the study conducted in the estuary,[19] the decrease of approximately 15% to 20% in the mean streamflow in the estuary would cause minor alterations in the dynamics of sedimentary deposits and would have the effect of shifting the equilibrium in favour of the long-shore drift. The main consequences would likely be increased erosion in the intertidal zone, the extension of active sand spits and more rapid filling of the secondary channels. Experts from the Earth Sciences Sector of Natural Resources Canada (NRCan) agree on the facts presented and the method used in this study.

Recent studies conducted by Professor Bernard F. Long[23, 24] also report that the sediment dynamics of the sand spit of the Portneuf bank or bar is a complex process on which flow reduction in the river would have little influence. In fact, according to these studies, the estuary system of the Portneuf River has not yet attained its sedimentation equilibrium and the sand spits that are currently in constant flux would continue to evolve following the partial diversion of the Portneuf River. However, since the sand spit of the Portneuf bank is of crucial importance to the citizens of Sainte-Anne-de-Portneuf and shelters a marsh of great ecological importance, a follow-up of the evolution of this shoreline sand spit would be conducted as part of the environmental follow-up program.

In this regard, Hydro-Québec and the ZIP [Priority Intervention Zones Program] of the north shore of the estuary have signed an agreement in order to define the commitments of the parties with a view to formulating a management plan for the protection and the development of the Portneuf sand bar. This agreement would allow for formulating implementation proposals in order to protect the natural components while maintaining human activities from the perspective of sustainable development. As for the bank follow-up program, it would be comprised of the following activities:

Hydro-Québec proposes an environmental follow-up that is essentially based on the following elements:

- the acquisition, the archiving and the processing of colour aerial photographs on a scale of 1:10,000 of the Portneuf estuary and of 5 km from the adjacent shore;
- a campaign of bathymetric surveys that would be conducted at a sampling interval of 100 m in the estuary and on the sand spits of the Pointe des Fortin and the Portneuf bank as far as the second island of the Portneuf bank, including the Portneuf bank marsh; and

- the validation and the processing of bathymetric data; the handling and the processing of water level data at the tide gage of the Portneuf marina; the installation, the handling and the processing of water level data from a tide gage at the head of the estuary (near Île de Cran).

This follow-up could be integrated into the follow-up on other environmental components, such as avifauna.

In light of the available information and the opinion of experts as well as the proposed preliminary follow-up measures, the DFO is of the opinion that the effect of the project on the sand spit of the Portneuf bank would not be significant.

7.2.5 Physical and cultural heritage

Since no archeological site has been discovered in the work zone, no impact is anticipated on this component. However, if the discovery of an archeological site were to occur during work, the proponent has committed to reporting the information to the competent authorities and to take appropriate measures as required.

7.2.6 Human health

The partial diversion of the Portneuf River project would not give rise to flooding or to the creation of a reservoir that would alter the mercury content in organisms (fish, waterfowl, etc.) consumed by local Aboriginal populations or by cottage-owners or vacationers. According to Health Canada experts, there is thus no risk of raising mercury concentrations in the food chain, arising directly from the carrying out of this project.

The monitoring and the maintenance of new retaining structures would be conducted in conformity with the monitoring program of the Manicouagan Territorial Directorate, the topic of Section 2.9.1.1 of the preliminary project report.[9] In addition, the Manicouagan Emergency Plan would be in effect during work to ensure preparedness for any contingency. The contractor who would be mandated to perform the work should also present his own emergency plan in the event of an accidental spill or any other emergency condition.

Given that there is no risk of increased mercury content in the organisms consumed by local populations concerned with the project's completion and that the monitoring of new retaining structures would be carried out in compliance with a well-established protocol, the DFO deems that the project's effect on human health would not be significant.

7.2.7 Socio-economic situation

The assessment of the economic impacts of the Portneuf River partial diversion project is mainly concerned with the regional economic benefits arising from construction work, therefore during the construction phase, as well as with changes to recreational and tourist activities caused by the project.

7.2.7.1 Economy and employment

The work, lasting approximately 4 months, would generate regional economic benefits ranging between a conservative estimate of $407,508 and an optimistic estimate of $684,001.[9] In addition, according to the same conservative and optimistic estimates, job creation during construction work is estimated to be between 5.03 and 9.09 person-years.

In the opinion of the DFO, even though the project is not a major economic issue for the workers of the affected region, it nevertheless represents an attractive contribution to the regional economy. The project would therefore have a positive effect on seasonal construction employment and the region's overall economic situation over a short period of time.

7.2.7.2 Use of resources by the non-Aboriginal community, recreation and tourism

Negative impacts on outdoor activities, mainly sportfishing, could be felt during the construction of retaining structures and the implementation of mitigation measures (spurs and baffles) in the sector between Itomamo and Sage lakes. During operation, the reduced flow would give rise to loss of fish habitats and thus fish production losses, as well as losses of fishing sites, which would be compensated as nearly as possible to the site of the impact, in accordance with the DFO's Policy for the Management of Fish Habitat. As well, the increased flow in the Sables River would slightly diminish the quality of fishing during the first years of the diversion, but subsequently, the quality of brook trout fishing would be enhanced in the river.

Brook trout fishing

As previously mentioned, the reduction in flow and levels in the Portneuf River would have effects on aquatic fauna. The anticipated decreases in potential harvest of brook trout are likely to be felt in fishing-related practices, on outfitters' land as well as on free access territory (or free lands) outside of the project's zone of influence. In addition, changes to conditions for the practice of fishing activities, constraints on navigation, berthing and launching would likely have effects on the volume of users of outfitters' and cottage and vacation facilities.

The decrease in patronage over the entire Portneuf River would vary from 5% to 51% depending on the sector.[9] It would have a greater effect on those sectors upstream from km 106, where the losses in potential occupancy would vary from 13% to 51%. The diversion project would not jeopardize the practice of fishing in the river, but it would have a marked effect on occupancy in some locations. Fishing in the Portneuf River represents, however, a fraction of the potential occupancy of outfitters' facilities. In fact, for the three affected outfitters, the losses would not surpass 8% of the overall potential occupancy of all the water bodies located on their respective lands.

In the sector of Itomamo and Portneuf lakes, the construction of the dike between these two lakes would cause a temporary disturbance in fishing activity in this sector as well as the permanent loss for clients of the Québec Nature outfitters company, of the recognized fishing site located between the two lakes. In addition, the decrease in potential occupancy is estimated at approximately 7% in this outfitter's sector including, among others, the area between Portneuf Lake, Bacon Lake and the segment of the Portneuf River that links these lakes.

The decrease in potential occupancy, as calculated by the proponent, would range approximately from 2% to 5%, in the area contained between Bacon Lake and Emmuraillé Lake (Dégelis Lake outfitter) and from 8% to 9% between km 106 and km 138, namely the lands containing the Domaine du Lac des Cœurs outfitter and the cottage vacation areas of Patien Lake and Sage Lake. Optimal river fishing in the upstream area occurs only on the

Dégelis Lake outfitter's land, where reduced brook trout production may well have short-term effects on the quality of fishing and on attendance.

The decrease in potential occupancy would likely be less significant in the downstream sector (km 0 to km 106) and would not surpass 5%, following the application of mitigation measures. In fact, the drop in brook trout production and the degradation of navigation conditions that are anticipated there would be less significant, and the fishing activity would only be subject to a slight disturbance there.

The increase in flows and water levels in the Sables River would involve a slight deterioration in the quality of fishing on this water body during the first years following the diversion, that is, about 5 years. However, as soon as the environment has reached a new geo-morphological equilibrium, brook trout production would likely experience a slight rise due to the increase in wet areas (7.2.1.3). In addition, the more lotic hydrological conditions that would prevail in the river following diversion would be more favorable to brook trout, to the detriment of the white sucker. At that time, as a result, the quality of brook trout fishing would be permanently improved, which constitutes a positive impact of the project.

Winter rainbow smelt fishing

No impact is anticipated on ice fishing for rainbow smelt in the bay of the mouth of the Portneuf River.

According to the proponent, even with a reduction on the order of 15% of the mean flow in the estuary, a channel would continue to be present, and species such as the rainbow smelt could continue to penetrate the river. As well, as stated in the section covering the project's effects on piscifauna and fish habitat, the partial diversion project would not likely have repercussions for the presence of smelt in the river during winter because this reduction in fresh water inflow in the estuary would not change the quality of this winter habitat as a thermal refuge and a wintering site.

The ice cover, needed for setting up cabins, would continue to be present and just as safe, because it would form and break up on virtually the same dates as under current conditions. In addition, the reduction of flows at the mouth of the river would not have the effect of degrading ice conditions in this area. As a result, no mitigation or security measure is anticipated for maintaining ice fishing.

7.2.7.3 Navigation

The construction of a dam between Itomamo and Portneuf lakes would prevent any possibility of navigation between these two water bodies. This would have the effect of physically separating the two lands under lease, namely that of the Club Homamo et Épinette Rouge outfitter and that of the Québec Nature outfitter company. However, the proponent would build a portage on the site of the dam to allow canoe-campers to circulate between the two lakes, as it has always been possible to do.

During the operation phase, the reduction of water levels in the Portneuf River would have effects on navigability and could necessitate the modification of certain boating facilities, such as docks. The landscape would thus be somewhat altered. These changes essentially concern the visual aspect of the river for canoers, kayakers and other users of the river. The importance of maintaining the navigability of the Portneuf River, particularly in the marina

area (estuary) and in the upstream segment (km 106 to km 169) where most fishing activities are concentrated, was raised repeatedly by the public and thus constitutes a very important issue.

The Portneuf River partial diversion project would lead to a variable decrease in water level depending on the sector, and would make movement in the shallow depth sectors more problematic, where the traffic is already difficult depending on the navigation season. Generally, clearing the rapids would be more difficult if there is unwatering of obstacles, and in the worst cases, these obstacles could become impassable. Elsewhere, the reduction in water levels could give rise to the unwatering of shoals or blocks on which craft could run aground or damage their propellers. According to the proponent, the water levels in the estuary area would be lowered by less than 2 cm, except in May, when the decrease would be more significant. This drop in the level would not create additional difficulties for navigation in this area.

However the partial diversion project would include the putting in place of a regulating structure at the outlet of Portneuf Lake, which, according to the proponent, would guarantee, during the dryer summers, a minimum flow similar to or superior to the current flow and prevent an exacerbation of navigation problems during this period, between km 109 and km 144, where there are currently eight zones unsuitable for the passage of outboard motorboats.

Moreover, the construction of a spur is planned at the outlet of Emmuraillé Lake to ensure the maintenance of current water levels and navigation conditions as well as access to the docks on this water body as well as on Dégelis Lake and Chailly Lake. According to the proponent, the structure of the spurs would not give rise to any navigational constraints, and their buoyage would help prevent the risk of collision or running aground for craft.

For the same reasons, spurs would also be built at the outlets of Sage Lake and Patien Lake. In fact, the currently practicable segments of the Portneuf River would be subject to alterations that could accentuate existing difficulties in certain passages, notably those located between km 96 and km 130, downstream from Sage Lake, without, however, compromising navigability. The only segment that would pose a problem is located between km 109 and km 114, where the number of passages that are impassable for motorized craft would increase from eight existing passages to eleven.

Few impacts are anticipated pertaining to the utilization of docks, except for fixed docks at the primary and secondary camps of Québec Nature outfitters. In fact, as a result of the management of Portneuf Lake to store spring flood water, the raising of the lake water level would probably submerge these docks, and affect a part of the building that houses the outfitter's kitchens. To redress the situation, the proponent proposes altering the dock installation and to elevate or move the affected buildings.

As far as non-motorized craft navigation is concerned, the same conclusions apply, and a number of difficult passages would become impassable. The proponent's plans pertaining to canoeing were presented at the BAPE public hearings, and state that the length of the portages on the Portneuf River course would increase from 7.7 km to 8.05 km, namely an extension of approximately 350 m. The length of "cord" passages would increase from 3.05 km to 3.50 km, namely an increase of approximately 450 m.[14]

This reduction of flow would certainly cost the Portneuf River a measure of attractiveness for canoeing and kayaking, as the Fédération québécoise du canot et du kayak (FQCK) maintains. The visual aspect of the river for canoers would deteriorate somewhat during the first years following the diversion due to unwatered banks, and clearing passages in certain segments would be more difficult. However, the possibility of practicing these activities would remain and would not be compromised. The proponent will have to conduct a specific follow-up of navigation conditions because the maintenance of navigation conditions is a highly important issue for many users of the Portneuf River.

For the purpose of validating the present assessment of impacts as well as completing a reference state, at the end of the summer 2000, the proponent carried out a series of measurements to reveal the depth of the summer minimum flow on three segments of the Portneuf River, namely in the segments km 110 to km 120, 85 km to 95 km, and 40 km to 70 km. Following the diversion, the proponent would proceed with the verification of the navigation conditions in these same segments as well as of the possibilities of access to the docks and other nautical infrastructures. If unforeseen constraints were to occur after the diversion, the necessary corrective measures (reshaping of thalweg, reconstruction of nautical infrastructures, etc.) would be taken in the affected sectors.

To enhance the current knowledge of navigation conditions, additional surveys were conducted in September 2001. Two separate teams carried out a down-river race in the Portneuf River in minimum flow conditions. The first team descended the river in a motor-craft to take depth measurements (thalweg) in the problematic sectors, that is, where the depth is less than 1 m. The second team descended the river in a canoe to characterize the run-off conditions by using the classification established by the Fédération québécoise de canot-kayak (R1, R2, etc.). The entire river was covered, with the exception of the sectors that are currently non-navigable, such as, for example, the canyon area. The results of this data acquisition will likely be submitted at the end of March 2002 and will be integrated into the reference state and the follow-up on navigation conditions (personal communication. Hydro-Québec, Nov. 30, 2001).

7.2.7.4 Conclusion

The Portneuf River partial diversion project would likely give rise to economic benefits of limited scope in the region, which could be considered a positive impact of the project. It would also alter the availability and the use of resources by the non-Aboriginal community as well the closely associated local recreation and tourism activity. However, the set of mitigation measures would permit supporting conditions favourable to the maintenance of brook trout and rainbow smelt populations that frequent or inhabit the Portneuf River and to fishing activities. In addition, the follow-up of the project's effect on aquatic fauna, fishing activity and navigation conditions will serve to verify these statements and to take corrective action when necessary.

As well, the compensation measures for losses in fish habitat and fish production planned as the result of an agreement between the proponent and the DFO would be implemented in the watershed of the Portneuf River on the land of the impacted outfitters and vacationers and cottage-owners. This would permit attaining the no net loss of habitat productive capacity of the Policy for the Management of Fish Habitat (PMFH), and thereby maintain the social benefits arising from sportfishing for the users of this region. In light of this information, the

DFO is of the opinion that the project's effects on the socio-economic situation, including the utilization of resources by the non-Aboriginal community and recreation and tourism would not be significant.

From the standpoint of navigation, the experts of the Coast Guard's Navigable Waters Protection program (Fisheries and Oceans Canada) are of the opinion that the various conclusions regarding the practice of navigation and compliance with conditions associated with formal approval to be issued under the *Navigable Waters Protection Act* (NWPA) will ensure navigation safety over the entire course of the Portneuf River and that the project will not give rise to any significant negative effect on navigation.

7.2.8 Current use of lands and resources for traditional purposes by Aboriginals

The reduction of flows and levels will have two major repercussions for the utilization of resources by the Montagnais of Betsiamites and of Essipit. Namely, the decreased access to a number of harvesting zones and the altered availability of certain harvested species.

7.2.8.1 Reduced access to certain harvesting zones

The intensity of impacts on the movements of the Montagnais would be marked in the segments of the Portneuf River that they use, between km 106 and km 121, km 146 and km 158, as well as between km 162 and km 169, which represent the segments where navigation conditions would be most severely affected. In addition, a crossing site at km 114.5 serving a camp located on the left bank might have to be reconstructed due to the reduced water level.

However, as mentioned in previous sections, the planned mitigation measures would permit maintaining summer minimum-flows similar to currently observed levels, and thereby avoid creating additional constraints on navigation where none currently exist. Some interventions, which would be determined during the operation phase, could also be considered for the problematic segments of the river in order to improve navigation and berthing conditions. Some corrective work is also considered at km 114.5, namely at the site of a raft crossing to serve a campsite on the land belonging to the Domaine du lac des Cœurs outfitters.

7.2.8.2 Altered availability of certain species

Overall, no impact is anticipated on the semi-aquatic and terrestrial fauna or on trapping and hunting activities, because only relatively small areas would be flooded or unwatered.[9]

The anticipated decrease in brook trout production over the entire Portneuf River would diminish the availability of this species for Aborginals who engage in subsistence fishing of this species during their stays in the surroundings of the river. However, Aboriginals seem to value brook trout fishing more highly in the lakes surrounding the Portneuf River.[9]

Therefore, the mitigation measures mentioned in the preceding sections to mitigate the project's impacts on aquatic fauna and navigation would reduce the negative effects on the anticipated movements of the Montagnais in these segments. In addition, the segment located between km 106 and km 121, heavily used by the Montagnais, is accessible over virtually its entire length by a road that skirts the river, which diminishes the risk of losing access to resource claim sites in this sector. Finally, the mitigation and compensation measures for the losses in fish production that are anticipated in the Portneuf basin, would also contribute to lessening the effect of diminished brook trout fishing potential in the river by Aboriginals for

subsistence purposes, which, as mentioned in the preliminary project report, is a less valued fishing practice than lake fishing.

7.2.8.3 Conclusion

Experts of the Department of Indian and Northern Affairs Canada (DINAC) stressed the importance of the implementation of mitigation and follow-up measures linked to subsistence fishing on the Portneuf River, as well as on trapping and hunting by Aboriginals on this land. They also indicated the importance of informing and involving Aboriginal communities in the follow-up process on the project's effects, which the proponent has committed to do. The DFO thus deems the project's impact on the current use of lands and resources for traditional purposes by Aboriginals to be not significant, to the extent that the proposed mitigation and follow-up measures are implemented.

7.3 Effect of the environment on the project

The effect of certain natural events such as significant flooding or the effect of waves and climate which might cause damage to or the failure of facilities was taken into consideration by the proponent in the design of these facilities. The planned dam, which would be located between Itomamo and Portneuf lakes, would be designed to divert the total 100-year flood, with the exception of the minimum flow of approximately 1 m^3/s which would flow through a gate inserted in the dam, to the Sables River. If a higher flood should occur, a portion of it would be spilled over the dam crest, designed in such a way as to resist sporadic overflows, without risk of failure.

Given that no submergence is anticipated following completion of this project, the wave climate would not be altered, either on Itomamo Lake or on Portneuf Lake. The upstream face of the dam would be protected by a riprap of sufficient size to remain stable under the effect of waves.

In light of this information, the DFO considers the handling of this aspect to be satisfactory and deems that the environment will not likely give rise to any significant impacts on the project's constructed facilities and components.

7.4 Impacts caused by accidents or malfunctions

As part of the preliminary project studies, simulated dam failures at the eastern outlet of Itomamo Lake were carried out. These simulations hypothesized a dam breach during a 10,000-year flood and assumed that the total volume of Itomamo Lake would be absorbed by Portneuf Lake. The results of these simulations showed that the flooded areas would be less significant than those flooded by a 10-year flood, if the latter were to occur under current hydrological conditions. Should the regulating structure at the outlet of Portneuf Lake fail, the flow discharged into the river would attain a maximum 27 m^3/s under normal operating conditions, a flow that is frequently encountered and surpassed in this location during spring flooding under natural conditions. Therefore, this scenario represents no environmental risk.

The DFO considers the handling of this aspect and the potential impacts identified in this regard to be satisfactory.

7.5 Effects of the project on renewable resources

The project is not likely to cause significant effects on the renewable resources of the forest and the fisheries.

The construction work on the facilities would be carried out in a sector that has already, for the most part, been subjected to logging, and the access roads are already present. The fisheries of the region should not be affected because the lost habitats would be compensated by developments aimed first at maintaining optimal brook trout productivity in the Portneuf River, in terms of the environment's support capacity, then to improve the brook trout productive capacity of the water bodies in the Portneuf River basin or connected basins, as nearly as possible to the site of the project's impact.

7.6 Cumulative effects

This section serves as a summary of the different sections dealing with the subject as well as of the meeting held between the Canadian Environmental Assessment Agency (CEAA), the Department of Fisheries and Oceans (DFO) and the proponent to clarify the assessment of this development project's cumulative effects. The method used and the handling of these effects are in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA) in this matter.

The method used is very broadly drawn from that advocated in the Canadian Environmental Assessment Agency's document. The major steps of this approach are briefly described. Step 1 consists of determining the importance of the problems and the priorities by identifying the issues and the related valued environmental components (VECs), by establishing the spatial and temporal boundaries and by determining the other projects or activities whose negative effects might add to those of the project. The second step consists of analyzing the effects by describing the reference state and by assessing the cumulative effects. The third step consists of determining the mitigation measures while the fourth step permits the assessment of the significance of the residual effects. Lastly, the fifth step identifies the follow-up required.

The valued ecosystem or environmental components (VECs) represent elements of the natural and human environment with a special value in the project region. The VECs were determined in consideration of the concerns of the regional stakeholders who met with the proponent as well as the knowledge of experts who studied the land.

The study area covers the total watershed of the Portneuf and Betsiamites rivers. It also includes an area of influence for each river in the St. Lawrence River, in the form of a semi-circle having as its centre the mouth of the water body and whose radius is 500 m in the case of the Portneuf River and 2 km in the case of the Betsiamites River. The temporal boundaries considered were set at ± 10 years from 1999, or from 1989 to 2009, as agreed at the meeting held between the Canadian Environmental Assessment Agency (CEAA), the Department of Fisheries and Oceans (DFO) and the proponent

Here are the environmental issues defined during the communications program implemented by the proponent in the receiving environment:

- Issue 1: piscifauna and fish habitats;
- Issue 2: use of resources by non-Aboriginals;
- Issue 3: use of resources by Aboriginals;

- Issue 4: vacation and cottage facilities, recreation and tourism.

7.6.1 Piscifauna and fish habitat

7.6.1.1 Portneuf River

In all likelihood, certain factors would have cumulative effects on piscifauna, particularly those with direct short-term effects, such as fishing pressure and hydroelectric operation, which account for a certain mortality level of populations in the river, as well as reduced flow, which would cause the unwatering of habitats and the diminished productive capacity of the water body. In fact, fishing pressure could increase in the beginning, at least temporarily because the fish in the Portneuf River would be located in a reduced volume of water at certain times of the year. Afterwards, a new harvesting equilibrium would be established in the river which would be less productive, but whose fish production losses would have been compensated in the same basin, maintaining productive capacity and fishing opportunities.

Other factors would have effects that would be manifested in the longer term. This is the case for logging and the forest road system, which may give rise, among others, to an alteration of the water regime, the thermal regime and increased inflow of fine particles in the river. This inflow could lead to a gradual deterioration of the habitat through the sedimentation of fine particles and the silting of the granular substrate beds used by brook trout for reproduction. Moreover, it is highly possible that this phenomenon of sedimentation brought about by logging would be accelerated by the decreased flow velocities caused by the partial diversion of the river. Special attention should thus be paid to the follow-up of the quality of brook trout spawning grounds in the Portneuf River, particularly in the upstream segment. However, logging practices in the basin will not intensify following the Portneuf River partial diversion project, which should limit the scope of this cumulative effect.

In this regard, over the course of the period between 1990 and 2000, logging practised in the watershed of the Portneuf River (common area 23-20) affected a total of 30,553 ha, or 25% of forest lands, excluding water, alder groves, dry and wet stripped areas and electrical transmission lines.[12] In the same watershed, future logging will cover 4,524 ha, or a proportion of less than 4% of forest land, in the course of the next five years, followed by partial logging (harvesting approximately one third of the volume) which will total 3,150 ha, or less than 3% of the area. In the 500 m corridor skirting either side of the Portneuf River, a harvest of 161 ha is planned, or approximately 5% of the riparian forest area.

The site for logging sectors targeted for the period 2001–2004 is divided into three areas, all located in the upstream section of the river, near the headwaters of the watershed:

- at the north-west of Portneuf Lake, near Itomamo Lake;
- at the north-east of Portneuf Lake;
- at the south of Portneuf Lake, near the outflow of the lake into the river.

7.6.1.2 Betsiamites River

The major activities having had an impact on the piscifauna of the Betsiamites River are hydroelectric operations and fishing.

The partial diversion of the Portneuf River would increase the water inflows into the Pipmuacan Reservoir by approximately 10 m^3/s, which is a relatively reduced inflow at this complex. Moreover, the partial diversion projects for the Sault aux Cochons, Manouane and Boucher rivers, likely to be more or less quickly completed, add several other development scenarios, the most extreme of which, in terms of impacts on the flow of the Betsiamites, would be the partial diversion of the Boucher River alone, which would trigger a flow decrease of 16.3 m^3/s in the Betsiamites, downstream from the Bersimis-1 and 2 complexes; and the partial diversion of the Portneuf, Sault aux Cochons and Manouane rivers alone, which would involve a mean flow increase of approximately 48.2 m^3/s over the entire course of the Betsiamites River.

According to the proponent, whatever the envisaged scenario, the flow increases or decreases in the Betsiamites would represent a small proportion of this water body's mean annual flow, which is 402 m^3/s. In addition, the operating levels of the headbays upstream of the Bersimis-1 and Bersimis-2 complexes would not be altered by the partial diversions. The maximum flows to be turbined would remain unchanged, because they correspond to the facility's design flow. The major changes would be to the frequency of use by the groups on site, which would increase or diminish depending on the chosen development scenario.

Currently, the quality of the different habitats of the Betsiamites River is variable and is dependent on the method of water management. Following the diversion of the Portneuf River, the biological resources that frequent the Betsiamites River would be subjected to changing habitat conditions, as is presently the case. According to the proponent, the increase in annual flow would have little or no effect on the use of habitats by the species present. The successful use of the river for feeding and reproduction would vary depending on the water management method. According to the calculations presented by the proponent, the increase of 38 m^3/s to summer flows in the Betsiamites River following the diversion of the Portneuf, Sault aux Cochons and Manouane rivers would involve a slight degradation of rearing areas usable by salmon juveniles in this body of water.

However, in accordance with an agreement undertaken between the proponent and the Betsiamites band council in 1999, the proponent modified its flow management in the Betsiamites to promote salmon production, notably by limiting the maximum hourly variation of the flow downstream from the Bersimis-2 complex. By limiting the complex's generation variation to one group per hour, the maximum hourly flow variation will be approximately 110 m^3/s to 140 m^3/s from June 15 to November 30 each year, from 1999 to 2004. The proponent specifies that at the end of this period, the assessment of the salmon restoration program could lead to the permanent modification of the flow management in the Betsiamites. The proponent also committed to ensuring a minimum flow of 1 group (approximately 110 to 140 m^3/s) for the entire year until June 4, 2005. In addition, to avoid the unwatering of redds and fry before the emergence period, the proponent committed to ensure that the minimum flow at the complex increase from the generation of one group (approximately 130 m^3/s) to that of two groups (approximately 260 m^3/s) from November 15, 2000 to June 30, 2001. This increase of the minimum flow during the egg incubation period would represent a gain of 3,041 m^2 of the fry area. The DFO deems that the changes in the flow management of the Betsiamites River described above would permit an increase in its current productive capacity.

At the mouth of the Betsiamites River, the inflow of a larger quantity of fresh water would alter the saltwater wedge intrusion. These changes would be more significant during low water spring tides and higher streamflows. The proponent considers that the planned flow alterations would be too insignificant to have an effect on habitats, marine resources and their harvesting. This given the natural variability attributable to the tide, to the influences of weather and the variability introduced by the management method of the Bersimis-2 complex. The DFO expresses certain reservations about these conclusions and asks the proponent to carry out an adequate follow-up program to clarify current and future conditions in the estuary of the Betsiamites River.

7.6.1.3 Conclusion

In summary, the diversion project would have effects on fish populations, particularly the brook trout populations of the Portneuf River. These effects would add to the major current effects of logging, and sport- and subsistence fishing of piscifauna and fish habitat. The cumulation of these effects may, however, be considered as not significant, given that the habitat losses attributable to the Portneuf River project would be compensated by fish management aimed at maintaining brook trout productivity in the affected areas, and that changes to the management of the Betsiamites River should increase current production. However, the DFO deems that a follow-up of the project's effects on brook trout populations and their habitats in the Portneuf River is necessary, as well as a follow-up of the current and future conditions in the of the Betsiamites River.

7.6.2 Use of resources by non-Aboriginals

7.6.2.1 Brook trout fishing

As previously mentioned in this report, the Portneuf River basin is a region reputed for the quality of brook trout fishing, with six outfitters. Recreational fishing, and particularly brook trout fishing, is considered to be a sensitive issue in the community. It is the principal activity for the outfitters and the ZECs (controlled harvesting zones) of the Côte-Nord.

The partial diversion of the Portneuf River would put additional pressure on the brook trout and its habitats, added to that attributable to forest fires, logging, the forest road system and the floods of 1996, as well as to the pressure of current sportfishing. That would entail a cumulative effect on the potential use of the Portneuf River for the sportfishing of brook trout, particularly upstream from km 106, on free lands and on outfitters' lands.

However, the DFO deems this effect to be not significant, given that on a regional scale, the use of the Portneuf River for sportfishing is relatively low and that the fish habitat losses would be compensated in the Portneuf River basin or a connected basin, which would permit the maintenance of fish productive capacity and fishing potential in this area.

7.6.2.2 Navigation

In the past, different activities or projects, such as the forest road system and the operation of hydroelectric generating stations, have altered navigation conditions of the Portneuf River. The drop in water levels caused by the diversion project would create further difficulties for navigation in certain areas where it is already difficult, as well as difficulties of access to certain nautical infrastructures such as docks or to certain hunting and trapping areas. According to the DFO and as stated in the preceding sections of this report, an extensive

follow-up of navigational constraints is therefore necessary to establish certain corrective measures as required. In consideration of this follow-up, the project's cumulative effects on navigation are deemed to be not significant.

7.6.3 Use of resources by Aboriginals

7.6.3.1 Subsistence fishing

Although brook trout fishing is a means of subsistence that is valued by the Montagnais, it plays a particularly complementary role to hunting and trapping, which are more highly valued and which generally yield a much more important product. The product of fishing is generally consumed on site. In addition, as previously mentioned, fishing in the lake occurs more frequently than in the river.

The effect of the decrease in harvestable biomass of brook trout in the Portneuf River on subsistence fishing by the Montagnais would therefore be of low intensity. It would be added to the major effects of logging, the forest road system and fishing pressure already acting on the fish populations of the Portneuf River.

As well, the previously described changes to the flow management of the Betsiamites River would permit the increase of its current productive capacity for the Atlantic salmon, a more highly valued fish species.

7.6.3.2 Hunting and trapping

No cumulative impact is expected on the availability of resources and game that are hunted and trapped by the local Aboriginal communities, because no direct impact on the resource is expected.

7.6.3.3 Access and traffic conditions

The degradation of navigation conditions in certain segments of the river, notably between Portneuf and Dégelis lakes, and between km 106 and km 120, would make access to the resource more difficult. However, since the Montagnais mainly use the road to reach their fishing site in this area, the access to the resource would be maintained in the same capacity as under natural conditions. The project would have no significant impacts on access and traffic conditions other than those already stated in Section 7.2.8.1 of this report. The year-long opening of roads R0954 and R0953, which would serve as access to the facilities, would facilitate winter access to the land.

7.6.3.4 Conclusion

Given that the brook trout population losses would be compensated by fish management on the immediate sites of the impacts and in the basins of the impacted bodies of water, that the salmon productive capacity of the Betsiamites River would not be diminished and that no overall impact would affect the availability of resources and trapping and hunting activities, the DFO is of the opinion that the project's cumulative effects on the use of resources by Aboriginals would not be significant.

7.6.4 Cottage and vacation facilities, recreation and tourism

As mentioned in the previous chapters, the diversion project would have direct impacts on navigation and on the quality of the landscape, the two valued components that are involved

in this issue. Apart from the cumulative effect mentioned in Issue 2 concerning the practice of fishing, the direct impacts would not be combined with any other. In the case of navigation, a follow-up of the constraints on this activity is planned to establish, if necessary, a number of corrective measures, notably the right of access to the river and docks.

As for the project's direct visual impacts on the quality of the landscape, they would be added to the existing impacts attributable to forest fires, logging, and the exceptional flooding of 1996. This addition of effects can however be considered of low magnitude because the unwatered banks of Portneuf River would be quickly colonized by herbaceous vegetation, then in the longer term by shrub vegetation (Section 7.2.2). The DFO therefore deems that the negative cumulative effect is not significant.

8 Follow-up program

Chapter 14 of volume 1 of the preliminary project report[9] describes the monitoring and follow-up program proposed by the proponent. Additional clarifications are also to be found in a number of complementary documents produced in response to the questions of federal authorities.[11, 12, 15] The proponent has committed, following approval of the project by the governmental authorities, to prepare a detailed environmental follow-up program in accordance with its commitments, which it will submit to the Department of Fisheries and Oceans (DFO).

Essentially, the follow-up program will spread over a minimum period of 10 years, affecting equally the natural environment, (dynamic and habitats of fish populations, wetlands and aquatic and riparian vegetation), the human environment (vacation area/cottage and outfitters' infrastructures, navigation and resource use conditions) and the physical environment (sedimentary and thermal regimes, erosion of banks and water quality). The proponent will be responsible for the implementation of these different follow-ups.

However, certain terms of the follow-up could be altered so as to allow a better assessment of the expected environmental effects. The following elements will have to be considered:

- The proponent concludes that the reduction of flow would not give rise to alteration of conditions of access to the tributaries nor the creation of additional obstacles to the movement of fish in the Portneuf River. The DFO is of the opinion that this element should be included in the follow-up in order to validate the assessment of anticipated impacts on the free movement of fish and to implement any corrective measures, if necessary.
- The proponent concludes that the recognized rainbow smelt spawning ground of approximately 1200 m^2 located downstream from PN-1 complex, in the Île de Cran area, would not experience any decrease in area or in quality following the cutoff of approximately 15% of the mean streamflow in the river's estuary. As well, the proponent concludes that the quality of the wintering site for rainbow smelt and other species frequenting the Portneuf estuary in winter would not be affected by the cutoff. Since little is known about the importance of the wintering sites for the physiology and the survival of smelt, the DFO deems that this element should be included in the development and the interpretation of the follow-up for this species, as well as the maintenance of the integrity of the spawning ground.

- Environment Canada (EC) recommends the integration of avifauna inventories into the follow-up of the evolution of the Portneuf sandbar due to the particular nature of this site and the steps currently undertaken by the Canadian Wildlife Service (CWS) in order to integrate this site into the Western Hemisphere Shorebird Reserve Network (WHSRN).
- The Department of Indian and Northern Affairs Canada (DINAC) recommends that the proponent consider involving the Montagnais more closely in follow-up activities.

The results of the follow-ups will have to be forwarded to the DFO, which may, if necessary, request changes in light of the results obtained.

9 Terms of approval

The terms of approval of the comprehensive study report are:

- That the proponent implement the anticipated mitigation and compensation measures, as well as the follow-up programs that are cited in the various documents produced by the latter, and in this document;
- That the proponent commit to assess, during the follow-up of aquatic and riparian vegetation, fish habitat losses likely to occur in such environments and which are attributable to the eroding action of the increased flow in the Sables and Betsiamites rivers (erosion and sediment deposits) and of the decreased flow in the Portneuf River. The fish habitat losses that are ultimately observed will have to be compensated, if necessary.

10 Conclusion

Following analysis of the nature of the project, the description of work, the infrastructures and the proposed changes to the hydraulic management regime, the Department of Fisheries and Oceans, as responsible authority, as defined in the *Canadian Environmental Assessment Act* (CEAA), has assessed the potential impacts that the partial diversion of the Portneuf River would be likely to have on the environment.

This review was completed on the basis of the information provided by the proponent and the opinions of notification from the various federal departments that have an interest in the project's completion.

Considering the proposed mitigation and compensation measures and follow-up programs, as well as the proponent's commitments, the DFO determined that the proposed project, as defined by the scope of the study, is not likely to cause significant negative environmental effects.

This is a preliminary conclusion that will be reconsidered following the examination of comments received at the time of the public consultation.

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April 2nd, 2002
Date

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Appendix 1: List of mitigation measures presented by the proponent

PARTIAL DIVERSION OF THE PORTNEUF RIVER

List of mitigation measures

PORTNEUF RIVER

- Construction of a flow-regulating structure at the outflow of Portneuf Lake.
- Implementation of a fish pass at the site of the regulating structure.
- Development of spawning grounds totalling, at minimum, 5,000 m^2 (order in council).
- Recovery of unwatered gravel and cleaning of fine sediments accumulated on existing spawning beds.
- Recovery of the gravel and cleaning in accordance with the follow-up at site P4 (km 154 to km 158.5).
- Possible recovery (to be determined following inventories) of the gravel downstream from Sage Lake.

PORTNEUF AND ITOMAMO LAKES

- Construction of a structure for minimum flow spillage of 1 m^3/s at the eastern outlet of Itomamo.
- Enlargement of the sill at the northern outlet of Itomamo Lake (work during minimum flow, no construction of new access roads).

MINIMUM FLOW

- Maintenance of a minimum flow of 1 m^3/s, except in the event that winter conditions so prevent, at the eastern outlet of Itomamo Lake. The follow-up of brook trout production will permit the assessment of the relevance of increasing mean annual flow up to 3 m^3/s.
- Maintenance of multiyear flow of 5.2 m^3/s at the outlet of Portneuf Lake.
- Modulation of flows at the outlet of Portneuf Lake to increase the summer minimum flow and to ensure a minimum flow of 2 m^3/s or of 4m^3/s at all times between May 1 and November 1.

TOURIST ACTIVITY AND COTTAGE VACATIONERS

- Undertaking of dam and regulating structure construction at the end of the summer, beyond the period of tourist traffic associated with the opening of and during the fishing season.
- Construction of a portage at the dam at Itomamo Lake for canoers and kayakers.
- Installation of a graduated rule near the PN-2 complex permitting all users to observe water levels in this location.
- Modify as needed the installation of docks and raise or displace affected buildings belonging to Québec Nature outfitters.
- The construction of small structures (spurs, sill, etc) on the course of the Portneuf River could be spread over the end of the summer and the beginning of the fall so as to reduce the impacts on cottage vacationers and on brook trout fry.

USE OF LAND BY THE MONTAGNAIS

- Inform users of the nature and the work calendar.
- Inform workers of local regulations concerning wildlife harvesting.

The follow-up program will include information and consultation meetings with the Aboriginal authorities involved.

Appendix 2: Location and size of spurs, baffles and spawning grounds.

Table 1. Location and size of spurs, baffles, and spawning grounds to be developed and implemented by the proponent, as a mitigation measure in the Portneuf River.

Site	Kilometre Point	Western longitude	Northern Latitude	Bank	Dam crest length (m)	Maximum height (m)	Crest level (m)	Existing spawning ground area to be recreated (m^2)	New spawning ground area to be developed (m^2)
Spawning Ground P-1	167.03 to 167.23	49° 05' 43.6''	70° 15' 52.9''	Right	n/a	n/a	n/a	0	2,000
Closing of 2 culverts to support the upstream basin and direct the current toward the P-2 spawning ground.	165.36	49° 05' 15.2''	70° 15' 48.6''	Right and centre	n/a	n/a	n/a	1,000	0
Spur at the outlet of Bacon Lake to maintain the level.	161.90	49° 05' 59.6''	70° 13' 20.3''	Left	19.3	1.2	468.23	0	0
Spur upstream from Dégelis Lake to maintain the river level and its left tributary upstream, to protect the S-3.1 and 3.2 spawning grounds.	156.91	49° 05' 49.3''	70° 11' 32.2''	Left	18.8	2.4	420.85	0	0
Baffle to direct the current toward the P-4.3 spawning ground. Connect the islet of km point 156.7 to the left bank.	156.7	49° 05' 44.7''	70° 11' 34.1''	Left	15	1	----	1,000	0

Baffle to direct the current toward the P-4.1 spawning ground.	155.9	49° 05' 27.8''	70° 11' 39''	Left	10	1.5	----	1,000	0
Spur at the outlet of Emmuraillé Lake to maintain the level.	138.08	48° 57' 57.7''	70° 07' 25.1''	Left	61.0	2.1	418.3	0	0
Spur at the outlet of Patien Lake to maintain the level.	133.27	48° 56' 03.7''	70° 09' 19.2''	Right	23.7	1.1	410.93	0	0
Spur at the outlet of Sage Lake to maintain the level.	129.62	48° 54' 17.5''	70° 10, 18.2''	Right	15.9	2.1	399.25 +	0	0
Baffle to direct the current toward the P-10 spawning ground. Connect the delta islet, at the entry to Collier Lake, to the left bank.	121.4	48° 52' 55''	70° 05' 32.9''	Left	20	1	----	1,000	0
P-11 Spawning ground	120.7	48° 52' 41.7''	70° 05' 04.4''	Right	n/a	n/a	n/a	500	0
Baffle to direct current toward the P-12 spawning ground.	118.8	48° 52' 16.7''	70° 04' 08.8''	Left	65	1.9	----	500	0
Spawning ground P-15	115.6	48° 52' 20.1''	70° 02' 00.3''	Right	n/a	n/a	n/a	500	0

Total		**5,000 m^2**	**2,000 m^2**