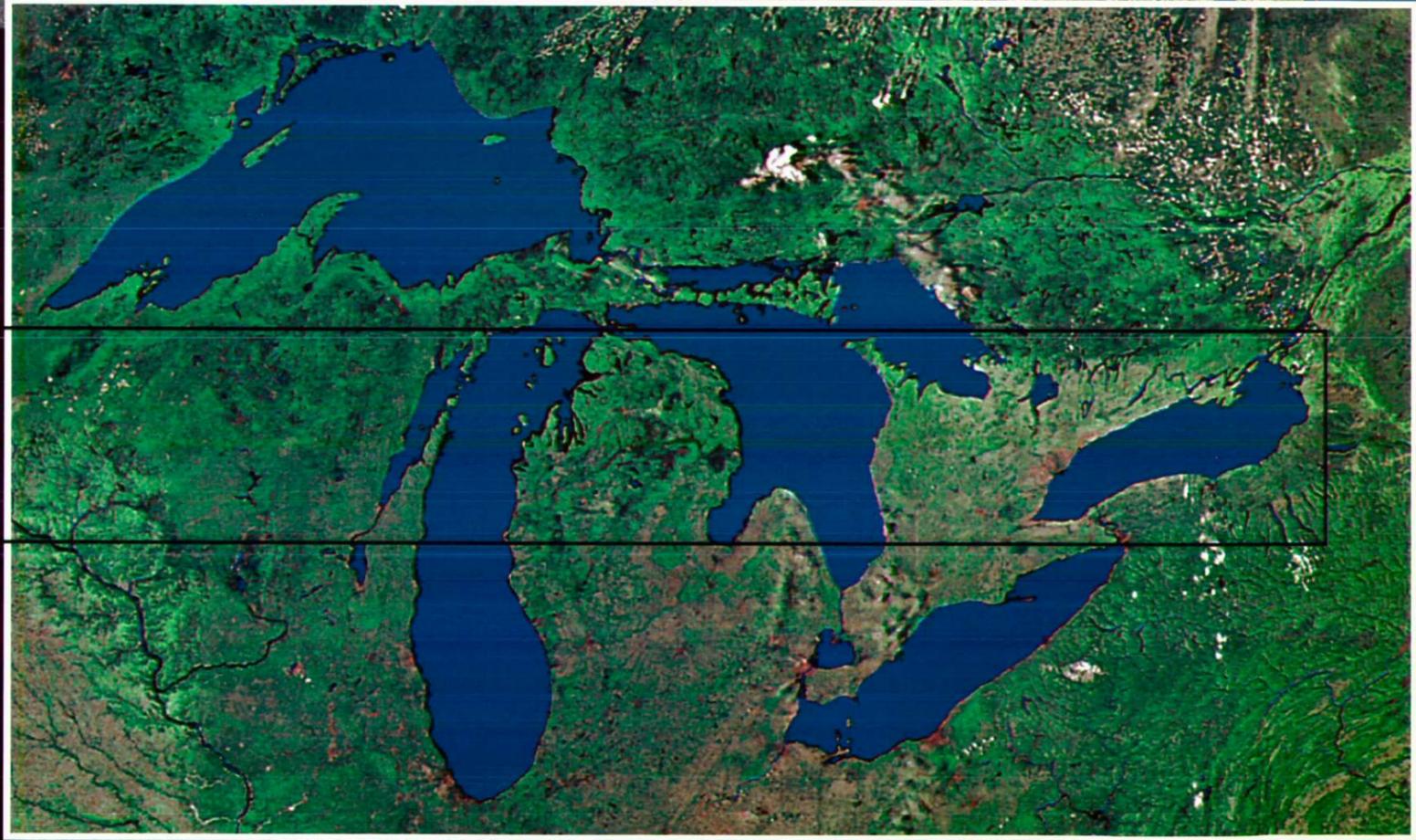


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# Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline



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# Legend

- ESI\* Ranking**
- 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
  - 2 Retaining Wall/Harbour Structure/ Breakwaters
  - 3 Shelving Bedrock
- Unconsolidated Sediment Shores**
- 4 Exposed Sediment Bluff
  - 5a Sand Beach: Depositional
  - 5b Sand Beach: Erosional or Transitory
  - 6 Sand Barrier With Lagoon
  - 7a Pebble Beach
  - 7b Pebble/Cobble Beach
  - 7c Cobble Beach
  - 8 Rip Rap
  - 9 Boulder Beach
  - 10 Mixed Beach (% by sediment in DOE Database)
- Vegetated Shores**
- 11 Low Vegetated Bank (Grass or Trees)
  - 12 Delta Mud Flat
  - 13a Fringing Wetland
  - 13b Broad Wetland
- \* ESI - Environmental Sensitivity Index  
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
  - Commercial Fisheries Activity
- Special Status Areas**
- Highly Sensitive Classified Feature (within 2km)
  - First Nation
  - National Park
  - Provincial Park, Nature Reserve or Wilderness Area
  - Conservation Area or Municipal Park
  - Environmentally Sensitive Area\*
  - Areas 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: Foreshore Flats/Rocky Reef
  - 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

## Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline

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### Great Lakes Action Plan



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**Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline**

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1993

**These maps are not to be used for navigational purposes.**

While every effort has been made to ensure the accuracy, quality and completeness of the data contained in the Environmental Sensitivity Atlas (and Supplement) for Lake Ontario's Canadian Shoreline, no responsibility will be accepted by Environment Canada for any consequential loss or damage arising from its use.

## **Acknowledgements**

Environment Canada's office of Environmental Protection - Ontario Region, would like to express its appreciation for the time and effort of all those who contributed to the development of the Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline. Appendix A has a list of these agencies and the data they contributed.

We would particularly like to acknowledge the extensive help we received from the Ontario Ministry of Natural Resources offices on Lake Ontario, Ray Amell of Canadian Coast Guard's Prescott District Office, the Canadian Petroleum Products Institute, the Ontario Ministry of the Environment, and the Canadian Wildlife Service's Nepean office.

The project was funded by Environment Canada, with the support of the Great Lakes Action Plan and Canada's Green Plan.

Elements of base topographic maps showing on each atlas page have been reproduced with Natural Resources Canada's permission.

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## 1.0 Introduction

The "Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline" is a publication designed for use in response to 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.

This project is a collaboration of Environment Canada's (DOE) Ontario Region office of Environmental Protection (EP-OR) and Transport Canada's Canadian Coast Guard (CCG) Central Region office.

Two versions of this information have been produced; a softbound Atlas, and a hardbound Supplement to the Great Lakes Annex of the Canada-United States Joint Marine Pollution Contingency Plan. A limited number of copies of the hardbound, laminated Supplement 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 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 information that is critical to spill response decision makers.

A softbound version of the Lake Ontario Atlas has been 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 for the use of 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 have been collected and represented on the paper 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 could be released periodically. More importantly, the system will allow for enhanced spill response management at the time of a spill.

The electronic desktop environmental sensitivity mapping system is a continually evolving system. EP-OR would welcome 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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Environmental Protection - Ontario Region  
Environment Canada  
25 St. Clair Avenue East, 7th floor  
Toronto, Ontario M4T 1M2  
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## 2.0 Project Background

In June, 1991, Environment Canada asked many agencies to assist in the development of the Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline. EP-OR received an excellent response, with many firms or agencies expressing interest or cooperating to provide data and expertise.

The Lake Ontario 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 1991-92, videotaped helicopter shoreline surveys were made of the lake, 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 from partner agencies.

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. Specific electronic layers were created to present geomorphological, cultural, biological and human-use information.

With input from many response experts, the project team has 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 Lake Ontario 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 Environment Canada's National Sensitivity Mapping Program, which is currently being developed. Consultations with the United States National Oceanic and Atmospheric Administration (N.O.A.A.) have 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 operational officers dictated many of the design layout features of the Atlas and Supplement.

## 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 MapInfo™ software and MapBasic™ 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. Information in this database will be readily available to responders in contact with Environment Canada 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 1:50,000 have been used. On each map page of the publication, reference is made to the relevant NTS map sheet(s) covering that portion of shoreline displayed. 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 620 kilometres of Lake Ontario shoreline in 44 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 5 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

EP-OR staff contacted or made visits to all contributing partner agencies between June 1991 and December 1992. 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, defined 19 different shoreline habitats. 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 Lake Ontario. To some degree, data availability on the Great Lakes has dictated definition of Legend features and the manner they are displayed on the maps. To use a cross-hatched 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 lake 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 Bird information is based on recent, thorough surveys by the Canadian Wildlife Service 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 lake's different regions.

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 - EP-OR video review sessions and helicopter and ground surveys between July 1991 and July 1992. These symbols were then reviewed for accuracy and modified where necessary by local experts familiar with the areas involved.

The geomorphology of approximately 99 percent of the Canadian shoreline of Lake Ontario was newly classified by the project geomorphologist during the 1991 and 1992 helicopter surveys which were undertaken specifically for this project. Videotapes were filmed during these surveys 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 of a 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 these 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 Lake Ontario's Canadian Shoreline ranks 'Shoreline Habitats' in order of increasing sensitivity based on factors such as oil residence time, cleaning potential and exposure. 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 prioritizing 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 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 symbol size shown on the individual maps, due to space constraints.

Figure 1

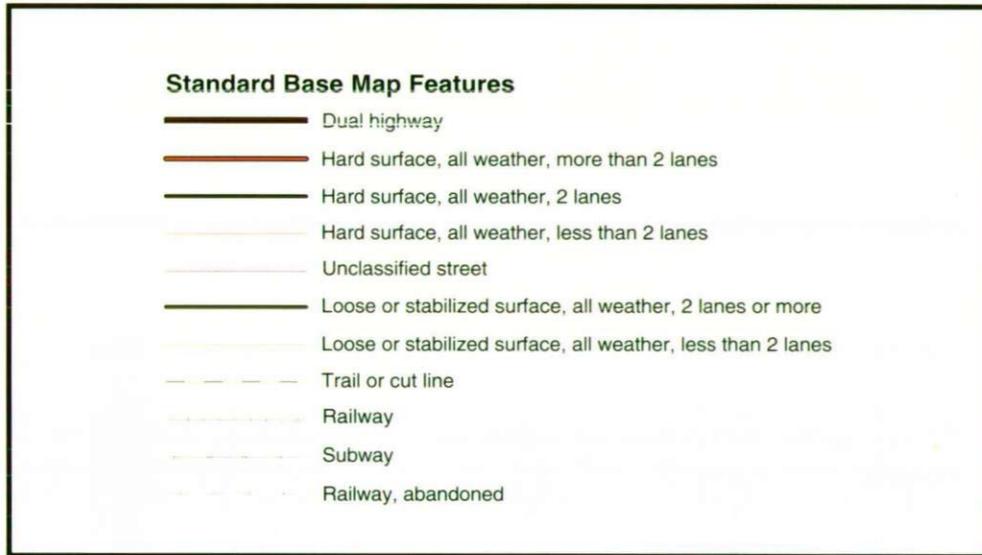
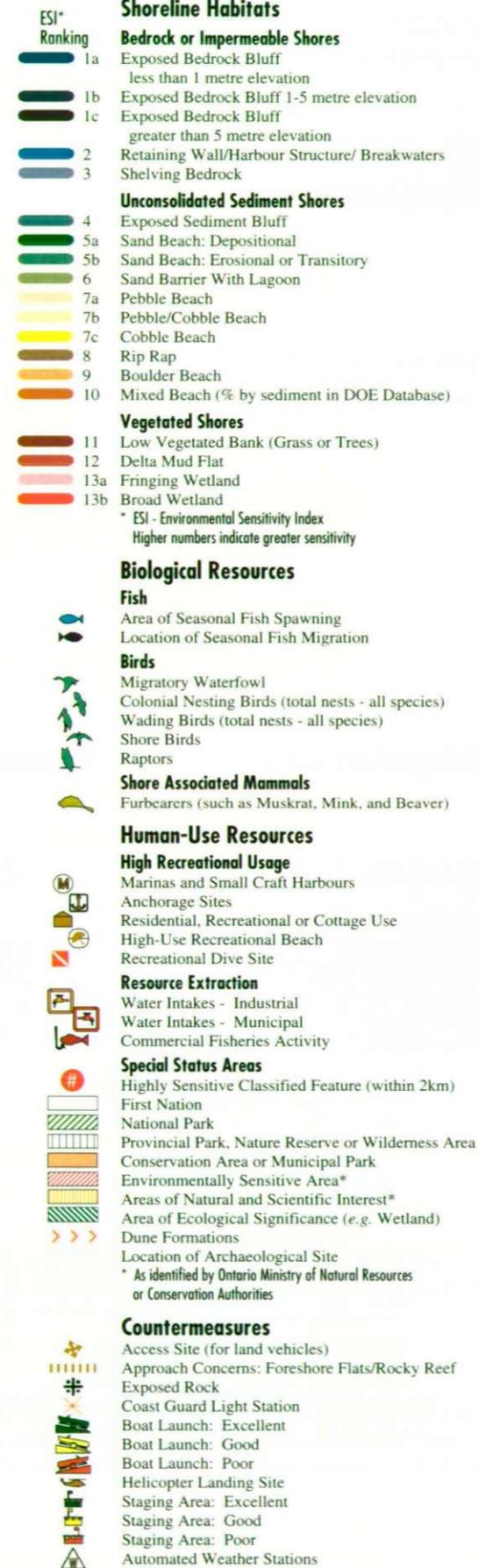


Figure 2: Standard Cartographic Legend for Base Maps

## 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 Lake Ontario's Canadian Shoreline is to present mapped sensitivity information that may be readily understood at a glance for the purposes of spill responders.

To maintain 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. 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.

Limited data were available for rare plants along the Lake Ontario shoreline. These rare plants are highly sensitive to human activity, and to some degree, to oiling. Reported locations have been described in the 'Notes' column. In general, they are sporadically located along the Lake Ontario shoreline, from the Rideau Canal to Kingston, on Wolfe Island, Huffs Island, Main Duck Islands, near Belleville, Point Anne, Long Point, Presqu'île Peninsula and Sandbanks Provincial Park.

### 6.2.1 Fish

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

In the Lake Ontario Atlas, the available data collected focused mainly on known areas of spawning and migration activity for fish species having commercial or recreational value. Site-specific information on non-commercial or non-sport fish species was not readily available during data collection for Lake Ontario. The primary forage fish on Lake Ontario include herring and smelt, and appropriate references have been made throughout the Atlas and Supplement. As more information becomes available, it will be incorporated into Environment Canada's master database, and 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 emergency, the Atlas symbols will provide critical initial information regarding fish spawning and fish migration.

The following species and seasonality information for Lake Ontario is derived from information supplied by the various District offices of the Ontario Ministry of Natural Resources (OMNR). This general information will complement details found on the individual maps.

Commercial fish species in Lake Ontario include lake herring, lake trout, lake whitefish, and smelt. Sport fishing species include lake trout, coho, chinook and pink salmon, yellow perch and walleye in some bays, and smelt in most streams during the spring. Rainbow trout, largemouth and smallmouth bass, carp and northern pike are also present along the shores of Lake Ontario and in most tributaries.

Lake trout in Lake Ontario spawn in the fall on gravelly beaches and rocky shoals in shallow water.

Lake whitefish are especially abundant along the shorelines of Lake Ontario in the fall. Adults congregate in shallow water (usually at depths of less than 8 metres) in November and December to spawn. Young whitefish are found in the shallow inshore waters until the early summer when they move into deeper water.

Lake herring generally occupy the open lake in deeper water. They spawn in late fall to early winter.

Rainbow trout enter most tributaries to spawn from December to May.

Brown trout enter tributaries to spawn in fall.

Smelt are present in most streams in spring.

Coho and chinook salmon are fall spawners in many Lake Ontario tributaries.

### 6.2.2 Birds

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

#### 'Migratory Waterfowl'

This category is comprised of both migrants and breeders which are present on the lake for at least part of the year. Species include those found on shoreline wetlands and sheltered waters such as the Canada goose and various dabbling ducks (including the mallard, black duck, gadwall, northern pintail, American wigeon and teal), plus those species of more open water such as loons, grebes and the diving ducks (including canvasback, redhead, bufflehead, common goldeneye, scaup, oldsquaw, scoters and mergansers). Often the 'Notes' column will identify critical staging areas and wetlands.

#### '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 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 the 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 Canadian Great Lakes and associated wetlands, with several of these species nesting in the Canadian portion of Lake Ontario: Ring-billed Gulls (by far the most widespread and numerous), Double-crested Cormorants, Herring Gulls, Great Blue Herons, Black-crowned Night Herons, Caspian, Black and Common Terns.

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 were provided by CWS from their 1989 to 1991 census. In the Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline, 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 by herons and egrets.

Where they occur on the individual map pages, these two symbols are followed by a number representing the total number of nests for all species at that location. Note that 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. The numbers are provided only as a guideline for deploying limited resources; in the event of a spill, the Canadian Wildlife Service 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 represents a foraging location and is typically mentioned in the 'Notes' column.

#### **'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 and feeding on sand or gravel beaches along Lake Ontario during the ice free season.

#### **'Raptors'**

The three most important raptor species found along shores of Lake Ontario are osprey, peregrine falcons and bald eagles. The bald eagle is an endangered species (CWS). Exact nesting locations of these raptors 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 its tributary rivers. Wetlands are the most important habitat for these species. Several species such as muskrat, beaver and mink have economic importance.

The 'Notes' column will also periodically make reference to shore associated mammals. Larger mammals such as deer also occasionally come to the shore but their locations cannot be pinpointed on the maps. Rather, a general comment is often made in the 'Notes' column. Oiled carcasses should be removed from shores whenever practical to prevent their ingestion by mammals or raptors.

Note that no symbol was used to denote reptiles. Relatively few species of reptiles are associated with the shorelines of the Great Lakes. Water snakes, and several species of turtles that use wetlands are likely to be found in some Lake Ontario habitats (E.H. Owens et al., 1992), but limited specific data were reported.

There was essentially no information available for amphibian distribution. Amphibians are at risk during an oil spill, but mapping their distribution would not be practical. Amphibians are dependent on water, especially wetlands. (E.H. Owens et al., 1992). The atlas identifies wetland habitats. By protecting these areas against oiling, reptile and amphibian populations will be taken into account, along with birds, fish, and mammals. In the few exceptions where specific information exists, the 'Notes' column includes a reference.

## **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 included.

#### **'Anchorage Sites'**

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

#### **'Residential, Recreational or Cottage Use'**

This symbol includes cottages, seasonal and permanent dwellings, resorts, campgrounds, picnic areas, and 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 by the Ontario Underwater Council.

### **6.3.2 Resource Extraction**

#### **'Water Intakes - Industrial'**

This symbol denotes locations where water is extracted from Lake Ontario for industrial, non-food related uses.

#### **'Water Intakes - Municipal'**

This symbol denotes locations where water is extracted from Lake Ontario for community use for drinking water or food processing.

#### **'Commercial Fisheries Activity'**

Commercial fishing is a significant industrial use of the aquatic biota of Lake Ontario. Note that commercial fishing is restricted in a one kilometre radius around every stream or river mouth on the lake.

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 Lake Ontario unless otherwise noted (for instance, restricted areas). More specific Commercial Fisheries Activity data may be added to the database as they become available.

### 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.

#### 'Highly Sensitive Classified Feature (within 2 km)'

Certain information sets were of a restricted nature due to the high biological, cultural or physical sensitivity of the features described. 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 effected area. By reporting the number inside the symbol, they will immediately receive the appropriate information and response advice from Environment Canada (416-346-1971) and the agency that provided the source data, so that they can effectively implement protection and clean up measures.

#### 'First Nation'

There is one First Nation identified along the shoreline of Lake Ontario, at the Bay of Quinte. A reference to the local First Nation Chief in this case is made in the 'Notes' column so that responders may contact him when responding to a spill in the local area.

#### 'National Park'

National Parks managed by the Canadian Parks Service are identified by a polygon symbol on the map pages. These can include underwater parks, although none are present on Lake Ontario.

#### 'Provincial Park, Nature Reserve or Wilderness Area'

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 several cases this polygon is used to represent National Wildlife Areas (NWA) administered by the Canadian Wildlife Service. Whenever possible, the 'Notes' column addresses sensitive features specific to the identified area.

#### 'Conservation Area or Municipal Park'

These are areas along the lakeshore managed either by Conservation Authorities or 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 and 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.

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

Significant wetland areas along the shores of Lake Ontario 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).

For a discussion of the different types of wetlands present on the Great Lakes, see 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 Ontario Ministry of Natural Resources.

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 Reef'

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.

#### '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 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.

#### '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 for 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 Coast Guard's '212' (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 by Environment Canada's Atmospheric Environment Service 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.

**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)'**

Canadian Coast Guard and Canadian Petroleum Products Institute response equipment depots and boom storage sites (Marine Emergency Response Trailers) are identified on the appropriate map page in the 'Notes' column, and as symbols in the Supplement.

**'Location of Collection and Recovery Site'**

These locations mark areas where oil will likely collect naturally, and where clean up activities 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 protect more sensitive adjacent shores.

**'Suggested Boom Deployment'**

These markings show only suggested positioning of boom. They do not give boom length requirements. 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 protection measures. The actual deployment of boom during an environmental emergency will be guided by spill response experts, after 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

This section includes direct quotes or summaries of information from the Canadian Wildlife Service and the Natural Resource Response Guide Series produced by the U.S. National Oceanic and Atmospheric Administration (N.O.A.A.). 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 soluble 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 (N.O.A.A., 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 water-soluble 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 open-water 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 open-water 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" (N.O.A.A., 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" (N.O.A.A., 1987).

According to the Ontario Ministry of Natural Resources, all wetlands on the shore of Lake Ontario 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 Lake Ontario 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 anadromous 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" (N.O.A.A., 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" (N.O.A.A., 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 water-repellent 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" (N.O.A.A., 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" (N.O.A.A., 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" (N.O.A.A., 1988). Direct exposure of eggs to oil has the greatest potential for reproductive damage. Exposure to oil during the early stages of incubation is most toxic. Oiled adult birds can easily transfer toxic doses to eggs.

Certain behavioural 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" (N.O.A.A., 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 (N.O.A.A., 1988). As discussed in Section 5.2, such factors will be taken into account by local resource experts at the time of 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 N.O.A.A.'s Natural Resource Response Guide for Marine Birds 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 concentrate, often 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 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 Lake Ontario Atlas, 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. 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" (N.O.A.A., 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" (N.O.A.A., 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 Lake Ontario, most activities at the nesting colonies will take place during April through August.

## 7.2.3 Wading Birds

Hérons, 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 of their food sources in the water column of shallow, sheltered waters (N.O.A.A., 1988). In Lake Ontario, 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. On Lake Ontario, shorebirds form large staging flocks along the shore in areas such as Hamilton Harbour and Presqu'île Peninsula. This habit of flocking by the thousands at certain times 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" (N.O.A.A., 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 Lake Ontario.

**Table 1A: Lake Ontario Bird Seasonality: Colonial Waterbirds**

Species	Period Present on Lake Ontario	Breeding Season	Nest Location	Category			Abundance		
				Migrant	Summer Resident	Winter Visitor	Common	Uncommon	Rare
Double-crested Cormorant	April to October	May to August	On ground and in trees (islands and peninsulas)	✓	✓			✓	
Herring Gull	February to November	April to July	On ground (islands and peninsulas)	✓	✓	✓		✓	
Ring-billed Gull	March to November	April to July	On ground (islands and peninsulas)	✓	✓	✓	✓		
Great Blue Heron	March to October	April to July	In trees (islands and coastline)	✓	✓			✓	
Black-crown Night Heron	April to September	May to August	In trees (islands and coastline)	✓	✓			✓	
Common Tern	May to October	May to August	On ground (islands and peninsulas)	✓	✓			✓	
Caspian Tern	May to October	May to August	On ground (islands and peninsulas)	✓	✓				✓

**Table 1B: Lake Ontario Bird Seasonality: Waterfowl, Shorebirds, Raptors**

Species	Status	Period Present on Lake Ontario
Common Loon	Common migrant and uncommon summer visitor	Whole ice-free period, particularly April and May, August to December
Grebe species	Common migrants	Whole ice-free period, particularly April and May, August to December
Canada Goose	Very common migrant; common local breeder	Year round, particularly April and May, August to December
Dabbling Ducks (including mallard, black duck, northern pintail, American wigeon, teal)	Very common migrants; common breeder	Year round when water open; highest number during migration (late March to May, August to December); moderate numbers during summer
Diving Ducks (including scaups, redhead, canvasback, common goldeneye, bufflehead, oldsquaw, scoters, mergansers)	Very common and abundant migrants; uncommon summer visitors	Year round when water open; highest counts during migration (late February to May, August to December); larger number of Oldsquaw winter offshore; their distribution is not well known
Shorebirds (including sandpipers and plovers)	Locally common migrants; uncommon breeders	Mostly during migration (late April and May; August and September)
Bald Eagles	Rare resident	Year round
Osprey	Uncommon migrant and breeder	April to November
Peregrine Falcon	Very rare migrant	April to November

### 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 (N.O.A.A., 1989).

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

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 Lake Ontario Shoreline Habitat Classification Scheme

The Canadian shoreline of Lake Ontario has been classified as shown below. The Environmental Sensitivity Index (ESI) number for each shore type indicates the sensitivity ranking of that type. Higher numbers indicate greater relative sensitivity to the impacts of an oil spill. Colours range from "coldest" for shore type 1c to "hottest" for 'Broad Wetland', shore type 13b.

#### ESI Ranking

##### 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
- 2. Retaining Wall/Harbour Structure/Breakwaters (Anthropogenically modified shore)
- 3. Shelving Bedrock

##### Unconsolidated Sediment Shores

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

##### Vegetated Shores

- 11. Low Vegetated Bank (Grass or Trees)
- 12. Delta Mud Flat
- 13a. Fringing Wetland
- 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, depicting a typical example on Lake Ontario. Expected oil behavior 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 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 in the event 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.**

## 9.2.1 Bedrock or Impermeable Shores

### 1a. Exposed Bedrock Bluff less than 1 metre elevation

No photograph available.

### 1b. Exposed Bedrock Bluff 1-5 metre elevation

No photograph available.

#### ESI 1a, 1b, and 1c. Exposed Bedrock Bluff

The majority of bedrock bluff shores along Lake Ontario are less than 1 metre in elevation. 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.

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, especially in areas of weak, friable rock such as the limestone bluffs near Presqu'île Provincial Park. 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 wave abrasion, if manual removal is unsafe or logistically impossible.

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



1c. Exposed Bedrock Bluff  
greater than 5 metre elevation

## ESI 2. Retaining Wall/Harbour Structure/Breakwaters

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 some birds along the

structure's upper portions. There is minimal oil persistence along sections exposed to 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

Shelving bedrock shores are wide, flat expanses of bedrock, at or immediately below normal water levels.

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 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

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. There is little biological activity along these bluffs.

Shoreline sections are commonly steep and relatively narrow (< 4 metres). Extremely thick segments of unconsolidated material, such as the Scarborough Bluffs, can produce a shoreline 55 metres high and 15 metres wide.

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

Depositional sand beaches occur where wave and littoral drift deposited sand has accumulated along a cove or other sheltered environment. Offshore regions tend to be shallow and uniformly sloping.

Small coves and bays tend to produce a thinner beach face, which rarely terminates with elevated sand dunes. The beaches of Presqu'île and Sandbanks Provincial Park are examples where large coves often produce very wide sand beaches, with a series of backshore dunes. Vegetation growing on the dunes enhances their stability. Destruction of this vegetation by clean up crews will lead to wind erosion of the dunes.

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, 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

No photograph available.

All sand beaches along Lake Ontario classified as 5b are transitory. Transitory beaches form down drift from eroding unconsolidated sediment bluffs. During times of normal water levels, eroded sediment may collect within small coves or wave-cut notches to form a poorly defined beach. Such deposits are transient and are regularly removed by intensified littoral drift 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 1 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

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.

The thin, low sand barrier now 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 splash or beach erosion. Oil could, however, enter the lagoon if waves cross the outlet. This 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. Heavy machinery must 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.

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

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. Pebble beaches are characteristically narrower and steeper than sand beaches; widths of 2-5 metres are common along Lake Ontario.

Oil will penetrate a pebble beach to occupy the spaces between pebbles; common penetration depths are 0.5 metres. 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 stranded oil. Oil buried at a depth of 0.5 metres or more could persist for years before natural abrasion by wave action removed the deposit.

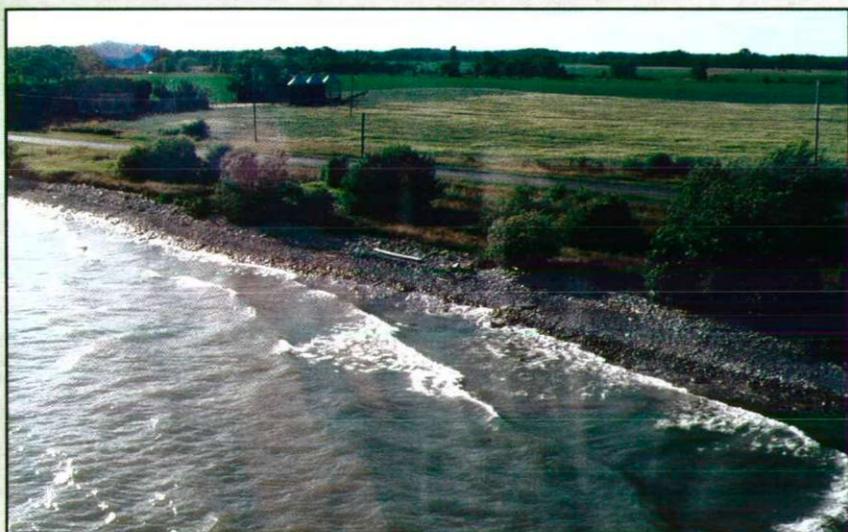
Sensitive flora and fauna may be adversely affected by oil on shore and in the water column.

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. Aeration 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 may assist in moving light oil through the sediment into the lake 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.

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

Pebble/cobble beaches are common along the Lake Ontario shoreline. 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 seep 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.

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, aeration 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 may assist in moving light oil through the sediment into the lake 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.

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

Cobble beaches are less common along the Lake Ontario shoreline than pebble/cobble beaches. Cobble beaches contain well sorted sediment clasts, 4.5-25 cm in diameter. West of Kingston, friable, bedded limestone acts as a source of cobble-sized material, resulting in irregular, plate shaped clasts.

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.

Heavy oil is 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.

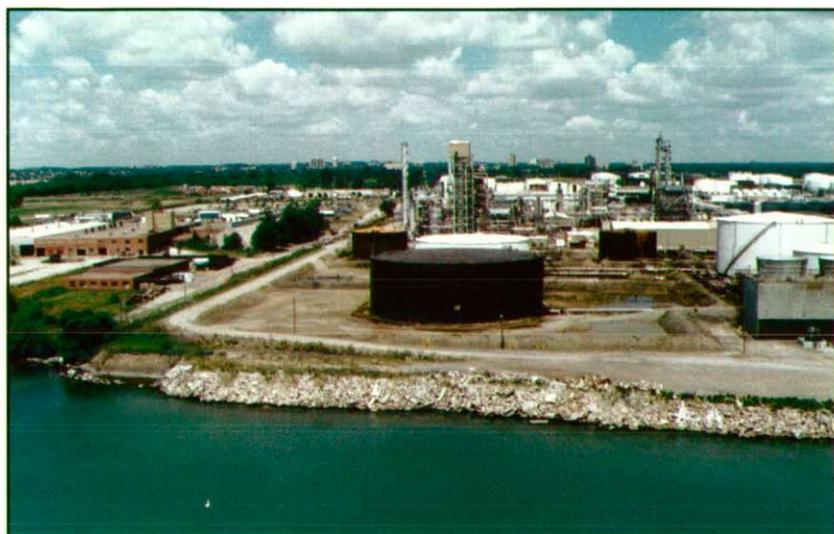
Most cobble beaches are extremely thin, steep, and rarely have easy road access, so use of heavy machinery is very restricted. The load bearing capacity of cobble beaches may support light equipment such as bobcats. If the cobbles are not too large, aeration using long tynes dragged through the sediment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

Low-pressure flushing may assist in moving light oil through the sediment into the lake 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.

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)

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. On Lake Ontario most rip rap shores are composed of roughly quarried limestone blocks. Other locally available material used includes 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, 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 high-pressure 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

Boulder beaches are extremely uncommon along Lake Ontario shores. Boulder beaches that have formed naturally are accumulations of large boulders (25+ centimetres diameter), the smaller sediments having been washed away by wave action in the high energy environment.

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.

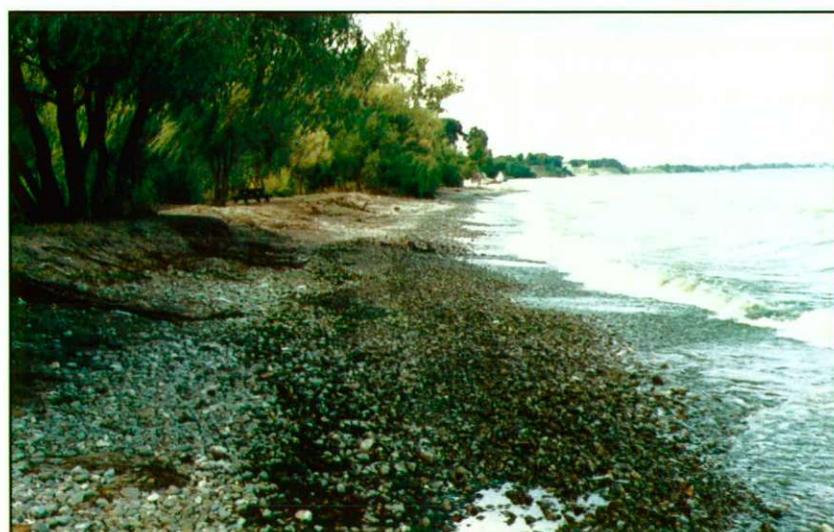
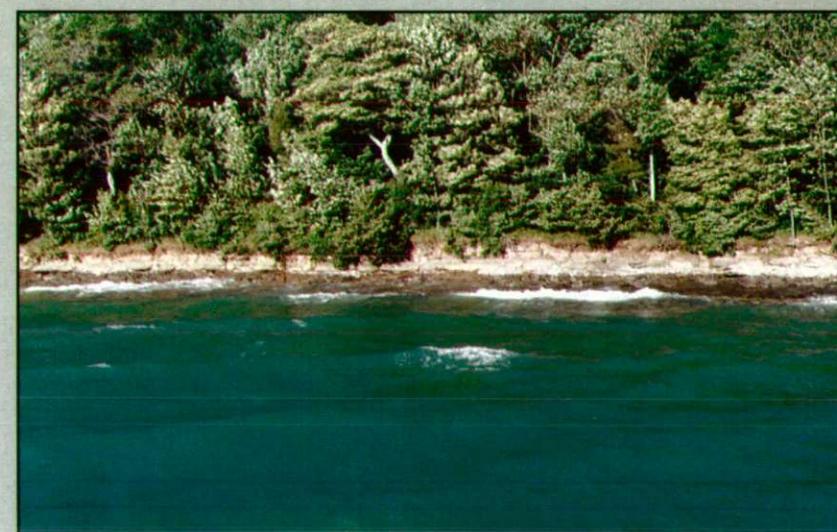
Heavy oil is likely to penetrate to a depth of 1 metre or more, and oil could remain trapped between boulders from where it will seep out over time if not cleaned. Very viscous oil may remain on the surface, and adhere to boulders where it will eventually weather and form an asphalt pavement.

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.



### ESI 10. Mixed Beach (% by sediment in DOE Database)

Mixed beaches are rare along the Lake Ontario shoreline. They are accumulations of very poorly sorted sediment including large amounts of coarse sediment (boulders and cobbles), and some finer materials (e.g. sand/silt). The percentage of component sediment types in each shore's case is expressed in descending order (e.g. boulders-60%; cobbles-30% and sand-10%) 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.

Where easy road access exists, heavier clean up equipment can be considered. However, 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.

### 9.2.3 Vegetated Shores

Shorelines dominated by vegetation are common features in sheltered environments along Lake Ontario. Coves protected by peninsulas, or the leeward edges of major Lake Ontario islands often are dominated by vegetated shores. The backwater bays of Prince Edward County (such as the Bay of Quinte) are excellent examples.

#### ESI 11. Low Vegetated Bank (Grass or Trees)

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.

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.

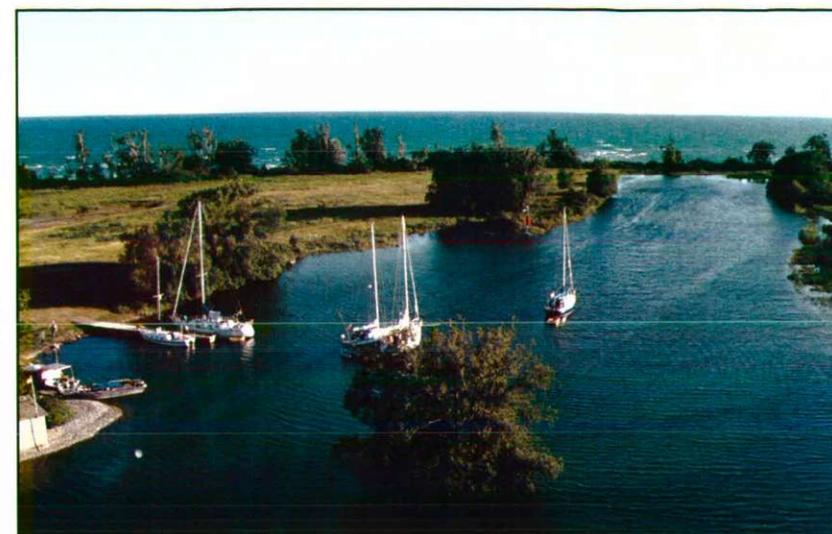
Due to the very low energy environment, stranded oil is unlikely to be removed naturally. The impact of spilled oil can be effectively reduced if there is time to manually spread sorbent material along the shore prior to oiling.

#### ESI 12. Delta Mud Flat

No deltaic mud flat shorelines are present along Lake Ontario.

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 13a. Fringing Wetland

Fringing wetlands are a type of vegetated shoreline containing an abundance of aquatic vegetation. They are usually much smaller than broad wetlands. Along Lake Ontario, 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.

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, but 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 disposal of oil as it is liberated from the shore.

#### ESI 13b. Broad Wetland

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

Broad wetlands are usually quite large (1 to 3 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.

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 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, but 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 Lake Ontario: Physical Overview

Lake Ontario is one of the largest freshwater lakes in the world. The lakeshore is densely populated, with close to 5 million Canadians living near its shoreline. Including islands, the Canadian shoreline of Lake Ontario is 620 kilometres in length.

The coast of Lake Ontario is characterized by bedrock outcrops in the eastern and western sections, with cliffs of unconsolidated sediments predominant along the north shore. Erosion rates are low on the northwest and south coasts as these are relatively sheltered environments (Owens, 1979). Maximum fetches (the area of open water over which waves are generated by wind) are approximately 250 kilometres along the axis of the lake, and wave energy levels increase to the east due to prevailing westerly winds that parallel the lake axis. The northeast section is a low energy environment due to the complex shoreline character (Owens, 1992).

## 10.1 Water Circulation and Shoreline Transport

In the event of a spill, 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. While overviews of circulation are not necessarily reliable measures of transport, the following information will assist response decision makers in assessing spill impact.

Longshore sediment transport is the mechanism by which sediment material is moved parallel to the coast (by wave-induced processes). Figure 3 shows the coastal environments and primary shore-zone transport directions for the Lake Ontario region. Table 2 summarizes the main features of each of the five subdivisions in Figure 3.

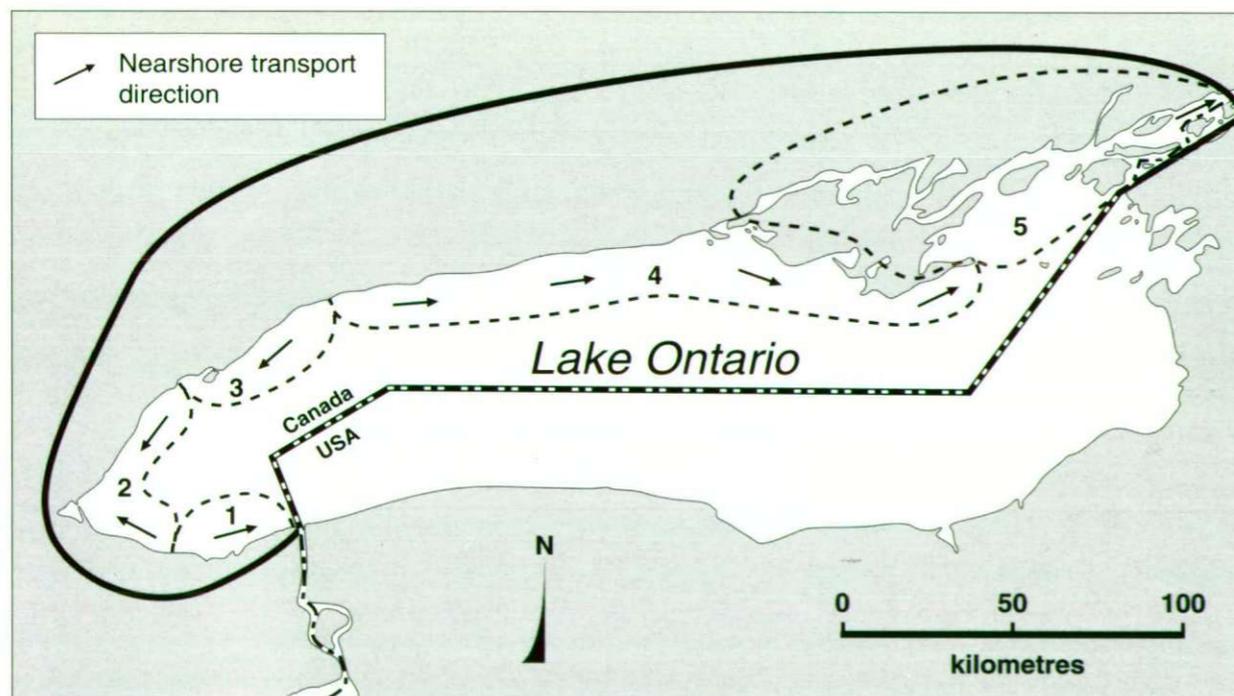


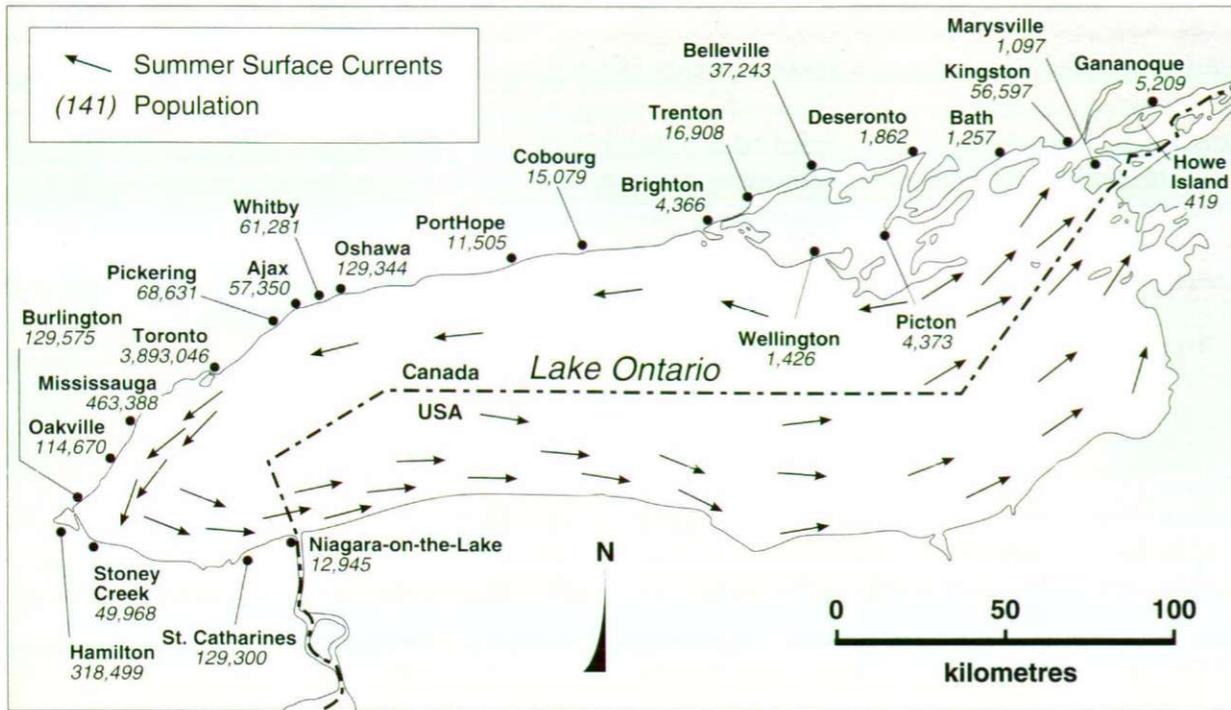
Figure 3: Coastal environments and primary shore-zone transport directions - Lake Ontario region.

(Owens, 1979)

Table 2: Coastal Environments of Lake Ontario

Subdivision	Relief and Geology	Coastal Zone		Fetch, Wave Exposure and Ice	Sediment Availability and Transport
		Shore-zone Character	Beach Character		
1. Southeast Coast	Low relief (<10 m); unconsolidated cliffs of predominantly clay-silt sediments	Straight coast of low cliffs with beaches across mouths of small rivers; many sections of artificial protection	Low, narrow beaches of sand, with pebble-cobble sediments adjacent to cliffed sections	Exposed to northeast (fetch 250 km), but sheltered coast because of predominantly offshore (westerly) winds; shore-zone ice up to 4 months/year	Limited sediment supply with transport to the east
2. Burlington Bar System	Sedimentary rocks outcrop in many sections, relief <10 m; some sections of unconsolidated materials	Straight, low coasts with large bay-barrier across Hamilton Harbour; many sections of artificial protection	Beaches absent or low and narrow except at Burlington Bar; this barrier has a high (2 m), wide sand beach	Exposed to east (fetch 250 km); sheltered coast because of predominantly offshore (westerly) winds; shore-zone ice up to 4 months/year	Sediments transported to the west, Burlington Bar is a convergency zone; sediments generally scarce along north coast of this system
3. Toronto Harbour System	Cliff heights decrease to east from a maximum of 100 m in Scarborough Bluffs; cliffs are unconsolidated silts, sands and gravel	Straight, high, cliffed coast gives way in west to large flying spit system that has been protected and stabilized by numerous artificial structures	Beaches absent or narrow in cliffed sections; Toronto spit beaches are low and narrow due to recent scarcity of sediments	Exposed to east and southeast (fetch 50-200 km), relatively sheltered because predominant west winds have maximum fetch of only 50 km; shore-zone ice up to 4 months/year	Sediments transported to the west, present-day supply of sediments is relatively scarce
4. North Coast-Southwest Prince Edward Peninsula	Unconsolidated cliffs (<15 m) give way in east to low, bedrock (limestone) shore-zone	North coast-straight, cliffed section with few beaches; the west coast of peninsula is an alternating sequence of rock headlands and bay-mouth barriers with many backshore marshes	Bay-mouth barriers generally have wide sand beaches with dunes; elsewhere sand-pebble beaches are absent or narrow	Exposed, high-energy coast; fetch 250 km; shore-zone ice up to 4 months/year	Sediment transport to east, material trapped in west-facing bays
5. Northeast Coast	Low relief; limestone outcrops give way east of Kingston to resistant Shield rocks	Complex coastline of channels, islands, headlands and bays; predominantly bedrock outcrops with few sections of unconsolidated cliffs; marshes in sheltered bays	Beaches absent or narrow; few sections of well-developed beaches; sediments are sand-pebble-cobble	Sheltered, low-energy coasts, fetches are generally <50 km; riverine processes east of Kingston; shore-zone ice up to 5 months/year	Sediments scarce; numerous local small transport system

(Owens, 1979)



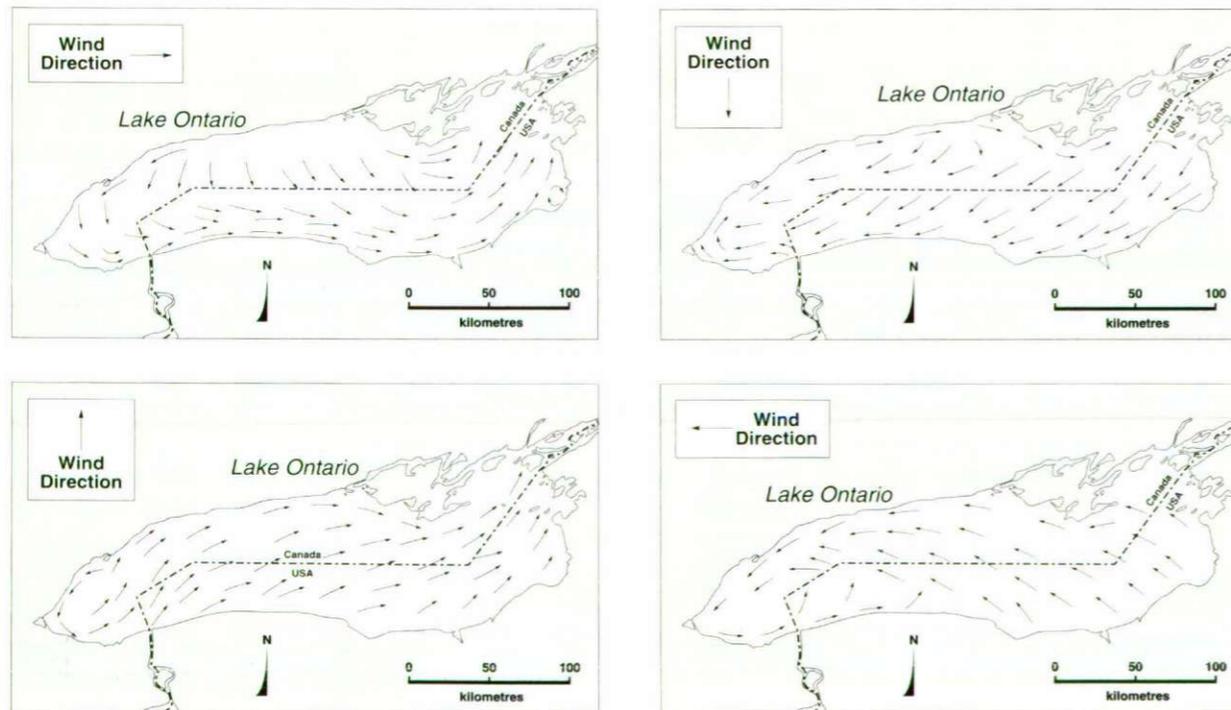
**Figure 4: Lake Ontario Overview, and Summer Surface Currents**

(Population Data Source: Statistics Canada Census, 1991)  
(Sailing Directions, Volume 1, Department of Fisheries and Oceans, 1986)

Wind-driven currents are the dominant surface circulation in the Great Lakes. Surface currents in Lake Ontario generally travel counterclockwise (see Figure 4), but the flow patterns are sensitive to wind direction, as seen in Figure 5. Water surface temperatures on Lake Ontario typically reach 24°C in summer. (A. Sauslesleja, 1986).

Figure 4 also gives general information such as communities and their populations.

**Figure 5: Lake Ontario Wind Direction and related Surface Circulation**



(Sailing Directions, Volume 1, Department of Fisheries and Oceans, 1986)

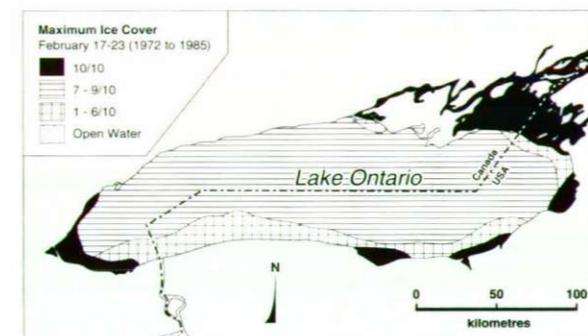
## 10.2 Ice Cover

“Initial ice formation normally begins in the Bay of Quinte during the first week of December. By the end of December ice begins to form in the bays and harbours at the western end of the lake. In the approaches to the St. Lawrence River the ice forms during the first half of January. An extensive ice cover does not normally develop.” (Sauslesleja, 1986). The maximum extent of ice occurs in February, but is confined mostly to the eastern end of the lake with total coverage of about 25% of lake area.

Maximum ice cover is 10% in a mild winter, while it can temporarily increase to 95% in a severe winter. Ice has formed as early as the third week of November and persisted as late as the first week of May. Ice may grow to a thickness of 20 to 60 cm in the sheltered harbours and bays during a normal winter. Ice on Lake Ontario normally starts to break up late in February, with ice covered areas becoming open water in early April. (Sauslesleja, 1986)

The average maximum and minimum ice coverage on Lake Ontario, at the normal time of greatest ice coverage is shown in Figure 6, for the period of 1972 to 1985.

**Figure 6a: Lake Ontario Maximum Ice Cover**



(Sauslesleja, 1986)

**Figure 6b: Lake Ontario Minimum Ice Cover**

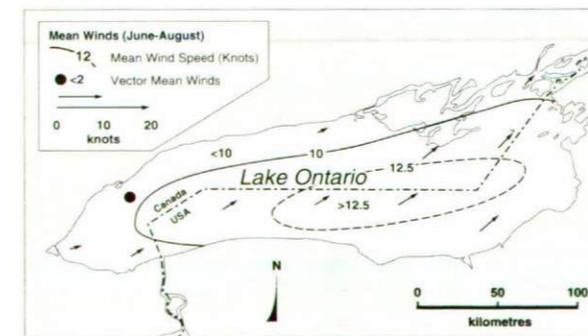


(Sauslesleja, 1986)

## 10.3 Wind and Waves

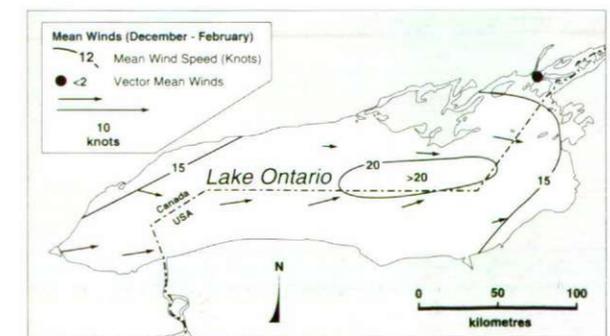
Figure 7 shows the mean winds information for Lake Ontario in summer and winter. Winter wave heights on Lake Ontario exceed 1 metre 60% of the time, with rare maximums of 3 to 6 metres possible. Summer wave heights exceed 1 metre only 25% of the time, with rare maximums of 2 to 4 metres possible. As the prevailing winds are out of the west over Lake Ontario, the mean annual significant wave height increases from 0.4 metres at Toronto to 0.8 metres at Main Duck Island, in the northeast end of the lake (Owens, et al., 1992).

**Figure 7a: Lake Ontario Summer Wind Information**



(Sauslesleja, 1986)

**Figure 7b: Lake Ontario Winter Wind Information**



(Sauslesleja, 1986)



# Environmental Sensitivity Maps for Lake Ontario's Canadian Shoreline



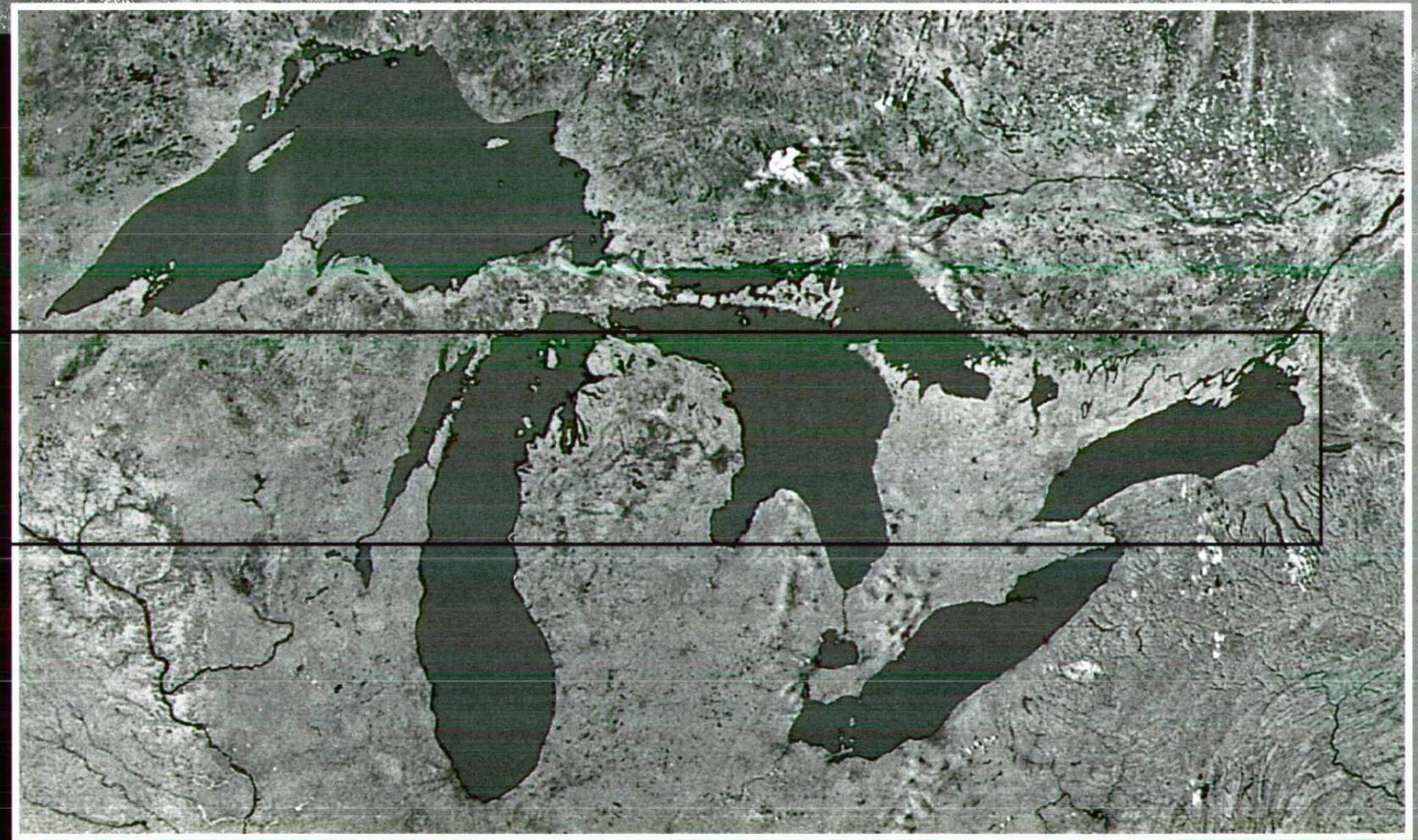
Environnement  
Canada

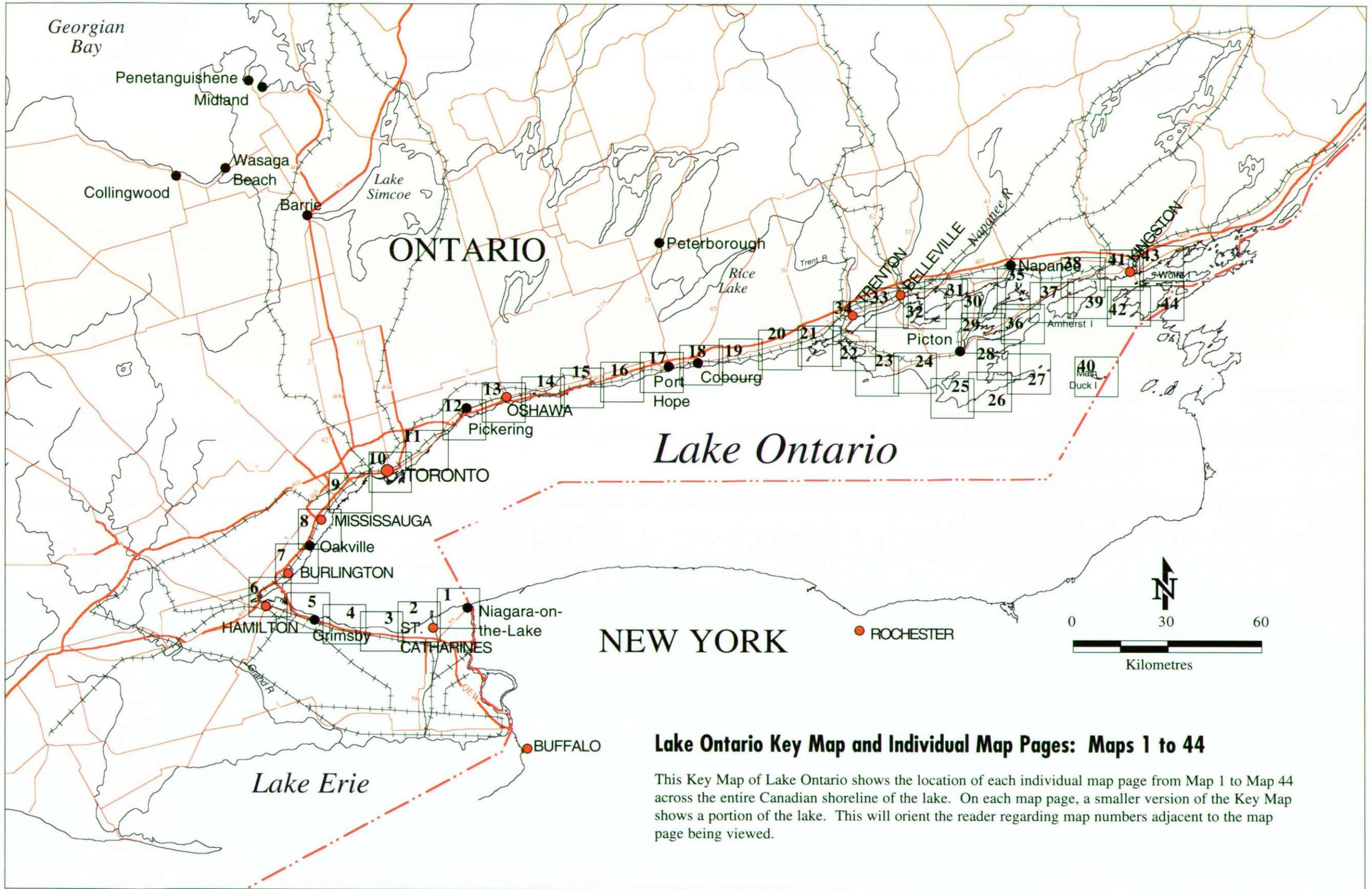
Environnement  
Canada

Conservation and  
Protection

Conservation et  
Protection

Environmental Protection  
Ontario Region





**Lake Ontario Key Map and Individual Map Pages: Maps 1 to 44**

This Key Map of Lake Ontario shows the location of each individual map page from Map 1 to Map 44 across the entire Canadian shoreline of the lake. On each map page, a smaller version of the Key Map shows a portion of the lake. 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 Niagara-on-the-Lake Water Treatment Plant Intake - Call (416) 295-4831.
-  2 Seasonal fish spawning occurs near the mouth of the Niagara River. Commercial and sport fishing activities have seasonal significance in this area.
-  3 Four Mile Creek Estuary is classified as an Area of Natural and Scientific Interest. This marsh area is a feeding habitat for provincially and regionally significant bird species and supports provincially significant plant species. The Four Mile Creek Wetland is an active feeding site for wading birds, a habitat for fur bearing mammals and provides winter cover for Cottontail Rabbits. This wetland supports seasonal fish spawning and is important for commercial fish harvesting activities.
-  4 Seasonal fish spawning occurs along the shore of Lake Ontario from Four Mile Creek to Mississauga Point: White Sucker, Brown Bullhead and Pumpkinseed in the Spring. Rainbow Trout spawn in Four Mile Creek in the Spring.
-  5 Eight Mile Creek Wetland is an active feeding site for wading birds, a habitat for fur bearing mammals and provides winter cover for rabbits and weasels. Spawning and commercial harvesting of coarse fish occur here.

43° 18' 36" N  
79° 11' 39" W

## Map 1

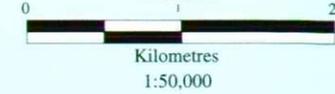
Contains Sections From NTS Map Numbers:  
**30M/3 & 6**



43° 18' 36" N  
79° 1' 33" W

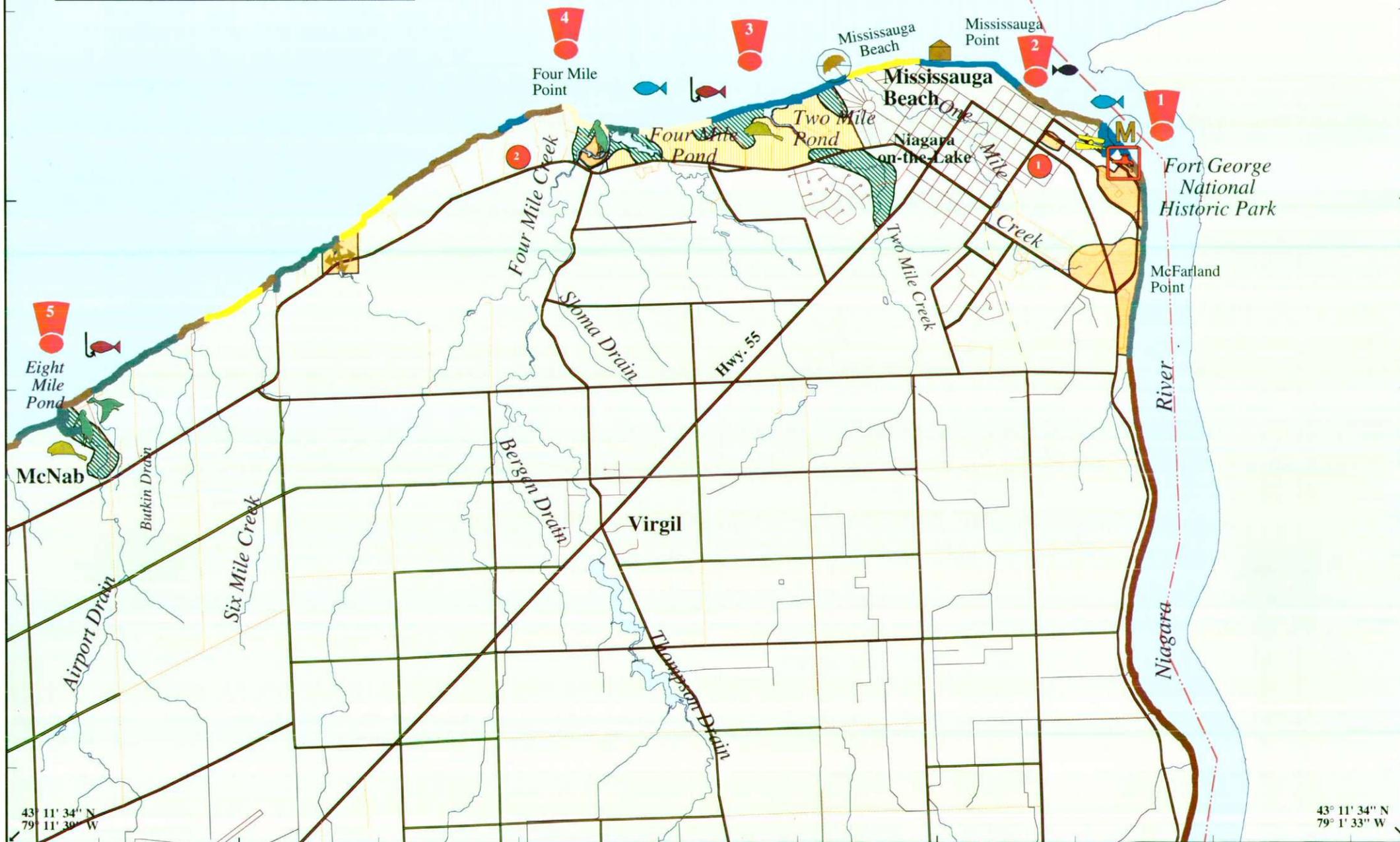


Scale



Outside study Area:  
For Environmental Sensitivity Information  
for Lake Ontario, contact United States  
N.O.A.A. For Niagara River, contact  
Environment Canada.

# Lake Ontario



43° 11' 34" N  
79° 11' 30" W

43° 11' 34" N  
79° 1' 33" W



**NOTES**

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

- 1** Eight Mile Creek Wetland is an active feeding site for wading birds, a habitat for fur bearing mammals and provides winter cover for rabbits and weasels. Spawning and commercial harvesting of coarse fish occur here.
- 6** Martindale Pond Marsh provides a habitat for waterfowl staging and production, feeding wading birds and supports seasonal fish spawning. Seasonal fish spawning occurs in Twelve Mile Creek: Rainbow Trout in Spring; Brown Trout, Coho Salmon and Chinook Salmon in Fall; Brook Trout in late Fall.
- 7** Seasonal fish spawning occurs in Fifteen Mile and Sixteen Mile Creeks. Fifteen-Sixteen Mile Creek Valley is classified as a Life Science Area of Natural and Scientific Interest. There are provincially significant Black Rat Snakes and plant species located here. This marsh is an important waterfowl staging and production area. Discharge to Lake Ontario occurs at a classic barrier beach. Charles Daley Park is important for recreational and educational activities. Fifteen and Sixteen Mile Creek Wetlands is a habitat for provincially significant animal and plant species. Locally, this marsh is significant for the presence of wading birds and for waterfowl staging and production.
- 8** Commercial and sport fishing occurs along the shore of Lake Ontario from west of Jordan Harbour to Port Weller.

## NOTES

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

- 7** Seasonal fish spawning occurs in Fifteen Mile and Sixteen Mile Creeks. Fifteen-Sixteen Mile Creek Valley is classified as a Life Science Area of Natural and Scientific Interest. There are provincially significant Black Rat Snakes and plant species located here. This marsh is an important waterfowl staging and production area. Discharge to Lake Ontario occurs at a classic barrier beach. Charles Daley Park is important for recreational and educational activities. Fifteen and Sixteen Mile Creek Wetlands is a habitat for provincially significant animal and plant species. Locally, this marsh is significant for the presence of wading birds and for waterfowl staging and production.
- 8** Commercial and sport fishing occurs along the shore of Lake Ontario from west of Jordan Harbour to Port Weller.
- 9** Seasonal fish spawning occurs in Twenty Mile Creek and Jordan Harbour. Jordan Station Marsh is a feeding habitat for birds, it is a habitat for fur bearing mammals and provides winter cover for muskrats. This marsh is regionally significant for waterfowl staging and production and fish spawning and supports provincially significant plant species. Jordan Valley is classified as an Area of Natural and Scientific Interest. It is a Life Science ANSI due to the presence of provincially significant wading and colonial waterbirds and Virginia Arrow Arum plant species. This is a regionally significant fish spawning and Yellow Water Lily area. Two earth science Areas of Natural and Scientific Interest occur in the area: Twenty Mile Creek is a classic drowned river mouth and the Ball's Falls region is a bedrock gorge. This is a heavily used tourist area due to the presence of hiking trails along the Niagara Escarpment and canoe routes in Twenty Mile Creek and Jordan Harbour.
- 10** Vineland Water Treatment Plant Intake - Call (416) 295-4831.
- 11** Many residential houses and cottages are located along the Lake Ontario shoreline from Jordan Harbour to Grimsby.
- 12** Beamsville Water Treatment Plant Intake - Call (416) 295-4831.

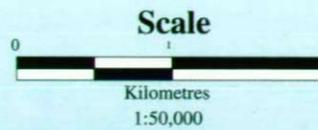


43° 15' 47" N  
79° 38' 24" W

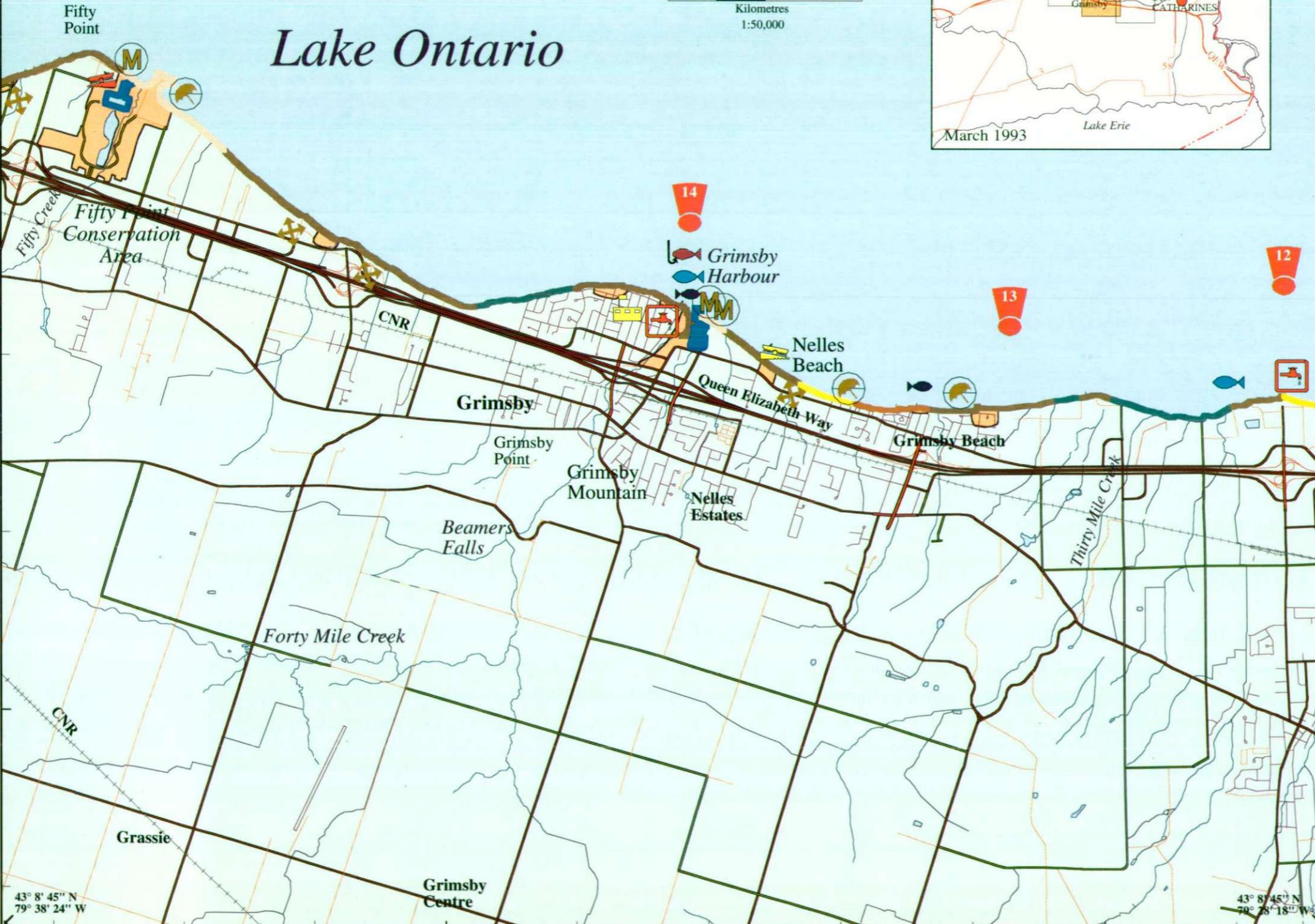
43° 15' 47" N  
79° 28' 18" W

# Map 4

Contains Sections From NTS Map Numbers:  
**30M/4 and 30M/3 & 6**



## Lake Ontario



### NOTES

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

- 12 Beamsville Water Treatment Plant Intake - Call (416) 295-4831.
- 13 Many residential houses and cottages are located along the Lake Ontario shoreline from Jordan Harbour to Grimsby.
- 14 Seasonal fish spawning occurs in Forty Mile Creek: Rainbow Trout in the Spring and Coho Salmon in Fall. Grimsby Water Treatment Plant Intake - Call (416) 945-4323. Commercial and sport fishing activities have seasonal significance near the shore of Lake Ontario from the mouth of Thirty Mile Creek to Fifty Point.

# NOTES

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

**15** Numerous recreational beaches, parks and residential and cottage dwellings occur along the Lake Ontario shoreline from Van Wagners Beach to Fifty Point. Residential housing exists along the Lake Ontario shoreline between Winona Park and Cherry Beach.

**16** Three municipal water intakes, under the jurisdiction of Hamilton Wentworth, are located between Van Wagners Beach and Hamilton Beach - Call (416) 526-4111.



## Map 5

Contains Sections From NTS Map Numbers:  
**30M/4 and 30M/5**



# Lake Ontario



**NOTES**

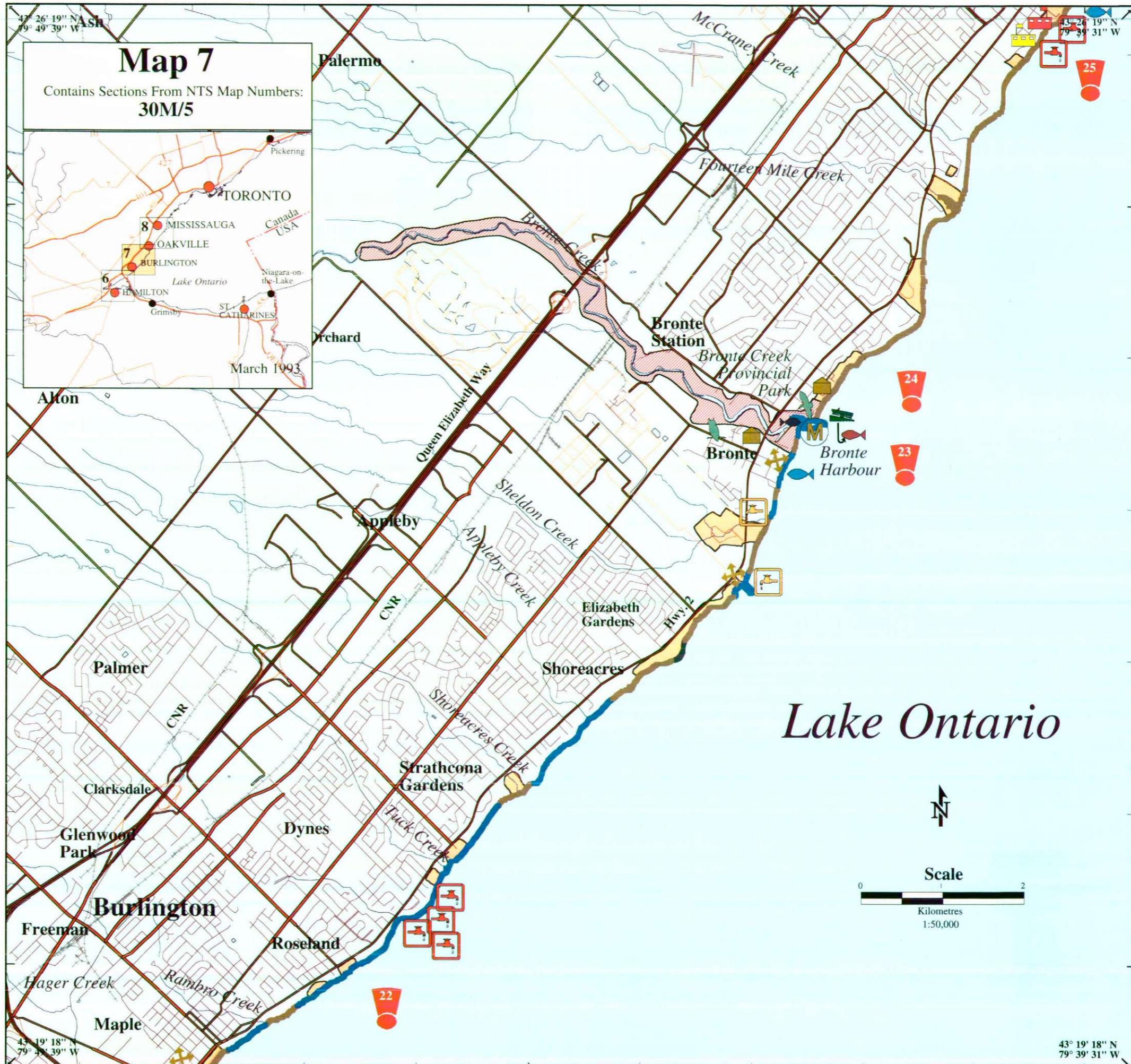
A red exclamation point symbol is used on the maps to catch the responder's attention.

- 16** Three municipal water intakes, under the jurisdiction of Hamilton Wentworth, are located between Van Wagners Beach and Hamilton Beach - Call (416) 526-4111.
- 17** The Cootes Paradise/Royal Botanical Gardens area is classified as an Area of Natural and Scientific Interest. It is the only remaining large marsh on the western shores of Lake Ontario and supports several provincially rare plant species. Seasonal fish spawning occurs along Lake Ontario at Cootes Paradise Wetlands: Brown Bullhead in Spring and White Perch and Carp in Summer. The Cootes Paradise Wetlands/Royal Botanical Gardens area is an active breeding area for waterfowl and wading birds. It is a habitat for fur bearing mammals and provincially and regionally rare plant species. This wetland supports seasonal fish spawning, migratory raptors and is important for recreational nature appreciation and tourism activities.
- 18** Seasonal fish spawning occurs in the Hamilton Harbour and Burlington Bay area: White Sucker, White Bass, Northern Pike, Freshwater Drum and Channel Catfish in Spring; Carp, Yellow Perch, Large and Small Mouth Bass in Summer. Commercial and sport fishing activities have seasonal significance along the shorelines of Lake Ontario and Hamilton Harbour. Numerous fish and bird habitats are proposed for Hamilton Harbour: Near Willow Point, at Coots Paradise, at LaSalle Park and near the Burlington Canal.
- 19** Nesting sites for provincially significant colonial waterbirds occur at Windermere Basin and on Stelco property.
- 20** Seasonal fish spawning occurs at Burlington Beach: Rainbow Smelt in Spring.
- 21** Burlington Skyway Water Treatment Plant Intake - Call (416) 827-2151.
- 22** Four water intakes under the jurisdiction of the municipality of Burlington - Call (416) 827-2151.

## NOTES

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

-  Four water intakes under the jurisdiction of the municipality of Burlington - Call (416) 827-2151.
-  The Bronte Creek Valley is classified as a Nature Reserve. Its significance is attributed to excellent exposures of Pleistocene geological rock formations. The Bronte Creek Valley is classified as an Environmentally Sensitive Area. It serves as a vital link in migratory routes for waterfowl and raptors. Bronte Creek is a migratory route for Chinook and Coho Salmon, and spawning Smallmouth Bass. This area is a habitat for nationally and provincially rare plants, rare breeding colony birds and is important for high use nature appreciation and educational activities. Seasonal fish spawning occurs in Bronte Creek: White Sucker, Rainbow Trout and Rainbow Smelt in Spring and Chinook Salmon, Coho Salmon, and Brown Trout in Fall.
-  Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
-  Oakville Water Treatment Plant Intakes - Call (416) 827-2151. Seasonal fish spawning occurs in Oakville Creek: Rainbow Trout in Spring and Chinook Salmon, Coho Salmon and Brown Trout in Fall.





**NOTES**

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

- 25** Oakville Water Treatment Plant Intakes - Call (416) 827-2151. Seasonal fish spawning occurs in Oakville Creek: Rainbow Trout in Spring and Chinook Salmon, Coho Salmon and Brown Trout in Fall.
- 26** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- 27** The Joshua Creek Valley is classified as an Environmentally Sensitive Area. There are approximately 5 acres of sand dunes which are recognized as unusual landforms in the area. This area supports nationally and provincially significant plant and tree species. Responders should take care not to damage this sensitive area. The Joshua Creek Marsh is an active feeding area for waterfowl and wading birds and a habitat for fur bearing mammals. This marsh supports nationally and provincially significant plant species.
- 28** The Rattray Marsh is classified as an Area of Natural and Scientific Interest. It is the last remaining lakefront marsh between Burlington and Toronto and provides a good example of marshland zonation. It is a sheltered environment with periodically exposed mud flats. The Rattray Marsh is designated as an Environmentally Sensitive Area. The marsh is an active feeding area for provincially significant Cattle Egret and regionally significant Great Blue Heron. It provides a habitat for fur bearing mammals, fish spawning, winter cover for several animals and is important for high use recreational nature appreciation and educational activities.
- 29** Lorne Park Water Treatment Plant Intake - Call (416) 791-9400. Lorne Park Estates is a residential housing area north of Shoreline Park.

## NOTES !

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

-  Lakeview Water Treatment Plant Water Intakes - Call (416) 791-9400.
-  Seasonal fish spawning occurs along the Lake Ontario shoreline at Marie Curtis Park to J C Saddington Park: White Sucker in Spring; Alewife in early summer and Lake Trout in Fall. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario. Seasonal fish spawning occurs at the mouth of the Credit River and Etobicoke Creeks: Rainbow Trout in Spring and Brown Trout, Coho Salmon and Chinook Salmon in Fall. An artificial wetland is under construction at Lakefront Promenade Park.
-  New Toronto Water Treatment Plant Intakes - Call (416) 392-8222.
-  The Humber River Marsh is an active feeding and breeding habitat for colonial waterbirds and wading birds. It is a habitat for several fur bearing mammals, supports seasonal fish spawning and is important for high use recreational boating, fishing and nature appreciation activities. This marsh area is designated as an Environmentally Sensitive Area. Seasonal fish spawning occurs in the Humber Bay area and at the mouth of the Humber River: Rainbow Trout, Rainbow Smelt and White Sucker in Spring; Gizzard Shad in late Spring; Alewife in early summer and Brown Trout and Lake Trout in Fall.
-  The High Park area is classified as an Environmentally Sensitive Area. It is a distinct sample of the remnant Lake Iroquois Sand Plain and it provides a habitat for the last extensive open oak woodland in the Metro Toronto and Region Conservation Authority jurisdiction. It supports numerous biological, rare plant and bird communities. The High Park Prairie Slope is classified as a Life Science Area of Natural and Scientific Interest. It contains remnants of oak forests along three ravines and remnants of semi-prairie habitat along the northeast side of Grenadier Pond.



## NOTES

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

**34** The High Park area is classified as an Environmentally Sensitive Area. It is a distinct sample of the remnant Lake Iroquois Sand Plain and it provides a habitat for the last extensive open oak woodland in the Metro Toronto and Region Conservation Authority jurisdiction. It supports numerous biological, rare plant and bird communities. The High Park Prairie Slope is classified as a Life Science Area of Natural and Scientific Interest. It contains remnants of oak forests along three ravines and remnants of semi-prairie habitat along the northeast side of Grenadier Pond.

**35** The Hanlan Area of the Toronto Islands is classified as an Environmentally Sensitive Area due to rare plants. The Wildlife Sanctuary on Forestry Island is classified as an Environmentally Sensitive Area. Island Filtration Plant Water Intakes - Call (416) 392-8222.

**36** Mugg's Island is classified as an Environmentally Sensitive Area and a Wildlife Sanctuary. Seasonal fish spawning occurs along the embayments and southern shore of the Toronto Islands-Inner Harbour.

**37** Snake Island is classified as an Environmentally Sensitive Area with rare plant species. The East Ward's Island is classified as an Environmentally Sensitive Area due to the presence of a limited dune ridge formation and rare plant species.

**38** Seasonal fish spawning occurs in the embayments in Tommy Thompson Park. Tommy Thompson Park is classified as an Environmentally Sensitive Area. It is the location of one of only two Caspian Tern colonies in Lake Ontario and supports five rare plant species. Tommy Thompson Park of the Outer Toronto Harbour is an important colonial waterbird nesting region.

**39** Seasonal fish spawning occurs in the embayments of Ashbridges Bay Park.



## Map 10

Contains Sections From NTS Map Numbers:  
**30M/11**

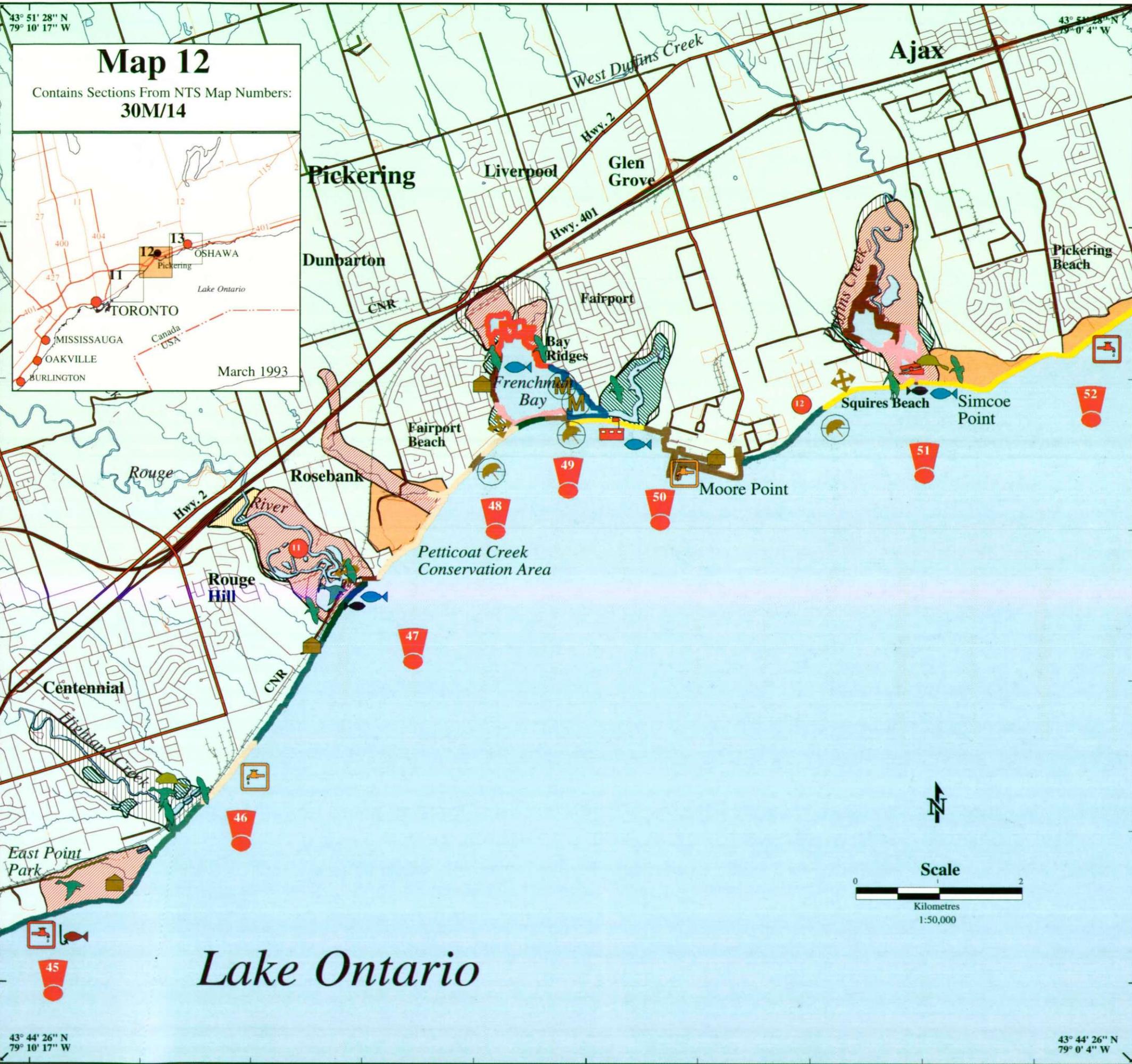


## NOTES

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

-  Seasonal fish spawning occurs in the embayments of Ashbridges Bay Park.
-  High use recreational beaches occur along the shore of Lake Ontario from Woodbine Beach to Balmy Beach.
-  R.C. Harris Water Treatment Plant Intake - Call (416) 392-8222. The Fallingbrook Woods is classified as an Environmentally Sensitive Area. It provides a habitat for nationally rare White Sassafras.
-  Scarborough Pump Station Water Intakes - Call (416) 392-8222. The Lake Ontario shoreline at the western end of the Scarborough Bluffs is a significant waterfowl habitat. Seasonal fish spawning occurs in the sheltered embayments of Bluffers Park.
-  The Scarborough Bluffs are classified as Environmentally Sensitive Areas. They exhibit the most complete record of Pleistocene geology in North America and are deemed a Provincially Significant Area. The Scarborough Bluffs are classified as Earth Science Areas of Natural and Scientific Interest. The Scarborough Bluffs are the highest and most continuous stretch of shoreline cliffs in the district. They are one of the last areas in the region where the Lake Iroquois shoreline can be observed. The site has high scientific and educational value.
-  Guild Woods is classified as an Environmentally Sensitive Area. It provides a habitat for provincially and regionally rare plant species and is important for recreational nature appreciation activities.
-  Easterly Municipal Filtration Plant Water Intake - Call (416) 392-8222. The East Point Park is classified as an Environmentally Sensitive Area. It supports rare plant species and is a stopover point for migratory birds. This park contains an exposed geologic section considered significant for comparative purposes.





**NOTES**

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

- 45** Easterly Municipal Filtration Plant Water Intake - Call (416) 392-8222. The East Point Park is classified as an Environmentally Sensitive Area. It supports rare plant species and is a stopover point for migratory birds. This park contains an exposed geologic section considered significant for comparative purposes.
- 46** The Highland Creek Wetlands provide a habitat for regionally rare plant and bird species.
- 47** Seasonal fish spawning occurs at the mouth of the Rouge River. The Rouge River Marsh is classified as an Environmentally Sensitive Area, a Wilderness Area and National Wildlife Area. The Lower Rouge Marsh Area is an Area of Natural and Scientific Interest. The Rouge River Marsh is an important bird migratory and feeding site and a habitat for several rare vascular plants.
- 48** The Petticoat Creek Forest is classified as an Environmentally Sensitive Area due to rare plants.
- 49** Seasonal fish spawning occurs along the shores of Frenchman Bay. Frenchman Bay Marsh is an Environmentally Sensitive Area as it contains the greatest variety of fishes of all waterfront areas. The Frenchman Bay Wetland is an active feeding area and important migratory bird stopover.
- 50** A fish farming facility and seasonal fish spawning occur along Lake Ontario at Pickering Nuclear Generating Station.
- 51** Seasonal fish spawning occurs along Lake Ontario at Duffin Creek. The Duffin Creek Wetland is an Environmentally Sensitive Area that is valuable due to its undisturbed state. The Duffin Creek Marsh is an important bird nesting, feeding and migratory stopover area and supports seasonal fish spawning.
- 52** Ajax Water Treatment Plant Intake - Call (416) 668-7711.

**NOTES**

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

- 

Ajax Water Treatment Plant Intake - Call (416) 668-7711.
- 

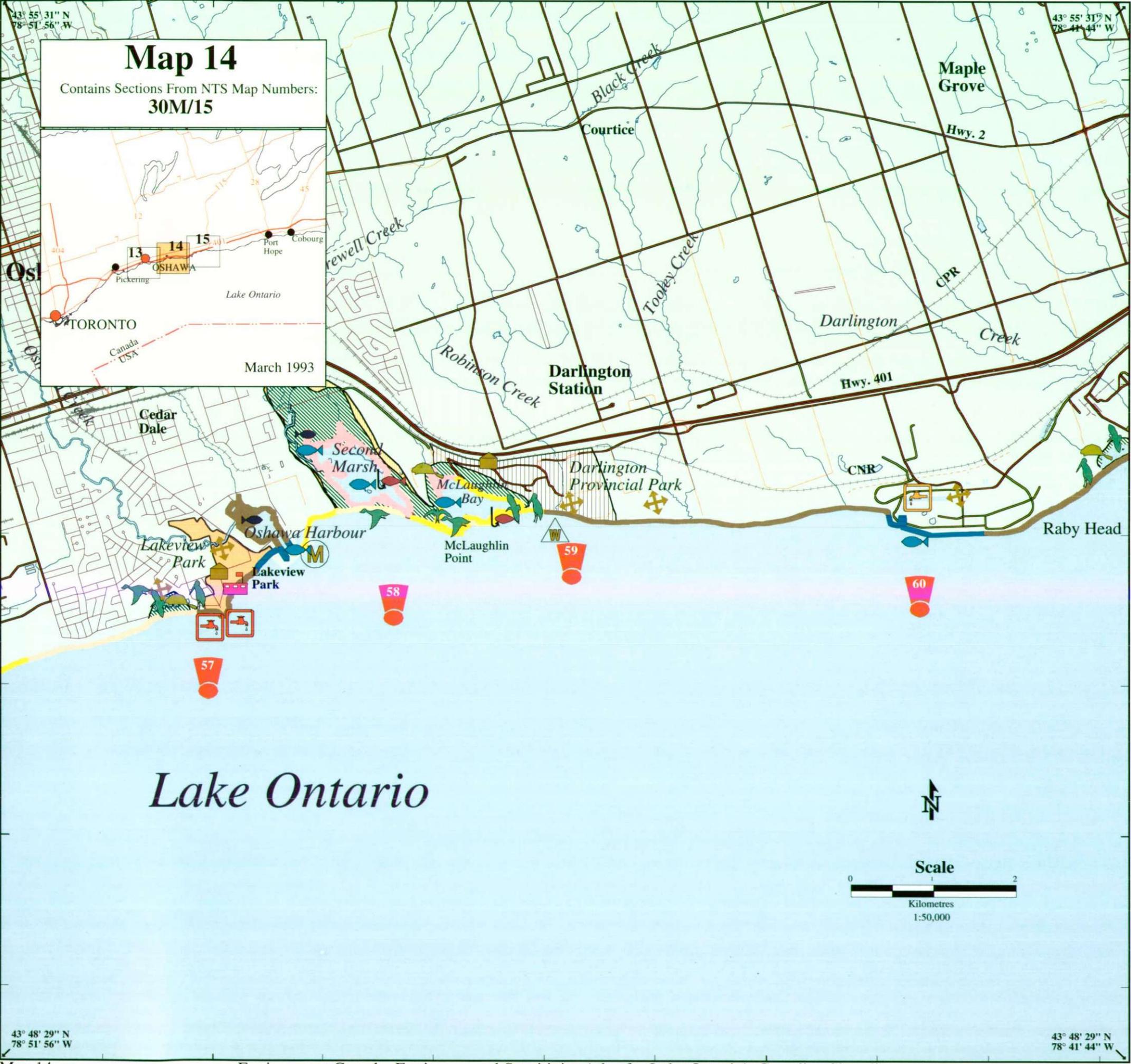
Carruther's Creek Marsh is an Environmentally Sensitive Area. This wetland is an important bird migrating area; it supports regionally rare nesting birds, provincially significant plant species and is one of 3 significant waterfront marshes remaining in the Metro Toronto and Region Conservation Authority jurisdiction. Carruther's Creek Marsh is a habitat for provincially significant plant and animal species and is a highly significant migratory passerine stop-over point. It supports several fur bearing species, is a feeding habitat for colonial waterbirds and wading birds and is a recreational nature appreciation area. Seasonal fish spawning occurs in this marsh.
- 

Fish farming activities occur at the Glenwood Fish Hatchery. The Cranberry Marsh is classified as an Area of Natural and Scientific Interest. It is separated from Lake Ontario by a classic gravel beach and sand bar. This marsh supports a diversity of vegetation and is designated as an Environmentally Sensitive Area. Cranberry Marsh is an active migratory and breeding waterfowl area and it is a habitat for marsh birds and fur bearing mammals. It is an internationally known staging area for migrating raptors. The Lynde Marsh is a resting station for migrating waterfowl and monarchs, it is a habitat for fur bearing mammals, it supports seasonal fish spawning and is important for recreational activities.
- 

Whitby Water Treatment Plant Intakes - Call (416) 668-7711.
- 

Seasonal fish spawning occurs along the shore of Lake Ontario at Corbett Creek. The Lower Corbett Creek Wetland is an active feeding area for colonial waterbirds and wading birds and it is a habitat for fur bearing mammals. It provides winter cover for animals, a fish spawning environment and is a recreational nature appreciation area.





**NOTES**

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

**57** The Pumphouse Marsh is an active feeding area for colonial water birds, waterfowl and wading birds. It provides a habitat for fur bearing mammals, winter cover for pheasant and is a recreational nature appreciation area. Oshawa Water Treatment Plant Intakes - Call (416) 723-4623.

**58** Seasonal fish spawning occurs in Oshawa Creek: Rainbow Trout in Spring and Coho Salmon in Fall. Seasonal fish spawning occurs in Farewell Creek: Rainbow Trout in Spring; Chinook Salmon in Fall. The Second Marsh is a significant habitat for migratory waterfowl breeding and staging, it is a habitat for several fur bearing mammals and is an important fish spawning and seasonal commercial fish harvesting area. The Second Marsh is classified as an Area of Natural and Scientific Interest. This marsh is the largest lake front cattail marsh supporting the highest concentration of waterfowl along this section of Lake Ontario shoreline. This marsh is part of the Oshawa Valleylands Conservation Area.

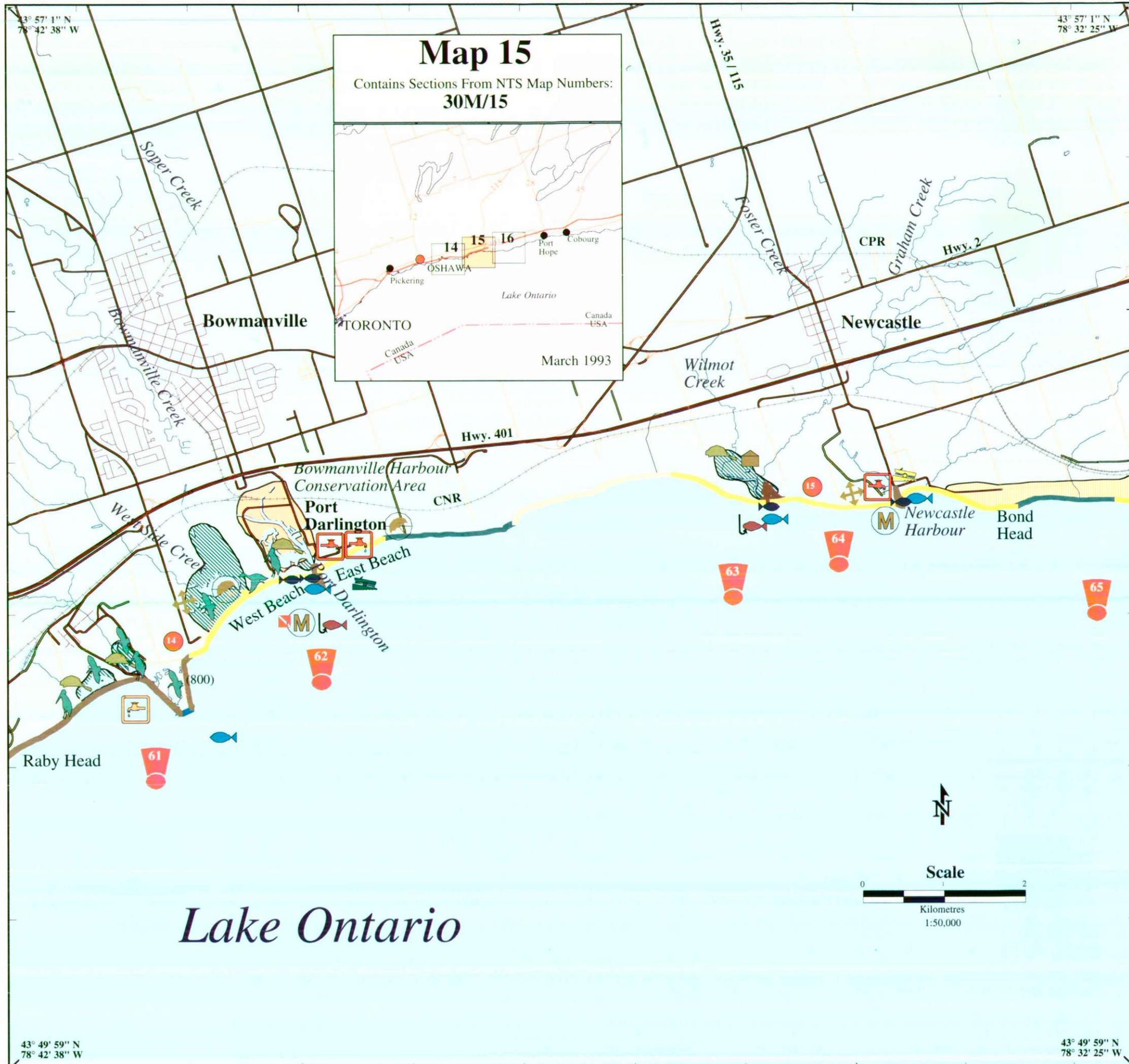
**59** The McLaughlin Bay Wetland is an active feeding area for colonial water birds, waterfowl, wading birds and shorebirds. This wetland is a highly significant migratory bird stopover and waterfowl staging area, a habitat for fur bearing mammals and is important for seasonal commercial fish harvesting and recreational hunting activities. Darlington Provincial Park is important for recreational and educational activities.

**60** Seasonal fish spawning occurs at the Darlington Generating Station water intake. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.

## NOTES

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

- 61** The Raby Head #1 Wetland is an active feeding area for birds, a habitat for fur bearing mammals and provides winter cover for pheasant. The Raby Head #2 Wetland supports feeding colonial waterbirds, wading birds and fur bearing mammals. Seasonal fish spawning occurs in creeks along the Lake Ontario shoreline from Port Darlington to Raby Head.
- 62** The Westside Creek Wetland is an active feeding area for birds and supports several fur bearing mammals. This area is part of the Bowmanville Harbour Conservation Area. The Pawson Marsh is an active feeding area and resting stop for birds, it provides a habitat for fur bearing mammals, winter cover for pheasant and is important for commercial fish harvesting and recreational activities. This area constitutes part of the Bowmanville Harbour Conservation Area. Bowmanville Water Treatment Plant Intakes - Call (416) 668-7711.
- 63** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario. The Lower Wilmot Creek Wetland is regionally significant for fish spawning, provides a habitat for fur bearing mammals and is important for commercial fish harvesting and high use recreational fishing.
- 64** Newcastle Water Treatment Plant Intake - Call (416) 668-7711. Seasonal fish spawning occurs in creeks along the shores of Lake Ontario, at Bond Head and Wilmot Creek.
- 65** The Bond Head Bluff region is classified as an Earth Science Area of Natural and Scientific Interest. Bond Head Bluff is a cliff with a broad precipitous face, varying from 8 to 46 meters in height. This post-glacial Lake Iroquois cliff formation represents the largest and most continuous section of shoreline bluffs with vegetation in this district.





**Map 16**  
 Contains Sections From NTS Map Numbers:  
**30M/16 and 30M/15**



**NOTES** !

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

- ! 65 The Bond Head Bluff region is classified as an Earth Science Area of Natural and Scientific Interest. Bond Head Bluff is a cliff with a broad precipitous face, varying from 8 to 46 meters in height. This post-glacial Lake Iroquois cliff formation represents the largest and most continuous section of shoreline bluffs with vegetation in this district.
- ! 66 Low level radioactive waste sites exist at Port Granby and Wesleyville. Seasonal fish spawning occurs in creeks at Crysler Point, Port Granby and Bouchette Point: Rainbow Trout in Spring. Commercial and sport fishing activities have seasonal significance along the Lake Ontario shoreline.
- ! 67 The Crysler Point Wetland is an active feeding area for wading birds and provincially significant White-eyed Vireo and is a habitat for several fur bearing mammals.

**NOTES** !

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

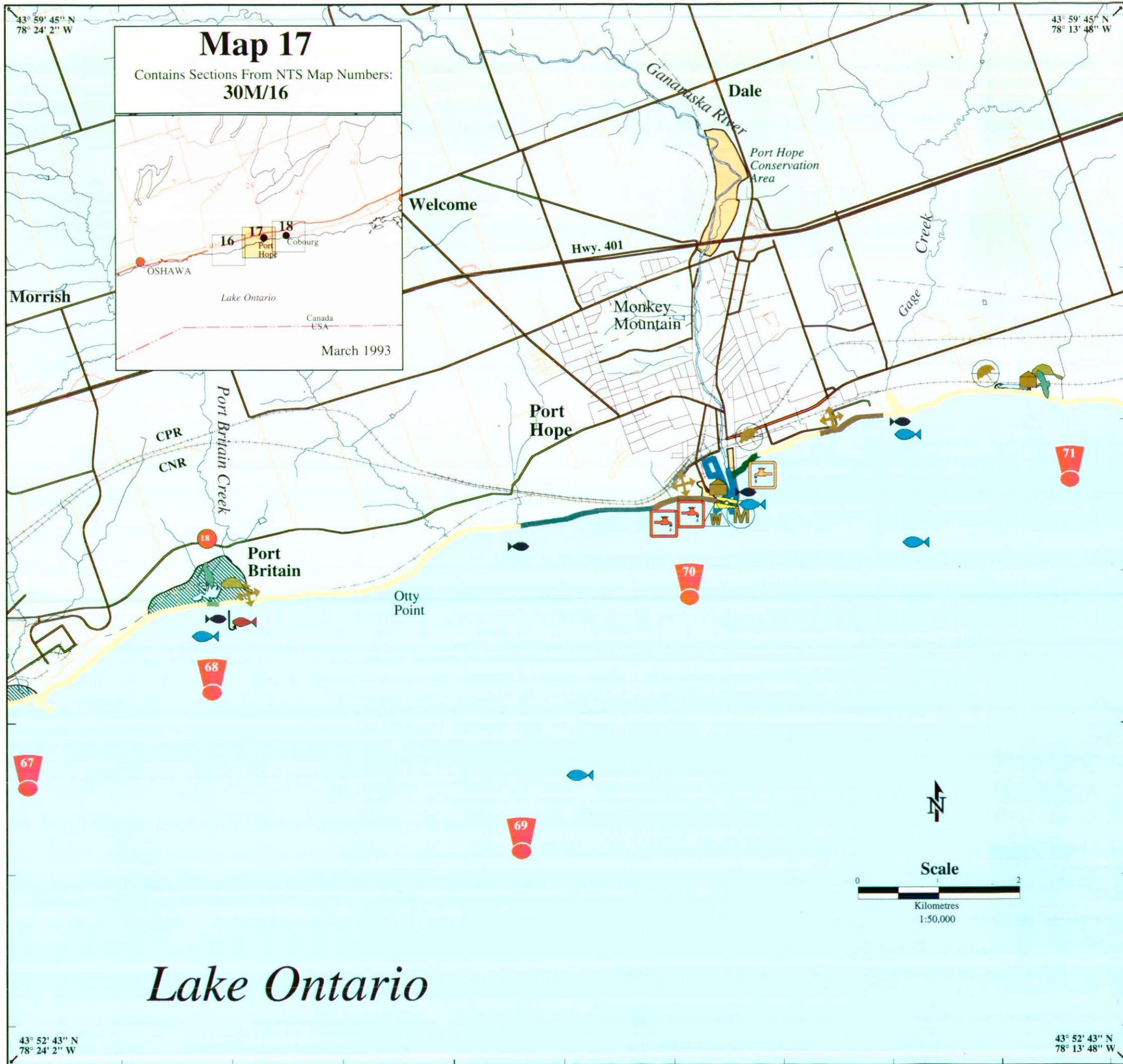
67 ! The Crysler Point Wetland is an active feeding area for wading birds and provincially significant White-eyed Vireo and is a habitat for several fur bearing mammals.

68 ! The Port Britain Wetland provides an active feeding habitat for wading birds, a warm water fish spawning environment, a habitat for several fur bearing mammals and is an area of seasonal commercial fisheries activity.

69 ! Seasonal fish spawning occurs in creeks along the shores of Lake Ontario from Port Britain to Gage Creek: Rainbow Trout in Spring, Brown Trout and Pacific Salmon in fall.

70 ! Port Hope Water Treatment Plant Water Intakes - Call (416) 885-2269.

71 ! The Peter Rock Marsh provides a habitat for provincially significant colonial waterbirds, animal species and regionally significant Flowering Rush. It is a habitat for fur bearing mammals and provides winter cover area for Eastern Cottontail.



44° 1' 4" N  
78° 14' 51" W

44° 1' 4" N  
78° 4' 38" W

### NOTES

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

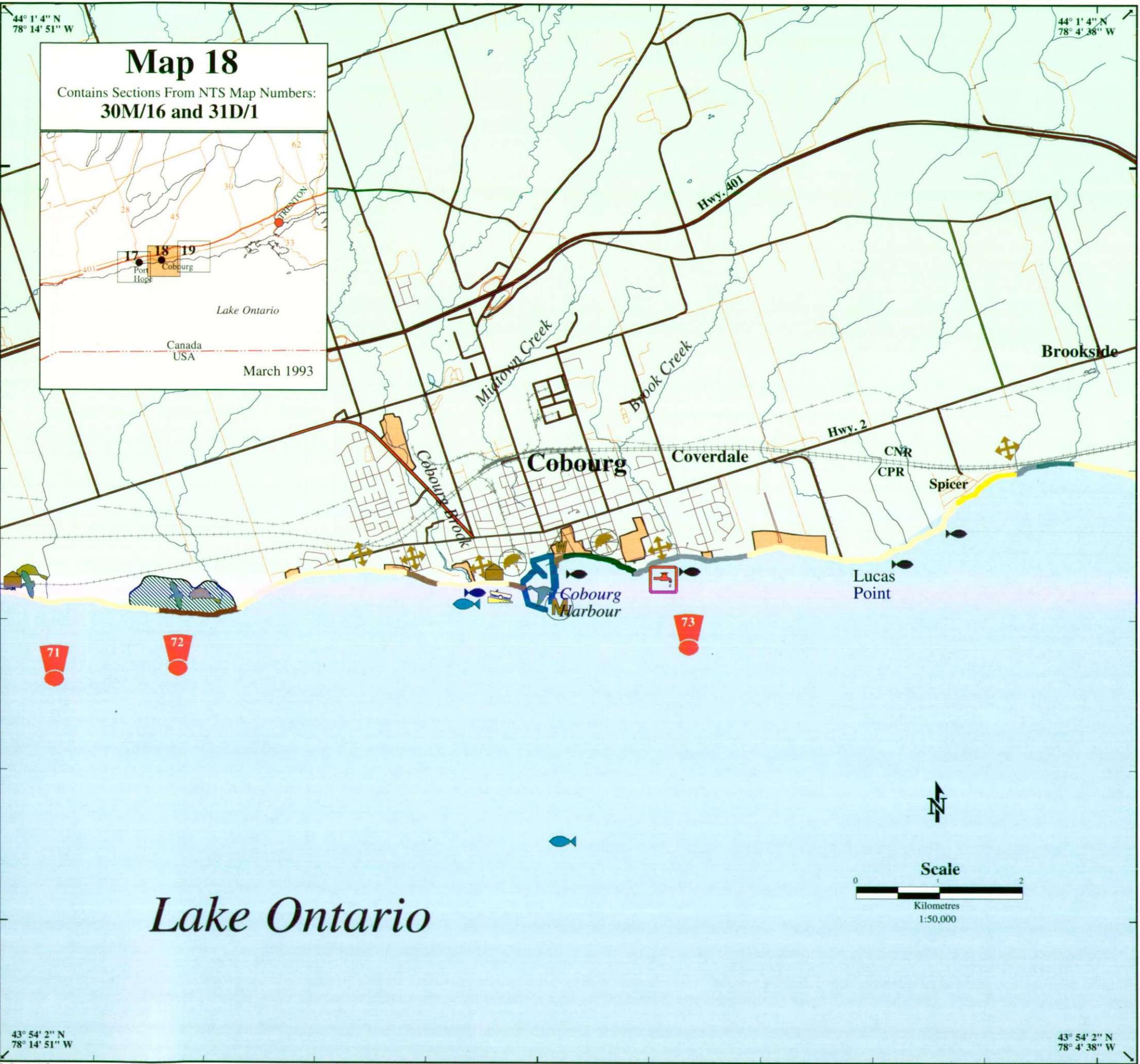
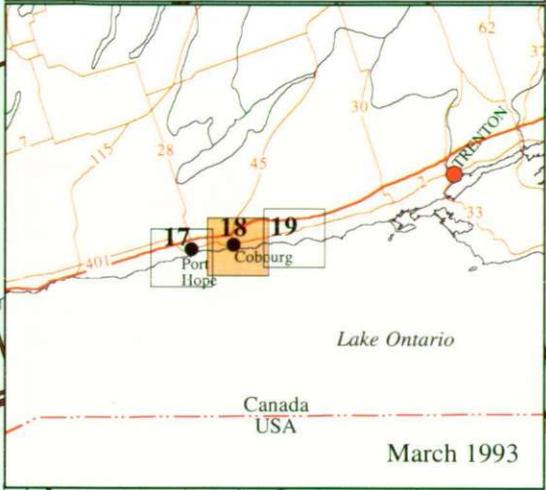
**71** The Peter Rock Marsh provides a habitat for provincially significant colonial waterbirds, animal species and regionally significant Flowering Rush. It is a habitat for fur bearing mammals and provides winter cover area for Eastern Cottontail.

**72** The Carr Marsh Wetland is classified as an Area of Natural and Scientific Interest due to its physical separation from Lake Ontario by a low, sparsely vegetated sand and cobble bar. Responders should take care not to damage this feature. The Carr Marsh Wetland is a feeding and nesting area for provincially significant Jefferson Salamanders, colony and water birds and is a habitat for several fur bearing mammals. The area also has local significance as a winter cover for deer.

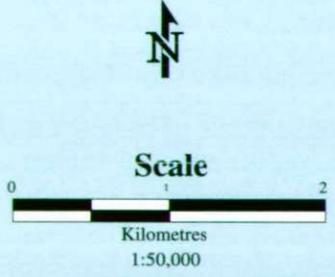
**73** Seasonal fish spawning and migration occurs in creeks along the shore of Lake Ontario from Peter Rock Marsh to Spicer: Rainbow Trout in Spring; Brown Trout and Coho Salmon in the Fall. Sport fishing has seasonal significance here as well. The Cobourg Harbour area supports seasonal recreational activities. Cobourg Water Treatment Plant Water Intake - Call (416) 372-2193.

## Map 18

Contains Sections From NTS Map Numbers:  
**30M/16 and 31D/1**



# Lake Ontario



43° 54' 2" N  
78° 14' 51" W

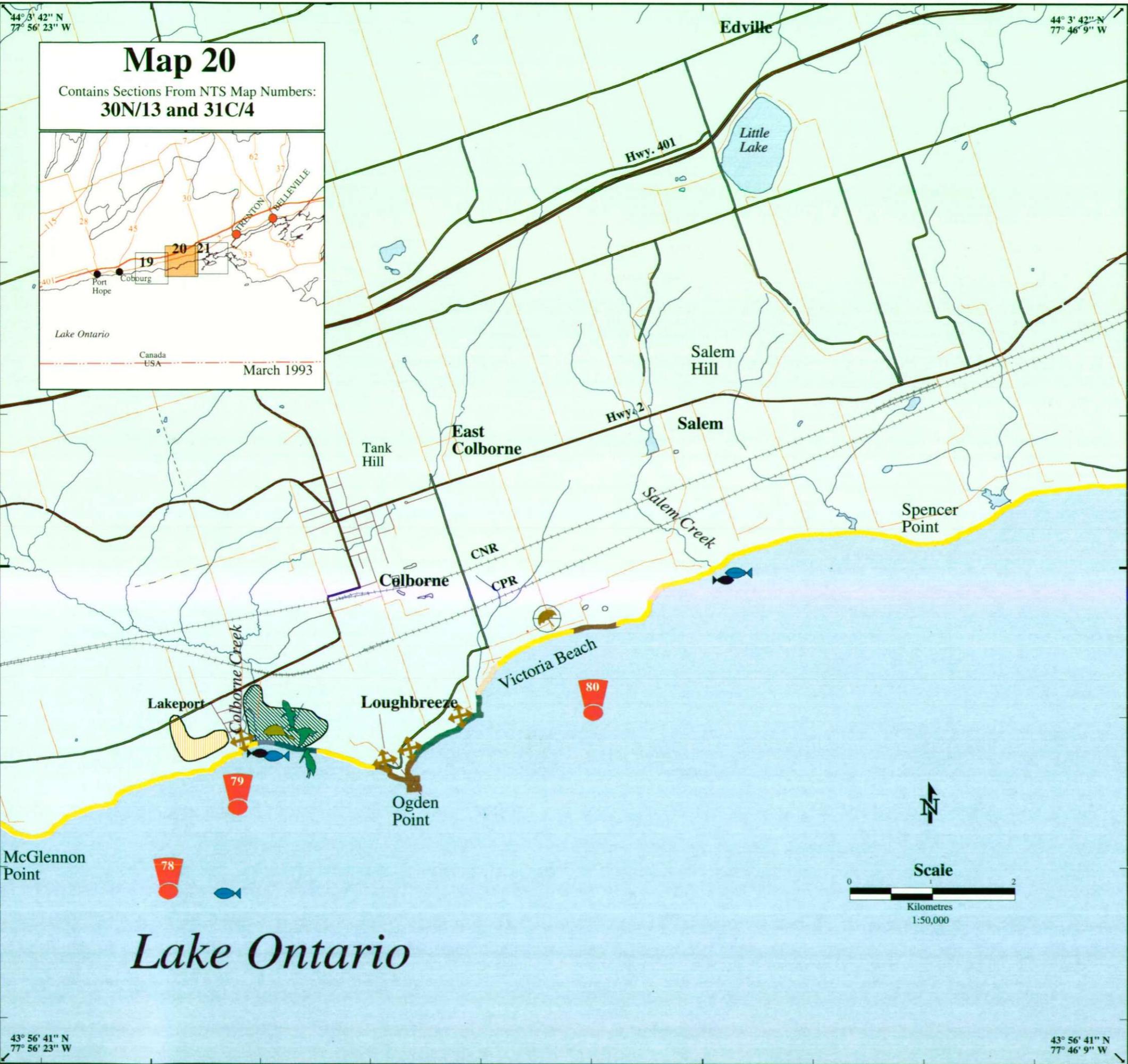
43° 54' 2" N  
78° 4' 38" W

## NOTES

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

- 74 Seasonal fish spawning occurs in creeks along the shoreline of Lake Ontario at Horton, Grafton and Shelter Valley Creeks: Rainbow Trout in Spring; Brown Trout, Rainbow Trout and Pacific Salmon in Fall.
- 75 Commercial and sport fishing has seasonal significance along the shoreline of Lake Ontario.
- 76 The Grafton Wetland is an active feeding area for provincially significant waterfowl and wading birds, raptors, a habitat for several fur bearing mammals and is important for fish spawning and recreational and commercial fisheries activity. The area also has local significance as a winter cover for deer.
- 77 The Wicklow Bay Wetland is an active feeding area for wading birds and provincially significant waterfowl and colony birds. It is a habitat for several fur bearing mammals and provides winter cover for Eastern Cottontail. The Wicklow Gravel Pit Wetland is also an active feeding area for colonial waterbirds. It provides a habitat for provincially and regionally significant plant species and supports several species of fur bearing mammals.





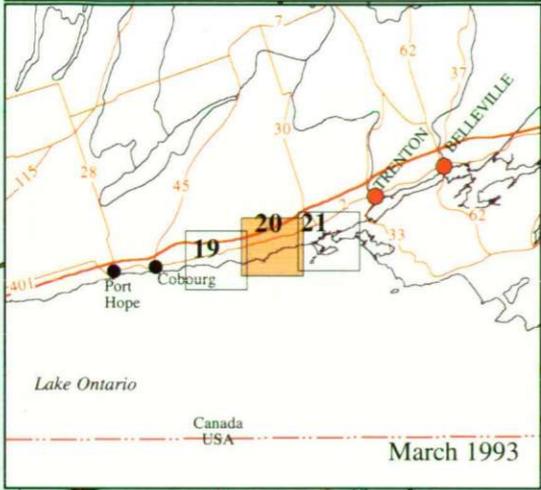
**NOTES** !

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

- ! 78 Seasonal fish spawning occurs in Lake Ontario, south of Lakeport: Lake Whitefish in Fall from November to December.
- ! 79 The Lakeport Area of Natural and Scientific Interest is the best known example of the Belleville stage in Ontario, providing a spit and beach deposit. At present the site is under mixed farming and orchards with several woodlots and pasture lots. The Colborne Creek Wetland is an active feeding area for wading birds and provincially significant waterfowl and colonial waterbirds. It is also a habitat for several fur bearing mammals, an important Rainbow Trout spawning region and provides winter cover for deer.
- ! 80 Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.

**Map 20**

Contains Sections From NTS Map Numbers:  
**30N/13 and 31C/4**

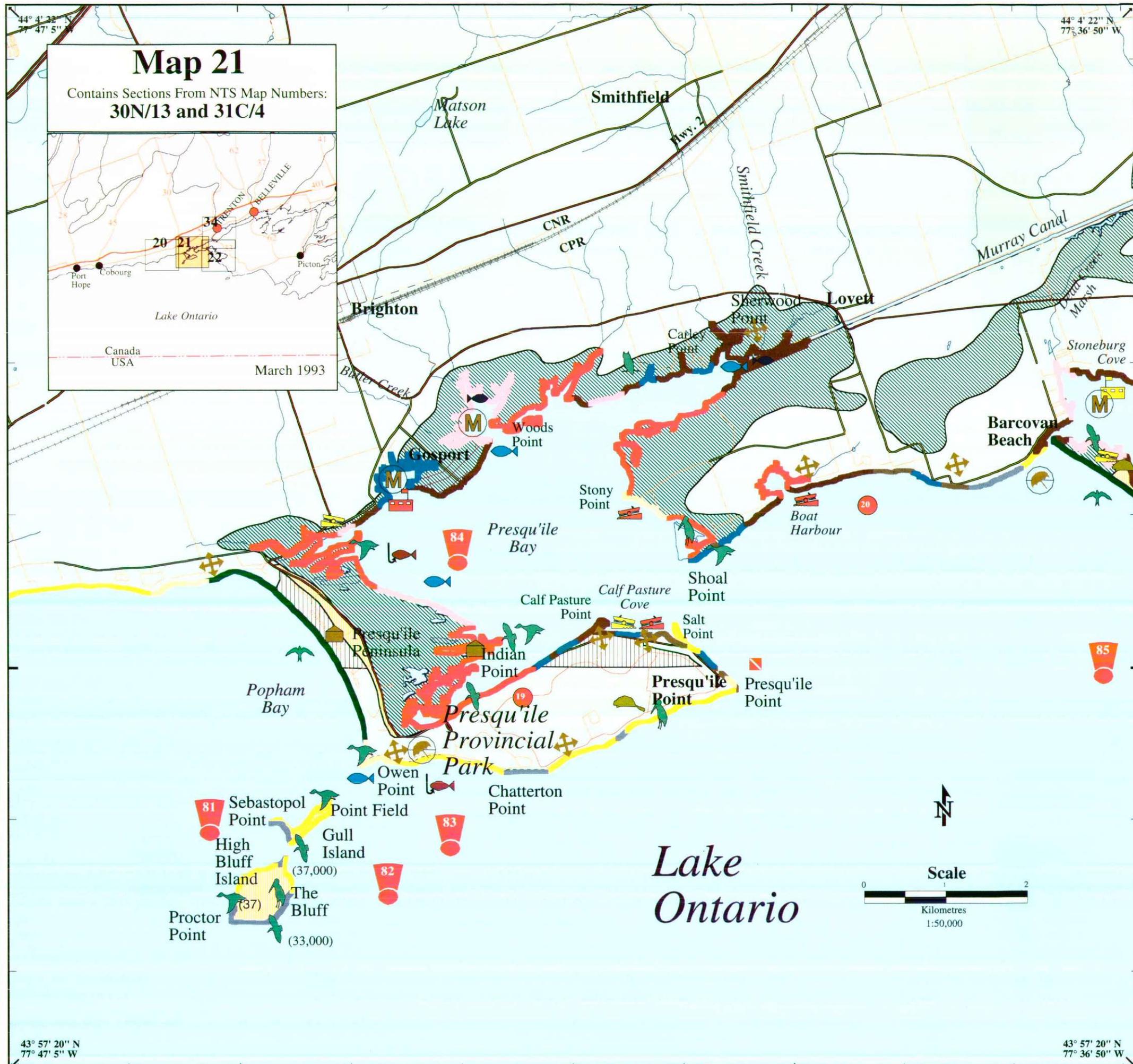


*Lake Ontario*

## NOTES

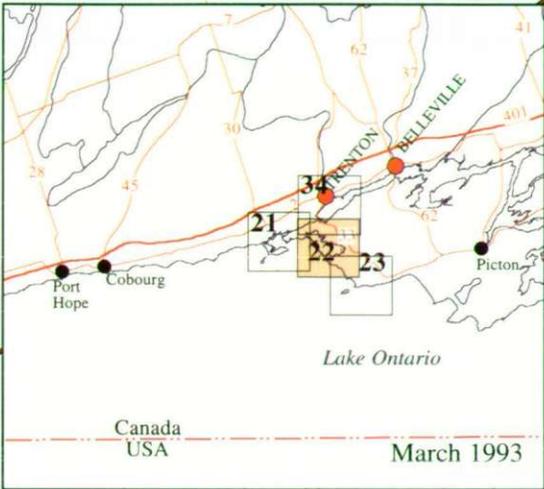
A red exclamation point symbol is used on the maps to catch the responder's attention.

- 81** The Presqu'ile Provincial Park Wilderness Area is a regionally significant Life Science Area of Natural and Scientific Interest. It contains coastal limestone islands and an offshore gravel bar complex. This is an important migratory bird stopover point and this area supports provincially and regionally significant flora.
- 82** The Presqu'ile Bay Peninsula is classified as a Life Science Area of Natural and Scientific Interest. It displays a classic Tombolo formation. Responders must take care not to damage the shoreline. This area supports provincially and regionally significant bird and plant species. It is a habitat for regionally significant fish spawning and is a highly significant migratory passerine. Presqu'ile Provincial Park is an active tourism centre, with headquarters for the annual Ontario Underwater Council Treasure Hunt Dive.
- 83** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- 84** The Presqu'ile Bay Marsh Complex is a habitat for provincially significant Four Toed Salamanders, colonial waterbirds, waterfowl, raptors and wading birds. It is a habitat for provincially significant plant species and several fur bearing mammals. It provides winter cover for animals and is a regionally significant fish spawning area. Commercial fish harvesting and several high use recreational activities are important in this region.
- 85** The Wellers Bay/Barcovan Beach Sandspit is classified as an Area of Natural and Scientific Interest. It is a sandspit displaying a classic baymouth bar, sand dunes and tombolo formations. Responders must take care not to damage these formations. This area is a highly significant migratory passerine route, and supports numerous provincially and regionally significant bird species. The Wellers Bay/Barcovan Beach Wetland is an active feeding area for birds, a habitat for fur bearing mammals and supports seasonal fish spawning. It is a significant migratory passerine area and important for commercial fish harvesting and high use recreational activities. There is good winter cover for rabbits and associated predators. Seasonal fish spawning occurs along the lakeshore at Bald Head Beach.





**Map 22**  
 Contains Sections From NTS Map Numbers:  
**30N/13, 30N/14, 31C/3**  
**and 31C/4**



**NOTES**

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

- 85** The Wellers Bay/Barcovan Beach Sandspit is classified as an Area of Natural and Scientific Interest. It is a sandspit displaying a classic baymouth bar, sand dunes and tombolo formations. Responders must take care not to damage these formations. This area is a highly significant migratory passerine route, and supports numerous provincial and regionally significant bird species. The Wellers Bay/Barcovan Beach Wetland is an active feeding area for birds, a habitat for fur bearing mammals and supports seasonal fish spawning. It is a significant migratory passerine area and important for commercial fish harvesting and high use recreational activities. There is good winter cover for rabbits and associated predators. Seasonal fish spawning occurs along the lakeshore at Bald Head Beach.
- 86** The Carrying Place Marsh is a feeding habitat for colonial waterbirds, provides good cover for muskrat and beaver and is a fish spawning habitat. Commercial fish harvesting and high use recreational fishing and canoeing activities are important in this area.
- 87** The Wellers Bay Wetlands are an active feeding area for birds and staging waterfowl. This marsh is a significant migratory passerine, a waterfowl production area and a fish spawning site. This wetland is a habitat for fur bearing mammals and seasonal commercial fishing activities.
- 88** Seasonal fish spawning occurs along the shore of Wellers Bay from Sugar Point to Consecon Lake.
- 89** Seasonal fish spawning occurs around the shores near the mouth of Consecon Lake: Northern Pike and Walleye in Spring. The Consecon Lake Marsh provides a habitat for provincially significant colonial waterbirds. This wetland supports wading birds, fur bearing mammals, Blandings Turtles and provides a habitat for fish spawning. It is an important recreational canoeing area.
- 90** Seasonal fish spawning occurs along the shore of Lake Ontario from Snider Point to Pierson Point.

## NOTES !

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

-  Seasonal fish spawning occurs along the shore of Lake Ontario from Snider Point to Pierson Point.
-  Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
-  The Pleasant Bay Wetland is a habitat for provincially significant waterfowl and colonial waterbirds. This marsh is an active feeding area for colonial waterbirds, shorebirds, a waterfowl staging and production habitat and a fish spawning environment. It is also a habitat for several fur bearing species and is classified as a high use recreational hunting area. Seasonal fish spawning occurs along the shores of Huycks Bay, Huycks Point, Hubbs River and Pleasant Creek: Northern Pike in Spring; Yellow Perch in late Spring; Smallmouth Bass in Summer.
-  Huycks Bay Wetland is an active feeding area for provincially significant colonial waterbirds. Locally, this wetland supports shorebirds, waterfowl staging and production, is a habitat for several fur bearing mammals and is important for seasonal fish spawning. Commercial fishing has seasonal significance.

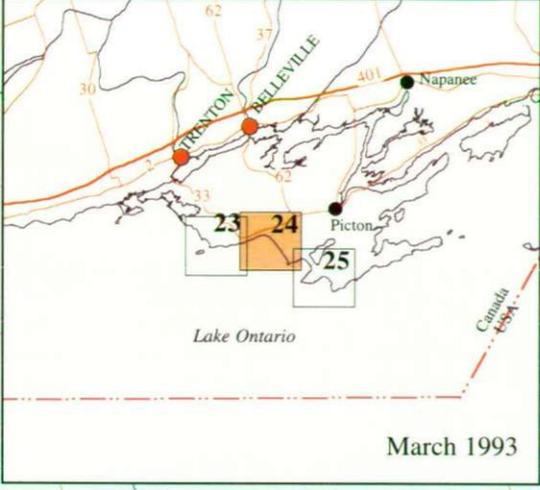


43° 59' 45" N  
77° 24' 43" W

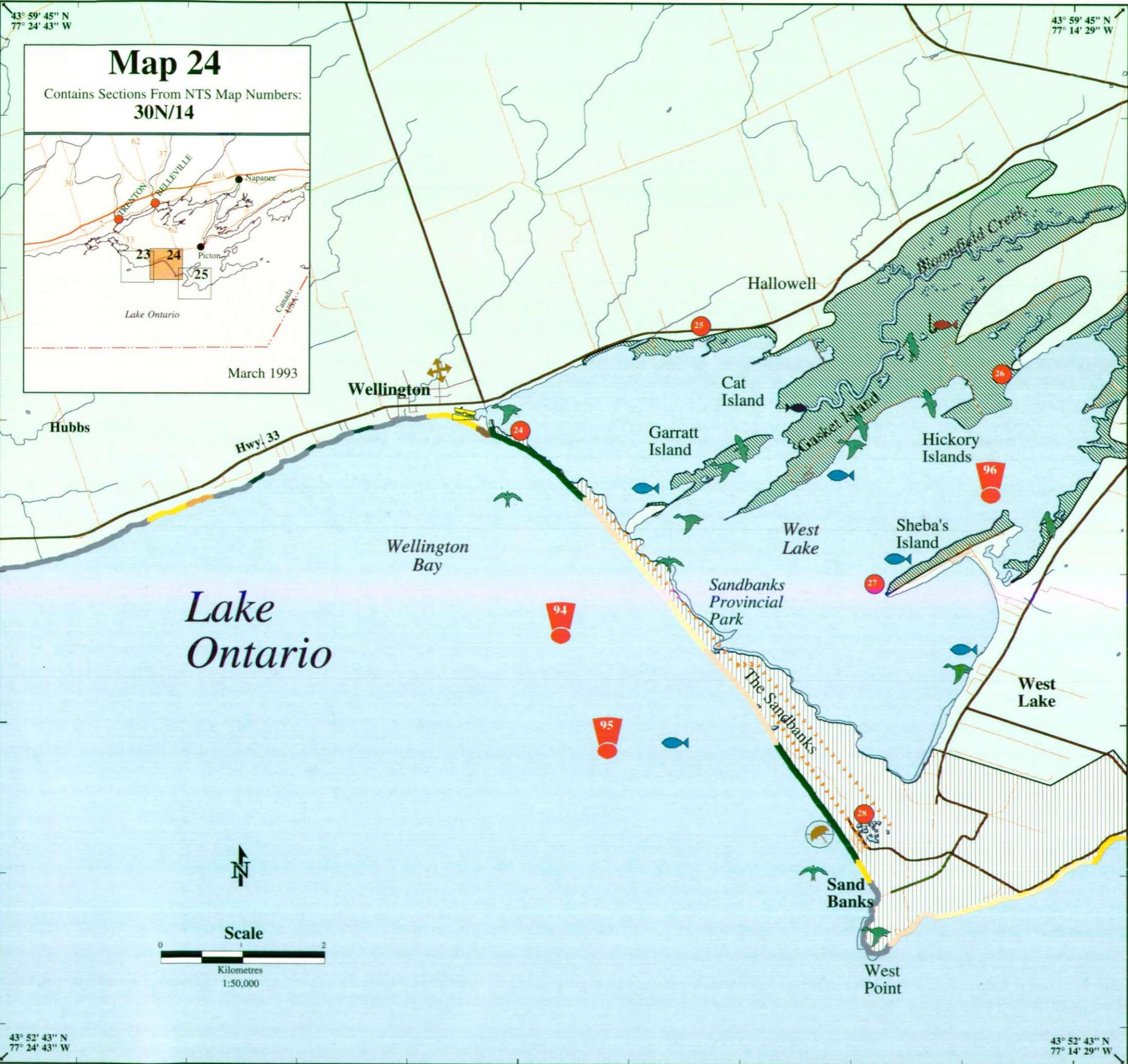
43° 59' 45" N  
77° 14' 29" W

# Map 24

Contains Sections From NTS Map Numbers:  
**30N/14**



March 1993



43° 52' 43" N  
77° 24' 43" W

43° 52' 43" N  
77° 14' 29" W

## NOTES

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

- 94** Sandbanks Provincial Park is an important recreational beach area that also supports recreational and educational activities. Sandbanks Provincial Park is classified as an Area of Natural and Scientific Interest. It is a classic baymouth bar which contains sand dune formations. Responders must take care not to damage these formations. This is the largest baymouth bar on freshwater in the world.
- 95** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario. Seasonal fish spawning occurs around the shores of numerous islands in West Lake and on the west side of Sandbanks Provincial Park in Wellington Bay: Northern Pike in Spring and Largemouth Bass in Summer.
- 96** The West Lake Wetland is an active feeding area for provincially significant waterfowl, wading birds nesting colonial waterbirds and is regionally significant for fish spawning. The wetland is important for waterfowl staging and production, is a habitat for several fur bearing mammals, provides local winter cover for deer and supports provincially significant plant species. Commercial fishing activities have seasonal significance in the area.

## NOTES !

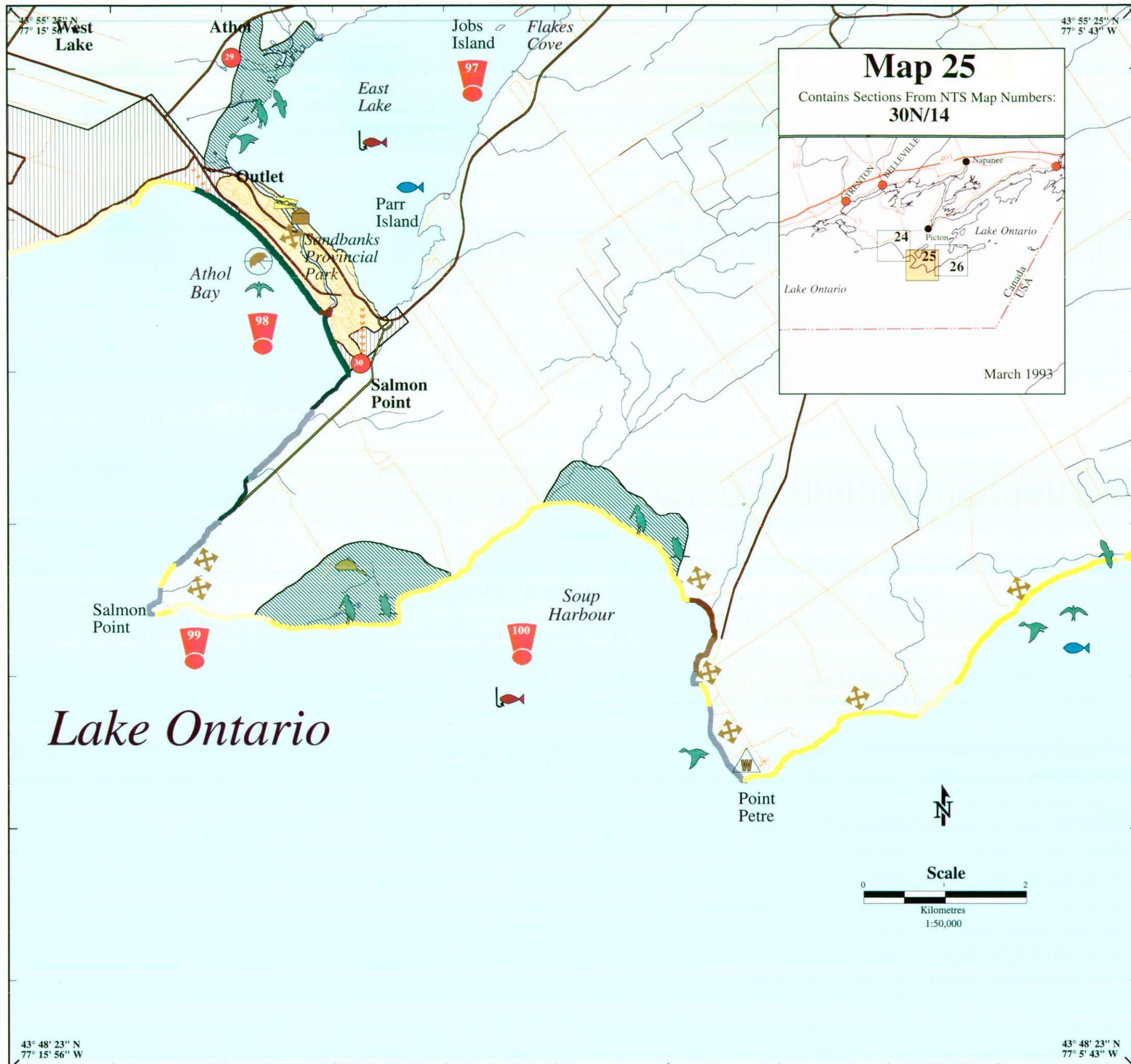
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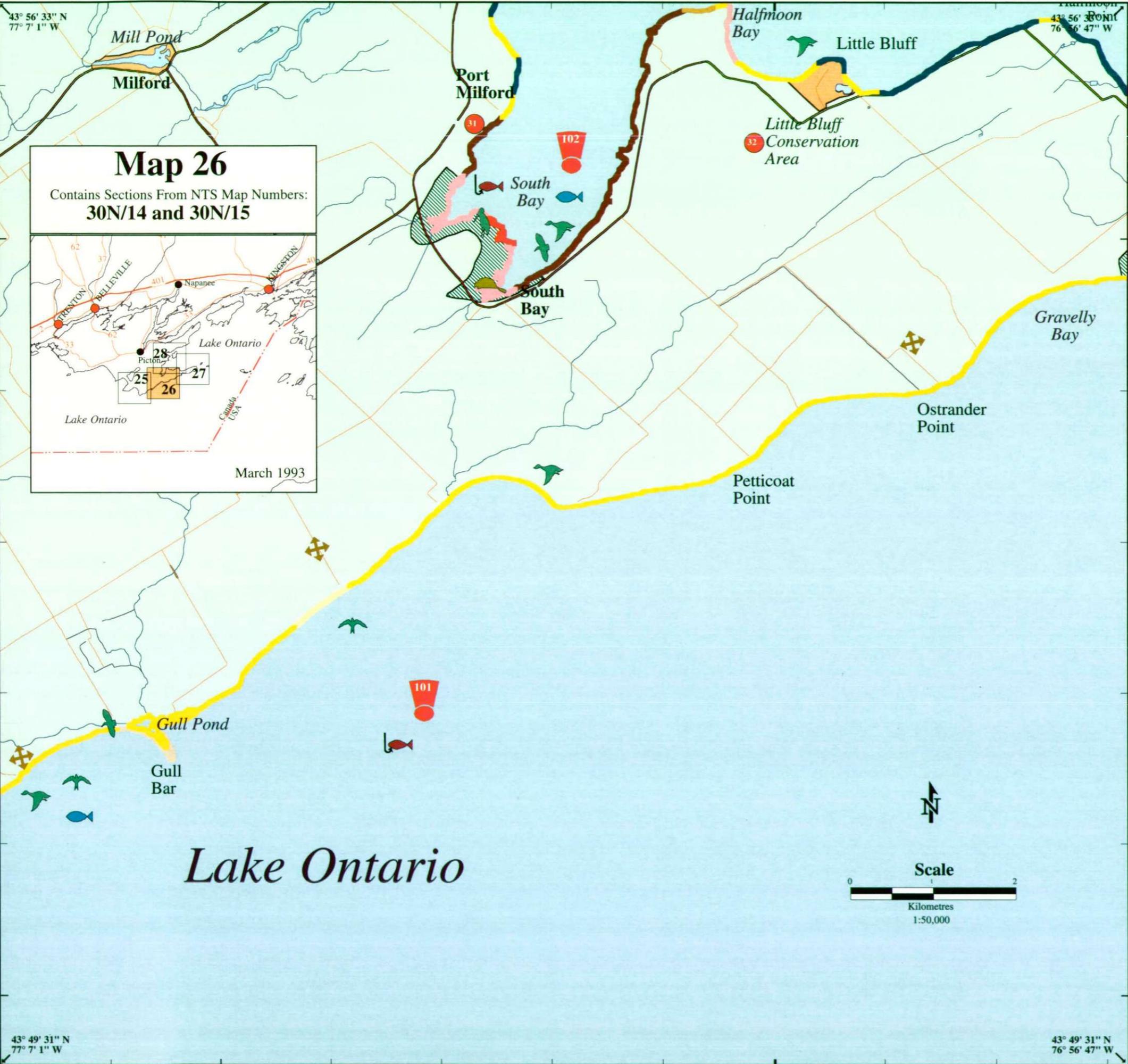
**97** The East Lake Marsh is a feeding and migration habitat for endangered raptors, provincially significant wading birds, waterfowls and nesting colonial waterbirds. This wetland provides a habitat for several fur bearing mammals, regionally significant Swamp Sparrows and Map and Blandings Turtles, and is important for seasonal fish spawning. Commercial fishing activities have seasonal significance in East Lake.

**98** Outlet Beach Provincial Park, which is part of Sandbanks Provincial Park, is classified as an Area of Natural and Scientific Interest. It is a classic baymouth bar with sand dune formations. This park is an important recreational beach area and supports recreational and educational activities. Responders should take care not to damage the shore in this area.

**99** Salmon Point Wetland is an active feeding area for provincially significant raptors and wading birds. Locally, this wetland supports nesting wading birds, waterfowl staging and production, fish spawning, fur bearing mammals and is a winter cover area for deer.

**100** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario. The Soup Harbour Wetland is an active feeding area for raptors, a nesting region for wading birds, a habitat for several species of fur bearing mammals and a winter cover for deer.





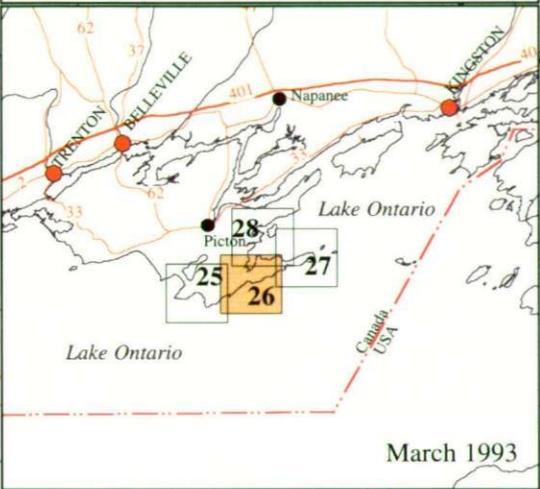
**NOTES !**

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

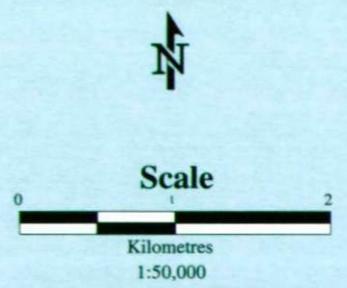
- ! 101** Seasonal fish spawning occurs in Lake Ontario from Gull Bar to Ostrander Point: Lake Whitefish in Fall. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- ! 102** The South Bay Marsh is a feeding habitat for colonial waterbirds, waterfowl and wading birds. It is a habitat for several fur bearing mammals, and is important for fish spawning and commercial fishing activities. Provincially significant plant species grow here in abundance. Seasonal fish spawning occurs in South Bay: Northern Pike in Spring.

**Map 26**

Contains Sections From NTS Map Numbers:  
**30N/14 and 30N/15**



*Lake Ontario*



## NOTES !

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

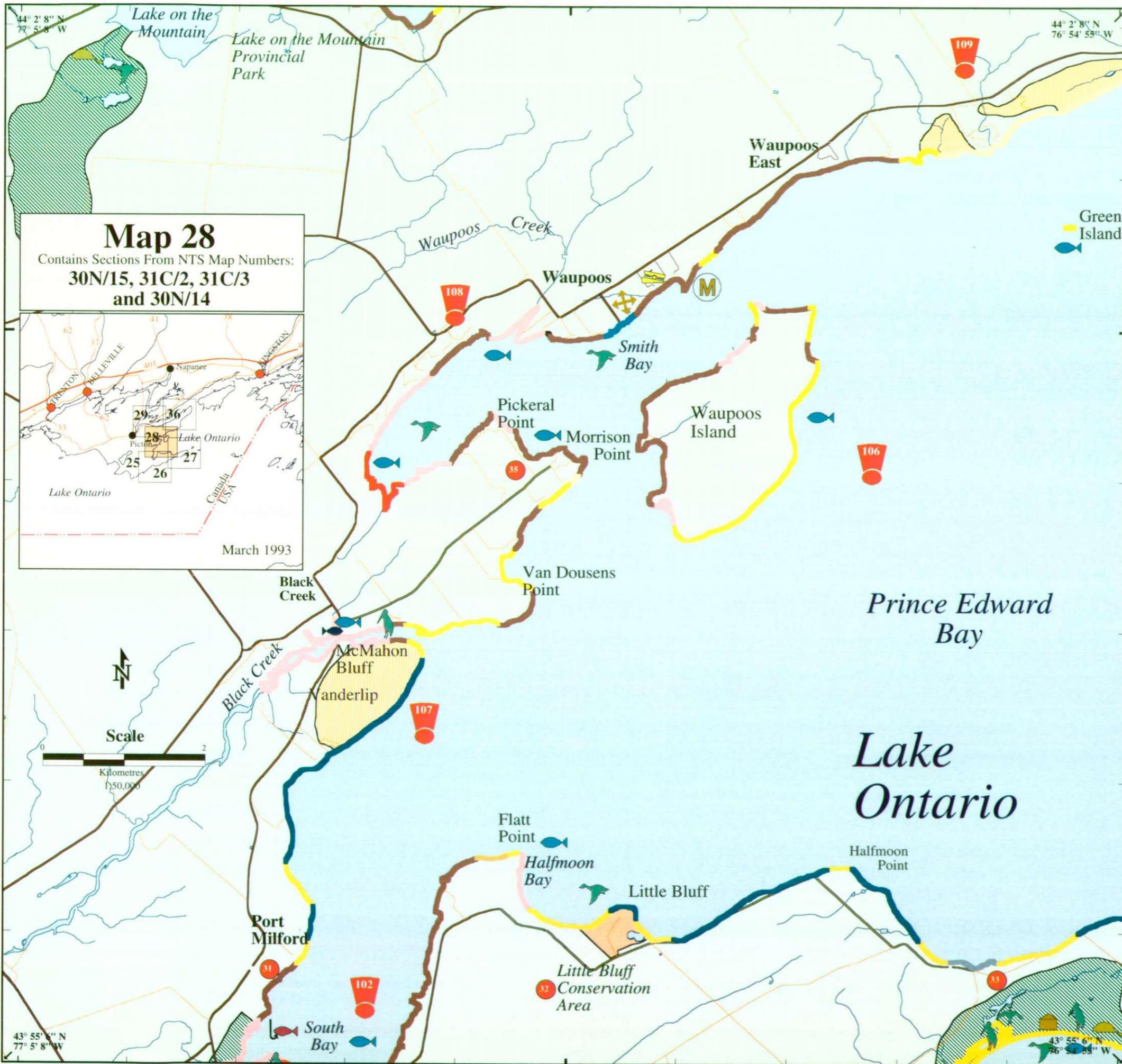
**103** ! The Big Sand Bay Wetland is an active feeding area for colonial waterbirds, wading birds, waterfowl, shorebirds and nesting colonial waterbirds. This wetland supports provincially significant plant species, is a habitat for several fur bearing mammals and provides high use recreational nature appreciation activity. Locally, this wetland provides winter cover for deer and supports fish spawning and commercial fish harvesting activities. Seasonal fish spawning occurs along the shore of Big Sand Bay: Northern Pike in Spring; Yellow Perch in late Spring and Carp in Summer.

**104** ! Seasonal fish spawning occurs along the Lake Ontario shoreline from Gravelly Bay to Prince Edward Point: Lake Whitefish in late Fall. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.

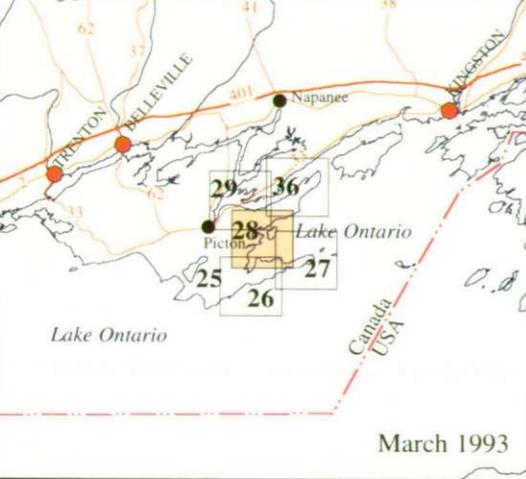
**105** ! Numerous historic ship wrecks lie in a triangle delineated by Timber Island, False Ducks Islands and Prince Edward Point. Seasonal fish spawning occurs along the shores of Timber Island and False Ducks Islands: Smallmouth Bass in Spring. Timber Island is classified as an Area of Natural and Scientific Interest. It is a Provincial Nature Reserve of low shore cliffs with an interior limestone plain supporting rich coastal shore flora and provincially significant wading birds. The island had an historic role in bird and plant migration. Responders must take care not to damage this shore.

**106** ! Commercial and sport fishing activities have seasonal significance along the shorelines of Lake Ontario and Prince Edward Bay.





**Map 28**  
 Contains Sections From NTS Map Numbers:  
**30N/15, 31C/2, 31C/3**  
**and 30N/14**



**NOTES**

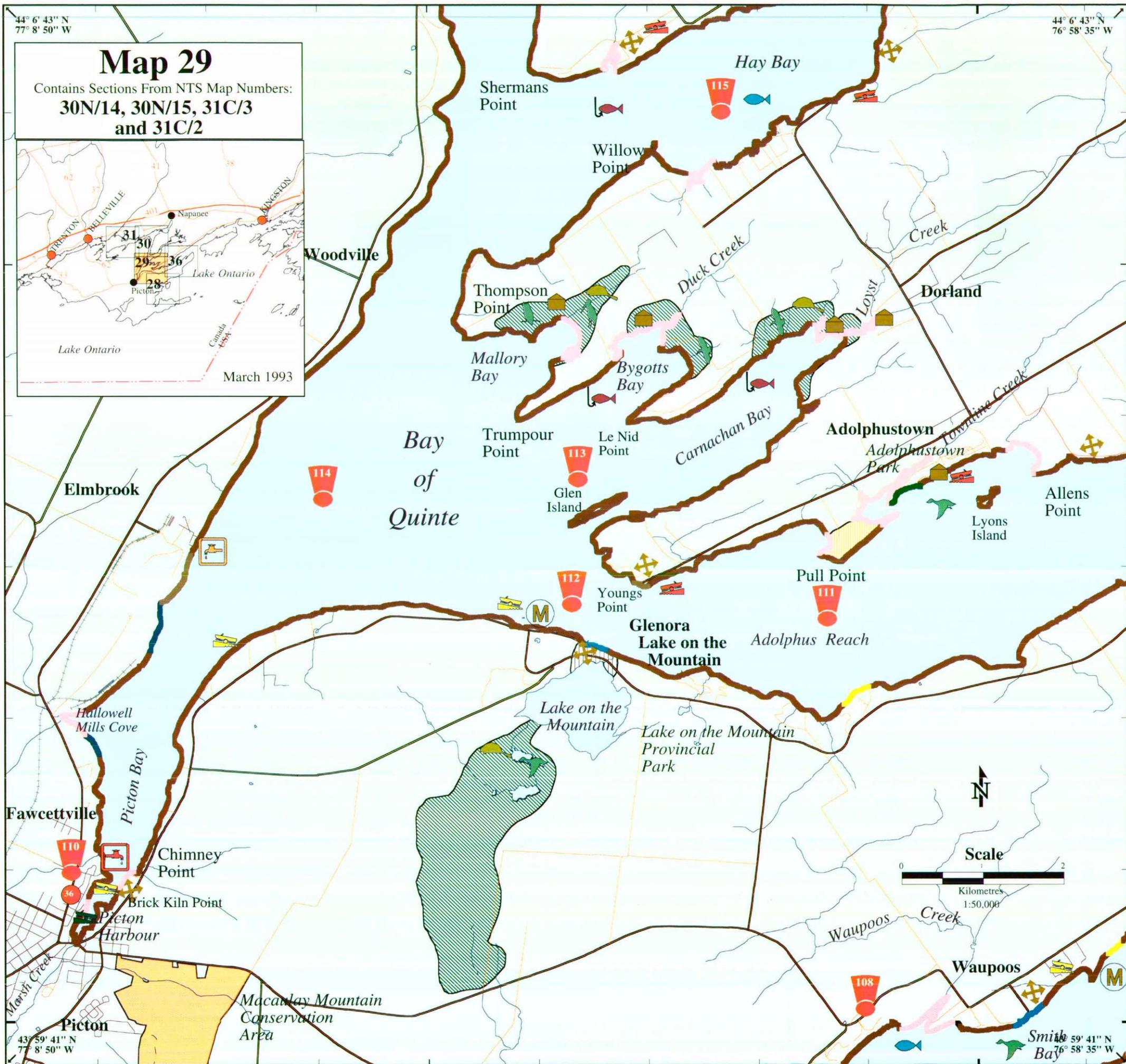
A red exclamation point symbol is used on the maps to catch the responder's attention.

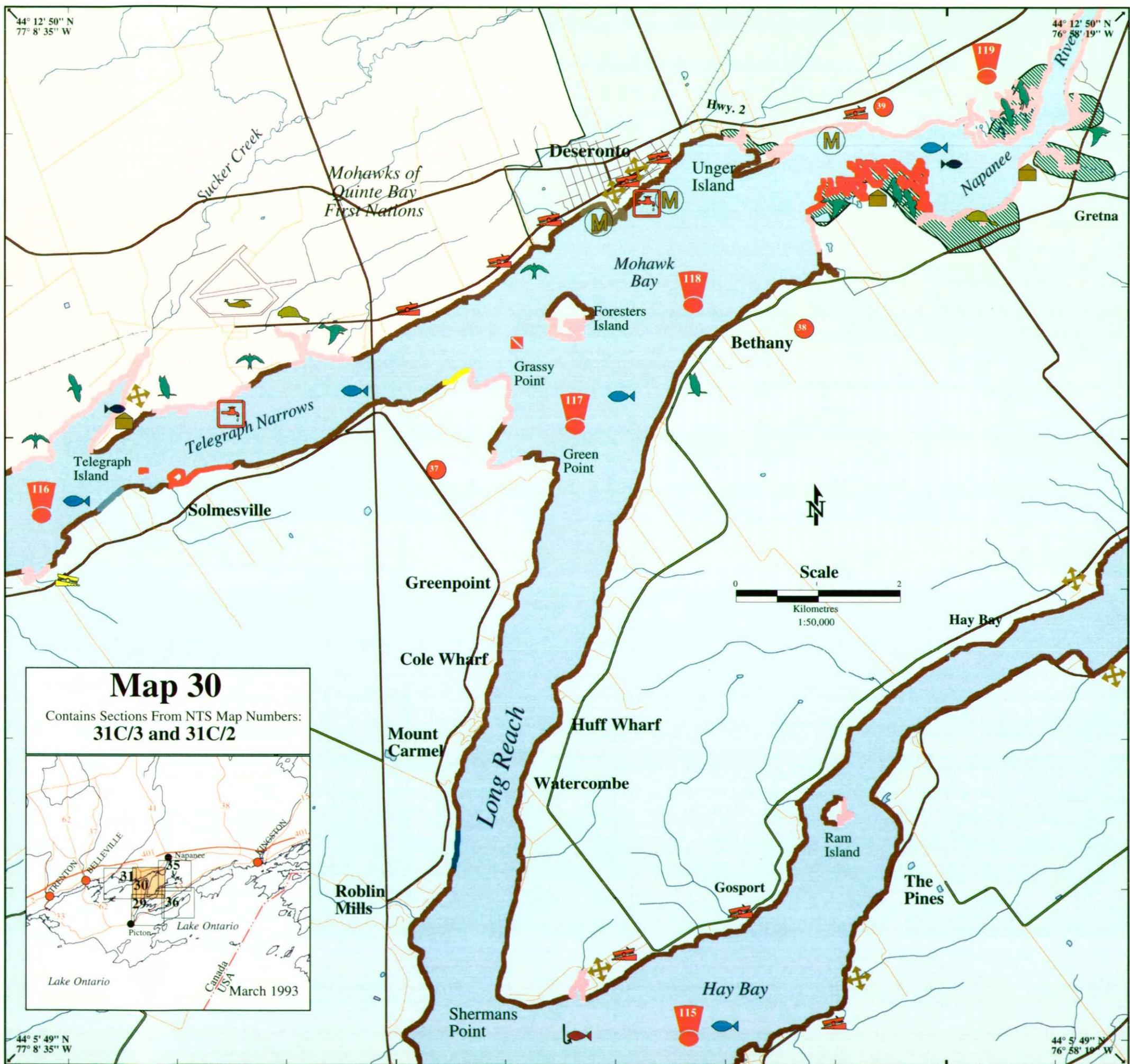
- 102** The South Bay Marsh is a feeding habitat for colonial waterbirds, waterfowl and wading birds. It is a habitat for several fur bearing mammals, and is important for fish spawning and commercial fishing activities. Provincially significant plant species grow here in abundance. Seasonal fish spawning occurs in South Bay: Northern Pike in Spring.
- 106** Commercial and sport fishing activities have seasonal significance along the shorelines of Lake Ontario and Prince Edward Bay.
- 107** McMahon Bluff is classified as an Area of Natural and Scientific Interest. The cliff illustrates the geological type section. The preservation of the outcrop is important for comparative purposes. Responders should take care not to damage this bluff formation.
- 108** Seasonal fish spawning occurs along all shores of Smith Bay: Northern Pike in Spring; Yellow Perch in late Spring and Largemouth Bass in Summer.
- 109** Seasonal fish spawning occurs along the north shore of Prince Edward Bay from Waupoos to Marys Cove: Smallmouth Bass in Summer. The Cape Vasey Escarpment is classified as an Area of Natural and Scientific Interest. It consists of an overhanging cliff and a single bar enclosing a wetland. The escarpment supports the growth of forests and provincially and regionally significant flora. Responders should take care not to damage this sensitive area.

## NOTES

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

- 108** Seasonal fish spawning occurs along all shores of Smith Bay: Northern Pike in Spring; Yellow Perch in late Spring and Largemouth Bass in Summer.
- 110** Picton Water Treatment Plant Intake - Call (613) 476-6151.
- 111** Pull Point is classified as an Earth Science Area of Natural and Scientific Interest. It is a drumlin, representative of Pleistocene geological strata. The preservation of the drumlin is important for comparative purposes.
- 112** The Lake on the Mountain Swamp provides a habitat for provincially significant wading birds and rare salamanders. This wetland provides a habitat for fur bearing mammals and winter cover for deer. Lake on the Mountain is about 50 metres above the Bay of Quinte. A ferry service exists between Youngs Point and Glenora.
- 113** The Carnachan Bay Wetlands Complex is an active feeding area for colonial waterbirds, wading birds and raptors. It is a habitat for fur bearing mammals, provides winter cover for muskrat and beaver and supports seasonal fish spawning. Commercial fish harvesting, high use recreational fishing and canoeing and educational visits are important activities in this area.
- 114** Commercial and sport fishing activities have seasonal significance along the shoreline of the Bay of Quinte.
- 115** Seasonal fish spawning occurs along both shores of Hay Bay: Northern Pike, Walleye and Gizzard Shad in Spring; Yellow Perch in late Spring and White Perch in Summer.





**NOTES**

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

- 115** Seasonal fish spawning occurs along both shores of Hay Bay: Northern Pike, Walleye and Gizzard Shad in Spring; Yellow Perch in late Spring and White Perch in Summer.
- 116** Mohawks of the Bay of Quinte Tyendingina Mohawk Territory contains areas which support colonial waterbirds, waterfowl, raptors, shorebirds, seasonal fish spawning and several fur bearing mammals. Responders should contact the Chief of the Tyendingina Mohawk Territory before commencing response activity in the area. Tyendingina Municipal Water Intake - Call (613) 396-3424.
- 117** Seasonal fish spawning occurs in Long Reach: Walleye in Spring and Largemouth Bass and Carp in Summer. Walleye spawn during spring along the shorelines of Telegraph Narrows.
- 118** Deseronto Water Treatment Plant Intake - Call (613) 396-3436.
- 119** The Lower Napanee River Wetland is an active feeding area for colonial waterbirds, waterfowl and wading birds. It is a habitat for several fur bearing mammals and is important for fish spawning and high use recreational fishing activity.

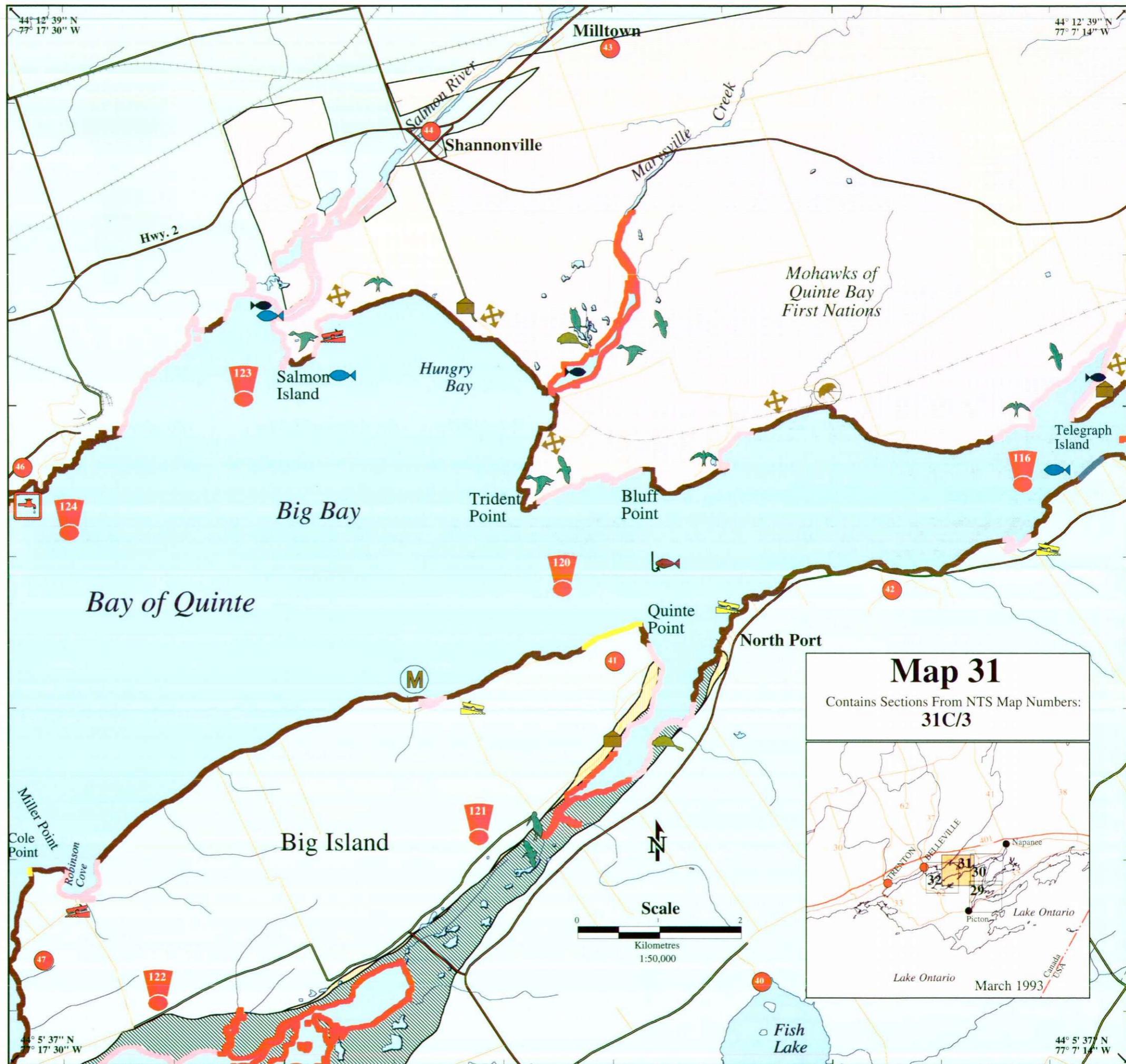
**Map 30**  
 Contains Sections From NTS Map Numbers:  
**31C/3 and 31C/2**

March 1993

## NOTES

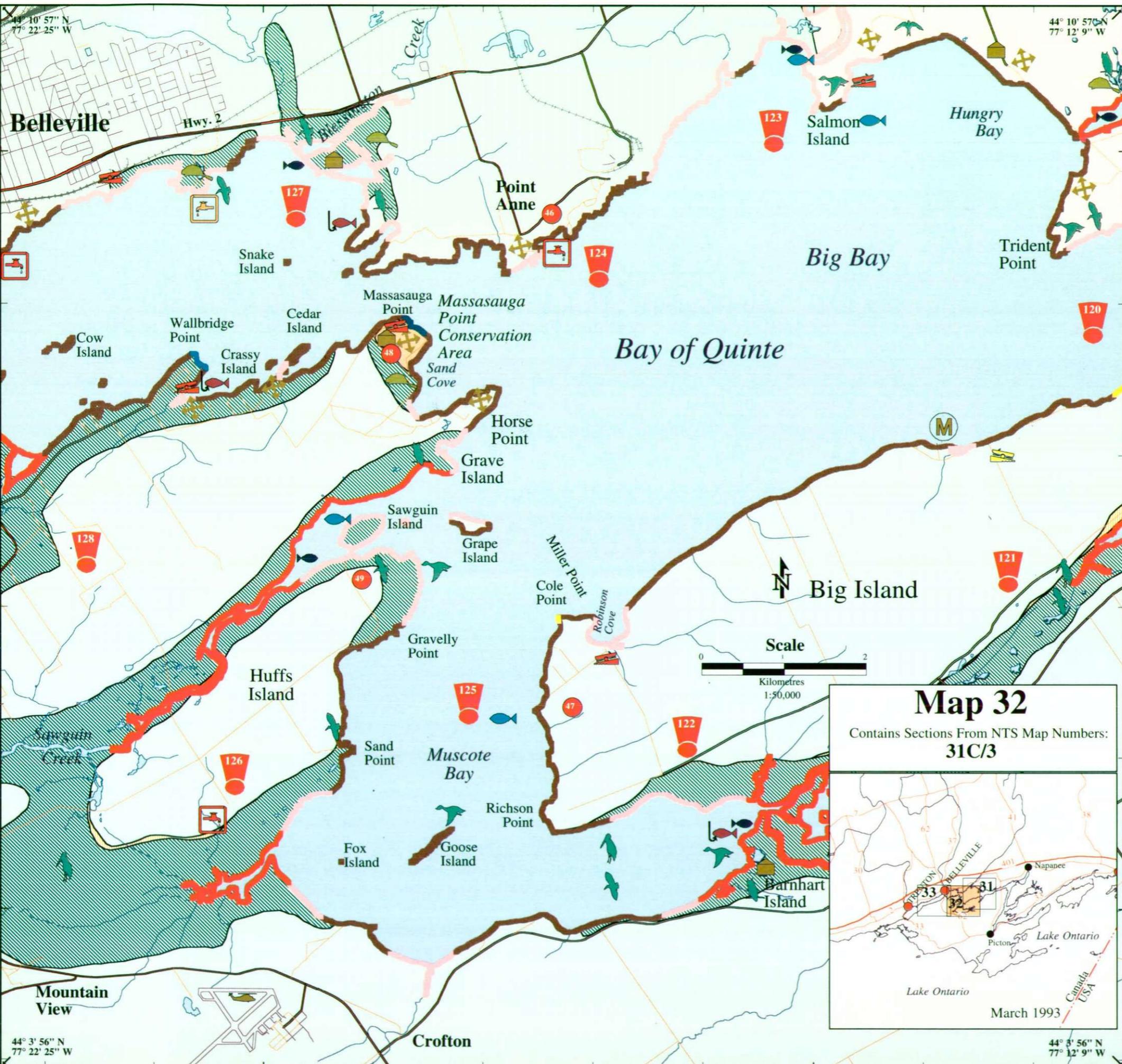
A red exclamation point symbol is used on the maps to catch the responder's attention.

- 116** Mohawks of the Bay of Quinte  
 Tyendinaga Mohawk Territory contains areas which support colonial waterbirds, waterfowl, raptors, shorebirds, seasonal fish spawning and several fur bearing mammals. Responders should contact the Chief of the Tyendinaga Mohawk Territory before commencing response activity in the area. Tyendinaga Municipal Water Intake - Call (613) 396-3424.
- 120** Commercial and sport fishing activities have seasonal significance along the shoreline of the Bay of Quinte.
- 121** The Big Island Coastal Wetland is classified as an Area of Natural and Scientific Interest. It is a habitat for rare, provincially significant plant species.
- 122** The Big Island Marsh provides a habitat for colonial waterbirds, wading birds, River Otters and rare, provincially significant plant species. This marsh is locally significant for waterfowl production and fish spawning. It is a habitat for fur bearing mammals and a winter cover area for muskrat and beaver. Commercial fish harvesting and recreational hunting and fishing are important activities in this area.
- 123** Seasonal fish spawning occurs along the north shore of the Bay of Quinte, east of Belleville: Walleye, Northern Pike, Brown Bullhead in Spring, Yellow Perch in late Spring, Largemouth Bass and Carp in Summer, Lake Whitefish in Fall. There is an area of cottage use in Hungry Bay.
- 124** Point Anne Water Treatment Plant Intake - Call (613) 962-2669.



**Map 31**  
 Contains Sections From NTS Map Numbers:  
**31C/3**

Lake Ontario  
 March 1993



**NOTES**

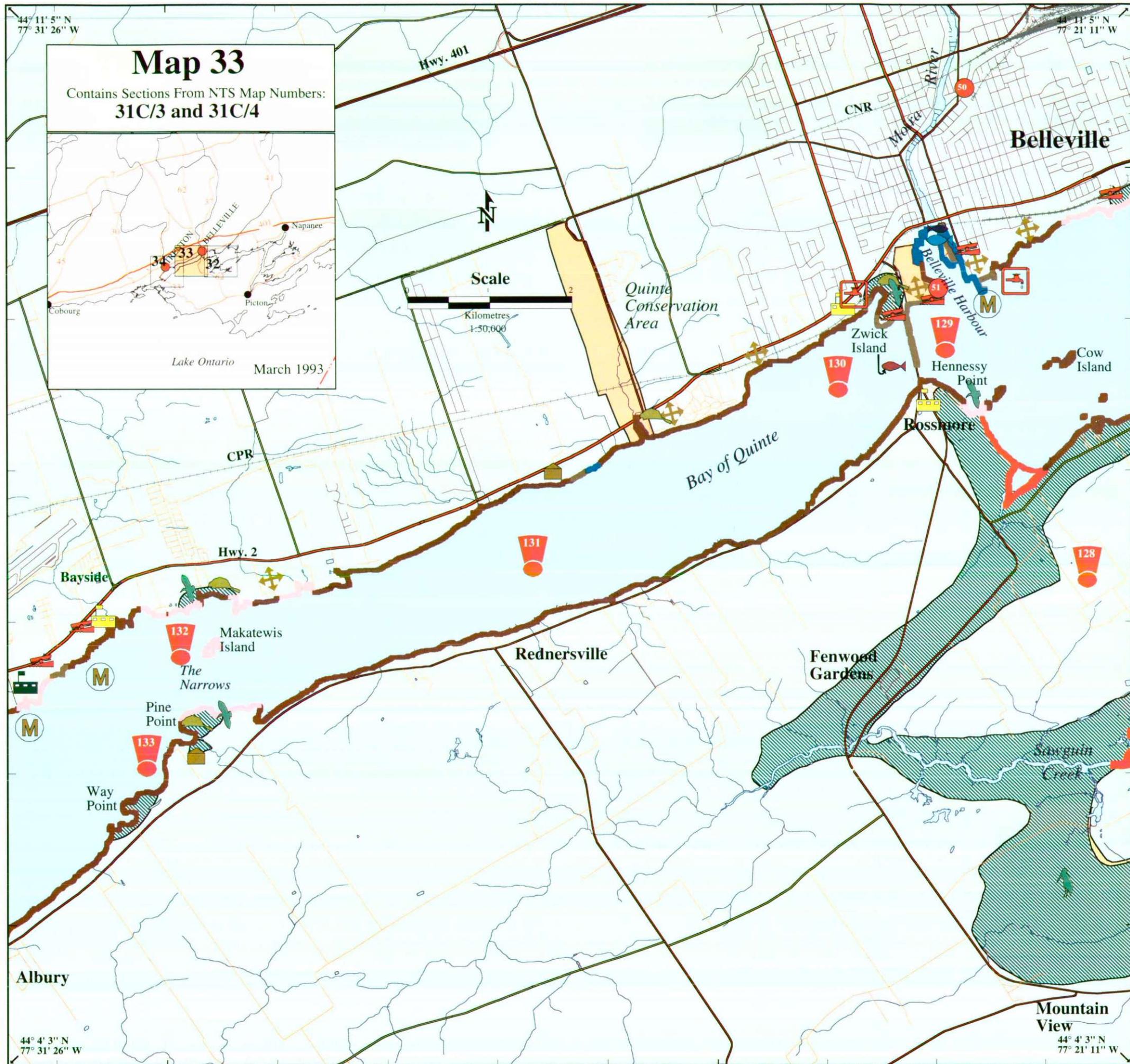
A red exclamation point symbol is used on the maps to catch the responder's attention.

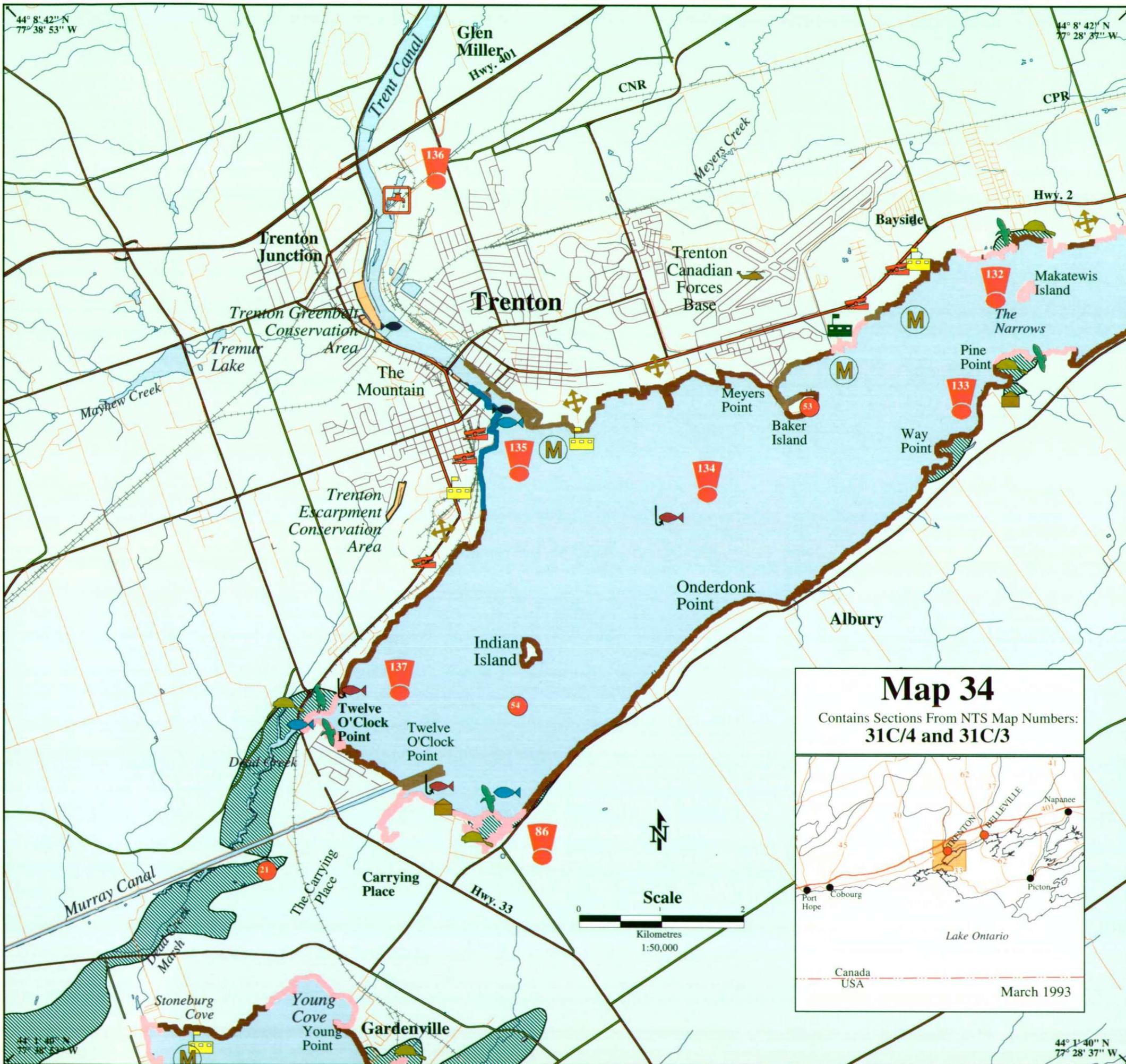
- 120** Commercial and sport fishing activities have seasonal significance along the shoreline of the Bay of Quinte.
- 121** The Big Island Coastal Wetland is classified as an Area of Natural and Scientific Interest. It is a habitat for rare, provincially significant plant species.
- 122** The Big Island Marsh provides a habitat for colonial waterbirds, wading birds, River Otters and rare, provincially significant plant species. This marsh is locally significant for waterfowl production and fish spawning. It is a habitat for fur bearing mammals and a winter cover area for muskrat and beaver. Commercial fish harvesting and recreational hunting and fishing are important activities in this area.
- 123** Seasonal fish spawning occurs along the north shore of the Bay of Quinte, east of Belleville: Walleye, Northern Pike, Brown Bullhead in Spring, Yellow Perch in late Spring, Largemouth Bass and Carp in Summer, Lake Whitefish in Fall. There is an area of cottage use in Hungry Bay.
- 124** Point Anne Water Treatment Plant Intake - Call (613) 962-2669.
- 125** Seasonal fish spawning occurs along the north shore of Big Island and in Muscote Bay: Northern Pike in Spring.
- 126** Mountain View Water Treatment Plant Intake - Call (613) 962-2669.
- 127** The Blessington Creek Marsh provides a feeding habitat for colonial waterbirds and raptors and is a habitat for fur bearing mammals. Seasonal fish spawning, commercial fish harvesting and recreational canoeing are important activities in this area. The Belleville Marsh is an active feeding area for colonial waterbirds. It provides a habitat for fur bearing mammals and supports seasonal fish spawning.
- 128** The Sawguin Creek Wetland is classified as an Area of Natural and Scientific Interest. It is a feeding habitat for colonial waterbirds, wading birds and raptors and supports rare, nationally and provincially significant plant species. It is a habitat for fur bearing mammals, waterfowl production, and is regionally important for fish spawning.

## NOTES

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

- 128** The Sawquin Creek Wetland is classified as an Area of Natural and Scientific Interest. It is a feeding habitat for colonial waterbirds, wading birds and raptors and supports rare, nationally and provincially significant plant species. It is a habitat for fur bearing mammals, waterfowl production, and is regionally important for fish spawning.
- 129** Belleville Water Treatment Plant Intakes - Call (613) 962-2669.
- 130** The Belleville Treatment Plant Marsh is an active feeding area for colonial waterbirds and a habitat for fur bearing mammals. It supports fish spawning and is an important seasonal commercial fish harvesting area.
- 131** Commercial and sport fishing activities have seasonal significance along the shoreline of the Bay of Quinte. Numerous residential and cottage dwellings exist along the shoreline of the Bay of Quinte from Bayside to Belleville.
- 132** The Bayside Wetland is an active feeding area for colonial waterbirds and a habitat for fur bearing mammals. It provides winter cover for small mammals and song birds and it supports seasonal fish spawning.
- 133** The Pine Point Wetland is an active feeding area for colonial waterbirds and it supports regionally significant Map Turtles. This wetland provides a habitat for fur bearing species, winter cover for deer and supports Carp spawning.





**NOTES**

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

- 86** The Carrying Place Marsh is a feeding habitat for colonial waterbirds, provides good cover for muskrat and beaver and is a fish spawning habitat. Commercial fish harvesting and high use recreational fishing and canoeing activities are important in this area.
- 132** The Bayside Wetland is an active feeding area for colonial waterbirds and a habitat for fur bearing mammals. It provides winter cover for small mammals and song birds and it supports seasonal fish spawning.
- 133** The Pine Point Wetland is an active feeding area for colonial waterbirds and it supports regionally significant Map Turtles. This wetland provides a habitat for fur bearing species, winter cover for deer and supports Carp spawning.
- 134** Commercial and sport fishing activities have seasonal significance along the shoreline of the Bay of Quinte.
- 135** Seasonal fish spawning occurs at the mouth of the Trent River: Walleye in Spring; Yellow Perch in late Spring and Smallmouth Bass in Summer. Migration occurs along the Trent River: Rainbow Trout in Fall.
- 136** Trenton Water Treatment Plant Intake - Call (613) 392-4978.
- 137** The Dead Creek Marsh is an active feeding area for wading birds and colonial waterbirds. It provides winter cover for foxes and coyotes and is a fish spawning area. Commercial fish harvesting is an important activity. Seasonal fish spawning occurs along the shores of the Bay of Quinte at the mouth of Dead Creek: Northern Pike and Brown Bullhead in Spring; Yellow Perch in late Spring and Smallmouth Bass in Summer.

**Map 34**  
 Contains Sections From NTS Map Numbers:  
**31C/4 and 31C/3**

Canada  
USA  
March 1993

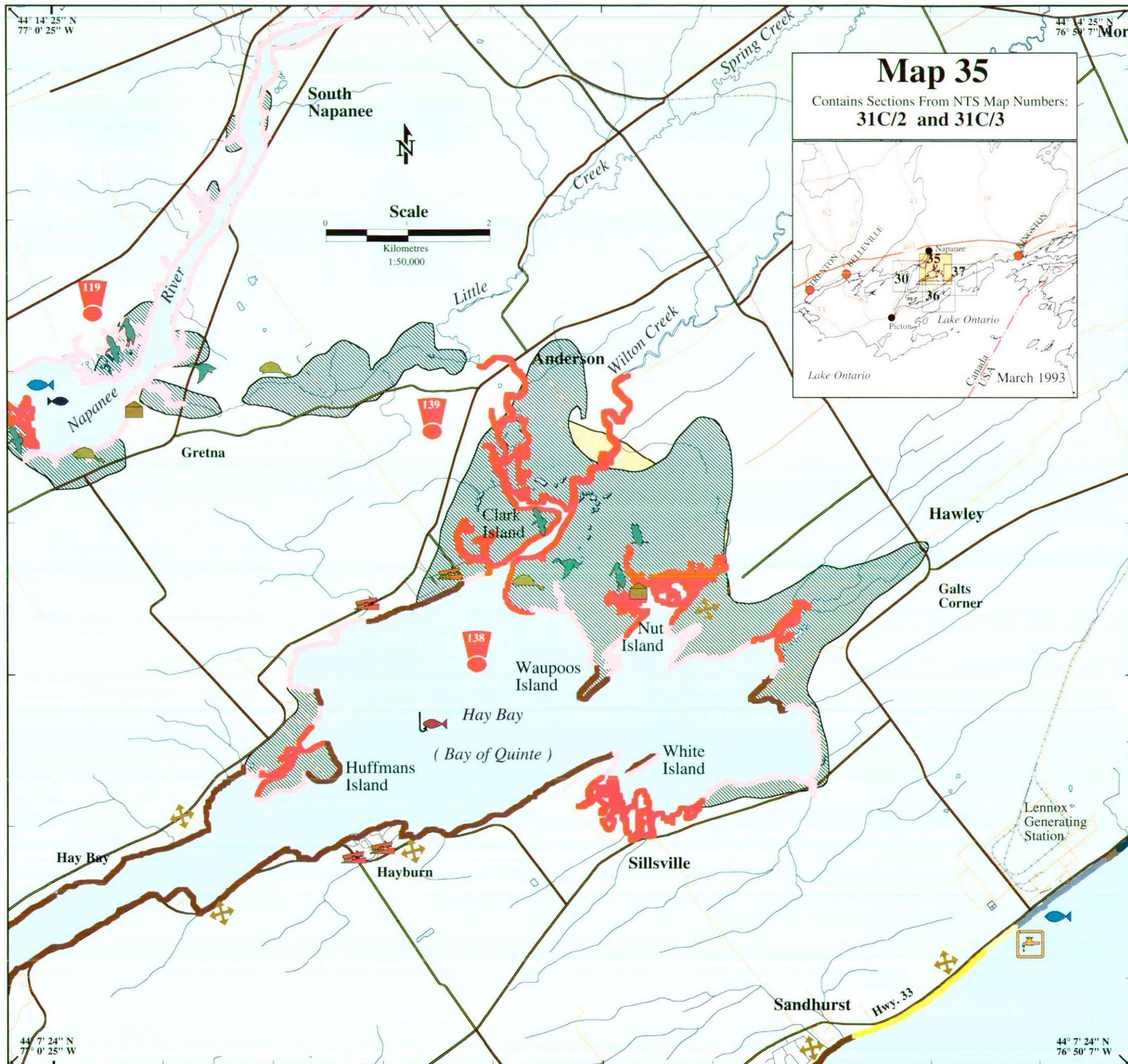
## NOTES

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

**119** The Lower Napanee River Wetland is an active feeding area for colonial waterbirds, waterfowl and wading birds. It is a habitat for several fur bearing mammals and is important for fish spawning and high use recreational fishing activity.

**138** The Hay Bay Wetland is classified as an Area of Natural and Scientific Interest. It is an active feeding area for provincially significant colonial waterbirds, waterfowl and wading birds. It is a habitat for several fur bearing mammals and is regionally significant for waterfowl staging and fish spawning. Commercial and recreational fishing have seasonal significance and this wetland has importance for high use recreational hunting and canoeing activities. Numerous boat launch sites provide responders access to Hay Bay.

**139** The Pike Creek Swamp provides a habitat for several fur bearing mammals and winter cover for deer.





**NOTES** !

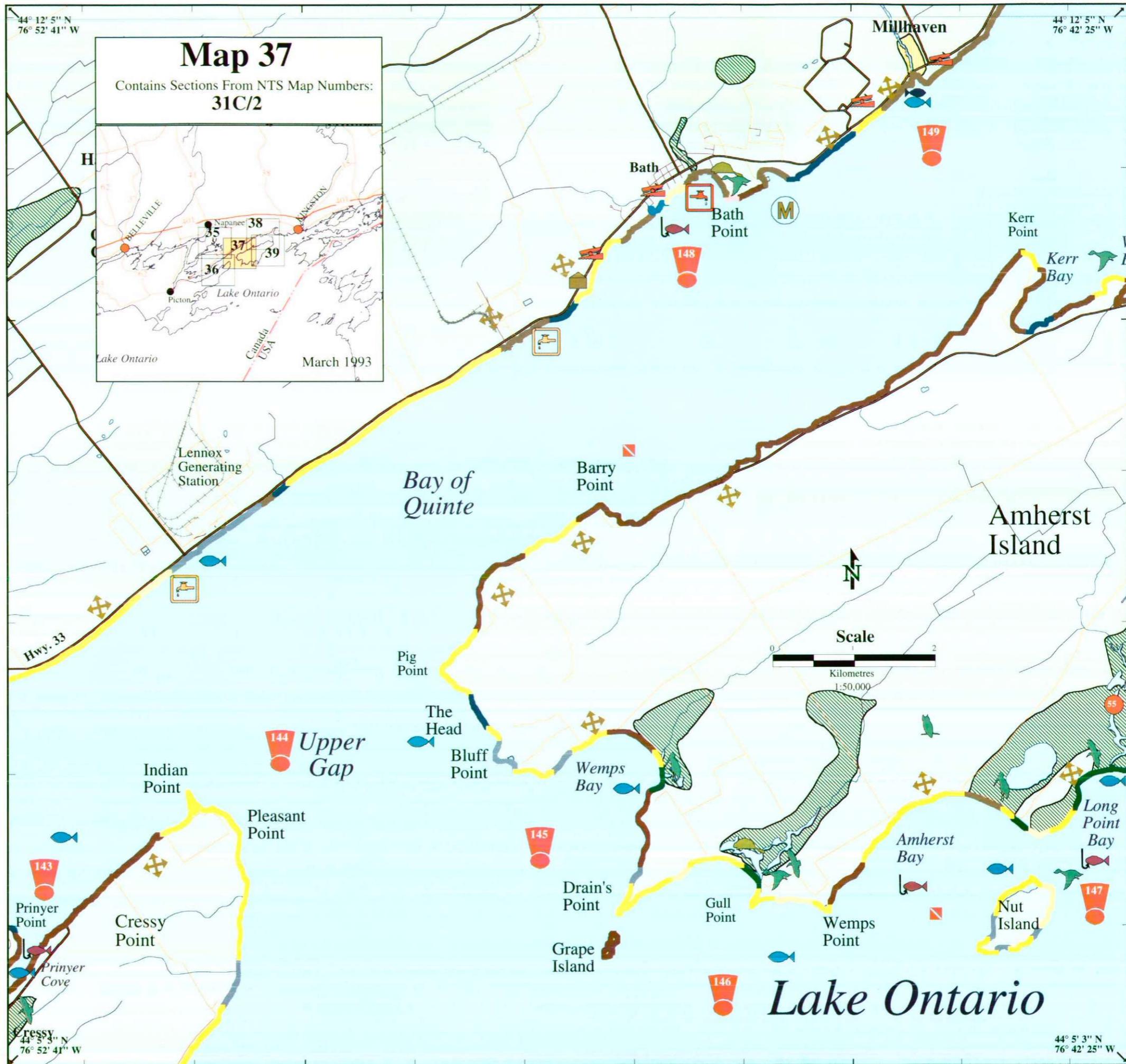
A red exclamation point symbol is used on the maps to catch the responder's attention.

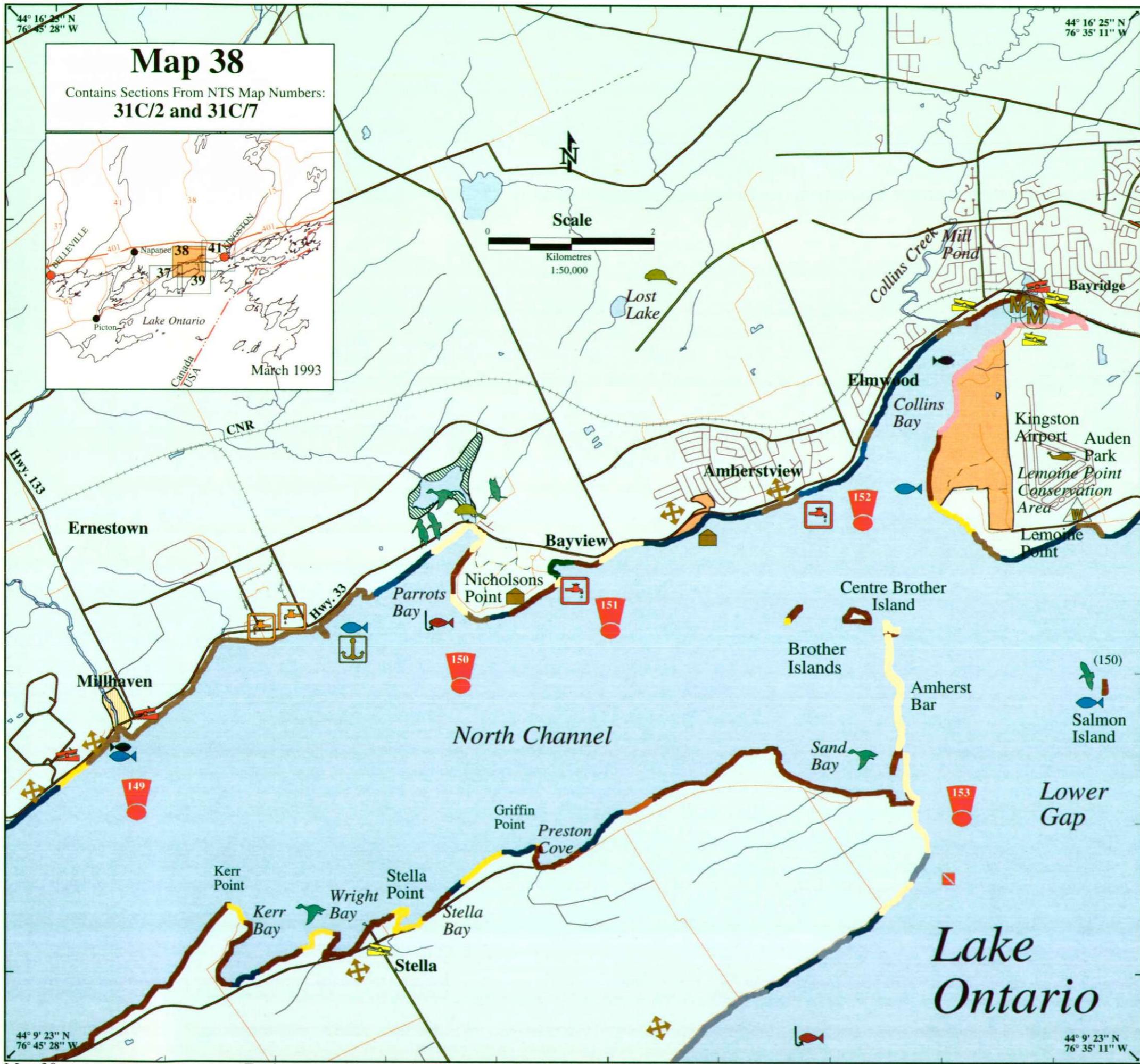
- ! 109 Seasonal fish spawning occurs along the north shore of Prince Edward Bay from Waupoos to Marys Cove: Smallmouth Bass in Summer. The Cape Vasey Escarpment is classified as an Area of Natural and Scientific Interest. It consists of an overhanging cliff and a single bar enclosing a wetland. The escarpment supports the growth of forests and provincially and regionally significant flora. Responders should take care not to damage this sensitive area.
- ! 140 Seasonal fish spawning occurs along the southern shore of Cressy Point: Smallmouth Bass in Summer.
- ! 141 Seasonal fish spawning occurs along the shores of the Bay of Quinte from Allens Point to just east of Sandhurst: Walleye in Spring.
- ! 142 Sandhurst Shores Water Treatment Plant Intake - Call (613) 392-2669. Seasonal fish spawning occurs along the shores of the Bay of Quinte from west of Bongard to Indian Point.
- ! 143 Cressy Swamp is an active feeding habitat for provincially significant colonial waterbirds and regionally significant Yellow Spotted Salamanders. It supports fur bearing mammals, fish spawning and commercial fishing activities.
- ! 144 Commercial and sport fishing activities have seasonal significance along the shorelines of Lake Ontario and Bay of Quinte.

## NOTES

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

- 143** Cressy Swamp is an active feeding habitat for provincially significant colonial waterbirds and regionally significant Yellow Spotted Salamanders. It supports fur bearing mammals, fish spawning and commercial fishing activities.
- 144** Commercial and sport fishing activities have seasonal significance along the shorelines of Lake Ontario and Bay of Quinte.
- 145** The Amherst Island/Long Point Wetlands support provincially significant birds. This wetland supports Milk Snakes and Blandings Turtles. They are a habitat for fur bearing mammals and raptors and are regionally significant for waterfowl staging. These marshes are important for fish spawning, commercial fishing and high use recreational hunting activities.
- 146** Seasonal fish spawning occurs at the south and west shores of Amherst Island. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- 147** The Long Point Bay region is classified as an Area of Natural and Scientific Interest. It is a geological formation called a drumlin. It is representative of the last ice age and is used for comparative purposes. Responders should take care not to damage this geological feature.
- 148** The Bath Point Wetland is a feeding habitat for provincially significant waterfowl, Blue Spotted Salamanders and regionally significant bird species. Locally, this wetland supports fur bearers, commercial fish harvesting and is a winter cover for deer. Bath Water Treatment Plant Intake - Call (613) 352-7204.
- 149** The shoreline at Millhaven Creek is classified as an Area of Natural and Scientific Interest. There is a preserved stromatoloid record which is important for comparative purposes. Responders should take care not to damage this area. Ferry service exists between Millhaven and Wright Bay, on Amherst Island.





**NOTES**

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

- 149** The shoreline at Millhaven Creek is classified as an Area of Natural and Scientific Interest. There is a preserved stromatoloid record which is important for comparative purposes. Responders should take care not to damage this area. Ferry service exists between Millhaven and Wright Bay, on Amherst Island.
- 150** The Parrots Bay Wetland is an active feeding area for provincially significant colonial waterbirds, waterfowl, wading birds, raptors, regionally rare bird species and Blandings Turtles. Regionally rare plant species thrive in this area. This wetland provides a habitat for several fur bearing mammals, supports seasonal fish spawning and is important for seasonal commercial fish harvesting and high use recreational fishing activities.
- 151** Amherstview Water Treatment Plant Intake - Call (613) 542-1763.
- 152** Amherstview Water Treatment Plant Intake - Call (613) 542-1763.
- 153** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.

## NOTES

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

- 147** The Long Point Bay region is classified as an Area of Natural and Scientific Interest. It is a geological formation called a drumlin. It is representative of the last ice age and is used for comparative purposes. Responders should take care not to damage this geological feature.
- 150** The Parrots Bay Wetland is an active feeding area for provincially significant colonial waterbirds, waterfowl, wading birds, raptors, regionally rare bird species and Blandings Turtles. Regionally rare plant species thrive in this area. This wetland provides a habitat for several fur bearing mammals, supports seasonal fish spawning and is important for seasonal commercial fish harvesting and high use recreational fishing activities.
- 151** Amherstview Water Treatment Plant Intake - Call (613) 542-1763.
- 153** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- 154** Point Pleasant Water Treatment Plant Intake - Call (613) 389-7888.
- 155** The Amherst Island/Long Point Wetlands support provincially significant birds. These wetlands support Milk Snakes and Blandings Turtles. They are a habitat for fur bearing mammals and raptors and are regionally significant for waterfowl staging. These marshes are important for fish spawning, commercial fishing and high use recreational hunting activities. Numerous land access sites for responders occur on Amherst Island.
- 156** Numerous historic shipwrecks are located near and adjacent to Simcoe Island.



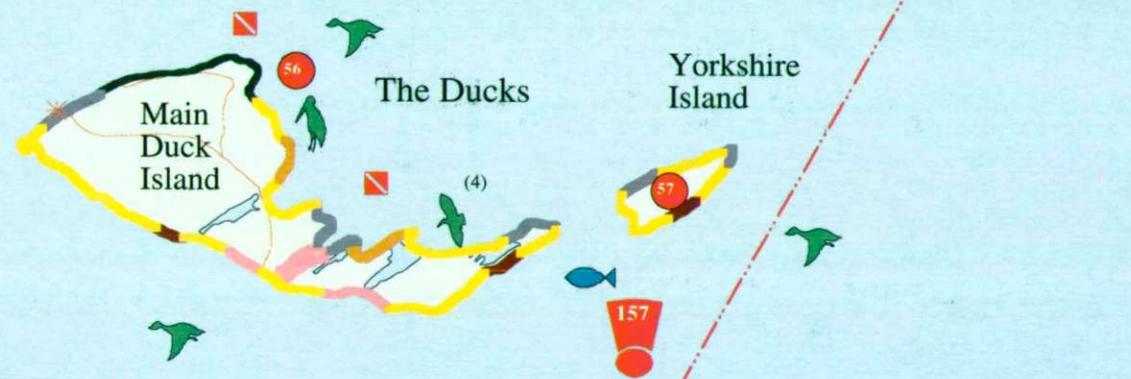
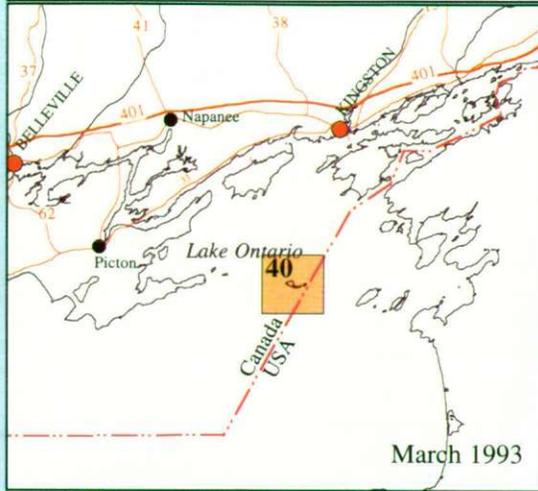
43° 59' 11" N  
76° 42' 12" W

43° 59' 11" N  
76° 31' 59" W

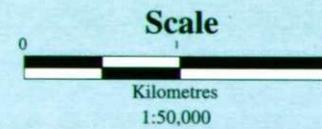
# Map 40

Contains Sections From NTS Map Numbers:  
**30N/15**

The Ducks are 17.5 kilometres  
east of Long Point.



# Lake Ontario



## NOTES !

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

- 157** ! Two historic ship wrecks are situated near Main Duck Island. The Ducks Islands provide a feeding habitat for migratory waterfowl and nesting Great Blue Herons. Lake Trout spawn during the fall along the shoals which surround the Ducks Islands.

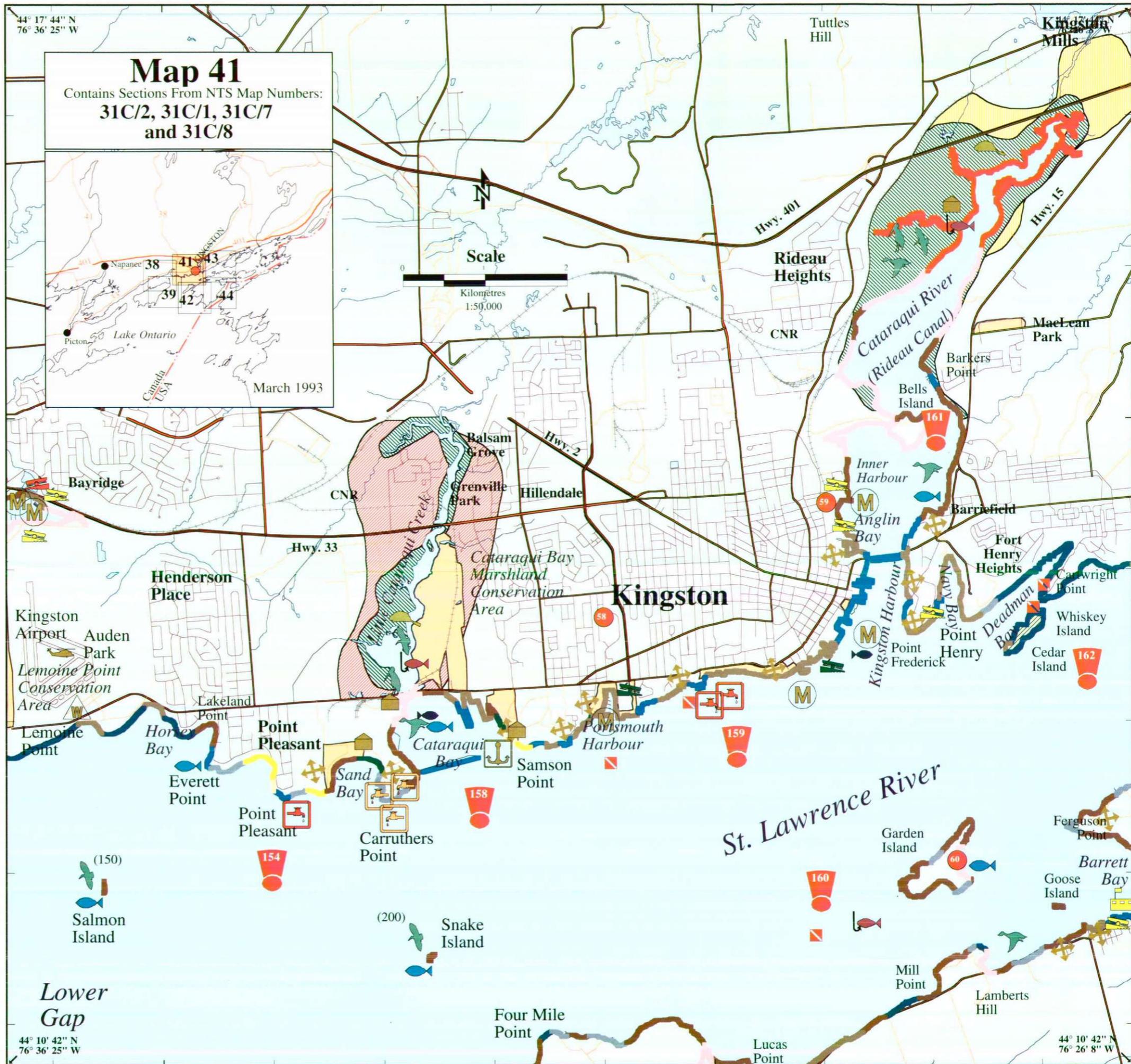
43° 52' 9" N  
76° 42' 12" W

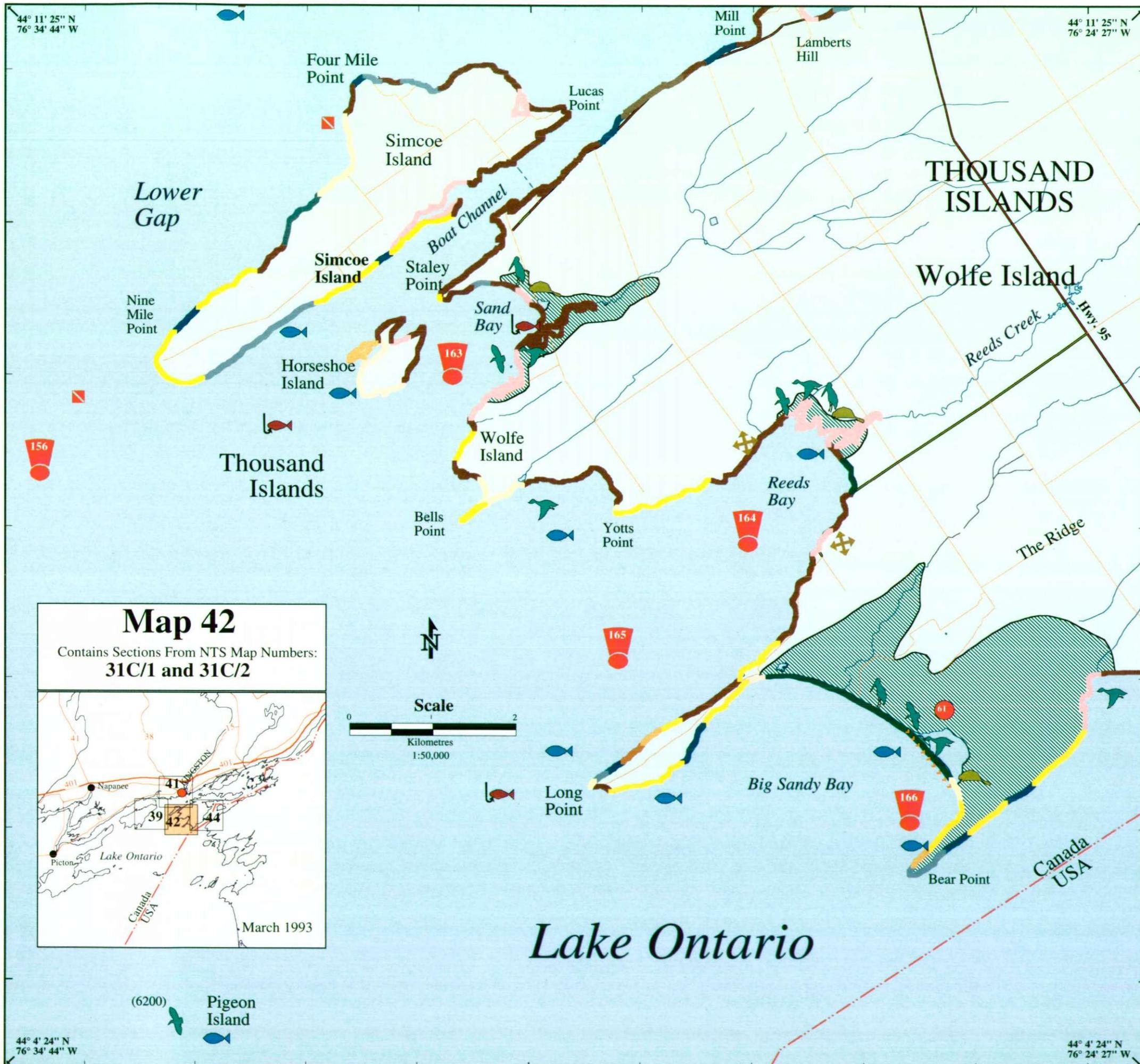
43° 52' 9" N  
76° 31' 59" W

# NOTES

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

- 154** Point Pleasant Water Treatment Plant Intake - Call (613) 389-7888.
- 158** The Little Cataraqui Wetland has National Significance as a waterfowl staging area. It is a feeding habitat for provincially significant birds and River Otters. This wetland is a highly significant Tree Swallow migration area, a habitat for several fur bearing mammals, and is important for seasonal fish spawning, commercial fish harvesting and high use recreational activities. The Little Cataraqui Wetland is classified as an Environmentally Sensitive Area due to its designation as a highly significant bird migration area.
- 159** Kingston Water Treatment Plant Intakes - Call (613) 542-1763.
- 160** Commercial and sport fishing activities have seasonal significance along the shoreline of the St. Lawrence River. Seasonal fish spawning occurs along the northwest shore of Wolfe Island at Mill Point and Garden Island.
- 161** The Cataraqui Marsh 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 classified as an Area of Natural and Scientific Interest. It is a significant river valley and coastal wetland land form representative of a "Class 1" wetland. The Cataraqui Marsh is classified as an Environmentally Sensitive Area due to its designation as a highly significant bird migration area.
- 162** Ferry service exists between Kingston Harbour and Marysville and Dawson Point on Wolfe Island.





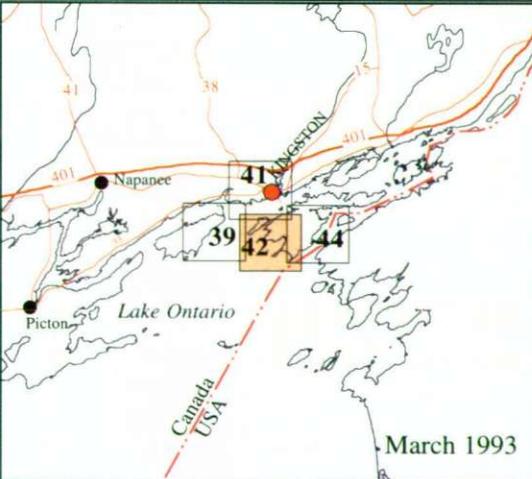
**NOTES** !

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

- 156** Numerous historic shipwrecks are located near and adjacent to Simcoe Island.
- 163** The Sand Bay Wetland is a feeding habitat for nesting colonial waterbirds, staging waterfowl and wading birds. This wetland supports numerous plant species, seasonal fish spawning and is a habitat for several fur bearing mammals. It is important for seasonal commercial fish harvesting activities. Seasonal fish spawning occurs along the shorelines of Simcoe, Horseshoe and Wolfe Islands: Smallmouth Bass in Summer.
- 164** The Reeds Bay Wetland 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.
- 165** Seasonal fish spawning occurs along the southwest shoreline of Wolfe Island at Yotts Point and Long Point: Northern Pike in Spring and Smallmouth Bass in Summer. Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario.
- 166** The Big Sandy Bay Wetland 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 Area of Natural and Scientific Interest. 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.

**Map 42**

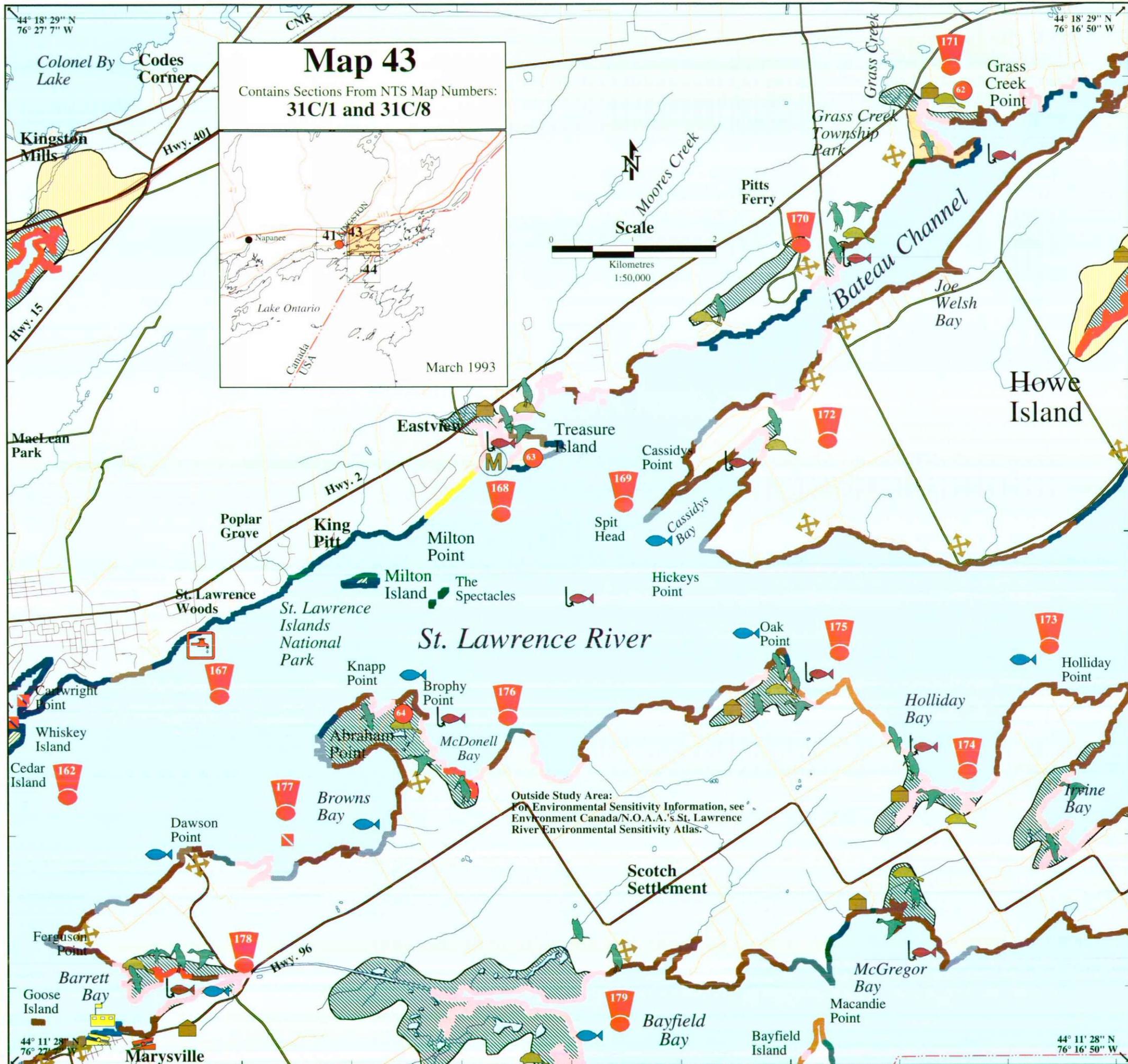
Contains Sections From NTS Map Numbers:  
**31C/1 and 31C/2**

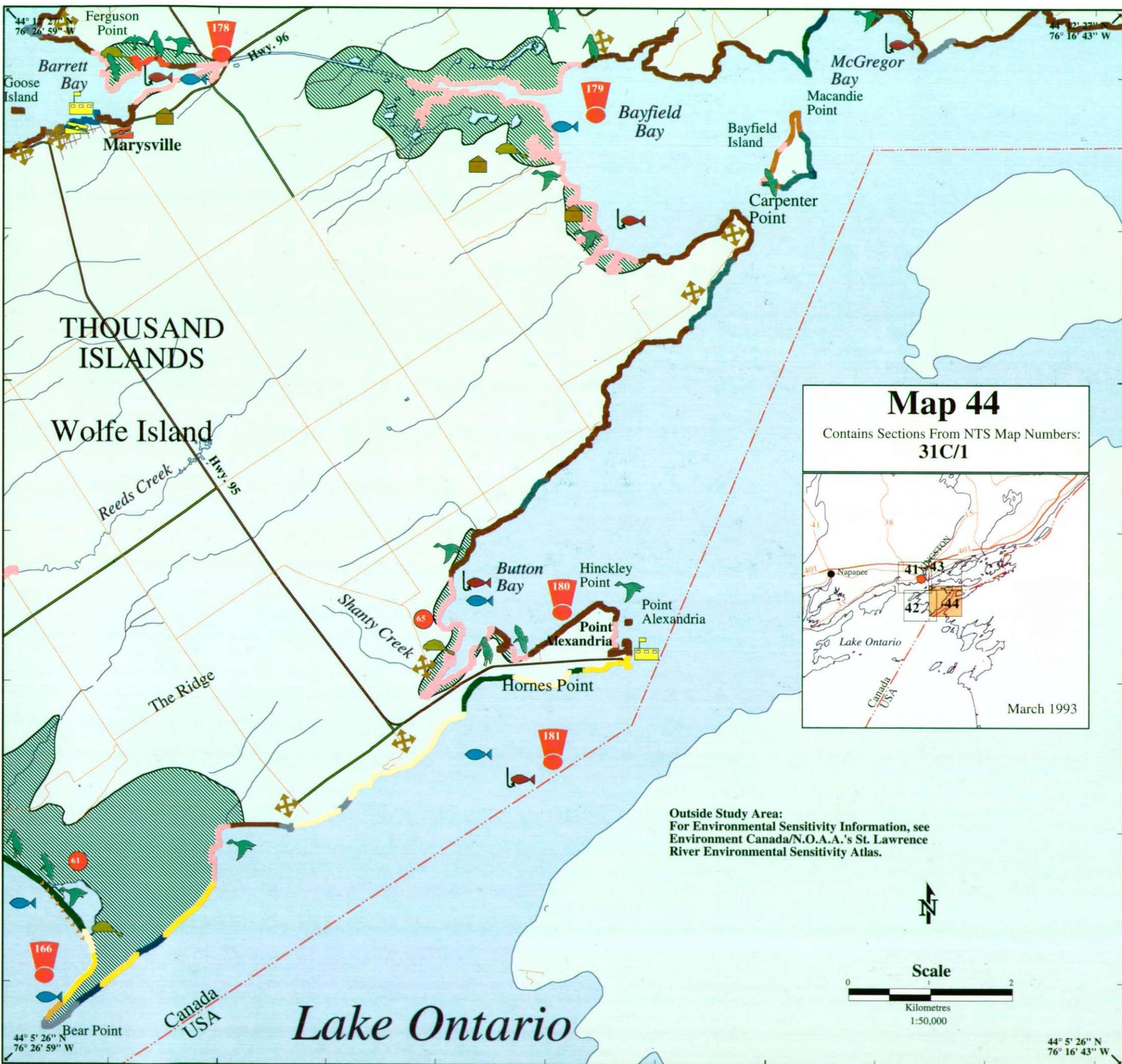


# NOTES

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

- 162 Ferry service exists between Kingston Harbour and Marysville and Dawson Point on Wolfe Island.
- 167 Kingston Sewage Treatment Plant Water Intake - Call (613) 542-1763.
- 168 The Madoma Marsh supports colonial waterbirds, Swamp Sparrows, fish spawning, commercial fish harvesting and recreational activities.
- 169 Seasonal fish spawning occurs along the shoreline of Cassidy's Bay.
- 170 The Lawless Wetland supports Green Herons and Eastern Milk Snakes. The Pitts Ferry Wetland supports birds, fur bearers, fish spawning and commercial fish harvesting.
- 171 The Grass Creek Wetland supports colonial waterbirds, fur bearers, fish spawning and commercial fish harvesting.
- 172 The Cassidy's Bay Wetland supports colonial waterbirds, fur bearing mammals, fish spawning and commercial fish harvesting.
- 173 Seasonal fish spawning occurs along the north shore of Wolfe Island from Oak Point to Holliday Point.
- 174 The Wolfe Island Wetlands support birds, rare plants, fur bearers, fish spawning, commercial fish harvesting and recreational activities.
- 175 The Oak Point Wetland supports birds, raptors, rare plants, fur bearers, fish spawning, commercial fish harvesting and educational visits.
- 176 The McDonnell Bay Wetland supports birds, plants, fish spawning, fur bearers and commercial fish harvesting.
- 177 Seasonal fish spawning occurs in Browns Bay and at Dawson Point.
- 178 The Barrett Bay Wetland supports birds, plants, fur bearers and fish spawning and harvesting.
- 179 The Bayfield Bay Marsh supports birds, raptors, rare plants, fish spawning, commercial fish harvesting, recreational hunting and fur bearers.





**Map 44**  
 Contains Sections From NTS Map Numbers:  
**31C/1**

March 1993

Outside Study Area:  
 For Environmental Sensitivity Information, see  
 Environment Canada/N.O.A.A.'s St. Lawrence  
 River Environmental Sensitivity Atlas.

**NOTES**

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

- 166** The Big Sandy Bay Wetland 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 Area of Natural and Scientific Interest. 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.
- 178** The Barrett Bay Wetland supports birds, plants, fur bearers and fish spawning and harvesting.
- 179** The Bayfield Bay Marsh supports birds, raptors, rare plants, fish spawning, commercial fish harvesting, recreational hunting and fur bearers.
- 180** The Button Bay Wetland 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 and is regionally important for waterfowl staging. Commercial fish harvesting is an important activity in this area.
- 181** Commercial and sport fishing activities have seasonal significance along the shoreline of Lake Ontario and the St. Lawrence River. Seasonal fish spawning occurs along the south shoreline of Wolfe Island from Bear Point to Hinckley Point: Smallmouth Bass in Summer.

## Appendix A - Data Sources

Source agencies for data used in the creation of the Environmental Sensitivity Atlas for Lake Ontario's Canadian Shoreline are listed below.

### A.1 Biological Resources

#### A.1.1 Bird Information

Colonial Waterbird Nesting Sites  
contact - Dr. Hans Blokpoel  
contact - Gaston Tessier  
Canadian Wildlife Service  
49 Camelot Drive, Nepean, ON, K1A 0H3  
(613) 952-2410

Waterfowl, Raptor, and Shorebird Data  
Contact - Joe Carreiro  
Canadian Wildlife Service  
49 Camelot Drive, Nepean, ON, K1A 0H3  
(613) 952-0931

Waterfowl Specialist  
Contact - Ken Ross  
Canadian Wildlife Service  
49 Camelot Drive, Nepean, ON, K1A 0H3  
(613) 952-2299

Waterfowl Specialist  
Contact - D. Dennis  
Canadian Wildlife Service  
London, Ontario  
(519) 681-0980

Ducks Unlimited  
1-800-665-DUCK

Long Point Bird Observatory  
Contacts - Ron Ridout  
Raptor Information  
John McCracken  
Bird Migration Specialist  
Dr. Richard Knapton  
Waterfowl Specialist

P. O. Box 106  
Port Rowan, Ontario  
N0E 1M0  
(519) 586-3531

Ministry of Natural Resources - Aurora  
Contact - James Duncan  
Rare Species Mapping Project  
Park and Recreational Area Section  
Aurora, Ontario

Ministry of Natural Resources - Elmer  
Contact - Pud Hunter  
Raptor Specialist  
Elmer, Ontario

Ministry of Natural Resources - Napanee  
Contact - Chris Schaefer  
Area Planner  
1 Richmond Blvd.  
Napanee, Ontario  
K7R 3M8  
(613) 354-2173

Ministry of Natural Resources - Niagara  
Contact - Linda Barbetti  
Resource Liason Officer  
P. O. Box 1070, #20 Highway  
Fonthill, Ontario  
L0S 1E0  
(416) 892-2656

Ministry of Natural Resources - Maple  
Contact - Tracey Smith  
Fish and Wildlife Supervisor  
10401 Dufferin Street  
Maple, Ontario  
L6A 1S9  
(416) 832-2761

Ministry of Natural Resources - Lindsay  
Contact - Rick Calhoun  
322 Kent Street West  
Lindsay, Ontario  
K9V 4T7  
(705) 324-6121

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

Royal Ontario Museum  
Contact - Ross James  
Curator of Ornithology

St. Thomas Field Naturalists  
Contact - Ceril Crocker  
St. Thomas, Ontario  
(519) 775-2507

University of Waterloo  
Mike Cadman  
Migratory Waterfowl  
(519) 885-1211 ext. 3237

#### A.1.2 Fish Information

Canada Centre for Inland Waters  
Fish and Ocean Charts  
Burlington, Ontario  
(416) 366-4549

Ministry of Natural Resources - Maple  
Contact - Ian Buchanan  
Area Biologist  
10401 Dufferin Street  
Maple, Ontario  
L6A 1S9  
(416) 832-2761

Ministry of Natural Resources - Niagara Region  
Contact - Linda Barbetti  
Resource Liason Officer  
P. O. Box 1070, #20 Highway  
Fonthill, Ontario  
L0S 1E0  
(416) 892-2656

Ministry of Natural Resources - Napanee  
Contact - Chris Schaefer  
Area Planner  
1 Richmond Blvd.  
Napanee, Ontario  
K7R 3M8  
(613) 354-2173

#### A.1.3 Shore Associated Mammals

Ontario Ministry of Natural Resources - Niagara, Napanee, Lindsay and Maple Regions.

### A.2 Countermeasures

Canadian Coast Guard (CCG)  
Contact - Ray Amell  
CCG Prescott District  
Prescott, Ontario  
(613) 925-2865

Canadian Coast Guard (CCG)  
Contact - Brian Riddell  
CCG Flight Supervisor  
Prescott, Ontario  
(613) 925-5840

Canadian Petroleum Products Institute  
Contact - Chuck Bailey  
Toronto, Ontario  
(416) 492-5713

Ontario Ministry of the Environment - Kingston, Toronto, Hamilton

Regional Environmental Emergencies Coordinator  
Environmental Protection - Ontario Region  
Environment Canada  
(416) 973-1059

Janet Huehn (Contractor) in consultation with Environment Canada and Canadian Coast Guard  
Contact - Environment Canada

### Weather Information

Atmospheric Environment Service  
Contact - Brian Smith  
Meteorological Station Sites, Meteorological Data (wind, temperature, precipitation etc.)  
8th Floor  
25 St. Clair Ave. East  
Toronto, Ontario

### A.3 Human-Use Resources

#### A.3.1 High Recreational Usage

Ministry of Natural Resources - Cambridge, Napanee, Niagara, Maple and Lindsay

Various Conservation Authorities

#### Anchorage Sites

Richardson's Chartbook and Cruising Guide: Lake Ontario Edition

#### Small Craft Harbours

Department of Fisheries and Oceans (DFO)  
Contact - Serge Metikosh  
Small Craft Harbours  
(416) 336-4637

#### Recreational Dive Sites

Ontario Underwater Council  
1220 Sheppard Ave. E.  
Willowdale, Ontario  
M2K 2X1  
(416) 495-4245

#### A.3.2 Resource Extraction

##### Water Intakes

Canadian Great Lakes Basin Intake and Outfall Atlas, Volume 7, Ontario  
Ministry of the Environment

##### Commercial Fisheries Activity

Department of Fisheries and Oceans (DFO)  
(416) 336-4637

Ministry of Natural Resources - Cambridge, Napanee, Niagara, Maple and Lindsay

#### 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  
Contact - Bernice Field  
Archaeological Site Database  
77 Bloor St. West, 2nd Floor  
Toronto, Ontario  
(416) 314-7161  
(416) 314-7790 (Fax)

##### Area of Ecological Significance

Ministry of Natural Resources - Central Region  
Contact - James Duncan  
Natural Heritage Technician  
"Old" Central Region  
50 Bloomington Road West  
R. R. #2  
Aurora, Ontario  
L4G 3G8  
(416) 841-9343

Canadian Wildlife Service  
Nepean, ON  
(613) 952-0931

Ministry of Natural Resources - Cambridge, Napanee, Niagara, Maple, Aurora and Lindsay

### Areas of Natural and Scientific Interest (ANSI)

Ministry of Natural Resources - Napanee  
Contact - Lands Division  
Areas of Natural and Scientific Interest  
1 Richmond Blvd.  
Napanee, Ontario  
K7R 3M8  
(613) 345-2173

Ministry of Natural Resources - Lindsay  
Contact - Lands Division  
Areas of Natural and Scientific Interest  
322 Kent Street West  
Lindsay, Ontario  
K9V 4T7  
(705) 324-6121

Ministry of Natural Resources - Niagara  
Contact - Lands Division  
Areas of Natural and Scientific Interest  
P. O. Box 1070, #20 Highway  
Fonthill, Ontario  
L0S 1E0  
(807) 475-1451

Ministry of Natural Resources - Maple  
Contact - Land Division  
Box 7400, 10401 Dufferin Street  
Maple, Ontario  
L6A 1S9  
(416) 832-2761

### Conservation Area Information

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

Credit Valley Conservation Authority  
(416) 670-1615

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

Halton Region Conservation Authority  
(416) 847-7430

Metropolitan Toronto and Region Conservation Authority  
(416) 661-6600

Napanee Region Conservation Authority  
(613) 354-3312

Prince Edward Region Conservation Authority  
(613) 476-7408

Cataraqui Region Conservation Authority  
(613) 546-4228

Ganaraska Conservation Authority  
(416) 885-8173

Moira River Conservation Authority  
(613) 968-3434

Lower Trent Region Conservation Authority  
(613) 394-4829

Niagara Peninsula Conservation Authority  
(416) 227-1013

### Dune Formation Information

Canada Mapping Company  
211 Yonge Street  
Toronto, Ontario  
(416) 362-9297

Energy, Mines and Resources Geological Survey of Canada  
Ottawa, Ontario  
(613) 995-4342

Federal Publications  
165 University Ave.  
Toronto, Ontario  
(416) 581-1552

Ministry of Natural Resources Crown Lands  
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) 392-2510

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. M2-17  
900 Bay Street, MacDonald Block  
Toronto, Ontario  
M7A 1C3  
(416) 314-3803

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

#### Environmentally Sensitive Areas

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

Credit Valley Conservation Authority  
(416) 670-1615

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

Halton Region Conservation Authority  
(416) 847-7430

Metropolitan Toronto and Region Conservation Authority  
(416) 661-6600

Napanee Region Conservation Authority  
(613) 354-3312

Prince Edward Region Conservation Authority  
(613) 476-7408

Cataraqui Region Conservation Authority  
(613) 546-4228

Ganaraska Conservation Authority  
(416) 885-8173

Moir River Conservation Authority  
(613) 968-3434

Lower Trent Region Conservation Authority  
(613) 394-4829

Niagara Peninsula Conservation Authority  
(416) 227-1013

Ministry of Natural Resources - Cambridge, Napanee, Lindsay, Maple  
and Niagara

#### First Nation Information

Indian and Northern Affairs Canada  
Toronto, Ontario  
(416) 973-6234

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

#### National Parks

Canadian Parks Service  
St. Lawrence Islands National Park

#### Provincial Parks, Nature Reserves or Wilderness Areas

Ministry of Natural Resources - Cambridge, Napanee, Lindsay, Maple  
and Niagara

#### A.4 Shoreline Habitats

##### Shoreline Classifications

Regional Environmental Emergencies Coordinator  
Environment Protection - Ontario Region  
Environment Canada  
(416) 973-1059

Andrew Podor (Contractor)  
Geomorphologist  
Contact - Environment Canada

#### Aerial Photos

Energy, Mines and Resources  
Air Photo Sales  
Ottawa, Ontario  
(613) 995-4560

Ministry of Natural Resources  
Aerial Mapping Service  
First floor, Room # M173  
900 Bay (Corner of Bay and Wellesley)  
Toronto, ON  
(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) 392-2510

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

Environment Canada and Digimap Data Services Inc. (Contractor)  
Contacts - Bruce Mooney & Michael Quinn  
Digimap Data Services Inc.  
37 Kodiac Crescent, Unit 3  
North York, Ontario  
(416) 633-2213  
(416) 633-3248 (Fax)

#### Municipal Maps

Ontario Base Maps (OBM) 1:2000

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  
615 Booth Street  
Ottawa, Ontario K1A 0E9  
(800) 661-2638

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

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

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

## Appendix B - Listing of National Topographic System (NTS) Map Sheets

The following NTS map sheets (1:50,000 scale) cover the Canadian portion of the Lake Ontario shoreline.

Map Sheet	Year	Map Sheet	Year
30 M/3		30 N/13	1981
& 30 M/6	1984	30 N/14	1981
30 M/4	1984	30 N/15	1982
30 M/5	1984	31 C/1	1991
30 M/12	1985	31 C/2	1991
30 M/11	1985	31 C/3	1991
30 M/14	1985	31 C/4	1991
30 M/15	1985	31 C/8	1982
30 M/16	1984		

Elements of base topographic maps showing on each atlas page  
have been reproduced with Natural Resources Canada's permission.

## Appendix C - References and Suggestions for Further Reading

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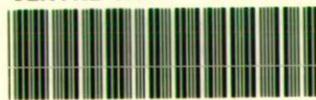
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To assist users in discerning one shoreline colour from another, a removable Legend insert has been included with the atlas. If required, users may line up this card over the shoreline habitat in question, to determine the exact colour of a given habitat.

## Legend

- ESI\* Ranking**
- 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
  - 2 Retaining Wall/Harbour Structure/ Breakwaters
  - 3 Shelving Bedrock
  - 4 Exposed Sediment Bluff
  - 5a Sand Beach: Depositional
  - 5b Sand Beach: Erosional or Transitory
  - 6 Sand Barrier With Lagoon
  - 7a Pebble Beach
  - 7b Pebble/Cobble Beach
  - 7c Cobble Beach
  - 8 Rip Rap
  - 9 Boulder Beach
  - 10 Mixed Beach (% by sediment in DOE Database)
  - 11 Low Vegetated Bank (Grass or Trees)
  - 12 Delta Mud Flat
  - 13a Fringing Wetland
  - 13b Broad Wetland
- \* ESI - Environmental Sensitivity Index  
Higher numbers indicate greater sensitivity
- Shoreline Habitats**
- Bedrock or Impermeable Shores**
- Unconsolidated Sediment Shores**
- Vegetated Shores**
- 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
  - Commercial Fisheries Activity
- Special Status Areas**
- Highly Sensitive Classified Feature (within 2km)
  - First Nation
  - National Park
  - Provincial Park, Nature Reserve or Wilderness Area
  - Conservation Area or Municipal Park
  - Environmentally Sensitive Area\*
  - Areas 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: Foreshore Flats/Rocky Reef
  - 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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