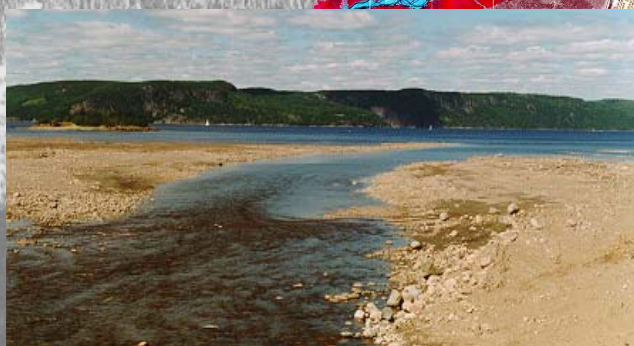
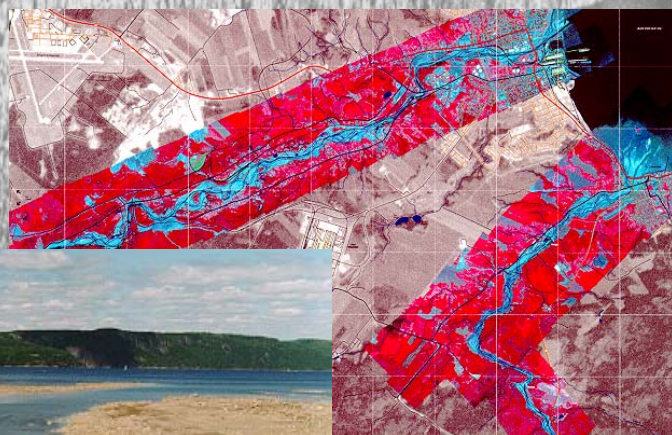


FEDERAL ENVIRONMENTAL ACTION PLAN IN RESPONSE TO THE 1996 SAGUENAY FLOODS

FINAL REPORT 1997-2001



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<i>The Saguenay Fjord</i>	Source : Parks Canada, Jacques Beardsell
<i>Miniature image map, La Baie</i>	Source : Natural Resources Canada, Quebec Department of Natural Resources, Air Focus inc.
<i>La Baie, August 1997</i>	Source : Environment Canada, Madeleine Papineau

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BACKGROUND

On July 19 and 20, 1996, the North Shore, Charlevoix and especially the Saguenay – Lac Saint-Jean Region were hit by exceptionally intense rains.

The downpours caused the level of watercourses to rise to unusual levels, and considerable physical and socio-economic damage was done to riverside infrastructures, river systems and living organisms that depend on the water.



Source : Natural Ressources Canada - Geological Survey of Canada

The profile of watersheds and their flood plains was affected, toxic substances from industries and homes were poured into watercourses and habitats necessary for the survival and reproduction of animal and plant species were disturbed. The torrential rainfall also caused many landslides (more than 600), most of which occurred outside the alluvial corridors, and severely affected local areas.

Several tourist activities, such as ice fishing, had to be rearranged because of environmental changes. These extraordinary and historic events have shaken residents' sense of security.



Source : Natural Ressources Canada - Geological Survey of Canada

Both levels of government, municipalities, businesses and citizens have had to work together and have made a considerable effort to identify, monitor and fix the environmental damage caused by the devastating rainfalls in the summer of 1996.

On August 15, 1996, the Government of Canada entrusted the Economic Development Agency of Canada for the Region of Quebec with follow up in two areas: the stimulation of business activity and the environment. With regard to the environment, the environmental interdepartmental co-ordinating committee, made up of several federal departments, developed an action plan based on environmental problems and needs.

The action plan on environmental issues related to the flooding in the Saguenay in 1996 was a four-year plan (1997 to 2001). Three annual reports were produced, in 1998, 1999 and 2000. This document is the final report of the 1997-2001 action plan.

PARTNERSHIPS

The main partners involved in developing the action plan on environmental issues related to the flooding in the Saguenay are Environment Canada, Fisheries and Oceans Canada and

Natural Resources Canada. Other federal partners who contributed were Parks Canada, Health Canada and National Defence.

Government spending

	Environment Canada	Fisheries and Oceans Canada	Natural Resources Canada	Canadian Parks Service	TOTAL
Amount invested from July 1996 to April 25, 1997.	\$125,000	\$545,000	\$230,000	\$12,600	\$912,600
Amount invested from April 25, 1997 to March 31, 1998.	\$428,000	\$104,500	\$380,000	\$10,000	\$922,500
Amount invested from April 1, 1998 to March 31, 1999.	\$565,000	\$83,300	\$330,000	\$12,600	\$990,900
Amount invested from April 1, 1999 to March 31, 2000	\$135,000	\$132,500	\$195,000	\$12,600	\$475,100
Amount invested from April 1, 2001 to March 31, 2001	\$43,400	\$178,500	\$65,000	\$12,600	\$299,500
Total investment to March 31, 2001	\$1,296,400	\$1, 043, 800	\$1,200,000	\$60,400	\$3,600,600
<i>Initial budgets (April 1997)</i>	<i>\$1,500,000</i>	<i>\$800,000</i>	<i>\$1,000,000</i>	<i>—</i>	<i>\$3,300,000</i>

MAJOR UNDERTAKINGS

Meteorology Services

The Meteorology Service of Canada (Environment Canada) has modernized the Department of National Defence's radar station at Lac Castor. The modernization will enable Environment Canada to use the latest Doppler technology to forecast the weather. Since the summer of 1999, information from this site has been available to dam controllers in the region. This technology has also enabled meteorology services to keep residents in the region informed of dangerous weather conditions that could put their health and safety at risk.

Environment Canada has put considerable effort into letting people in the communities concerned know how to use the meteorology services and into improving access to weather information in unusual situations.

Environment Canada has also put out a climate guide specific to the disaster area for the major infrastructure reconstruction or future construction plans.

Geological and Geomorphological Aspects

The Geological Survey of Canada (Natural Resources Canada), in collaboration with provincial agencies involved in lands administration, conducted a study on areas at risk of landslides in the Saguenay – Lac Saint-Jean Region. The first part of this study looked at developing a georeferencing database that includes available information on unstable watersheds in the Saguenay-Lac Saint-Jean Region. The purpose of the second

part was to redefine the geoscientific parameters, some of which were unclear after the July 1996 disaster, used in the zoning of «landslide» variables. Data on the typology of landslides helped establish new guidelines regulating zone planning in potentially unstable areas of Quebec.

Based on geological, geomorphological and paleogeographic data, a history was put together of major floods and large landslides during the last millennium on the Ha! Ha! and Mars Rivers.

Natural Resources Canada also made necessary geoscientific information available to the scientific community, and to provincial and municipal bodies involved, so they can make decisions in the interest of residents' safety. Reports were also issued on the geomorphological effects of the flooding and rain in 1996, specifically on bank erosion along the selected reaches on the five rivers most affected in the Saguenay – Lac Saint-Jean Region, as well as the stability of argillous slopes.

Remote Sensing and Modelling

Geomatics Canada (Natural Resources Canada) produced three very detailed image maps (1:10,000 scale) of a portion of the affected area and six image maps of La Baie. These maps were the basic tools for reconstruction projects.

A process based on remote sensing and satellite data and enabling the long-term monitoring of environmental changes in the Saguenay Region was also developed. The long-term objective of this project is to develop a method whereby environmental

changes can be detected automatically. This method would be used in other areas, not only the Saguenay.

State of Biological Resources

Fisheries and Oceans Canada monitored the effects of the July 1996 flooding on the marine environment in the Saguenay Fjord. They looked at:

- the impacts on ice fishing in the Saguenay Fjord;
- bottom-dwelling organisms in the Saguenay Fjord; and
- sediment contamination in the Saguenay Fjord.

The results of the monitoring of ice fishing in the Fjord from 1996 to 2000 confirmed that the July 1996 flooding had had little effect on the quantity and the distribution of the most exploited fish, the rainbow smelt, Atlantic cod and redfish. Since 1997, fewer fishermen fish for smelt because it is difficult for them to get to the area where this species is predominantly found (Saint-Fulgence); therefore, fewer smelt have been caught.

Results indicate that, since the flooding, there are fewer bottom-dwelling organisms as a whole upstream in the Fjord. There were fewer bottom-dwelling organisms after the downpour but they were even less abundant after the work in 1990. It appears that this is more marked in the Bras du Nord. The composition of the communities and the ecological indicators in 1998 and 1999 demonstrate that the situation is still evolving. None of the sites have reached the point at which they were prior to the flooding, although the situation is improving. The project will continue through 2001-2002.

The results of sediment contamination in the Saguenay Fjord indicate that sediments

resulting from the runoff of the sea floor of Ha! Ha! Bay have approximately the same level of concentration of polychlorinated biphenyles (PBC) as the surface sediments before the downpour, except in the case of some PBC compounds whose concentrations are two to five times weaker. These results seem to indicate that the new sediments from the 1996 flooding have not negatively affected organochlorine contaminant transfers to sea floor organisms and fish.

Support of Restoration and Reconstruction Projects

- Environment Canada funded environmental projects aimed at restoring habitats destroyed by the July 1996 events.



Transplanting Scirpus americanus, Ha ! Ha ! Bay (spring 2000)
Source : A. Bourgeois, Environnement Canada

The main projects carried out involve:

- Restoration of ten hectares of bulrush marsh at the mouth of the Ha! Ha! River;
- Restoration of several wildlife habitats of the Chicoutimi River (in the area of the Arnaud Bridge and Garneau Falls) devastated by the flooding; and
- Reconstruction of the trail along the urbanized stretch of the Rivière du Moulin.

Environment Canada also helped develop the Saguenay ZIP Committee's Ecological Restoration Action Plan (ERAP).

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Poster

University of Quebec at Chicoutimi and Natural Resources Canada, 1997: "20 JUILLET 1996, LE DELUGE ", 77 cm X 117 cm poster available from UQAC, shows a NOAA satellite image from July 20, 1996, taken and processed by STARIMSAT, clearly showing the low that affected the Saguenay and the North Shore.

CDs

Natural Resources Canada, 1997: "Inondations au Saguenay 1996, vues sous l'angle de la télédétection", CD-ROM with different types of images (regular pictures, aerial photographs and satellite images) taken in the Saguenay during the flooding. Available from the Photocartothèque québécoise.

Internet Sites on Flooding in the Saguenay Region

University of Quebec at Chicoutimi

<http://www.uqac.quebec.ca>

- Click on «Actualité». Under «Sites d'intérêt», click on «*Les anciens glissements de terrain au Saguenay*»
- Click on «Actualité». Under «Sites d'intérêt», go to «*Les inondations de juillet 1996*»

Natural Resources Canada

<http://www.ccrs.nrcan.gc.ca/ccrs/tekrd/rd/apps/hydro/saguenay/saguene.html>
Saguenay Flood 1996
Canadian Centre for Remote Sensing

<http://sts.gsc.nrcan.gc.ca/page1/geoh/saguenay/fsaguenay.htm>
Effets et conséquences géomorphiques de la grande inondation de juillet 1996 dans le Saguenay (Québec)
Geological Survey of Canada, Earth Sciences Division

<http://www.qc.ec.gc.ca/envcan/indexe.html>

Études spécialisées ... les événements météorologiques de 1996 (Pluies diluviennes du 18 au 21 juillet 1996 au Québec)
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http://www.biosphere.ec.gc.ca/bio/actu/actu-redirect_a.html?doss/doss_00009_a
Environmental News: *The Lessons Drawn from the Flooding in the Saguenay in July of 1996.*

University of Quebec, Institut national de recherche scientifique - Eau

<http://www.inrs-eau.quebec.ca/saguenay/>
Simulations des crues du Saguenay
INRS-Eau