Environmental Sensitivity Atlas for the

St. Lawrence River Shorelines

Environment Canada

Environmental [illegible]tion Branch
[illegible]o Region

Environnement Canada

Direction générale de la protection de l'environnement
région de l'Ontario

Legend

Shoreline Habitats

ESI* Ranking

Bedrock or Impermeable Shores

- 1a(1a) Exposed Bedrock Bluff less than 1 metre elevation
- 1b(1a) Exposed Bedrock Bluff 1-5 metre elevation
- 1c(1a) Exposed Bedrock Bluff greater than 5 metre elevation
- 2(1b) Retaining Wall/Harbour Structure/Breakwaters
- 3(2) Shelving Bedrock

Unconsolidated Sediment Shores

- 4(3) Exposed Sediment Bluff
- 5a(4) Sand Beach: Depositional
- 5b(4) Sand Beach: Erosional or Transitory
- 6(4) Sand Barrier With Lagoon
- 7a(6a) Pebble Beach
- 7b(6a) Pebble/Cobble Beach
- 7c(6a) Cobble Beach
- 8(6b) Rip Rap
- 9(6a) Boulder Beach
- 10(5) Mixed Beach (% by sediment in DOE Database)

Vegetated Shores

- 11(9a) Low Vegetated Bank (Grass or Trees)
- 12(9b) Delta Mud Flat
- 13a(10a) Fringing Wetland
- 13b(10b) Broad Wetland

* ESI - Canadian Environmental Sensitivity Index (USA ESI Ranking follows in brackets) Higher numbers indicate greater sensitivity.

Biological Resources

Fish

- Area of Seasonal Fish Spawning
- Location of Seasonal Fish Migration

Birds

- Migratory Waterfowl
- Colonial Nesting Birds (total nests - all species)
- Wading Birds (total nests - all species)
- Shore Birds
- Raptors

Shore Associated Mammals

- Furbearers (such as Muskrat, Mink, and Beaver)

Human-Use Resources

High Recreational Usage

- Marinas and Small Craft Harbours
- Anchorage Sites
- Residential, Recreational or Cottage Use
- High-Use Recreational Beach
- Recreational Dive Site

Resource Extraction

- Water Intakes - Industrial
- Water Intakes - Municipal
- Outfall
- Commercial Fisheries Activity

Special Status Areas

- Highly Sensitive Classified Feature (within 2km)
- First Nation/Native American Reservation
- National Park/National Forest
- Provincial/State Park, Wilderness Area or Nature Reserve/State Forest
- Conservation Area or Municipal Park
- Environmentally Sensitive Area*
- Area of Natural and Scientific Interest*
- Area of Ecological Significance (e.g. Wetland)
- Dune Formations

* As identified by Ontario Ministry of Natural Resources or Conservation Authorities

Countermeasures

- Access Site (for land vehicles)
- Approach Concerns
- Exposed Rock
- Coast Guard Light Station
- Boat Launch: Excellent
- Boat Launch: Good
- Boat Launch: Poor
- Helicopter Landing Site
- Staging Area: Excellent
- Staging Area: Good
- Staging Area: Poor
- Automated Weather Stations

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Environmental Sensitivity Atlas for the St. Lawrence River Shorelines

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Copies may be obtained from:

Environment Canada
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Environmental Sensitivity Atlas for the St. Lawrence River Shorelines

Prepared by:

Environment Canada -
Environmental Protection Branch
Ontario Region
Canadian Coast Guard

United States Coast Guard
District 9
United States National
Oceanic and Atmospheric Administration

1994

These maps are not to be used for navigational purposes.

Acknowledgements

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We would particularly like to acknowledge the extensive help we received from the following: the Ontario Ministry of Natural Resources District Offices along the St. Lawrence River shoreline; Ray Amell of Canadian Coast Guard's Prescott Base; the Great Lakes Response Corporation (PIMEC, Inc.); Jacqui Michel of Research Planning, Inc.; the Ontario Ministry of the Environment and Energy, and the Environmental Conservation Branch (DOE) of Ontario Region. Elements of base topographic maps showing on each atlas page have been reproduced with Natural Resources Canada's (NRC) permission.

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Atlas and Supplement Project Team

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Table of Contents

1.0 Introduction

The "Environmental Sensitivity Atlas for the St. Lawrence River Shorelines" is a publication designed for use in response to marine spills of oil and other hazardous materials. This Atlas will allow responders to work from a common basis to rapidly identify the resources at risk during a spill. Information in the Atlas will assist decision makers to quickly assign priorities for protection measures.

The Atlas focuses on both the Canadian and United States shorelines of the St. Lawrence River, from the Lake Ontario entrance to the river, near Kingston, Ontario and Clayton, New York, to just west of Montreal at the Beauharnois Canal. The Canadian and United States shorelines west of the study area in this atlas can be found in Environment Canada's "Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline" (DOE 1993) and NOAA's "Lake Ontario Atlas: Sensitivity of Coastal Environments and Wildlife to Spilled Oil" (U.S. shores - RPI, 1993). For environmental sensitivity information east of the study area, contact Environment Canada's Environmental Emergencies Section in Quebec Region (Montreal).

This project is a collaboration of Environment Canada's (DOE) Ontario Region office of the Environmental Protection Branch (EPB-OR), Transport Canada's Canadian Coast Guard (CCG) Central Region office, United States Coast Guard (USCG) District 9 and the United States National Oceanic and Atmospheric Administration (NOAA). Environment Canada's Environmental Protection Branch - Quebec Region coordinated the provision of all data and information pertaining to the Quebec portion of the study area.

Two versions of this information have been produced; a softbound (paper) Atlas, and a hardbound (vinyl) Supplement to the Great Lakes Annex of the Canada-United States Joint Marine Pollution Contingency Plan for Spills of Oil and Other Noxious Substances. A limited number of copies of the hardbound Supplements have been produced. This version is designed for the day to day operational use by several agencies and organizations which have major spill related jurisdictional responsibilities, or deal with environmental emergencies on the Great Lakes and Connecting Channels on numerous occasions.

The Supplement is designed to complement the Joint Marine Pollution Contingency Plan, which contains additional spill response information such as spill response personnel and procedures. The Supplement differs from the Atlas only in its requirement for field durability, and the addition of several types of spill response countermeasures and highly classified sensitivity information that are critical to spill response decision makers.

The softbound version of the Atlas was prepared for broad distribution to assist agencies and companies in spill preparedness and response. While it will be useful for resource management in general, this Atlas has been designed primarily to assist spill responders.

Numerous references are made in this publication to the Atlas, and to the Supplement. These references indicate the two versions described above. Both versions have been generated from Environment Canada's master database, which is the major product of the project. All data which has been collected and represented on the maps reside digitally in an electronic desktop environmental sensitivity mapping system, similar to a Geographic Information System (GIS). This system will readily allow additions or changes to the database so that updated versions of the Atlas can be released periodically. More importantly, the system will allow for enhanced spill response management at the time of a spill.

Work is underway to create a user friendly' Graphical User Interface for the system. Simultaneous viewing of shoreline video and the corresponding GIS screen is also under development.

The electronic desktop environmental sensitivity mapping system is a continually evolving system. EPB-OR welcomes additional information and updates that could enhance the master database. For questions, suggestions or concerns about this publication or the master database, please contact:

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2.0 Project Background

In April 1994, EPB-OR asked many agencies to assist in the development of the Environmental Sensitivity Atlas for the St. Lawrence River Shorelines. EPB-OR received an excellent response, with many agencies and communities expressing interest or cooperating to provide data and expertise. American agencies agreed that this project was an excellent opportunity to pool resources and create an international product for the St. Lawrence River area.

The St. Lawrence River project consisted of six major phases; digital base map preparation, data collection, data digitizing, legend definition, data overlay layer creation, and finally, Atlas layout design.

During the data collection phase in 1994, videotaped helicopter shoreline surveys were made of the entire study area, which facilitated the completion of shoreline classification, and identification of many countermeasure features. Biological and human-use resources data were assembled from reviews of existing information provided by partner agencies, as well as from site visits and reviews of video tapes. Copies of the video tapes are available by contacting the Ontario Region Environmental Emergencies Section at 416-739-4994.

Environment Canada was given access to various agencies' resource information. Appendix A has a list of these agencies and the data they contributed. This resource information was subsequently transcribed and digitized to suit the electronic requirements of the production process.

A great deal of care was directed to the selection of legend features and symbols which would serve the immediate needs of spill responders on the Great Lakes and the Connecting Channels. Specific electronic layers were created to present geomorphological, cultural, biological and human-use information.

With input from many response experts, the project team designed the Atlas to convey critical information to a spill responder in a concise, straightforward manner, with a minimum of extraneous detail. Before final publication, these map pages for the St. Lawrence River were reviewed extensively (for both accuracy and utility) by the key response and resource agencies instrumental in its development and future use.

2.1 Regional Approach within a National and International Framework

Every effort has been made to ensure that the Ontario Region master database will be compatible with the recommendations of DOE's National Sensitivity Mapping Program, which is currently being developed.

Close coordination with national and international sensitivity mapping programs was essential for this project because shorelines and sensitive resources for both the American and Canadian sides of the Connecting Channels were mapped. Environment Canada was responsible for the ranking classification of both United States and Canadian shorelines. Since somewhat different shoreline sensitivity ranking and colour schemes are used in the United States, the Atlas legend includes both Environmental Sensitivity Index (ESI) rankings.

The United States Coast Guard (USCG) and National Oceanic and Atmospheric Administration (NOAA) provided all of the sensitive biological and human-use resource information for the United States. This information was obtained through a combination of reviewing existing ESI atlases (produced in 1985) and the new sensitive resource annexes from the Area Contingency Plans covering each Connecting Channel's U.S. side (produced in 1993). All of this international information now resides digitally within Environment Canada's master database used to create this atlas (see Section 3.0).

All of the sensitive resource data have been presented using Canadian Great Lakes map symbology methods. However, joint development work with NOAA and USCG has ensured that data and sensitivity representation is similar to Atlas production underway for the American shorelines of the Great Lakes. Close cooperation with Canadian Coast Guard and United States Coast Guard operational officers dictated many of the design layout features of the Atlas and Supplement. For all Connecting Channels atlas work, Environment Canada, NOAA and USCG have all collaborated closely to ensure the international utility of the atlases.

3.0 Environment Canada's Desktop Environmental Sensitivity Mapping System

The maps in this publication have been generated from Environment Canada's electronic desktop environmental sensitivity mapping system. The system currently employs MapInfoTM software and MapBasicTM programming language to overlay sensitivity and countermeasure data on electronic base maps.

To show all data at once on paper maps would impact on the clarity and utility of the publication. The specific resource agency information supplied to Environment Canada in the data collection phase of this project has been entered into a comprehensive master database. Some of the data provided are more appropriate as background information, and will remain in the master database but will not be present on paper maps. Information in this database will be readily available to responders (EPB-OR Environmental Emergency Duty Officer at 416-346-1971 in Canada or NOAA Scientific Support Coordinator at 206-526-6317 in the United States) during a spill. This database will also form an appendix to the Supplement version.

For base maps, National Topographic System (NTS) digital map sheets at a scale of 1:50,000 have been used to create the digital Canadian shorelines for the St. Lawrence River. The digital U.S. shoreline of the St. Lawrence River was created from United States Geological Survey (USGS) Quad Maps (scale of 1:24,000). On each map page of the publication, reference is made to the relevant NTS or USGS Quad map sheet(s) covering that portion of shoreline displayed. Elements of Canadian base topographic maps showing on each atlas page have been reproduced with Natural Resources Canada's permission. Once data overlays (or 'layers') are added to the base maps, the assembled Atlas information is printed at a scale of 1:50,000, covering the entire 1238 kilometres (774 miles) of the St. Lawrence River shorelines (including islands) contained within the study area; 684 kilometres (428 miles) of Canadian shoreline and 346 miles (554 kilometres) of American shoreline, on a total of 23 map pages.

The system displays a latitude/longitude graticule superimposed over each map, with hatch marks for every minute of latitude or longitude, and darker hatch marks for every five minutes. A full degree is denoted by the thickest mark. Arrows in the corners of each map page point to the exact location of the displayed coordinates. This system has created maps employing an unprojected latitude and longitude coordinate system.

4.0 Nature of Data

4.1 Data Collection and Levels of Confidence

EPB-OR staff contacted or made visits to all contributing partner agencies between April and August 1994. Existing and new data sets were gathered or surveyed for the project. For collection of existing data, relevant maps, publications and databases were reviewed, and pertinent information transcribed then digitized by Environment Canada. A new shoreline classification scheme, most suitable for spill response on the Great Lakes and Connecting Channels, defines nineteen (19) different shoreline habitats and their U.S. equivalents. This was the major component of new information specifically surveyed for this project.

Data in digital form existed for only a few Legend features for the St. Lawrence River. To some degree, data availability on the Great Lakes and Connecting Channels has dictated definition of Legend features and the manner they are displayed on the maps. To use a crosshatched or coloured polygon to represent an area implies a level of certainty regarding the boundaries of that area. Such detailed boundary accuracy was not always available at the time of the data collection phase of the project.

For example, since fish spawning activity information was often supplied for general areas rather than for specific areas or points, a decision was made to use a point symbol, but one defined as an area, hence the Legend feature 'Area of Seasonal Fish Spawning'. This works well considering that the source information does not allow for the rigorous definition of exact boundaries of all fish activity; it more customarily identifies general areas of observed activity, or of suitable habitat. For spill response, it can be assumed that activity occurs in the general vicinity of each fish spawning symbol, with more specific information often being found in the 'Notes' column when available.

Fish spawning and migration data for the study area were often based more on suitable habitat identification than recent specific activity observations. Consultations with local resource experts can assist in defining boundaries more specifically at the time of a spill.

The majority of the Canadian bird information is based on recent, thorough surveys by the Canadian Wildlife Service, Royal Ontario Museum, and the Ontario Ministry of Natural Resources, and is quite accurate and up to date. 'Shore Associated Mammal' information is based on observations, or identification of suitable habitats. 'High Recreational Usage', and 'Resource Extraction' features are based on documented surveys. Prior to publication, these locations were thoroughly reviewed and modified by local individuals familiar with the different shoreline regions of the study area.

For 'Special Status Areas', polygon boundaries have been digitized as provided by various agencies and are considered accurate and up to date. 'Countermeasures' symbols were placed following joint CCG - USCG - NOAA - EPB-OR video review sessions and helicopter and ground surveys during July 1994. These symbols were then reviewed for accuracy and modified where necessary by local experts familiar with the areas involved.

The geomorphology of 100 percent of the Canadian and American shorelines of the St. Lawrence River falling within the study area was newly classified by the Project Geomorphologist during the 1994 helicopter survey which was undertaken specifically for this project. Videotapes were filmed during these surveys and then reviewed to confirm the shore classifications that comprise the 'Shoreline Habitat' layer of information. The confidence level for these data is excellent.

These 'Shoreline Habitat' classifications are an excellent guide for responders at the time of a spill. On-site examination (or 'ground truthing') will ensure that any minor discrepancies are identified during spill response.

5.0 Atlas Design and Function

5.1 Symbology and Use of Colour

Each Legend 'feature' represents a different 'layer' of information. These features have been defined by three types of symbols: point symbols, line symbols, and areas, or polygons. A municipal water intake is an example of a point symbol, a Shoreline Habitat classification is a line symbol, and a National Park is an example of an area or polygon, with defined boundaries.

Colour has been used to provide a richness in display and to denote differences among similar symbols, such as an excellent and a poor boat launch. It also distinguishes different shoreline classifications. To assist users in discerning one shoreline colour from another, a removable Legend guide has been included with the Atlas in a pocket attached to the back cover. If required, users may line up this card over the shoreline habitat in question to determine the exact colour code for any given habitat.

During spill response, photocopying and facsimile transmission form a large part of information transfer. Each of the symbols chosen are unique (with only a few exceptions) so that black and white reproductions of the Atlas pages will result in minimal information loss.

For Shoreline Habitats, colours are the best manner to convey this key information without obscuring other valuable data on the maps. In situations where colour cannot be conveyed, the electronic system can produce maps showing Shoreline Habitats by Environmental Sensitivity Index (ESI) number, rather than colour, to meet those needs.

5.2 Sensitivity Ranking

Much international work has gone into determining environmental sensitivity ranking schemes. It is a very complex undertaking. Shoreline habitats, biological, cultural and human-use resources all form an intricate system with many different potential impacts at the time of an oil spill. Some ranking schemes endeavour to weigh many factors and values to come up with a single numerical ranking indicating relative sensitivities of all resources in question. From this ranking, protection and clean up priorities are assigned when deploying limited response equipment and available resources. Alternatively, some atlases limit information to identifying the location of resources at risk without ranking them.

Some sensitivities are readily identified and ranked, such as shoreline habitats. Other resources' relative sensitivities can be completely dependent on circumstances surrounding the spill itself. During any significant spill, a consultation among spill response experts will consider those spill-specific circumstances before coming up with the set of protection and clean up priorities appropriate for that particular incident.

Taking this into consideration, the Environmental Sensitivity Atlas (and Supplement) for the St. Lawrence River Shorelines ranks 'Shoreline Habitats' in order of increasing sensitivity based on factors such as oil residence time, cleaning potential and exposure to natural removal processes. A full description of the Shoreline Habitats' used in this Atlas is contained in Section 9.0.

Environment Canada's newly revised Ontario Region classification scheme for shoreline habitats differs somewhat from that used on Environmental Sensitivity Index (ESI) maps of other United States Great Lakes shores. For this and other newly completed Great Lakes Connecting Channel atlases, the American equivalent to Canadian shoreline habitat rankings is noted (see Section 9.1). The United States shoreline habitat rankings are listed below:

United States ESI Ranking	Shoreline Habitat Description
1A	Exposed Rocky Cliffs
1B	Exposed, Solid Man-made Structures
2	Shelving Bedrock Shores
3	Eroding Scarps in Unconsolidated Sediments
4	Sand Beaches
5	Mixed Sand and Gravel Beaches
6A	Gravel Beaches
6B	Riprap Revetments
7	Exposed Flats
8A	Sheltered Scarps in Bedrock
8B	Sheltered, Solid Man-made Structures
9A	Sheltered, Vegetated Low Banks
9B	Sheltered Sand/Mud Flats
10A	Fringing Wetlands
10B	Extensive Wetlands

Features such as 'Biological Resources' and 'Human-Use Resources' are identified on the maps, but are not specifically ranked in relation to one another. Broad terms such as low, moderate or high priority are used in the 'Notes' column on many map pages to give an indication of relative sensitivity, and relative sensitivities are broadly discussed in the text of Section 7.0, but the final priorizing decisions will be made by qualified response experts at the time of the spill.

6.0 Description of Atlas Legend Features

A colour example of the Environmental Sensitivity Atlas legend is shown in Figure 1. Figure 2 identifies standard features appearing on the base maps in the Atlas and Supplement. A definition of each Environmental Sensitivity Atlas legend feature follows in Sections 6.1 through 6.4. Section 9.0 defines the Shoreline Habitats found in the Atlas.

The size of the symbols in the legend do not represent the exact size shown on the individual maps, due to space constraints.

Figure 2: Standard Cartographic Legend for Base Maps

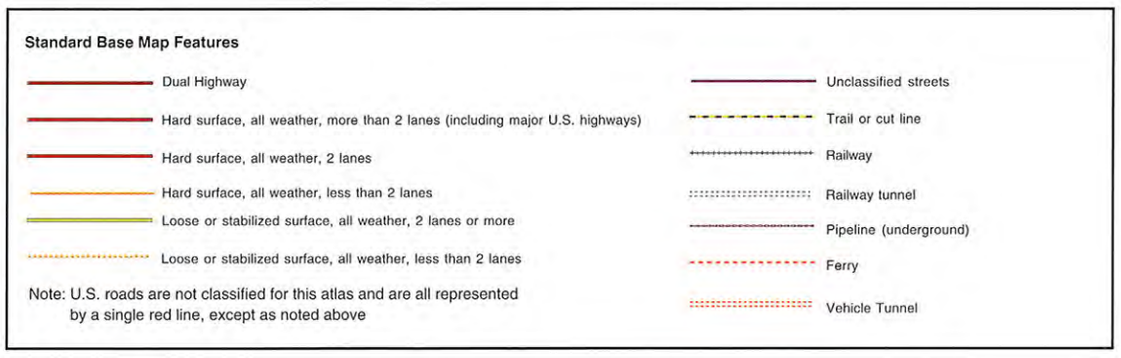


Figure 1: Environmental Sensitivity Atlas Legend

6.1 'Notes'

One current constraint of the electronic desktop mapping system is that it does not allow the use of symbology to identify both species and their seasonality in a clear, easily understood manner. The central objective of the Environmental Sensitivity Atlas for the St. Lawrence River Shorelines is to present mapped sensitivity information that may be readily understood at a glance by spill responders.

To achieve this objective, the 'Notes' column on the side of each map page was used to display species and seasonality information, when available. The symbol on the maps for 'Notes' is a red exclamation point with a white number inside it. Each numbered 'Note' symbol on a map corresponds to the same number in the 'Notes' column for that page. These 'Notes' also highlight important site-specific facts or concerns for the responder including approach concern descriptions (foreshore flats, rocky reefs or submerged vegetation). The 'Notes' are anecdotal. They can be expanded in future Atlas updates as more sensitivity information becomes available.

6.2 Biological Resources

Biological Resources include broad groupings entitled Fish, Birds and Shore Associated Mammals. While specific species information is valuable to the responder, the 'top layer' of an Atlas should provide a straightforward initial indication of the general biological activity in an area. The responder can quickly get a sense of local sensitivities without deciphering complex symbology, or cross-referenced tables of data. This latter detail will be required, but it can reside in the 'hidden layers' of the master database, for use by responders in consultation with local resource experts at the time of a spill.

A limited amount of data was available for rare plants along the St. Lawrence River shorelines. Rare plants are highly sensitive to human activity, and to some degree, to oiling. Reported locations have been described in the 'Notes' column. Consult with local offices of the Ontario Ministry of Natural Resources or New York Department of Environmental Conservation (NYDEC) for additional information.

6.2.1 Fish

'Area of Seasonal Fish Spawning' and 'Location of Seasonal Fish Migration'

In the St. Lawrence River Atlas, the available data collected focused mainly on known areas of spawning and migration activity for fish species having commercial or recreational valuc. Site-specific information on non-commercial or non-sport fish species was not readily available during data collection for the St. Lawrence River. As more information becomes available, it will be incorporated into the master database, and in Atlas updates.

As explained in Section 4.1, to use a polygon to represent an area implies a level of certainty regarding the boundaries of that area. Since fish spawning activity information was supplied for general areas, a point symbol defined as an area is used. The symbol for 'Area of Seasonal Fish Spawning' is used to denote habitats such as fish spawning streams, reefs and beaches, and also locations where sensitive life stages (egg, larvae and juvenile) are concentrated. For 'Location of Seasonal Fish Migration', the symbol is typically placed at the mouth of a river or stream known to be used for migration.

For spill response, it can be assumed that activity occurs in the general vicinity of each fish symbol, with more specific information often being found in the 'Notes' column when available. Consultations with local resource experts can assist in defining boundaries more specifically at the time of a spill. In times of an environmental emergency, the Atlas symbols will provide critical initial information regarding fish spawning and fish migration.

The following species and seasonality information for the St. Lawrence River is derived from information supplied by the various District Offices of the Ontario Ministry of Natural Resources (OMNR) and Freshwater Fishes of Canada (Scott and Crossman 1973). This general information will complement details found on the individual maps.

Sport fishing species in the study area include: largemouth, smallmouth and rock bass; yellow and white perch; northern pike, muskellunge and walleye; and rainbow smelt. On certain maps, specific note has been made of identified muskellunge nursery habitat; there are few actual sites identified, making them of increased importance and value. Commercial catches are taken in several areas of the river, for instance near Gananoque, at Jones Creek and throughout Lake St. Francis.

Carp, black crappie, channel catfish, pumpkinseed, brown bullhead, American eel, sturgeon (Lake St. Francis) and white and redhorse sucker are also present in the study area in various locations.

Spawning activity for walleye occurs in most tributaries along the St. Lawrence River during the spring, often over boulder or coarse gravel shoals.

Yellow perch spawn in the spring in the shallows of the river or in its tributary rivers.

Rainbow smelt are present spawning in most streams in spring.

The Thousand Islands section of the St. Lawrence River is an important area for smallmouth bass sport fishing success. Smallmouth bass spawn in late spring to early summer in 0.5 to 6 metres of water on a sandy, gravel or rocky bottom of the river, usually near the protection of rocks or logs.

Largemouth bass spawn in the St. Lawrence River from late spring to early summer in shallow, protected spawning sites in quiet bays, among emergent vegetation. Spawning grounds are typically on soft mud in reeds, bullrushes or water lilies.

Northern pike and muskellunge are spring spawners over flooded margins of rivers, marshes or large bays in the St. Lawrence River.

6.2.2 Birds

Areas requiring protection in the event of an oil spill include staging areas for migrating birds, breeding colony sites, foraging areas of breeding birds, important wetlands along the shore, and endangered species habitats. Through a combination of Notes and symbols, these areas have been identified, or the information is available in the master database whenever such data were supplied for the study area.

'Migratory Waterfowl'

This category is comprised of both migrants and breeders which are present in the study area for at least part of the year. Species include those found on shoreline wetlands and sheltered waters such as Canada geese and various dabbling ducks (including mallard, black duck, northern pintail, American widgeon and teal), plus those species of more open water such as loons, grebes and diving ducks (including common goldeneye, scaup, old squaw, scoter and merganser). Often the 'Notes' column will identify critical staging areas, feeding areas or wetlands for these migratory waterfowl.

'Colonial Nesting Birds (total nests all species)', and 'Wading Birds (total nests all species)'

Regarding colonial waterbirds, the information presented in this Atlas was obtained as part of a program to census all gulls, terns, cormorants, herons and egrets nesting on the Great Lakes and Connecting Channels during 1989 to 1991. This program was carried out simultaneously in Canada and the U.S. In Canada the program was coordinated and supervised by Environment Canada's Canadian Wildlife Service (CWS).

CWS is preparing a number of Technical Reports, which together will constitute the "Atlas of Colonial Waterbirds Nesting on the Canadian Great Lakes". The CWS Technical Reports will provide detailed information, compare present (1989-91) breeding distribution and abundance data with data for earlier years, and discuss the census findings in a biological context.

The Technical Reports will also deal with the relative scarcity of different species and habitats, and their needs for conservation. For more information on the "Atlas of Colonial Waterbirds Nesting on the Great Lakes", please contact Dr. Hans Blokpoel, Canadian Wildlife Service (see Appendix A under 'Bird Information').

There are numerous species of colonial waterbirds that nest regularly on the Great Lakes with several of these species nesting in the study area: herring gulls, double-crested cormorants, great blue herons, black-crowned night herons (rare), ring-billed gulls, common terns and Caspian terns (rare along the St. Lawrence River).

Cormorants are large, dark-plumaged birds with long necks and long bills with a sharp hook at the tip. Terns are small to medium sized, light coloured birds with forked tails and long narrow wings. Gulls are medium sized birds with long wings and rounded tails. Wading birds such as the Great Blue Heron are easily recognized by their distinctive long legs, neck, and bill.

All nesting locations in Canada were acquired from the 1989 to 1991 CWS census, and the Royal Ontario Museum's (ROM) ongoing "Ontario Nest Records Scheme" established prior to 1900. Nesting locations in the U.S. were obtained from the original "St. Lawrence River Atlas: Sensitivity of Coastal Environments and Wildlife to Spilled Oil" (RPI), compiled in 1985, in which information from the U.S. Fish and Wildlife Service was used.

Two symbols are used to indicate nesting colonies of waterbirds. One symbol, a gull in flight ('Colonial Nesting Birds'), represents nesting locations for gulls, terns and cormorants. The other symbol, a standing heron ('Wading Birds'), represents nesting or breeding and feeding areas used by herons and egrets.

Where they occur on the individual map pages, these two symbols are sometimes followed by a number (when available) representing the total number of nests for all species at that location. The species-specific nest numbers are available in the master database. The total nests number was used for a quick reference to give responders an order of magnitude idea of site-specific occurrence of the category; for instance, less than 10 nests is a lower priority; 10 to 100 is of higher priority; and over 100 nests is a high priority concentration.

Of course, number of nests is not the only consideration in setting spill response priorities, but this information will assist responders in initial assessments. Responders will typically be interested in protecting the most vulnerable resources, rather than focussing strictly on the greatest numbers. The numbers are provided only as a guideline for deploying limited resources; in the event of a spill, the appropriate experts will be consulted for specific species information that may change priorities. When a 'Wading Bird' or 'Colonial Nesting Bird' symbol occurs without a number in brackets, it either represents a feeding or foraging location, or a site for which the number of nests was not available.

'Shore Birds'

This category includes species such as sandpipers and plovers which are small, active birds with short to medium length legs and bills. They can be found nesting or feeding on sand and gravel beaches along the St. Lawrence River during the ice free season.

'Raptors'

The three most important raptor species found along the St. Lawrence River shorelines are peregrine falcons (a very rare migrant), osprey and bald eagles. The maps show general locations of nest sites. The bald eagle is an endangered species (CWS) in Ontario, and a threatened species in the U.S. Exact nesting locations of bald eagles remain classified in the master database for use by responders during an environmental emergency.

6.2.3 Shore Associated Mammals

'Furbearers (such as Muskrat, Mink and Beaver)'

This biological grouping includes mammals such as otters, muskrats, or beavers that are known to occur along the shorelines of the Great Lakes and Connecting Channels and their tributary rivers. Wetlands are the most important habitat for these species. Several species, such as muskrat, beaver and mink have local economic importance.

The 'Notes' column will also periodically make reference to shore associated mammals. Larger mammals, such as moose and bears, occasionally come to the shore but their locations cannot be pinpointed on the maps. Rather, a general comment can be made to alert responders to be prepared for possible encounters with these mammals during shore clean up activities. Oiled carcasses should be removed from shores whenever practical to prevent their ingestion by mammals or raptors such as bears, wolves or eagles.

Note that no symbol was used to denote reptiles and amphibians. Relatively few species of reptiles and amphibians are associated with the shorelines of the Great Lakes and Connecting Channels. Water snakes and several species of turtles that use wetlands are likely to be found in various shoreline habitats (Owens et al., 1992). There was a limited amount of information available for reptiles and amphibian distribution (specific information can be obtained from Environment Canada's Environmental Conservation Branch at 905-336-4843). Where specific information was provided, the 'Notes' column includes a reference to a specific reptile or amphibian species. Both reptiles and amphibians are at risk during an oil spill, but mapping their distribution would not be practical because of their mobility and widespread occurrence. As they are dependent on water, especially wetlands (Owens et al., 1992), the Atlas identifies these wetland habitats. By protecting these areas against oiling, reptile and amphibian populations will be taken into account, along with birds, fish, and mammals.

6.3 Human-Use Resources

Human-Use Resources are features that have a heightened sensitivity or value because of their use or importance to humans. Locations with these symbols will typically have higher protection and clean up priorities associated with them. These features include areas of high recreational usage, economic benefit or special status (cultural, scientific or ecological importance).

6.3.1 High Recreational Usage

'Marinas and Small Craft Harbours'

In order for a facility to receive the 'marina' symbol, it must have fuel, docking, parking and telephone facilities. Small Craft Harbours, under the jurisdiction of the Department of Fisheries and Oceans, are also included.

'Anchorage Sites'

These sites offer suitable and secure anchorage for small watercraft. They are often located in sheltered bays or inlets.

'Residential, Recreational or Cottage Use'

This symbol indicates the presence of cottages, seasonal or permanent dwellings, resorts, campgrounds, picnic areas, or trailer parks. Residential 'clusters' were often grouped together and denoted as a single symbol.

'High-Use Recreational Beach'

These areas have a heightened sensitivity during the summer months.

'Recreational Dive Site'

These locations have been identified using the guidebook "Dive Ontario!" which draws heavily on information from the Ontario Underwater Council, and from U.S. and Canadian diving clubs.

6.3.2 Resource Extraction

'Water Intakes - Industrial'

This symbol denotes locations where water is extracted from the St. Lawrence River for industrial, non-food related uses. Contact numbers when available for these industries are provided in the 'Notes' column and should be used to advise that water intakes should be shut down or monitored if threatened by a spill. Any telephone numbers noted in the Atlas are subject to change and should be verifed regularly.

'Water Intakes - Municipal'

This symbol denotes locations where water is extracted from the St. Lawrence River for community use for drinking water or food processing. Contact numbers for these intakes are provided in the 'Notes' column and should be used to advise that water intakes should be shut down or monitored if threatened by a spill. Any telephone numbers noted in the Atlas are subject to change and should be verified regularly.

'Outfall'

This symbol denotes locations of municipal and industrial water outfalls discharging into the St. Lawrence River. Though outfalls are not water resource extraction elements, they are associated with water-use operations. Contact numbers when available for these industries are provided in the 'Notes' column. For mystery spills, water outfalls should be checked as a possible source of the discharge or release.

Commercial Fisheries Activity'

Commercial fishing is a significant economic resource along the shores of the St. Lawrence River, especially near Gananoque at Jones Creek and throughout Lake St. Francis. The activity is most dependent on that area within two kilometres of the shoreline (Scott and Crossman 1973). Note that commercial fishing is restricted in a one kilometre radius around every stream or river mouth on the St. Lawrence River.

The 'Commercial Fisheries Activity' symbol was used whenever such activity was specifically identified in source data either for shore activity such as a primary fish processing facility, or areas along the shores where commercial fishing activity takes place, including harvesting and stocking. Individual map pages identify specific commercial and recreational fishing areas. Generally though, this activity can occur anywhere on the St. Lawrence River unless otherwise noted (for instance, restricted areas). No commercial fish farms were identified on the St. Lawrence River. More specific Commercial Fisheries Activity data may be added to the database as they become available.

For the Lake St. Francis area, the commercial fishery focusses mainly on the following species: brown bullhead, American eel, black crappie, sunfish (pumpkinseed) and carp.

6.3.3 Special Status Areas

These are areas where implementation of protection measures and/or assessment of the effects of oil spills are considered a high priority, especially for those locations within Special Status Areas that are vulnerable to oiling or responder activities.

'Highly Sensitive Classified Feature (within 2 km)'

Certain information sets of a restricted nature due to the high biological, cultural or physical sensitivity of the features described are given this symbol. Endangered species information and archaeological sites are two examples. Exact locations and details are maintained in Environment Canada's master database, but agencies providing the source data did so only with the understanding that this information would not be made readily available, except to responders.

In the event of a spill, responders will report all occurrences of this symbol in an affected area. By reporting the number inside the symbol, they will receive the appropriate information and response advice from EPB's Environmental Emergencies Duty Officer (416-346-1971) and the agency that provided the source data, so that they can effectively implement proper protection and clean up measures.

'First Nation/Native American Reservation'

In Canada, Aboriginal people living on a reserve are referred to as a First Nation. In the U.S., the reserve is known as a Native American Reservation. There is extensive Akwesasne Mohawk First Nations property in the Cornwall area, sharing boundaries with Ontario, Quebec and New York. Where First Nations are identified, a reference is made in the 'Notes' column in each case advising responders to contact the local First Nation/Native American Reservation Chief and advise him/her when responding to a spill in their local area or when a spill threatens to impact their shorelines or water intakes.

'National Park/National Forest'

National Parks (including National Heritage Sites) are managed by Heritage Canada's Canadian Parks Service in Canada. St. Lawrence Islands National Park is an example. National Forests and Parks in the United States are managed by the Department of the Interior. In both countries, these areas are identified by a polygon symbol on the map pages. This category may include underwater parks, although none are present in the study area.

'Provincial/State Park, Wilderness Area or Nature Reserve/State Forest'

Provincial Parks, Nature Reserves or Wilderness Areas are areas representing different classes of Provincial Parks under the jurisdiction of the Ontario Ministry of Natural Resources in Canada. In the U.S., spills affecting State Parks and State Forests are under the jurisdiction of the New York State Department of Environmental Conservation. Whenever possible, the 'Notes' column addresses sensitive features specific to the identified area with appropriate contact numbers. In several cases, this polygon is used on the Great Lakes to represent National Wildlife Areas (NWA) administered by the Canadian Wildlife Service.

'Conservation Area or Municipal Park'

These are areas along the shoreline managed either by Conservation Authorities or local municipalities, and may include urban recreation areas. Orange polygons marked on the maps without an associated name represent municipal parks in most cases.

'Environmentally Sensitive Area'

These are areas designated by various Conservation Authorities, or sensitive areas identified by the Ontario Ministry of Natural Resources in series such as their Sensitive Area Reports (SAR). They have especially sensitive features which are identified in the 'Notes' column.

'Area of Natural and Scientific Interest'

An Area of Natural and Scientific Interest (ANSI) is designated by the Ontario Ministry of Natural Resources in Canada. An ANSI as defined in Canada is an "area of land and water containing natural landscapes or features which have been identified as having values related to protection, natural heritage appreciation, scientific study or education."

> "Where ANSIs occur on public lands managed by the Ministry, it will ensure that the land uses and activities which occur, provide for the protection of the identified values."
>
> "On private lands, the Ministry will, through cooperation with others, attempt to ensure that landowners are aware of significant features on their properties and seek the owner's cooperation in protecting such features." (OMNR, 1983)

Site-specific information for ANSIs is detailed in the 'Notes' column. There are no equivalent officially designated areas of this type in the United States.

'Area of Ecological Significance (e.g. Wetland)'

Significant wetland areas along the shores of the St. Lawrence River have been identified by several agencies providing source data. Their particular sensitivities are represented by a combination of Biological Resources symbols and entries in the 'Notes' column. These areas defined by polygons are in addition to the broad and fringing wetland habitats that have been identified along the shore as part of the shoreline geomorphological classification (Shoreline Habitats). The polygons are used to show the extent of the most significant wetland areas.

> "Wetlands support many species of water-associated terrestrial animals. Waterfowl (ducks, geese and swans) and herons are dependent on wetlands, primarily during migration and nesting periods. Many species of amphibians are especially dependent on wetlands throughout their annual cycles. Several species of mammals use wetlands during parts of their annual cycles, but a few, such as muskrats, beaver and mink, are essentially year-round inhabitants. Lakeshore and connecting channel marshes in particular, provide critical feeding, nesting, rearing and moulting habitats for a wide variety of waterbirds and waterfowl." (Owens et al., 1992).

In Ontario, wetlands can be distinguished by Class or Type. In 1985 the Ontario Ministry of Natural Resources and the Canadian Wildlife Service introduced an evaluation system to classify Ontario wetlands (Southern Ontario Wetland Evaluation System 1985) which was updated in 1992 (OMNR 1992). The system identifies four main components: biological, social, hydrological and special features. Each component is assessed and assigned a total value up to 250 points, making the highest possible score 1000 points. The biological component studies the productivity, diversity and overall size of the wetland. The social component includes an assessment of the valued resource products, recreational activity, aesthetics, educational value, proximity to urban areas, ownership and size with regard to the social aspects. The hydrological component examines the connection to a large waterbody, flow stabilization, potential for water quality improvement and erosion control. The fourth component identified as special features includes presence of rare, threatened or endangered flora and fauna, fish habitat, waterfowl nesting, migratory bird staging and also ecological age (succession stage).

The value for each of the four components is summed and a total score is assigned. Based on this score, the Wetland Class is designated according to the following:

Class 1 - 700 or more total points (or 3 of the 4 components score higher than 200)
Class 2 - 650 - 700 (or 2 of the 4 components score higher than 200)
Class 3 - 600 - 650 (or 1 of the 4 components score higher than 200)
Class 4 - 550 - 600 (or all 4 components score higher than 100)
Class 5 - 500 - 550 (or 3 of the 4 components score higher than 100)
Class 6 - 450 - 500 (or 2 of the 4 components score higher than 100)
Class 7 - all others not included above

Provincially significant wetlands include Classes 1, 2 and 3. The objective of this Atlas is to identify all available data on wetland boundaries. The 'Notes' column will also identify wetland class, when that information is available. For further information on wetland classes, contact OMNR.

For a discussion of the different Types of wetlands present on the Great Lakes, see Appendix D of Environment Canada's "Oil Spill Shoreline Clean Up Assessment Team (SCAT) Manual for the Ontario Great Lakes and St. Lawrence River Shorelines", or consult the local office of the Ontario Ministry of Natural Resources. In the United States, contact the New York State Department of Environmental Conservation.

Areas with unique or regionally or seasonally significant habitats (e.g. migratory stopovers) are also considered to be Areas of Ecological Significance.

'Dune Formations'

This line symbol denotes areas along the shore where vegetated or unvegetated sand dunes exist. Their sensitivity is outlined in the 'Notes' column for responders. Damage to vegetation on dunes can lead to further dune erosion.

6.4 Countermeasures

'Access Site (for land vehicles)'

This symbol identifies locations where a good road is close enough to the shore, and an existing trail is adequate to walk to the water and drag boom and light equipment for response purposes. Note that any access over private property will require permission from the landowner before response activities commence at that location. The same applies to the use of private boat launches. Comments regarding private property are noted on the Supplement version and in the master database.

'Approach Concerns: Foreshore Flats/Rocky Reefs/Submerged Vegetation'

Approach concerns may indicate the presence of foreshore flats, rocky reefs or submerged vegetation (seasonal variation). These markings denote some of the features that will be of concern to responders when approaching a shore from the water. These markings are meant to reinforce existing navigational aids and charts, not replace them.

The submergent vegetation beds located along the St. Lawrence River represent more than an approach concern. Responders should make efforts to protect the submergent vegetation beds as they are critical habitats for numerous aquatic species and important feeding areas for fish populations (OMNR, 1994).

'Exposed Rock'

This marking denotes a feature that will be of concern to responders during response activity. These markings are meant to reinforce existing navigational aids and charts, not replace them.

'Coast Guard Light Station'

This symbol shows the approximate location of manned or unmanned Canadian or United States Coast Guard light station installations. Equipment and facility details vary by location; full information is maintained in the master database. Often, facilities such as helicopter pads and buildings will also be identified by their own corresponding symbol. Contact CCG Operations Centre at 800-265-0237 (519-337-6360) or USCG District 9 at 216-522-4404 for further information regarding available facilities.

'Boat Launch: Excellent'

A boat launch is rated "excellent" if it has a large, firm surface ramp into deep water, is protected from waves, has good road access, and has sufficient space for manoeuvring large trailers. Docks to accomodate large boats must also be present.

'Boat Launch: Good'

A "good" boat launch has a solid ramp for small vessels leading into deep water.

'Boat Launch: Poor'

A "poor" boat launch symbol marks a site where a ramp of gravel exists, or merely a trail over the beach. Such sites may need additional work before being useable for response efforts. Certain additional locations have been described in the 'Notes' column as suitable sites for dragging small craft over the sand or cobble beach, but these have not received boat launch symbols.

'Helicopter Landing Site'

Only designated sites with proper pads for helicopters up to the 'B212' (or equivalent) size are noted. Pilots will advise on other acceptable landing sites, as required, during response to a spill.

'Staging Area: Excellent'

Staging areas are locations for setting up and deploying response equipment and for establishing command centres or outposts. Before a staging area is rated "excellent", it must have large parking and storage space, a building suitable for operational headquarters, adequate power and telephone, road and water access, and docking facilities.

'Staging Area: Good'

A "good" staging area has road and water access, telephone, power, parking space, and facilities adequate enough to establish a small or secondary command post/headquarters.

'Staging Area: Poor'

A "poor" staging area is in a more remote location, and is probably the only site available. It will have road and water access, as well as space for a command post trailer.

'Automated Weather Stations'

These locations have been identified in Canada by DOE's Atmospheric Issues Division or by NOAA in the United States to give an indication of the nearest station to a given spill. Portable emergency equipment is available for site specific weather reporting in case of an environmental emergency. Contact DOE's Ontario Region Environmental Emergencies Duty Officer (416-346-1971) or NOAA's Scientific Support Coordinator (206-526-6317) to make the appropriate arrangements.

Additional Countermeasures Note:

The Supplement version of this Atlas includes additional layers of information for use by spill response experts, as outlined below:

'Equipment Depot' and 'Boom Storage Site (Marine Emergency Response Trailer)'

Great Lakes Response Corporation (PIMEC, Inc.), Canadian Coast Guard and United States Coast Guard response equipment depots and boom storage sites (Marine Emergency Response Trailers) are identified on the appropriate map page in the 'Notes' column of the atlas, and as symbols in the Supplement. Contact CCG Operations Centre at 800-265-0237 (519-337-6360) or USCG District 9 at 216-522-4404 for further information regarding available equipment.

'Location of Collection and Recovery Site'

These locations mark areas where oil will likely collect naturally, and where clean up and recovery operations could be carried out, for instance on sand beaches or platform rock. In some cases, booms could be used to direct oil to these locations to facilitate clean up and recovery and protect more sensitive adjacent shores.

'Suggested Boom Deployment'

These markings show only suggested positioning of boom. They do not give boom length requirements. Estimated boom length requirements, however, are listed in the master database. The master database will describe the use for the boom, i.e., whether deflection, exclusion or containment booming should be used, or suggest the sealing of a culvert in a causeway.

These boom deployments are only suggestions for countermeasures. The actual deployment of boom during an environmental emergency will be guided by spill response experts, following a prompt review of the circumstances related to the actual spill.

7.0 Sensitivities of Biological Resources; Vulnerability to Spilled Oil on the Great Lakes and Connecting Channels

This section includes direct quotes or summaries of information from the Canadian Wildlife Service and the Natural Resource Response Guide Series produced for the U.S. National Oceanic and Atmospheric Administration (NOAA) by Research Planning, Inc. (RPI). Such guides, along with local resource experts, may be consulted to obtain specific information regarding life history, habitat preferences, behaviour, and other ecological factors that influence sensitivity to spilled pollutants.

A short description of the sensitivity to spilled oil or hazardous materials will follow for the biological groupings of fish, birds and shore associated mammals. Prior to discussing individual biological groupings, a few definitions will assist responders in determining the expected impact of spills.

Aromatic hydrocarbons are a major group of cyclic petroleum hydrocarbons such as benzene and toluene that are moderately soluhle in water and are generally highly toxic to aquatic organisms. **Refined oil** is the product of distillation of crude oil into light or heavy components. Light refined oils include gasoline, kerosene, diesel oil, and individual components such as benzene or toluene. Heavy refined oils include fuel oil Numbers 4 (Heating Oil), 5, and 6 (Bunker C). The **water-soluble fraction (WSF)** is that portion of an oil that is soluble in water under equilibrium conditions. The water-soluble fraction of petroleum hydrocarbons is composed mostly of aromatic hydrocarbons, such as benzene or toluene (NOAA, 1987).

7.1 Fish

Regarding fish, the adverse impacts associated with spills of crude and refined oils are primarily caused by the chemical toxicity of the watersoluble fraction.

> "The WSF is the portion of oil that marine fish are most likely to be exposed to during an oil spill. Oils that are relatively soluble in water will be more likely to cause toxic effects to fish. For this reason, refined petroleum products (especially gasoline) present a much more severe threat to openwater marine fish than do crude oils."

> "A review of experimental and accidental oil spills shows that...the average concentrations of oil likely to be encountered by openwater fish are about 100 to 10,000 times lower than the acute toxicity values of most petroleum hydrocarbons. Therefore, an oil slick floating on the water surface is unlikely to affect adult fish, but there is some potential for toxic effects to...eggs and larvae" (RPI, 1987).

Toxic effects may also occur as a result of direct contamination of the shallow habitats used by fish and it is therefore important to identify critical fish habitats.

> "Such contamination may result in acute short term toxic effects from the oil or long term effects from residual hydrocarbons that are persistent in sediments. Heavy refined oils (including Heating Oil and Bunker C) contain a high proportion of these hydrocarbons known to cause chronic contamination of shorelines. This type of contamination can cause toxic effects to fish species that spawn in shallow areas, and these effects may occur long after the spawning sites were initially exposed to oil" (RPI, 1987).

According to the Ontario Ministry of Natural Resources, all wetlands along the shores of the St. Lawrence River are considered critical fish habitat which should be given high priority for protection (pers. comm., OMNR, 1992). Other areas of critical fish habitat such as spawning beds and migration routes are identified throughout the St. Lawrence River on the individual maps.

Much of the data represented in the Atlas refers to anadromous fish. These are fish species that live in brackish (slightly salty) or salt water as adults and ascend freshwater coastal rivers to spawning and nursery grounds. Many freshwater fish such as lake sturgeon, walleye, trout and salmon are considered to be auadromous fish in the Great Lakes where they ascend tributary rivers during spawning.

> "All anadromous species are considered to be at moderate to high risk from oil and hazardous materials spills occurring in navigable waters due to their dependence on certain nearshore and shallow water habitats for critical stages of their life cycle" (RPI, 1987).

Adult fish are at moderate risk during spawning runs since they must pass through nearshore areas where spills are likely to pose a significant threat of toxic exposure.

> "Eggs and larvae are at a high risk of exposure at spawning areas. These life stages are unable to avoid waterborne pollutants due to poor swimming ability or dependence on certain habitats such as gravel streambeds. Spills that result in contamination of bottom sediments pose the most serious threat to anadromous fish populations because eggs of many species adhere to or are buried in sediments. Salmonids are probably the most sensitive to contamination of spawning areas because their eggs are spawned in shallow waters, and they remain in the sediments for many months prior to hatching and downstream migration" (RPI, 1987).

Juvenile fish are dependent on shallow, nearshore nursery areas. This places them at a moderate to high risk of exposure to toxic concentration of pollutants during spills.

7.2 Birds

> "Most of the negative effects of oil spills on marine birds are the result of the birds coming into direct contact with floating oil. Exposure of birds to oil has the primary effect of fouling the plumage. Oil causes disruption of the fine structure of the small strands that form the feathers, causing loss of their waterrepellent characteristics. The plumage of oiled birds also becomes matted, allowing water to penetrate to the body surface, which results in chilling and hypothermia as well as a loss of buoyancy" (RPI, 1988).

Some bird species are more vulnerable to oil spills than others.

> "Presumably, those species that are able to leave the water and thereby reduce or avoid hypothermia (such as gulls, wading birds, and some waterfowl) are more tolerant to oil" (RPI, 1988).

> "Oiled birds can also readily ingest oil during preening. The effects of ingested oil include anemia, pneumonia, intestinal irritation, kidney damage, altered blood chemistry, decreased growth, and decreased production and viability of eggs" (RPI, 1988).

Direct exposure of eggs to oil has the greatest potential for reproductive damage. Exposure to very small quantities of oil during the early stages of incubation are most toxic. Oiled adult birds can easily transfer toxic doses to eggs.

Certain behavioral characteristics of birds can increase their vulnerability to impacts of oil spills. "Feeding, flocking and roosting behaviours of many species result in repeated or prolonged diving into or sitting on the water surface where contact with floating oil is possible" (RPI, 1988).

There have been various indices developed to determine relative sensitivities of birds to oil. These typically consider factors such as range, population, habits, mortality, and annual exposure in a given region (RPI, 1988). As discussed in Section 5.2, such factors will be taken into account by local resource experts at the time of a spill. For the purposes of this Atlas, some considerations have been listed to give a general idea of relative sensitivities.

The following paragraphs summarize the vulnerability of the various bird categories symbolized in the Atlas legend. Again, the Canadian Wildlife Service and NOAA's Natural Resource Response Guide for Marine Birds (by RPI) are the main sources for this information.

7.2.1 Migratory Waterfowl

The vulnerability of waterfowl to spilled oil is highly variable, depending primarily on habitat preference. Geese and many diving ducks are highly vulnerable because they tend to concentrate in large flocks on relatively exposed offshore and nearshore waters during migration. Dabbling ducks are less vulnerable due to their preference for more protected coastal wetlands. Loons and grebes (water birds) are highly adapted to an aquatic existence and rarely leave the open water where they are present during much of the year. This increases their vulnerability to an oil spill, but they do not form large flocks. They tend to occur in small groups or as scattered individual birds.

7.2.2 Colonial Nesting Birds

> "The most significant offshore terrestrial animal resources at risk from an oil spill are nesting colonies of gulls, terns, and cormorants. Although colonies on the Great Lakes are widely scattered, an oil spill could have a significant effect if large colonies are within the spill zone" (Owens et al., 1992).

For the "Environmental Sensitivity Atlas for the St. Lawrence River Shorelines", as noted in Section 6.2.2, the Colonial Nesting Birds category includes gulls, terns and cormorants. Only one species of cormorant nests on the Great Lakes and Connecting Channels. Terns and cormorants are highly vulnerable in that they feed on fish and are therefore forced to use waterbodies for foraging. Cormorants are true divers (i.e. they dive from the surface of the water and swim underwater pursuing their prey), whereas terns plunge dive from the air. The feeding behaviour of diving birds such as cormorants results in regular entry into the water, increasing their vulnerability to spilled oil. On the other hand, terns and cormorants tend to roost on islands, structures, etc., rather than on the water itself.

> "These birds do not form large flocks or roost on the water, so mass mortalities are not likely" (RPI, 1988).

Gulls (ring-bills and herring) often feed on sources such as dumps or farm fields, but they also forage along the shores of the Great Lakes, catching fish by plunge diving, as terns do. Surface feeding birds such as gulls...

> "...often form large flocks that regularly roost on the open water. This behaviour can result in large kills from spilled oil, but based on numerous case histories, impacts to these birds are usually not severe. This is due in large part to their highly adaptable nature. Gulls are well known for their ability to exploit a wide range of habitats and food sources and they also are relatively prolific breeders. They are readily able to avoid oil spills, and their populations can recover from mortalities if they occur" (RPI, 1988).

The breeding season varies for colonial waterbird species. Gulls usually return to the colonies before snow and ice has melted, but terns normally return several weeks later (feeding exclusively on fish, they need to be assured of open water). In the St. Lawrence River shoreline areas most activities at the nesting colonies will take place during April through August.

7.2.3 Wading Birds

Herons, egrets and cranes have much lower vulnerability to floating oil because they are rarely immersed in the water and do not flock or roost on the water. For this reason they are identified separately on the maps, even though herons and egrets are also considered to be colonial waterbirds. Herons and egrets stalk shallow pools, immersing only their heads to catch prey. These types of birds tend to avoid oiled areas, but responders must be aware of the possibility of contamination or loss of their food sources in the water column of shallow, sheltered waters (RPI, 1988). On St. Lawrence River shorelines, most activities at the nesting colonies will take place during April through August.

7.2.4 Shore Birds

Most shorebirds have low to moderate vulnerability to spilled oil. They are rarely immersed in water and are unlikely to encounter spilled oil. They do not form large staging flocks along the St. Lawrence River shorelines. At certain times in other areas (for instance, on Lake Ontario), their habit of flocking by the thousands to a limited number of specific locations (very shallow, productive waters) increases their vulnerability, due to the impact that oil spills could have on their highly localized food source (on which they are heavily reliant).

7.2.5 Raptors

Bald eagles are considered to be highly vulnerable in the event of an oil spill. Although they rarely enter the water and are unlikely to be oiled, they have a small population and a very long recovery rate. "Osprey are much more marine oriented and will capture fish directly from the water. They are ranked as moderately vulnerable (lower than bald eagles) because they are more common and more widely distributed than bald eagles" (RPI, 1988). For both of these species, and for peregrine falcons, consumption of oiled prey is a concern.

7.2.6 Bird Seasonality

When such information is available, the 'Notes' column on individual map pages gives site specific descriptions of seasonality. In the following table, a general description is provided for species occurring on the St. Lawrence River shorelines.

Table 1A: St. Lawrence River Bird Seasonality: Colonial Waterbirds

				Category			Abundance		
Species	Period present on St. Lawrence River	Breeding Season Δ	Nest Location	Migrant	Summer Resident	Winter Visitor	Common	Uncommon	Rare
Double-crested Cormorant	April to October	April to August	On ground and in trees (islands and coastlines).	√	√			√	
Great Blue Heron	March to December	April to August	In trees (islands and on mainand)	√	√			√	
Black-crown Night Heron	April to September	April to July	In trees and bushes (islands)	√	√				√
Herring Gull	All year	April to July	On ground. (islands)	√	√	√	√		
Ring-billed Gull	All year	April to July	On ground and on islands	√	√	√	√		
Common Tern	April to October	May to July	On ground (islands)	√	√			√	
Caspian Tern	April to May and July to August		On ground (islands)	√					√

Δ From establishing nesting territories through fledgling chicks. (Canadian Wildlife Service, 1994)

Table 1B: St. Lawrence River Bird Seasonality: Waterfowl, Shorebirds, Raptors

Species	Status	Period Present on St. Lawrence River
Common Loon	Common migrant and summer resident; breeder	April to November
Grebe species	Common migrants	During ice-free period, particularly May, October and November
Canada Goose	Very common migrant; local breeding	March to December (peak April and November)
Dabbling Ducks (including mallard, black duck, northern pintail, american wigeon, teals)	Common migrants and summer residents; breeding	March to December
Diving Ducks (including scaups, oldsquaw, common goldeneye, scaters, mergansers)	Common to very common migrants; rare breeding	During ice-free period; highest counts during migration (March, April, October to December)
Shorebirds (including sandpipers and plovers)	Locally common migrants; uncommon breeders	Mostly during migration (July to October)
Bald Eagles	Rare migrant; very rare breeder; uncommon winter visitor	November to April, rare in summer
Osprey	Uncommon breeder	April to November
Peregrine Falcon	Very rare migrant and extremely rare breeder	April to November

(Royal Military College and CWS, 1994)

7.3 Shore Associated Mammals

A shore associated mammal's exposure to spilled oil can result in a significant reduction in the insulative property of its fur. Once exposed to oil, a mammal's grooming activity may lead to ingestion of oil. (RPI, 1989).

8.0 Sensitivities of Human-Use Resources; Vulnerability to Spilled Oil on the Great Lakes and Connecting Channels

Factors to consider when establishing sensitivities of Human-Use Resources include economic value, resource 'replaceability', risk to public health, and cultural/archaeological value.

No rigorous ranking scheme has been employed for these features, as discussed in Section 5.2. Broad terms such as "highly valued" have been used in the 'Notes' column to give an indication of the level of priority likely to be assigned to a Human-Use Resource during spill response.

9.0 Shoreline Habitats and Associated Countermeasures

9.1 St. Lawrence River Shoreline Habitat Classification Scheme

The Canadian shoreline of the St. Lawrence River has been classified as shown below. The Canadian Environmental Sensitivity Index (ESI) number for each shoreline type indicates the sensitivity ranking of that type. The equivalent United States ESI is also listed to aid U.S. agencies and responders familiar with the Sensitivity of Coastal Environments and Wildlife to Spilled Oil" Atlas series prepared by Research Planning, Inc. In both classification schemes the higher numbers indicate greater relative sensitivity to the impacts of an oil spill. Colours range from "coldest" (blue) for 'Exposed Bedrock Bluff', shore type 1a to "hottest" (red) for 'Broad Wetland', shore type 13b.

Response priorities will be finalized at the time of a spill. The fact that a Broad Wetland is denoted in red does not necessarily mean that it would be boomed ahead of all other areas. Spill-specific circumstances will dictate actual protection measures.

U.S. ESI Ranking	Can ESI Ranking	
		Bedrock or Impermeable Shores
1a	1a	Exposed Bedrock Bluff less than I metre elevation
1a	1b	Exposed Bedrock Bluff 1-5 metre elevation
1a	1c	Exposed Bedrock Bluff greater than 5 metre elevation
1b	2	Retaining Wall/Harbour Structure/Breakwaters (Anthropogenically modified shore)
2	3	Shelving Bedrock
		Unconsolidated Sediment Shores
3	4	Exposed Sediment Bluff
4	5a	Sand Beach: Depositional
4	5b	Sand Beach: Erosional or Transitory
4	6	Sand Barrier with Lagoon
6a	7a	Pebble Beach
6a	7b	Pebble/Cobble Beach
6a	7c	Cobble Beach
6b	8	Rip Rap (Anthropogenically modified shore)
6a	9	Boulder Beach
5	10	Mixed Beach (% by sediment in DOE Database)
		Vegetated Shores
9a	11	Low Vegetated Bank (Grass or Trees)
9b	12	Delta Mud Flat
10a	13a	Fringing Wetland
10b	13b	Broad Wetland

9.2 Shoreline Habitat Characteristics and Appropriate Countermeasures

In this section, the major physical characteristics of each Shoreline Habitat will be discussed. A photograph is provided for each shoreline type present in the study area, depicting a typical example on the St. Lawrence River. Expected oil behaviour and residence time for each Shoreline Habitat will be described. Suggestions for appropriate clean up methods for each shore type will be made.

The following shoreline characteristics will be addressed:

i) Shoreline Morphology - includes a description of shoreline width, slope and characteristic topography, component sediment type(s), and the wave/littoral drift environment. Littoral drift is sedimentary material that is transported in the littoral (coastal) zone under the influence of waves and currents.

ii) Shoreline Sensitivity - includes oil residence time, natural oil removal processes/rate, and the impact to immediate flora and terrestrial fauna.

iii) Clean Up Operations - involves identifying effective clean up methods for each shoreline type, as well as indicating potential environmental hazards that the clean up operation may pose.

In general, in the Great Lakes and Connecting Channels the water volume and distances between shores are insufficient to "absorb" large quantities of oil. Oil moved off one shoreline will likely reappear on an adjacent shore. Environment Canada recommends cleaning any oil deposits which can be removed safely and without causing further habitat damage.

All of the clean up methods outlined are suggestions only. Each has certain implications or drawbacks that must be weighed on a site by site basis by spill response experts at the scene of a spill. **All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.**

Additional information on shoreline protection and clean up is addressed in the Environment Canada video **"Great Lakes Shoreline Protection and Clean Up"**. Contact Chromavision International Inc. (613-748-5335) for ordering details.

9.2.1 Bedrock or Impermeable Shores

1a. Exposed Bedrock Bluff
less than 1 metre elevation

1b. Exposed Bedrock Bluff
1-5 metre elevation

1c. Exposed Bedrock Bluff
greater than 5 metre elevation


1a.


1b.


1c.

ESI 1a, 1b, and 1c. Exposed Bedrock Bluff (U.S. ESI 1a)

The combination of resistant bedrock surfaces, little sediment, steep slopes, and a constant, high wave energy environment make exposed bedrock bluffs the least sensitive shoreline to oiling. This shoreline type is common in the study area, although wave energies are typically not as high as in the open lakes. Huckleberry Island near Gananoque has shore type 1a. Shoreline habitat 1b is predominant on many of the other islands clustered around Gananoque. South Bay on Wellesley Island exhibits a stretch of shoreline habitat 1c.

If the stranded oil is below the normal limit of wave action, it would persist for only a few days to weeks. If shoreline oiling occurred during a storm event then the material would be stranded and unaffected by normal wave action, until the recurrence of a subsequent storm event of similar magnitude. Lower bluffs (< 1 m elevation) are generally more sensitive since they usually have rough surfaces, containing many fractures and depressed pockets. Oil may collect within these surfaces and persist for up to several seasons.

Bedrock bluff shorelines are not especially biologically sensitive due to scant flora and terrestrial fauna.

Bedrock bluff shorelines with a heightened Human-Use value or bluffs which were oiled during storm events, will likely require remedial clean up measures. Low-pressure hosing and manual oil scraping are the preferred clean up methods. Steam cleaning and/or high-pressure hosing may be considered for the most resistant rock surfaces.

Access to these shores is often poor by land and hazardous by water. Bedrock bluff shorelines in locations without heightened Human-Use value may be permitted to self-clean through natural abrasion processes, if manual removal is unsafe or logistically impossible.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 2. Retaining Wall/Harbour Structure/Breakwaters (U.S. ESI 1b)

When artificial shorelines are created through construction, the shoreline is designated as Retaining Wall/Harbour Structure/Breakwaters. Retaining walls are usually small isolated features used to protect private property from bank erosion. They are composed of wood pilings, structural steel, asphalt, or concrete. When concentrated in near-continuous stretches (such as along large ports) they are termed harbour structures. Rip rap material encased within wire netting can be used to front shorelines, resulting in a vertical shore classified as harbour structure.

Retaining wall/harbour structure shores are not particularly sensitive to oil, or clean up operations. This shoreline type commonly supports very little plant or animal life, except for bird use along the structure's upper portions. There is minimal oil persistence along sections exposed to regular waves, but long term oil persistence is possible along sheltered sections.

Hard, durable harbour structure surfaces permit the use of high-pressure hosing or steam cleaning for clean up. Recently spilled oil can be effectively cleaned by means of low-pressure hosing. Ships docked along harbour facilities will similarly require all traces of oil residue removed from their hulls before leaving the port.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 3. Shelving Bedrock (U.S. ESI 2)

Shelving bedrock shores are wide, flat expanses of bedrock, at or immediately below normal water levels. This shoreline type is fairly common in the study area, especially along Wolfe Island.

Generally, shelving bedrock shores are lower energy wave environments than bedrock bluff shores. Waves could carry oil across the full width of the shelf.

Continued wave exposure would likely readily cleanse oil from the lower reaches of the shelf. Oil deposited during a storm would be stranded above normal water levels and would be naturally cleansed only during storms of similar magnitude.

Inaccessible shelving bedrock shores may naturally self-clean (perhaps within two seasons). Other shores, including those with high aesthetic or recreational value, will likely require remedial clean up measures. Oil which collects within depressed regions of the shelf may be cleaned manually or by sump/pump removal. Stranded deposits could be removed by low or high-pressure hosing or steam cleaning for the most resistant rock surfaces. Shelving bedrock shores which support high populations of birds, especially nesting sites, should be cleaned manually to minimize disturbance.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

9.2.2 Unconsolidated Sediment Shores

Unconsolidated sediment shores differ from bedrock shores in that the material is loose and non-cemented.

ESI 4. Exposed Sediment Bluff (U.S. ESI 3)

These bluffs are predominantly erosional forms, carved by wind, wave and surface water erosion. They form where accumulations of glacial material border the shoreline and are exposed to direct wave action. The St. Lawrence River has several long sections of exposed sediment bluff, for instance, on the U.S. side opposite Cardinal, Ontario. There is little biological activity along these bluffs.

Shoreline sections are commonly steep and relatively narrow (< 4 metres).

Spilled oil would be deposited along the lowest portion of the bluff, where wave energy is high, and the oil would be self-cleaned within days or weeks through wave abrasion. Oil deposited during storms may be stranded above this level and may persist until manually removed or subsequent storm surges self-clean the area.

The clean up of stranded oil along unconsolidated sediment bluffs is made difficult by the lack of a shore zone beach, steep bluff slopes, and the ease of bluff erosion. Heavy machinery would be unable to access high or extensive sediment bluff sections. The removal of material at the base of the bluff could promote slumping or landsliding; a serious hazard to clean up crews, and land owners residing on the crest of the bluff. Similarly the use of low/high-pressure hosing or steam cleaning could remove sufficient sediment to induce slope failure.

In the case of small sediment bluffs where shore zone access is available, manual clean up is recommended. Very steep or high sediment bluff sections are generally not accessible; in these instances it is recommended that the oil deposit naturally self-clean.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 5a. Sand Beach: Depositional (U.S. ESI 4)

Depositional sand beaches occur in this area where wave deposited sand has accumulated, often in coves or other sheltered environments. On a depositional beach, the gross annual amount of sediment entering the system exceeds the gross annual amount of sediment leaving the system (positive net annual sediment budget). Offshore regions in this area tend to be shallow and uniformly sloping.

The depositional sand beaches tend to be quite thin and narrow, and are rarely backed by sand dunes. In fact, Sand Bay on the U.S. side of the river (south of Wolfe Island, Ontario) is one of the few depositional sand beaches along this section of the St. Lawrence River.

Biological activity typically includes the presence of shorebirds, and sand beaches are often of high recreational value.

Spilled oil would be deposited along the upper limit of wave action. Heavy or viscous oil rarely penetrates more than 2 centimetres, though with higher temperatures or lighter oil, penetration depth will likely increase.

If water levels were normal the stranded oil deposit may be buried by subsequent storm beach deposits. It is important to locate and remove oil before subsequent burial, when possible. When buried, stranded oil can persist for decades, requiring regular clean up for several years, as the deposits resurface.

In times of elevated water levels, oil may be stranded above the normal swash zone if not removed by clean up teams, where it could weather to form an "asphalt pavement". Eroded asphalt pavement material is often deposited over a wide area as small "tar balls".

Sand beaches, due to their shallow slopes, load bearing capacity, lack of vegetation, and many access roads often permit the use of heavy machinery such as graders/scrapers. Note that sediment removal must be minimized; if too much sand is removed, the beach may be destabilized, causing accelerated beach erosion.

Beach cleaning machines may be used to remove stray tar ball deposits from affected beaches. On very narrow beaches, or those without road access, manual raking is a slow but effective method.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 5b. Sand Beach: Erosional or Transitory (U.S. ESI 4)

Both erosional and transitory sand beaches are present along the St. Lawrence River shoreline, although most are erosional. Grindstone Island, for instance, has many examples of shore type 5b. On an erosional beach the gross annual amount of sediment leaving the system exceeds the gross annual amount entering the system (negative net annual sediment budget). For the purposes of spill response, an erosional beach at any given point in time behaves in the same manner as a depositional beach, except that buried oil will likely resurface more often.

Transitory beaches tend to form in areas with a neutral or near zero net annual sediment budget. During times of normal water levels, sediment may collect in small coves or wave-cut notches to form a poorly defined beach. Such deposits are transient and are regularly removed during storms.

Transitory sand beaches are extremely narrow and often quite steep. Offshore regions are often very deep, permitting waves to break very close to the shoreline.

Oil deposited on a transitory sand beach during times of normal water level is apt to be quickly eroded during the next major storm surge, and transported down drift (likely within one season) to strand elsewhere, likely as sediment-laden tar balls".

Clean up operations along transitory sand beaches are complicated by the lack of access roads, and the mobility of the beach material. Where clean up can be very quickly undertaken, manual raking of the beach is recommended.

Clean up should not be attempted along transitory beaches which occupy wave-cut notches in unconsolidated sediment bluffs. The danger of bluff slumping to clean up crews, as well as the risk to property owners at the crest of the bluff, is too great. In this environment natural self-cleaning should be allowed, though down drift locations are likely to be affected by tar balls which wash ashore.

ESI 6. Sand Barrier with Lagoon (U.S. ESI 4)

No photograph available.

This shore type occurs where littoral drift causes a smooth barrier of sand to form and effectively seal a cove. Coves containing a stream typically have a very small opening (the "outlet") in the sand barrier. The backwater cove which forms is termed a lagoon. There were no examples of this shoreline type in the study area. A description is included here for general spill response information for the Great Lakes area.

The thin, low sand barrier protects the lagoon from wave action, and a wetland often develops. Such wetlands are especially sensitive to disturbances of the protective sand barrier.

The impact of an oil spill on the sand barrier would be similar to that for a depositional sand beach. It is unlikely that oil could cross the barrier through wave washover or beach erosion. Oil could, however, enter the lagoon if waves cross the outlet, which is likely in storm events.

In the event of a spill, boom should be deployed to seal the barrier outlet, and diversion booms used to deflect oil from the sand barrier. Small outlets could be closed with a sediment dyke or sand bags. Heavy machinery should not be employed for clean up. The removal of sand during clean up, compaction of sand by machinery, plus the potential of vegetation disturbance along the barrier crest could result in extensive barrier erosion and the inundation of the lagoon environment. In this instance manual raking of affected shorelines is the only acceptable clean up method, except in those cases where close supervision ensures minimal sediment removal or compaction.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 7a. Pebble Beach (U.S. ESI 6a)

Pebble beaches are shore accumulations of coarse sediment (0.2-4 cm diameter) that form in a higher energy wave environment compared to sand beaches. There are only a few pebble beaches along the St. Lawrence River shorelines. Pebble beaches are characteristically narrower and steeper than sand beaches; widths of 2-5 metres are common.

Oil will penetrate a pebble beach to occupy the spaces between pebbles; penetration depths of 0.5 metres have been observed. Very light oil, though able to penetrate the sediment, would be washed through the beach sediment and into the lake by wave action. Heavy oil may remain on the surface and, after weathering, cement pebble grains to form asphalt pavement.

On a pebble beach, where the sediment moves more readily with wave action, subsequent storms tend to bury oil stranded high on the beach. Oil buried at a depth of 0.5 metres or more could persist for years before natural abrasion by wave action removed the deposit.

Sensitive flora and fauna may be adversely affected by oil on shore and in the water column, for instance when certain fish species are spawning along these shores, or if organisms ingest oil or become coated in oil.

Most pebble beaches are thin, relatively steep and lack easy road access, so use of heavy machinery is restricted. The load bearing capacity of pebble beaches can often support light equipment such as bobcats. Physical breaking or tilling using long tynes dragged through the pebble can be effective in bringing oil nearer to the surface for self-cleaning and weathering.

Low-pressure flushing with a header deluge may assist in moving light oil through the sediment to the water's edge for collection. The use of steam cleaning and low or high-pressure hosing should be avoided on pebble beaches, since they temporarily reduce the viscosity of the oil and could drive oil deeper through the pebble material, making removal more difficult. Pebble beaches must be water flushed (header deluge) quickly, while the spilled oil is still fresh. Otherwise, the oil will be present in the substrate for a much longer time.

Manual cleaning can be an effective clean up option. Responders must be careful to minimize sediment removal.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 7b. Pebble/Cobble Beach (U.S. ESI 6a)

Pebble/cobble beaches are fairly common in certain areas along the St. Lawrence River shorelines, for instance on Barnhart Island in St. Lawrence State Park. They consist of a mixture of pebbles (0.2-4 cm diameter) and larger cobble material (4.5-25 cm). Generally pebble/cobble beaches are narrower and steeper than pebble beaches; widths of 2-3 metres are common.

Oil may rapidly penetrate into the spaces between pebble/cobble sediment. Even heavy oil may penetrate to a depth of 1 m or more, where it can persist for years before natural abrasion by wave action would remove the deposit.

Very light oil, though able to penetrate the sediment, would be washed through the beach sediment and into the lake by wave action. Heavy or viscous oil may remain on the surface and, after weathering, cement pebble/cobble material to form an asphalt pavement.

Sensitive flora and fauna may be adversely affected by oil on shore and in the water column, for instance when certain fish species are spawning along these shores, or if organisms ingest oil or become coated in oil.

Most pebble/cobble beaches are very thin, relatively steep, and do not have easy road access, so use of heavy machinery is restricted. The load bearing capacity of pebble/cobble beaches may support light equipment such as bobcats. If the cobbles are not too large, physical breaking or tilling using long tynes dragged through the sediment can be effective in bringing oil nearer to the surface for self-cleaning and weathering.

Low-pressure flushing with a header deluge may assist in moving light oil through the sediment to the water's edge for collection. The use of steam cleaning and low or high-pressure hosing should be avoided on pebble/cobble beaches, since they temporarily reduce the viscosity of the oil and could drive oil deeper through the shore material, making removal more difficult. Pebble/cobble beaches must be water flushed (header deluge) quickly, while the spilled oil is still fresh. Otherwise, the oil will be present in the substrate for a much longer time.

Manual cleaning can be an effective clean up option. Responders must be careful to minimize sediment removal.

All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 7c. Cobble Beach (U.S. ESI 6a)

There are short stretches of cobble beach scattered throughout the islands at the Lake Ontario entrance to the river, for instance, at Howe Island. In the east end of the study area, Cornwall Island has several examples. This shore type is made up of well sorted sediment clasts, 4.5-25 cm in diameter.

Cobble beaches are generally narrower and steeper than pebble/cobble beaches; widths of 2 metres or less are common. Cobble-sized material cannot pack tightly, permitting oil to rapidly infiltrate cobble sediment.

Large amounts of stranded heavy oil are likely to penetrate to a depth of 1 metre or more, where it can persist for years before natural abrasion by wave action would remove the deposit. Very light oil, though able to penetrate the sediment, would be washed through the beach sediment and into the lake by wave action. Heavy or very viscous oil may remain on the surface, and, after weathering, cement cobble clasts to form an asphalt pavement.

Sensitive flora and fauna may be adversely affected by oil on shore and in the water column, for instance when certain fish species are spawning along these shores, or if organisms ingest oil or become coated in oil.

Most cobble beaches are extremely thin, steep, and rarely have easy road access, so use of heavy machinery is very restricted. The load bearing capacity of cobble beaches may support light equipment such as bobcats. If the cobbles are not too large, physical breaking or tilling using long tynes dragged through the sediment can be effective in bringing oil nearer to the surface for self-cleaning and weathering.

Low-pressure flushing with a header deluge may assist in moving light oil through the sediment to the water's edge for collection. The use of steam cleaning, and low or high-pressure hosing should be avoided on cobble beaches, since they temporarily reduce the viscosity of the oil and could drive oil deeper through the shore material, making removal more difficult. Cobble beaches must be water flushed (header deluge) quickly, while the spilled oil is still fresh. Otherwise, the oil will be present in the substrate for a much longer time.

Manual cleaning can be an effective clean up option. Responders must be careful to minimize sediment removal. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 8. Rip Rap (Anthropogenically Modified Shore) (U.S. ESI 6b)

When natural shorelines are mantled with debris to protect the shore from wave-induced bank erosion, the resulting shoreline is termed rip rap. Rip rap usually takes the form of large, coarse material which is inexpensive and locally available. This may include roughly quarried stone, scrap wood, damaged concrete castings, or clay pipe refuse.

Most rip rap shores are narrow and fairly steep. Wave energy within these locales tends to be high (hence the need for rip rap).

Rip rap can be an important substrate for some bird and fish activity.

The large blocks often used in rip rap behave as a boulder beach in terms of oil penetration, having large interstitial pockets between blocks that can retain oil if not thoroughly cleaned. For these reasons, certain rip rap shores may be a priority for protection measures.

In most cases, good road access permits the use of several forms of heavy equipment. In some cases, the large, blocky nature of rip rap permits the use of highpressure hosing or steam cleaning without significantly endangering (through erosion) the underlying protected shoreline.

Recently spilled oil can often be effectively cleaned by low-pressure hosing. Small spills can be cleaned by employing manual labour and scraping the rip rap, or through the use of sorbent material to remove pooled oil. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 9. Boulder Beach (U.S. ESI 6a)

Boulder beaches are rare along the St. Lawrence River shorelines. Boulder beaches are accumulations of large boulders (25+ centimetres diameter), the smaller sediments having been washed away by wave action in the high energy environment. There is a similarity (from an oil residence perspective) between some rip rap and boulder beaches.

Boulder beaches are extremely narrow and often quite steep; beach widths of 2 metres or less are common.

Boulder beach sediment, due to its large size, cannot pack densely. Light oil, when washed onshore, will rapidly penetrate boulder sediment and be washed through the beach sediment and returned to the lake by wave action. Abrasion by breaking waves and a very permeable sediment combine to remove trapped light oil relatively quickly.

Large amounts of oil are likely to penetrate to a depth of 1 metre or more, and oil could remain trapped between boulders from where it will seep out over time if not cleaned. Very viscous oil may remain on the surface, and adhere to boulders where it will eventually weather and form an asphalt pavement.

Sensitive flora and fauna may be adversely affected by oil on shore and in the water column.

Since boulder beaches are extremely thin, steep, and rarely have easy road access, the use of heavy machinery for clean up operations is severely limited. Where possible, steam cleaning or low/high-pressure hosing may be effective in speeding the removal of recently stranded oil. Due to the permeable nature of boulder beaches, oil buried to a great depth (+0.5 metres) can be effectively removed by these methods.

If these methods are not feasible, isolated boulder beaches may be considered for self-cleaning through wave abrasion, as long as adjacent sensitive shores are protected. Boulder beaches with sensitive features or high Human-Use value may be cleaned manually, using aids such as sorbent pads and scrapers. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

9.2.3 Vegetated Shores

Shorelines dominated by vegetation are common features in sheltered environments along the St. Lawrence River shorelines. Coves protected by peninsulas, or the leeward edges of major islands often are dominated by vegetated shores.

ESI 10. Mixed Beach (% by sediment in DOE Database) (U.S. ESI 5)

Mixed beaches are quite uncommon along the St. Lawrence River shorelines; there are only seven examples.

They are accumulations of very poorly sorted sediment including large amounts of coarse sediment (boulders and cobbles), and some finer materials (e.g. sand). The percentage of component sediment types in each shore's case is expressed in descending order (e.g. boulders-70%; cobbles-30%) in Environment Canada's master database.

Mixed beaches are typically shallow sloped, very small (less than 100 metres in length), fairly wide, and restricted to pockets/coves between headlands, in well-sheltered, low energy wave environments. The sheltered wave environment permits the finer sediment to remain and fill the spaces between larger cobble/boulder sized material.

Oil washed ashore along mixed beaches with finer sediment is unlikely to penetrate much; this sediment limits the downward movement of oil.

Only very light oils could penetrate this material. Since the sheltered wave environment limits the oil's removal by wave abrasion, deposits of oil are likely to persist for a long time on the surface of mixed beaches. Heavier oils could slowly weather to form asphalt pavements.

Sensitive flora and fauna may be adversely affected by oil on shore and in the water column, for instance if organisms ingest oil or become coated in oil.

Heavy machinery can be quite destructive to the beach surface; the sheltered wave environment ensures beach damage will not quickly be repaired by natural deposition and reworking of shoreline sediments.

On newly deposited oil, low-pressure hosing and flushing, and manual clean up with shovels, pitchforks, and sorbent pads can be effective. Sump/pump operations can be effective on thick accumulations of oil on the beach surface. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 11. Low Vegetated Bank (Grass or Trees) (U.S. ESI 9a)

Low vegetated banks are sheltered environments nearly covered in vegetation, with no erosive bluffs or exposed sediment immediately above the waterline; vegetation covers all land surfaces along the shore. Low vegetated bank shorelines are distinguished from broad and fringing wetland shores by the absence of aquatic vegetation. This shore type is widespread along the St. Lawrence River, especially near Cardinal and Long Sault.

Most low vegetated shorelines exist in low wave energy environments.

Generally gentle in slope, these shores include environments such as forests, meadows, fields and lawns.

Due to the very low energy environment, stranded oil is unlikely to be removed naturally. The impact of spilled oil can be effectively reduced if there is time to manually spread sorbent material along the shore prior to oiling.

Great care must be taken not to harm the vegetation during clean up, since it serves to stabilize the banks. Low-pressure flushing and hosing may be used to remove recently stranded oil as long as smaller vegetation species are not apt to be damaged, and if topsoil will not be removed by the process. Runoff water must be collected and removed. This method may drive residual oil into soil, complicating clean up operations.

An on-site expert is recommended for supervision during clean up. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 12. Delta Mud Flat (U.S. ESI 9b)

No deltaic mud flat shorelines are present in the study area.

ESI 13a. Fringing Wetland (U.S. ESI 10a)

Fringing wetlands are a type of vegetated shoreline containing an abundance of aquatic vegetation. They are usually much smaller than broad wetlands. Along the St. Lawrence River shorelines, marsh communities are the most common form of fringing wetland. Characteristically, they are restricted to shallow water coves protected from wind or waves. They closely border the shore to form a narrow belt of aquatic vegetation offshore. The shores along Mallorytown Landing and Grenadier Island contain excellent examples.

Oil spills pose a serious threat to fringing wetlands, which are highly valued for their importance as significant fauna habitats (nesting and spawning sites of various, often endangered species), or for the sensitive flora they contain.

Oil spilled in fringing wetlands could persist for years since wave abrasion processes are absent. The use of floating barrier booms at the mouth of coves, or deflection booms updrift of fringing wetlands could reduce oil damage to these sensitive environments.

All wetland environments are extremely sensitive to destructive clean up practices, especially when vegetation or sediment is removed, since wetland regeneration happens very slowly. The use of heavy equipment is potentially more hazardous to the wetland community than the spill itself due to the risk of vegetation destruction, compaction of organic matter, grinding of oil into marsh soil, and the spreading of oil adhered to equipment surfaces to uncontaminated wetland regions.

Low-pressure flushing and hosing, and manual use of sorbents are the safest clean up methods. Usually road access does not exist; clean up crews would likely have to be transported to and from the site by small flat-bottomed boats. The use of low-pressure hosing to herd thin sheens of oil away from vegetation and towards deeper water (where it may be collected by skimming) is one method that has been effective.

Cutting oiled vegetation should only be considered as a last resort where large amounts of persistent oil are stranded in areas sheltered from natural removal processes, and where sensitive biological resources are at risk of being affected by the residual oil. Cutting does not improve vegetative recovery in most cases. Great care must be taken not to damage or trample roots.

An on-site expert is recommended for supervision during clean up. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

ESI 13b. Broad Wetland (U.S. ESI 10b)

Broad wetlands are vegetated shorelines which contain an unusual abundance of diverse aquatic vegetation. Along the St. Lawrence River shorelines, marsh communities are the most common form of broad wetland.

Broad wetlands are usually quite large (1 to 2 km long), and occupy shallow water coves (often containing creek outlets) protected from wind or wave action in very low energy environments. They may extend into bay waters for hundreds of metres. Wilson Hill State Fish and Game Management Area west of Massena is an excellent example of an extensive broad wetland, as is the Ile Simard area of Lake St. Francis.

Oil spills pose a serious threat to broad wetlands, which are highly valued for their importance as significant fauna habitats (nesting and spawning sites of various, often endangered species), or for the sensitive flora they contain.

Oil spilled in broad wetlands could persist for years since wave abrasion processes are absent. The use of floating barrier booms at the mouth of coves, or deflection booms updrift of broad wetlands could reduce oil damage to these sensitive environments. In very dense wetlands, oil is unlikely to penetrate past the outer edge of the vegetation.

All wetland environments are extremely sensitive to destructive clean up methods, especially when vegetation or sediment is removed or damaged, since wetland regeneration happens very slowly. The use of heavy equipment is potentially more hazardous to the wetland community than the spill itself due to the risk of vegetation destruction, compaction of organic matter, grinding of oil into marsh soil, and the spreading of oil adhered to equipment surfaces to uncontaminated wetland regions.

Low-pressure flushing and hosing, and manual use of sorbents are the safest clean up methods. Usually road access does not exist; clean up crews would likely have to be transported to and from the site by small flat-bottomed boats. The use of low-pressure hosing to herd thin sheens of oil away from vegetation and towards deeper water (where it may be collected by skimming) is one method that has been effective.

Cutting oiled vegetation should only be considered as a last resort where large amounts of persistent oil are stranded in areas sheltered from natural removal processes, and where sensitive biological resources are at risk of being affected by the residual oil. Cutting does not improve vegetative recovery in most cases. Great care must be taken not to damage or trample roots. An on-site expert is recommended for supervision during clean up. All clean up methods employed require measures to ensure the collection and proper disposal of oil as it is liberated from the shore.

10.0 St. Lawrence River: Physical Overview

East of Kingston, Lake Ontario drains through the Thousand Islands into the St. Lawrence River. The St. Lawrence River has the largest discharge of any river in North America. Including islands, the Canadian shoreline length of the upper St. Lawrence River (from the Kingston area to the end of Lake St. Francis) is 684 kilometres. The United States shoreline length of the upper St. Lawrence River is 346 miles (554 kilometres). The shore is moderately populated, and many of the islands and peninsulas are developed (primarily cottages) and fairly accessible. Since much of the shoreline is populated and developed, the St. Lawrence River has been the subject of study by a variety of government and resource agencies.

The Thousand Islands area, a complex system of islands and channels, is a sheltered environment dominated by river currents rather than by wave generated processes, although waves generated by passing vessels can be as high as 0.5 metres and are an important factor on shores adjacent to shipping lanes. The complex Thousand Islands area gives way east of Mallorytown Landing to a simpler narrow, single or double channel system (approximately 2 to 4 kilometres wide) (Owens 1979) that cuts through less resistant sedimentary rock outcrops (Owens et al., 1992).

This area is referred to as the Middle Corridor (from Jones Creek near Brockville to just west of the Iroquois Locks system). This single deep channel has a relatively uniform shoreline. Littoral areas (water depth of less than two metres) are confined to small bays and shoreline indentations. Currents are strong and water depths throughout the main channel average 20-25 metres. Productivity is reduced in this section of the river due to the deep channel and relative absence of littoral areas (OMNR, 1994).

The river widens at Lake St. Lawrence and Lake St. Francis, where extensive vegetated shallow areas are present. Between Lake Ontario and Montreal, the St. Lawrence River water level "drops 69 metres, and has been modified by the construction of the St. Lawrence Seaway, a 290 kilometre system of locks and canals" (Owens 1994) that forms a major commercial shipping route. The Seaway is generally open to shipping from April to December.

Maximum fetches (the area of open water over which waves are generated by wind) are very low compared with the open lakes (Owens, et al., 1992). The shore zone of the St. Lawrence River is dominated by low rocky outcrops with a few sections of low cliffs. Marshes are common in sheltered bays where fine-grained sediments have accumulated, but beach deposits are rare. Erosion rates from the shores of Kingston to Brockville are low as they are relatively sheltered environments consisting of bedrock.

10.1 Water Circulation and Shoreline Transport

In the event of a spill, currents, wind and wave conditions must be monitored to assist in predicting the trajectory of a contaminant. When the trajectory and destination of a spill have been defined, the target shoreline should be assessed for shoreline transport. Longshore sediment transport is the mechanism by which sediment material is moved parallel to the coast (by wave-induced processes). However, sediment availability is scarce in the upper St. Lawrence River, and wave induced processes are not predominant, making shoreline transport assessment rather straightforward in much of the study area.

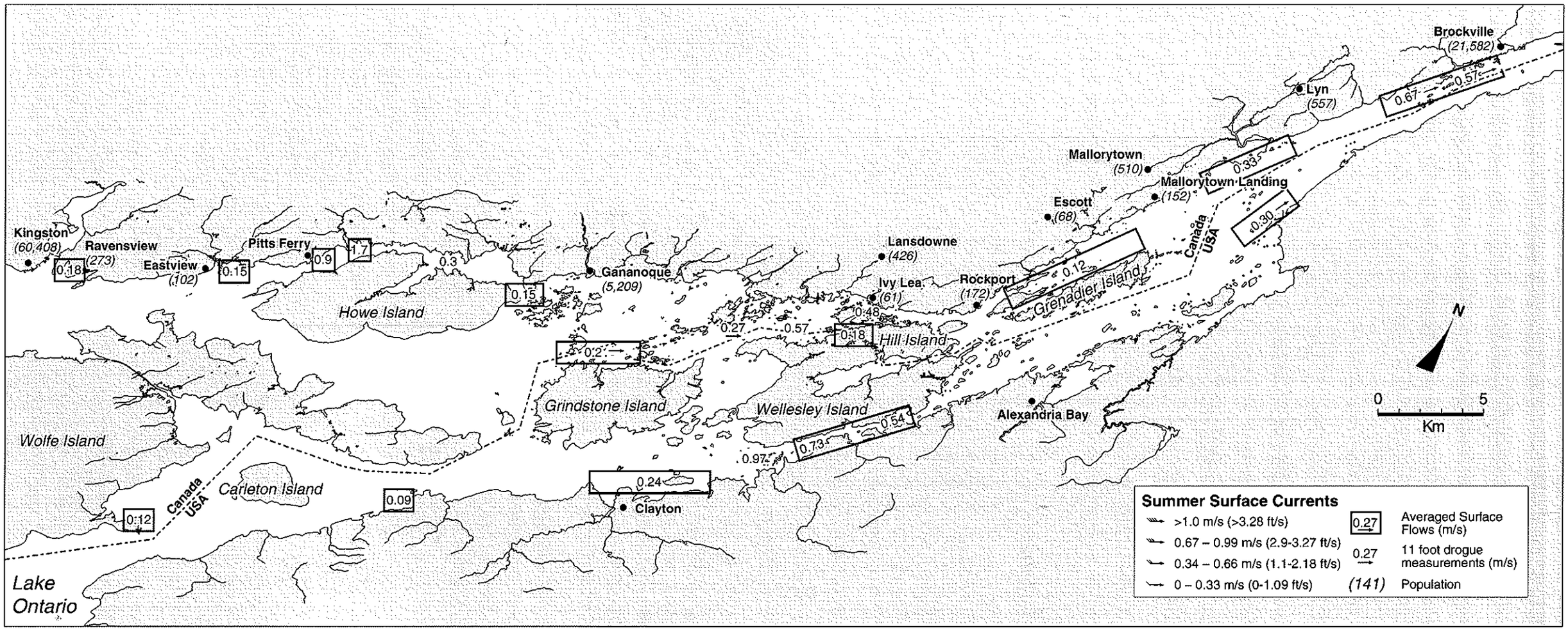
An important consideration on the St. Lawrence River is the historical, annual and storm variation in water levels. This will partially dictate which part of the shore will be oiled during a spill event. A Great Lakes Water Level Bulletin is published each month by the Canadian Hydrographic Service. It includes a six month forecast of water levels. Exact water levels during a response to a spill can be obtained from Environment Canada by phoning 905-336-4581.

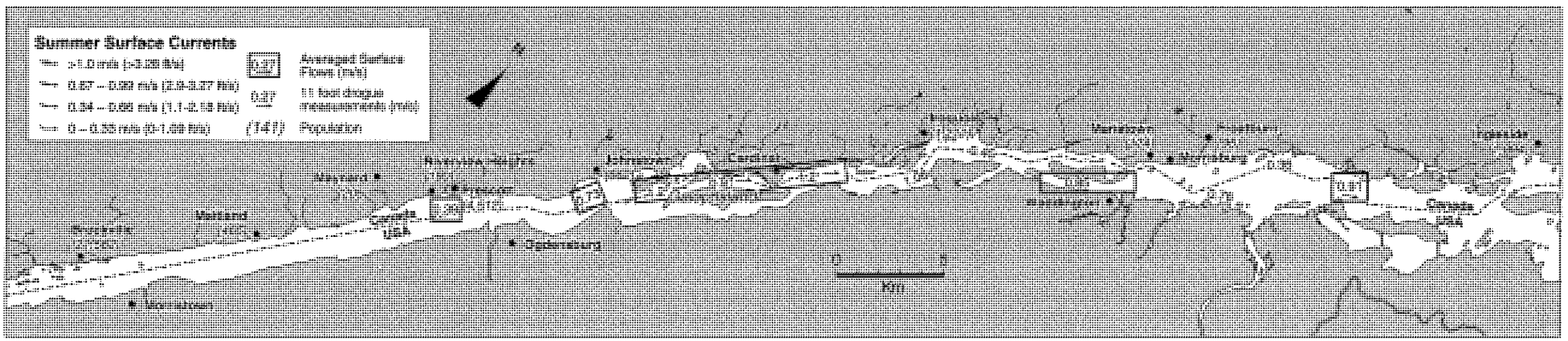
Wind driven currents form the dominant surface circulation on open water in the Great Lakes, while river currents and wind effects combine to form circulation patterns along the St. Lawrence River. The general pattern of the surface water flow in the river is from southwest to northeast (see Figure 3).

"Between Lake Ontario and Montreal the rate of current varies directly with the width of the river channel. In the canals the rate is generally slight, with the exception of Canal de Beauharnois, where the rate although moderate, will vary with the volume of water used at the power dam. In lakes and open reaches, currents vary between 0.2 and 1 knot, and in the narrower sections of the river between 2 and 3.5 knots. The swiftest currents are to be found in the channel between Cornwall Island and the United States shore where a current of up to 6 knots may be encountered." (DFO, 1986).

Maximum water surface temperatures on the St. Lawrence River typically reach above 20°C by late summer (Saulesleja, 1986). Figure 3 also gives general information such as communities with their populations.

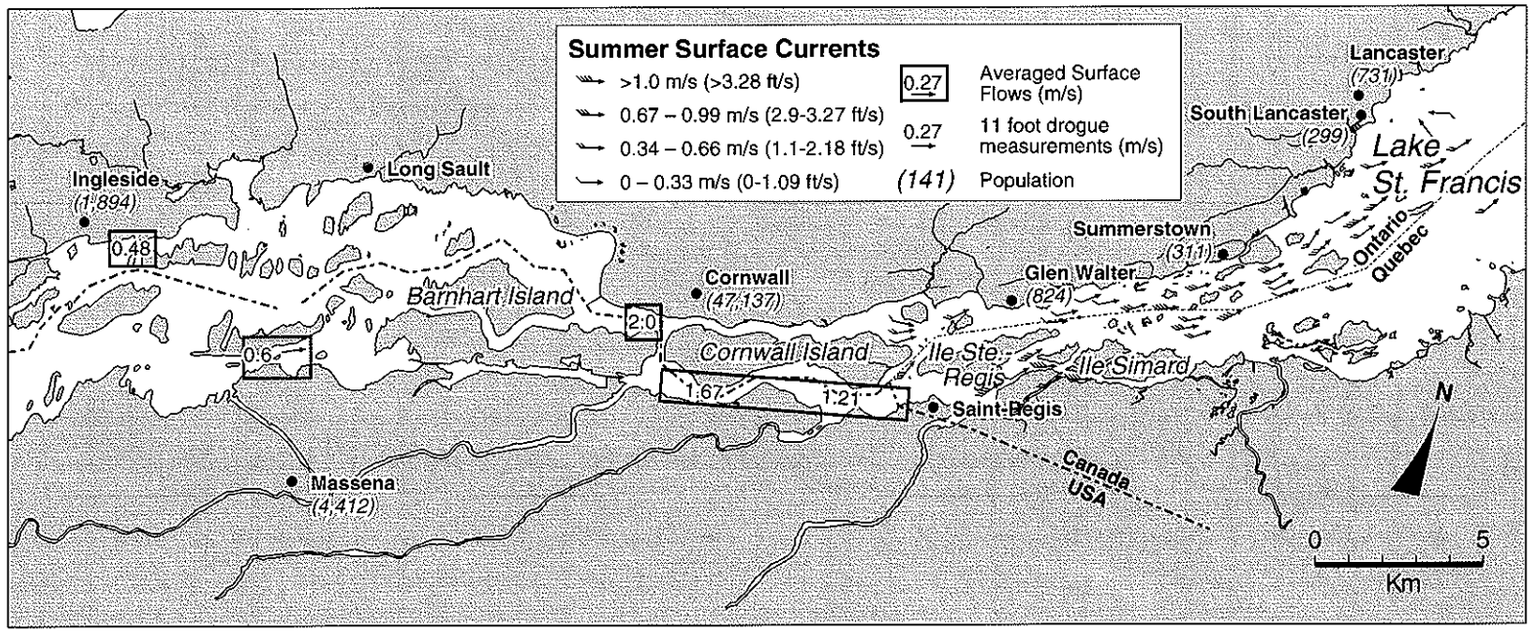
Figure 3: St. Lawrence River Overview and Surface Currents

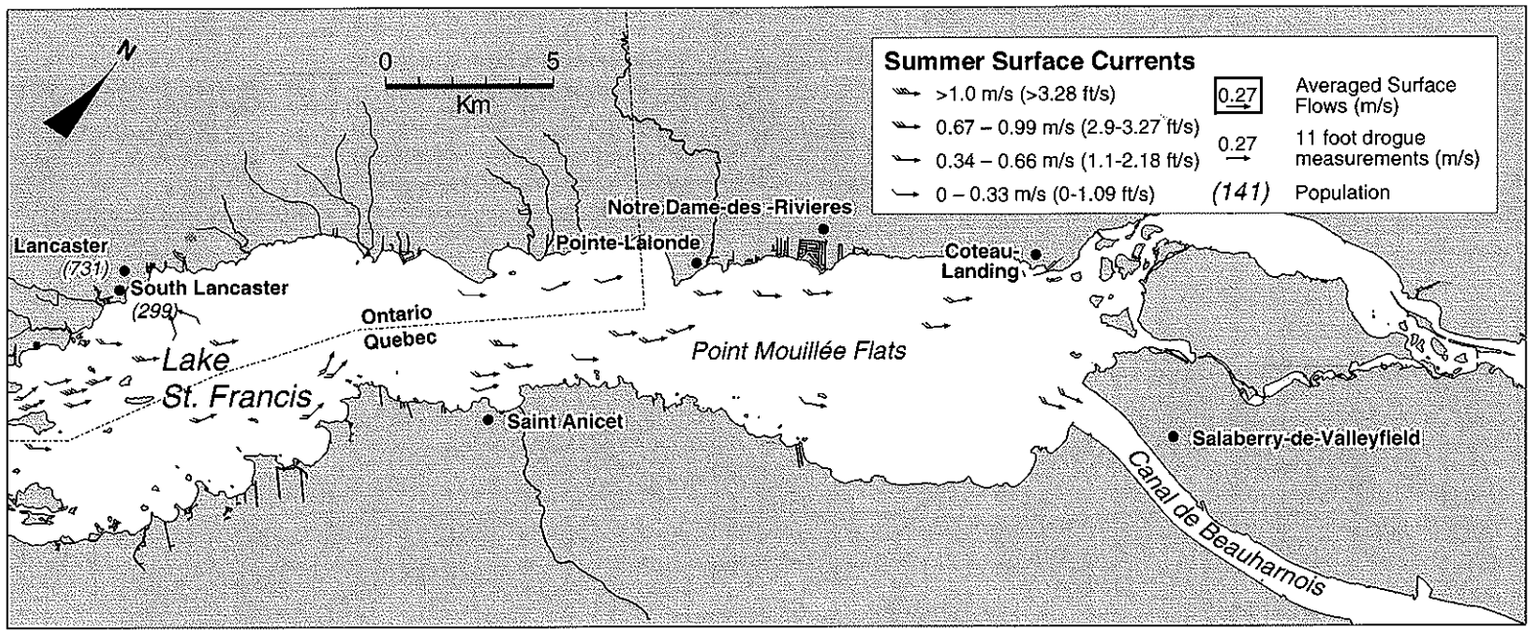




(Canadian Coast Guard, 1981)
(Population Data Source: Statistics Canada Census, 1991)

Figure 3: St. Lawrence River Overview and Surface Currents (continued)

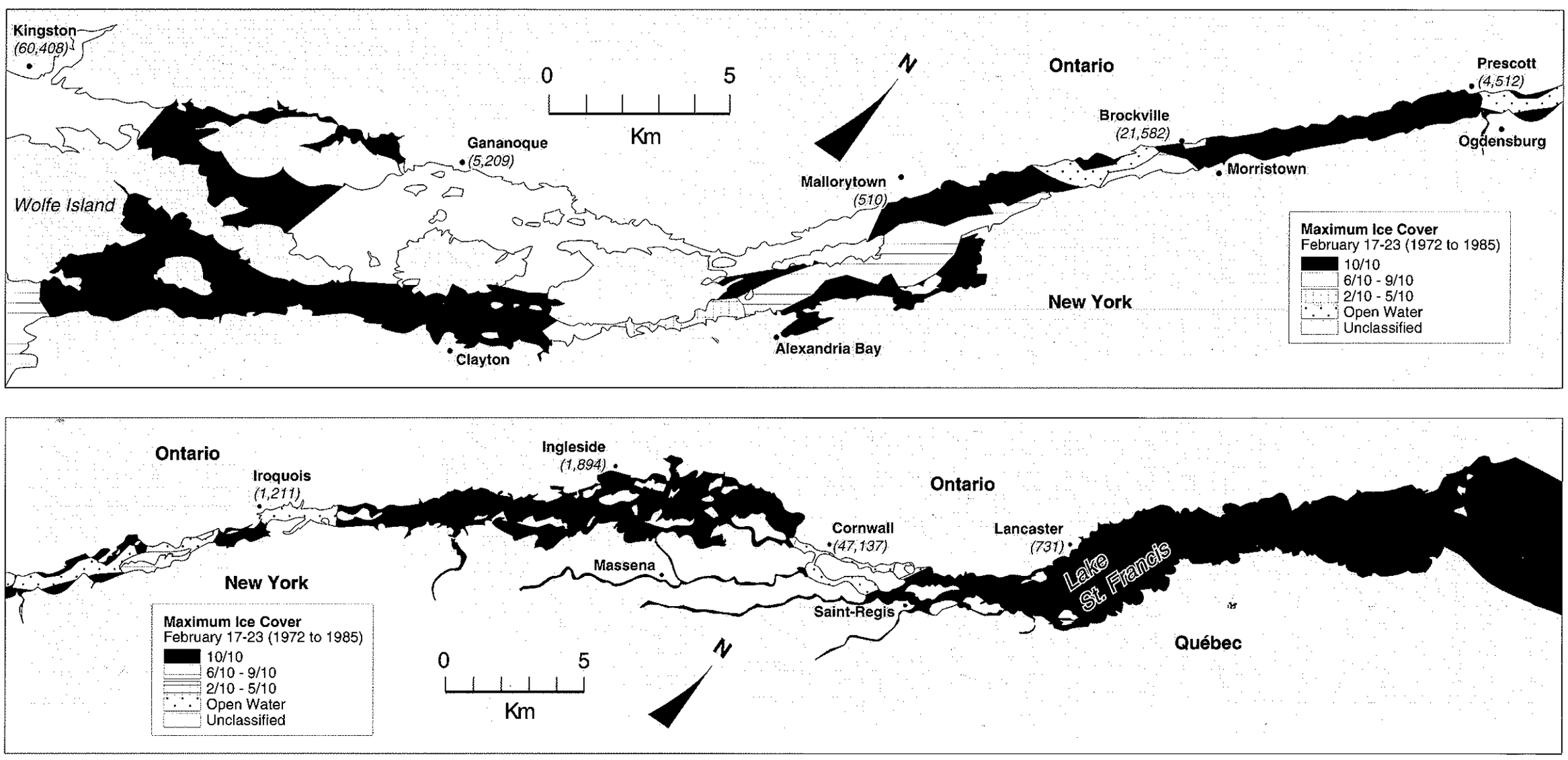




10.2 Ice Cover

Normally ice begins to form spreading upstream from the Montreal area early in December to reach the entrance to Lake Ontario early in January. A normal extensive ice cover exists throughout the winter on the river. The maximum ice cover exists typically from the last week of January until mid-February. The St. Lawrence River typically has close to 100% ice coverage in the winter with the exception of several small areas located between Montreal and Lake Ontario (see Figure 4). Ice thicknesses vary during the winter months, and from year to year. In a normal season, maximum average (1973-1994) ice thickness can range from 20 centimetres between Wolfe Island and Prescott, to 60 centimetres in some canals (locks). Break up of ice cover progresses downstream on the St. Lawrence River from Lake Ontario during the first half of April (DFO 1986). Figure 4 shows typical mid-winter ice conditions on the St. Lawrence River.

Figure 4: St. Lawrence River: Typical Mid-Winter Ice Cover



(St. Lawrence Seaway Authority, 1994)

10.3 Wind and Waves on the St. Lawrence River

The prevailing winds for the St. Lawrence River alternate from the southwest and northeast along the length of the river. Wave energy levels are lower in the relatively sheltered environment of the river compared with the open lakes, although passing vessels will often generate waves from their wakes up to 0.5 metres in height at the shore. Near the Lake Ontario entrance to the St. Lawrence River, waves up to 2 metres height are possible in strong winds due to the distance over Lake Ontario that the waves have travelled. At points where the river widens, for instance at Lake St. Lawrence (14 kilometres long, up to 6 kilometres wide) and Lake St. Francis (43 kilometres long, up to 6 kilometres wide), higher waves are possible due to the increased fetch.

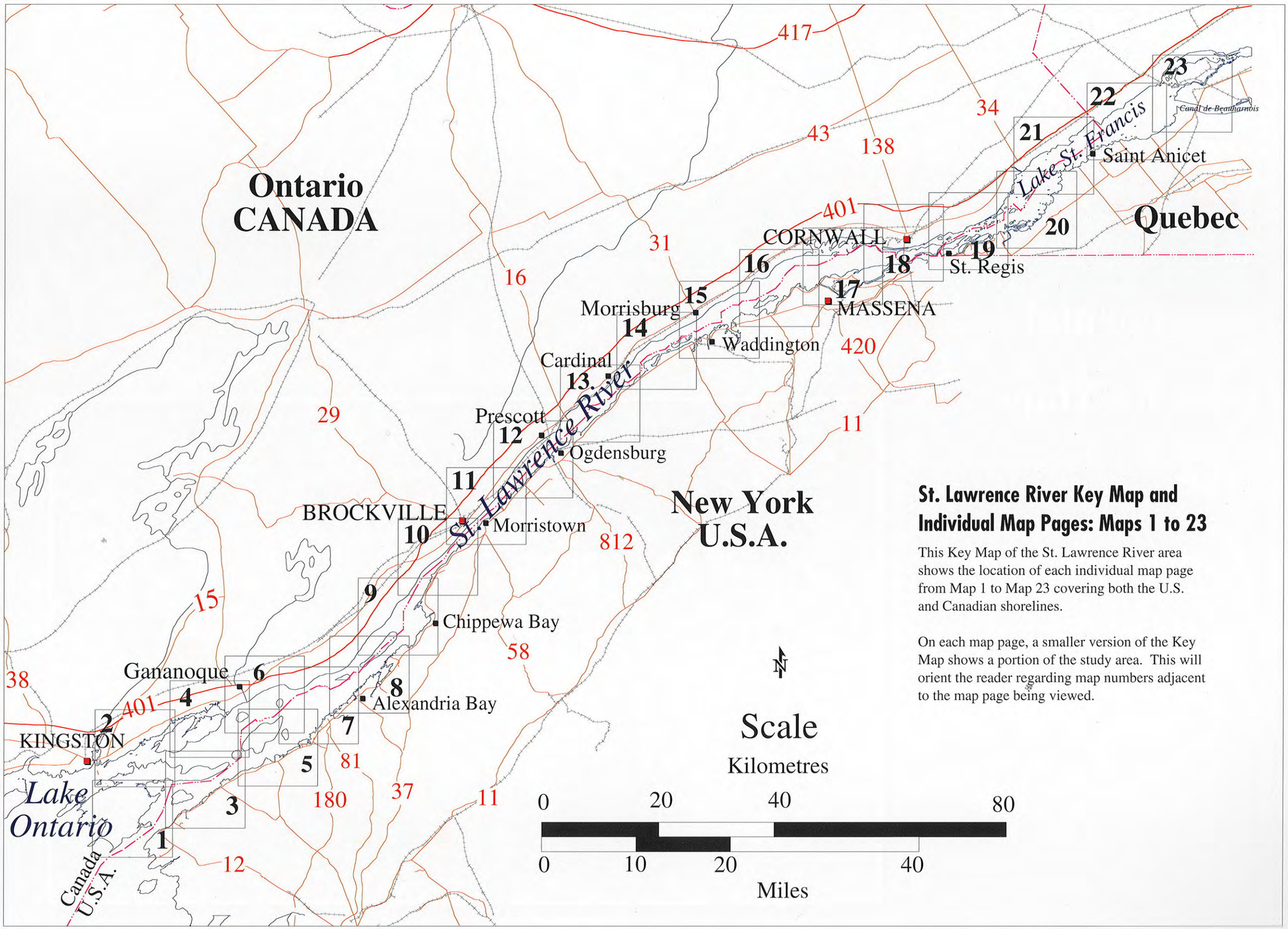
Environmental Sensitivity Maps for the St. Lawrence River Shorelines

Environment Canada

Environmental Protection Branch
Ontario Region

Environnement Canada

Direction générale de la protection de l'environnement
Région de l'Ontario



St. Lawrence River Key Map and Individual Map Pages: Maps 1 to 23

This Key Map of the St. Lawrence River area shows the location of each individual map page from Map 1 to Map 23 covering both the U.S. and Canadian shorelines.

On each map page, a smaller version of the Key Map shows a portion of the study area. This will orient the reader regarding map numbers adjacent to the map page being viewed.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

1. The Fuller Bay/Tibbetts Point area is heavily used by migratory birds in spring and fall.

2. The Big Sandy Bay Wetland (Class 2) is an active feeding habitat for colonial waterbirds, waterfowl and wading birds and supports provincially and regionally significant plant species. It is a habitat for several species of fur bearing mammals, a winter cover area for fox and is regionally important for waterfowl production.
   The Big Sandy Bay area is classified as an ANSI. It represents an exterior coastal wetland developed behind a low sand ridge and dune system. This forms a classic Barrier Beach. Responders should take care not to damage these sand formations.

3. Seasonal fish spawning occurs along the south shoreline of Wolfe Island from Bear Point to Hinckley Point: Smallmouth Bass in Summer.
   There is ferry service between Point Alexandria and Cape Vincent, New York.

4. The Reeds Bay Wetland (Class 2) is an active feeding area for colonial waterbirds, wading birds and waterfowl and supports provincially significant plant species. It is a habitat for several species of fur bearing mammals and provides winter cover for deer.
   Seasonal fish spawning occurs in Reeds Bay: Yellow Perch in late Spring; Largemouth Bass in Summer.

5. The Button Bay Wetland (Class 2) is an active feeding area for colonial waterbirds, wading birds and waterfowl and supports provincially and regionally significant plant species. This wetland is a habitat for fur bearing mammals and seasonal fish spawning. Commercial fish harvesting is an important activity in this area.

6. Feather Bed Shoals are rocky, moss covered and contain extensive beds of submergent aquatic vegetation. The location is one of five major waterfowl concentration areas in the St. Lawrence River. These shoals provide important fish spawning and nursery habitat for many resident warmwater fish species.

7. The Barrett Bay Wetland (Class 2) supports birds, plants, fur bearers and fish spawning and harvesting.
   There is ferry service between Kingston Harbour and Marysville on Wolfe Island.

8. The Bayfield Bay Marsh (Class 2) supports furbearers, birds, raptors, rare plants, fish spawning, commercial fish harvesting and recreational hunting.

44° 12' 17" N
76° 28' 48" W

44° 12' 15" N
76° 18' 32" W

Garden Island

Barrett Bay

Goose Island

Hwy. 96

Marysville

Mill Point

Lamberts Hill

Bayfield Bay

Macandie Pt

McGregor Bay

Bayfield Island

Carpenter Point

North Bay

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

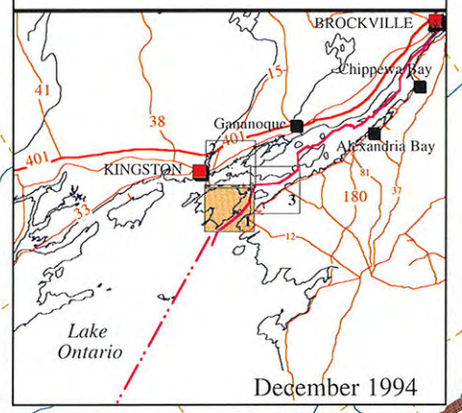
THOUSAND ISLANDS

Wolfe Island

St. Lawrence River

Map 1

Contains Sections From NTS and USGS Maps:
31C/1 and 44076



Hwy. 95

Reeds Creek

For environmental sensitivity information for the Canadian shore of Lake Ontario, see Environment Canada's 1993 publication, "Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline".

Shanty Creek

Button Bay

Hinckley Point

Point Alexandria

Hornes Point

Reeds Bay

The Ridge

Ontario
New York

Canada
U.S.A.

Cape Vincent

Big Sandy Bay

Tibbetts Point

Fuller Bay

Bear Point

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Lake Ontario

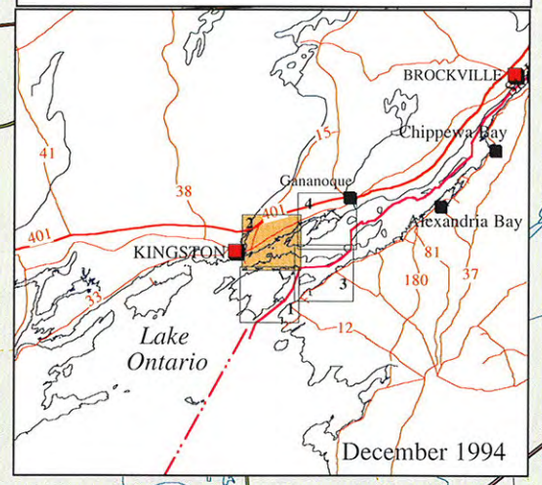
For the U.S. shore of Lake Ontario, see NOAA's "Lake Ontario Atlas: Sensitivity of Coastal Environments and Wildlife to Spilled Oil" (RPI, 1993).

44° 5' 15" N
76° 28' 48" W

44° 5' 15" N
76° 18' 32" W

Map 2

Contains Sections From NTS and USGS Maps:
31C/1, 31C/8 and 44076



Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

For environmental sensitivity information for the Canadian shore of Lake Ontario, see Environment Canada's 1993 publication, "Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline".

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 18' 42" N
76° 28' 31" W

44° 18' 42" N
76° 18' 15" W

44° 11' 40" N
76° 28' 31" W

44° 11' 40" N
76° 18' 15" W

Hemlock Downs
Maple Lawn
Colonel By Lake
Codes Corner
CNR
Kingston Mills
Hwy. 401
Hwy. 15
Cataraqui River (Rideau Canal)
MacLean Park
Barkers Point
Bells Island
Poplar Grove
King Pitt
Hwy. 2
St. Lawrence Woods
Barriefield
Fort Henry Heights
Navy Bay
Deadman Bay
Point Henry
Point Frederick
Kingston Harbour
Cartwright Point
Whiskey Island
Cedar Island
Milton Point
Milton Island
The Spectacles
St. Lawrence Islands National Park
St. Lawrence River
Eastview
Treasure Island
Cassidys Point
Spit Head
Cassidys Bay
Howe Island
Hickeys Point
Oak Point
Knapp Point
Brophy Point
Abraham Point
McDonell Bay
Browns Bay
Dawson Point
Wolfe Island
Scotch Settlement
Ferguson Point
Garden Island
Barrett Bay
Goose Island
Hwy. 96
Bayfield Bay
Macandie Pt
McGregor Bay
Irvine Pt
Holliday Bay
Wolfe Island Wetland Complex
Grass Creek
Grass Creek Park
Moores Creek
Pitts Ferry
Bateau Channel
Joe Welsh Bay

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

7 The Barrett Bay Wetland (Class 2) supports birds, plants, fur bearers and fish spawning and harvesting.
There is ferry service between Kingston Harbour and Marysville on Wolfe Island.

8 The Bayfield Bay Marsh (Class 2) supports furbearers, birds, raptors, rare plants, fish spawning, commercial fish harvesting and recreational hunting.

9 The Cataraqui Marsh (Class 1) is an active feeding area for birds and River Otters. This marsh provides a habitat for several species of fur bearers and is regionally significant for waterfowl production and fish spawning. Commercial fish harvesting and high use recreational activities are important in this area. This wetland is a highly significant Tree Swallow migration area. The Cataraqui Marsh is an ANSI and ESA due to its designation as a highly significant bird migration area.

10 Kingston Wastewater Treatment Plant Water Intake and Outfall - Call (613) 542-1763.

11 Seasonal fish spawning occurs in Browns Bay and at Dawson Point. McDonnell Bay is a Class 2 wetland.

12 The Madoma Marsh (Class 2) at Eastview supports colonial waterbirds, Swamp Sparrows, fish spawning, commercial fish harvesting and recreational activities.

13 Seasonal fish spawning occurs along the shoreline of Cassidys Bay.

14 The Lawless Wetland supports Green Herons and Eastern Milk Snakes. The Pitts Ferry Wetland supports birds, fur bearers, fish spawning and commercial fish harvesting.

15 The Grass Creek Wetland supports colonial waterbirds, fur bearers, fish spawning and commercial fish harvesting.

16 The Cassidys Bay Wetland supports colonial waterbirds, fur bearing mammals, fish spawning and commercial fish harvesting.

17 The Oak Point Wetland (Class 2) supports birds, raptors, rare plants, fur bearers, fish spawning and commercial fish harvesting. Educational visits are made on site.

18 The Wolfe Island Wetland Complex supports various birds, rare plants and fur bearing mammals. It is also a site for fish spawning, commercial fish harvesting and recreational activities. Holliday Bay (Class 2 wetland) is a stopover site for various migrating waterfowl. Irvine Bay is a Class 2 wetland.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

6 Feather Bed Shoals are rocky, moss covered and contain extensive beds of submergent aquatic vegetation. The location is one of five major waterfowl concentration areas in the St. Lawrence River. These shoals provide important fish spawning and nursery habitat for many resident warmwater fish species.

18 The Wolfe Island Wetland Complex supports various birds, rare plants and fur bearing mammals. It is also a site for fish spawning, commercial fish harvesting and recreational activities. Holliday Bay (Class 2 wetland) is a stopover site for various migrating waterfowl. Irvine Bay is a Class 2 wetland.

19 Burnham Point State Park Drinking Water Intake - Call (315) 654-2522.

20 Millen Bay, Dodge Bay and surrounding area wetlands are important fish spawning and nursery areas supporting productive populations of warmwater species including Brown Bullhead, Largemouth Bass, Carp and Muskellunge.

21 The shores of Carleton Island provide a good spawning and nursing habitat for Alewife.

22 Sand Bay is shallow with dense beds of aquatic vegetation. Gulls feed along the islands and shoals. It is also an important wintering area for Hawks and other landbirds.
Cedar Point State Park Drinking Water Intake - Call (315) 654-2522.

23 Seasonal fish spawning occurs along the north shore of Wolfe Island.

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 14' 57" N
76° 19' 27" W

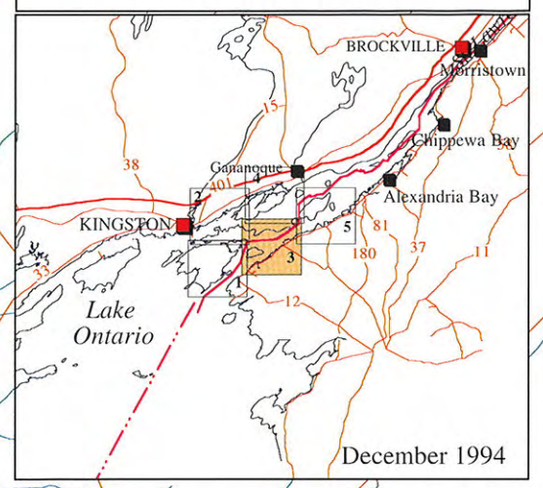
44° 14' 57" N
76° 9' 11" W

Francis I
Arabella I
Wolfe Island Cut
Ontario
New York
Holliday Point
Holliday Bay
Brakey Bay
Irvine Bay
Wolfe Island
Wolfe Island Wetland Complex
Canada
U.S.A.
Irvine Pt
McGregor Bay
St. Lawrence River
Linda I
Cedar Point
Sawmill Bay
Sand Bay
Cedar Pt State Park
Wheeler Creek
Beadle Pt
Hwy. 12
Dodge Bay
Carleton Island
North Bay
South Bay
Millen Bay
Grass Bay
Burnham Pt. State Park
Poplar Tree Bay

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Map 3

Contains Sections From NTS and USGS Maps:
31C/1 and 44076



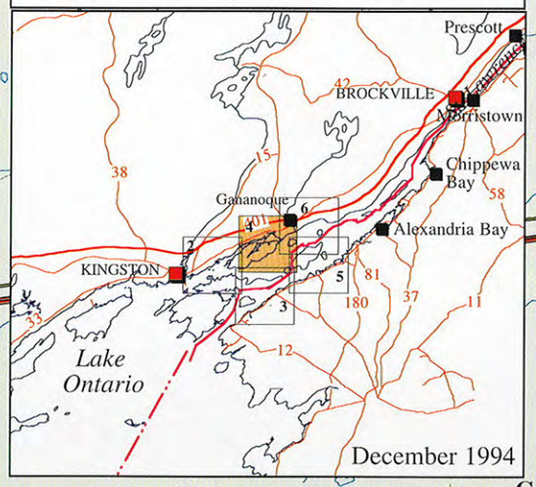
December 1994

44° 7' 55" N
76° 19' 27" W

44° 7' 55" N
76° 9' 11" W

Map 4

Contains Sections From NTS and USGS Maps:
31C/1, 31C/8 and 44076



44° 21' 21" N
76° 18' 55" W

44° 21' 21" N
76° 8' 39" W

Gananoque Provincial Wildlife Area
Hwy. 401
Gananoque River
Hwy. 32
Willowbank Marsh
Leakey's Creek
Brown's Creek
Gananoque
Hwy. 2
Firmans Creek
Campbell Maxwell Front
Edwards Pt
Apohaqui I
McDonald I
Forsyth I
St. Lawrence Islands National Park
Lyndsey Pt
Lindsay I
Mudlunta I
Sagistawika I
Bishops Pt
Beaurivage I
Island 6
Bostwick I
Bluff I
Huckleberry I
Bostwick Island Complex
Juniper I
Aubrey I
Mermaid I
Hemlock I
Blackduck I
Leek I
Seven Pines I
Trident Pt
Byrne Point
Grog Island
Firmans Point
Thompsons Pt
Thompsons Bay
Grices I
Cooks Pt
Seburns Creek Wetland
Seburns Creek
Gillespies Pt
Grass Creek Point
Grass Creek Park
Johnson Bay
Johnson Bay Wetland
Howe Island
Joe Welsh Bay
Rush Bay
Quinns Bay
St. Lawrence River
Black Ant Island
(640)
Canada
U.S.A.
Francis I
Arabella I
Wolfe Island Cut

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 14' 20" N
76° 18' 55" W

44° 14' 20" N
76° 8' 39" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

15 The Grass Creek Wetland supports colonial waterbirds, fur bearers, fish spawning and commercial fish harvesting.

24 Black Ant Island is a nesting area for Ring-Billed Gulls, Herring Gulls and Black Ducks; and, provides a feeding and loafing habitat for Great Blue Herons, shorebirds, gulls and various other waterfowl.

25 Johnson Bay Wetland (Class 1) is a very productive habitat with waterfowl nesting in spring and summer.

26 Leakey's Creek is a waterfowl brooding area. It also supports Pike and Largemouth Bass spawning in spring.
Gananoque Provincial Wildlife Area is a Class 1 wetland. Willowbark Marsh is a Class 3 wetland with a Black Tern habitat.

27 Gananoque Municipal Water Treatment Plant Drinking Water Intake - Call (613) 382-4360.
The Gananoque River is a Walleye spawning tributary (April).

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

28 This series of boulders is important for gulls, terns and shorebirds, and it provides a nesting habitat for Great Blue Herons and Common Terns from May to August.
This is the last good anchoring site for ships headed downstream.

29 French Creek Marsh is a very productive nesting area for various waterfowl including: Pied-billed Grebe, Green Heron, American Bittern, Least Bittern, Northern Harrier, Virginia Rail, Sora, Common Snipe, Belted Kingfisher, Yellow Warbler and Swamp Sparrow. Other wildlife include Mink, Beaver, Muskrat and Northern Leopard Frog. French Creek Marsh is one of approximately four very large, undeveloped, streamside wetland ecosystems along the St. Lawrence River. French Creek Bay is a valuable fish spawning and nursery habitat for Northern Pike, Brown Bullhead, Largemouth Bass and Black Crappie.

30 City of Clayton Drinking Water Intake - Call (315) 785-1578.

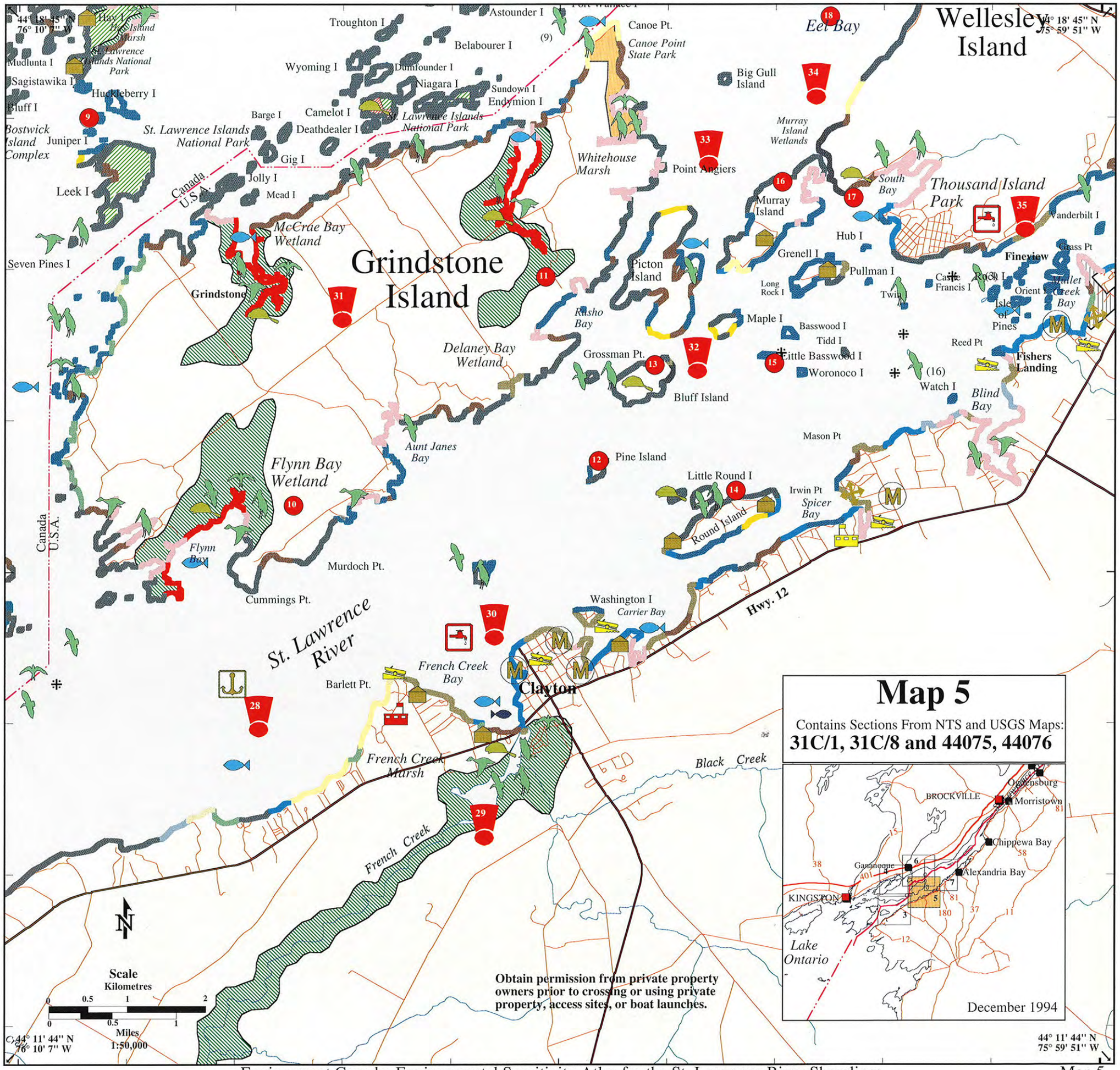
31 Grindstone Island consists of four large coastal areas of undeveloped bays and wetlands. These wetlands serve as a major reproductive habitat for Pike, Brown Bullhead and Largemouth Bass. Nearby shoals serve as spawning and nursery habitat for Muskellunge. This is also a productive nesting area for waterfowl and other marsh birds. Migratory birds feed and nest here during spring and fall.
Delaney and McCrae Bays are home to productive amphibian and reptile populations.

32 Picton Island area is used as a feeding and loafing site for gulls. A very large concentration of Ringbilled Gulls is located near Bluff Island.

33 The Whitehouse Marsh area provides important winter cover for hawks and other landbirds.
Murray Island Wetlands is a 2100 acre fish and wildlife habitat. It contains extensive beds of submergent aquatic vegetation extending southwest to Murray Island. This is an excellent habitat for a variety of fish and wildlife species.

34 Eel Bay is the second of five major waterfowl concentration areas on the St. Lawrence River during the spring and fall. The area provides suitable habitat for a variety of warmwater fish species and is an important concentration area for Northern Pike. Common Loons breed in the bay.

35 Thousand Islands Park Drinking Water Intake - Call (315) 785-1588 (24 hour pager).



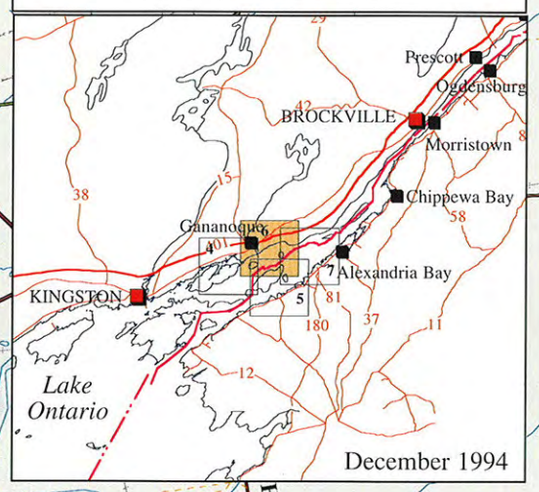
Map 5

Contains Sections From NTS and USGS Maps:
31C/1, 31C/8 and 44075, 44076

December 1994

Map 6

Contains Sections From NTS and USGS Maps:
31C/8 and 44075



44° 23' 35" N
76° 11' 50" W

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 23' 35" N
76° 1' 34" W

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Hwy. 2
Hwy. 401
CNR
Wilstead
Legge
Gray's Creek
Gray's Creek Wetland
Halstead Creek Marsh
Landon Bay Marsh
Ivy Lea Complex
Knights Creek
Landons Bay
Halsteads Bay
Halstead Bay Marsh
Collier I Wetland
Thousand Islands Parkway
Heritage Hwy.
Davis I
Lancaster I
Potato I
Popham I
Nimotte I
Collier I
Otty I
Hickey I
Curtis I
Hog I
Perch I
Dobbs I
Legges Creek Marsh
Mulcaster I
Spilsbury I
Owen I
St. Lawrence Islands National Park
Downie I
Rowley I
Rich I
Stave Island
Stave Island Marsh
Sisters I
(9)
Jackstraw I
Dark Island
Gordon Island
Gananoque
Gananoque River
Hwy. 32
Hwy. 2
St. Lawrence River
St. Lawrence Islands National Park
Gananoque Narrows
Prince Regent I
Squaw I
Princess Charlotte I
Abercrombie I
Flatiron I
Sargent I
Grandview Park
Robinson Group
Eel Bay
Corn Island
Cob Island
Apohaqui I
Sugar I
Psyche I
Axeman I
Astounder I
Fort Wallace I
Canoe Pt.
Canoe Point State Park
Troughton I
Belabourer I
(9)
Wyoming I
Dunfounder I
Niagara I
Sundown I
Endymion I
Big Gull Island
Canada
U.S.A.
McDonald I
Forsyth I
Hay I
Hay Island Marsh
St. Lawrence Islands National Park
Lyndsey Pt
Lindsay I
Mudlunta I
Bishops Pt
Beaurivage I
Sagistawika I
Huckleberry I
Island 6
Bostwick I
Bluff I
Bostwick Island Complex
Juniper I
Aubrey I
Mermaid I
Hemlock I
Blackduck I
Leek I
Seven Pines I
Barge I
Camelot I
Deathdealer I
St. Lawrence Islands National Park
Gig I
Jolly I
Mead I
McCrae Bay Wetland
Grindstone
Grindstone Island
Whitehouse Marsh
Point Angiers
Murray Island Wetlands
Murray Island
South Bay
Hub I
Grenell I
Pullman I
Long Rock I
Twin I
Picton Island
Rasho Bay
Maple I
Basswood I
44° 16' 33" N
76° 11' 50" W
44° 16' 33" N
76° 1' 34" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

27 Gananoque Municipal Water Treatment Plant Drinking Water Intake - Call (613) 382-4360.
The Gananoque River is a Walleye spawning tributary (April).

31 Grindstone Island consists of four large coastal areas of undeveloped bays and wetlands. These wetlands serve as a major reproductive habitat for Pike, Brown Bullhead and Largemouth Bass. Nearby shoals serve as spawning and nursery habitat for Muskellunge. This is also a productive nesting area for waterfowl and other marsh birds. Migratory birds feed and nest here during spring and fall.
Delaney and McCrae Bays are home to productive amphibian and reptile populations.

33 The Whitehouse Marsh area provides important winter cover for hawks and other landbirds.
Murray Island Wetlands is a 2100 acre fish and wildlife habitat. It contains extensive beds of submergent aquatic vegetation extending southwest to Murray Island. This is an excellent habitat for a variety of fish and wildlife species.

34 Eel Bay is the second of five major waterfowl concentration areas on the St. Lawrence River during the spring and fall. The area provides suitable habitat for a variety of warmwater fish species and is an important concentration area for Northern Pike. Common Loons breed in the bay.

36 The 37km Thousand Islands Parkway runs between Brockville and Gananoque.
Halstead Bay is an important fish spawning area. Angling, hunting and trapping activities also occur here.

37 Landon Bay Marsh (Class 3) is an important stopover point for migrating waterfowl and is a significant fish spawning area for Smallmouth Bass, Largemouth Bass and Pike. It is a commercial fish harvest area for Bullhead and Perch. There are Muskellunge nursery habitats at the north end of Stave Island, and at Lancaster and Spilsbury Islands. The Ivy Lea Wetland Complex is an important fish production and nursery area for Bass, Yellow Perch, Pike, Bullhead and Muskellunge. This is a commercial fish harvesting area. Some waterfowl stage here in spring and fall, and in winter in open water areas.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

32 Picton Island area is used as a feeding and loafing site for gulls. A very large concentration of Ringbilled Gulls is located near Bluff Island.

33 The Whitehouse Marsh area provides important winter cover for hawks and other landbirds.

Murray Island Wetlands is a 2100 acre fish and wildlife habitat. It contains extensive beds of submergent aquatic vegetation extending southwest to Murray Island. This is an excellent habitat for a variety of fish and wildlife species.

34 Eel Bay is the second of five major waterfowl concentration areas on the St. Lawrence River during the spring and fall. The area provides suitable habitat for a variety of warmwater fish species and is an important concentration area for Northern Pike. Common Loons breed in the bay.

35 Thousand Islands Park Drinking Water Intake - Call (315) 785-1588 (24 hour pager).

37 Landon Bay Marsh (Class 3) is an important stopover point for migrating waterfowl and is a significant fish spawning area for Smallmouth Bass, Largemouth Bass and Pike. It is a commercial fish harvest area for Bullhead and Perch. There are Muskellunge nursery habitats at the north end of Stave Island, and at Lancaster and Spilsbury Islands. The Ivy Lea Wetland Complex is an important fish production and nursery area for Bass, Yellow Perch, Pike, Bullhead and Muskellunge. This is a commercial fish harvesting area. Some waterfowl stage here in spring and fall, and in winter in open water areas.

38 Grass Point State Park Drinking Water Intake - Call (315) 654-2522.

This area is a waterfowl nesting and staging area during the spring and fall. Brown Bay and Swan Bay are important spawning and nursery areas for various warmwater fish species.

39 Point Vivian Marsh is one of eight shallow bays (St. Lawrence River Shoreline Bays) between Clayton and Alexandria Bay. All eight bays support various warmwater fish species including Northern Pike and Largemouth Bass. The bays are also important Muskellunge spawning and nursery areas.

Keywaydin Point State Park Drinking Water Intake - Call (315) 482-2593.

40 Lake of the Isles contains extensive beds of submergent aquatic vegetation. The lake is a productive nesting and feeding area for a variety of migratory birds. This habitat also favours warmwater fish spawning and nursing.

41 For trans border spill response activity, contact the Landsdowne International Bridge Authority at (613) 659-2301.

42 Alexandria Bay Municipal Drinking Water Intake - Call (315) 482-2171.

The Otter Creek Marsh serves as a warmwater fish nursery for Pike, Smallmouth Bass and Bullhead.

43 Mary Island State Park Drinking Water Intake - Call (315) 654-2522.

Wellesley Island

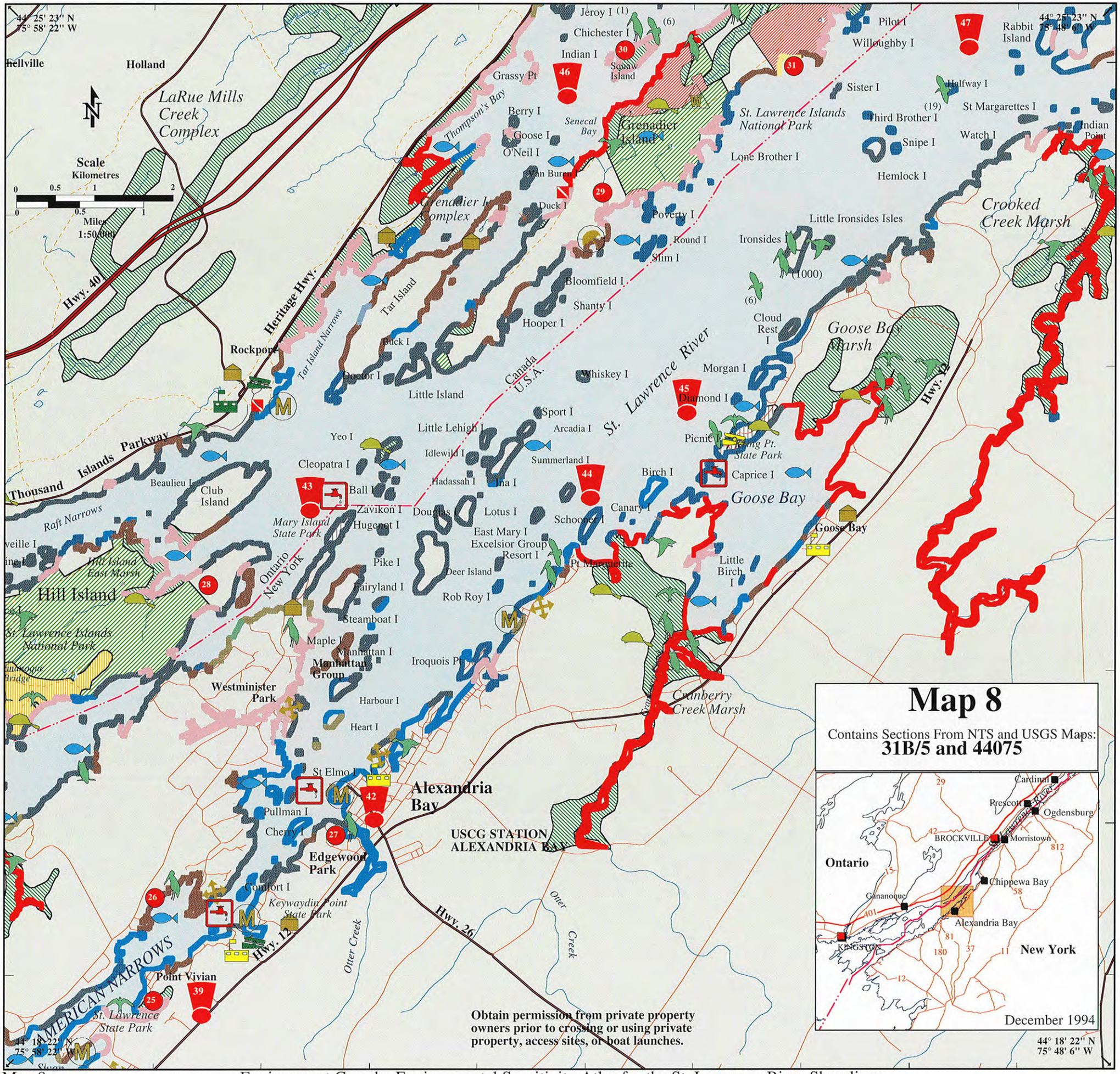
Scale
Kilometres 0 0.5 1 2
Miles 0 0.5 1
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Map 7

Contains Sections From NTS and USGS Maps:
31C/8, 31B/5 and 44076, 44075

December 1994



NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

39 Point Vivian Marsh is one of eight shallow bays (St. Lawrence River Shoreline Bays) between Clayton and Alexandria Bay. All eight bays support various warmwater fish species including Northern Pike and Largemouth Bass. The bays are also important Muskellunge spawning and nursery areas.

Keywaydin Point State Park Drinking Water Intake - Call (315) 482-2593.

42 Alexandria Bay Municipal Drinking Water Intake - Call (315) 482-2171.

The Otter Creek Marsh serves as a warmwater fish nursery for Pike, Smallmouth Bass and Bullhead.

43 Mary Island State Park Drinking Water Intake - Call (315) 654-2522.

44 Arcadia Island and Summerland Island group provide feeding, resting and perching habitat for Great Blue Herons.

The Excelsior Islands support large concentrations of gulls, various waterfowl and shorebirds.

45 The Goose Bay and Cranberry Creek area is one of the most important coastal freshwater wetland areas in New York State. The shallow, sheltered bay provides protection for various waterfowl, gulls and landbirds. Fish spawning and nursing activity occurs in spring.

Kring Point State Park Drinking Water Intake - Call (315) 482-2593.

The park area is a very important fish habitat for Muskellunge and Smallmouth Bass. Other warmwater fish species spawn here as well. This is a very popular recreational fishing site.

Ironsides Island is an important habitat as it has the only sizeable Great Blue Heron rookery known on the St. Lawrence River. Responder activity must be minimized in the nesting period (April to August). Goose Bay is an important feeding ground for the herons.

46 Duck Island area is a critical spawning and nursery habitat for Muskellunge.

The Grenadier Island Wetland Complex (Class 1) is an important area for muskrat and commercial fish harvests. It is the largest evaluated wetland in the Upper St. Lawrence River, containing extensive areas of submergent vegetation critical for the spawning/nursery habitat of almost all warmwater fish species in the river. It is a good staging area for migrating waterfowl in spring and fall. At least 2 Osprey pairs nest and feed in the vicinity. The Grenadier Island shoreline is a very important Smallmouth and Largemouth Bass spawning area.

47 The Chippewa Bay Tern Colonies are located between Alexandria Bay and Oak Point, specifically at Ironsides Island (Navigation Light 180), Halfway Island, Whaleback Island and Light 156 (141 nests), and at Chippewa Point.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

46 Duck Island area is a critical spawning and nursery habitat for Muskellunge.
The Grenadier Island Wetland Complex (Class 1) is an important area for muskrat and commercial fish harvests. It is the largest evaluated wetland in the Upper St. Lawrence River, containing extensive areas of submergent vegetation critical for the spawning/nursery habitat of almost all warmwater fish species in the river. It is a good staging area for migrating waterfowl in spring and fall. At least 2 Osprey pairs nest and feed in the vicinity. The Grenadier Island shoreline is a very important Smallmouth and Largemouth Bass spawning area.

47 The Chippewa Bay Tern Colonies are located between Alexandria Bay and Oak Point, specifically at Ironsides Island (Navigation Light 180), Halfway Island, Whaleback Island and Light 156 (141 nests), and at Chippewa Point.

48 Crooked Creek and Chippewa Creek further north are two of the most productive fish spawning and nursery habitats along the St. Lawrence River, especially for Northern Pike and Largemouth Bass.

49 Crooked Creek and Chippewa Creek Marshes are the least disturbed of four very large, undeveloped streamside ecosystems along the St. Lawrence River. The marshes attract a variety of wetland birds. The Northern Harrier and Least Bittern both nest here.
The shoals at Sturgeon Point provide feeding, resting and nesting for waterfowl, gulls and terns.

50 Mallorytown Landing is the home of the St. Lawrence Islands National Park offices. The area is an important migratory waterfowl stopover. Call (613) 923-5261.

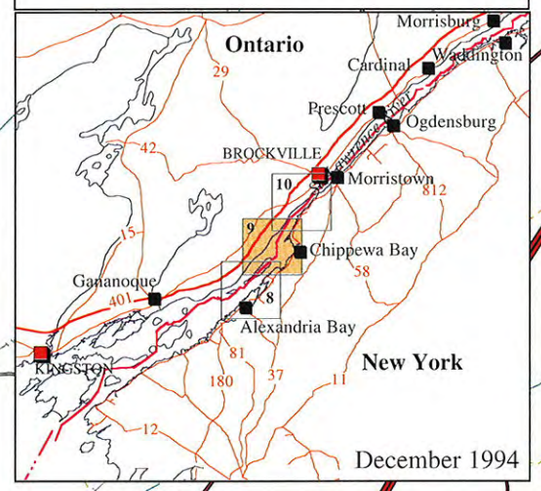
51 The islands in this area provide nesting and feeding habitat for waterfowl and shorebirds. There is Muskellunge spawning along the Canadian shore near Cordwood Island.

52 The Wetlands at Sheephead Point provide year round habitat for waterfowl, gulls, hawks, landbirds and muskrats.

53 Jones Creek Marsh (Class 2) has significant fish migration for spawning and nursery activity. This area is commercially fished.

Map 9

Contains Sections From NTS and USGS Maps:
31B/5, 31B/12 and 44075



44° 30' 40" N
75° 54' 42" W

44° 30' 40" N
75° 44' 26" W

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

44° 23' 38" N
75° 54' 42" W

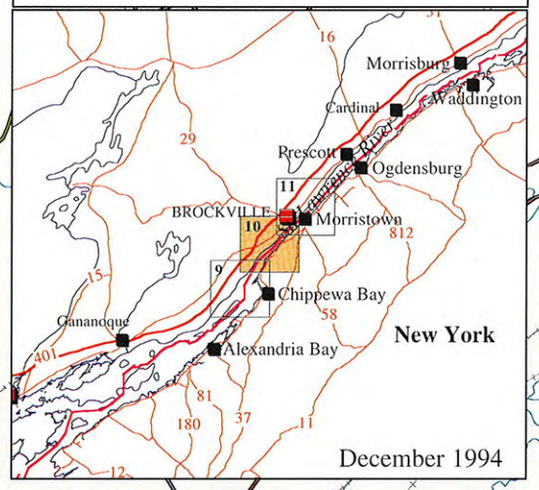
44° 23' 38" N
75° 44' 26" W

Hwy. 2
Hwy. 401
CNR
Parkway
Thousand Islands
Ontario
New York
Canada
U.S.A.
Polly Creek
Mud Creek
Jones Creek Marsh
Browns Bay Complex
St. Lawrence Islands National Park
Grenadier Island Complex
Chippewa Creek Marsh
Crooked Creek Marsh
Oak Island
Thompson's Bay
Senecal Bay
Chippewa Bay
Mallorytown Landing
Schermerhorn Landing
Pooles Resort
Brown's Bay Park
Blind Bay
Cedar Island State Park
Jones Cr.
Thousand Islands
Parkway
Savage I
Green I
Raleigh I
Princess I
Whitney Pt
Sifton
Elliott Pt
Browns Bay
Patterson Pt
Cordwood I
Chimney I
Griswold I
Pine Tree I
Robinson I
Renny I
Ingall I
Bilberry I
Big I
Middle I
Indian Chief I
Whaleback I
Crows Nest I
Crossover I
Peach I
Hwy. 12
Sheephead Point
Little Chippewa Pt
Chippewa Point
Lone Tree I
Bluff I
Ollver I
Snakeoil I
Allens Pt
Garden I
Iron Is
Manzanita Island
Daney Pt
Chippewa Bay
Atlantis I
Twilight I
Chokecherry I
Temagami I
Cedar I
Dark I
Corn I
Little Corn I
Grape I
Marsh I
Robert I
Peel I
Bagot I
Rough I
Adelaide I
St Helena I
Dromedary I
Cook I
Harrowsmith I
Long Schooner I
Pilot I
Willoughby I
Sister I
Halfway I
St Margarettes I
Third Brother I
Snipe I
Watch I
Hemlock I
Lone Brother I
Indian Point
Mink I
Rabbit Island
Snug Harbour I
Scow I
Owatonna I
Brush I
Wyanoke I
Sturgeon Point
Grants I
Ice I
Gull I Shoal
Miller I
Channel I
Bobs I
Twin I
La Rue Mills
Buell's Point
Poole I
Jeroy I
Chichester I
Indian I
Squaw Island
Grassy Pt
Berry I
Goose I
O'Neil I
Van Buren I
Duck I
Poverty I
Round I
Slim I
Ironsides I
Little Ironsides Isles
Bridge Island
Grenadier Island
(1)
(6)
(18)
(12)
(120)
(4)
(31)
(19)
(10)
(141)
(4)

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Map 10

Contains Sections From NTS and USGS Maps:
31B/5, 31B/12 and 44075



44° 36' 6" N
75° 49' 37" W

44° 36' 6" N
75° 39' 21" W

Lees Pond

Brockville

Hwy. 401

Lyn Valley Conservation Area

CNR

Golf Side Gardens

Grant's Creek

Grant's Creek Wetland

Hallecks

Hwy. 2

Fernbank

Hillcrest

Molly's Gut Complex

Brockville Narrows

Lily Bay

Woodridge

Fulford Point

Hudson's Point

Cole Bay

Blackstone Bay

Birch Point

Sherwood Springs

Lyn Creek

Tunnel Bay

Murray I

McNair I

(5768)

(621)

Bogardus I

Blockhouse I

Ontario
New York

Skelton I

Oriental I

Smith I

(3)

Old Man I

Holmes Pt

Chub I

Harvey I

Refugee I

Delack Pt

McDonald Bay

Cockburn I

Everest I

Stovin I

(6)

Pt Comfort

DeRottenburg I

Sheaffe I

DeWatteville I

St. Lawrence Islands National Park

Myers I

American I

Hwy. 12

Jacques Cartier State Park

Hwy. 37

Brier Hill

Canada
U.S.A.

St. Lawrence River

Butternut Bay

Oak Point

Jones Creek Marsh

Parkway

Savage I

Green I

Raleigh I

Princess I

Whitney Pt

Sifton

Thousand Islands

Jones Creek

Whaleback I

(141)

Crow Nest I

(10)

Crossover I

Peach I

Ontario
New York

Hwy. 12

Brown's Bay Park

Elliott Pt

44° 29' 4" N
75° 49' 37" W

44° 29' 4" N
75° 39' 21" W

N

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

54 Blackstone Bay is a feeding and nesting area for terns, waterfowl and gulls.
Navigation Light 156 near Whaleback Island has a large Common Tern nesting colony where responders should minimize disturbance.
The water area from Oak Point to Point Comfort (American Island Pools) contains large, open water pools during the winter ice-in period. The pools attract major concentrations of migratory birds (1000 to 2000).

55 Jacques Cartier State Park Drinking Water Intake - Call (315) 482-2593.
Phillips Cable Industrial Process Water Intake and Outfalls - Call (613) 345-5666.
Brockville Water Treatment Plant Intake - Call (613) 342-7819.
Brockville Sewage Lift Station Emergency Outfall - Call (613) 342-8772 (from 9-5) or (613) 498-1261 (after hours).

56 Morristown Drinking Water Treatment Plant Intake - Call (315) 375-4400.

57 Murray Island, McNair Island and Bogardus Island are exceptional habitats for bird nesting (mainly Ring-billed Gulls).
Brockville wastewater Treatment Plant Outfall - Call (613) 342-8772 (9-5) or (613) 498-1261 (after hours).
Whitehouse Terrace Wastewater Treatment Plant Outfall - Call (613) 342-7844.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

55 Jacques Cartier State Park Drinking Water Intake - Call (315) 482-2593.
Phillips Cable Industrial Process Water Intake and Outfalls - Call (613) 345-5666.
Brockville Water Treatment Plant Intake - Call (613) 342-7819.
Brockville Sewage Lift Station Emergency Outfall - Call (613) 342-8772 (from 9-5) or (613) 498-1261 (after hours).

56 Morristown Drinking Water Treatment Plant Intake - Call (315) 375-4400.

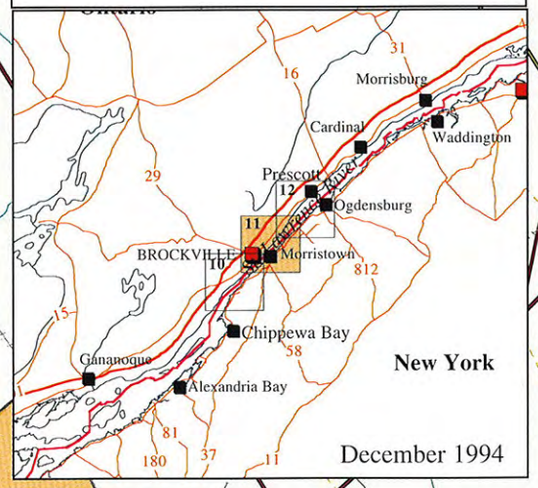
57 Murray Island, McNair Island and Bogardus Island are exceptional habitats for bird nesting (mainly Ring-billed Gulls).
Brockville Wastewater Treatment Plant Outfall - Call (613) 342-8772 (9-5) or (613) 498-1261 (after hours).
Whitehouse Terrace Wastewater Treatment Plant Outfall - Call (613) 342-7844.

58 Nutrite Inc. Process Water Intake and Outfalls - Call (613) 348-3990.
Liquid Carbonic Cooling Water Outfalls - Call (613) 348-3635.
The U.S. shoreline is sparcely populated between Morristown and Ogdensburg.
The shoreline area between Lemons Point and Wells Creek is a spring and summer spawning, nursery and feeding area for a variety of fish species.

59 Dupont Canada Process Water Intake and Outfalls - Call (613) 348-3616.
The river area surrounding Blue Church Bay and Bradley's Creek serves as a waterfowl staging area in fall.

Map 11

Contains Sections From NTS and USGS Maps:
31B/12 and 44075



44° 40' 43" N
75° 43' 23" W

44° 40' 43" N
75° 33' 7" W

Smades Creek
Blue Church Bay
South Augusta Wetland Complex
South Augusta
Bethel
Rows Corners
Lemons
Wells Creek
Lemons Creek
Claybank Bay
Stillwells Pt
Lemons Pt.
Maitland
Weatherheads Point
St. Lawrence River
Hwy. 401
CPR
CNR
Mac Johnson Wildlife Area
Flanders Heights
Sheridan Park
Windsor Heights
Hwy. 29
Hwy. 2
Canada U.S.A.
Brooks Point
Hwy. 37
Perch Bay
Morristown Pt
Edgewater Park
Terrace Park
Morristown
(5768)
McNair I
(621)
Murray I
Bogardus I
Tunnel Bay
Morristown Bay
Blockhouse I
Brockville
Ontario
New York
Golf Side Gardens
Skelton I
Old Man I
Oriental I
(3)
Smith I
Chub I
Holmes Pt
Refugee I
Harvey I
Delack Pt
Cockburn Is
Hwy. 12
Hwy. 58
Hwy. 37

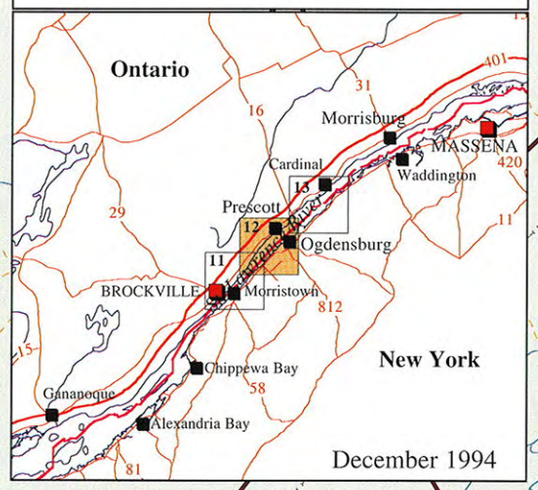
Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 33' 41" N
75° 33' 7" W

Map 12

Contains Sections From NTS and USGS Maps:
31B/12, 31B/14, and 44075



44° 44' 58" N
75° 37' 23" W

44° 44' 58" N
75° 27' 7" W

Johnstown Marsh Conservation Area

Johnstown Creek

CNR

Prescott Heronry

Battle of the Windmill National Historic Site

Wexford

Windmill Pt

Fort Wellington National Historic Park

Prescott

Bradleys Creek

Kellys Bay

Riverview Heights

Bradley's Cr. Wetland

Ogdensburg

Hwy. 2

Hwy. 401

Hwy. 68

Canada
U.S.A.

Ontario
New York

Blue Church

Blakeys Pt

Smades Creek

Blue Church Bay

Nevins Pt

Ogdensburg Municipal Airport

New York Central Railway

Hwy. 87

Oswegatchie River

Hwy. 37

St. Lawrence River

Wells Creek

Lemons Creek

Claybank Bay

Stillwells Pt

Lemons Pt.

Weatherheads

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 37' 56" N
75° 37' 23" W

44° 27' 7" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

58 Nutrite Inc. Process Water Intake and Outfalls - Call (613) 348-3990.
Liquid Carbonic Cooling Water Outfalls - Call (613) 348-3635.
The U.S. shoreline is sparcely populated between Morristown and Ogdensburg.
The shoreline area between Lemons Point and Wells Creek is a spring and summer spawning, nursery and feeding area for a variety of fish species.

59 Dupont Canada Process Water Intake and Outfalls - Call (613) 348-3616.
The river area surrounding Blue Church Bay and Bradley's Creek serves as a waterfowl staging area in fall.

60 City of Ogdensburg Drinking Water Treatment Plant Intake and Outfall - Call (315) 393-0490.

61 Town of Prescott Municipal Drinking Water Treatment Plant Intake and Outfall - Call (613) 925-3734.
Bradley's Creek Wetland is a fish spawning area in spring and summer, and is a site of locally significant waterfowl breeding.

62 The Oswegatchie River is the only significant area of riffle habitat associated with the Lower St. Lawrence River. Human disturbance has reduced the extent of the habitat; however, it is still an important spawning area for Walleye. There is substantial recreational fishing in this area, as Northern Pike and Lake Sturgeon are also present in the river.

63 Prescott Municipal Watewater Treatment Plant Outfall - Call (613) 925-5115 (9-5) or 1-800-267-0971 (pager A-64).
The open water in winter in this area provides excellent feeding habitat for high concentrations of birds until ice breakup in the spring.
Johnstown Bay/Marsh, and Grenville Park, the McLaughlins Creek Complex, Sawmill Creek and Presqu'île Island (all further downstream), are spawning and nursery areas for Muskellunge as well as other fish species in spring and summer. Such Muskellunge spawning sites are rare along the river and should be a priority for protection. Locally significant waterfowl breeding also occurs at Johnstown Bay and McLaughlins Creek. The area of Johnstown Bay to the International Bridge has moderate to high ice fishing use.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

63 Prescott Municipal Watewater Treatment Plant Outfall - Call (613) 925-5115 (9-5) or 1-800-267-0971 (pager A-64).
The open water in winter in this area provides excellent feeding habitat for high concentrations of birds until ice breakup in the spring.
Johnstown Bay/Marsh, and Grenville Park, the McLaughlins Creek Complex, Sawmill Creek and Presqu'île Island (all further downstream), are spawning and nursery areas for Muskellunge as well as other fish species in spring and summer. Such Muskellunge spawning sites are rare along the river and should be a priority for protection. Locally significant waterfowl breeding also occurs at Johnstown Bay and McLaughlins Creek. The area of Johnstown Bay to the International Bridge has moderate to high ice fishing use.

64 Ogdensburg Co-generation Plant Water Intake - Call (315) 393-9048.
Ogdensburg-Prescott International Bridge Canada Customs - For trans border spill response activity, call (613) 925-4225; for U.S. Customs, call (315) 769-3091.

65 The Galop Island Bays provide a nesting and staging area for migrating waterfowl in the spring and fall and a fish spawning area in the spring and summer. The Galop Island embayments provide a Muskellunge nursery habitat which contributes to a regionally significant sport fishing.
Swift currents through this area would preclude most exclusion booming. The best strategy may be to divert oil to shore at the eastern end of Galop Island.

66 CASCO process water Intake and Outfall - Call (613) 657-3131.
Rock structures extending from the shoreline have been constructed here to provide nesting and feeding areas for fish.
Cardinal Municipal Water Treatment Plant Intake - Call (613) 657-4850 (9-5) or (613) 498-9325 (after hours pager).
The Old Galop Canal west of Cardinal is a spawning, nursery and feeding area in spring and summer for a variety of fish species.

67 The Galop Island Pools along either side of Galop Island are large, open water pools during the winter ice-in period. The pools attract major concentrations (1000-2000) of wintering waterfowl and gulls.

44° 50' 2" N
75° 28' 47" W

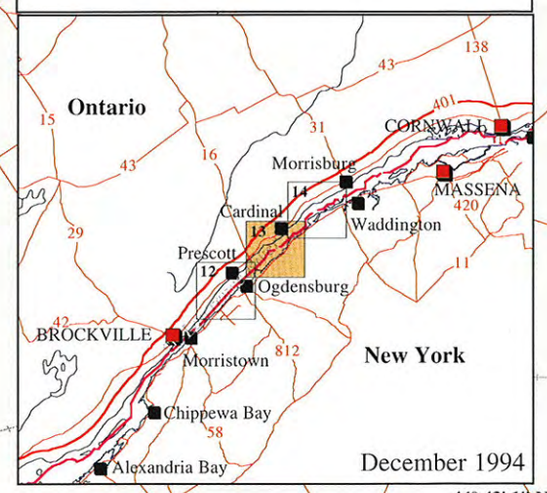
Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Brouseville
Mainsville
Black Creek
McLaughlins Creek
Hwy 401
CNR
Cardinal
Sawmill Creek
Old Galop Canal
Presqu'ile
Toussaint I
Sparrowhawk Pt
Iroquois I
Ontario
New York
St. Lawrence River
McLaughlins Creek Complex
Hwy. 2
Edwardsburgh Marsh
Prison I
Township Beach
Benedict I
Galop Island
Grass I
Pier I
Johns I
Lame Squaw I
(128)
Grenville Park
North Channel
Red Mills
Hwy. 16
Johnstown
Drummond I
Spencer I
St. Regis Akwesasne First Nation
Johnstown Marsh Complex
Ogdensburg-Prescott International Bridge
Chimney Pt
Canada
U.S.A.
Hwy. 37
New York State Fish Hatchery

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Map 13

Contains Sections From NTS and USGS Maps:
31B/14 and 44075



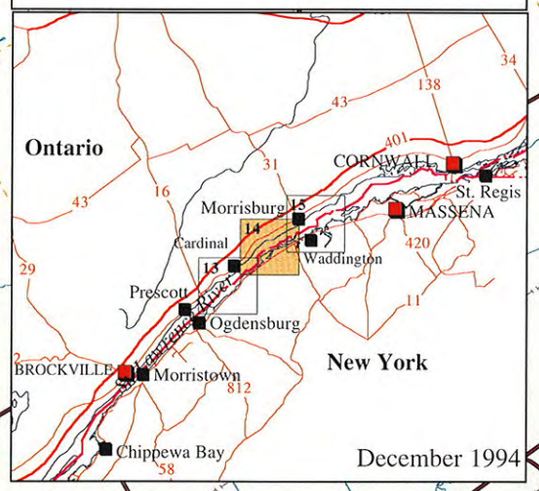
December 1994

44° 43' 1" N
75° 18' 31" W

44° 43' 1" N
75° 28' 47" W

Map 14

Contains Sections From NTS and USGS Maps:
31B/14 and 44074, 44075



44° 54' 50" N
75° 21' 32" W

44° 54' 50" N
75° 11' 16" W

Muttonville

Rowena

Morrisburg

Stata's Ck.

Hwy. 31

UNIVERSAL TERMINALS

60

Stata's Bay

Mariatown

Mariatown Bay

Flagg Creek

CNR

Hwy. 2

59

Heritage Highway

Clark Point

Rapide Plat Pt

Ogden Island

Robertson Pt

70

Little River

Waddington

Leishman Pt

Waddington Beach

Suckers Brook

Hwy. 401

Doran Creek Marsh

Hillyards Creek

Pinetree Pt

58

Canada
U.S.A.

Iroquois

Doran Creek

St. Lawrence River

68

69

Iroquois Beach

Whitehouse Bay

Hwy. 37

Rockway Pt

Iroquois Dam

Harkness I

Pt Iroquois

Iroquois I

Ontario
New York

Presqu'ile

Toussaint I

Old Carillon Canal

Sparrowhawk Pt

N

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 47' 49" N
75° 21' 32" W

44° 47' 49" N
75° 11' 16" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

68 Contact Iroquois Control Dam to regulate water flow for spill containment purposes.
The section of the Old Galop Canal in Iroquois and Presqu'île Island are spawning and nursery areas for Muskellunge as well as for other fish species in spring and summer. Such Muskellunge spawning sites are rare along the river and should be a priority for protection.
Town of Iroquois Water Treatment Plant Intake and Outfall - Call (613) 652-4422.
At Doran Creek and Hillairds Creek, there is spawning, nursery and feeding activity for a variety of fish in spring and summer.

69 Migratory waterfowl concentrate in the shallow bays from Whitehouse Bay to Ogden Island during spring and fall.
The same area is an important fish spawning and nursery habitat for various warmwater fish, especially Muskellunge. This contributes to a regionally significant sport fishery and provides a fish feeding habitat for Common Terns.

70 Many shorebirds and waterfowl occupy the west shore of Ogden Island from May to September.
Ogden Island is home to large flocks of Canadian Geese. From mid-May to mid-August, the broods are flightless and disturbance must be minimized.
At Flagg Creek there is spawning, nursery and feeding activity for a variety of fish in spring and summer.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

71 Little Sucker Brook provides a waterfowl nesting and staging habitat during spring and fall.
The shoreline near Clark Point provides a feeding and nesting habitat for gulls, waterfowl and terns.
Brandy Brook is one of the most productive fish habitats on the St. Lawrence River. It is a Muskellunge nursery area, and the site of a major Walleye spawning run. There is substantial recreational fishing use. The area also provides a feeding habitat for various waterfowl, raptors and shorebirds.

72 Town of Morrisburg Water Treatment Plant Intake and Wastewater Treatment Plant Outfall - Call Alliance Paging at 1-800-267-0971 (pager A-30).

73 Rohm and Hass Canada Inc. Industrial Outfall - Call (613) 543-2983.
The mouth of Hoasic Creek is an important Muskellunge and Bass year round spawning and nursery area.

74 Coles Creek comprises one of the largest areas of sheltered shallow water habitat along the New York St. Lawrence County shoreline. Coles Creek also serves as a feeding and resting area for a substantial number of migrating waterfowl, shorebirds and raptors. Coles Creek is one of the most productive fisheries habitats on the St. Lawrence River. It is a Muskellunge nursery area. There is substantial recreational fishing use here.

75 The Lake St. Lawrence Tern Colonies are a series of nesting Common Tern colonies located from Ogden Island to the Long Sault Islands on Navigation Lights 91, 79, 75, 73, Old Light 58 and 57.

76 Shell 401 service station lagoon Outfall - Call (613) 543-2260.
The Riverside Marsh extends out into the river almost to the border, and runs the length of Riverside Park. It is a provincially significant wetland with a Pike spawning creek and a controlled hunting area at its eastern end.

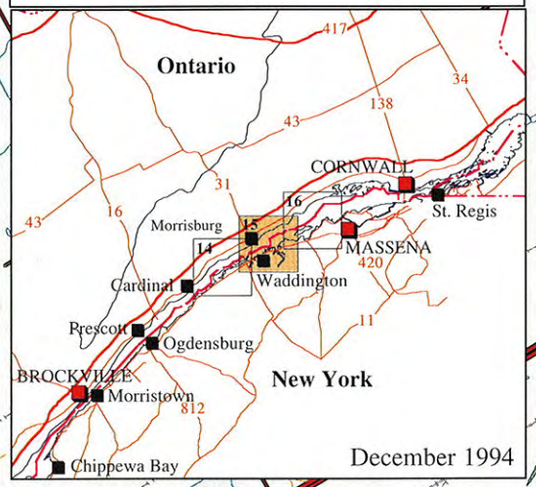
77 Upper Canada Village Drinking Water Intake and Outfall - Call the St. Lawrence Parks Commission at (613) 543-3704 (9-4) or (613) 552-0302 (after hours).
The Upper Canada Migratory Bird Sanctuary is an important waterfowl breeding and migratory bird staging area.
There is Walleye spawning by Whitney Point, and a Muskellunge spawning and nursery area of year round importance by Cooks Point.

78 Wilson Hill Wildlife Management Area extends the length of Bradford and Wilson Hill Islands. It contains one of the largest shallow water areas along the St. Lawrence River. This man-made habitat is a very productive nesting area for a diverse variety of waterfowl and other marsh birds. As many as 100 pairs of Canada Geese nest here. The area is an important nesting and feeding stop for migrating birds in spring and fall. Waterfowl hunting and muskrat trapping are important human use activities. The area also serves as a nursery habitat for Muskellunge and Yellow Perch.

44° 57' 39" N
75° 13' 29" W

Map 15

Contains Sections From NTS and USGS Maps:
31B/14 and 44075

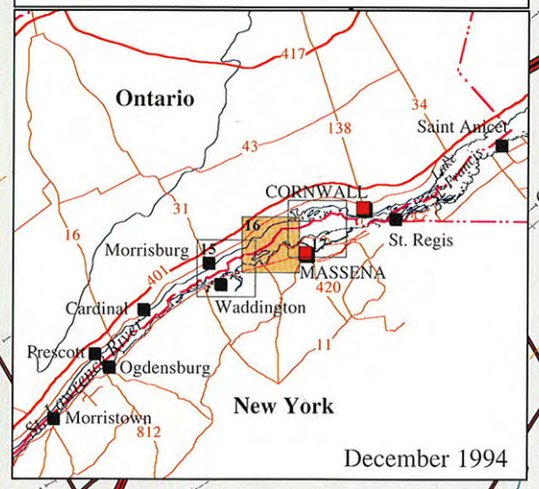


Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Hoasic Creek Swamp
Hoasic Creek
Hwy. 401
Aultsville Creek
44° 57' 39" N
75° 3' 13" W
Upper Canada Migratory Bird Sanctuary
Chrysler Farm Battlefield Park
77
Upper Canada Village
Whitney Pt
Cooks Point
Riverside Heights
Riverside Park
76
Ontario
New York
Macdonald I.
St. Lawrence River
75
Bradford Island
Wilson Hill State Fish and Game Management Area
78
Nichols Hill I
Broder I
Morrisburg Station
(264)
Hwy. 31
Hwy. 2
Morrisburg
Stata's Ck.
73
74
61
Hwy. 37
Canada
U.S.A.
60
UNIVERSAL TERMINALS
Stata's Bay
72
Murphy Islands
Mariatown
Canada Island
Coles Creek State Park
Coles Creek
Brandy Bay
Mariatown Bay
Clark Point
71
Ogden Island
Little River
Waddington
Little Sucker Brook
Brandy Brook
NORWOOD & ST. LAWRENCE
Sucker Brook
Grass River
N
Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000
44° 50' 37" N
75° 13' 29" W
44° 50' 37" N
75° 3' 13" W

Map 16

Contains Sections From NTS and USGS Maps:
31B/14, 31G/3, 31G/2 and 44074, 44075



45° 0' 33" N
75° 5' 47" W

45° 0' 33" N
74° 55' 31" W

Hwy. 401

Ingleside

Upper Canada Migratory Bird Sanctuary and Marsh

CNR

Hwy. 2

Farran Park

Woodlands I

Hoople I

Centre Woodlands I

West Woodlands I

Long Sault Parkway

Fraser I

Woodlands Islands

Bredin I

Canada
U.S.A.

80

Croil Islands

Morrison Island

Richards Pt

81

Ontario
New York

79

Tucker Terrace

Massena Beach

Aultsville Creek

Upper Canada Migratory Bird Sanctuary

Ault Island

Chrysler Farm Battlefield Park

77

Upper Canada Village

Whitney Pt

St. Lawrence River

Cooks Point

62

Wilson Hill Island

(160)

Hwy. 131

Bradford Point

Bradford Island

Wilson Hill State Fish and Game Management Area

78

Dodge Creek

Grass River

Hwy. 37

Louisville

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

44° 53' 31" N
75° 5' 47" W

44° 53' 31" N
74° 55' 31" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

77 Upper Canada Village Drinking Water Intake and Outfall - Call the St. Lawrence Parks Commission at (613) 543-3704 (9-4) or (613) 552-0302 (after hours).
The Upper Canada Migratory Bird Sanctuary is an important waterfowl breeding and migratory bird staging area.
There is Walleye spawning by Whitney Point, and a Muskellunge spawning and nursery area of year round importance by Cooks Point.

78 Wilson Hill Wildlife Management Area extends the length of Bradford and Wilson Hill Islands. It contains one of the largest shallow water areas along the St. Lawrence River. This man-made habitat is a very productive nesting area for a diverse variety of waterfowl and other marsh birds. As many as 100 pairs of Canada Geese nest here. The area is an important nesting and feeding stop for migrating birds in spring and fall. Waterfowl hunting and muskrat trapping are important human use activities. The area also serves as a nursery habitat for Muskellunge and Yellow Perch.

79 Feeding and loafing for gulls and terns occurs on Navigation Lights 57 and 58, where large Common Tern nesting colonies are located.
The Wilson Hill Island - Tucker Terrace Area is a significant Muskellunge nursery area, contributing to a substantial regional sport fishery. This shallow area supports many warmwater fish species, and is a feeding habitat for three Common Tern colonies (160 pairs). Waterfowl nest and feed here, and use the area during migration.

80 Osnabruck Twp. Municipal Water Treatment Plant Water Intake and Wastewater Treatment Plant Outfall - Call (613) 537-2362 (9-4) or (613) 930-9541 (after hours pager).
Kraft Foods Ltd. Industrial Outfall to Hoople Creek - Call (613) 537-2226.
Bredin Island is a sensitive environment.

81 Croil Islands provide nesting and staging sites for waterfowl and shorebird populations. Fields provide feeding for Canadian Geese which are vulnerable from May to August as broods are flightless.
Tucker Terrace Drinking Water Intake - Call (315) 764-0661.
Village of Massena Drinking Water Treatment Plant Intake and dam - Call (315) 769-6823 (8-5).
ALCOA Industrial Water Intake - Call (315) 764-4500.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

81 Croil Islands provide nesting and staging sites for waterfowl and shorebird populations. Fields provide feeding for Canadian Geese which are vulnerable from May to August as broods are flightless.
Tucker Terrace Drinking Water Intake - Call (315) 764-0661.
Village of Massena Drinking Water Treatment Plant Intake and dam - Call (315) 769-6823 (8-5).
ALCOA Industrial Water Intake - Call (315) 764-4500.

82 The Long Sault Islands and Parkway Islands provide feeding and resting habitat for large flocks of Canadian Geese. The critical time when the birds are vulnerable is from mid-May to mid-August when the broods are flightless. These island shorelines provide habitat for gulls and waterfowl.

83 The area of Lake St. Lawrence enclosed by the Long Sault Parkway is a controlled hunting area in fall. This entire enclosed area is a Walleye nursery of year round importance.
Long Sault Municipal Wastewater Treatment Plant Outfall - Call (613) 534-2152 (7-3) or (613) 936-2040 (after hours pager).

84 Long Sault Drinking Water Treatment Plant Intake - Call (613) 936-2040 (pager).
Bergin and Sheek Islands form an important fish spawning and migrating bird staging area.
There is a very large nesting colony of Ring-billed Gulls in this area.

85 The control dam west of Barnhart Island is normally closed.

86 Robinson Creek provides a fish spawning and waterfowl nesting area in the spring and summer.

87 The Wiley Dondero Canal between Eisenhower and Snell Locks provides feeding habitat for Great Blue Herons, resting for waterfowl and perching for gulls and terns.
This is a waterfowl nesting and staging area during the spring and fall.

88 Cornwall Drinking Water Treatment Plant Intake - Call (613) 932-2235.
Strachan Island has a huge nesting colony of Ring-billed Gulls.

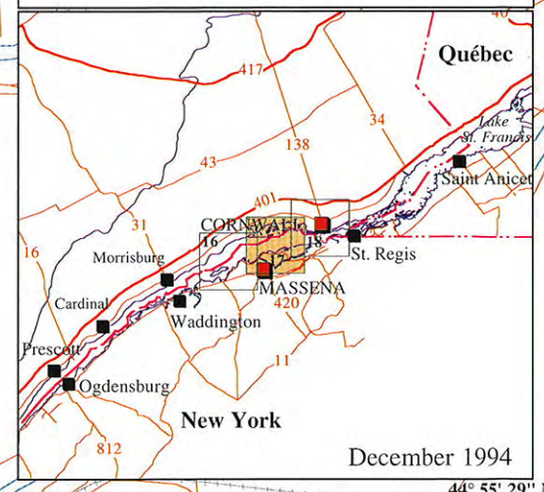
45° 2' 30" N
74° 57' 38" W

45° 2' 30" N
74° 47' 22" W

CNR
Hwy. 401
Hoople Bay Marsh
Long Sault
Lakeview Heights
Heritage Highway
Guindon Muncipal Park
Lake St. Lawrence
Mille Roches I
(19712)
Strachan I
64
88
(31)
Bergin I
Sheek Island
(1)
(1357)
Moulinette I
Canada
U.S.A.
Hoople Bay
Hwy. 2
83
84
Snetsinger I
Moses-Saunders Power Dam
Wales I
St. Lawrence Parks Commission
Long Sault Rapids Pt
St. Lawrence State Park
Vankoughnet I
Macdonell I
63
Woodlands I
Hoople I
Centre Woodlands I
Long Sault Parkway
Phillpotts I
Barnhart Island
Hawkins Pt. Lookout
85
82
Heriot I
Fraser I
Dickinson I
Robinson Bay
Woodlands Islands
St. Lawrence River
Canada
U.S.A.
Long Sault Islands
Long Sault Lookout
Wiley Dondero Canal
87
Eisenhower Lock
Hopsons Bay
Robinson Creek
86
Hwy. 131
81
Massena Power Canal
Massena Beach
Massena
Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000
Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.
44° 55' 29" N
74° 57' 38" W
44° 55' 29" N
74° 47' 22" W

Map 17

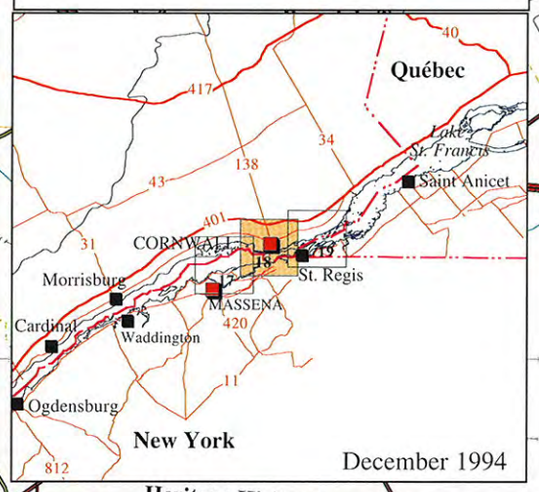
Contains Sections From NTS and USGS Maps:
31B/14, 31G/3, 31G/2 and 44074



December 1994

Map 18

Contains Sections From NTS and USGS Maps:
31G/2 and 44074



45° 4' 39" N
74° 49' 47" W

45° 4' 39" N
74° 39' 31" W

Churchill Heights
Eamers Corners
South Raisin River
Hwy. 401
Glendale
CNR
Ty
Pommee Drain
Gray's Creek Conservation Area
Gray's Creek
Hwy. 138
Cornwall
Heritage Highway
Guindon Muncipal Park
Glenview Heights
Pilon I
St. Lawrence River
Third Crab I
Hwy. 2
(19712)
Strachan I
64
88
Canada
U.S.A.
Riverdale
Dover Heights
Seaway International Bridge
St. Regis-Akwesasne First Nation
Moses-Saunders Power Dam
89
Cornwall Canal
Massena Pt
91
Cornwall Island
St. Lawrence State Park
63
65
Barnhart Island
Hawkins Pt. Lookout
Polly's Gut
66
St. Regis Akwesasne First Nation
Ontario
New York
Raquette Pt
Robinson Bay
Wiley Dondero Canal
Snell Locks
87
90
Raquette River
Grass River

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

44° 57' 38" N
74° 49' 47" W

44° 57' 38" N
74° 39' 31" W

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

87 The Wiley Dondero Canal between Eisenhower and Snell Locks provides feeding habitat for Great Blue Herons, resting for waterfowl and perching for gulls and terns.
This is a waterfowl nesting and staging area during the spring and fall.

88 Cornwall Drinking Water Treatment Plant Intake - Call (613) 932-2235.
Strachan Island has a huge nesting colony of Ring-billed Gulls.

89 The world's highest eel ladder (and the only one in North America) is located at the dam in Cornwall.
By the Moses-Saunders Tailwaters, exceptional concentrations of migratory waterfowl gather during fall migration. Thousands of gulls may be observed in fall and winter, including several rare Arctic species. The diversity and abundance of migrating birds in the area makes this a very popular birdwatching site, especially during fall and early winter. The area is also considered to be a foraging and overwintering area for juvenile and adult Lake Sturgeon. Bass spawn in the CornwallCanal.
Iroquois Chemicals Industrial Outfall - Call (613) 936-8164.

90 St. Regis-Akwesasne Native American Reservation Community Water System Drinking Water Intake - Call (518) 358-4804 or (518) 483-1212 (after hours).
Reynolds Industrial Water Intake - Call (315) 764-6000.
This is a waterfowl and gull nesting, staging and wintering area. The Grass River supports cool and warmwater fish spawning including Muskellunge and Lake Sturgeon.

91 Domtar Industrial Water Intake and Outfall - Call (613) 932-6620.
Seaway International Bridge Corporation Limited - Call Canada Customs for trans border spill response activity at (613) 932-3805, or for U.S. Customs, call (315) 769-3091.

92 City of Cornwall Municipal Wastewater Treatment Plant Outfall - Call (613) 933-5157 (8-4) or (613) 930-9555 (after hours).
Farlinger Point Estates Private Drinking Water Intake - Call (613) 524-2955.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

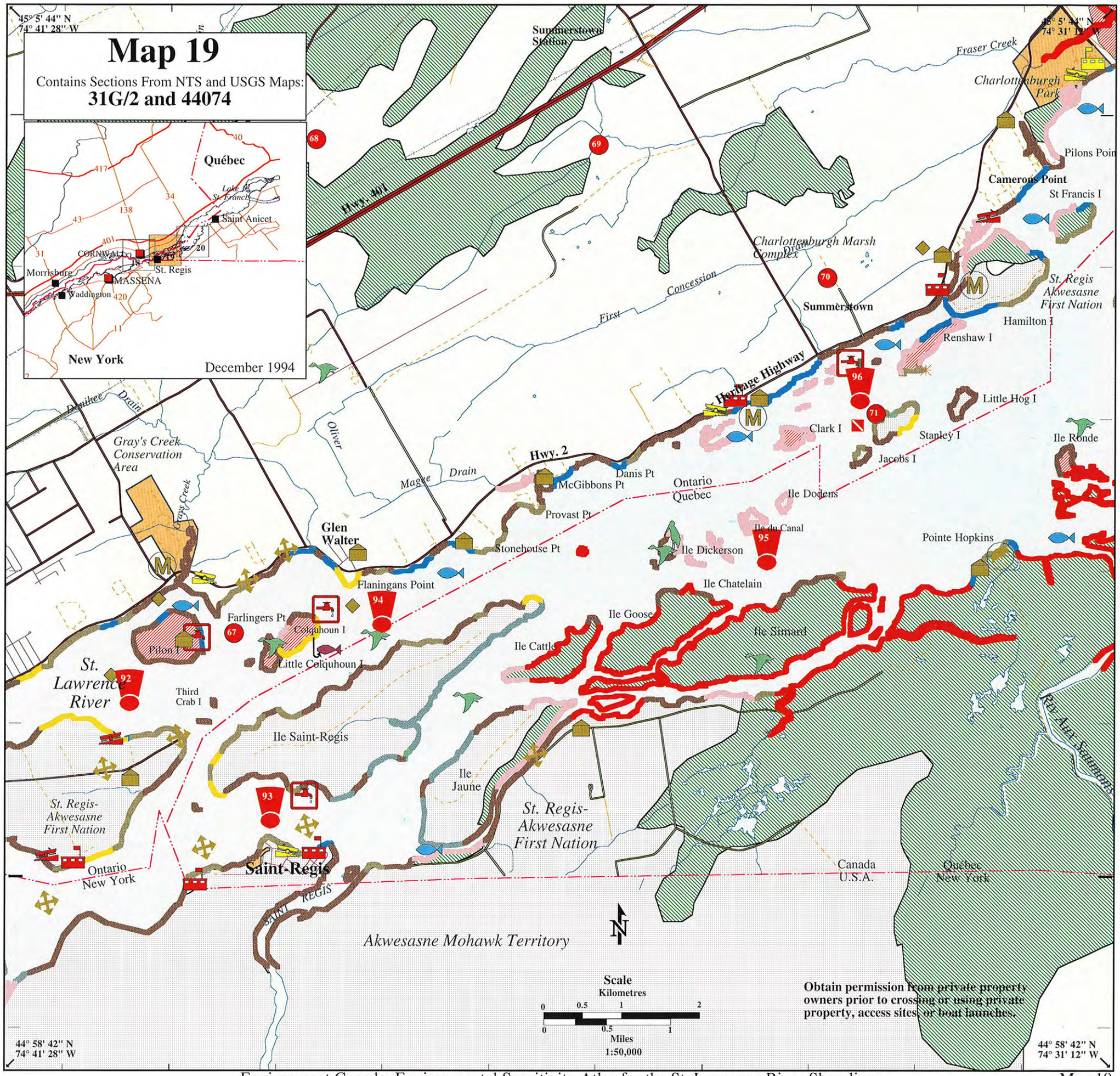
92 City of Cornwall Municipal Wastewater Treatment Plant Outfall - Call (613) 933-5157 (8-4) or (613) 930-9555 (after hours).
Farlinger Point Estates Private Drinking Water Intake - Call (613) 524-2955.

93 St. Regis-Akwesasne First Nation Drinking Water Intake - Call St. Regis Police at (613) 575-2000.

94 Charlottenburg Township Municipal Wastewater Treatment Plant Intake - Call (613) 931-3036 (8-4) or 1-800-267-0971 (pager A-87 after hours).
Colquhoun, Pilon and Little Colquhoun Islands are part of the St. Regis-Akwesasne First Nation. This area comprises the major commercial fishing grounds for the First Nations of Cornwall and St. Regis Islands. The small marsh area to the east of the Colquhoun Islands is an important nesting and feeding ground for a number of species of ducks.

95 The entire width of the St. Lawrence River from Ile St. Regis east to Pointe Fraser is covered in very thick marsh. This "wet meadow" is nearly impassable by boat in summer.
These critical areas are the only places in the upper St. Lawrence where significant numbers of Atlantic Brant are known to stage in fall. The majority of Lake St. Francis' high quality marshes lie within this area. During all seasons there are various waterfowl species found in the marsh.
There are American Egrets, Great Blue Herons, Black-crowned Night Herons and Green Herons present on Ile Dickinson.
There is fish spawning activity throughout the marshes. Clark, Renshaw and St. Francis Islands, and Ile Cattle, Goose and Simard are all part of the St. Regis-Akwesasne First Nation.
Lake St. Francis has a large commercial Yellow Perch fishery (Walleye, Smallmouth and Large-mouth Bass, Northern Pike and Panfish are also common). There is extensive sport fishing of Walleye and Muskellunge.

96 Charlottenburg Municipal Drinking Water Treatment Plant Intake - Call the Fire Department at 1-800-387-1214.
Richmond Die Casting Ltd. has an Outfall east of Summerstown - Call (613) 534-1480.
The area from Danis Point to east of Renshaw Island (including Clark Island) and extending out to the shipping lane is a wildlife complex providing an important nesting and staging area. It is also significant as a sport fishery.



45° 7' 40" N
74° 32' 41" W

45° 7' 40" N
74° 22' 25" W

45° 0' 39" N
74° 32' 41" W

45° 0' 39" N
74° 22' 25" W

CNR

Hwy. 401

Hwy. 2

Charlottenburgh Marsh

Donald McLennon

McNaught

Meadow Bay

Grape I

LAKE ST. FRANCIS (St. Lawrence River)

Ontario

Quebec

Fraser Creek

Charlottenburgh Park

Fraser Pt

Squaw I

Butternut I

Ross I

Pilons Point

Camerons Point

St Francis I

Camerons Crab

Ile Bass

Ile Kit-Kit

St. Regis Akwesasne First Nation

Hamilton I

Renshaw I

Ile Thompson

LAC SAINT - FRANCOIS

Ile Collins

Île René Lapierre

St. Regis Akwesasne First Nation

Little Hog I

Ile Plum

Ile Ronde

Ile Sénécal

Ile Content

Ile Christatie

Pointe Fraser

Pointe-Fraser

Isle-of-Skye

Ile Hopkins

Riv. Aux Saumons

Ruisseau Fraser

Ruisseau McArthur

Hwy. 132

Pte Dupuis

Ile Dupuis

Ile Dansereau

Pointe Castagnier

Pte Breezy

Baie de Perron

Ile au Mouton

Pte Latreille

Ile au Cedre

Pte au Cedre

Ile Buchanan

Plage Sommerville

Ruisseau Cameron

Cazaville

Ile Cat

Ile Kitten

Pointe-Leblanc

Dundee-Centre

99

74

76

98

72

97

73

100

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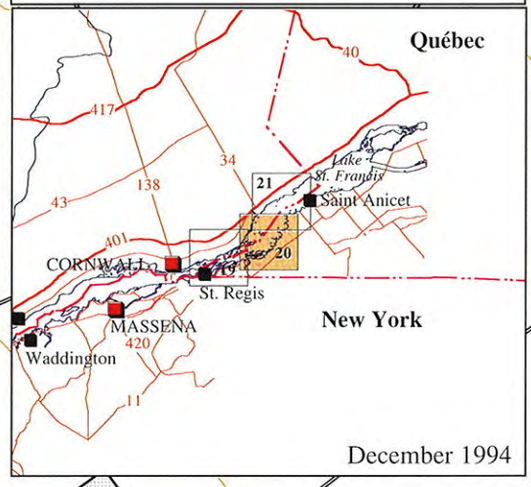
Map 20

Contains Sections From NTS and USGS Maps:
31G/2 and 31G/1



Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

97 The entire width of the St. Lawrence River from Ile St. Regis east to Pointe Fraser is covered in very thick marsh. This "wet meadow" is nearly impassable by boat in summer.

These critical areas are the only places in the upper St. Lawrence where significant numbers of Atlantic Brant are known to stage in fall. The majority of Lake St. Francis' high quality marshes lie within this area. Species found in the marsh areas are as follows: Black Duck and Canada Goose in spring; Black Duck, Blue-winged Teal, Wood Duck, Scaup, Merganser, Common Goldeneye and Bufflehead in summer; American Green-winged Teal, Blue-winged Teal, Mallard, Black Duck, Wood Duck, Pintail, Redhead, Scaup, Common Goldeneye, Bufflehead and Atlantic Brant in fall; Common Merganser, Common Goldeneye and Black Duck in winter.

There is fish spawning activity throughout the marshes.

Lake St. Francis has a large commercial Yellow Perch fishery (Walleye, Smallmouth and Largemouth Bass, Northern Pike and Panfish are also common). There is extensive sport fishing of Walleye and Muskellunge.

98 The area surrounding Thompson Island is a significant nesting and feeding ground for ducks. It is a staging area for migratory birds in spring and fall. There is also a Black Tern colony nesting seasonally in the area.

99 The Charlottenburg Marsh (a designated Environmentally Sensitive Area) extends along the shore and out into the water from Fraser Point to South Lancaster.

The Ontario Ministry of Natural Resources has identified the area as the most sensitive on the Ontario portion of Lake St. Francis. It is a diverse habitat for ducks, geese and many other bird and fish species. The marsh provides a high quality nesting, feeding and staging area (spring and fall), as well as a significant spawning ground for sport fish. It supports a large commercial and sport fishery on the lake.

100 The broad wetland that extends from Ile St. Regis continues right to Plage Sommerville. This entire wetland area is heavily used by fish and birds.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

99 The Charlottenburg Marsh (a designated Environmentally Sensitive Area) extends along the shore and out into the water from Fraser Point to South Lancaster.
The Ontario Ministry of Natural Resources has identified the area as the most sensitive on the Ontario portion of Lake St. Francis. It is a diverse habitat for ducks, geese and many other bird and fish species. The marsh provides a high quality nesting, feeding and staging area (spring and fall), as well as a significant spawning ground for sport fish. It supports a large commercial and sport fishery on the lake.

101 Lancaster bar in Lake St. Francis is a productive fish spawning habitat and an important area for several thousand migratory waterfowl from September to December. It extends along the provincial border east to Point Mouillée.

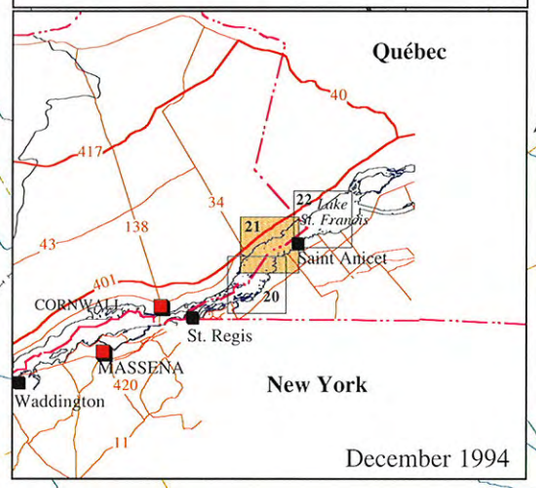
102 Greg Quay Private Sewage Lagoon Outfall - Call (613) 347-2705.

103 Point Mouillée/Mouillée Bay is a smaller scale version of the Charlottenburgh Marsh. This area supports essentially the same mix of fish and bird populations. The only Redhead nesting colony in the Ontario portion of Lake St. Francis is located here.

104 Rheal's Truck Stop Private Drinking Water Intake and Outfall - Call (613) 347-2925.

Map 21

Contains Sections From NTS and USGS Maps:
31G/2 and 31G/1



December 1994

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

45° 12' 35" N
74° 30' 29" W

45° 12' 35" N
74° 20' 13" W

45° 5' 33" N
74° 30' 29" W

45° 5' 33" N
74° 20' 13" W

Curry Hill
Sutherland Creek
Gunn Creek
Woods Creek
Hwy. 401
Hwy. 2
CPR
Westleys
Creek
CNR
Bainsville
Mouillée Bay
Bainsville Bay Marsh
Pointe Mouillée
Point Mouillée Flats
Westley's Creek Marsh
Greg Quay
Nadeaus Pt
Westleys Pt
Pattingale Creek
Finney Creek
Hwy 34
Lancaster
Glengarry Park
Brittania Pt
Faulkners Pt
South Lancaster
Raisin R.
LAKE ST. FRANCIS
(St. Lawrence River)
Meadow Bay
Grape I
Ontario
Quebec
Ile au Mouton
Ile au Cedre
Pte Latreille
Pte Breezy
Baie de Perron
Pointe Castagnier
Ile Marchand
Pte Dupuis
Ile Dupuis
Ile Dansereau
Ile à Aubin
Ile Cherry
Pte Saucier
Pte Dupuis
Saint Anicet
Baie Saint-Anicet
Pte Castagner
Pointe-Castagner
Pte Doyon
Ile Cuisy
Ile Ahiot
Pointe Caza
Rivière a la Guerre
Hwy 132
Hwy. 132
Cedarville
75
76
74
77
99
101
102
103
104

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

45° 15' 42" N
74° 21' 8" W

45° 15' 42" N
74° 10' 52" W

Côteau-Landing

Ile Perinoux

Ile Lalonde

Ile Lo

108

107

Saint-Zotique

Ruisseau du Grand Ma...

Saint-Thomas de-Soulanges

106

Notre-Dame-des-Rivières

Riviere-Beaudette

Pte au Foin

Rivière Beaudette

Hwy. 20

Hwy. 338

Hwy. 2

Pointe-Lalonde

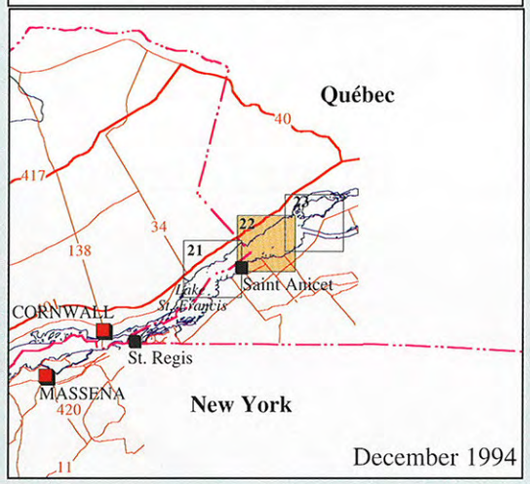
105

LAC SAINT-FRANCOIS
(FLEUVE SAINT-LAURENT)

Pte Beaudette

Map 22

Contains Sections From NTS and USGS Maps:
31G/1 and 31G/8



December 1994

Ile du Grenadier

Pte Seigneuriale

Haut-fond de Port-Lewis

Ile Cormier

Ile des Francs Tireurs

Pte Leduc

Pointe Biron

Pointe Lalonde

Plage-Saint-Francois

Pte McKillop

Ile Beaubien

Pte Saint-Louis

Ile Vassal

Hwy. 132

Pointe Génier

Port-Lewis

Pte De Coigne

Ile Chrétien

Ile Kindly

Pte Doyon

Ile Cuisy

Ile Ahiot

Pointe Caza

Ontario

Quebec

Sainte-Barbe

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

Ruis Doyon

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

Pointe-Castagner
45° 8' 40" N
74° 21' 8" W

45° 8' 40" N
74° 10' 52" W

NOTES !

A red exclamation point symbol is used on the maps to catch the responder's attention.

105 The Point Beaudette area has narrow shore-based marshes extending as far east as Pointe au Foin. Although commercial and residential development in this area has had an adverse effect on the marsh's viability as a waterfowl nesting area, it is still an important staging and feeding ground. It is essentially an extension of the Port Lewis Flats, separated only by the shipping channel, and it shares the sport fishery of the flats.

106 This is an important area for migratory waterfowl.

107 St. Zotique Drinking Water Treatment Plant Intake - Call (514) 267-9335.

108 Côteau-Landing Drinking Water Treatment Plant Intake - Call (514) 267-3531.

NOTES

A red exclamation point symbol is used on the maps to catch the responder's attention.

108 Côteau-Landing Drinking Water Treatment Plant Intake - Call (514) 267-3531.

109 Salaberry-de-Valleyfield Drinking Water Intake (Ile au Chat) - Call (514) 373-7570.

110 Salaberry-de-Valleyfield Grande Ile Drinking Water Treatment Plant Intake - Contact local police at (514) 373-3131.

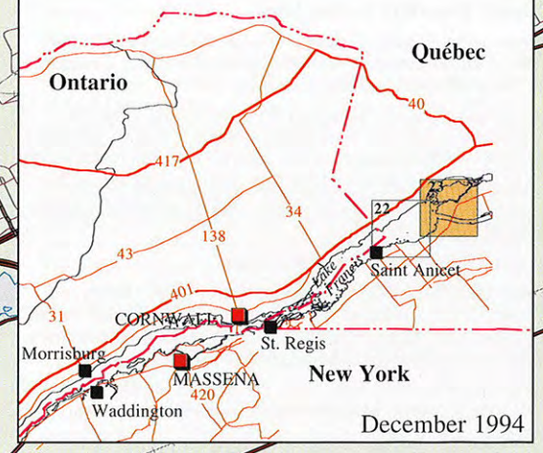
111 Canal de Beauharnois is an important area for migrating wildlife from mid-March to mid-May and mid-September to December. The canal may also be important for some aquatic plant species.

45° 18' 14" N
74° 12' 43" W

45° 18' 14" N
74° 2' 27" W

Map 23

Contains Sections From NTS and USGS Maps:
31G/1 and 31G/8



December 1994

Pointe au Diable

Coteau-du-Lac

Ile Arthur

Ile Dondaine

Ile De Salaberry

Ile Bienville

Ile Léonard

Ile Marcourt

Ile d'Aloigny

Ile De Beaujeu

Bellerive

Coteau-Landing

Ile Giroux

Ile Sérigny

Baie Saint-Francois

Ile Lalonde

Ile Longueil

Ile aux Chats

108

109

Pointe-Rousson

Ile de la Grosse Pte

Ile Mercier

La Grosse Pointe

110

SALABERRY-DE-VALLEYFIELD
(Valleyfield B de p)

Hwy. 30

Hwy. 132

For further environmental sensitivity information for outside of the study area, contact Environment Canada's Quebec Region office in Montreal at (514) 283-2345.

Tete du Canal

111

Pont de Valleyfield

Baie Hungry

Hungry Bay

CANAL DE BEAUHARNOIS

Pte Frappier

CANAL MGR. LOUIS

Hwy. 201

Rivière Saint-Louis

Baie des Brises

Hwy. 132

Cartier

Baie-des-Brises

Pte Seigneuriale

Obtain permission from private property owners prior to crossing or using private property, access sites, or boat launches.

N

Scale
Kilometres
0 0.5 1 2
0 0.5 1
Miles
1:50,000

45° 11' 13" N
74° 12' 43" W

45° 11' 13" N
74° 2' 27" W

Appendix A

Data Sources

Source agencies for data used in the creation of the Environmental Sensitivity Atlas for the St. Lawrence River Shorelines are listed below.

A.1 Biological Resources

A.1.1 Bird Information

Colonial Waterbird Nesting Sites

Environment Canada, Canadian Wildlife Service, 49 Camelot Drive, Nepean, Ontario, K1A 0H3 (613) 952-2410. Contacts - Dr. Hans Blokpoel and Gaston Tessier

Environment Canada, Canadian Wildlife Service - Habitat Conservation, 152 Newhold Court, London, Ontario. N6E 1Z7 (519) 681-9486. Contacts - Gary McCullough and Norm North

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier - phone - 613-933-1774

Royal Ontario Museum Contact - Dr. Jim Dick, Department of Ornithology, Ontario Nest Records Scheme

Dr. Lee Harper, New York State Department of Environmental Conservation, (315) 764-1861

Waterfowl, Raptor, and Shorebird Data

Environment Canada, Canadian Wildlife Service, 49 Camelot Drive, Nepean, Ontario, K1A 0H3. (613) 952-0931. Contact - Joe Carreiro

Environment Canada, Canadian Wildlife Service - Habitat Conservation, 152 Newbold Court, London, Ontario. N6E 1Z7 (519) 681-9486. Contacts - Gary McCullough and Norm North

Environment Canada, Canadian Wildlife Service, 152 Newbold Court, London, Ontario. N6E 1Z7. (519) 681-0980. Contact - D. Dennis, Waterfowl Specialist

Ducks Unlimited 1-800-665-DUCK

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Long Point Bird Observatory - P. O. Box 106, Port Rowan, Ontario. N0E 1M0 (519) 586-3531. Contacts - Raptor Information - Ron Ridout, Bird Migration Specialist - John McCracken, Waterfowl Specialist - Dr. Richard Knapton

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier - phone - 613-933-1774

Ontario Ministry of Environment and Energy Offices:

Kingston MOEE, P.O. Box 820, 133 Dalton Ave., Kingston, ON K7L 4X6, Contact: Rick Kirk, phone - 613-549-4000

Cornwall MOEE, 205 Amelia Ave., Cornwall, ON K6H 3P3, Contact: Bob Hellier, phone 613-933-7402

Ottawa MOEE, 2435 Holly Lane, Ottawa, ON K1V 7P2, Contact: Bob Dunn, phone - 613-521-3450

National Museum of Canada

Royal Ontario Museum Flora and Fauna (including rare) information, historic data (geological, meteorological)

Royal Ontario Museum Contact - Dr. Jim Dick, Department of Ornithology, Ontario Nest Records Scheme

A.1.2 Fish Information

Ontario Ministry of Natural Resources, Lake Erie Fisheries Station, RR #2, Wheatly, Ontario. N0P 2P0. 519-825-4684. Contact: Joseph Leach

Canada Centre for Inland Waters, Fish and Ocean Charts, Burlington, Ontario. (905) 366-4549

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier - phone - 613-933-1774

Ontario Ministry of Environment and Energy Offices:

Kingston MOEE, P.O. Box 820, 133 Dalton Ave., Kingston, ON K7L 4X6, Contact: Rick Kirk, phone - 613-549-4000

Cornwall MOEE, 205 Amelia Ave., Cornwall, ON K6H 3P3, Contact: Bob Hellier, phone 613-933-7402

Ottawa MOEE, 2435 Holly Lane, Ottawa, ON K1V 7P2, Contact: Bob Dunn, phone - 613-521-3450

A.1.3 Shore Associated Mammals

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier - phone - 613-933-1774

Environment Canada, St. Lawrence Centre, 105 McGill St., 4th fl., Montreal, Quebec - Contact: Marie Josée Auclair, phone - 514-283-6431

A.2 Countermeasures

Transport Canada, Canadian Coast Guard, Prescott District, Prescott, Ontario. (613) 925-2865 (Ext. 258). Contact - Ray Amell

The following USCG - MSO - Buffalo (address below) personnel participated in joint Countermeasures determination sessions:

James McDowell

Mike Evanish

Brad Homan

Frank Shelly - USCG - Massena

Don Kast - USCG - Massena

United States Coast Guard - Marine Safety Office, Room 1111, Federal Building, 111 West Huron Street, Buffalo, New York. 14202-2395. (716) 846-4168. Contact: James McDowell

National Oceanographic and Atmospheric Administration, 1240 East 9th Street, Cleveland, Ohio. 44199. (216) 522-7760. Contact: Ken Barton

United States Coast Guard, District 9, 1240 East Ninth Street, Cleveland, Ohio. 44199-2060. 216-522-3994. Contact: Laurie Perry

Great Lakes Response Corporation (PIMEC, Inc.), 291 St. Clair Parkway, Corunna, Ontario. N0N 1G0. (519) 862-2281. Contact - Chuck Bailey, Dave Engleson

Environment Canada, Regional Environmental Emergencies Coordinator, Environmental Protection Branch - Ontario Region, 25 St. Clair Avenue East, 7th Floor, Toronto, Ontario. M4T 1M2. (416) 973-1059. Contact: Philip Baker

Environment Canada, Environmental Emergencies Officers, Environmental Protection Branch - Ontario Region, 25 St. Clair Avenue East, 7th Floor, Toronto, Ontario. M4T 1M2. Contact: Steve Clement - (416) 973-1061; Sheelagh Hysenaj - (416) 973-5854

Environment Canada, Environmental Emergencies Section, Environmental Protection Branch - Quebec Region, 1179, rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9, phone - (514) 283-2345. Contact: Claude Rivet, Chantal Duhaime

St. Lawrence Seaway Development Corporation (U.S.) - Contact Stephen Hung, Massena, phone - 315-764-3265

St. Lawrence Seaway Authority (Canada) - Captain Joseph Craig, Cornwall, phone - 613-932-5170

Weather Information

Atmospheric Environment Service - Meterological Station Sites, Meterological Data (wind, temperature, precipitation etc.) 4905 Dufferin Street, Downsview, Ontario.

St. Lawrence Seaway Authority, 202 Pitt St., Cornwall, ON K5J 3P7, Contact - G. McKercher (ice conditions)

A.3 Human-Use Resources

A.3.1 High Recreational Usage

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier - phone - 613-933-1774

Ontario Ministry of Environment and Energy Offices:

Kingston MOEE, P.O. Box 820, 133 Dalton Ave., Kingston, ON K7L 4X6, Contact: Rick Kirk, phone - 613-549-4000

Cornwall MOEE, 205 Amelia Ave., Cornwall, ON K6H 3P3, Contact: Bob Hellier, phone 613-933-7402

Ottawa MOEE, 2435 Holly Lane, Ottawa, ON K1V 7P2, Contact: Bob Dunn, phone - 613-521-3450

Cataraqui Region Conservation Authority, P.O. Box 160, Glenburnie, ON K0H 1S0, Contact: Robert Gerritsen, Allen Hansen, Graham David, phone - 613-546-4228

Raisin River Conservation Authority, P.O. Box 10, Martintown, ON K0A 2N0, Contact: Michel Lalonde, Richard Pilon, phone - 613-528-4823

South Nation River Conservation Authority, P.O. Box CP 69, Berwick, ON K0C 1G0, Contact: Dennis O'Grady, Scott Smith, Louis Prevost, phone - 613-984-2949

Environment Canada, St. Lawrence Centre, 105 McGill St., 4th fl., Montreal, Quebec - Contact: Marie Josée Auclair, phone - 514-283-6431

Anchorage Sites

Richardson's Chartbook and Cruising Guide, Richardson's Marine Publishing Inc., Streamwood, Illinois

Environment Canada, Environmental Emergencies Section, Environmental Protection Branch - Quebec Region, 1179, rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9, phone - (514) 283-2345. Contact: Claude Rivet, Chantal Duhaime

Scuba Sites

"Dive Ontario!" publication. Contact: Cris Kohl, 16 Stanley Avenue, Chatham, Ontario. N7M 3J2 - (519) 351-1966

Small Craft Harbours

Department of Fisheries and Oceans, Canadian Centre for Inland Waters, Small Craft Harbours, Burlington, Ontario. (905) 336-4637

A.3.2 Resource Extraction

Water Intakes/Outfalls

Canadian Great Lakes Basin Intake and Outfall Atlas, Ontario Ministry of the EnvironmentDOE - Ontario Region Staff Inquiries

Commercial Fisheries Activity

Department of Fisheries and Oceans (DFO), Canadian Centre for Inland Waters, Burlington, Ontario. (905) 336-4637

Environment Canada, Environmental Emergencies Section, Environmental Protection Branch - Quebec Region, 1179, rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9, phone - (514) 283-2345. Contact: Claude Rivet, Chantal Duhaime

A.3.3 Special Status Areas

Archaeological Site Information

The Ontario Ministry of Culture, Tourism and Recreation includes the following statement as a matter of standard policy with data distribution: "While the Ministry of Culture, Tourism and Recreation attempts to maintain a current and reliable database covering all known archaeological occurrences in the province, the Ministry waives responsibility for the quality, accuracy and completeness of this information and any damages which may be incurred through its use."

Heritage Policy Branch, Ontario Ministry of Culture, Tourism and Recreation, Archaeological Site Database, 77 Bloor St. West, Toronto, Ontario. (416) 314-7161, (416) 314-7790 (fax). Contact - Bernice Field

Area of Ecological Significance

Environment Canada, Canadian Wildlife Service, Nepean, Ontario. (613) 952-0931

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier phone - 613-933-1774

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Environment Canada, St. Lawrence Centre, 105 McGill St., 4th fl., Montreal, Quebec - Contact: Marie Josée Auclair, phone - 514-283-6431

Heritage Canada, 111 Water St. E., Cornwall, ON K6H 6S3. (613) 938-5745. Contact: Jim Barlow, Henry Schryver

Cataraqui Region Conservation Authority, P.O. Box 160, Glenburnie, ON K0H 1S0, Contact: Robert Gerritsen, Allen Hansen, Graham David, phone - 613-546-4228

Raisin River Conservation Authority, P.O. Box 10, Martintown, ON K0A 2N0, Contact: Michel Lalonde, Richard Pilon, phone - 613-528-4823

South Nation River Conservation Authority, P.O. Box CP 69, Berwick, ON K0C 1G0, Contact: Dennis O'Grady, Scott Smith, Louis Prevost, phone - 613-984-2949

Areas of Natural and Scientific Interest (ANSI)

Ontario Ministry of Natural Resources - Contact - Lands Division, Areas of Natural and Scientific Interest, Ontario.

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier phone - 613-933-1774

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Environment Canada, St. Lawrence Centre, 105 McGill St., 4th fl., Montreal, Quebec - Contact: Marie Josée Auclair, phone - 514-283-6431

Heritage Canada, 111 Water St. E., Cornwall, ON K6H 6S3. (613) 938-5745. Contact: Jim Barlow, Henry Schryver

Cataraqui Region Conservation Authority, P.O. Box 160, Glenburnie, ON K0H 1S0, Contact: Robert Gerritsen, Allen Hansen, Graham David, phone - 613-546-4228

Raisin River Conservation Authority, P.O. Box 10, Martintown, ON K0A 2N0, Contact: Michel Lalonde, Richard Pilon, phone - 613-528-4823

South Nation River Conservation Authority, P.O. Box CP 69, Berwick, ON K0C 1G0, Contact: Dennis O'Grady, Scott Smith, Louis Prevost, phone - 613-984-2949

Conservation Area Information

Cataraqui Region Conservation Authority, P.O. Box 160, Glenburnie, ON K0H 1S0, Contact: Robert Gerritsen, Allen Hansen, Graham David, phone - 613-546-4228

Raisin River Conservation Authority, P.O. Box 10, Martintown, ON K0A 2N0, Contact: Michel Lalonde, Richard Pilon, phone - 613-528-4823

South Nation River Conservation Authority, P.O. Box CP 69, Berwick, ON K0C 1G0, Contact: Dennis O'Grady, Scott Smith, Louis Prevost, phone - 613-984-2949

Association of Conservation Authorities of Ontario, Suite 127, Times Square 380 Armour Road, Peterborough, Ontario. K9H 7L7. (705) 749-9131. Contact: Jan Street

Ministry of Natural Resources Conservation Authority Information: Contact - Phyllis Miller, Toronto, Ontario. (416) 314-1978

Dune Formation Information

Natural Resources Canada, Geological Survey of Canada, Ottawa, Ontario. (613) 995-4342

Ontario Ministry of Natural Resources, Crown Lands, 77 Wellesley St., MacDonald Block, Toronto, Ontario. M7A 2C1. (416) 314-2001

Ontario Ministry of Natural Resources, Surveys, Mapping and Remote Sensing Branch, Geographic Information Services, Topographic Data Base, 90 Sheppard Ave. East, 4th Floor, North York, Ontario. M2N 3A1. (416) 392-2510

Ministry of Northern Development and Mines, 900 Bay St., Toronto, Ontario (416) 314-3790

Ontario Geological Survey, Mines and Minerals Information Centre Library c/o Janet Heitshu, Rm. M2-17900, Bay Street, MacDonald Block, Toronto, Ontario. M7A 1C3. (416) 314-3803

Ontario Government Book Store, (Publications, road maps, and Provincial Electorial Districts), Toronto, Ontario. (416) 326-5300

Environmentally Sensitive Areas

Cataraqui Region Conservation Authority, P.O. Box 160, Glenburnie, ON K0H 1S0, Contact: Robert Gerritsen, Allen Hansen, Graham David, phone - 613-546-4228

Raisin River Conservation Authority, P.O. Box 10, Martintown, ON K0A 2N0, Contact: Michel Lalonde, Richard Pilon, phone - 613-528-4823

South Nation River Conservation Authority, P.O. Box CP 69, Berwick, ON K0C 1G0, Contact: Dennis O'Grady, Scott Smith, Louis Prevost, phone - 613-984-2949

Ontario Ministry of Natural Resources:

Brockville Office, P.O. Box 605, 10 Oxford Ave., Brockville, ON K6V 5Y8, Contacts: Ruth Grant, Grenville/Dundas West Area Biologist, phone - 613-342-8524 and Ross Cholmondeley, Leeds County Biologist, phone - 613-342-8524

Cornwall Office, P.O. Box 1749, 113 Amelia St., Cornwall, ON K6H 5V7, Contact: Mike Eckersley, Bob Hellier phone - 613-933-1774

Environment Canada, Environmental Emergencies Section - Quebec Region, 1179 rue de Bleury, 2nd fl., Montreal, Quebec H3B 3H9. (514) 283-2345

Environment Canada, St. Lawrence Centre, 105 McGill St., 4th fl., Montreal, Quebec - Contact: Marie Josée Auclair, phone - 514-283-6431

Heritage Canada, 111 Water St. E., Cornwall, ON K6H 6S3. (613) 938-5745. Contact: Jim Barlow, Henry Schryver

Ontario Ministry of Natural Resources Conservation Authority Information Contact - Phyllis Miller, Toronto, Ontario. (416) 314-1978

Association of Conservation Authorities of Ontario, Contact - Jan Street, Suite 127, Times Square 380 Armour Road, Peterborough, Ontario. K9H 7L7 (705) 749-9131

First Nation/Native Land Information

Indian and Northern Affairs Canada, 25 St. Clair Avenue East, 5th Floor, Toronto, Ontario. M4T 1M2 (416) 973-6234

Ontario Ministry of Natural Resources, Native Register Population (maps of settlements - numbers, locations, resources used)

National Park/National Forests

Heritage Canada, Canadian Parks Service, St. Lawrence Islands National Park, RR #3, 2 County Road 5, Mallorytown, ON K0E 1R0, Contact: Jeff Leggo, Mary Alice Snetsinger, Larry Harbidge, phone - 613-923-5261

Heritage Canada, 111 Water St. E., Cornwall, ON K6H 6S3. (613) 938-5745. Contact: Jim Barlow, Henry Schryver

Provincial/State Park, Nature Reserves or Wilderness Areas

St. Lawrence Parks Commission (Canada) (613) 537-2209

Burnham Point State Park (315) 654-2522

Cedar Point State Park (315) 654-2522

Wellesley Island State Park (315) 482-2722

Grass Point State Park (315) 654-2522

Jacques Cartier State Park (315) 375-6371

Coles Creek State Park (315) 388-5636

Robert Moses State Park (315) 769-8663

Kring Point State Park (315) 482-2444

Mary Island State Park (315) 654-2522

Canoe Point State Park (315) 654-2522

A.4 Shoreline Habitats

Shoreline Classifications

Environment Canada, Environmental Emergencies Section, Environment Protection Branch - Ontario Region, (416) 973-1059.

Jeff Ollerhead (Contractor), Geomorphologist. Contact - Environment Canada

Aerial Photos

Natural Resources Canada, Air Photo Sales, Ottawa, Ontario (613) 995-4560

Ontario Ministry of Natural Resources, Aerial Mapping Service First Floor, Room # M173900 Bay St. (corner of Bay and Wellesley), Toronto, Ontario (416) 314-2001

Ministry of Natural Resources Air Photos (road, forestry and ground) 77 Wellesley St., MacDonald Block, Toronto, Ontario. M7A 2C1 (416) 314-2001

Ministry of Natural Resources Surveys, Mapping and Remote Sensing Branch, Geographic Information Services, Topographic Data Base, 90 Sheppard Ave. East, 4th Floor, North York, Ontario. M2N 3A1. (416) 392-251

University of Toronto Mapping Library, Toronto, Ontario

University of Waterloo Map and Design Library, Environmental Studies Building 1, University of Waterloo, Waterloo, Ontario. (519) 885-1211

A.5 Base Maps and Mapping System

Digital Layer Creation and System Consulting

Environment Canada staff, Christine Rowe (Contractor - contact DOE) and Digimap Data Services Inc. (Contractor), 37 Kodiac Crescent, Unit 3, North York, Ontario.

Municipal Maps

Ontario Base Maps (OBM) 1:20,000 Ontario Ministry of Natural Resources, Topographic Mapping Section, 90 Sheppard Ave. East, 4th Floor, North York, Ontario. M2N 3A1 (416) 733-5090

Topographical Maps

Natural Resources Canada, Geological Survey of Canada, Ottawa, Ontario. (819) 564-5600

United States Geological Survey

Ontario Ministry of Natural Resources, Crown Lands (land titles, patents and leases), 77 Wellesley St., MacDonald Block, Toronto, Ontario. M7A 2C1. (416) 314-2001

Ontario Ministry of Natural Resources, Topographical Maps, 77 Wellesley St., MacDonald Block, Toronto, Ontario. M7A 2C1 (416) 314-1666

Ontario Government Book Store Publications, Ontario Road Maps and Provincial Electorial Districts, Toronto, Ontario (416) 326-6500

A.6 Main United States Data Sources

Primary biological resource information was extracted from the New York State Office of Ocean and Coastal Resource Management summary, "Significant Coastal Fish and Wildlife Habitats in St. Lawrence County" (1994), "USCG's Eastern Great Lakes Area Contingency Plan" (1993) and NOAA's "St. Lawrence River Atlas: Sensitivity of Coastal Environments and Wildlife to Spilled Oil" (RPI, 1985). Where necessary, updates to that information were received from resource managers from the New York State Department of Environmental Conservation.

Human-use, protection strategy, and sensitive area information was compiled from the USCG's Eastern Great Lakes Area Contingency Plan (1993).

Appendix B

Listing of National Topographic System (NTS) and United States Geological Survey (USGS) Map Sheets

The following NTS map sheets (1:50,000 scale) cover the Canadian shoreline of the St. Lawrence River. Elements of base topographic maps showing on each atlas page have been reproduced with Natural Resources Canada's permission.

Map	Year
31 B/5	1982
31 B/12	1982
31 C/8	1991
31 C/1	1991
31 G/2 & 31 B/15	1982
31 B/14 & 31 B/11	1982
31 G/8	1984
31 G/1	1983

The following USGS Quad map sheets (1:24,000 scale) cover the United States shoreline of the St. Lawrence River. The USGS map number (e.g. 43082) located in the Key Map Box on each map corresponds to the block (identified in the USGS Index to Topographic and Other Map Coverage publication) which includes the area covered by each map page.

Map Title	Map Number
Louisville, N.Y.-Ont.	N4452.5-W7500/7.5
Massena, N.Y.-Ont.	N4452.5-W7452.5/7.5
Waddington, N.Y.- Ont.	N4445-W7507.5/7.5
Redwood, N.Y.- Ont.	N4415-W7545/7.5
Raquette River, N.Y.-Ont.	N4452.5-W7445/7.5
Morristown, N.Y.-Ont.	N4430-W7537/7.5
Chippewa Bay, N.Y.-Ont.	N4422.5-W7545/7.5
Gananoque, Ont.-N.Y.	N4415-W7607.5/7.5
Morrisburg, Ont.-N.Y.	N4452.5-W7507.5/7.5
Sparrowhawk Point, N.Y.	N4445-W7515/7.5
Red Mills, N.Y.	N4445-W7522/7.5
Ogdensburg East, N.Y.	N4437.5-W7522.5/7.5
Ogdensburg West, N.Y.	N4437.5-W7530/7.5
Edwardsville, N.Y.	44075-E5-TF-024
Alexandria Bay, N.Y.	N4415-W7552.5/7.5
Thousand Island Park, N.Y.	N4415-W7600/7.5
Cornwall West, Ont.-N.Y.	N4500-W7445/7.5

Appendix C

References and Suggestions for Further Reading

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Appendix D

Acronyms and Abbreviations Used in Environmental Sensitivity Atlases

AID	Atmospheric Issues Division
ANSI	Area of Natural and Scientific Interest
CA	Conservation Authority
CCG	Canadian Coast Guard
CWS	Canadian Wildlife Service (recently renamed Canadian Wildlife Science)
NYDEC	New York State Department of Environmental Conservation
DOE	Department of Environment/Environment Canada
EPA	Environmental Protection Agency
EPB	Environmental Protection Branch
ESA	Environmentally Sensitive Area
ESI	Environmental Sensitivity Index
Ft	Feet
GIS	Geographic Information System
GLRC	Great Lakes Response Corporation
GS	Generating Station
IBP	International Biological Program
Km or km	Kilometre
M or m	Metres
MDNR	Michigan Department of Natural Resources
MSO	Marine Safety Office
NOAA	National Oceanic and Atmospheric Administration
NRC	Natural Resources Canada
NTS	National Topographic Series
OMNR	Ontario Ministry of Natural Resources
OMOEE	Ontario Ministry of Environment and Energy
OR	Ontario Region
RAP	Remedial Action Plan
REEC	Regional Environmental Emergencies Coordinator
RPI	Research Planning, Inc.
SAR	Sensitive Area Reports
Twp	Township
US	United States
USCG	United States Coast Guard
USGS	United States Geologic Survey
WSF	Water Soluble Fraction

To assist users in discerning one shoreline colour from another, a removable Legend insert has been included with the atlas. If required, users may line up this card over the shoreline habitat in question, to determine the exact colour of a given habitat.

Legend

Shoreline Habitats

ESI* Ranking

Bedrock or Impermeable Shores

- 1a(1a) Exposed Bedrock Bluff less than 1 metre elevation
- 1b(1a) Exposed Bedrock Bluff 1-5 metre elevation
- 1c(1a) Exposed Bedrock Bluff greater than 5 metre elevation
- 2(1b) Retaining Wall/Harbour Structure/Breakwaters
- 3(2) Shelving Bedrock

Unconsolidated Sediment Shores

- 4(3) Exposed Sediment Bluff
- 5a(4) Sand Beach: Depositional
- 5b(4) Sand Beach: Erosional or Transitory
- 6(4) Sand Barrier With Lagoon
- 7a(6a) Pebble Beach
- 7b(6a) Pebble/Cobble Beach
- 7c(6a) Cobble Beach
- 8(6b) Rip Rap
- 9(6a) Boulder Beach
- 10(5) Mixed Beach (% by sediment in DOE Database)

Vegetated Shores

- 11(9a) Low Vegetated Bank (Grass or Trees)
- 12(9b) Delta Mud Flat
- 13a(10a) Fringing Wetland
- 13b(10b) Broad Wetland

* ESI - Canadian Environmental Sensitivity Index (USA ESI Ranking follows in brackets) Higher numbers indicate greater sensitivity.

Biological Resources

Fish

- Area of Seasonal Fish Spawning
- Location of Seasonal Fish Migration

Birds

- Migratory Waterfowl
- Colonial Nesting Birds (total nests - all species)
- Wading Birds (total nests - all species)
- Shore Birds
- Raptors

Shore Associated Mammals

- Furbearers (such as Muskrat, Mink, and Beaver)

Human-Use Resources

High Recreational Usage

- Marinas and Small Craft Harbours
- Anchorage Sites
- Residential, Recreational or Cottage Use
- High-Use Recreational Beach
- Recreational Dive Site

Resource Extraction

- Water Intakes - Industrial
- Water Intakes - Municipal
- Outfall
- Commercial Fisheries Activity

Special Status Areas

- Highly Sensitive Classified Feature (within 2km)
- First Nation/Native American Reservation
- National Park/National Forest
- Provincial/State Park, Wilderness Area or Nature Reserve/State Forest
- Conservation Area or Municipal Park
- Environmentally Sensitive Area*
- Area of Natural and Scientific Interest*
- Area of Ecological Significance (e.g. Wetland)
- Dune Formations

* As identified by Ontario Ministry of Natural Resources or Conservation Authorities

Countermeasures

- Access Site (for land vehicles)
- Approach Concerns
- Exposed Rock
- Coast Guard Light Station
- Boat Launch: Excellent
- Boat Launch: Good
- Boat Launch: Poor
- Helicopter Landing Site
- Staging Area: Excellent
- Staging Area: Good
- Staging Area: Poor
- Automated Weather Stations

Canada