THE TORONTO AND REGION CONSERVATION AUTHORITY

PRESENTATION ON HURRICANE HAZEL AND THE TRCA

FRIDAY FORUM MEETING OCTOBER 20,2000

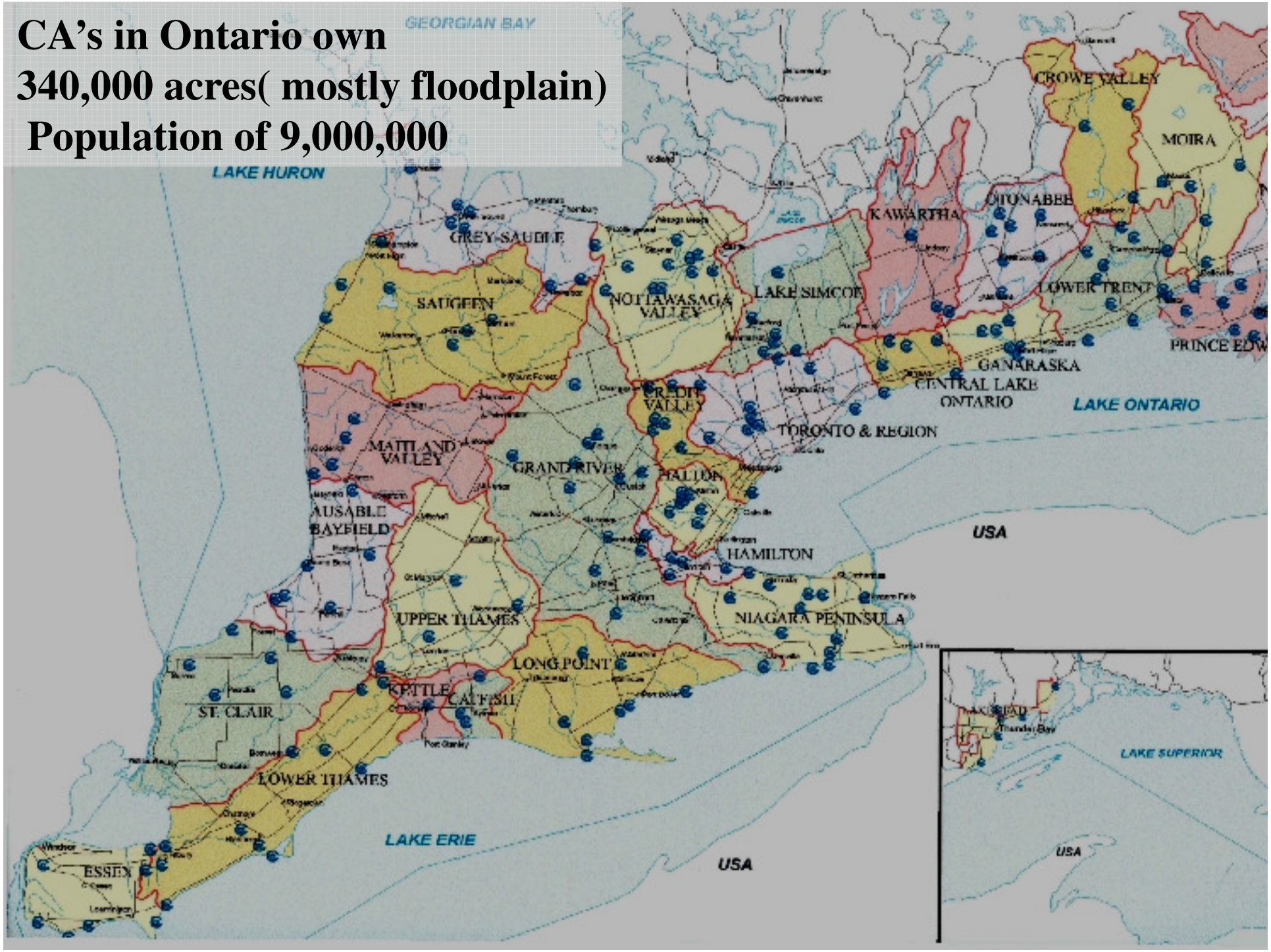
INSTITUTE FOR CATASTROPHIC LOSS REDUCTION

- **Provincial Conservation Authorities Program was first set forth during the early 1940's**

- **There role was to initially manage the natural resources and functions on a watershed basis**

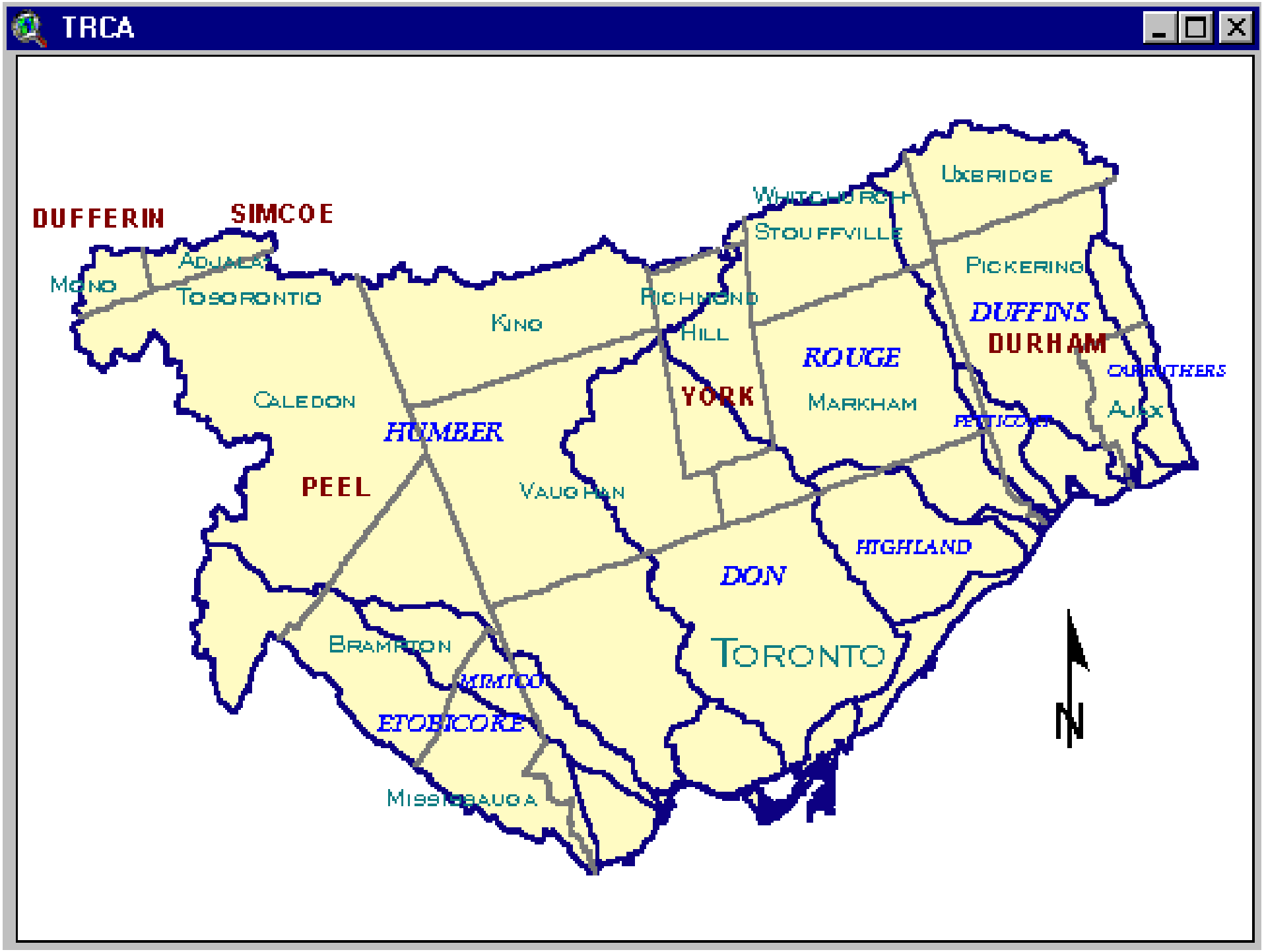
- **Many of the early CA's dealt with programs such as reforestation and flood control**

CA's in Ontario own
340,000 acres(mostly floodplain)
Population of 9,000,000



Originally Four CA's established in mid-late 1940's

- Etobicoke Mimico Creek CA
- Humber River CA
- Don River CA
- Rouge Duffins Highland Petticoat CA


TRCA
DUFFERIN
SIMCOE
Mono
Adjala
Tosorontio
King
Caledon
HUMBER
PEEL
Brampton
Mississauga
ETOBICOKE
MIMICO
Vaughan
YORK
Richmond Hill
Whitchurch
Stouffville
Uxbridge
Pickering
DUFFINS
DURHAM
ROUGE
Markham
Ajax
Currithers
HIGHLAND
DON
Toronto
N

Prior to Hurricane Hazel

Existing CA's dealt with local flooding issues and Reforestation within each watershed

For example, in the Etoicoke Mimico CA

Downtown Brampton 1947

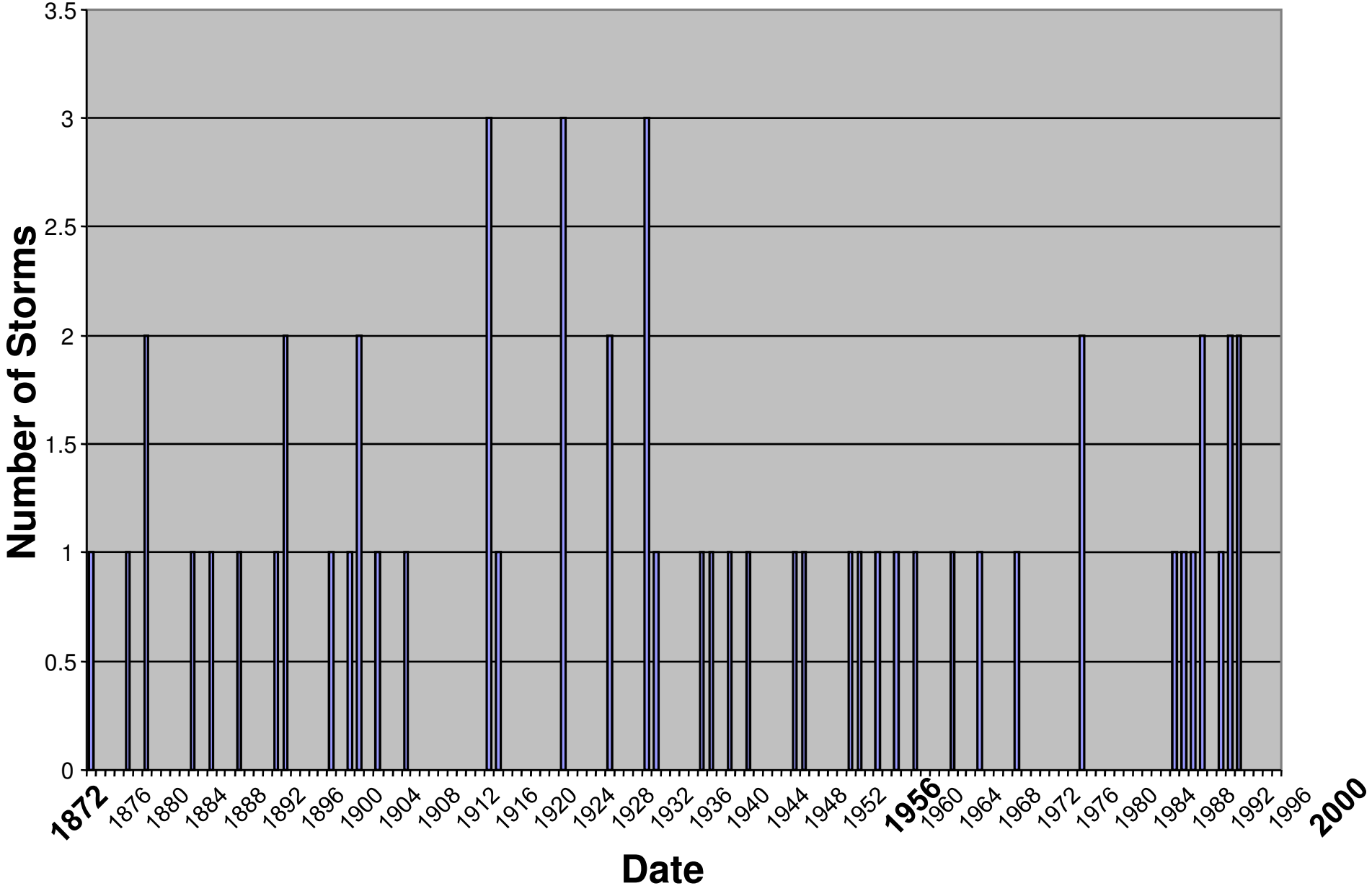

Brampton Channel Constructed 1951

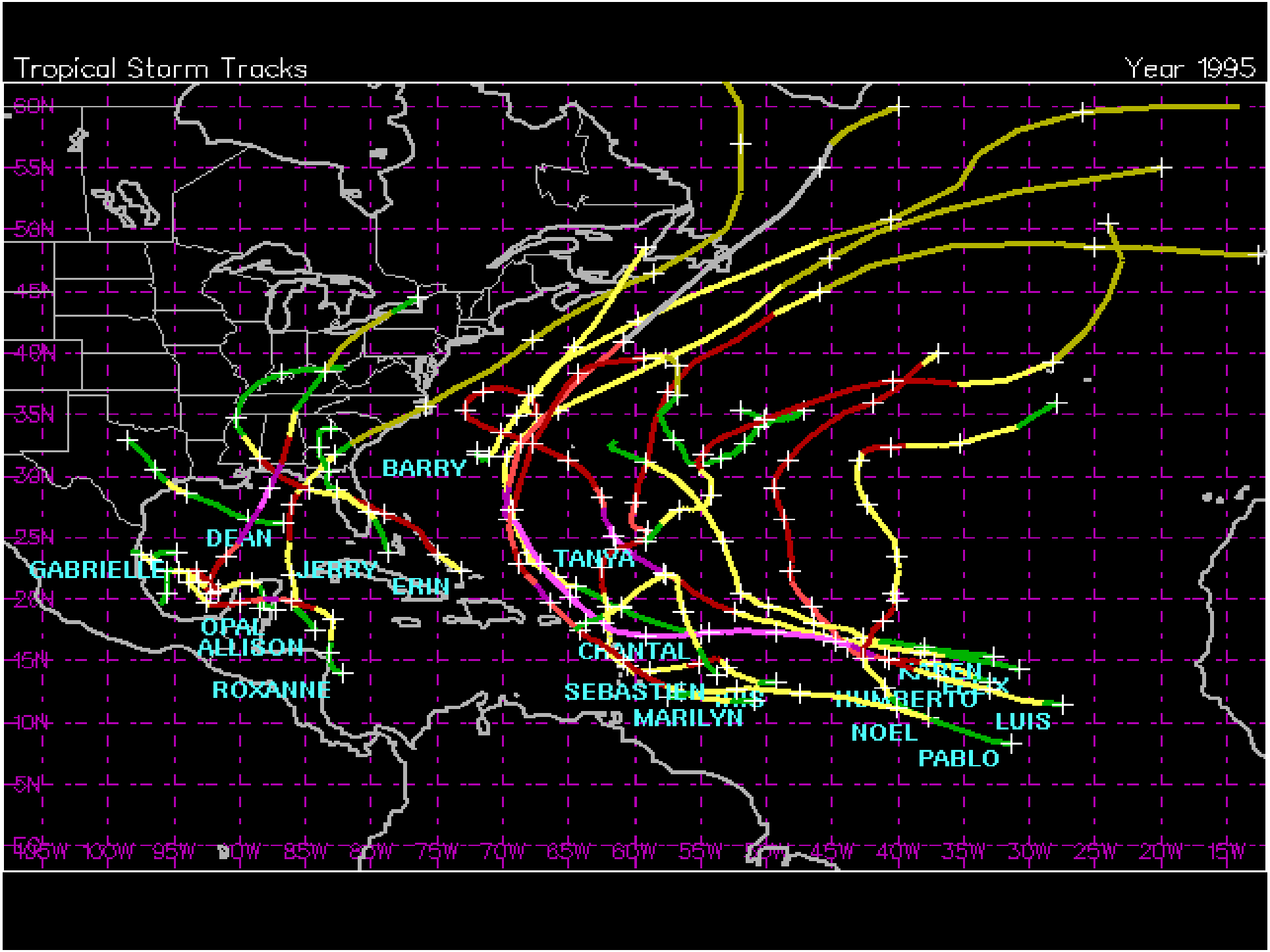
Reforestation Planting

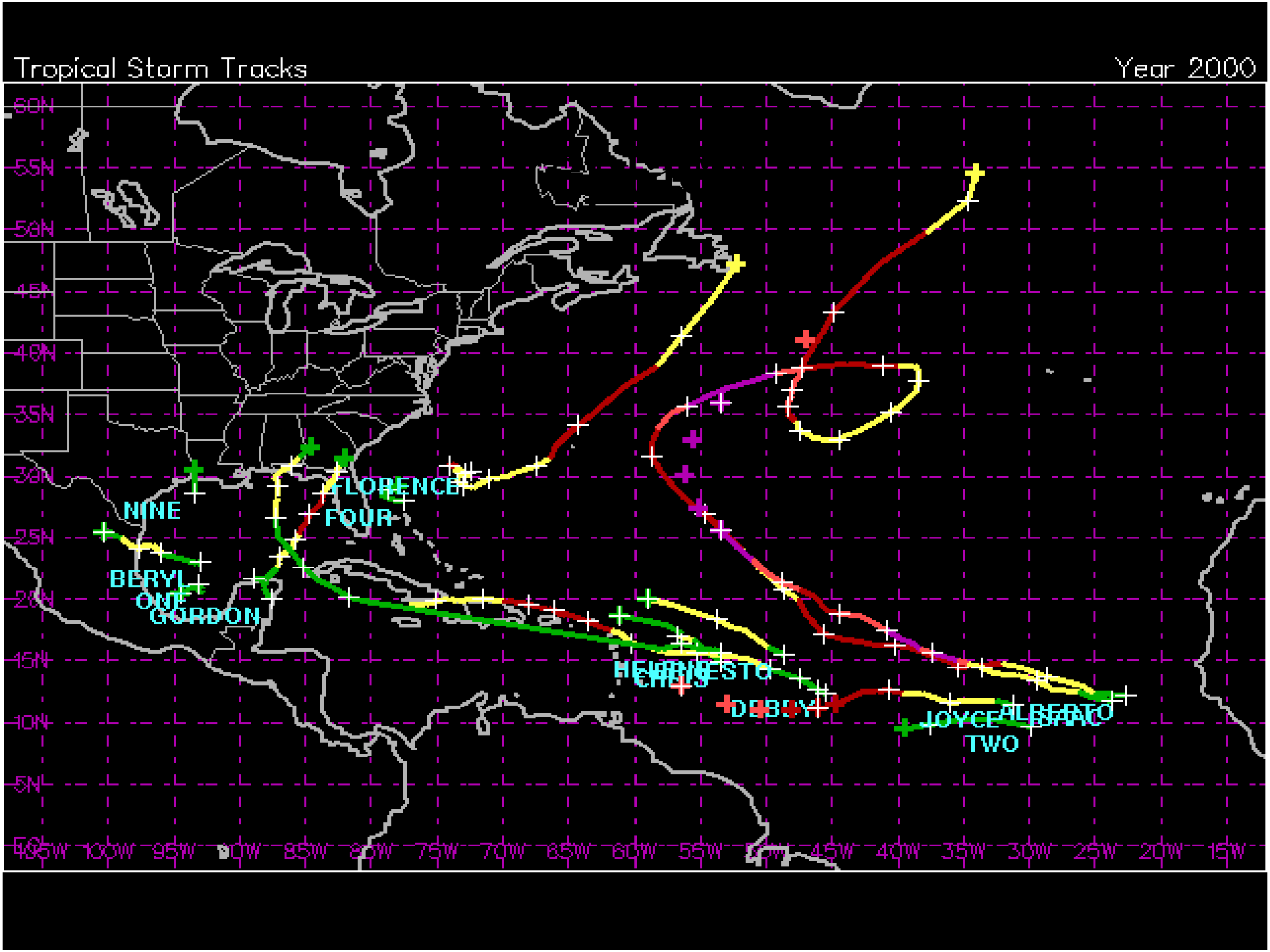
HURRICANES
And Ontario

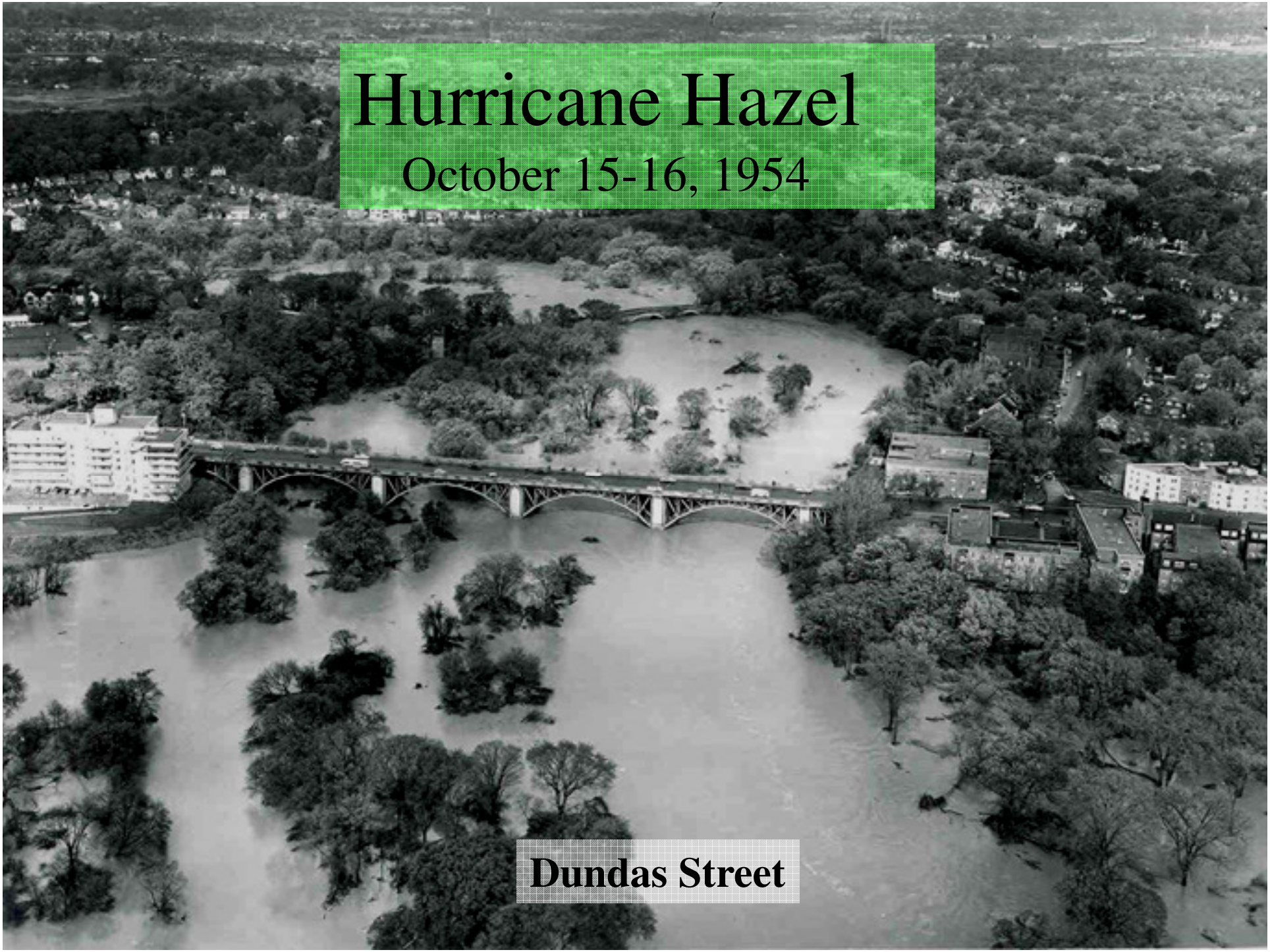
Southern Ontario experiences Tropical Storms
Or their remnants almost on an annual basis

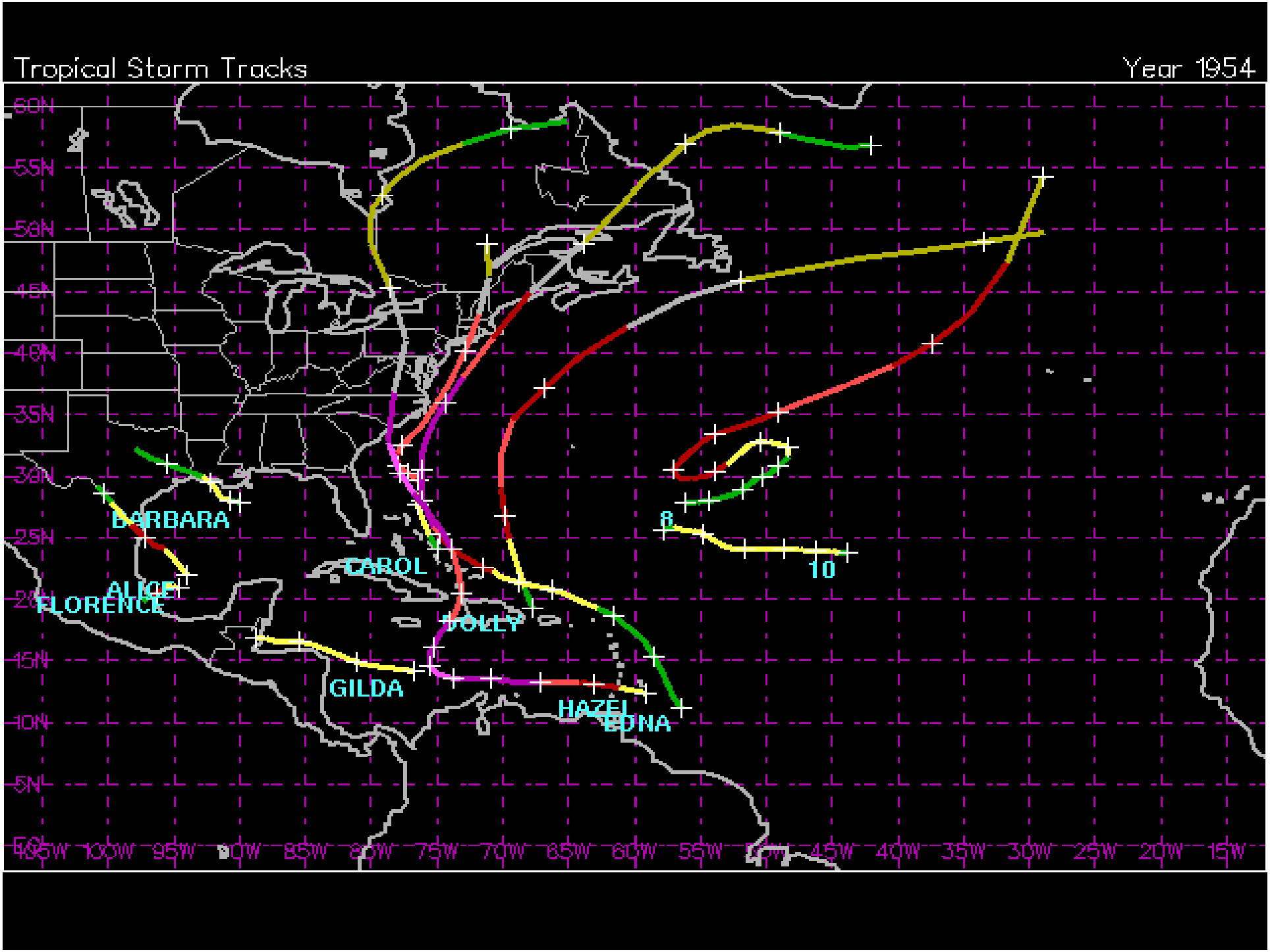
Hurricanes Affecting Ontario 1872-2000

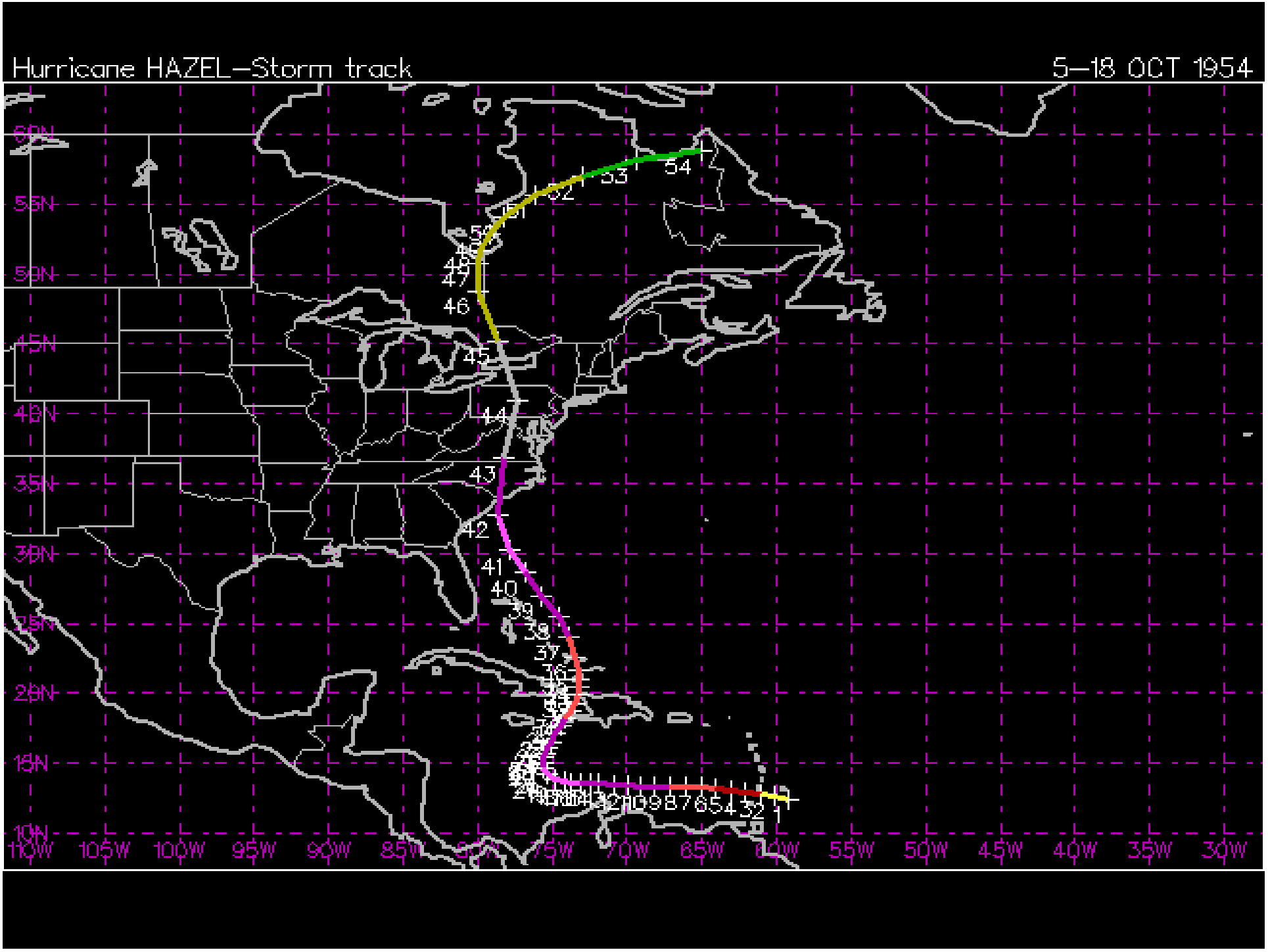



Tropical Storm Tracks
Year 1995
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
105W
100W
95W
90W
85W
80W
75W
70W
65W
60W
55W
50W
45W
40W
35W
30W
25W
20W
15W
BARRY
DEAN
GABRIELLE
JERRY
ERIN
OPAL
ALLISON
ROXANNE
TANYA
CHANTAL
SEBASTIEN
MARILYN
NOEL
HUMBERTO
LUIS
PABLO


Tropical Storm Tracks
Year 2000
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
105W 100W 95W 90W 85W 80W 75W 70W 65W 60W 55W 50W 45W 40W 35W 30W 25W 20W 15W
NINE
FLORENCE
FOUR
BERYL
ONE
GORDON
HELENE
CHRIS
DEBBY
JOYCE
ALBERTO
TWO


Hurricane Hazel
October 15-16, 1954
Dundas Street


Tropical Storm Tracks
Year 1954
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
105W
100W
95W
90W
85W
80W
75W
70W
65W
60W
55W
50W
45W
40W
35W
30W
25W
20W
15W
BARBARA
ALICE
FLORENCE
CAROL
JOLLY
GILDA
HAZEL
EDNA
8
10


Hurricane HAZEL–Storm track
5–18 OCT 1954
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
10N
110W
105W
100W
95W
90W
85W
80W
75W
70W
65W
60W
55W
50W
45W
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35W
30W
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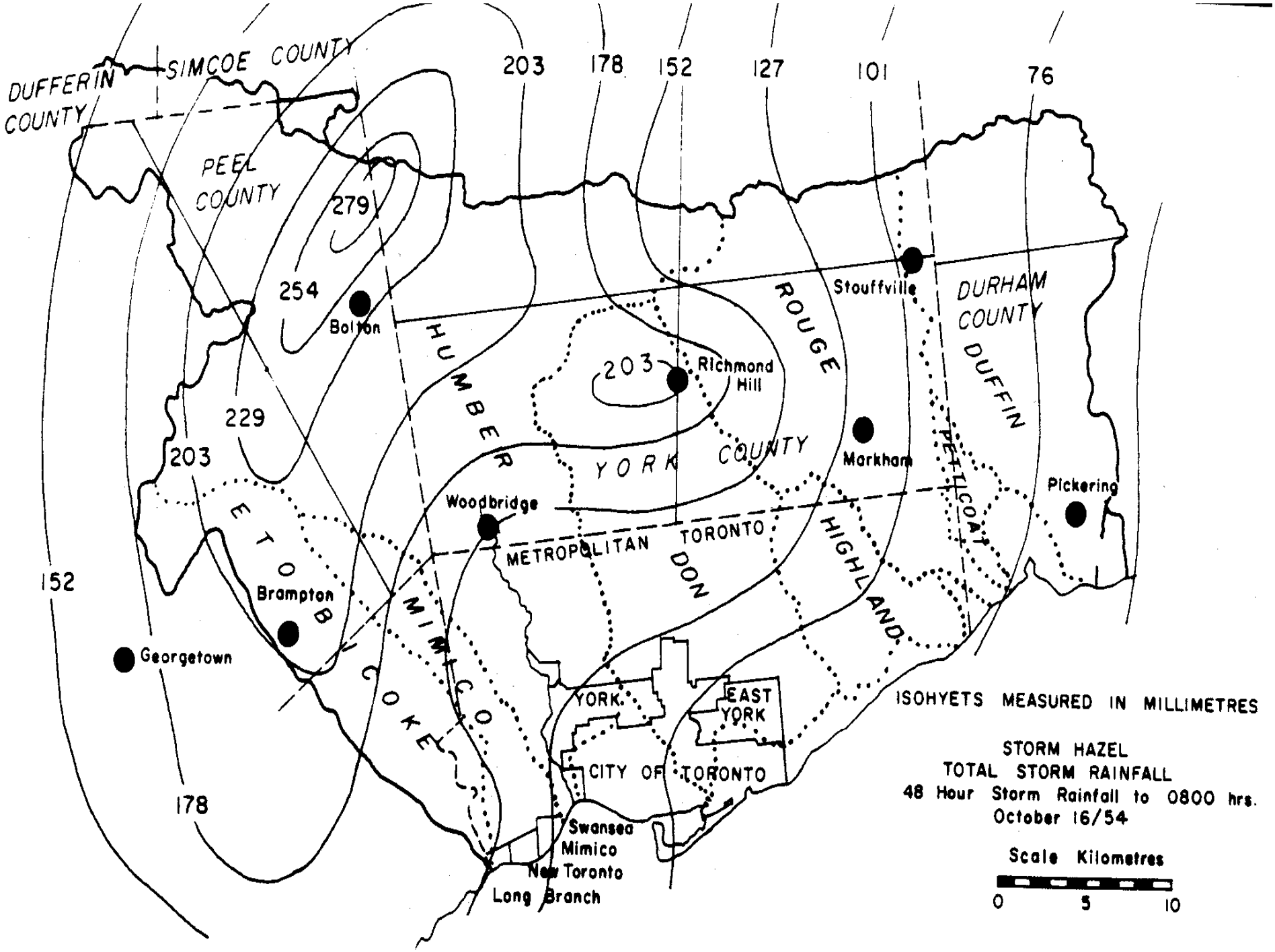
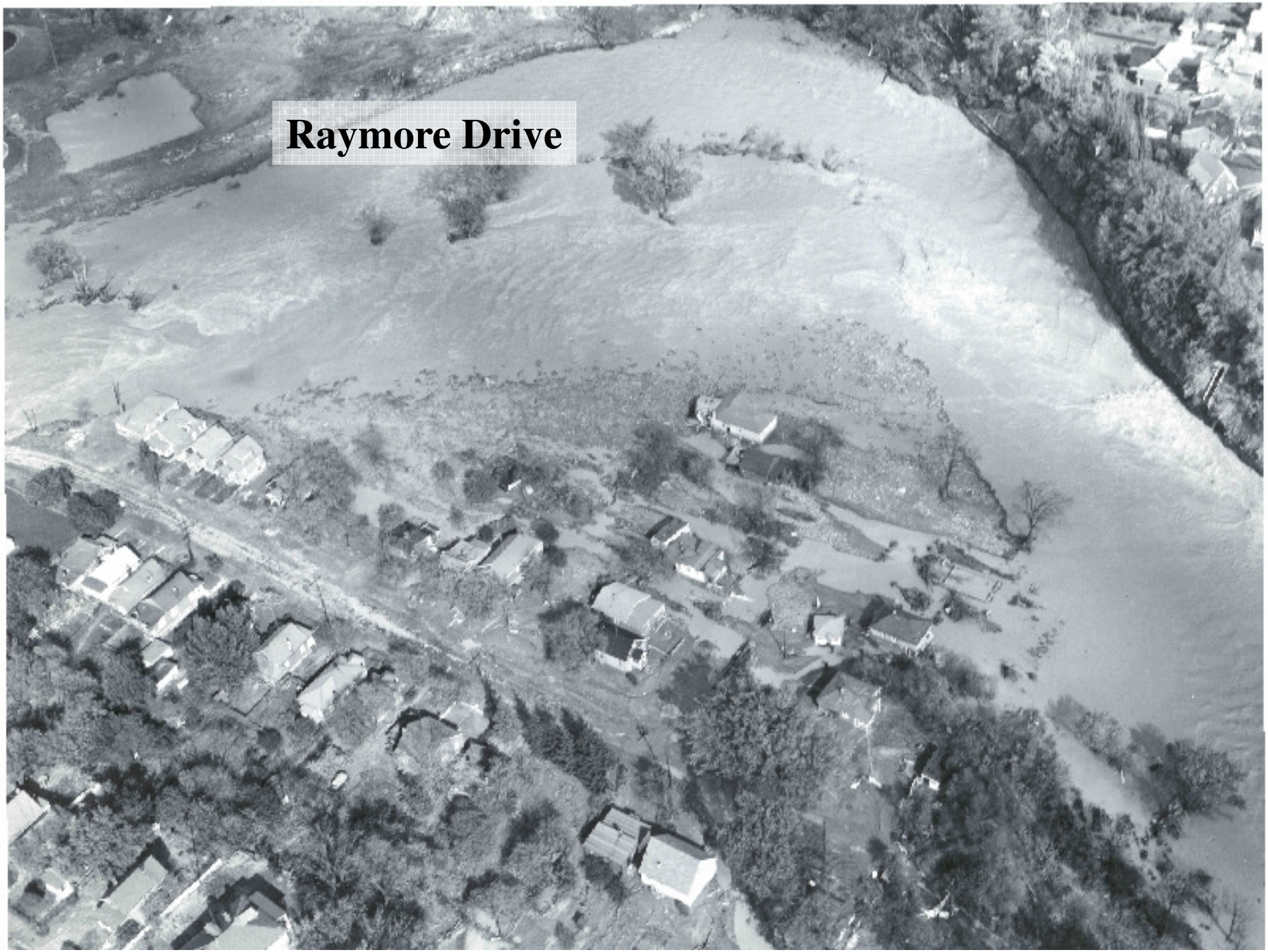
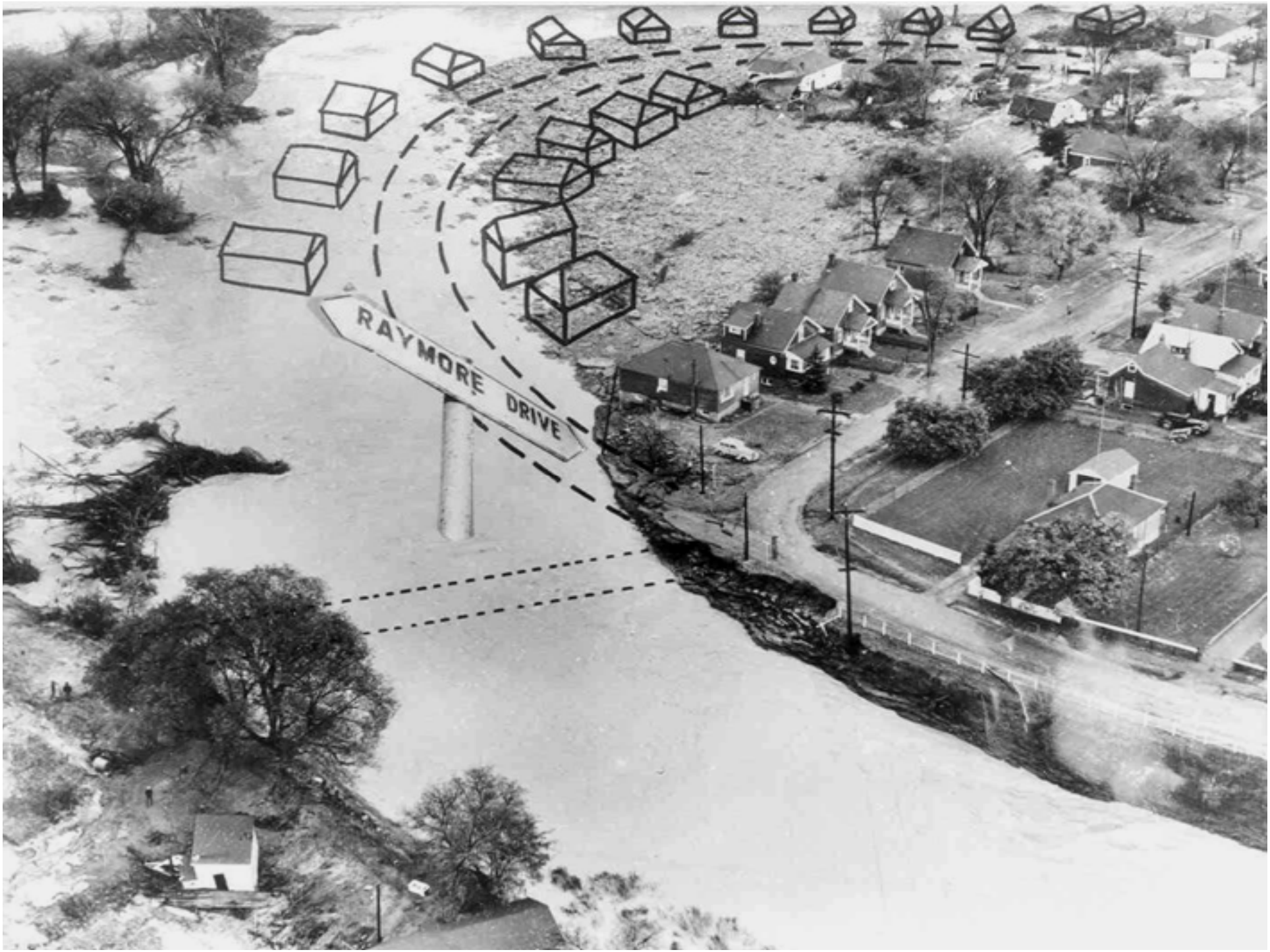
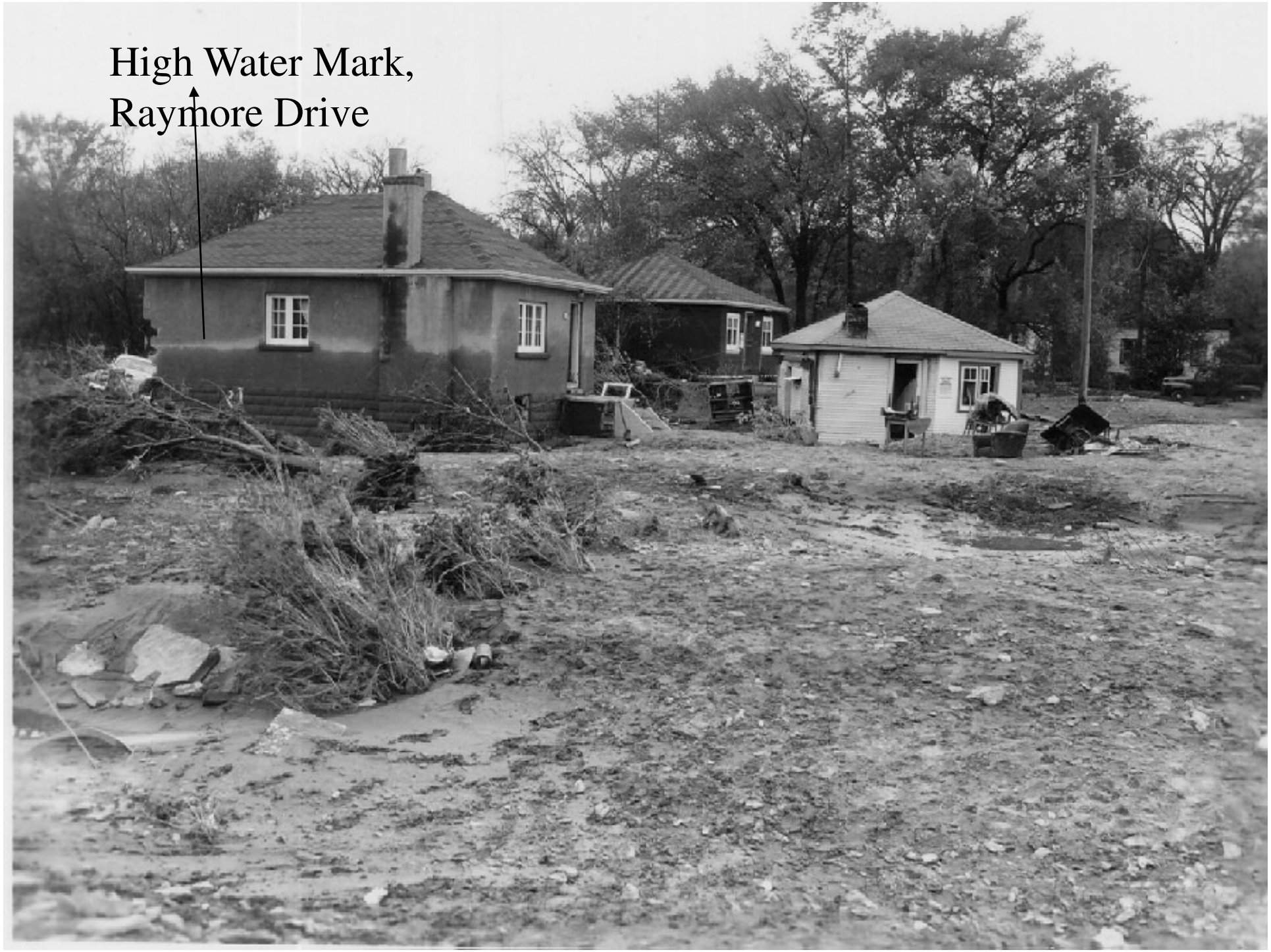
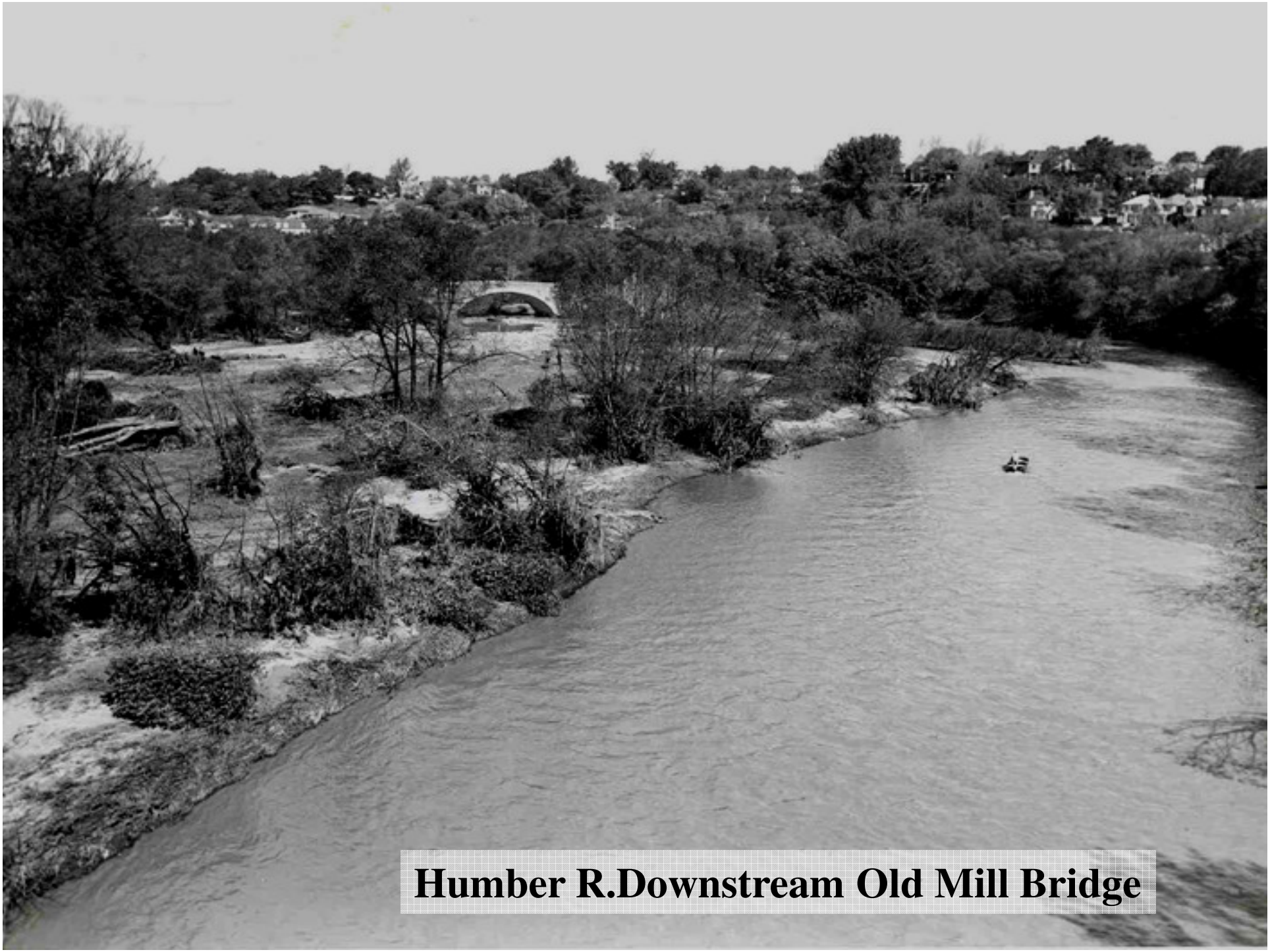

DUFFERIN COUNTY
SIMCOE COUNTY
PEEL COUNTY
203
178
152
127
101
76
279
254
229
203
152
178
Bolton
Richmond Hill
Stouffville
Markham
Pickering
Woodbridge
Brampton
Georgetown
HUMBER
ROUGE
DURHAM COUNTY
DUFFIN
PETTICOAT
YORK COUNTY
METROPOLITAN TORONTO
ETOBICOKE
MIMICO
DON
HIGHLAND
YORK
EAST YORK
CITY OF TORONTO
Swansea
Mimico
New Toronto
Long Branch
ISOHYETS MEASURED IN MILLIMETRES
STORM HAZEL
TOTAL STORM RAINFALL
48 Hour Storm Rainfall to 0800 hrs.
October 16/54
Scale Kilometres
0
5
10


Woodbridge

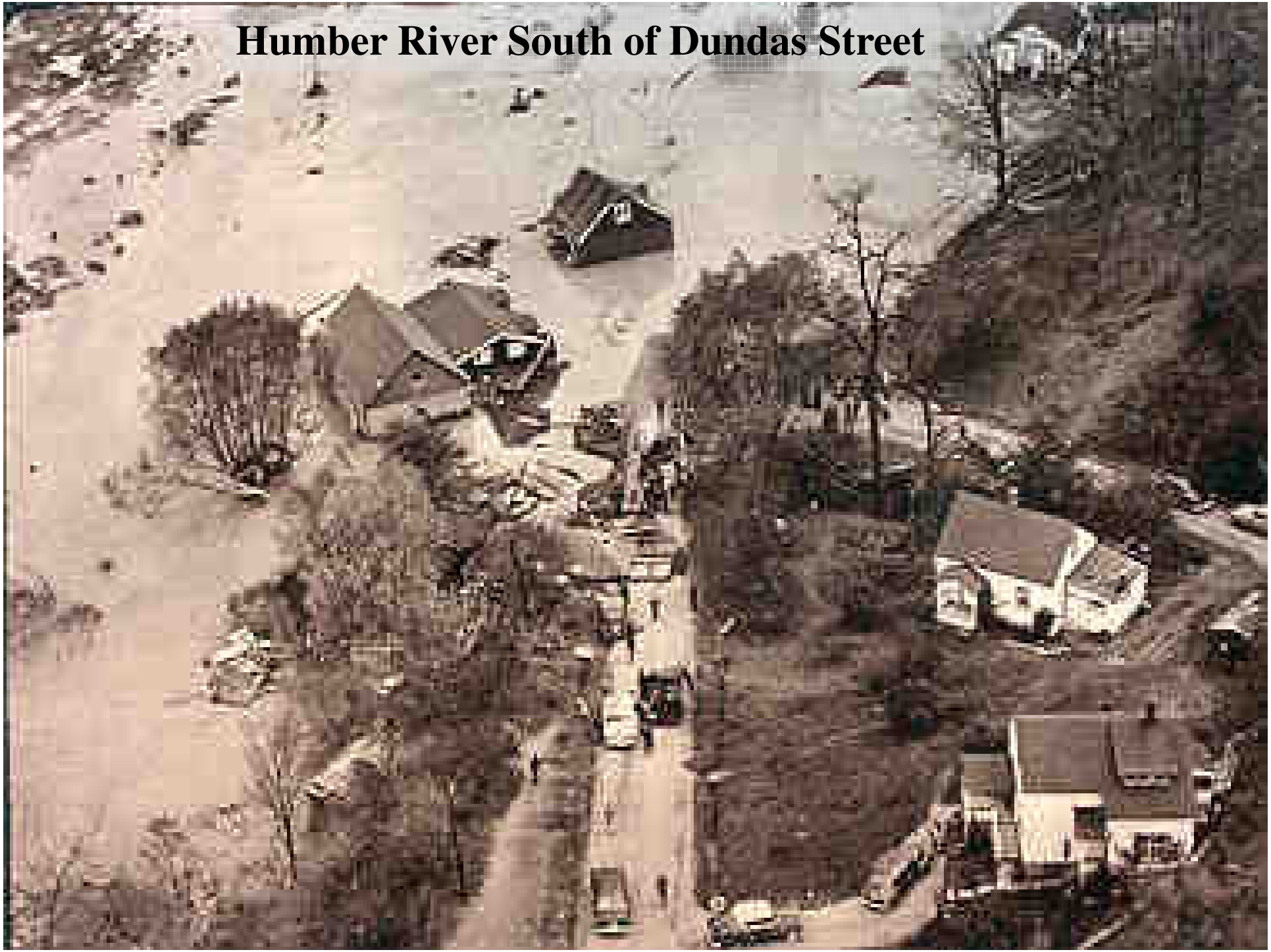

Raymore Drive

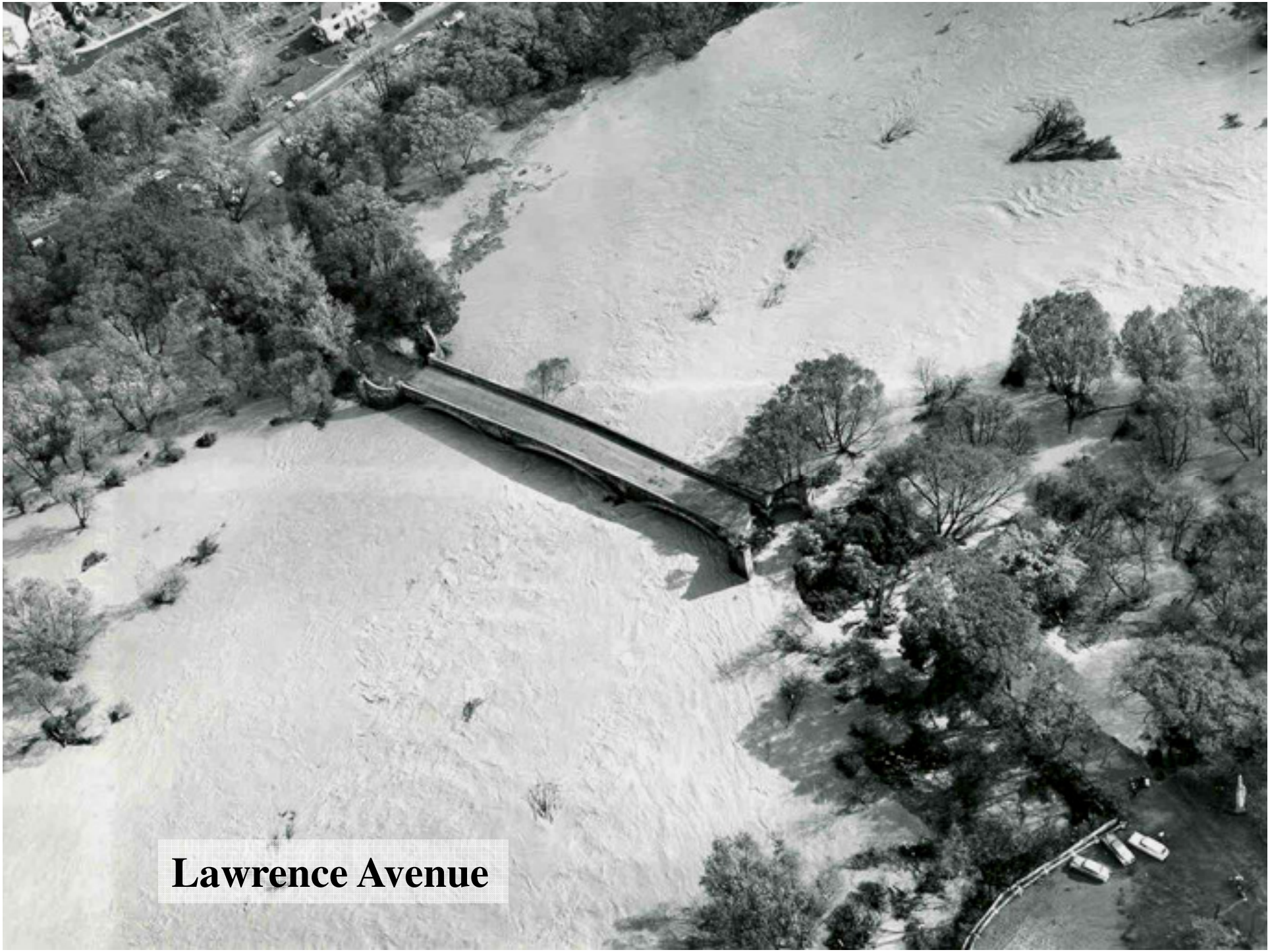

RAYMORE DRIVE


High Water Mark,
Raymore Drive

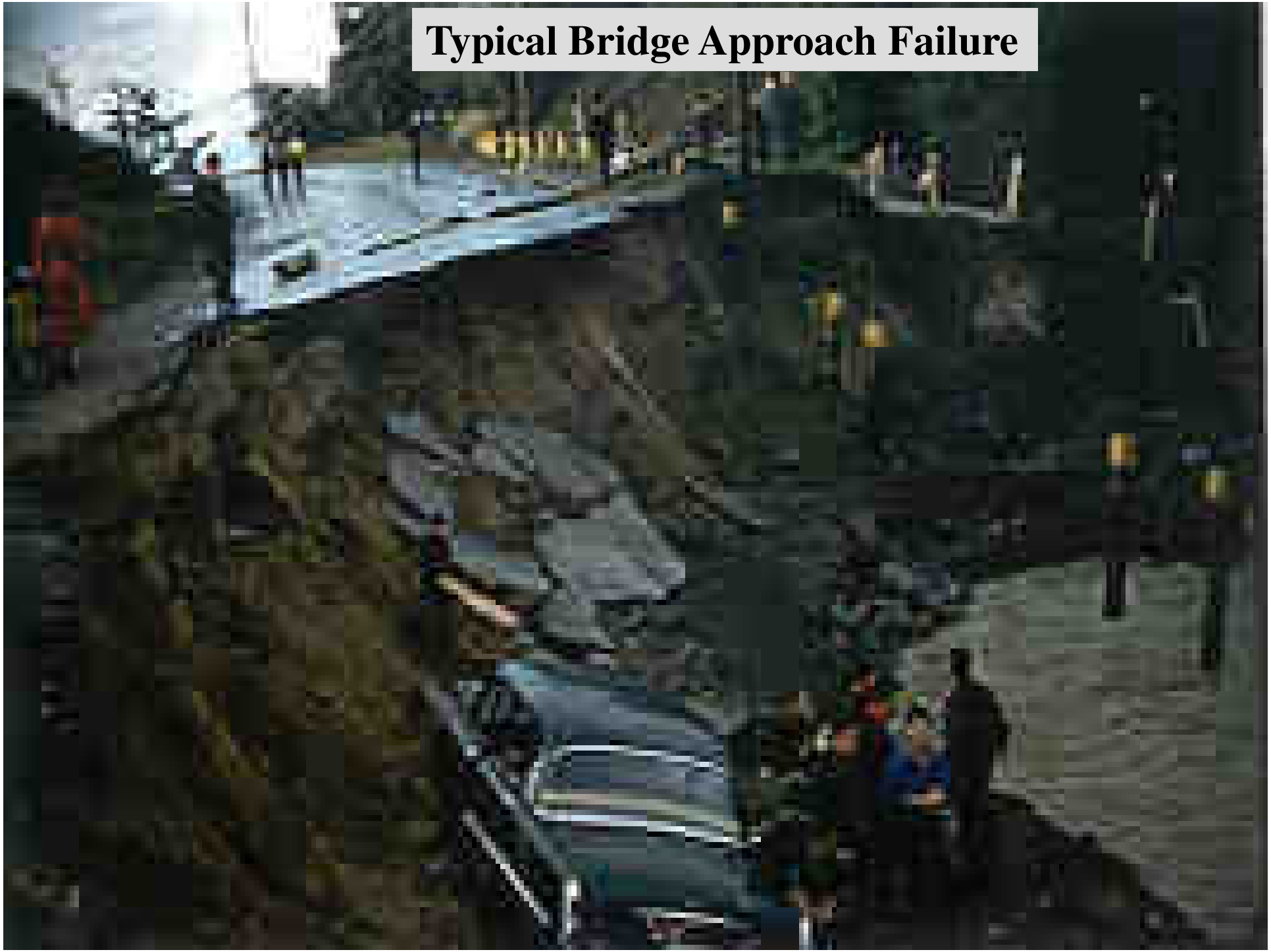

Humber R.Downstream Old Mill Bridge

Humber River South of Dundas Street



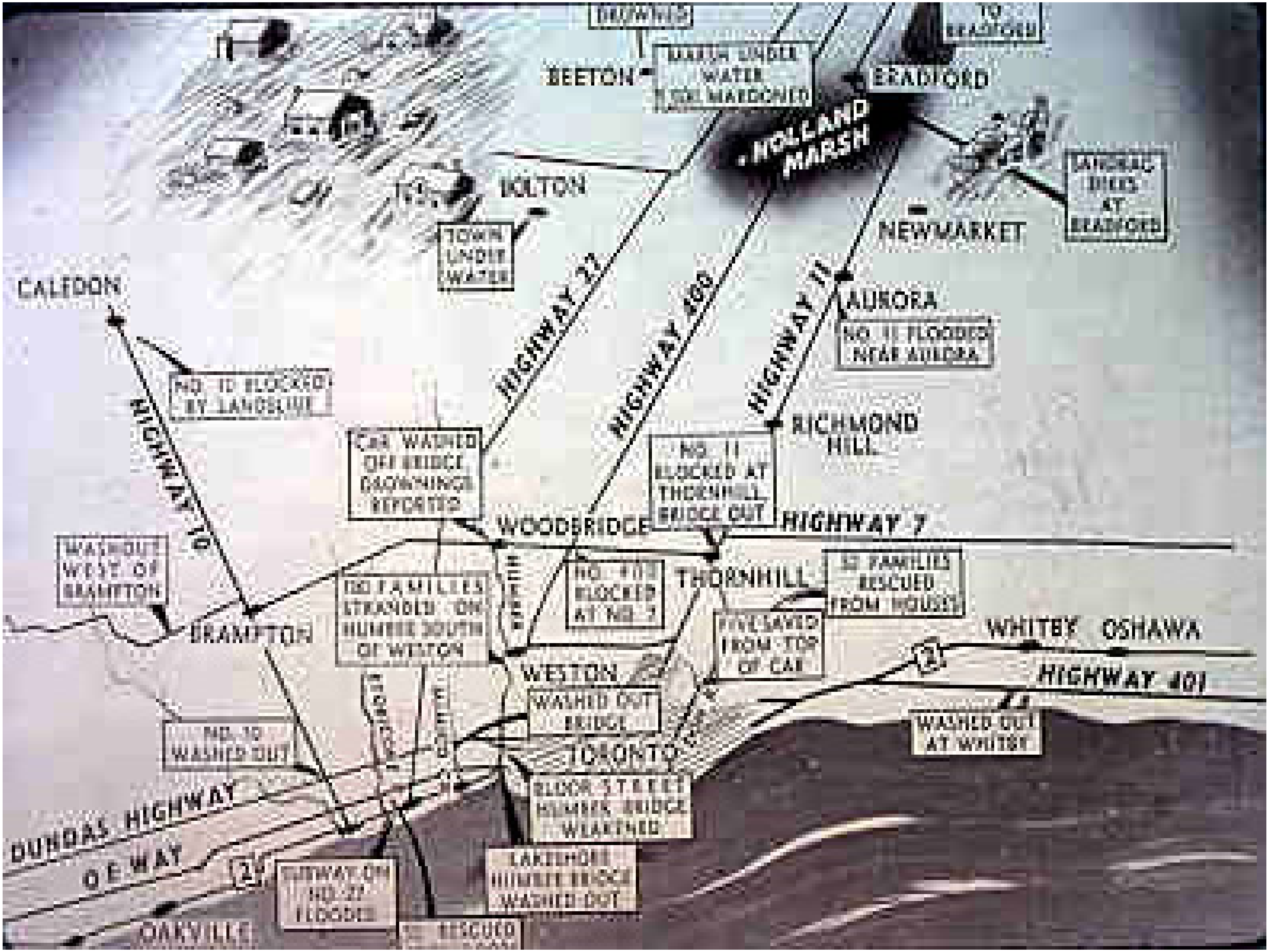

Lawrence Avenue

Typical Bridge Approach Failure



Humber at Lakeshore Blvd.


Highland Creek


BEETON
MARSH UNDER WATER
BRADFORD
HOLLAND MARSH
BOLTON
TOWN UNDER WATER
SANDBAG DIKES AT BRADFORD
NEWMARKET
CALEDON
HIGHWAY 27
HIGHWAY 400
HIGHWAY 11
AURORA
NO. 11 FLOODED NEAR AURORA
NO. 10 BLOCKED BY LANDSLIDE
HIGHWAY 10
RICHMOND HILL
CAR WASHED OFF BRIDGE DROWNINGS REPORTED
NO. 11 BLOCKED AT THORNHILL BRIDGE OUT
WOODBRIDGE
HIGHWAY 7
WASHOUT WEST OF BRAMPTON
100 FAMILIES STRANDED ON HUMBER SOUTH OF WESTON
NO. 400 BLOCKED AT NO. 7
THORNHILL
52 FAMILIES RESCUED FROM HOUSES
BRAMPTON
FIVE SAVED FROM TOP OF CAR
WHITBY
OSHAWA
WESTON
HIGHWAY 401
WASHED OUT BRIDGE
NO. 10 WASHED OUT
TORONTO
WASHED OUT AT WHITBY
BLOOR STREET HUMBER BRIDGE WEAKENED
DUNDAS HIGHWAY
LAKESHORE HUMBER BRIDGE WASHED OUT
SUBWAY ON NO. 27 FLOODED
OAKVILLE
RESCUED

Hurricane Hazel, the Aftermath

- 81 Dead
- Thousands left Homeless
- $ 25,000,000. in damages, 1954 Dollars
  $ 169,500,000. in 2000 Dollars)

CONSERVATION AUTHORITIES POST HURRICANE HAZEL

- **Original Four CA's Amalgamated into Metropolitan Toronto and Region Conservation Authority 1957**
- **Carruthers Creek Added to MTRCA 1958**
- **Plan for Flood Control and Water Conservation Developed in 1959**

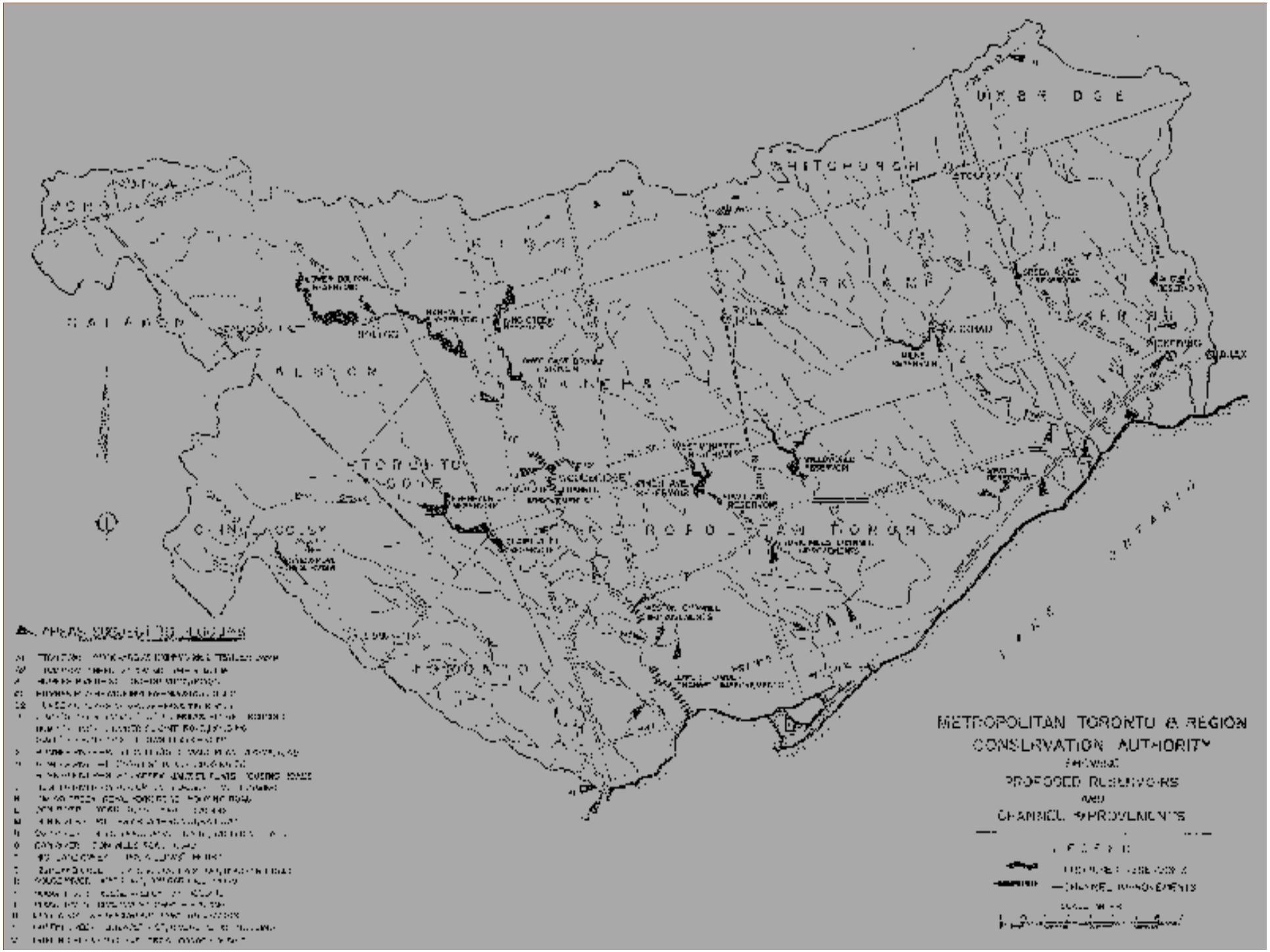
Highlights
1959 Plan for Flood Control and Water Conservation

Structural Works Identified

- **Construction of 15 Large Control Dams**
- **Four Major Flood Control Channels**

At a Cost of $ 22,500,000.

- **Initiation of Erosion Control Program**


METROPOLITAN TORONTO & REGION
CONSERVATION AUTHORITY
PROPOSED RESERVOIRS
AND
CHANNEL IMPROVEMENTS
LEGEND
CHANNEL IMPROVEMENTS

Highlights
1959 Plan for Flood Control and Water Conservation

Non Structural Works Identified

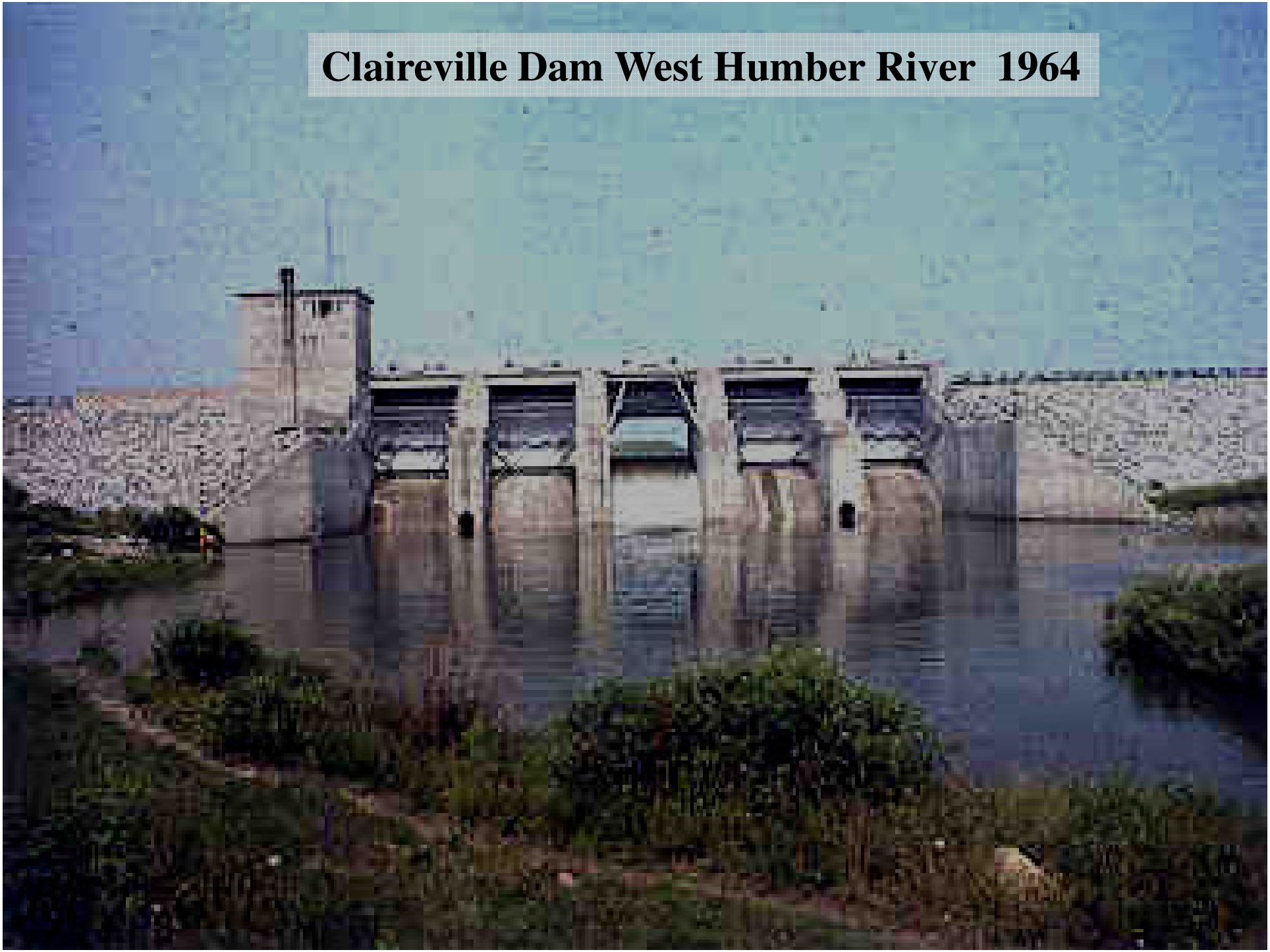
- **7200 acres identified for Acquisition At a cost of $11,600,000.(1954)**
- **Continuation of Reforestation Programs**
- **Initiation of Flood Warning Program**

PROVINCIAL INITIATIVES

- 11 year Process begun to develop and implement A Provincial Flood Plain Planning Policy
- Development of Flood Plain Development Regulations (One Zone Policy)
- Updating of CA Act to Allow for Fill Regulations

MTRCA REMEDIAL WORKS , 1959-1995

- The MTRCA has actively pursued both Structural and Non-Structural Flood Mitigation works
- Three of the Major Dams have been Constructed, plus one at Stouffville and one on Black Creek not previously identified
- 12 Major Flood Control Channels Works and Flood Control Dykes
- In excess of 100 major Erosion Control Works


Claireville Dam West Humber River 1964


G. Ross Lord Dam and Reservoir
West Don River 1973

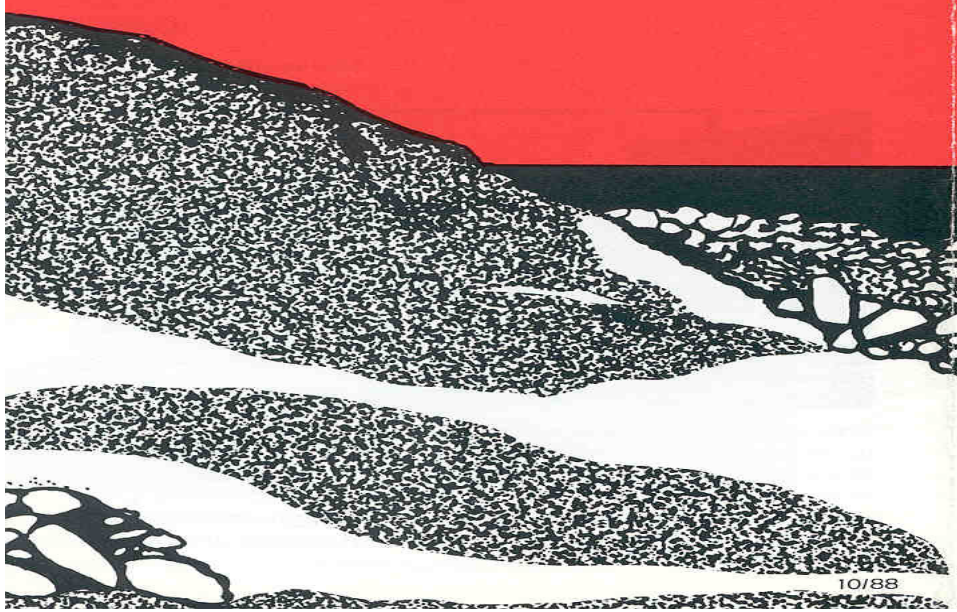

Little Etobicoke Creek Channel


Erosion Control Site

NON STRUCTURAL WORKS

- FLOOD PLAIN REGULATIONS
- ACQUISITION
- FLOOD PLAIN MAPPING
- STORMWATER MANAGEMENT
- FLOOD WARNING

Ontario Regulation 293/86 exists for the protection of you and your upstream and downstream neighbours. Placing fill, constructing a structure or altering a watercourse without a permit may result in prosecution under the Conservation Authorities Act. Your co-operation and assistance is appreciated. If you have any questions or concerns regarding development within the valleys or along the water-front, please contact the Conservation Authority.



10/88

Ontario Regulation

Valley, Stream, and Waterfront Regulation

WHAT YOU SHOULD KNOW

the metropolitan toronto and region conservation authority

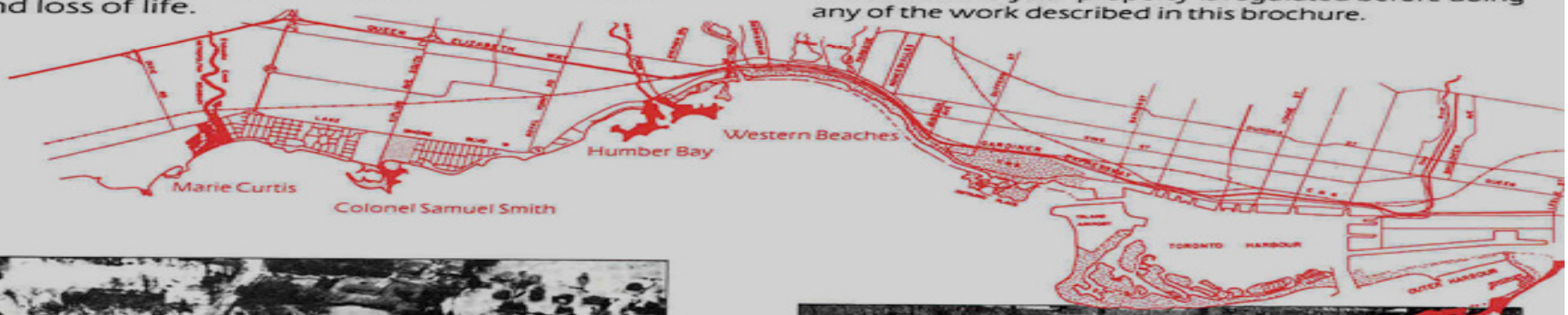
Why The Regulation Is Necessary

Unrestricted development within a floodplain, or indiscriminate filling within a regulated area, can damage buildings and threaten public safety. Fill placed on a valley slope can aggravate existing erosion problems or create new ones. Development can also affect neighbouring properties, both upstream and downstream, by changing the physical characteristics of the floodplain and the stream.

Similarly, unrestricted development along the Lake Ontario waterfront may be damaged by flooding due to high lake levels or severe wave action. Fill placed on a bluff slope can also aggravate existing erosion problems or create new ones.

Ontario Regulation 293/86 was enacted to prevent problems such as the above from occurring. The co-operation of landowners in complying with the Regulation will reduce the risk of property damage, personal injury, and loss of life.

(cross-section diagram)
This is a typical valley — the regulated areas of many valleys are not so easy to define. Therefore, it is important to determine if your property is regulated before doing any of the work described in this brochure.



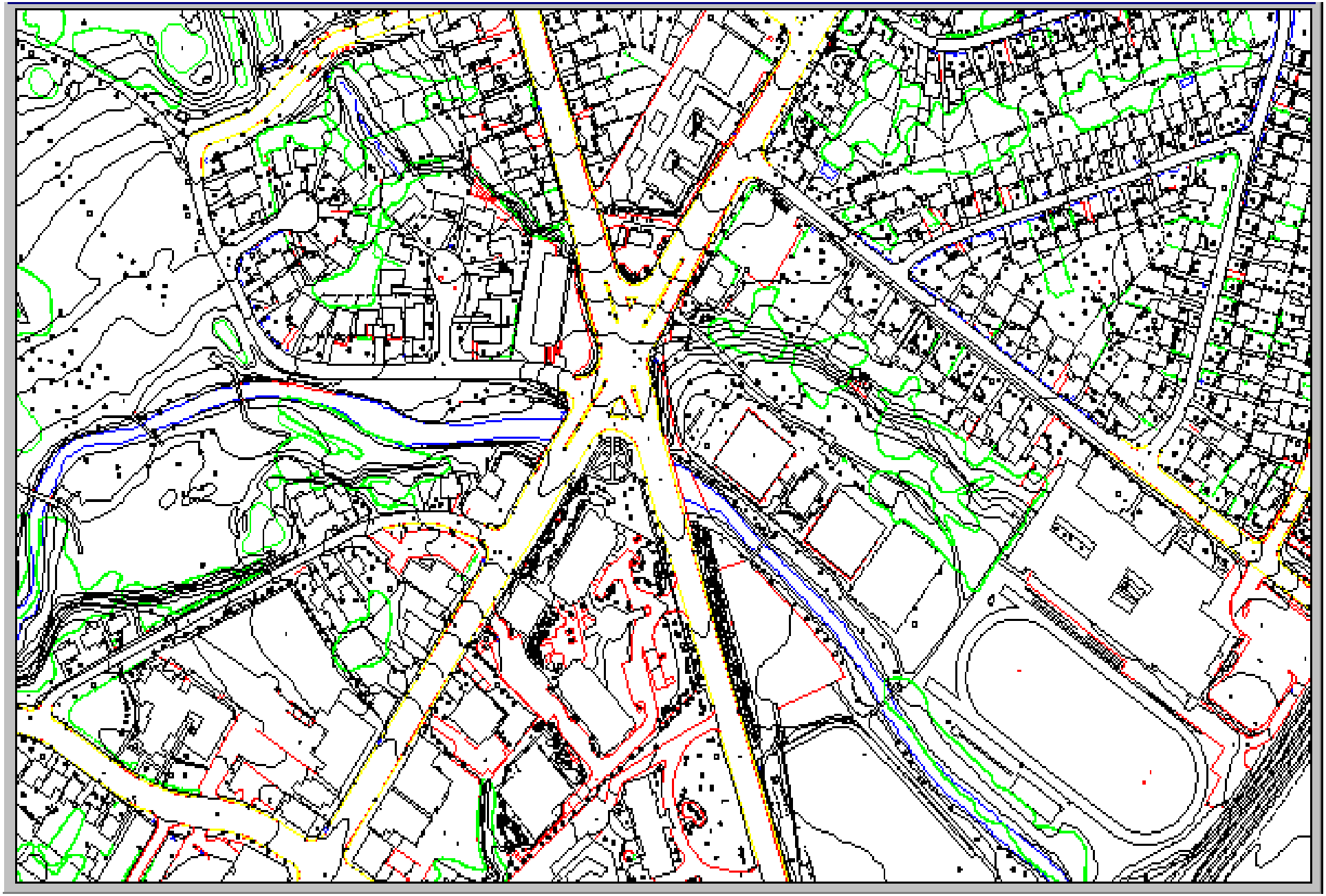
These homes were located on a floodplain and were destroyed by Hurricane Hazel, which struck the Toronto region in October 1954. In total, 81 lives were lost and the property damage was valued in the millions of dollars.

Unauthorized filling on the waterfront could result in a site that is technically or structurally unsound.

Lands Acquired By TRCA

Watershed	Lands Acquired During 1999	Hectares To Date
Etobicoke Creek		374
Mimico Creek		40
Humber River	43	6,741
Don River	3	917
Highland Creek		395
Rouge River	7	1,113
Duffins Creek	69	2,316
Petticoat Creek		134
Carruthers Creek		25
Lake Ontario Waterfront	8	1,322
Total	**130**	**13,377**

Highland Creek Digital Flood Plain Mapping



STORM WATER MANAGEMENT

New Program initiated in The Authority's 1980 Watershed Plan Update to:

- **Recognize the Impact that Urbanization has on the Components of the Hydrologic Cycle in our Watersheds**

- **To specifically address impacts of Urbanization Related to Flooding and Erosion**

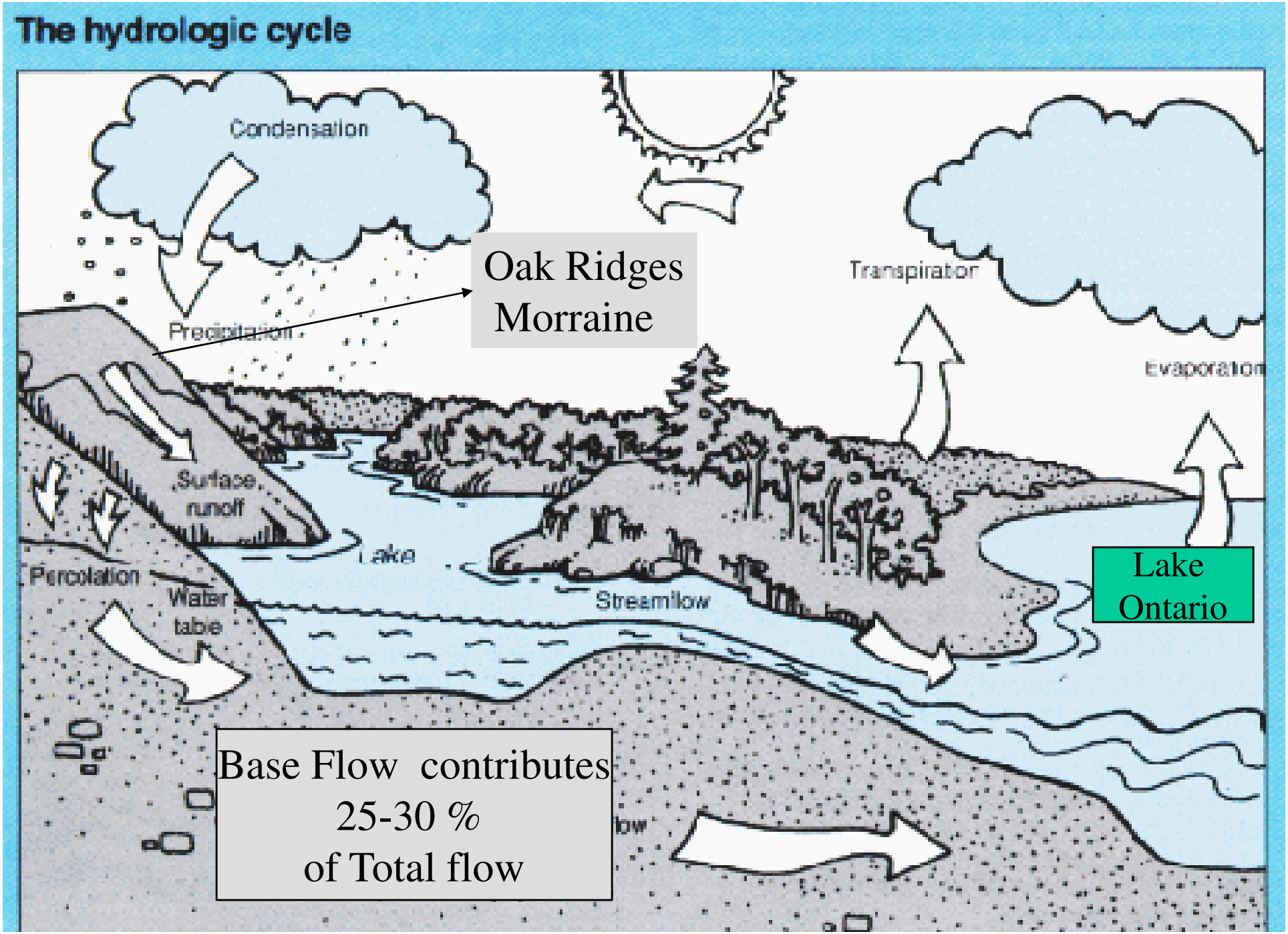
STORM WATER MANAGEMENT

Since 1980, the Program has evolved to:

- **Include Water Quality and Temperature impacts**
- **Source Controls and Infiltration to mimic the Natural Hydrologic Cycle**
- **Undertake retrofits of facilities which do not Meet current design standards**

Richmond Hill Oak Ridges

Richmond Hill Bathurst/Mill Street


The hydrologic cycle
Condensation
Oak Ridges
Morraine
Transpiration
Precipitation
Evaporation
Surface
runoff
Lake
Percolation
Water
table
Streamflow
Lake
Ontario
Base Flow contributes
25-30 %
of Total flow


Lower Humber Ice Jamming 1994

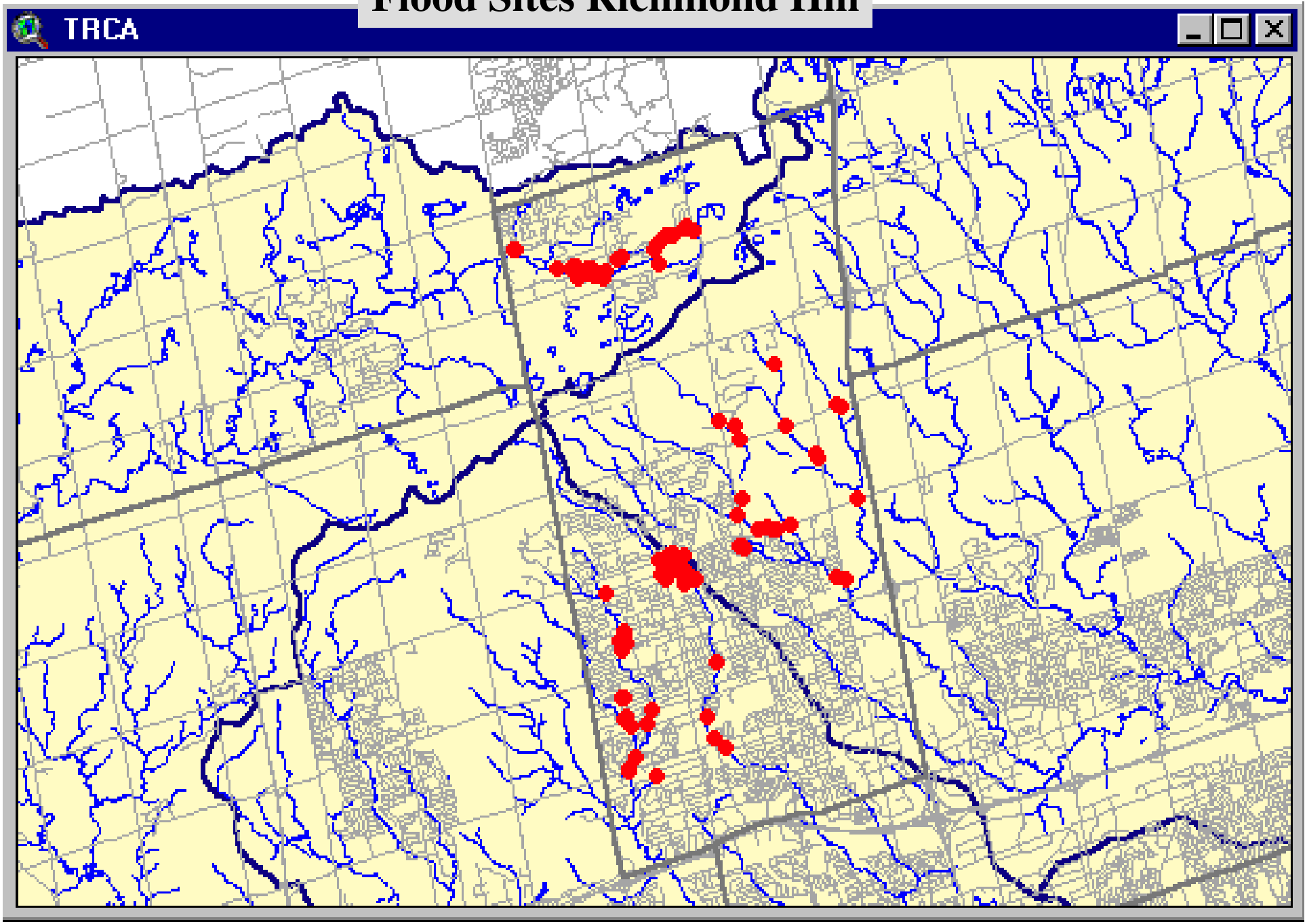

Lower Don River May 13, 2000

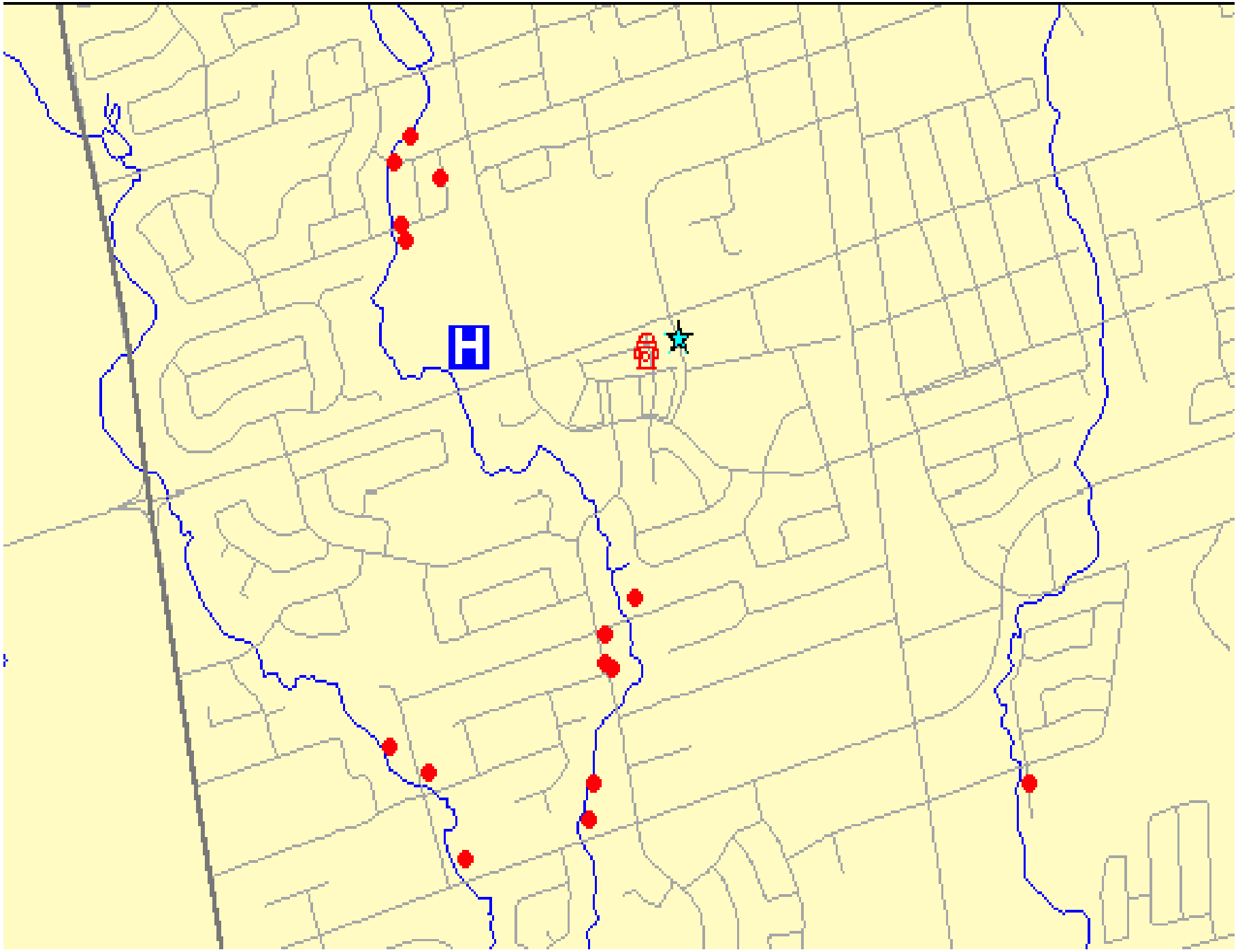
FLOOD WARNING SYSTEM

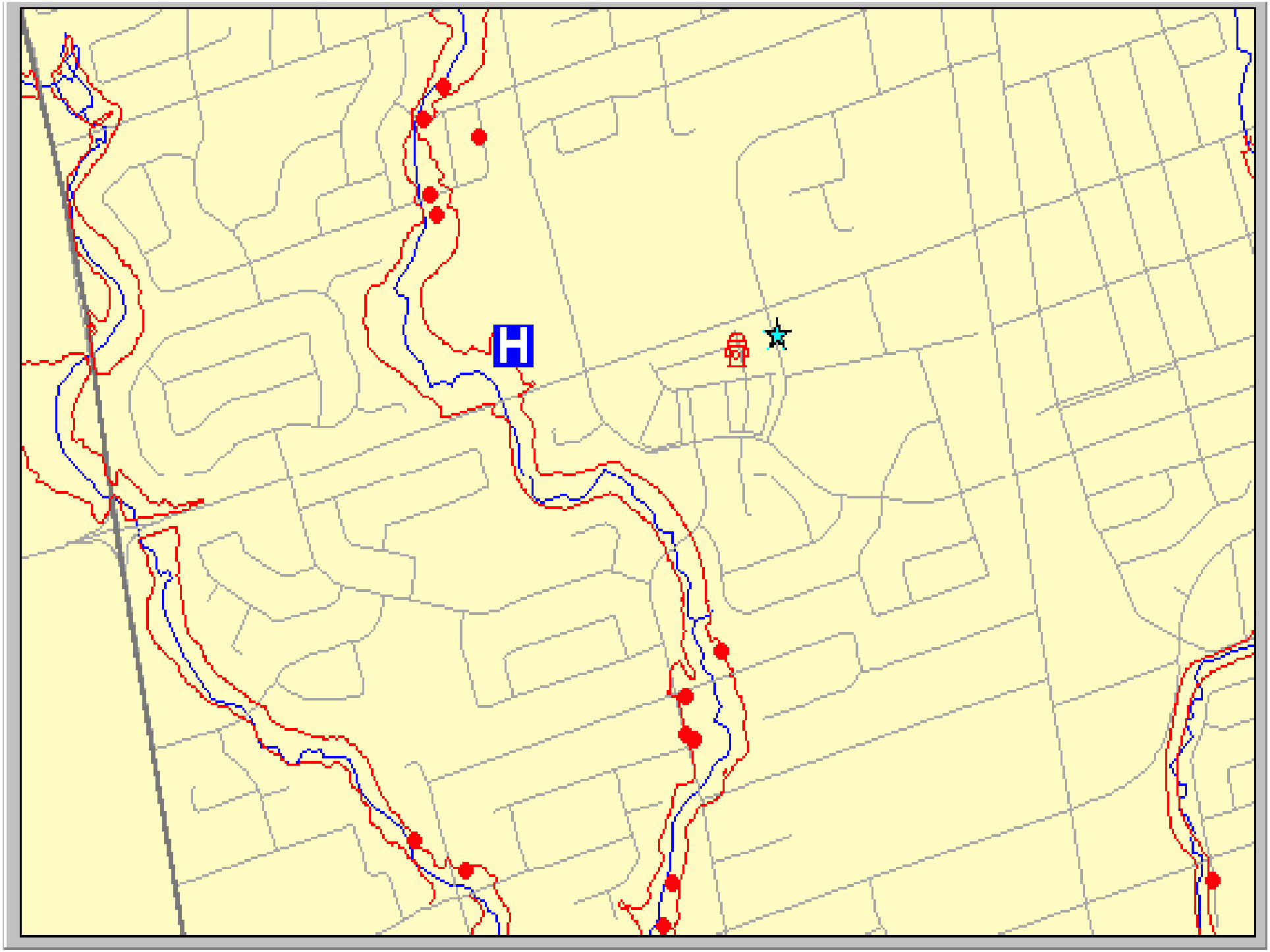
- **Monitor Watershed Conditions**
  - **Snow**
  - **Precipitation**
  - **Flow**
- **Issue Flood Messages to Municipalities When Conditions Warrant**
- **Operate Flood Control Facilities**

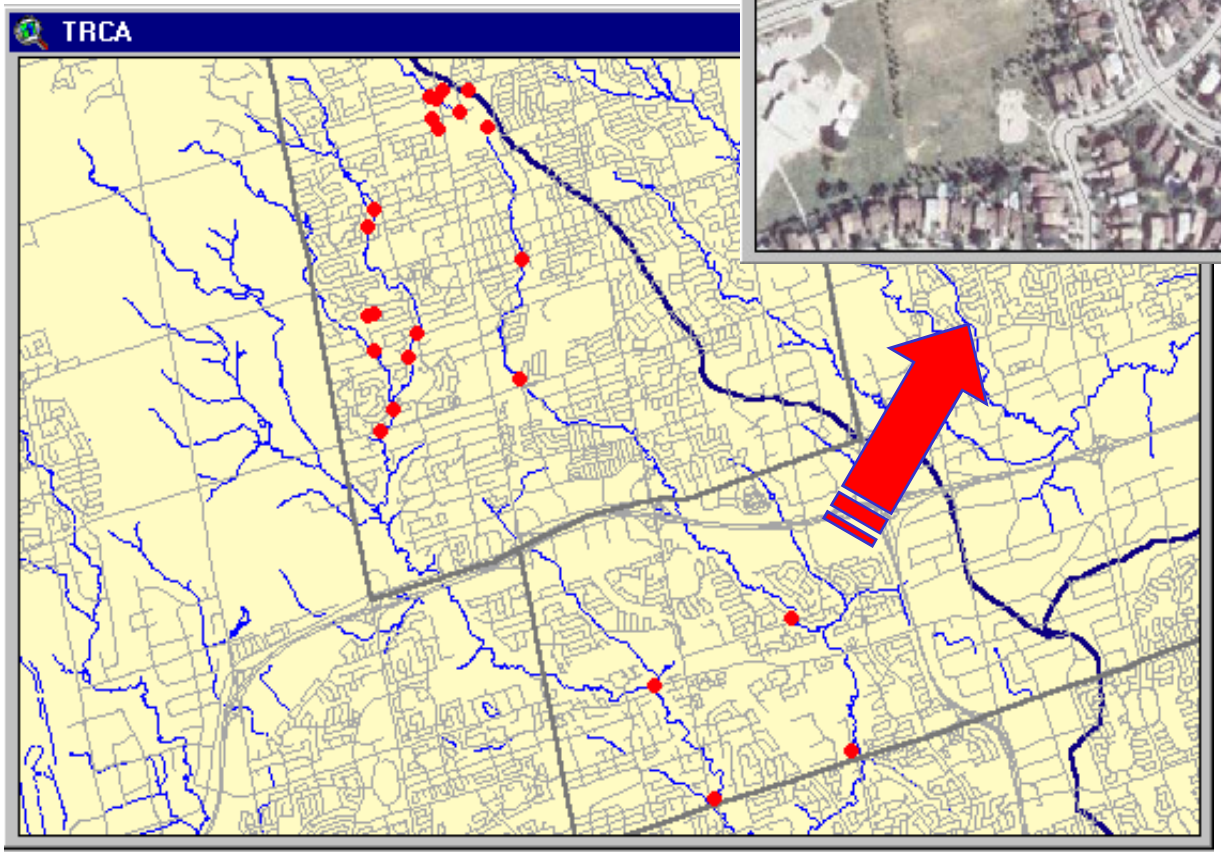

Welcome to the
Toronto and Region Conservation Authority
Flood Warning Database
HUMBER RIVER
Bloor Street Bridge
(1954)
F11
to Begin

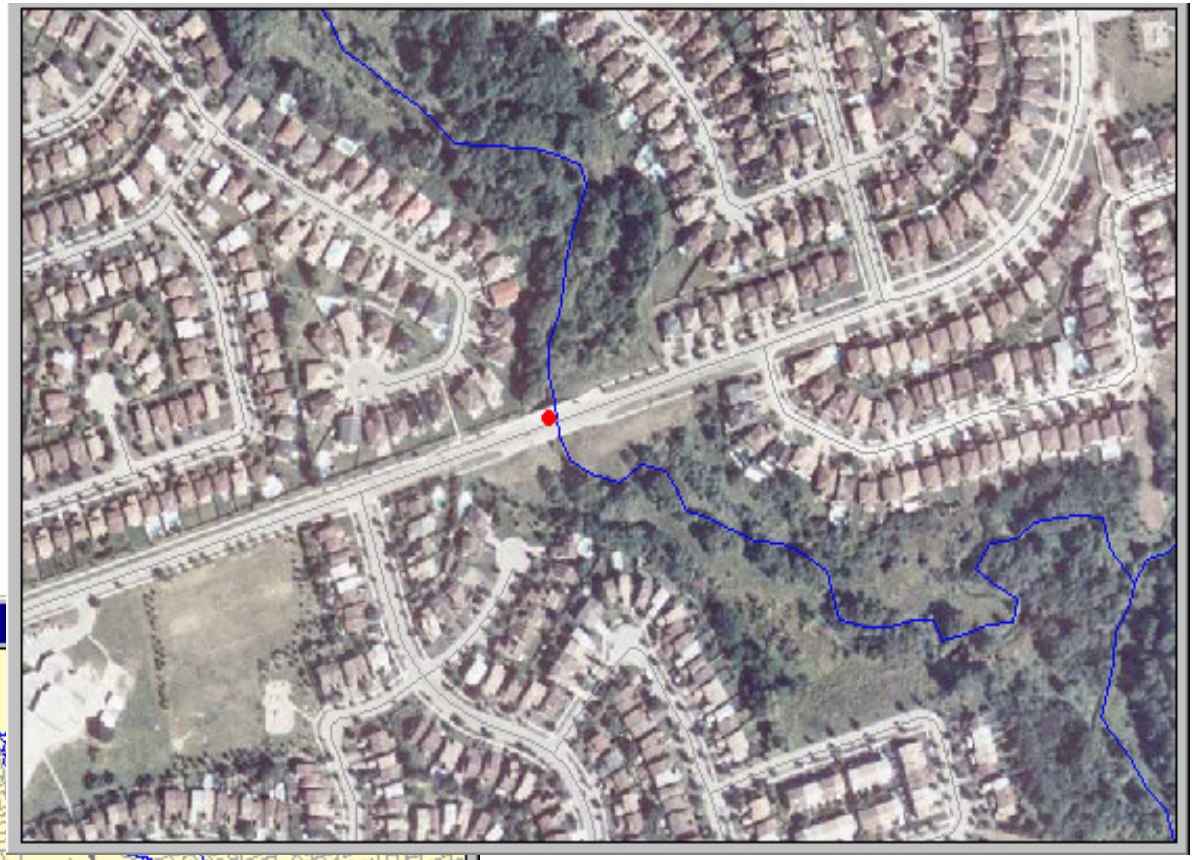
Flood Sites Richmond Hill

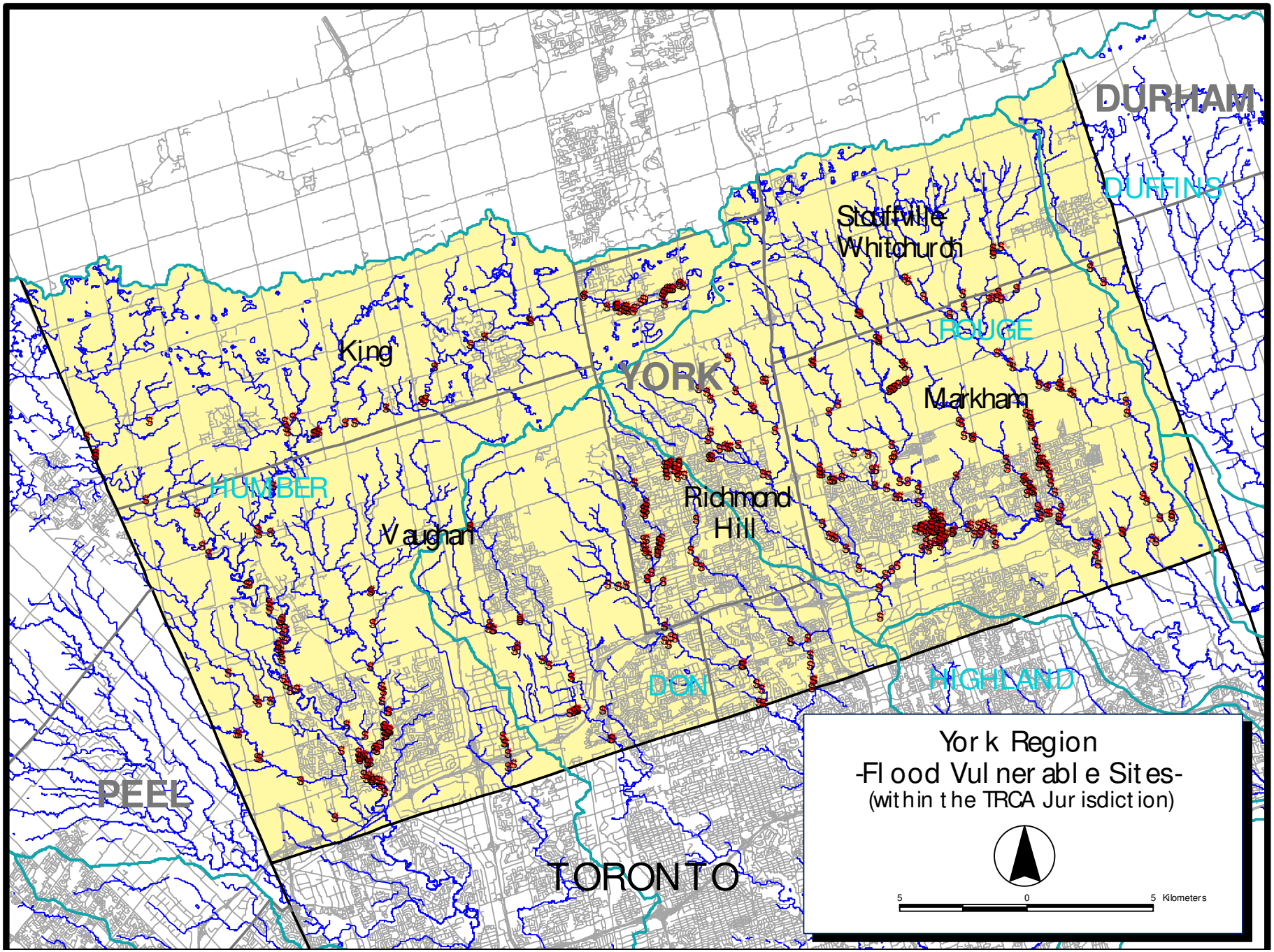


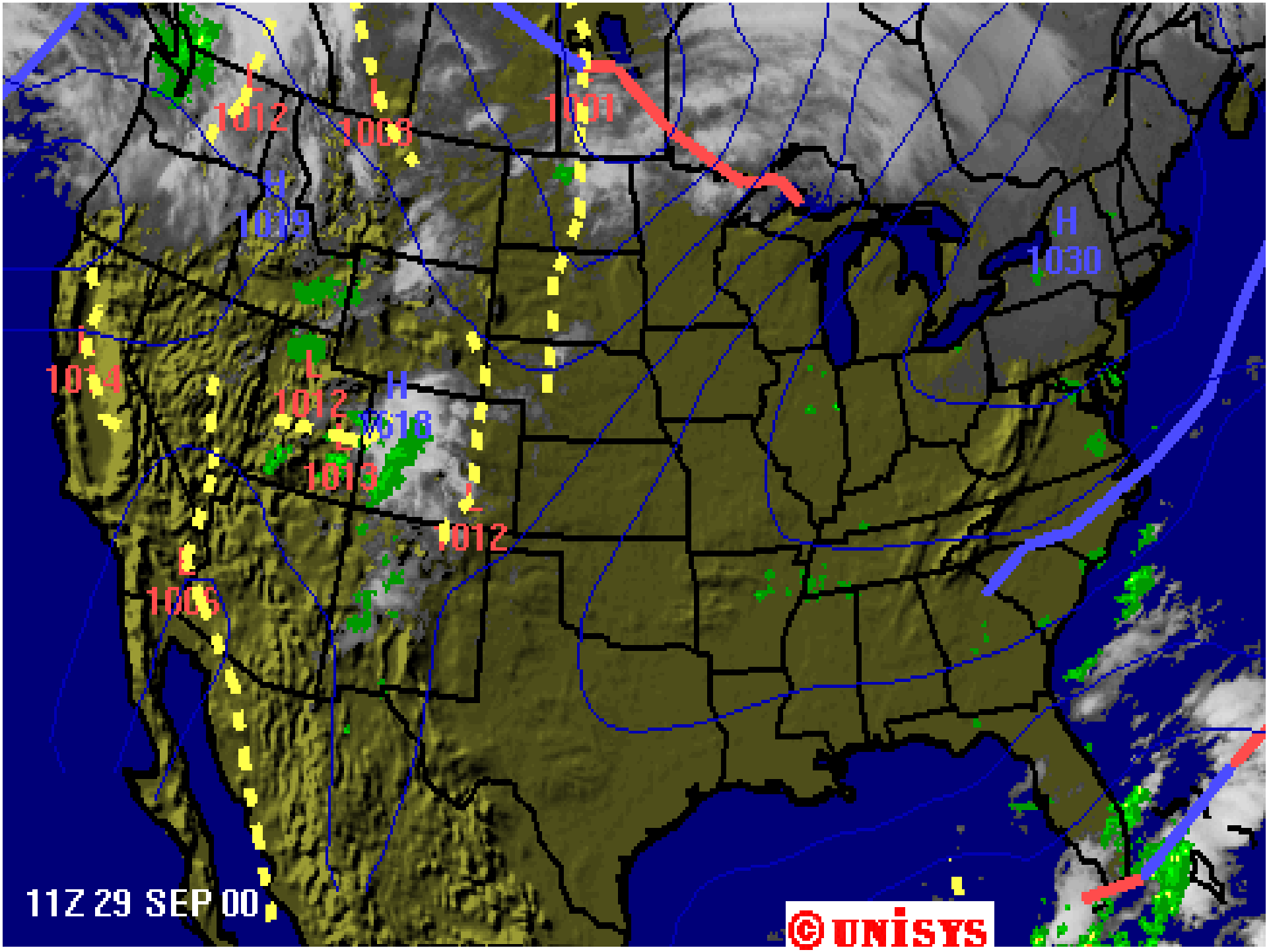





TRCA




DURHAM
DUFFINS
Stouffville
Whitchurch
ROUGE
King
YORK
Markham
HUMBER
Richmond
Hill
Vaughan
DON
HIGHLAND
PEEL
TORONTO
York Region
-Flood Vulnerable Sites-
(within the TRCA Jurisdiction)
5
0
5 Kilometers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