

Flood Damages in Ontario

1996	2000
1997	2001
1998	2002
1999	2003



Ontario

Ministry of Natural Resources
Ministère des Richesses naturelles

ACKNOWLEDGEMENTS

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This Report was prepared under the direction and guidance of the Ministry of Natural Resources' (MNR) Water Resources Section. The report was authored by Karen Wianecki, Planning Solutions and Ed Gazendam, Planning & Engineering Initiatives Ltd. who worked in conjunction with Carl Seider and Rob Fox of the Lands and Waters Policy Branch.

This report summarizes the key findings associated with flood damages from 1996 - 2003, based on the collection of base line data from Ontario's Conservation Authorities and MNR District Offices outside of CA jurisdiction.

The authors of this report would like to acknowledge the support and contribution of in-kind efforts by a number of individuals and organizations with an interest in floodplain management in the Province of Ontario. Special thanks in this regard are extended to the following organizations:

- Ministry of Municipal Affairs, Disaster Assistance Review Office
- AGRICORP
- Institute for Catastrophic Loss Reduction
- Emergency Management Ontario
- Insurance Bureau of Canada
- The Canadian Natural Hazards Assessment Project
- Public Safety and Emergency Preparedness Canada (PSEPC)

In particular, special thanks are extended to Conservation Ontario who provided corporate endorsement and support for this initiative. To MNR District Offices and Ontario's Conservation Authorities who diligently recorded and submitted flood event data, not only within a very short timeframe, but also during the middle of flood season, we owe an immense debt.

General weather and climate information contained in this report, including all maps and tables but excluding anecdotal information obtained from flood reports, was unabashedly obtained from various Environment Canada websites.

This report is intended to provoke thought and discussion about the future of floodplain management in Ontario. Future comments or questions concerning the content of this report are invited and may be directed to Rob Fox.

While many individuals have contributed in a variety of ways to this report, the authors assume responsibility for its content.

EXPLANATION OF SUMMARY OF FLOOD EVENTS

The scale of significant flood events is taken from the following table developed jointly by the Ministry of Natural Resources and Ontario's Conservation Authorities.

Scale of Significant Flood Events

Classification

CLASS 0

- No flooding

CLASS 1 - NUISANCE

- Flooding of low lying land
- No residential flooding
- Access routes are not disturbed

CLASS 2 - MINOR

- Some disruption to roads
- No evacuations
- Minor residential flooding such as some basement seepage or minor sewer backup

CLASS 3 - MAJOR

- Significant road damage
- Surface water in basements
- 1st floor residential flooding
- potential evacuation due to loss of services

CLASS 4 - SEVERE

- Major disruption to roads and services
- Many residences, 1st floor flooded
- Houses destroyed
- Evacuations
- Major risk to loss of life
- Industrial, commercial and agricultural damages

CLASS 5 - CATASTROPHIC

- Loss of life
- Community destruction

FATALITIES

It is inherently difficult to attribute fatalities directly to flooding. Causal effects as well as instances of high water need to be reported. In the final analysis, however, resulting fatalities will need to assess whether the outcome was the direct result of a decision made or action taken and could have potentially been avoided as a result.

DAMAGES

The damages and costs presented here are an estimate. For the most part, damage figures have been secured from two sources: information provided by Conservation Authorities and/or MNR District Offices and secondly, from newspaper reports. This report includes damage resulting from riverine flooding, and does not address damage resulting from sewer backup or from Great Lakes flooding and erosion hazards. Damage figures are estimates only as the calculation of flood damages varies across the Province. In some instances, the MNR 1990 Flood Damage Estimation Guide has been used. In other instances, updated studies have been completed with revised flood damage curves and that data has been employed to calculate damage. For the most part, damage figures include only the physical/direct economic cost associated with flooding and does not address the social/human costs attributed to flood events.

EVACUATIONS

Evacuations are reported either as the total number of people moved, or the number of families or households displaced.

FARMLAND FLOODED

This is extremely difficult data to obtain and often is unreported. Damage to agricultural crops and farmland are often reported as 'significant', with no quantifiable measure associated with the damage. Damage to insured crop land is retained by AGRICORP but is not readily accessible, given concerns with the integrity of the data.

CAUSE

Causes of floods include rainfall, snowmelt, wind, ice jams, thunderstorms and combinations of these.

EMERGENCY DECLARED

A flood emergency may be declared where a community requires outside assistance in order to cope with a flood event. The occurrences are documented here. Emergency Management Ontario retains detailed information on municipal emergency declarations where a multi-Ministry response is required.

DISASTER ASSISTANCE

A community may request that the Ontario Provincial Government declare a disaster area, thereby enabling the transfer of funds through the Disaster Relief Assistance Program to compensate municipalities for infrastructure damage and/or compensation to individual victims. This is independent of the declaration of a flood emergency. The communities receiving this assistance are listed. Disaster Financial Assistance is also available from the Federal Government, although Ontario has not been the recipient of federal disaster relief funding for many years.

EXECUTIVE SUMMARY

This report presents a summary of the damages and costs due to floods in Ontario for the period 1996-2003. A brief description of the damages and causes of the major flood events is provided.

Overall, Ontario is experiencing an increase in the frequency and intensity of flood events. Increasingly severe storms are causing an escalation in flood damage across the Province.

In Ontario, a state of emergency/municipal disaster has been declared virtually every year since 1995. Disaster relief assistance to municipalities have been provided by the Province at increasing rates since that time, with some of the most extensive payments being made in the last two years.

Observable trends in the data suggest that flooding in Ontario is occurring year-round. Flooding is not restricted to the spring, as, in the past, was generally the norm. In fact, data for the 1990-2003 period suggests that the most devastating flood in Ontario's history was not Hurricane Hazel in 1954, but the 49th Parallel Storm that hit the Northwestern part of the Province in June 2002. Damage from the 2002 storm was assessed by Acres International who concluded the storm "dropped as much as 401 mm of rain in the region of Northwestern Ontario bordering Manitoba and Minnesota. The thunderstorms and heavy rainfall were linked to a series of Mesoscale Convective Complexes (MCCs) associated with an east-west oriented quasi-stationary front stretching along the 49th parallel from Saskatchewan to well east of Lake Superior."¹ Acres concluded that this event was possibly the largest rainstorm ever monitored in this part of Canada and, in total, it was estimated to have caused \$31 million dollars damage, including \$3 million in infrastructure repairs.²

Trends in flood data suggest an increase in occurrence, an escalation in severity and an overall increase in damage. The data on flooding in general and flood damage in particular, however, is poor. There is no standard methodology for calculating flood damage and most definitions of flood damage focus on direct economic costs. The social and human cost associated with flooding is generally recognized but poorly understood. Ontario needs a comprehensive flood damage database upon which to make informed decisions respecting hazard management and the assessment of risk.

This report begins to update the provincial flood damage inventory for the period 1990-2003. Initially, it was hoped that extensive data would be provided for the entire thirteen (13) year period. A standard flood damage/cost survey was distributed to each of Ontario's 36 Conservation Authorities and 14 MNR District Offices outside of CA jurisdiction. A request for flood event information was requested however, the timeframe for completion of the review was six weeks and time constraints posed some challenges for the completion of the data set. In addition, while the Ministry used to collect flood event data from CA's and MNR District Offices, this practice had been discontinued. No updated flood event data had been collected by MNR since 1990.

The study determined that the quality of flood damage data varies widely across Ontario. While some flood damage costs were provided, these represented in some instances, a "best guess" as the data had not been collected at the time of the event. Some Conservation Authorities used the 1990 Flood Damage Estimation Guide for calculating flood damage while others relied on

¹ Acres International. Evaluation of the Storm and Flood of June 2002 in Northern Ontario. Acres International Limited. Winnipeg, Manitoba. October 2003.

² Ibid., p. ES-4.

damage reports filed in local newspapers. There is a need for a consistent methodology for calculating flood damage and reporting on flood events.

This Report does not provide a comprehensive nor conclusive study of all flood events that occurred in Ontario from 1996-2003. Rather, it is based on the best available information, secured from a variety of sources, and made available to the authors over a limited timeframe.

This report should be read in conjunction with a concurrent report prepared by Planning Solutions and Planning & Engineering Initiatives Ltd entitled "Evaluation of Water Resources Management Strategies and Flood Damages" (MNR, 2004) which provides specific recommendations for the future of flood damage data collection by the Ministry of Natural Resources.

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FLOOD DAMAGES IN ONTARIO 1996 - 2003

Purpose

This report presents a summary of flood damages in Ontario for the period 1996 to 2003. Some data is provided for the period from 1990 to 1995 though the quality and accuracy of the flood event and flood damage data for this period is not of uniform quality.

This report should be read in conjunction with a concurrent report prepared by Planning Solutions and Planning & Engineering Initiatives Ltd entitled "Evaluation of Water Resources Management Strategies and Flood Damages" (MNR, 2004) which provides specific recommendations for the future of flood damage data collection by the Ministry of Natural Resources. MNR (2004) also provides a definition of a flood event for the purposes of data collection and reporting.

The information contained in this report was compiled from a variety of sources. Flood event and flood damage data was supplied using a standard template provided to Ontario's 36 Conservation Authorities and 14 MNR District Offices. Flood damage costs were obtained through a focused newspaper search, with damage estimates supplementing the information supplied by the Conservation Authorities and MNR District Offices. Maps 1 and 2 detail the location of the various MNR and CA areas.

Evacuation information was supplied by the Flood and Fire Management Section of the Aviation and Forest Fire Management Branch of the Ministry of Natural Resources, though these records were far more complete for fire-related evacuations than for evacuations involving flood-related events. The costs associated with disaster relief funding were supplied by the Ministry of Municipal Affairs and Housing. In addition, reported costs on flood damage were obtained from a draft MNR Report on Hazard Identification and Risk Assessment, produced in March 2003. Information on municipal emergency declarations were obtained from Emergency Management Ontario.

Despite the variety of data sources used, there are inherent limitations associated with the data. These limitations warrant specific mention at the outset. The collection of flood event data was a standard practice in place in the Ministry of Natural Resources for many years. Staff in the Lands and Waters Policy Branch collected flood event and flood damage data on an annual basis from all Conservation Authorities and MNR District Offices. The data was analyzed and an Annual Flood Damage Report was issued each year. This practice was discontinued in 1990.

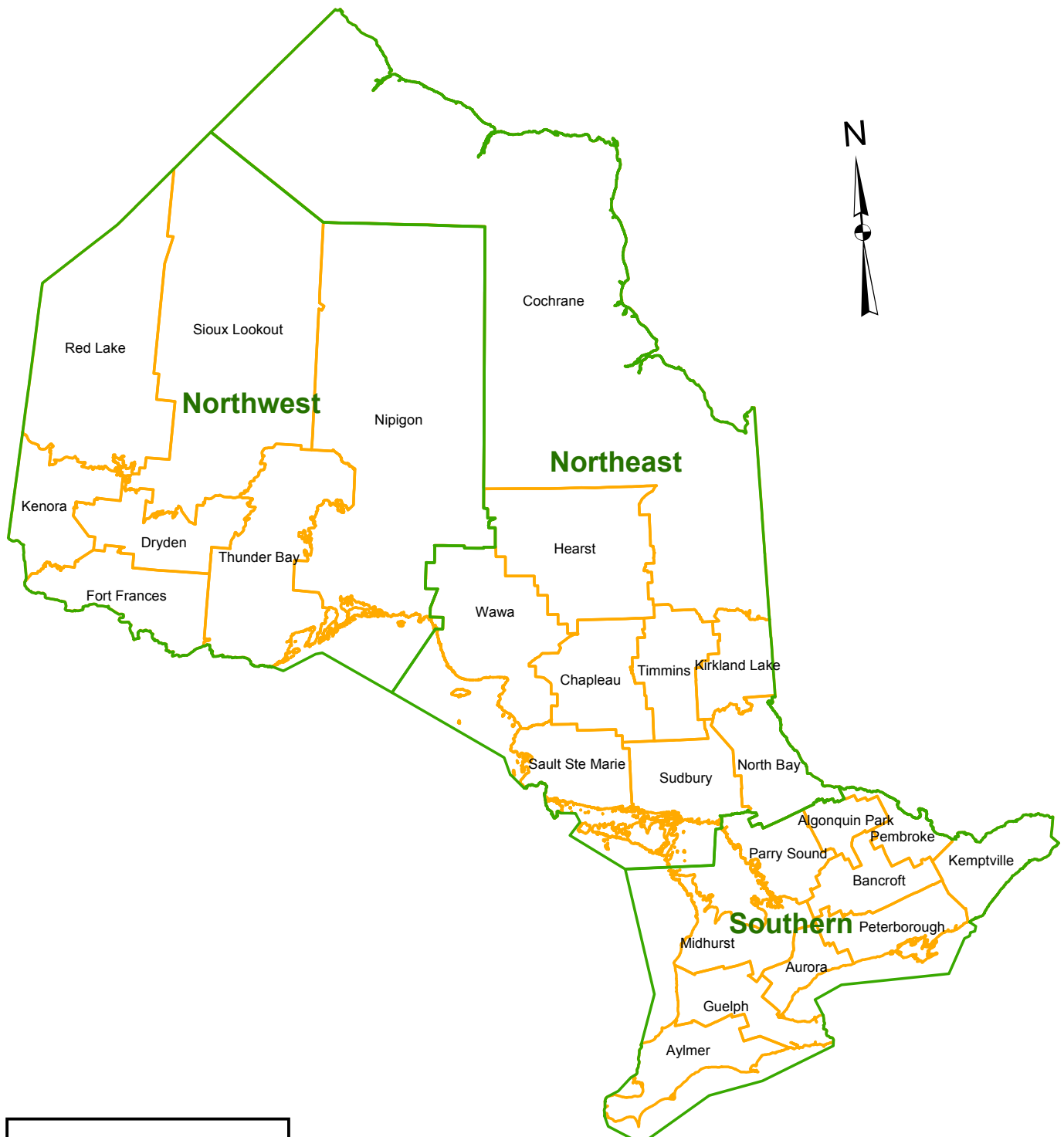
For the past thirteen years, there has been no effort made to collect data on flood events in general, or flood damage in particular. Reactivating the practice has been met with some difficulty. There has been no standard methodology in place for calculating flood damages or reporting on flood events. Data varies in quality from one Conservation Authority to another and from one MNR District to another. In some cases, meticulous records on flood events and flood damage have been recorded over the thirteen year period. In other cases, flood damage costs have neither been reported nor estimated. We can only conclude that flood damage data was of much better quality in the 1990s, than it is currently - a situation that can only be expected to improve with time.

Given emerging trends, there is a need - more than ever before - for a comprehensive and complete flood damage database for Ontario. The Ministry of Natural Resources needs to take a lead role in establishing the basis for this data collection.



Flood events and flood damages need to be calculated consistently and comprehensively. A standard methodology for calculating flood cost needs to be communicated to Conservation Authorities and MNR District Offices across Ontario. Flood information needs to be collected at the time of the event, and that this information needs to be

Ministry of Natural Resources

Regions and Districts



LEGEND

-  District Boundary
-  Region Boundary

Kilometers
0 150 300 600

Map 1 - MNR Districts and Regions

Conservation Authorities of Ontario



forwarded promptly to the Ministry of Natural Resources for input into a centralized flood damage database.

Better linkages need to be established between provincial government ministries and agencies to ensure a complete picture of flooding in Ontario. At this time, information on flooding is fractured among a number of different agencies and organizations. Work is underway at the Federal level to improve the existing Canadian Disaster Database. The Ministry of Natural Resources needs to partner more effectively with agencies at all levels, including the Federal Government. Finally, considerable research is being conducted by various organizations including the Institute for Catastrophic Loss Reduction on natural hazards in general, and flooding in particular. Opportunities exist to strengthen existing partnerships and build new alliances to improve the Province's understanding of flood hazards.

The following information is an initial first step aimed at providing insight into flood damage in Ontario.

Background

Flooding is the most common natural disaster in North America. In the United States, damage from flooding causes \$5.1 billion damage each year.³ In Canada, Federal Financial Assistance for flood related disasters has topped over \$700 million dollars since 1970. The trends are alarming.

In Ontario, over \$10 million in financial assistance was provided to municipalities under the Ontario Disaster Assistance Program in 2002 alone. In the seven year period from 1996 to 2002, flood damage costs in Ontario have exceeded \$16 million. This data includes only those losses reported under the ODRAP, SAM and Shoreline Property Assistance Programs, administered by the Ministry of Municipal Affairs and Housing and in no way, represents the true cost of flood damages from a physical, social, environmental and human perspective. The statistics are presented in **Table 1** below. What is alarming is that much of the damage from flooding is occurring in the same municipalities across Ontario. **Over time, it is becoming apparent that there are identifiable "wet spots" across the Province - areas that are experiencing increasingly severe flood activity on an almost predictable basis.**

Table 1 - Flood Damage Assistance to Municipalities 1996-2003⁴ (Values in \$)					
Year of Event	Municipality	ODRAP Public⁵	ODRAP Private⁶	Shoreline Property Assistance Program	Special Assistance to Municipalities (SAM)⁷
2002	Pembroke				253,000
	Fort Frances	469,743	4,250,000		
	Alberton	92,033	"		
	Atikokan	568,446	"		
	Chapple	537,954	"		
	Dawson	425,190	"		
	Lake of the Woods		"		
	La Vallee	307,755	"		
	Machin	144,733	"		

³ Flooding & Insurance. Munich Reinsurance Company.

⁴ Source of Data: Ministry of Municipal Affairs ODRAP, SPAP & SAM Files. Compiled by MMAH Staff.

⁵ ODRAP public = money to municipalities.

⁶ ODRAP private figures represent the provincial contribution only. ODRAP private = money to individuals, small businesses or farmers.

⁷ SAM = public money to municipalities where no formal disaster is declared.

Table 1 - Flood Damage Assistance to Municipalities 1996-2003 ⁴ (Values in \$)					
Year of Event	Municipality	ODRAP Public ⁵	ODRAP Private ⁶	Shoreline Property Assistance Program	Special Assistance to Municipalities (SAM) ⁷
	Morley	441,900	"		
	Emo	201,964	"		
	Sioux Narrows	152,460	"		
	Ignace	26,573	"		
	Rainy River	784,075	"		
	Peterborough	1,448,071	"		
	Smith-Ennismore	120,080	270,595		
		67,558	"		
	Total 2002	5,788,535	4,520,595		253,000
2001	Chapple		"		125,791
	Dawson		"		52,861
	Dryden		"		4,559
	Emo		"		10,361
	Fort Frances		"		28,989
	Lake of the Woods		"		
	La Vallee		"		114,138
	Morley		"		33,505
	Rainy River		"		22,120
	Tupman Lake		"		18,325
			"		5,755
	Total 2001		482,825		416,404
1999	Amherstburg			13,100	
	Total 1999			13,100	
1998	Essex			32,900	
	Central Manitoulin		7,281		
	Gosfield South	50,000			
	Gravenhurst	64,367			
	Brudnell & Lyndock	50,000			
	Addington Highlands	41,600			
	Central Manitoulin	5,000			
	Huntsville	17,250	18,989		
	Penetanguishene	57,568			
	Bracebridge	185,000			
	Peelee	300,000			
	Drummond/ North Elmsley	28,320			
	Beckwith	130,448			
	Lanark	221,324	428,172		
	Snowdon	40,000			
	Dysart et al	151,927			
	Cardiff	30,850			
	Glamorgan	6,017			
	Monmouth	13,062			
	Anson, Hindon & Minden	77,500			

Table 1 - Flood Damage Assistance to Municipalities 1996-2003 ⁴ (Values in \$)					
Year of Event	Municipality	ODRAP Public ⁵	ODRAP Private ⁶	Shoreline Property Assistance Program	Special Assistance to Municipalities (SAM) ⁷
	Burleigh-Anstruther-Chandos	40,963			
	Havelock, Belmont & Methuen	30,571			
	Renfrew	844,000			
	North Frontenac	78,000			
	Hastings	29,136			
	Wollaston	306,000			
	Mississippi Mills	27,500			
	Carleton Place	75,000			
	Ramara	21,819			
	Severn	23,255			
	Amherstburg	30,000			
	Somerville	287,390			
	Essex County	635,000	161,152		
	Total 1998	3,898,867	615,594	32,900	
1997	Shuniah Twp.	241,400			
	Romney Twp.				15,100
	Rochester Twp.				10,000
	Mersea Twp.				17,700
	Leamington				9,498
	St. Clair Beach				7,500
	Belle River				37,700
	Colchester				12,200
	Total 1997	241,400			109,698
1996	Atikokan		188,658		
	Chapleau		10,902		
	Timmins		116,642		
	Total 1996		316,202		
Totals		\$9,928,802	\$5,935,216	\$46,000	\$526,102

The Ministry of Natural Resources has lead responsibility for water quantity management and, by Order in Council, has been identified as the lead provincial agency responsible for flood emergency management. Ontario's 36 Conservation Authorities retain responsibility for the management of water and resources on a watershed basis. A key mandated objective of the CAs (and MNR Distinct Offices outside of CA jurisdiction) is to "develop and maintain programs that will protect life and property from natural hazards such as flooding, erosion (and drought)."⁸

⁸ Ministry of Natural Resources. Provincial Hazard Identification and Assessment Report. March 27, 2003.

Flood damage costs are escalating. The following data, obtained from the March 2003 Ministry of Natural Resources' Provincial Hazard Identification and Risk Assessment Report, shows a growth in reported costs by decade.

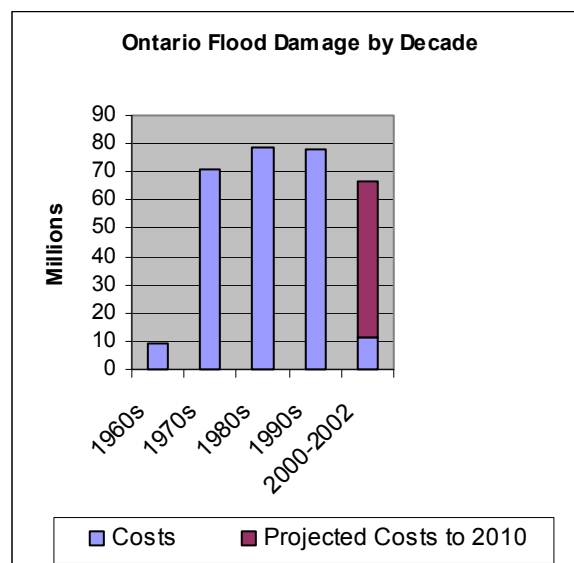


Figure 1 – Ontario Flood Damage by Decade

In the 1960s, reported flood costs totaled \$9.2 million. By the 1980s, that figure had jumped to more than \$78 million. In the first two years of this decade, over \$11 million has been paid in Ontario Disaster Relief Assistance alone. Perhaps the only reason that general flood damages are lower for the first few years of 2000 is that climatic conditions have been reasonably dry and lake levels low (as will be discussed in subsequent sections). Should high lake levels and a wet period occur again, such as typically occurred in the 1970s, 1980s and 1990s, this value could be significantly higher again.

However, the data in no way represents the true costs of flood damage but only that portion of the funding bill being paid through ODRAP, SAM and Shoreline Assistance. Clearly flood costs are on the rise and predictions suggest that this growth will only increase, given the growth in Ontario's population, the increase in property values, the trend toward more frequent and more severe flood events and the overriding concern with an aging infrastructure.

Not only are flood costs increasing in Ontario, but so too are the frequency of flood events. At one time, flooding occurred mostly during the March and April period, largely associated with snowmelt and increased runoff. These facts no longer hold true. Flooding occurs year-round, in response to a combination of factors including ice jams, rain, thunderstorms and spring melt:

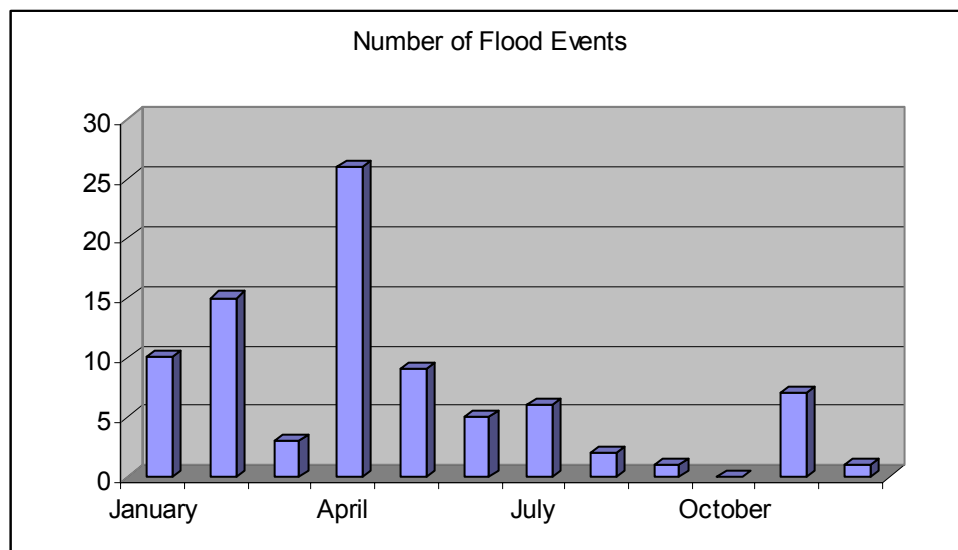
Table 2 - Causal Factors Associated with Flooding 1990-2003		
Cause	Number of Flood Events	Percentage of Total
Ice Jam	14	17%
Rain on Snowmelt	38	47%
Rain	26	31%
Wind	3	3%
Thunderstorm	2	2%

* Source: Flood Damage/Cost Survey Data Completed by Ontario Conservation Authorities & MNR District Offices (N = 83).

For the period 1990 to 2003, a total of 85 recorded flood events were examined.⁹ The distribution of these events is summarized below:

Table 3 - Distribution of Flood Events By Month 1990-2003		
Month	Number of Flood Events	Percentage of Total
January	10	12%
February	15	18%
March	3	4%
April	26	30%
May	9	11%
June	5	6%
July	6	7%
August	2	2%
September	1	1%
October	0	0%
November	7	8%
December	1	1%

Figure 2 – Number of Flood Events by Month 1990 - 2003



A study conducted in 1991 by The Water Network traced Ontario's flood history from 1680-1989. In total, 547 flood events were examined and the data analysis revealed the majority of these 547

⁹ Note: This does not include the 271 reported floods on the Grand River or the catastrophic flooding that occurred in 2001 and 2002 in Northwestern Ontario.

floods occurred in March and April.¹⁰ Clearly there has been a change in the pattern of flood occurrence since 1991. Flooding now occurs year-round, as evidenced from the above.

The Water Network study also determined that floods that occurred in the study period were caused by a combination of spring melt, precipitation and/or ice jams. **From 1990-2003, greater intensity storms, perhaps associated with environmental instability and the affects of climate change are becoming increasingly event driven, particularly in the Northwestern part of the Province.** As noted earlier, areas across the Province are flooding with increased frequency.

The number of flood events across Ontario is also evidenced by the number of municipalities having declared flood emergencies/disasters. The following table highlights the annual statistics for municipal flood emergencies for the 11 year period from 1992 to 2003:

Table 4 - Flood Emergencies Declared By Ontario Municipalities 1992-2003¹¹			
Date	Location	Emergency Declared	Emergency Terminated
May 1992	Beardmore	May 14, 1992	May 20, 1992
May 1992	Attawapiskat First Nation	May 15, 1992	May 20, 1992
April 1993	Ottawa		
April 1993	Bancroft		
October 1995	Central Ontario		
May 1996	Kashechewan First Nation	May 15, 1996	May 19, 1996
May 1996	Fort Albany First Nation	May 15, 1996	May 19, 1996
May 1996	Timmins	May 19, 1996	June 10, 1996
May 1996	White River First Nation	May 21, 1996	May 31, 1996
May 1996	Beardmore	May 21, 1996	May 28, 1996
May 1996	Foleyet	May 21, 1996	June 14, 1996
May 1996	Attawapiskat First Nation	May 21, 1996	May 27, 1996
May 1996	Pic Moberg First Nation	May 21, 1996	June 17, 1996
July 1996	Atikokan Twp.	July 6, 1996	July 10, 1996
Jan. 1997	Durham	Jan 8, 1997	Jan. 30, 1997
Feb 1997	Durham	Feb. 23, 1997	Feb. 24, 1997
Feb 1997	Southern Ontario		
April 1997	Rainy River	April 8, 1997	April 14, 1997
April 1997	Harwich Twp.	April 22, 1997	
May 1997	Fort Albany First Nation	May 4, 1997	
May 1997	Kashechewan First Nation	May 4, 1997	
May 26, 1997	Fort Severn First Nation	May 26, 1997	
May 28, 1997	Weenusk First Nation	May 28, 1997	June 1, 1997
March 30, 1998	Goulais River		
March 31, 1998	Sudbury Region		
March 31, 1998	Somerville Twp., Burleigh-Anstruther- Chandos Twp.		
April 8, 1998	Point Au Baril; Sturgeon		

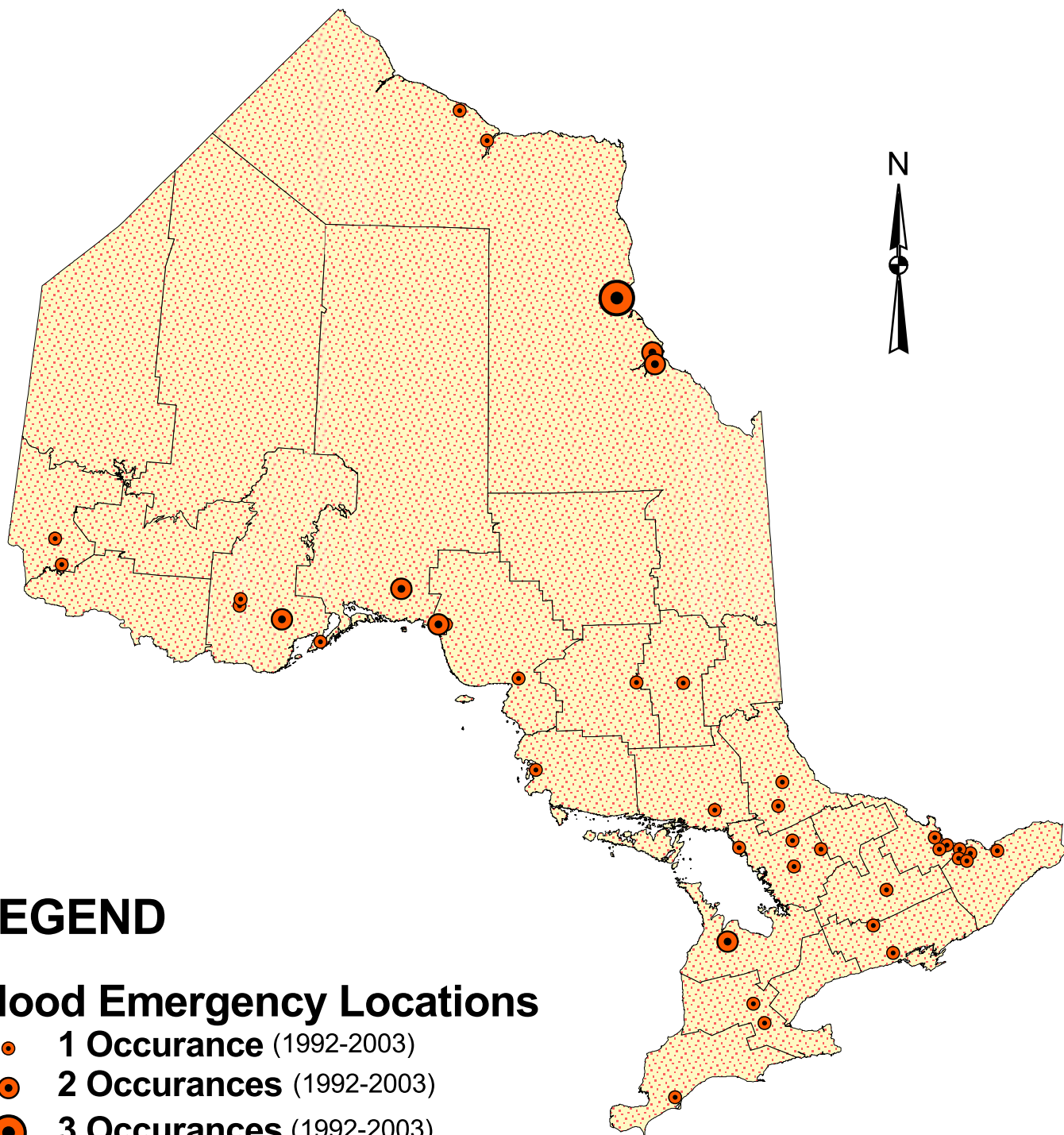
¹⁰ The Water Network. A Report on Ontario Flood History. An Initiative of the Grand Valley Conservation Foundation. January 1991. Faculty of Environmental Studies, University of Waterloo.

¹¹ Source of Data: Emergency Management Ontario Flood Damage Statistics. Compiled by EMO Staff. February 22, 2004.

Table 4 - Flood Emergencies Declared By Ontario Municipalities 1992-2003 ¹¹			
Date	Location	Emergency Declared	Emergency Terminated
	Falls; Renfrew Area; Village of Pakenham		
April 1998	Lanark Highlands	April 1, 1998	
April 1998	Kearney	April 3, 1998	
April 1998	Drummond Twp.	April 3, 1998	
April 1998	North Elmsley	April 3, 1998	
April 1998	Beackwith Twp.	April 3, 1998	
April 1998	Carleton Place	April 6, 1998	
April 1998	Mississippi Mills	April 6, 1998	
April 7, 1998	Ryerson	April 7, 1998	April 9, 1998
June 30, 1999	Jaffray Melick	June 30, 1999	July 4, 1999
May 2000	Grand River		
April 2001	Pic Mobert First Nation	April 30, 2001	
August 2001	Thunder Bay Area		
October 2001	Nipissing First Nation	October 30, 2001	Nov. 23, 2001
May 2002	Attawapiskat	May 15, 2002	May 27, 2002
June 2002	Dawson Twp.	June 10, 2002	June 13, 2002
June 2002	Rainy River	June 11, 2002	June 17, 2002
June 2002	Atikokan	June 11, 2002	June 17, 2002
June 2002	Lake of the Woods Twp.	June 11, 2002	June 13, 2002
May 2003	Dubreuilville	May 11, 2003	May 14, 2003




This data is depicted geographically on Map 3.

This data includes only those flood events where municipalities declared a flood emergency. It does not capture the many smaller flood-related events that occurred during this time period throughout Ontario. **The trends in the data however point to an increase in flood emergencies over time.**



LEGEND

Flood Emergency Locations

-  1 Occurance (1992-2003)
-  2 Occurances (1992-2003)
-  3 Occurances (1992-2003)

 MNR Districts

Not to Scale

Map 3 - Locations of Declared Flood Emergencies in Ontario

1996-2002: GENERAL CLIMATIC TRENDS

General Canadian Weather Conditions¹²

Ontario is located within two distinct climatic regions as identified by Environment Canada, specifically the Great Lakes / St. Lawrence and the Northeastern Forest Climate Regions. **Figure 3** shows the extent of the climatic regions, suggesting that the Great Lakes / St. Lawrence Climate Region is generally located south of a direct line between Parry Sound and Ottawa. The remaining area of the province is considered the Northeastern Forest Climate Region.

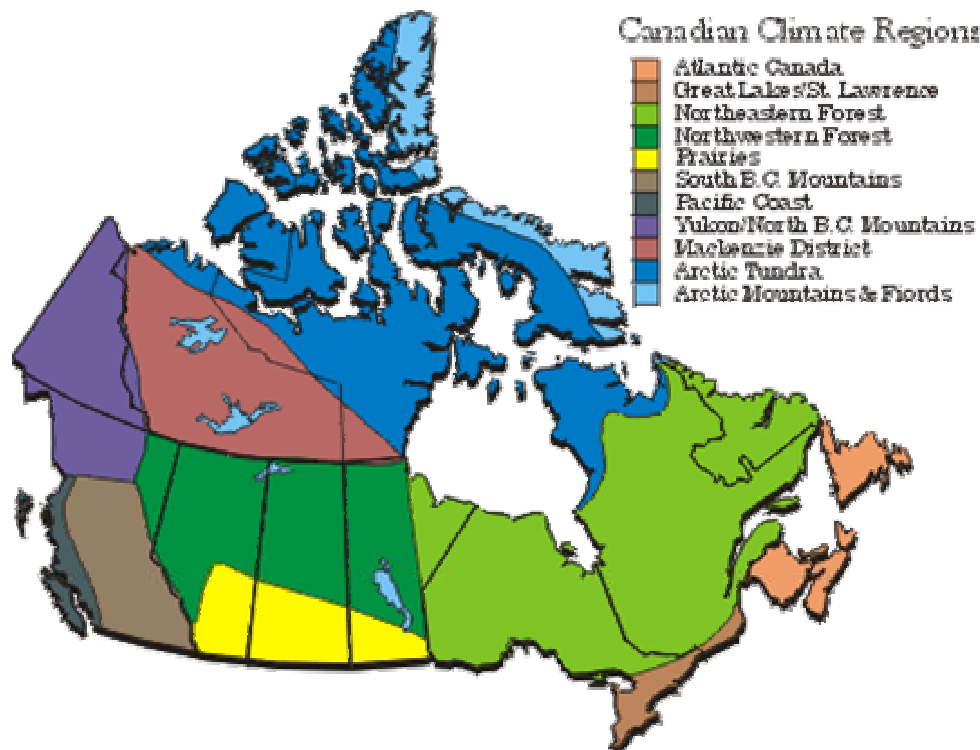


Figure 3 – Canadian Climate Regions

Temperature

As of the end of 2003, most areas of Canada have experienced warmer than normal temperatures, with 25 of the last 26 seasons having experienced above normal temperatures. **Figure 4** details that temperatures, with the exception of Spring 2002, have been above normal for more than six years.

¹² General weather and climate information contained, including all maps and tables but excluding anecdotal information obtained from flood reports were obtained from various Environment Canada websites.

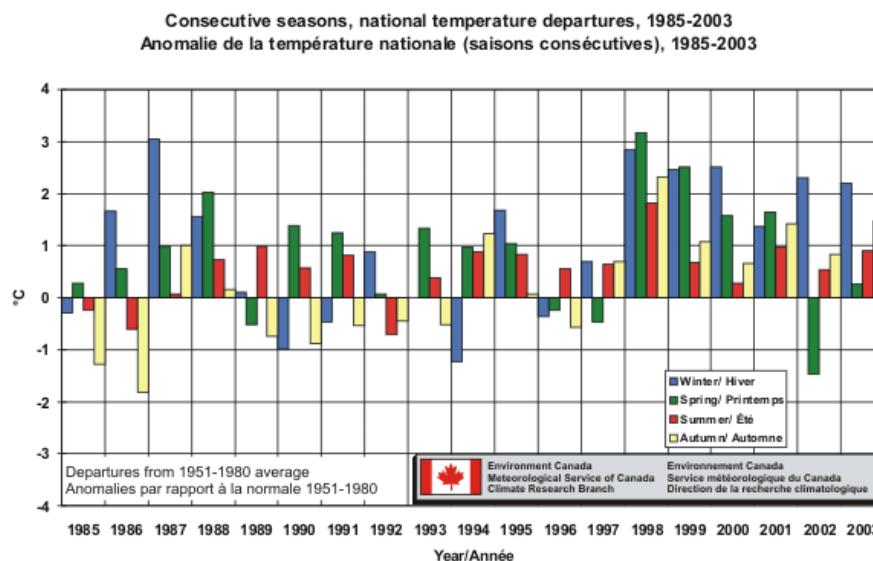


Figure 4 – Consecutive Seasons, National Temperature Departures, 1985 - 2003

Figure 5 details that temperatures have been at or above normal for the last 11 years while the red dashed line suggests a warming linear trend of 1.1°C over the period of record (56 years).

Precipitation

Figure 6 suggests that generally conditions have been wetter since about 1970. As shown in **Table 6**, the wettest year was 1996 (+9.1%). Also of note is that 1999 was the 8th wettest while 2001 was the 5th driest. This would suggest that, nationally, precipitation variations are fluctuating rapidly. The last three seasons have had wetter than normal conditions, as shown in **Figure 6**, however, over the last four years there hasn't been the persistence of above or below normal conditions as were experienced during the 1980s.

Table 5 lists the ten coolest and warmest years for the entire country. This table shows that 1998 (+2.5°C) was the warmest year. We can also note that 2001, 1999, 2003 and 2000 all made the top ten list. Environment Canada data also indicates that 5 of the warmest 10 years, since 1948, have occurred within the last 10 years.

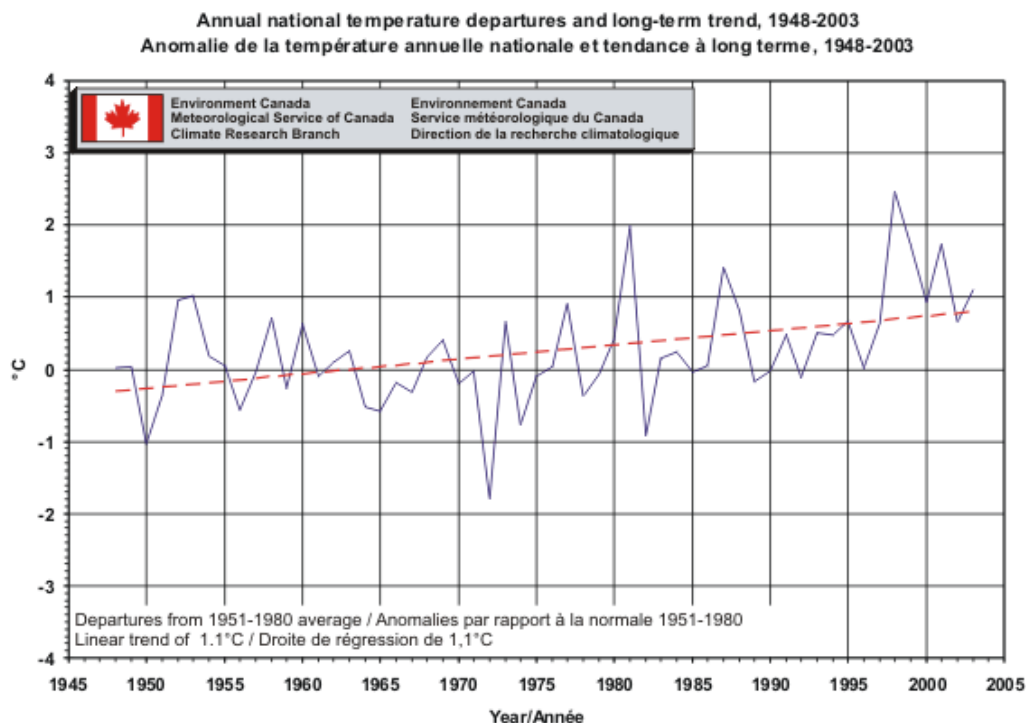


Figure 5 – Annual National Temperature Departures and Long-term Trends, 1948 – 2003

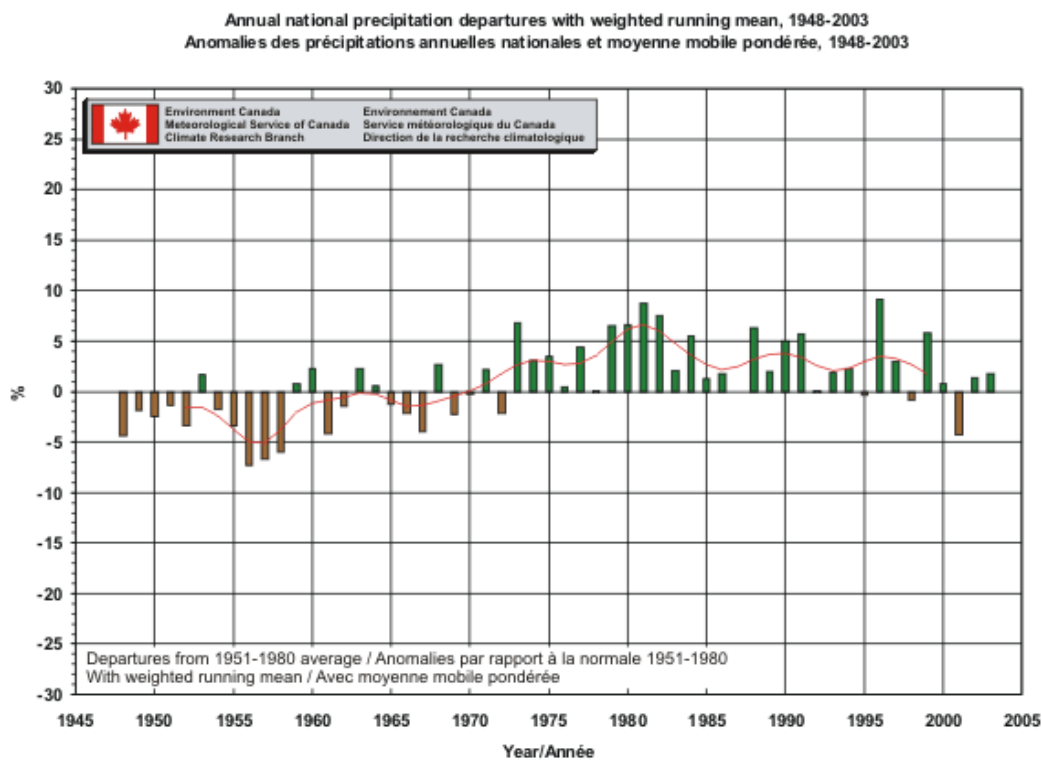


Figure 6 – Annual National Precipitation Departures with Weighted Running Mean, 1948 – 2003

Table 5 - Annual National Temperature Departures, Warmest/Coolest Ten Years in the Period 1948 – 2003

Annual national temperature departures, warmest/coolest ten years in the period 1948 – 2003

	10 Warmest		10 Coolest	
Rank	Year	Depart. °C	Year	Depart. °C
1	1998	2.5	1972	-1.8
2	1981	2.0	1950	-1.0
3	2001	1.7	1982	-0.9
4	1999	1.7	1974	-0.8
5	1987	1.4	1965	-0.6
6	2003	1.1	1956	-0.6
7	1953	1.0	1964	-0.5
8	1952	1.0	1978	-0.4
9	2000	0.9	1951	-0.4
10	1977	0.9	1967	-0.3

Consecutive seasons, national precipitation departures, 1985-2003
Anomalies des précipitations nationales (saisons consécutives), 1985-2003

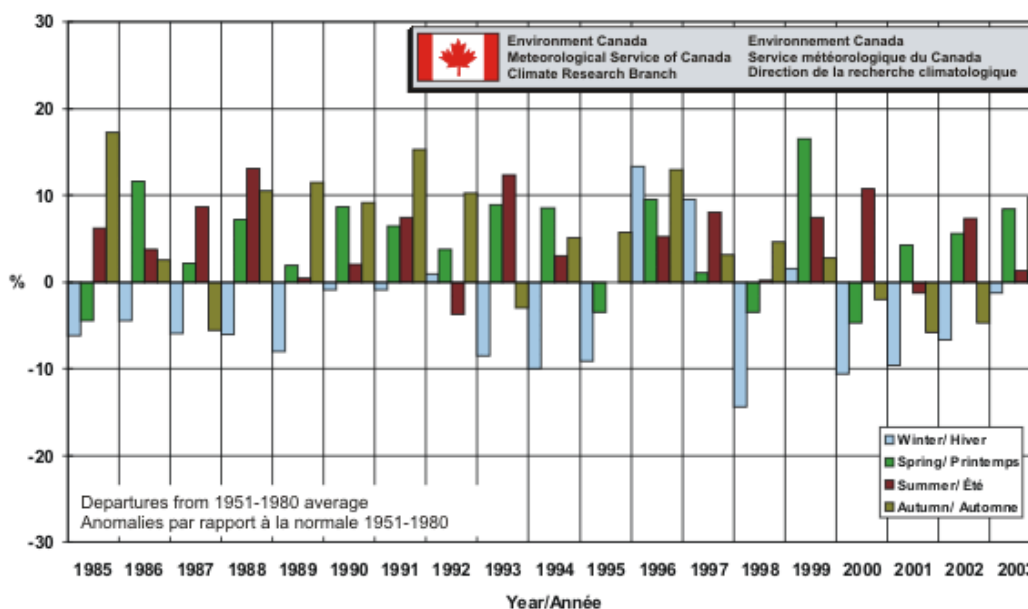


Figure 7 –Consecutive Seasons, National Precipitation Departures, 1985 - 2003

Table 6 - Annual National Precipitation Departures, Wettest/Driest Ten Years in the Period 1948 - 2003

Annual national precipitation departures, wettest/driest ten years in the period 1948 – 2003

	10 Wettest		10 Driest	
Rank	Year	Depart. °C	Year	Depart. °C
1	1996	9.1	1956	-7.3
2	1981	8.8	1957	-6.8
3	1982	7.5	1958	-6.0
4	1973	6.8	1948	-4.4
5	1980	6.6	2001	-4.3
6	1979	6.5	1961	-4.2
7	1988	6.3	1967	-4.0
8	1999	5.8	1955	-3.4
9	1991	5.7	1952	-3.4
10	1984	5.5	1950	-2.4

General Ontario Weather Conditions

Ontario, generally like the rest of Canada, has since 1970 experienced wetter conditions overall, though from 1996 onward, precipitation levels have been lower for both the Great Lakes/St. Lawrence Valley and the Boreal Forest. Across the country, temperature data suggests a general warming trend, particularly apparent from 1998 onward. In fact, 70% of all winters over the last 10 year period were all warmer than normal. Winters have also tended to be drier on the whole which has significant implications for spring-based flooding.

Environment Canada cautions the reader that "normal" precipitation in northern Canada is generally much less than it is in southern Canada, and hence a percentage departure in the north represents much less actual precipitation than the same percentage departure in the south. National and large-area regional precipitation statistics can therefore be somewhat skewed by these northern departures, with their higher percentages, which in fact represent much less actual precipitation reaching the ground, than in the corresponding southern regions.

Additional details regarding specific climatic conditions for 1996 to 2003 are provided in annual summaries for each year in subsequent sections.

General Great Lakes Water Levels

Lake level trends are important to recognize as they give a general indication of precipitation trends. In addition, flooding can also occur along lake frontages due to high water levels, wave setup, ice and general weather conditions. While the majority of flood events that have occurred in the 1996 to 2003 period have been riverine in nature, minor flooding events have also occurred

along lakefronts. In some cases, riverine flooding can be compounded by high lake levels. As a result, we have shown water levels for the Great Lakes as they are an indicator of flood potential.

Lake water levels for the Lake Superior, Lake Huron, Lake Erie and Lake Ontario have been provided in Figures 8 to 11. Long term mean water levels are also shown for comparison.

Other than Lake Ontario, lake water levels have generally gone down from the mid 1990s, with the most severe drop in water levels being experienced in Lake Huron which is approaching record lows for the period of monitoring.

The result of generally decreasing lake levels is a reduction in lakefront flooding as confirmed by the data submitted by the agencies for this time period.

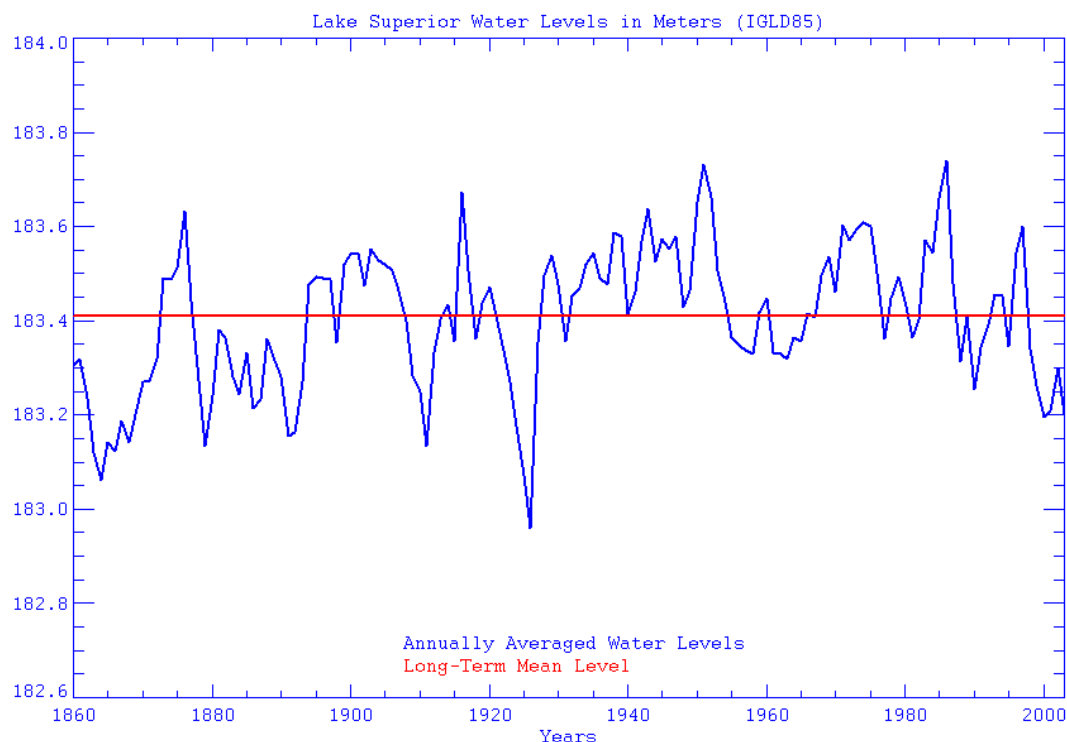


Figure 8 – Lake Superior Annually Averaged Water Levels, Long-term Mean Levels

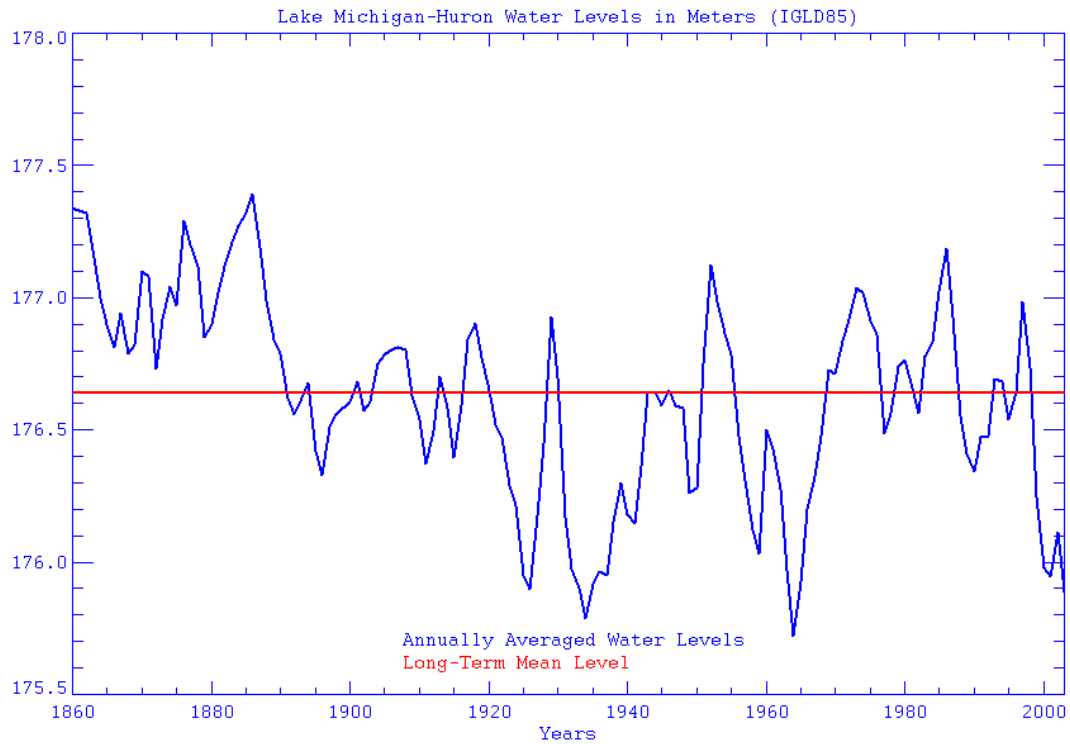


Figure 9 – Lake Michigan - Huron Annually Averaged Water Levels, Long-term Mean Levels

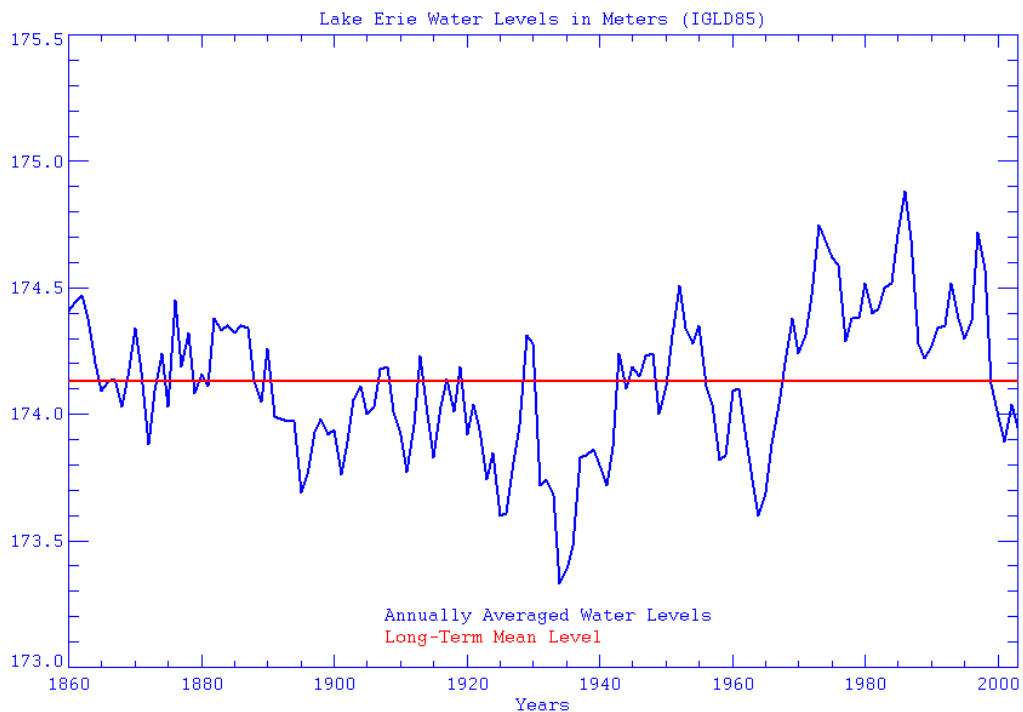


Figure 10 – Lake Erie Annually Averaged Water Levels, Long-term Mean Levels

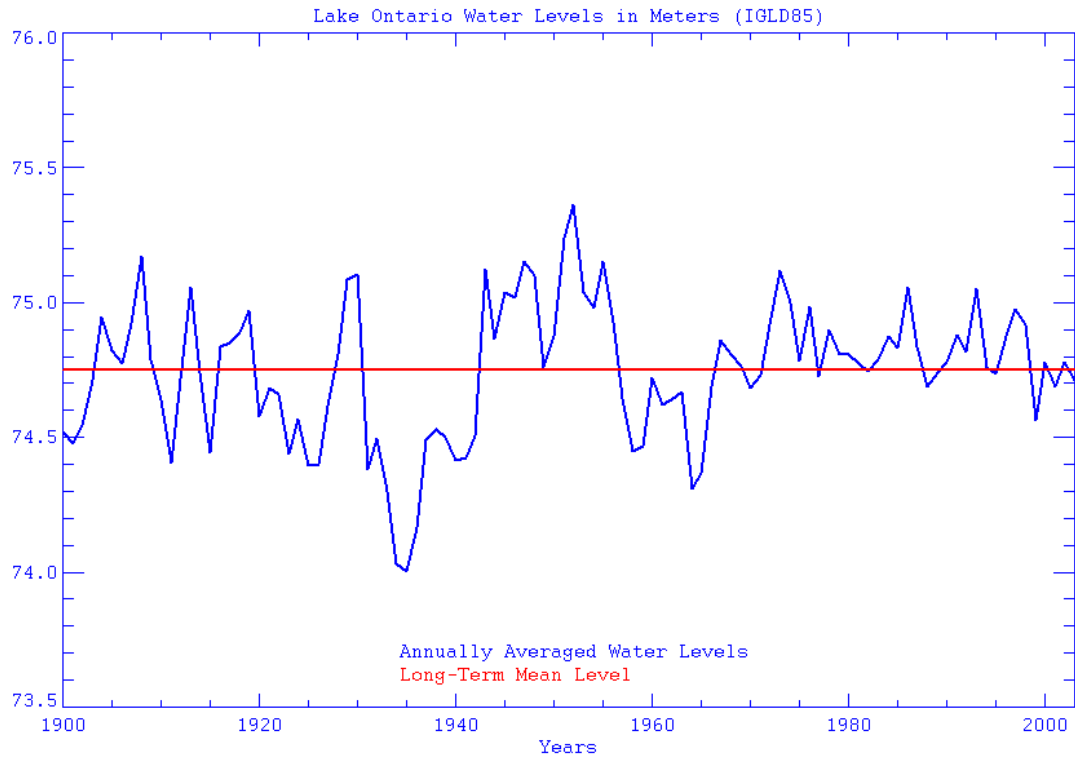


Figure 11 – Lake Ontario Annually Averaged Water Levels, Long-term Mean Levels

1996 FLOODS

Annual Weather Summary and General Flood Threat

Regional average temperatures from January to December 1996 were generally below the long-term means in the upper Great Lakes Basin to the west, and above the long-term values in the east to Atlantic Canada. This pattern of cold-west and warm-east represents a reversal of annual temperature patterns experienced across Canada in recent years.

Regional precipitation amounts when averaged over the year were about 7% above-normal from Ontario to Atlantic Canada.

Winter

Flooding occurred on the Grand River system (including the Nith and Conestoga tributaries) at a variety of places early in year. Typically the flooding was limited to Class 2 or 3. Flooding occurred on January 18 to 19, February 24 to 25 and on March 19.

Spring

Flooding occurred again on the Grand River at a variety of places during the springtime as well. Typically the flooding was limited to Class 2 or 3. Flooding occurred on May 21 to 22 and from June 23 to 24.

On June 20, the Ausable River flooded in Exeter. The Class 3 flood impacted 75 homes and less than 10 roads with some commercial impact.

The Pic Mobert First Nations Community on the White River in Nipigon District declared an emergency on May 21. Approximately 200 people were evacuated. In addition, Chapleau, Foleyet and Beardmore were declared emergencies. Beardmore sustained over \$17,000 in damages. The Attawapiskat and White River First Nations communities were also declared emergencies and 670 people were evacuated from the Attawapiskat community.

On the same day, the Mattagami River in the City of Timmins also flooded, impacting 53 homes and requiring the evacuation of 20 people. Ten roads and 13 businesses were impacted during this event and total damages were over \$500,000.

Summer

Flooding continued to occur during the summer of 1996 with the province declaring an emergency in Atikokan on July 8. Over 600 homes were impacted and damages were in the order of \$4.5 million as per the Globe and Mail.

Flooding also occurred in Kanata where 100s of homes were impacted on August 2 as reported in the Ottawa Citizen. On August 8, more flooding occurred in the Ottawa-Hull area and over 1700 homes were impacted and damages were in the order of \$20 million as reported by the Ottawa Citizen.

Fall

Regional average temperatures for the September to November 1996 period show below-normal values. In fact, 6 to 8 of the last 10 autumns have all been below normal and regional trends since 1948 are all negative. In southern Ontario, it was on the cool side with the 13th coldest autumn in both regions since 1948.

In the lower Great Lakes area of southern Ontario, it was significantly wetter than normal at 11% above, and here, 9 of the last 10 autumns have also been above the long-term average.

Class 3 flooding occurred on the Gananoque River in Maple Hill on September 15. Two homes were impacted along with 1 provincial highway, a bridge and agricultural crops. Financial impacts were estimated at over \$200,000. A school bus had to be rerouted 10 km for over 4 months and provincial assistance was denied.

On October 17, flooding occurred on the Speed River and impacted a local trailer park.

1997 FLOODS

Annual Weather Summary and General Flood Threat

In the South and East, from Ontario to Quebec, 1997 was on the cool side, at 15th coldest since 1948 in the lower Great Lakes and 20th coldest in the boreal forests of northern Ontario. In Ontario, 1997 marks the 2nd year in a row with below-normal temperatures overall.

From a precipitation perspective, the East from Ontario to the East Coast was drier-than-normal. In the lower Great Lakes/St. Lawrence Valley it was about 2% drier than normal. 1997 breaks a string of 5 consecutive wetter-than-normal years since 1992. The Northeastern Boreal Forest zone of northern Ontario was about 10% drier than normal (4th driest on record since 1948).

Winter

Regional average temperatures for the December 1996 to February 1997 period were above normal. Southern Ontario averaged 1.7 degrees warmer than normal, making it the 9th warmest winter there since records began in 1948. In the boreal forests of northern Ontario, winter 1996/97 temperatures were also warmer than normal averaging 0.6 degree warmer across the region.

Regional average precipitation amounts for the December 1996 to February 1997 period show a major "wet" area in southern Ontario. In southern Ontario, winter 1996/97 was the 2nd wettest there since 1948. This breaks a string of 5 consecutive winters, since 1992, with drier-than-normal conditions. To the north and east the more southern portions of the boreal forest regions of northern Ontario were also wetter than normal this winter, but only slightly, averaging only about 2% wetter overall.

The warm winter with additional precipitation resulted in Class 3 condition flooding on the Otonabee River with 5 families requiring evacuation on February 7. On February 21, 7 families were evacuated on the Catfish Creek. The trend continued until February 28 as the Grand River in East Garafraxa experienced Class 4 flooding with 1 family evacuated but 4 homes flooded. Twenty homes were affected during flooding on the Ausable River Cut in Lambton Shores. Further flooding was reported in the Town of Durham on the Saugeen River, in St Thomas and Port Stanley on the Kettle Creek system, in Drayton on the Conestoga River, in New Hamburg and Ayr on the Nith River and in Brantford, Caledonia and the Six nations Reserve on the Grand River.

On March 30 and 31, Class 2 flooding occurred on the Grand River at Cambridge, Brantford and Caledonia. Class 3 flooding occurred on the Six Nations Reserve.

Spring

Regional average temperatures for the March to May 1997 period were considerably colder than normal throughout Ontario, ranking it the 4th coldest in Ontario. Long-term temperature trends over all springs in eastern Canada since 1948 show spring-season temperatures that are little changing, with nearly flat 50-year trend lines, and trend magnitudes as slightly positive in the lower Great Lakes and over the boreal forest regions of northern Ontario.

It was also drier than normal overall in southern Ontario. Spring 1997 was about 2% drier than normal making it the 22nd driest spring there since 1948. The western part of the lower Great Lakes region was wetter than normal but this was offset in spatial averaging by the eastern part which was drier. The boreal forest regions of northern Ontario were also drier than normal overall at about 8% drier than the long-term average.

In Manitoba, the devastating Red River flooding of late April/early May resulted from a rapid spring thaw and twice-normal April precipitation amounts in the valley.

Similar weather conditions likely also affected the Rainy River area where an emergency was declared on April 8. On April 22, an emergency was also declared in Harwich Township on the Saugeen River system.

In May, a series of emergencies were declared in northern First Nations communities (Fort Albany, Kashechewan, Fort Severn and Weenusk). Almost 450 homes were evacuated at the Fort Albany and Kashechewan communities.

On May 1, both the Long Point Region and the Lower Thames Valley Conservation Authorities reported lakeshore flooding due to high water and wave setup along various points on Lake Erie. The LTVCA also reported that approximately 65 homes were affected with about 20 first floors flooded during this event. In addition, flood waters crossed 2 km of road. Damage was estimated at \$200,000 but may have been as high as \$2,000,000 if effective flood fighting measures had not been carried out.

Summer

Regionally-averaged temperatures for the June to August 1997 period were near normal over the lower Great Lakes. In northern Ontario, temperatures were also slightly warmer than normal overall at 0.2 degree above the long-term average at 23rd warmest.

Regional average precipitation amounts for summer 1997 were generally below normal in most eastern and southern regions, drier than long-term averages over the 3-month period. In the Great Lakes Basin/St. Lawrence Lowlands it was only slightly drier at about 3% below normal making it the 19th driest since 1948. Throughout the boreal forest regions of northern Ontario it was dry at about 14% drier than the long-term average (5th driest on record since 1948).

Class 3 flooding due to rain was reported by Lakehead Region Conservation Authority for Wild Goose, No Name, Bind and Mosquito Creek on July 3 and 4.

Fall

Across the boreal forest regions of the Canadian Shield, autumn 1997 temperatures were only slightly warmer than normal. In southern Ontario and the lower Great Lakes, autumn 1997 was on the cool side.

In Ontario, autumn 1997 was drier than normal. In the lower Great Lakes region, it was 15% drier making it the 10th driest autumn there since 1948. Further north, across the boreal forest regions of northern Ontario, autumn 1997 was also dry at about 3% below the long-term average.

No flooding was reported for this period.

1998 FLOODS

Annual Weather Summary and General Flood Threat

All regions across Canada were ranked among the ten warmest years on record in 1998. The Great Lakes/St. Lawrence region experienced both its warmest year and its 5th driest year, which has caused the Great Lakes water level to drop by twice their normal amount. A new low annual water supply record for the century was set for Lake Superior and the level of Lake Ontario dropped more than a metre (120 cm) from its spring time high.

Winter

Average temperatures for the December to February period were above normal in almost all regions. Both the Great Lakes/St. Lawrence (+3.7° C) and the Northeastern Boreal Forest (+4.2° C) experienced their warmest winter for the 51-year period examined.

Linear warming trends are most prevalent in the winter season analysis. The Northeastern Boreal Forest region (one of two regions) shows a cooling trend (0.2° C) over the 51-year period. The Great Lakes/ St. Lawrence region shows no trend over the period.

The Northeast Boreal Forest and the Great Lakes/St. Lawrence regions were also distinctly drier than normal.

The Grand River at Grand Valley experienced Class 2 flooding on March 28. On the same day, Class 2 flooding occurred on the Nith River at New Hamburg and Ayr.

On March 30, Nickel District CA reported flooding in Nickel Centre which impacted 7 homes and required the evacuation of 21 people. On the same day, 4 people were evacuated when the Goulais River flooded.

On March 31, six families were evacuated in the Townships of Somerville and Burleigh-Anstruther- Chandos as reported by the Kawartha Region Conservation Authority. Several roads were closed or washed out during this event.

In the Bonnechere Valley, Class 2 flooding resulted in 6 houses being flooded and one family being evacuated. Two roads were also temporarily closed.

Spring

The Great Lakes/St. Lawrence (+2.8° C) region experienced its warmest spring in the 51-year period examined.

Most regions experienced a drier-than-normal spring this year, extending conditions from the winter season.

Regardless of the climatic conditions, Spring 1998 was a busy time for flooding. In May 1998, ten emergencies related to riverine flooding were declared. Flooding occurred in the Mississippi River system which required the evacuation of approximately 60 people. Additional flooding in the Mississippi system occurred in Carleton Place and Mississippi Mills where several roads and bridges were affected. The Ottawa Citizen reported that 400 to 500 homes were evacuated due to flooding on the Mississippi system.

MNR Midhurst District noted a flood along the Black and Severn Rivers and on Lake St John which lasted from April 4 to 8.

In the MNR Parry Sound District, 75 people were evacuated and 35 homes were flooded on the Big East River in the Muskokas. Twenty-five homes were flooded and twenty families evacuated in various areas on the Otonabee system. On the Magnetawan River, 33 homes were affected by flooding.

Summer

Every region across Canada experienced above-normal temperature anomalies for the summer of 1998. The temperatures ranged from 0.8°C to 3.0°C above normal.

Most regions experienced a drier-than-normal summer this year, extending conditions from the winter and spring seasons for many regions. The Northeastern Forest (-9.4%) is ranked among the 10 driest summers.

Only one flood event was reported for the summer of 1998. On an unnamed creek in Brockville, Class 3 flooding due to a thunderstorm affected 4 multi-unit buildings and 2 roads. A car dealership was also flooded during the event. A law suit regarding the flooding is still pending at this time.

Fall

Both the Ontario regions experienced above-normal temperature anomalies for autumn 1998 (1.2 to 1.3 °C for the Great Lakes/St. Lawrence Lowlands and Northeastern Forest regions respectively. Similarly, both regions had below average precipitation as well.

No flood events were reported for the fall period.

1999 FLOODS

Annual Weather Summary and General Flood Threat

All the climate regions were either at or above normal temperatures in 1999. In addition, most of the regions across Canada had above normal amounts of precipitation in 1999. The Northeastern Boreal Forest had an excess of +6.5%, making it the 6th wettest year. 1999 was a very quiet year for flooding as there was only 1 event reported during this year.

Winter

All but 3 regions across Canada were more than 1.5°C above normal this winter. The Great Lakes Region was 2.7°C above normal while the Northeastern Forest was 2.3°C above normal. Precipitation was down 4% and 12% respectively.

No flooding was reported during this period.

Spring

Ten of the eleven climate regions for Canada were warmer than normal this spring. The Northeastern Boreal Forest (+3.3°C) Region set a new record for the 52-year period of comparable nationwide records.

It is interesting to note the abundance of precipitation which is delaying crop planting in the Prairies is in sharp contrast to the Great Lakes/ St. Lawrence Region, which just experienced its 3rd driest spring, at 29.1 % below normal. This region was the only region which was particularly dry this spring.

No flooding was reported during this period.

Summer

The Northeastern Boreal Forest experienced one of the top ten warmest summers this year. The Great Lakes/St. Lawrence and Northeastern Forest have had at least two years of consecutive seasons with above normal temperatures.

After experiencing extreme precipitation conditions in the spring, i.e. 3rd driest spring, the Great Lakes/St. Lawrence region returned to near normal this summer. The Great Lakes/St. Lawrence region has experienced at or below normal precipitation conditions for the last 10 seasons.

Only one flood event was reported. As a result of rain on August 30, the Jaffray-Malick area in the Kenora District experienced a declared Emergency. It was reported that several homes were affected by the flooding and that roads were flooded.

Fall

All the climate regions had above normal temperatures this fall. Autumn 1999 meant a 7th place finish on the regional temperature departures list for the Great Lakes/St. Lawrence. The Great Lakes/St. Lawrence and Northeastern Boreal Forest Regions have experienced two years of consecutive seasons with above normal temperatures.

Precipitation in autumn 1999 was very near normal for the country as a whole, but some individual regions experienced very wet or very dry conditions. The Northeastern Forest region (+26.1%) made 2nd place on the wettest ten years table. The Great Lakes region was only 10.3% above normal.

No flooding was reported during this period.

2000 FLOODS

Annual Weather Summary and General Flood Threat

In 2000, all 11 climate regions had above normal temperatures, however, the Great lakes and Northeastern Forest regions were only +0.4 and 0.9°C over the norm.

According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels continue to be below the long term average as of the beginning of December.

In terms of precipitation, the Great Lakes and Northeastern Forest regions experienced a 6.9% and a -4.8% departure from the norm respectively.

Winter

Both Ontario regions had temperatures at or above normal this winter. In addition, both regions had below normal amounts of precipitation this winter. The below normal precipitation in the Great Lakes Region will continue to affect last year's below normal lake levels.

The year started off interestingly enough in Waldemar on the Grand River with a Class 2 flood on January 1. Fortunately no homes or people were directly affected but one road was flooded.

Three days later, the Grand River flooded in East Garafraxa where a Class 3 flood affected 5 homes and one road was flooded, causing significant erosion damage.

On February 25 and 26, the Credit River in Mississauga and Caledon experienced flooding. Several roads and trailers were impacted.

Spring

Every region of Canada had above normal temperatures this spring. The Great Lakes/St. Lawrence Region ranked highest coming in at 5th warmest, 1.9°C above normal, for the 53-year period. The Northeastern Forest region came in 6th.

Only the Great Lakes/St. Lawrence Region (+20.8%) made it to the wettest ten years table, ranked in 9th place. By the end of May, as reported by the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), only Lake Ontario had returned to slightly above its long term average lake level, with Lakes Superior, Huron, Michigan and Erie continuing to be 20-50 cm below their long term average.

On April 20 to 21, flooding occurred on Kettle and Dodd Creeks with Class 2 flooding in Port Stanley, London and St. Thomas. Three homes and seven roads were impacted. Approximately \$3,500 in damages was done to municipal infrastructure.

On May 12, flooding occurred on a tributary of the Credit River in Orangeville. The cause was attributed to sedimentation in a culvert but resulted in impacts to a single home.

On May 13, flooding occurred on the Bayfield River and Silver Creek. The community of Seaforth was impacted as a result of the Class 3 flooding.

Several key storm events resulted in a series of flooding problems along the Grand River (including the Nith River tributary) from its headwater communities to near its mouth at Lake Erie. The first event on May 13 resulted in flooding of 8 basement floodings in New Hamburg. The flood wave moved through the system and into lake Erie on May 15 causing flooding at numerous

points along the way. A second flood event started on May 18 and worked its way through the system until discharging into Lake Erie on May 20. A third event affected primarily the downstream communities along the Grand River on June 15. Finally, starting on June 26 with flooding in the upper watershed and moving downstream until June 28, a fourth event caused substantial Class 3 and 4 flooding all along the Grand River.

On June 13, flooding occurred in Clearview Township in the Nottawasaga valley, washing out several roads and causing major flooding to agricultural lands.

On June 26, flooding occurred on the Innisfil Creek system. The Barrie Examiner reported that there was \$40 Million damage that occurred province-wide as a result of recent flooding.

During May and June, the Lake Simcoe and Region Conservation Authority reported general flooding on a watershed wide basis.

Summer

Temperatures for the various regions of the country were all very close to normal this summer, none of which make it to either the [ten warmest springs table](#) or the [ten coolest years table](#). The Great Lakes/St. Lawrence Region was the coolest region this summer, 14th coolest for the 53-year period, only 0.4°C below normal. The popular misconception of a much cooler than normal summer could come from two conditions: one, Canadians have experienced warmer summers over the last seven years, with the record warmest being only two summers ago; and two, there were few "heat waves" to give it that summer feeling. This cooler than normal summer, for the region, breaks the previous 10 straight seasons of above normal temperatures.

The Summer of 2000 saw the Great Lakes/St. Lawrence Region ranked among the ten wettest. According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), even with the above normal precipitation levels in the Great Lakes/St. Lawrence Region, Lake Ontario remains the only Great Lake with water levels above the long term average by the beginning of September.

There was a Class 3 flood on the Ausable River in Exeter on July 9 which flooded 3 minor roads and flooded the local hospital basement.

Minor flooding occurred on July 11 in London. On July 14, Chatham experienced flooding in which 6 homes were impacted and 4 businesses were closed as reported in the local newspaper.

Nuisance flooding was reported August 2 on the Moon River in Muskoka on the Wahta First Nation community. Approximately \$1,000 damage to recreational property was reported. On August 4, flooding was also reported on the South Muskoka River in the community of Fraserburg. Three homes were impacted.

Fall

Both Ontario climatic regions were above normal this autumn (0.1°C and 0.7°C for the Great Lakes and Northeastern Forest respectively).

The autumn of 2000 saw the Northeastern Forest have its 3rd driest autumn, 17.7% below normal. According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels were below the long term average at the beginning of November.

No flooding events were reported during this period.

2001 FLOODS

Annual Weather Summary and General Flood Threat

Every climate region had above normal temperatures this year. The Northeastern Forest region (+2.0°C) and the Great Lakes/St. Lawrence region (+1.5°C) were also above normal.

In terms of precipitation, the Great Lakes / St Lawrence region was down 6.1% while the Northeastern Forest was 0.8 above normal precipitation levels.

Winter

According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels continue to be below the long term average as of the beginning of February.

On February 9 the Belle and Pace Rivers in the Essex Region experienced Class 3 flooding. Twenty homes and several roads were impacted. Total damages were approximated at \$500,000.

From February 10 to February 12, the Grand system experienced a series of flood events as high flows moved through the system. At the same time, Kettle Creek in St Thomas and Port Stanley experienced a Class 3 flood. Seven homes were flooded over the 1st floor.

At a similar time, the lower Thames River experienced Class 3 flooding at Lighthouse Cove where 20 homes were impacted. Damages are estimated at \$58,000.

Spring

All of the climate regions of Canada had temperatures above normal this spring. The Northeastern Forest (at +2.2°C) was warm enough to make it to the [ten warmest spring table](#) for spring 2001, ranked 5th.

The Great Lakes/St. Lawrence (at -18.7%) made it to the [ten driest spring table](#), ranked 8th. According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels continue to be below the long term average as of the beginning of May.

The villages of Elora, Grand Valley and West Montrose were subject to flooding on April 9. Three basements and three first floor buildings were impacted. The flooding in West Montrose caused significant damage and was a risk to life.

In the Crowe watershed, Wallastan and Belmont Townships experienced flooding on April 11 and 13th respectively. Also on the 13th, Class 2 flooding affected 10 homes in the Big East River in Muskoka.

One home was flooded in Sault Ste Marie on April 15 as noted in the local newspaper. On April 17, the local paper in Peterborough noted that flooding on the Otonabee resulted in impacts on 50 homes and several private roads were flooded as well.

The Pic Mobert First Nations Community on the White River in Nipigon District was declared an emergency on April 30.

Summer

Remarkably, even though the country as a whole experienced its 3rd warmest summer, it was because of the spatial extent of the above normal temperatures, not an extreme in any particular region. The Northeastern Forest (at +1.1°C) was warm enough to make it to the [ten warmest summers table](#), ranked 7th.

The Great Lakes/St. Lawrence Region (-26.8%) experienced its driest summer in 54 years of records. According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels continue to be below the long term average as of the beginning of August, which wasn't helped by the below normal precipitation and the above normal temperatures experienced in the Great Lakes region.

Only a single flood was reported during this time period, occurring in the Thunder Bay area on August 1. The event caused 3 roads to be flooded.

Fall

The two Ontario regions had above normal temperatures this autumn. The Great Lakes/St. Lawrence region was at 1.4°C above normal while the Northeastern Forest was at 1.8°C above normal.

The Great Lakes/St. Lawrence Region (+29.0%) experienced its 7th wettest autumn, making it to the [ten wettest autumns table](#). Although the wetter than normal autumn helps the replenish the ground water levels in the Great Lakes region, it did little to raise the lake levels in the Great Lakes themselves. According to the [Canadian Hydrographic Service, Department of Fisheries and Oceans](#), all of the Great Lakes' water levels continue to be below the long term average as of the end of October.

On November 3, 2001, the water level of Lake Nipissing peaked at 196.33 metres above sea level, resulting in varying flood conditions for North Bay, West Nipissing, French River and Jocko Point. The normal water level of Lake Nipissing rests at 195.36 metres above sea level at that time of year.

According to MNR staff, Jocko Point was the hardest hit, with 250 property lots suffering damage as a result of the flooding waters. Jocko Point is Native land, owned by the Nipissing First Nation, that is leased to non-natives.



Photograph 1: Jocko Point (November 27, 01) (Source: MNR, Compass #30)

On October 30, 2001, the Nipissing First Nation area was declared an Emergency and MNR responded by sending 51,000 sandbags to help protect the property on Jocko Point from further damage. MNR delivered a total of 95,000 sandbags to the surrounding municipalities and Native lands, including Jocko Point. Several days latter (November 3) Parks Creek and the shoreline of Lake Nipissing in North Bay experienced flooding and 150 homes were impacted. Total damages were estimated to be \$230,000. Damages could have been as high as \$2,500,000 if appropriate flood control measures were not implemented at the time. The local paper also notes that on November 12, additional flooding in North Bay resulted in impacts of 75 homes and 4 roads.

The rise of the water levels in both Lake Nipissing and the French River were the result of 20 inches of rain that had fallen in the region since late October.

2002 FLOODS

Annual Weather Summary and General Flood Threat

Every climate region in Canada experienced above normal temperatures this year. The Great Lakes/St. Lawrence region ranked 8th at +1.1°C above normal.

As for precipitation, the Great Lakes/St. Lawrence region was down 7.7% from normal. However, the 49th Parallel storm, which affected Winnipeg and northwestern Ontario dramatically, added some excitement to the weather picture for the year.

Winter

Every climate region had above normal temperatures this winter. The Great Lakes/St. Lawrence region had its warmest winter, 4.8°C above normal. In fact, it was substantially warmer, 1.1°C warmer, than 1997/98, the next warmest winter. The Northeastern Forest was 2nd at +3.1°C above normal.

Although this was a dry winter for Canada, no climate region had their driest winter. The Great Lakes/St. Lawrence region was down 21.6%, ranked 9th.

One reported flood occurred on the Grand River on February 28. Class 4 flooding affected one home and 4 people were evacuated in East Garafraxa.

Spring

The Northeastern Forest region (at -1.5°C) experienced a cool spring this year. On the other hand, the Great Lakes/St. Lawrence (at +33.6%), and Northeastern Forest (at +12.9%), were very wet.

On April 17, an event occurred in the Timmins area which flooded a local hotel and caused \$132,000 damage (Timmins Daily Press).

Two smaller events occurred on trailer parks located on the Grand River on May 18.

While not documented in this report, the 49th Parallel Storm occurred on June 11 and affected northwestern Ontario, particularly Fort Francis, Dawson, Atikokan, Rainy River and Lake of the Woods. The area was declared an Emergency and a disaster area by Ministry of Municipal Affairs and Housing. Additional document on this event is being prepared by MNR. No other information is available at this time. The North Bay Nugget estimated that millions of dollars of road damages had occurred in the Fort Francis area.

In the Kawartha Region, 102.5 mm fell in 12 hours on June 12. The communities of Little Britain and Omeemee experienced flooding and 3 to 5 homes were evacuated. Four roads, a local grocery store and a community hall basement were flooded.

Close by on the Otonabee River, Class 3 flooding impacted 800 homes over a 12 to 14 hour period during which 202.5 mm of rain (June 11 and 12, 2002). Fifteen families were evacuated and 400 basements were flooded. Damage was estimated to be \$800,000 to \$1,000,000.

During May and June, the Lake Simcoe and Region Conservation Authority reported general flooding on the Black and Beaver Rivers and Pefferlaw Brook.

Summer

The Great Lakes/St. Lawrence Region experienced many days of above 30°C, but those hot days were tempered by a cooler than normal start to June. As a result the region only had temperatures 1°C above normal.

In terms of precipitation, the Great Lakes/St. Lawrence was below normal by 15.4%

One event impacted the Whiteman's and McKenzie Creeks in the Burford area of the Grand River watershed. Class 2 flooding affected local agricultural areas causing unquantified damages.

Fall

A slightly cooler than normal autumn was experienced by the Northeastern Forest (at -0.7°C). The Great Lakes region was slightly above normal at +0.2°C.

Precipitation in the Great Lakes / St Lawrence Region was down 13% from the norm while the Northeastern Forest Region was down 0.9% from the norm.

No flood events were reported during this period.

2003 FLOODS

Annual Weather Summary and General Flood Threat

All but 1 of the 11 Climate regions had temperatures above normal in 2003. The Great Lakes/St. Lawrence Region was the one region that was cooler than normal (22nd coolest, -0.1°C).

Nationally, 2003 was a wetter than normal year. The Great lakes / St Lawrence region was wetter by 34.3% (2nd highest on record). The Northeastern Boreal Forest region was wetter by 8.6%.

Winter

This winter saw many regions of the country with temperatures well above normal. However, the Great Lakes/St. Lawrence Region was ranked 10th at -1.0°C.

It was a winter of extremes, with one region having its driest winter, and one region having its wettest. The Great Lakes/St. Lawrence was the climate region with its driest winter, 38.9% below normal. Our other region, the Northeastern Forest was ranked 8th at -19.3%.

Localized flooding on Sheridan Creek caused by ice jams on February 18 resulted in minimal damage to trails in the Rattray Marsh (Credit Valley Conservation Authority).

On March 21, the Grand River flooded a trailer park in Cayuga but no damages were reported as flooding was minimal.

Spring

Although the country as a whole was slightly warmer than normal, people who live in southern Ontario will remember the spring of 2003 as cooler than normal. In fact, the Great Lakes/St. Lawrence region (ranked 10th at -0.8°C) made it to the [ten coolest springs table](#).

The Northeastern Forest region was drier than normal (ranked 12th at -8.5%).

On April 21, Class 2 flooding occurred in the Thunder Bay area on the Neebling, McIntyre and Kaministiquia Rivers. Several roads were impacted on the first two systems while Historic Fort William Park was impacted by the latter system causing \$3,000,000 in damages.

The community of Dubreuilville was impacted by flooding on May 11. An emergency was declared. EMO reports noted that the community was isolated from Hwy 17 and access to the hospital in Wawa due to a 40 foot washout of Hwy 519 as a result of heavy rain.

Summer

Much of the country was warmer than normal including the Northeastern Forest (ranked 9th at +1.1°C).

This summer was very dry for several regions, and wet for a couple of others across Canada. In Ontario however, the Great Lakes / St Lawrence region was slightly drier than normal by 0.7% while the Northeastern Forest was wetter by only 2.6%.

The Owen Sound Times noted a flood in Durham on August 9 during which 12 homes and many roads, including provincial highways, were impacted.

The Ottawa Citizen noted that flooding had occurred in Pembroke on August 10 which impacted 100 homes and caused 100s of thousands of dollars in damages.

Fall

Both climatic regions had temperatures above normal this autumn but only marginally. Nationally this was a wet autumn. The Great Lakes/St. Lawrence region was ranked 2nd at +34.0%.

The Big East River flooded on November 20 in River Cove, Muskoka causing a Class 2 flood which impacted 10 homes and a single road. On November 28, a Class 2 flood occurred in the South Muskoka River in Fraserburg which resulted in impacts to 3 homes.

CONCLUSIONS

Results from the request for flood data are varied. A number of Conservation Authorities (CAs) were able to provide some level of data with respect to flooding; however there is a great deal of variability in the response.

In order to run a statistical analysis on any data set, particularly one which covers a wide range of responses and is intended to determine flood frequency and damage, there must be consistency in the data set. This consistency is not present in the current data. Flood data provided by the Grand River Conservation Authority (GRCA) greatly exceeded the amount of data from the next highest respondent. If we were to run traditional statistical analyses on this entire data set then the results would be skewed toward the GRCA data, providing inaccurate results.

There are strategies which can be applied in situations like this. First, the analyst can separate out the GRCA data and run it separately from the rest, in essence creating two sets of results. This removes the skew caused by the GRCA data set. However it becomes statistically invalid to compare the two sets of results as they are not based on similar data, though they are based on similar conditions. The second strategy would be to parse out some of the GRCA data, in particular the lower damage results. It could be assumed that the difference in the datasets between Conservation Authorities lies in the fact that lower order storms / results were not recorded by the majority of CAs; therefore it might be possible to remove all lower order storms / results from the GRCA to reduce this influence within the dataset. This is not a valid statistical practice for two reasons: first, it is based on an assumption which cannot be verified; and second, it is unethical to removed data from a set in order to alter the statistical properties of the entire dataset.

Therefore, it is not possible to run statistical or benefit/cost analyses on this dataset, because the results would be invalid. It is highly likely that the low response is a staffing issue, however this is only an assumption as some of the larger CAs had low responses to the request for information.

Future requests for this type of information from MNR should be made with these results in consideration; that is, MNR should either firmly require all CA's to provide the same level of participation or they should provide funding for an independent body to search out and report the required information.

Appendix A
Summary Damage Tables by Region,
Conservation Authority and Municipality

**Appendix A - Flood Damage Centres By MNR divisions, Conservation Authority and Municipality
1996**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
1996 - 1999 (various)	Midhurst	Southern	Credit Valley	Orangeville	CVC	
January - February 1996	Peterborough	Southern	Cataraqui Region	Ernestown Twp.	Millhaven Cr. Lake Ontario	
01/18/96	Midhurst	Southern	Grey Sauble	Town of the Blue	Beaver	\$100,000.00
01/18/96	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
01/19/96	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$0
01/19/96	Kemptville	Southern	Cataraqui Region	Brockville	Buell's Cr. / St. Lawrence River	
01/19/96	Guelph District	Central	Grand River	Township of Mapleton	Grand River	N/A
01/19/96	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
01/20/96	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$27,045
02/24/96	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
02/25/96	Guelph District	Central	Grand River	City of Brantford	Grand River	N/A
02/25/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
03/19/96	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
04/13/96	Guelph District	Central	Grand River	Centre Wellington	Grand River	\$0
04/14/96	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
04/14/96	Guelph District	Central	Grand River	City of Brantford	Grand River	0
04/14/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
04/15/96	Guelph District	Central	Grand River	Six Nations	Grand River	N/A
04/22/96	Parry Sound	Southern	N/A	Huntsville	Muskoka	
05/15/96	Cochrane Region	Northwestern	NA			
05/17/96	Thunder Bay	Northwest	Lakehead Region	Oliver Palpoonge	Superior	N/A
05/17/96	Thunder Bay	Northwest	Lakehead Region	Dorion	Superior	N/A
05/21/96	Timmins	Northeastern	Mattagami Region	City of Timmins	Mattagami (Upper) River	535 000
05/21/96	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
05/21/96	Nipigon	Northwestern	Lakehead Region		Lake Nipigon	
05/21/96	Chapleau	Northeastern	NA	Algoma County		
05/21/96	Cochrane Region	Northeastern	NA			
05/21/96	Nipigon	Northwestern	NA			
05/21/96	Nipigon	Northwestern	NA			
05/21/96	Sault Ste. Marie	Northeastern	Sault Ste. Marie			
05/22/96	Guelph District	Central	Grand River	Brant County	Grand River	N/A
05/22/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/22/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/22/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/22/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/23/96	Timmins District	Northeastern	Mattagami			
06/20/96	Guelph	South	Ausable Bayfield	South Huron	Ausable River	
06/23/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/23/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/24/96	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
07/06/96	Fort Frances	Northwestern	Lakehead Region			\$4.5 Million
08/02/96	Kempville	Southern	Mississippi Valley			
08/08/96	Kempville	Southern	Rideau Valley			\$20 Million
09/15/96	Kemptville	Southern	Cataraqui Region	Front of Leeds &	Gananoque River / St.	
10/17/96	Guelph District	Central	Grand River	Guelph Township	Grand River	N/A

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
1997**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
01/08/97-01/30/97		Southern	Saugeen Valley	West Grey, Grey	Lake Huron	Est. \$1 million (\$1.1 Million, The Globe and Mail)
02/21/97	Aylmer	Southern	Catfish Creek	Malahide Township	Catfish Creek	\$54,864.00
02/21/97	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
02/21/97	Guelph District	Central	Grand River	Woolwich Township	Grand River	N/A
02/22/97	Aylmer	South Central	Kettle Creek	St. Thomas & Port	Kettle Creek	unknown
02/22/97	Guelph District	Central	Grand River	Township of Mapleton	Grand River	N/A
02/22/97	Aylmer	South	Ausable Bayfield	Lambton Shores	Ausable River	
02/22/97	Guelph District	Central	Grand River	Haldimand County	Grand River	na
02/22/97	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$36,909
02/22/97	Guelph District	Central	Grand River	City of Brantford	Grand River	0
02/22/97	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
02/23/97	Midhurst District	Southern	Saugeen Valley			
02/23/97	Guelph District	Central	Grand River	Six Nations	Grand River	N/A
02/23/97	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$99,806
02/25/97	Guelph District	Southern	Grand River		Grand River	
02/25/97	Midhurst District	Southern	Grey Sauble			\$10,000.00
02/26/97	Aylmer District	Southern	Lower Thames			
03/30/97	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
03/30/97	Guelph District	Central	Grand River	City of Cambridge	Grand River	0
03/30/97	Guelph District	Central	Grand River	South Dumfries	Grand River	N/A
03/30/97	Guelph District	Central	Grand River	City of Brantford	Grand River	0
03/30/97	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
03/31/97	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$5,644
03/31/97	Guelph District	Central	Grand River	Six Nations	Grand River	N/A
04/06/97 - 04/07/97	N/A	Aylmer	Lower Thames	Harwich	Lake Erie	220 000
04/22/97	Midhurst District	Southern	Saugeen Valley		Lake Erie	
05/01/97	Aylmer	South	Long Point	Norfolk (Port Dover)	Lake Erie	
05/01/97	N/A	Aylmer	Lower Thames	Harwich	Lake Erie	220 000
05/04/97	Cochrane Region	Northwestern	NA			
05/04/97	Kempville	Southern	Rideau Valley			
05/26/97	Cochrane Region	Northeastern	NA	Fort Severn		
05/28/97	Cochrane Region	Northeastern	NA	Peawanuk		
07/03/97	Thunder Bay	Northwest	Lakehead	Shuniah	Superior	N/A
07/03/97	Thunder Bay	Thunder Bay	Lakehead	Shuniah	Superior	N/A
07/03/97	Thunder Bay	Thunder Bay	Lakehead	Shuniah	Superior	N/A
07/04/97	Thunder Bay	Northwest	Lakehead	Thunder Bay	Superior	N/A
07/16/97	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
12/17/97	Midhurst District	Southern	Credit Valley	Town of Orangeville		

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
1998**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
03/28/98	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
03/28/98	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
03/30/98	Sudbury	Northeastern	Nickel District			
03/30/98	Sault Ste. Marie	Northeastern	Sault Ste. Marie			
03/31/98	Pembroke	Southern	N/A	Bonnechere Valley	Constant Lake	unknown
03/31/98	Peterborough District	Southern	Kawartha Region			
03/31/98	Sudbury	Northeastern	Nickel District			
04/01/98	Parry Sound	Southern	NA			
04/02/98	Peterborough	Southern	Crowe Valley	Wallaston Township	Grove Lake	
04/02/98	Kemptville	Southern	Mississippi Valley	Township of Lanark		
04/02/98	Parry Sound	Southern	N/A	Huntsville	Muskoka	
04/03/98	Pembroke District	Southern	Mississippi Valley			
04/03/98	Parry Sound	Southern	NA			
04/03/98	Parry Sound	Southern	NA			
04/03/98	Parry Sound	Southern	NA			
04/03/98	Parry Sound	Southern	NA			
04/04/98 - 04/08/98	Midhurst District	Southern	N/A	Severn / Ramara Twp.	Black River / Severn River	
04/04/98		Southern	Crowe Valley	Belmont TWP.	Goroova Lake	
04/05/98	Peterborough	Southern	Otonabee Region	Peterborough and	Otonabee River	N/A
04/06/98		Southern	Crowe Valley	Belmont TWP.	Belmont Lake	
04/06/98	Kemptville District	Southern	Mississippi Valley			
04/06/98	Kemptville District	Southern	Mississippi Valley			
04/06/98	Parry Sound	Southern	N/A	Kearney	Magnetawan	
04/06/98	Parry Sound	Southern	N/A	Armour	Magnetawan	
04/07/98		Southern	Crowe Valley		Grove River	
04/07/98	Kemptville	Southern	Mississippi Valley	Township of Beckwith	Township of Drummond / North	
04/07/98	Parry Sound	Southern	NA			
04/09/98	Aylmer	Southern	Essex Region	several	Lake Erie, Lake St.Clair	4.5 million
04/21/98	Kemptville	Southern	Mississippi Valley	Township of Lanark	Mississippi	
07/08/98	Kemptville	Southern	Cataraqui Region	Brockville	St. Lawrence River	

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
1999**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
06/30/99	Kenora District	Northwestern	NA			

**Appendix A- Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2000**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
01/01/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	N/A
01/04/00	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
02/01/00	Aylmer	South	Ausable Bayfield	Lambton Shores	Ausable River	
02/25/00-02/28/00	Aurora	Southern	Credit Valley	Caledon / Mississauga	CVC	
02/25/00	Midhurst	Southern	Grey Sauble	Town of the Blue	Beaver	\$70,000.00
02/25/00	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
02/25/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
02/26/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$80,411
02/26/00	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
02/28/00	Guelph District	Southern	Grand River		Grand River	
04/20/00 - 04/21/00	Aylmer	South Central	Kettle Creek	Port Stanley, London, St.	Kettle Creek Watershed	3500 + unknown
May and June 2000	Midhurst	Southern	Lake Simcoe		Lake Simcoe	
May and June 2000	Midhurst	Southern	Lake Simcoe		Lake Simcoe	
05/13/00	Guelph District	Central	Grand River	Centre Wellington	Grand River	\$16,020
05/13/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$117,483
05/13/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	N/A
05/13/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
05/13/00	Aylmer	South	Ausable Bayfield	Huron East	Bayfield River	
05/13/00	Guelph District	Southern	Niagara			
05/13/00	Guelph District	Central	Grand River	Township of Mapleton	Grand River	N/A
05/13/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
05/13/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	City of Cambridge	Grand River	0
05/14/00	Guelph District	Central	Grand River	South Dumfries	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Brant County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	City of Brantford	Grand River	0
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$20,703
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Six Nations	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/14/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/18/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
05/18/00	Guelph District	Central	Grand River	Centre Wellington	Grand River	\$0
05/18/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$0
05/19/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
05/19/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A

**Appendix A- Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2000**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/20/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/15/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/25/00	Guelph District	Central	Grand River	Township of Mapleton	Grand River	N/A
06/25/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
06/26/00	Guelph District	Central	Grand River	Centre Wellington	Grand River	\$25,181
06/26/00	Guelph District	Central	Grand River	WoolwichTownship	Grand River	N/A
06/26/00	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$0
06/26/00	Midhurst District	Southern	Lake Simcoe		Lake Simcoe	
06/26/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
06/26/00	Guelph District	Central	Grand River	City of Kitchener	Grand River	N/A
06/26/00	Guelph District	Central	Grand River	Brant County	Grand River	N/A
06/26/00	Guelph District	Central	Grand River	City of Brantford	Grand River	0
06/26/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	City of Cambridge	Grand River	0
06/27/00	Guelph District	Central	Grand River	South Dumfries	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Six Nations	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/27/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/28/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/28/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/28/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/28/00	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
07/09/00	Guelph	South	Ausable Bayfield	South Huron, Bluewater	Ausable River	
07/11/00	Aylmer District	Southern	Upper Thames	London		
07/14/00	Aylmer District	Southern	Lower Thames			
08/02/00	Parry Sound	Southern	N/A	Wahta First Nation	Muskoka	\$1,000.00
08/04/00	Parry Sound	Southern	N/A	Bracebridge	Muskoka	

**Appendix A- Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2000**

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2001**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
02/09/01	Aylmer	Southern	Essex Region	Town of Calumet	Belle River and Pace River	1/2 million
02/10/01	Guelph District	Central	Grand River	Township of Mapleton	Grand River	N/A
02/10/01	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$0
02/11/01-02/13/01	N/A	N/A	Lower Thames Valley	Lakeshore	Thames River	\$56,000.00
02/11/01	Guelph District	Central	Grand River	Haldimand County	Grand River	na
02/12/01	Aylmer District	Southern	Essex Region			minimum \$30, 000
02/12/01	Guelph District	Central	Grand River	Wilmot Township	Grand River	\$26,154
04/08/01	Guelph District	Central	Grand River	Centre Wellington	Grand River	\$16,020
04/09/01	Guelph District	Central	Grand River	East Luther Twp	Grand River	\$0
04/09/01	Guelph District	Central	Grand River	Woolwich Township	Grand River	N/A
04/11/01	Peterborough District	Southern	Crowe Valley	Wallaston TWP	Wallaston Lake	
04/13/01			Crowe Valley	Belmont TWP	Cordova Lake	
04/13/01	Parry Sound	Southern	N/A	Huntsville	Muskoka	
04/15/01	Sault Ste. Marie	Northeastern	Sault Ste. Marie			
04/17/01	Peterborough District	Southern	Otonabee			
04/30/01	Nipigon	Northwestern	NA		White Lake	
08/01/01	Thunderbay	Northwestern	Lakehead Region			
10/30/01	North Bay District	Northeastern	North Bay - Mattawa			
11/03/01	North Bay	Northeast	North Bay - Mattawa	North Bay	Lake Nipissing	230 000
11/12/01	North Bay District	Northeastern	North Bay - Mattawa			

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2002**

Date of Flood Peak	MNR District	MNR Region	C.A.	Municipality	Watershed or Great Lake	Total Damages
						\$
2002	Fort Frances	Northwestern	NA	Atikoken and Fort Frances		\$ 2.5 Million
02/28/02	Guelph District	Central	Grand River	East Garafraxa	Grand River	N/A
04/17/02	Parry Sound	Southern	N/A	Huntsville	Muskoka	
04/22/02	Kempville	Southern	Rideau Valley			
04/24/02	Pembroke	Southern	NA			
May and June 2002	Midhurst	Southern	Lake Simcoe		Lake Simcoe	
05/15/02	Cochrane Region	Northeastern	NA			
05/18/02	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
05/18/02	Guelph District	Central	Grand River	Haldimand County	Grand River	N/A
06/10/02	Kenora	Northwestern	NA			
06/11/02	Fort Frances	Northwestern	Lakehead Region			
06/11/02	Kenora	Northwestern	NA			
06/11/02	Kenora	Northwestern	NA			
06/12/02	Peterborough	South Central	Kawartha Region	Cay of Kawartha Lakes	Sevese River/ Mariposa Brooks	unknown
06/12/02	Peterborough	South Central	Kawartha Region	City of Kawartha Lakes	Pigeon River / Pigeon Lake	unknown
06/12/02	Peterborough	Southern	Otonabee Region	Peterborough	Otonabee	\$800,000 to \$1 Million
06/13/02	Fort Frances	Northwestern	Lakehead Region			
07/30/02	Guelph District	Central	Grand River	Bruford Township	Grand River	Agricultural Damages
07/30/02	Guelph District	Central	Grand River	Bruford Township	Grand River	Agricultural Damages

**Appendix A - Flood Damage Centres By MNR Division, Conservation Authority and Municipality
2003**

Date of Flood Peak	MNR District	MNR Region	Municipality	C.A.	Watershed or Great Lake	Total Damages
						\$
02/18/03	Aurora	Southern	City of Mississauga	Credit Valley	CVC	
03/21/03	Guelph District	Central	Haldimand County	Grand River	Grand River	na
03/30/03	Parry Sound	Southern	Huntsville	N/A	Muskoka	
04/21/03	Thunder Bay	Northwest	Thunder Bay	Lakehead Region	Superior	+ 3 million
04/21/03	Thunder Bay	Northwest	Thunder Bay	Lakehead Region	Superior	
04/21/03	Thunder Bay	Northwest	Thunder Bay	Lakehead Region	Superior	\$5,000.00
05/11/03	Sault Ste. Marie	Northwestern		Sault Ste. Marie		
08/09/03	Midhurst District	Southern		Saugeen Valley		
08/10/03	Pembroke	Southern		NA		100's of thousands
11/20/03	Parry Sound	Southern	Huntsville	N/A	Muskoka	
11/28/03	Parry Sound	Southern	Bracebridge	N/A	Muskoka	
12/02/03	Kempville	Southern		Rideau Valley		