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UTRCA Flood Control System and Watershed Management

for
Water and Disasters Workshop
Dec 13, 14, 2004
London, Ontario, Canada

" Reducing the risk to life and property from flooding"

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Hydrologist

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Resources Engineer

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Outline

- History of the UTRCA
- Historic flooding on the Thames River
- Contemporary flood control
  - Flood forecasting and Warning
  - Structural flood control
  - Flood hazard avoidance
- Programs and Services

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- Settlement of Southern Ontario - mid 1800's
- Late 1800's - reports of extreme drought and extreme flooding
- 1883 Flood
- Extended periods of drought in the 1920's and 1930's
- 1937 Thames River Flood

Conservation Authorities: History

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Conservation Authorities: History

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Conservation Authorities: History

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Conservation Authorities Act - 1946
Section 20 -C.A. Mandate

"To establish and undertake a program designed to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals"

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Founding Principles:

- Watershed based management unit
- Local initiative
- Shared costs

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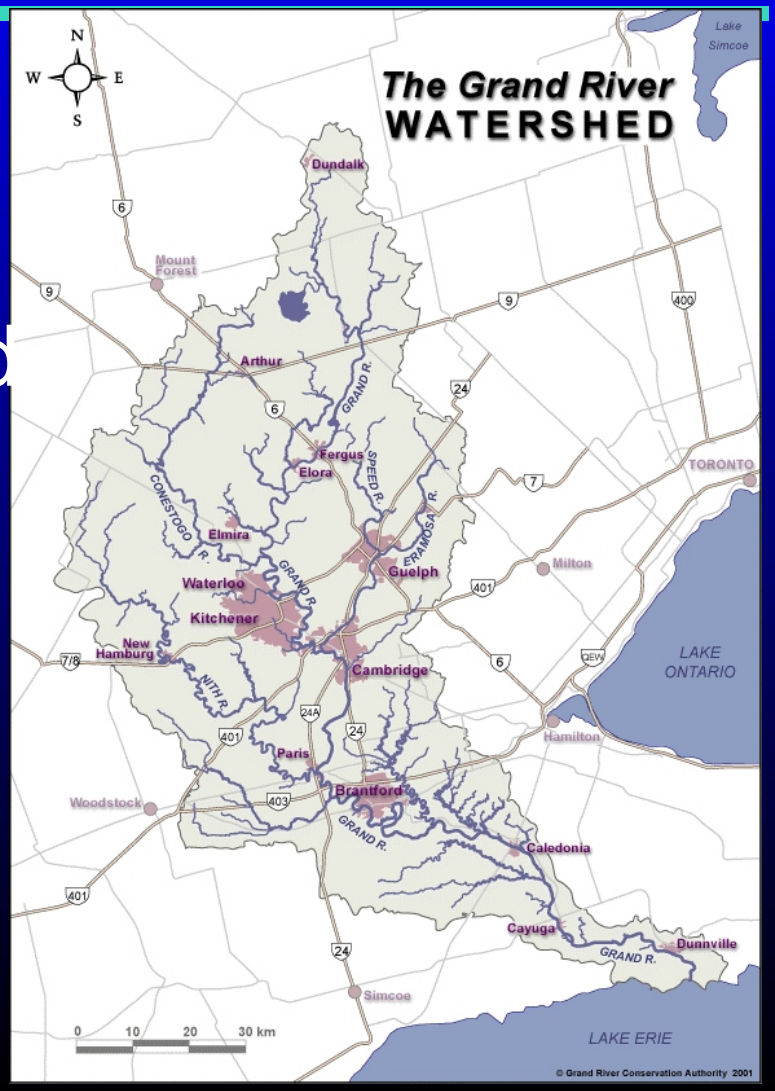
Principle 1: Watershed Based

A Watershed

All of the land that is drained by a watercourse and its tributaries



CA Founding Principles

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Principle 2: Shared Costs

- 50/50 split between the Province and the watershed municipalities
- Contribution from municipalities is levied
- General levy is based on discounted equalized assessment and is proportional to area in the watershed
- Projects that provide a special benefit for any particular municipal are funded out of special levy

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Principle 3: Local Initiative

- Municipalities must collectively decide to form an Authority
- Municipalities have representation on a Board of Directors that guides the Authority Program

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Provincial legislation (1946) allowed municipalities to form CA's on a watershed basis if they desired to manage natural resources

Conservation Authorities of Ontario

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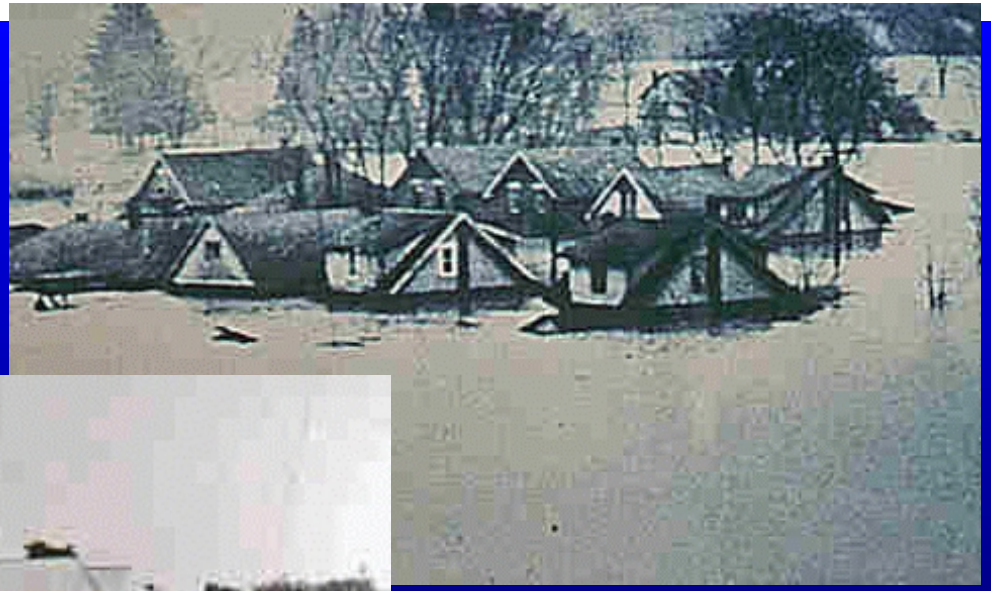
Flooding in 1937 and 1947 were driving forces behind the formation of the UTRCA

The effects of the 1937 flood were quite devastating in the Coves and West London areas.



Historic Flooding

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The flood of 1937 caused extensive damage in the downtown area of St. Marys.

The dam in Stratford was damaged by the flood.

Historic Flooding

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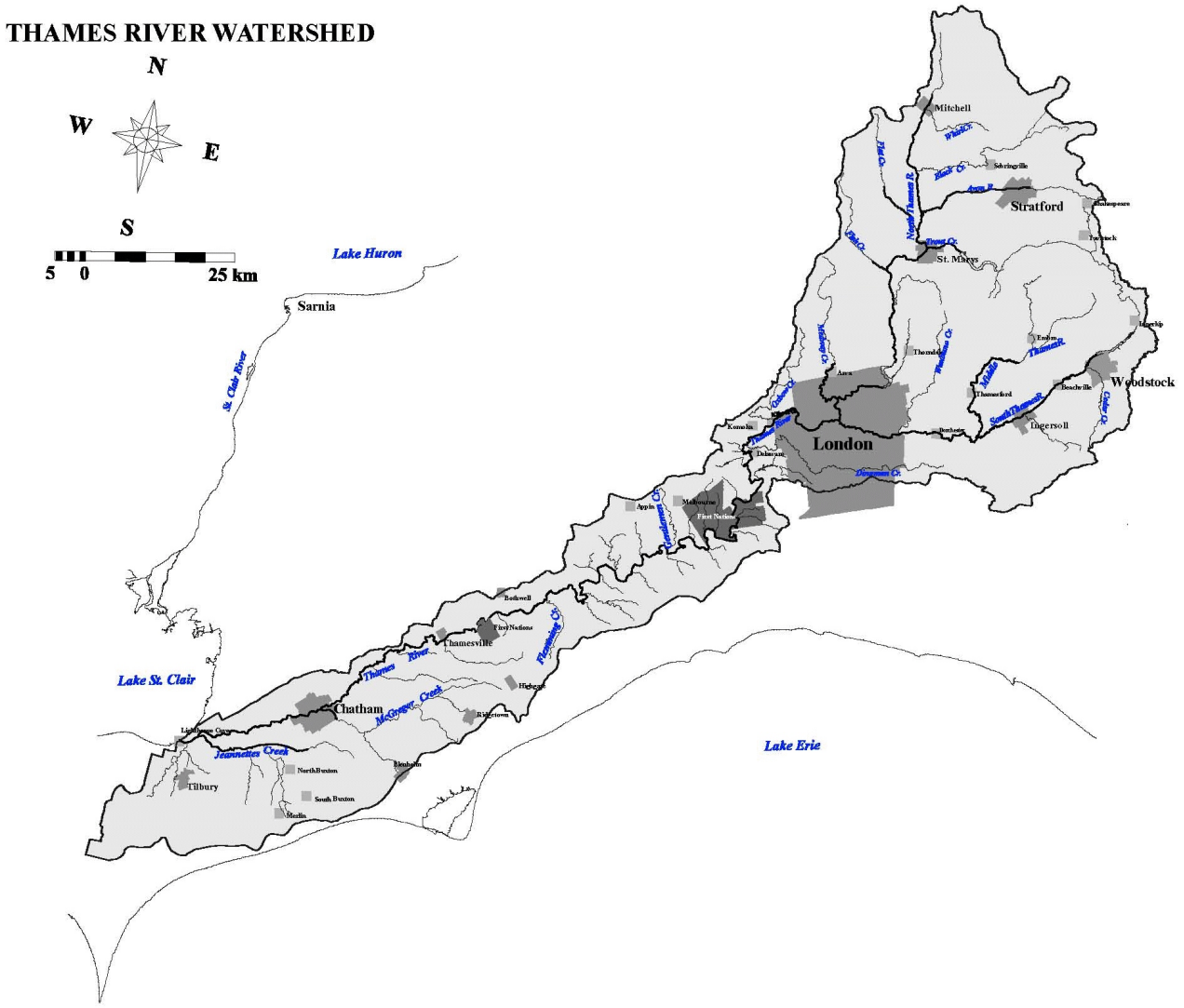
Thames River Watershed



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The UTRCA was formed in 1947 in response to local concern about soil loss, water quality and flood control management

Southwestern Ontario CA Boundaries

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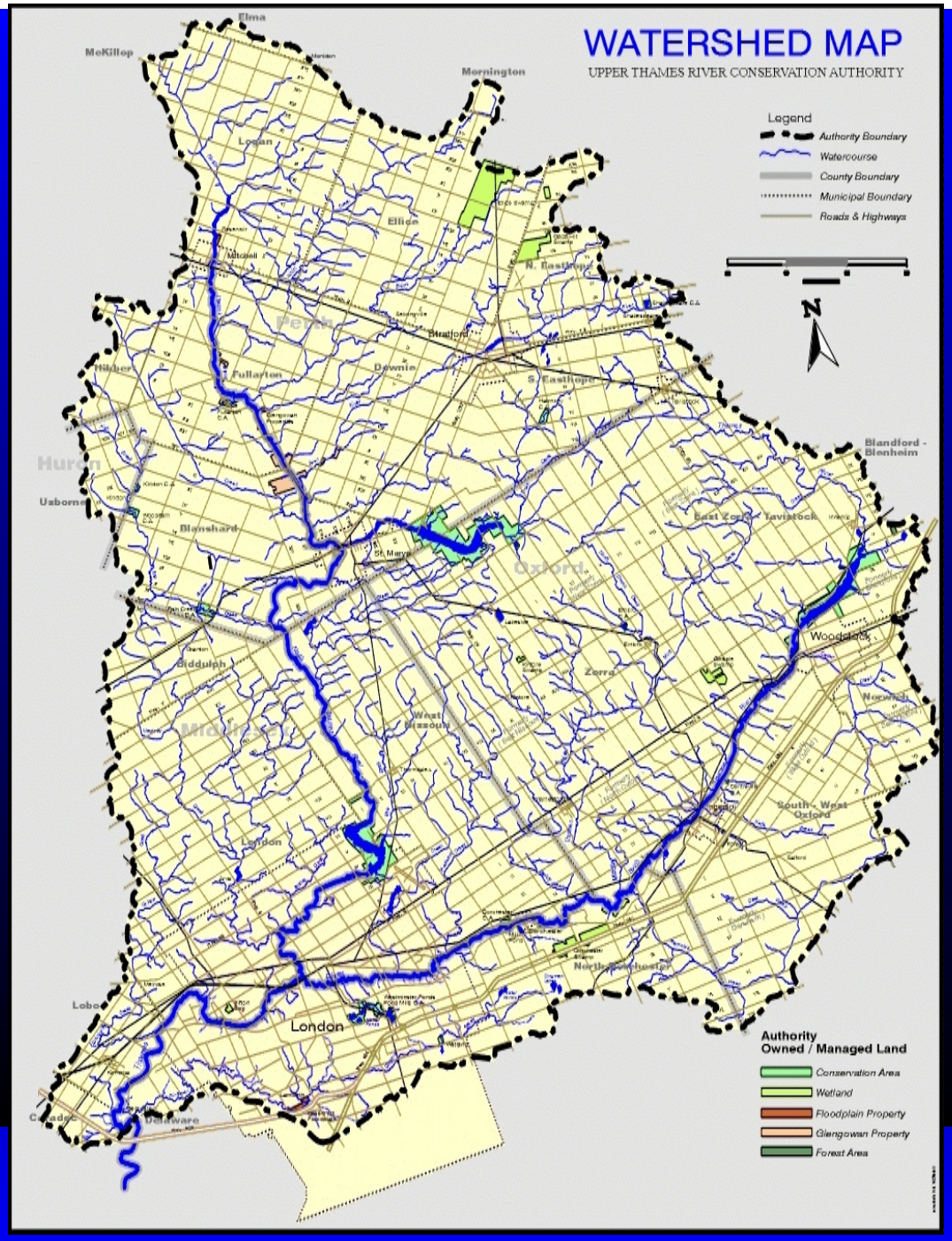
Upper Thames Watershed

- 3400 sq km
- Perth, Oxford, Huron and Middlesex Counties
- London Stratford and St Marys
- 400,000 residents
- Lower Thames starts at approx. Delaware
- Thames enters Lake St Clair at Lighthouse Cove



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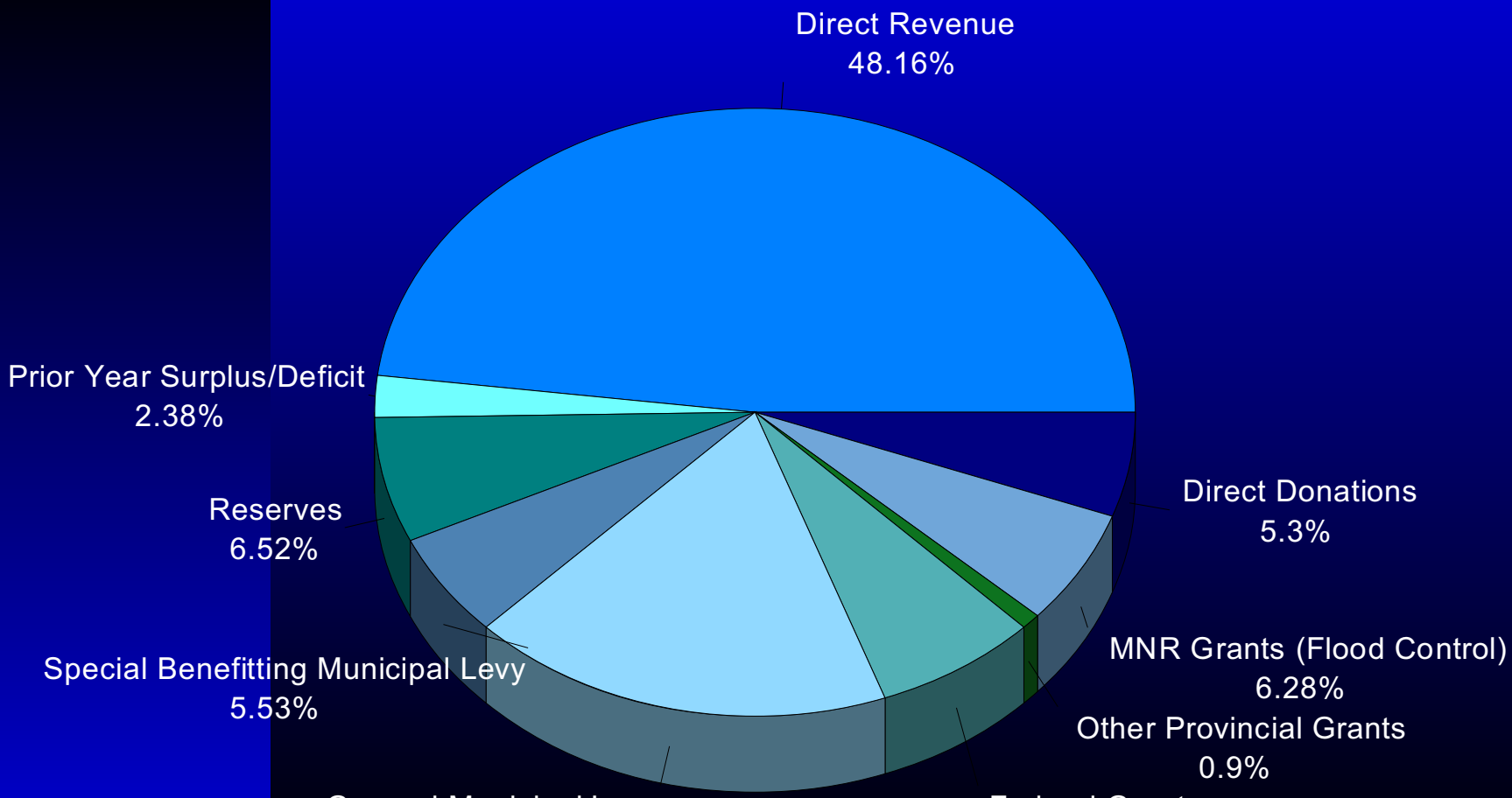
Cost Sharing: 1999 UTRCA Revenue



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Flood History

- Watershed Flood Records date back to 1793, significant flood in 1883 (’52 Report).
- Significant watershed floods in 1937 and 1947, thought to be a modern phenomena resulting from settlement.
- Streamflow Records beginning with daily records1915 (Thames River South Branch), hourly records and telephone recordings started in 1950's.
- Provincial and Regional Events: Hazel 1954, Port Hope 1980, Harrow 1989.
- Watershed Events (post dams): 1963, 1968,1975,1977, 1982, 2000.
- Major Flood Damage Centres: London, St Marys, Ingersoll, Woodstock, Stratford, Mitchell
- Estimate of Average Annual Damages (AAD) due to Flooding = $700,000 (1996$)
- Estimate of AAD with structures (dams, dykes) and warning = $400,000

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Low lying areas near the confluence of the North Thames River and the Trout Creek were flooded.

Note the hydraulic jump formed by the River through the Queen Street bridge in St Marys.

1977 Flooding - St. Mary's

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In London, park areas such as Gibbons Park were flooded, and the forks of the thames were filled to near capacity

The 1977 event was considered to be a 1:25 year return event. Without flood control reservoirs the event is estimated to have been approximately a 1:40 year event.

1977 Flooding - North Thames River in London

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The summer of 2000 was asummer of several floods events, the most serious for the Thames river being July 9. An average of about 95 mm of rain fell on the Upper Watershed, flooding agricultural land, roads, parkland and two trailer parks

July 2000 Flooding

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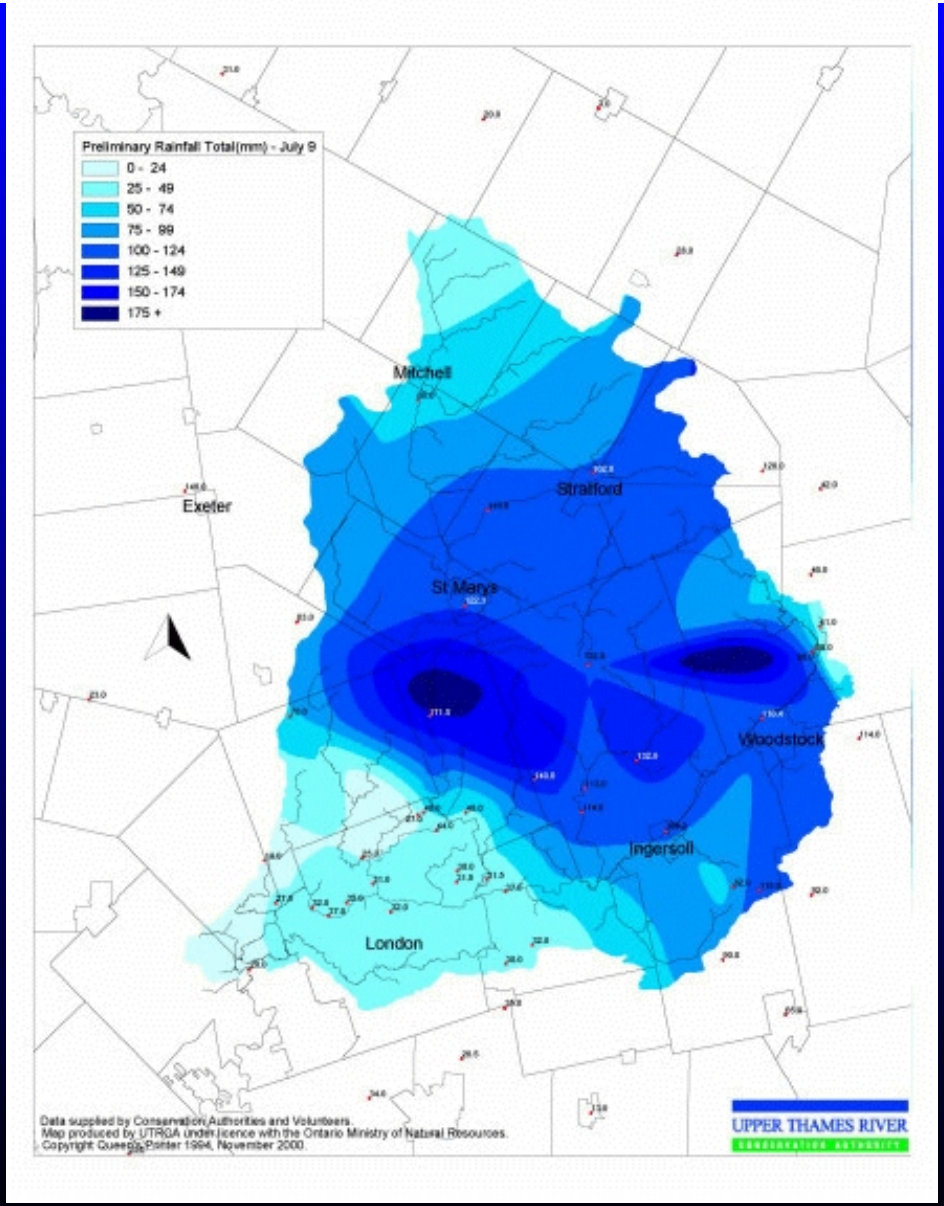
Rain totals of greater than 175 mm were recorded near Thorndale, and north of Woodstock.

Rain totals in London were relatively low, between 25 and 50 mm.



July 9, 2000 Rain Totals

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July 2000 Flooding - Reservoir Operations

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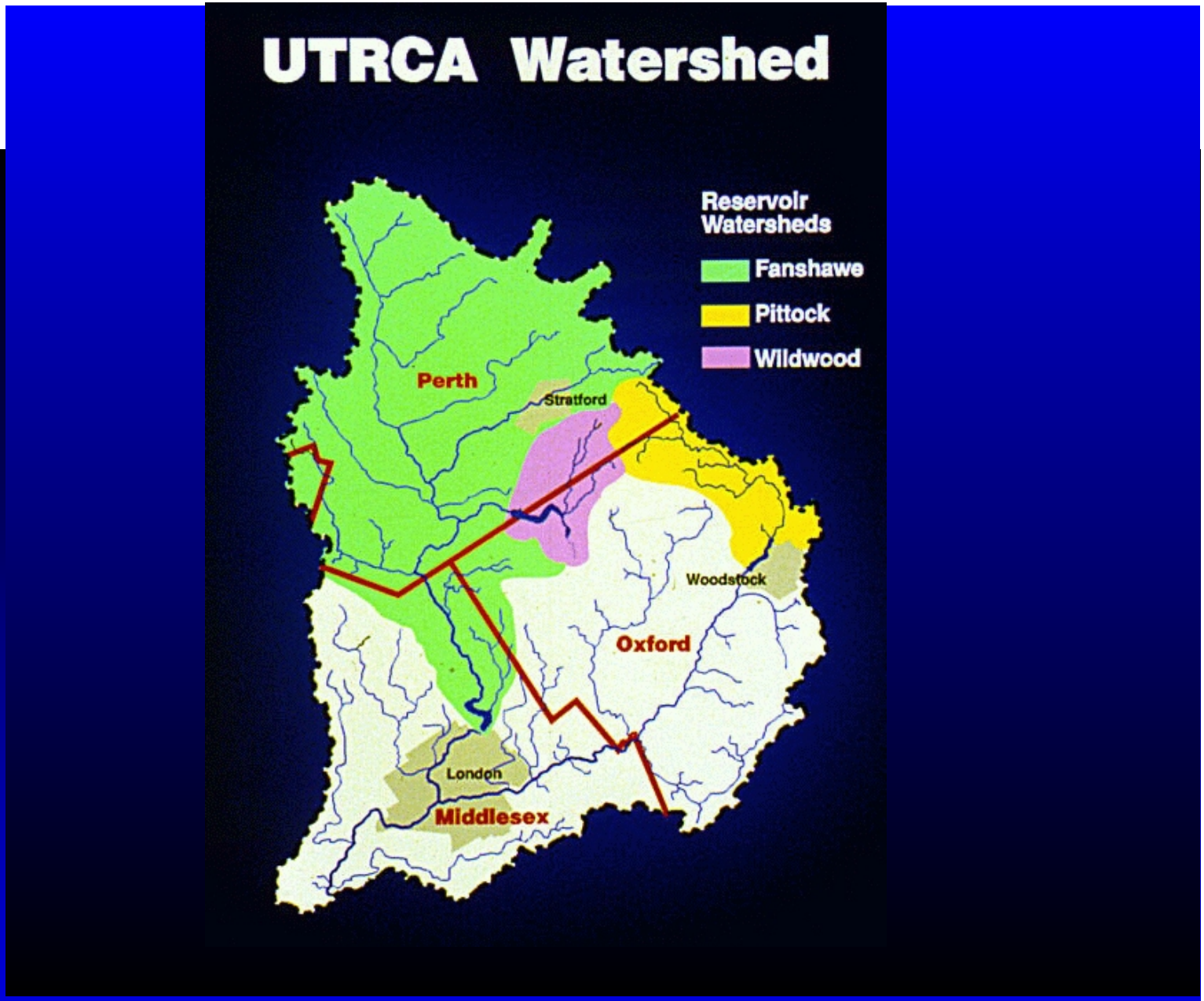

Reservoir Watersheds

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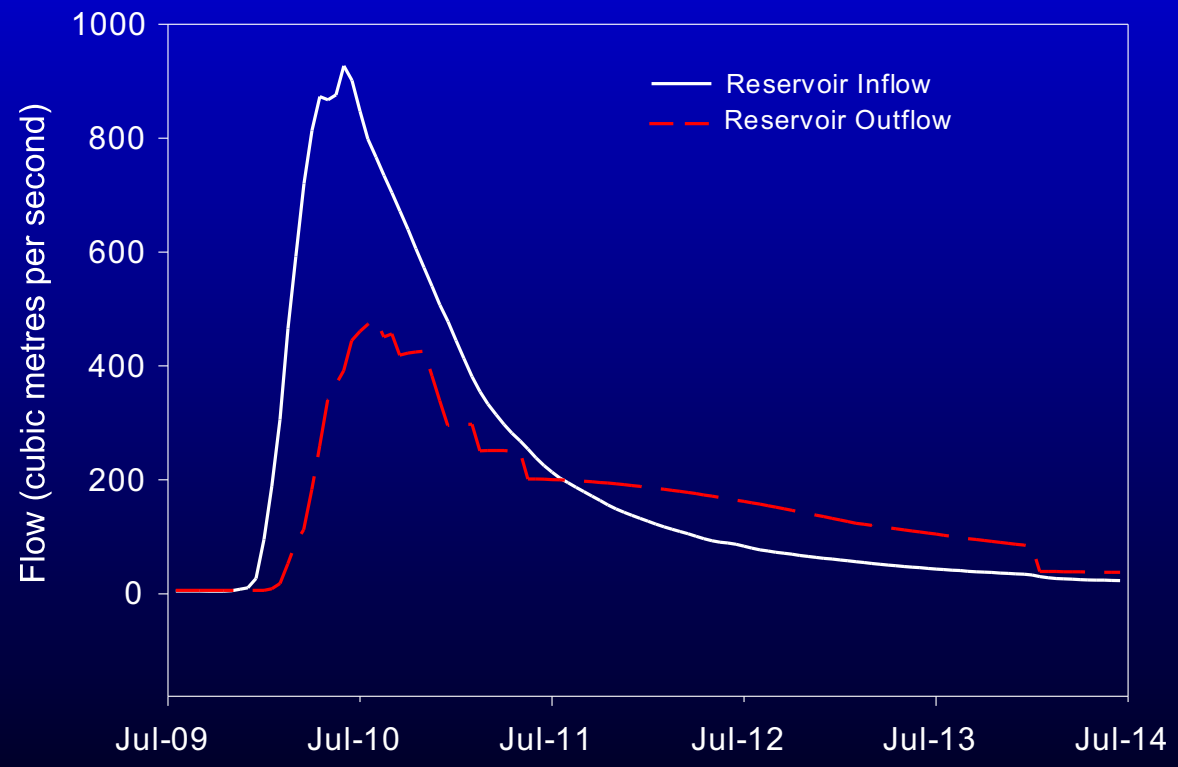
Inflows to Fanshawe Reserior were the highest on record, near the 1:250 year return period.



Fanshawe Reservoir Hydrographs

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Contemporary Flood Control Program

- Flood Forecasting
- Flood Warning
- Structural Flood Control
  - Operation & maintenance of existing structures
- Hazard Avoidance
  - Land Use Planning
  - Regulations on private property
  - Acquisition

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Flood Forecasting

- gauge network and snow courses
- data acquisition
  - stream flow
  - weather
- computerized modelling

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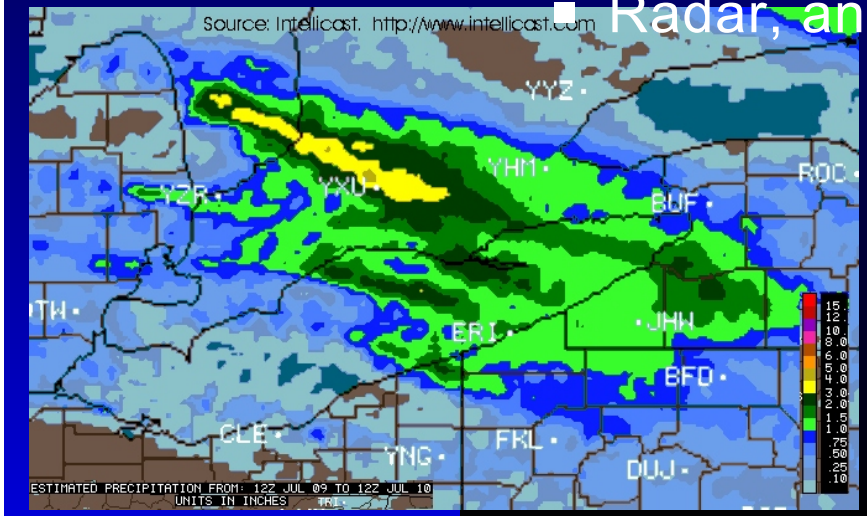
Watershed Monitoring

- 20 Real Time stream gauges (15 with rainfall) including 2 sites in Lower Thames
- 4 water level stations at dams (3 with rain)
- 4 stations include other climate and water quality
- Access to adjacent CA stations (rain, snow)
- 13 snow courses
- Radar, and Internet Weather services



Flood Forecasting & Warning

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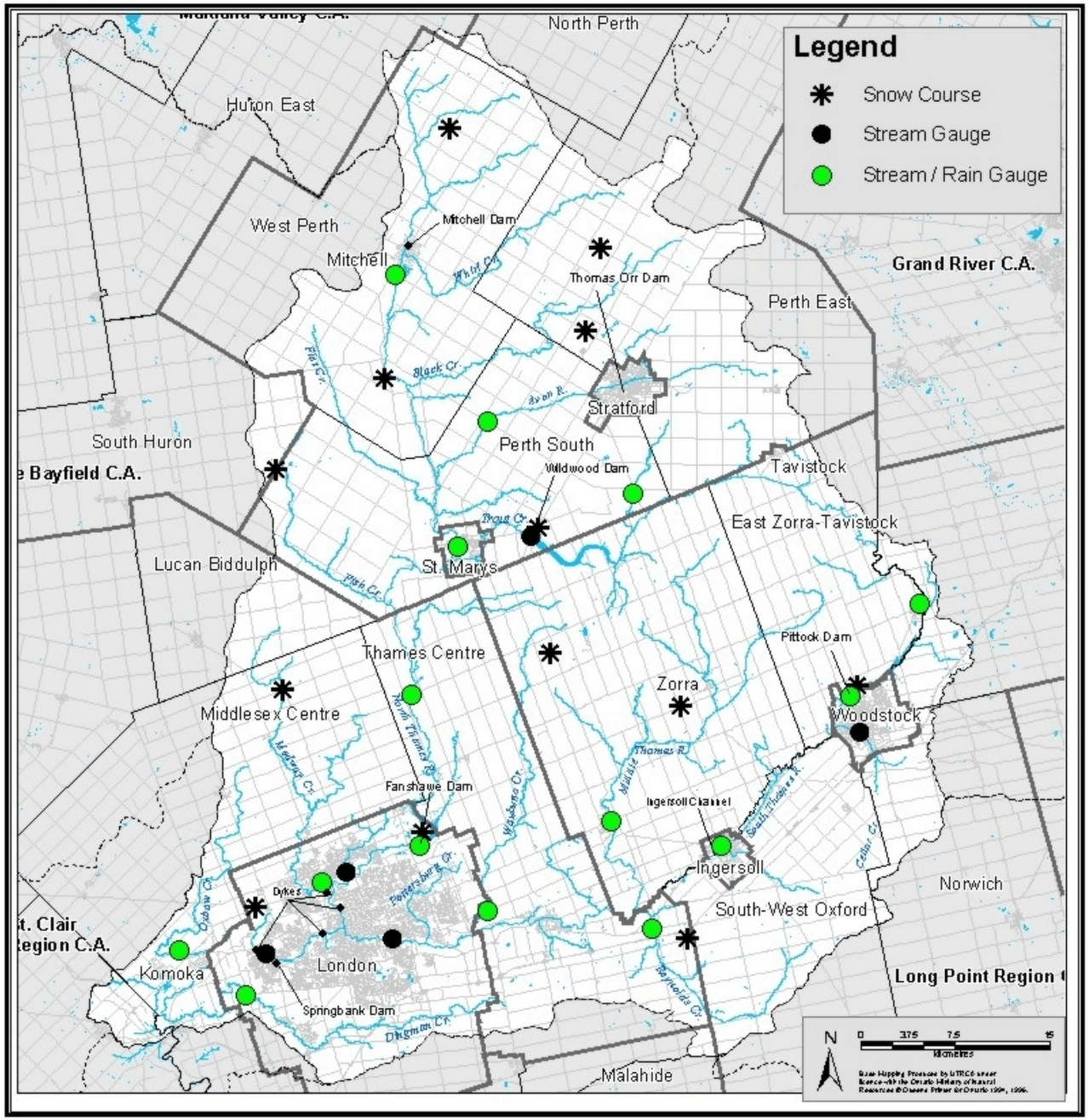
Gauges strategically located throughout the watershed collect data on stream flow, rainfall, temperature, and wind.

Snow courses are used to estimate the water content stored in the snow pack

Flood Control Monitoring Network



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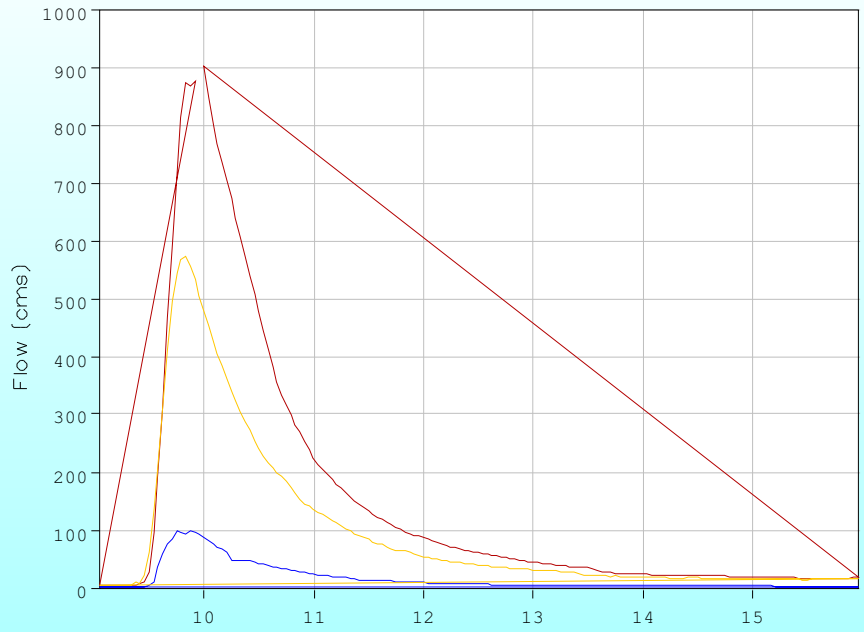
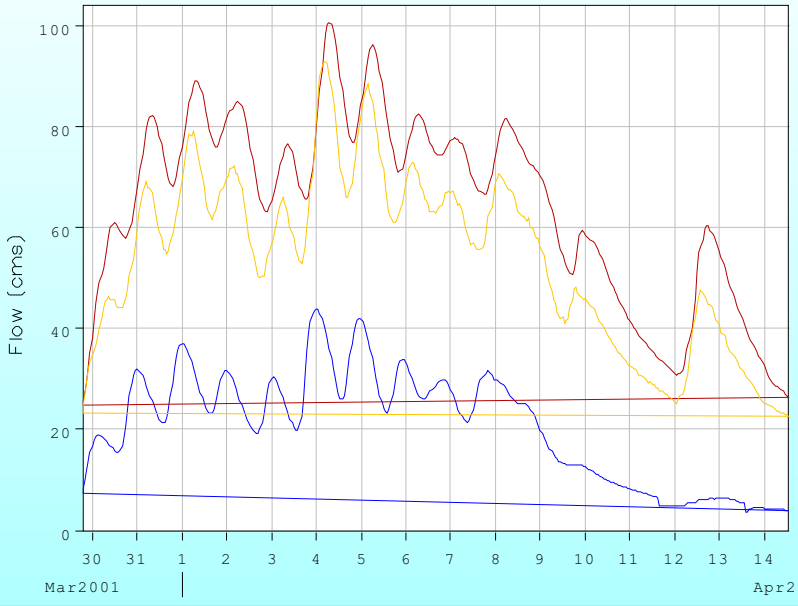
Watershed Streamflow Monitoring

July 09 - 15 2000 North Branch Flow



Spring 2001 North Branch Flow



Mitchell Plover Mills St. Marys

Flood Forecasting & Warning

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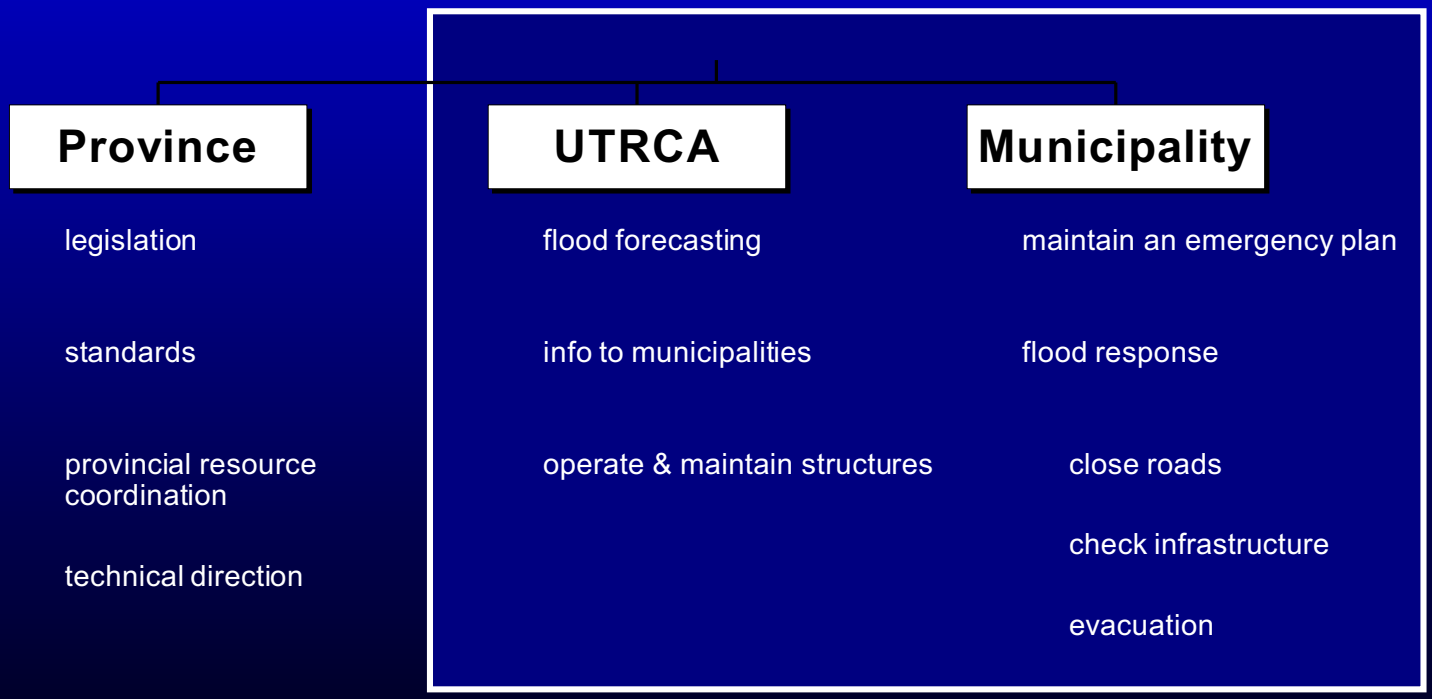
Flood Forecasting & Response Responsibilities



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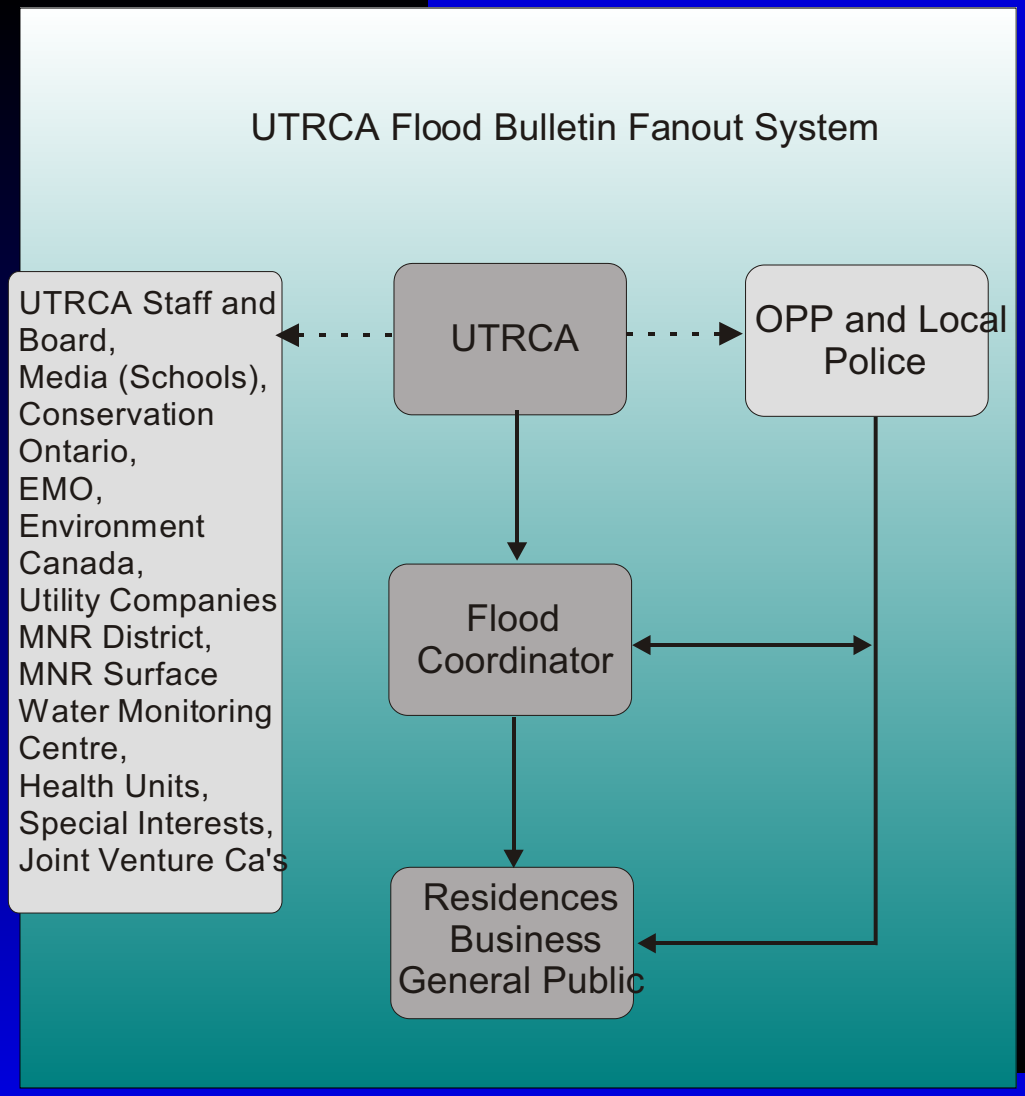
Flood Bulletins



Flood Monitoring/Safety Bulletins are dual purpose in nature, with Monitoring Bulletins used to report on general watershed conditions to flood coordinators, and Safety Bulletins to remind the general public of general river safety issues.

Flood Advisory Bulletins are issued when the potential for flooding exists in specific municipalities.

Flood Warning Bulletins are issued after a forecast has been made and apply to specific flood damage centres where serious flooding appears inevitable.

Flood Warning System

- - - - - - - Broken line indicates communications if required

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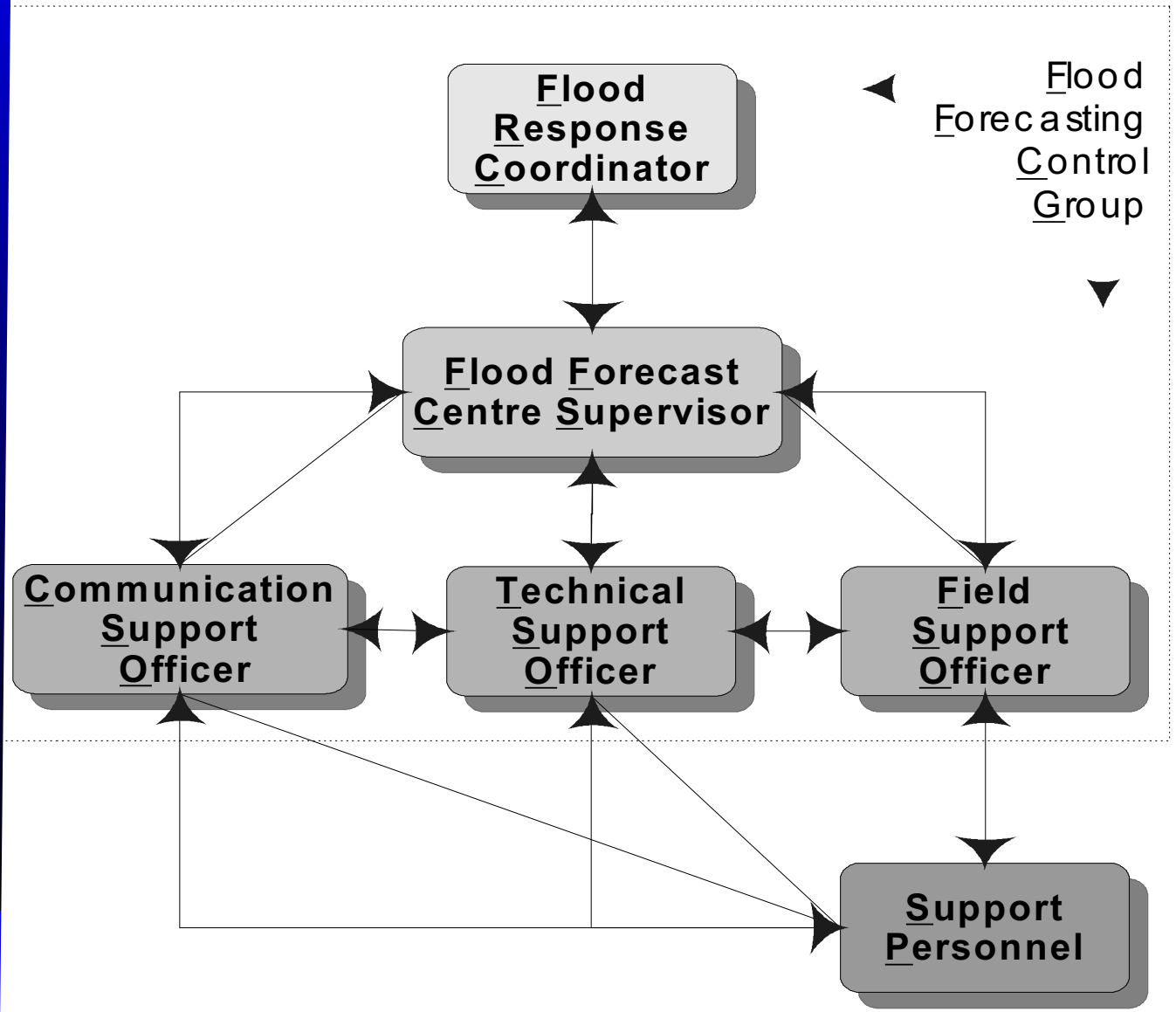
UTRCA Flood Response



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Structural Flood Control

- Dams and reservoirs
- Dykes and flood walls
- Flood control channels

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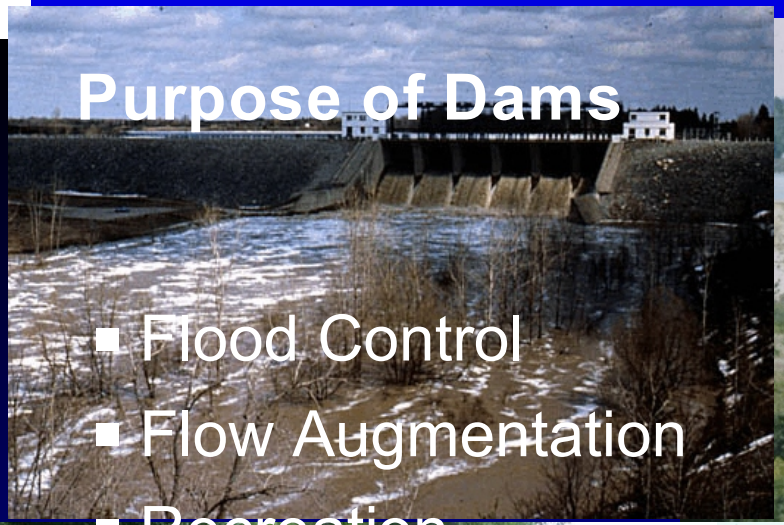
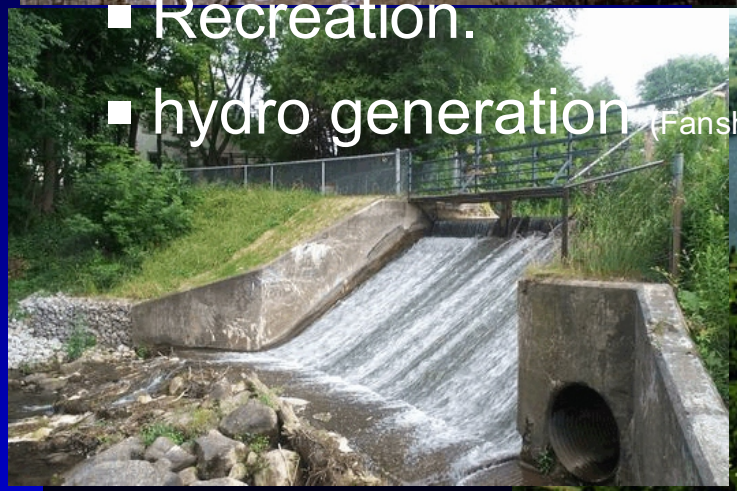
Purpose of Dams



- Flood Control
- Flow Augmentation
- Recreation.
- hydro generation



(Fanshawe Dam)

Water and Erosion Control Structures

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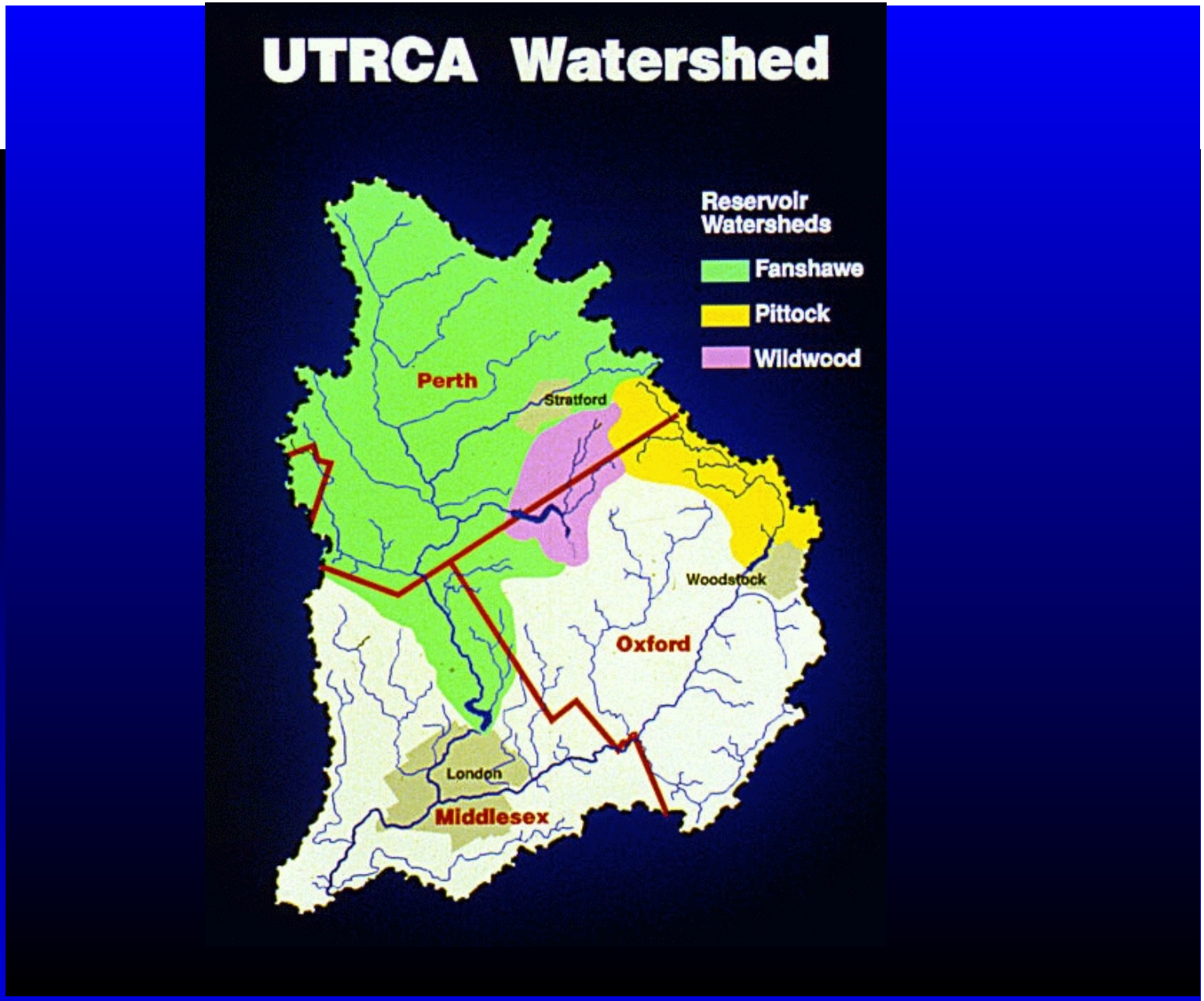

Reservoir Watersheds

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Wildwood Dam creates a flood control reservoir, near St.Marys.

Wildwood reservoir also supports various recreational uses as well as providing storage for flow augmentation over the summer and fall.

Flood Control Program

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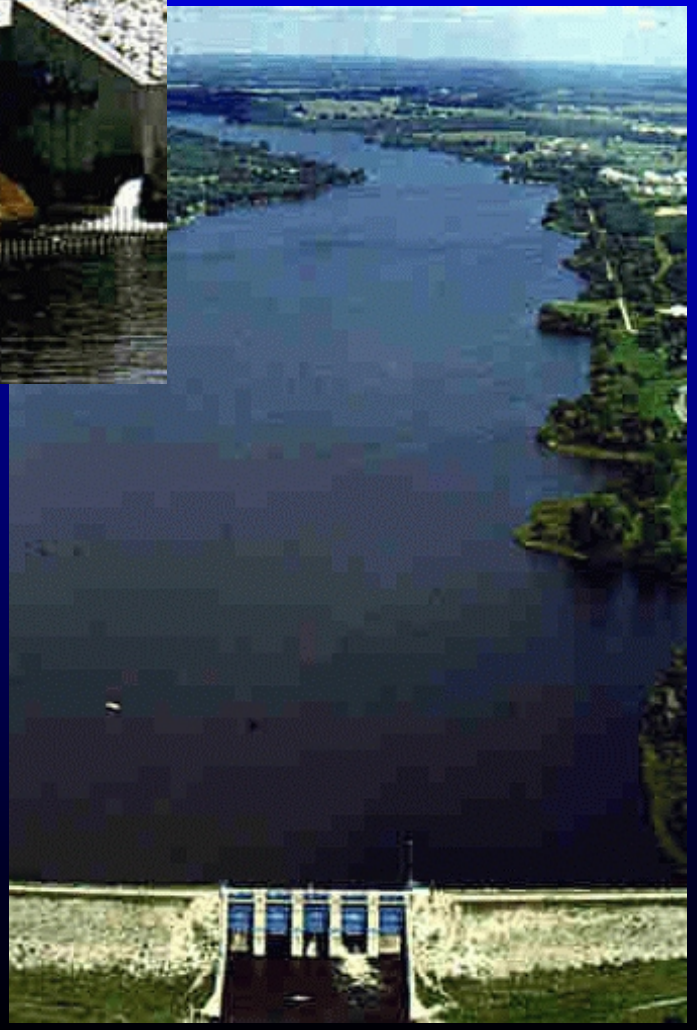
Pittock Dam and Reservoir in Woodstock is used to reduce the damages caused by flooding.

Pittock also supports many types of recreation as well as storage for flow augmentation.



Flood Control Program

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Fanshawe Dam and Reservoir in London plays an important role in our flood control program.

Fanshawe Reservoir is also used for many types of recreation as well as hydro production.

Fanshawe Dam

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The UTRCA also maintains and operates smaller dams such as RT Orr Dam in Stratford and Springbank Dam in London.

Springbank Dam is a seasonally operated structure. Logs are installed in May and removed in October.

Flood Control Program

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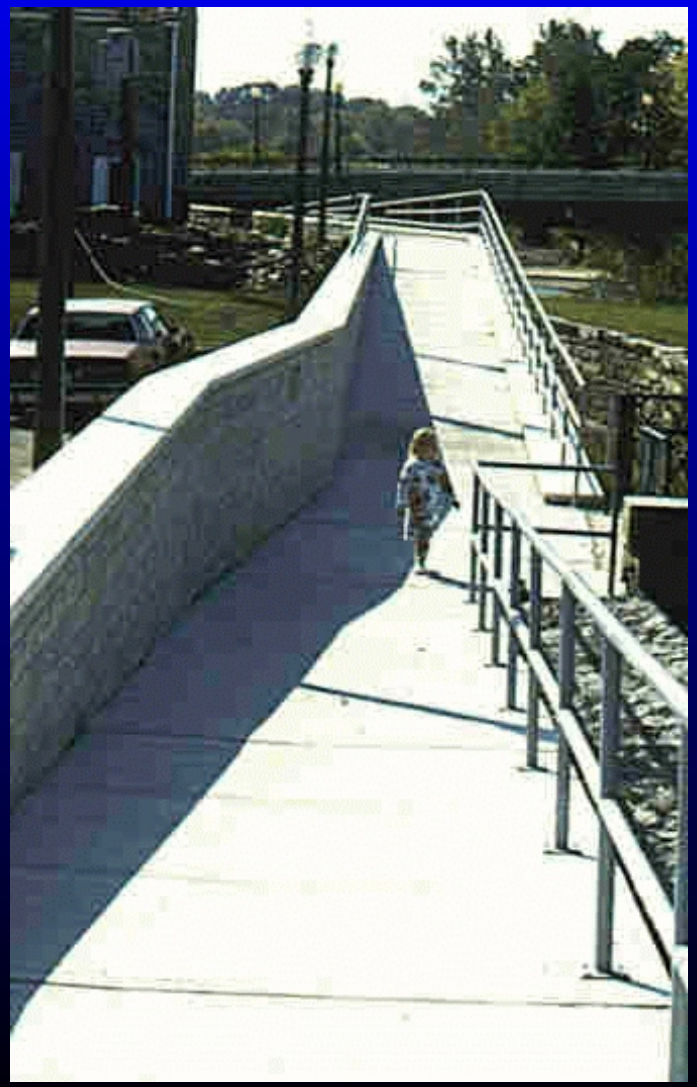
The West London Dykes and the St. Marys Flood wall provide some protection for existing development



Flood Control Program

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Control Structures

- West London Dykes
- Broughdale Dykes
- St Mary Flood wall
- Ingersoll Channel

Water and Erosion Control Infrastructure

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Ingersoll Channel provides flood protection for downtown Ingersoll.

The vegetation along the banks of this channel must be controlled to maintain the level of flood protection.

Flood Control Program

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Dam Maintenance

- Weekly inspection and maintenance (large dams)
- Monthly Inspections (small dams)
- Annual/Seasonal Maintenance
- Annual Inspections
- External Engineering Inspection (5yrs)
- Dam Safety Review (new) (10yrs)
- Routine Maintenance and overhauls
- Capital Maintenance

Water and Erosion Control Structures

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Dam Safety Program

- 3 year program reviewing all UTRCA dams (2 dams from ABCA)
- Reviews all aspects of the design, operation, maintenance of the dams including:
  - Stability of the structure
  - Hydraulic capacity of the structure
  - Consequences of the failure of the structure
  - Operation, Maintenance and Surveillance of the structure
  - Condition of the structure
- Includes developing structure specific emergency preparedness plans

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Hazard Avoidance

- Land Use Planning
- Regulation
- Acquisition

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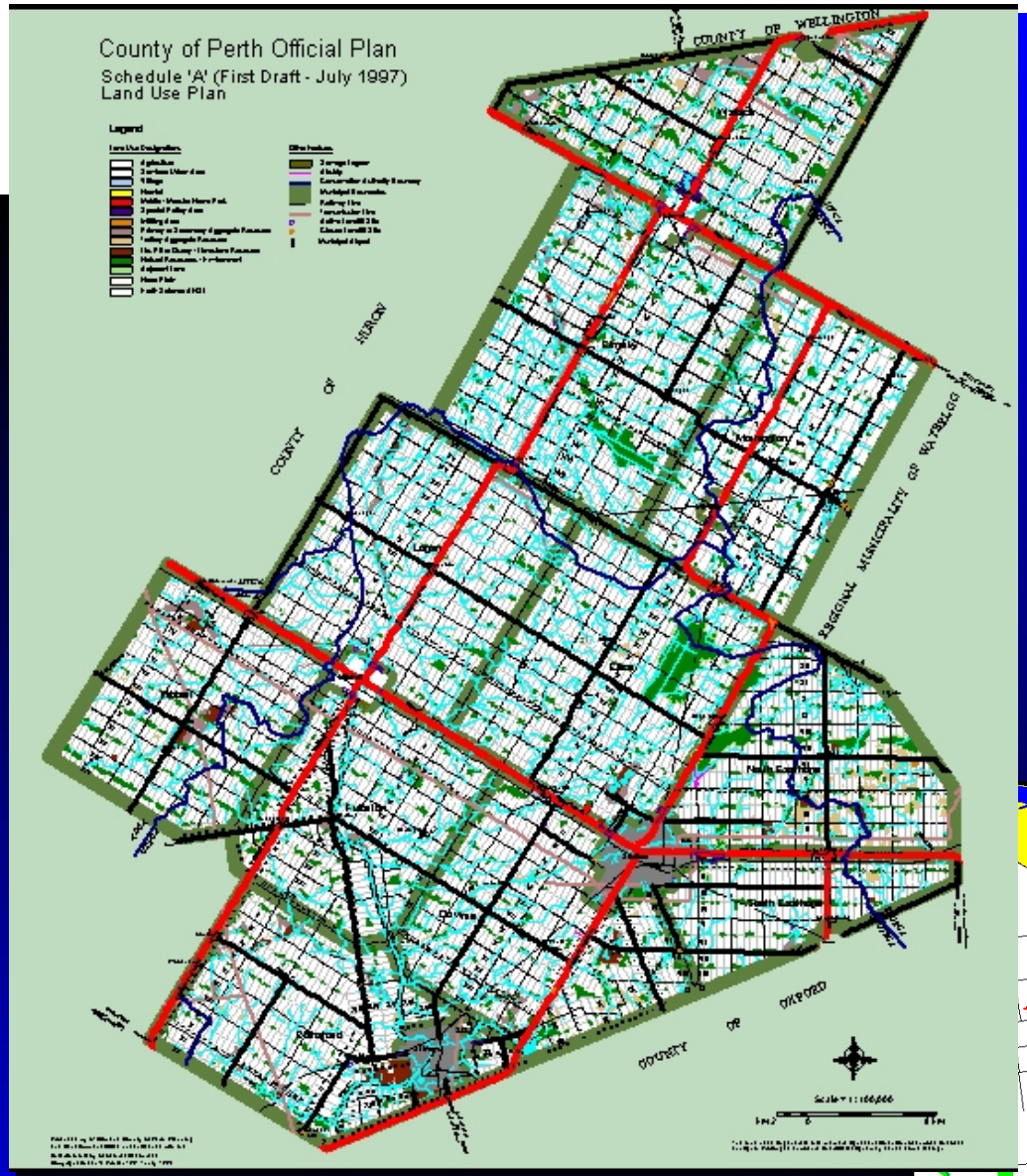
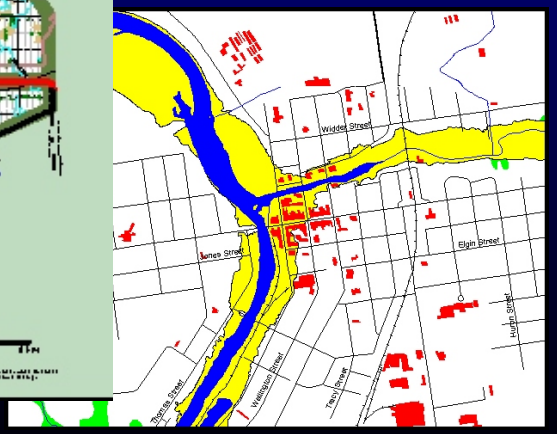
The input into municipal official plans is directed at removing people from the flooding hazard

GIS mapping is a tool to identify and restrict development in flood prone areas





Hazard Avoidance

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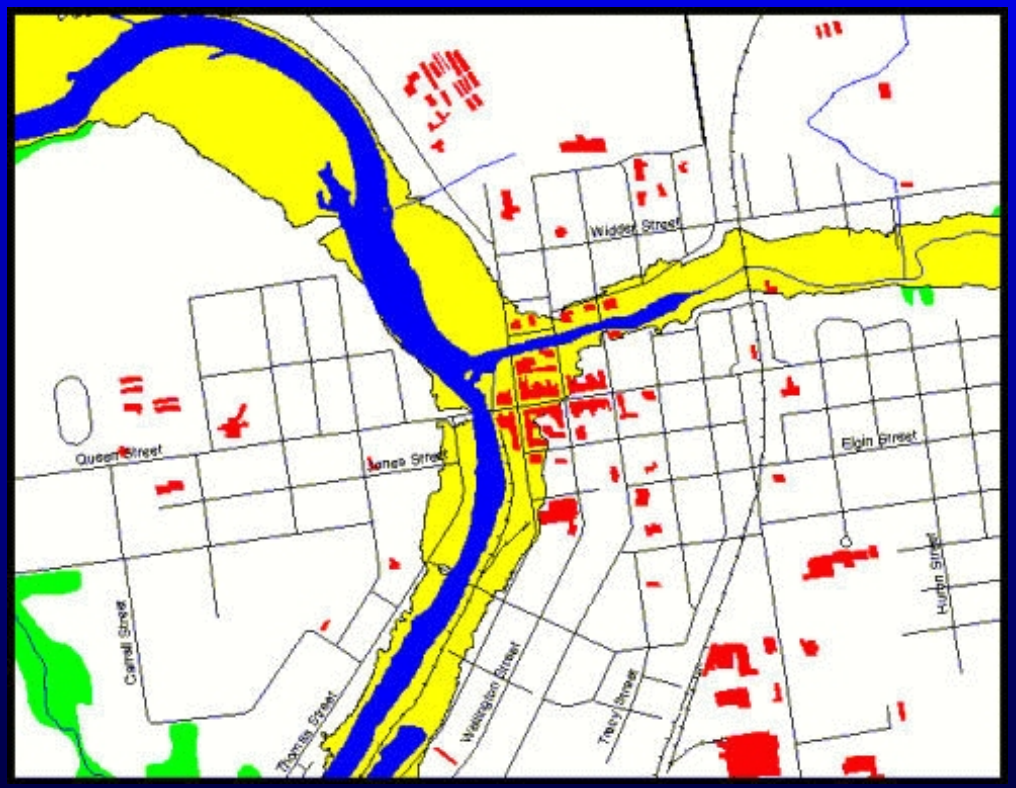
Flood levels determined from hydraulic modelling (HEC Ras) are plotted onto maps and used to delineate flood plain areas.

The 1:250 return flood level is used for land use regulation in flood plains of the Upper Thames River basin. New development is restricted in these areas.



Hazard Avoidance

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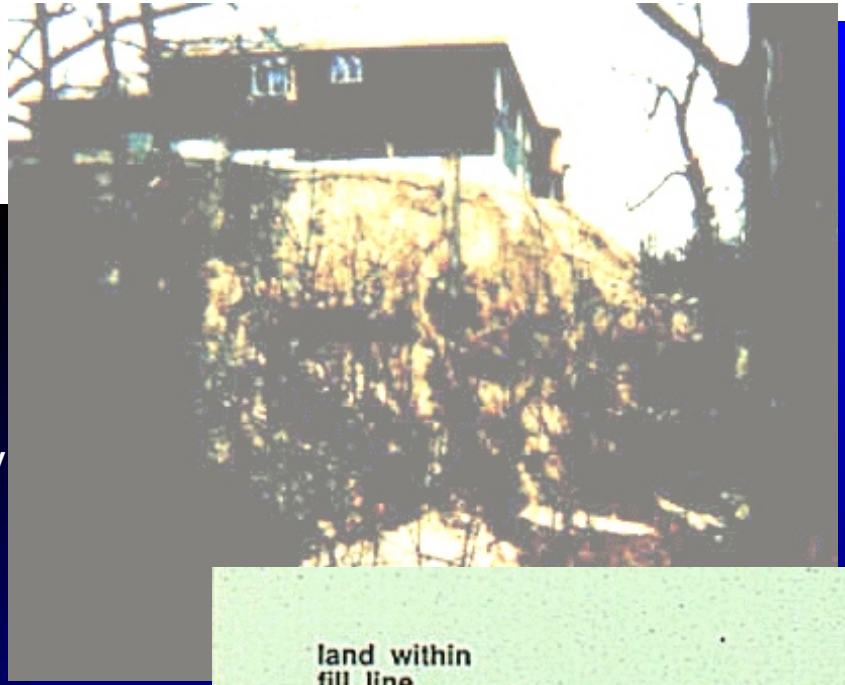
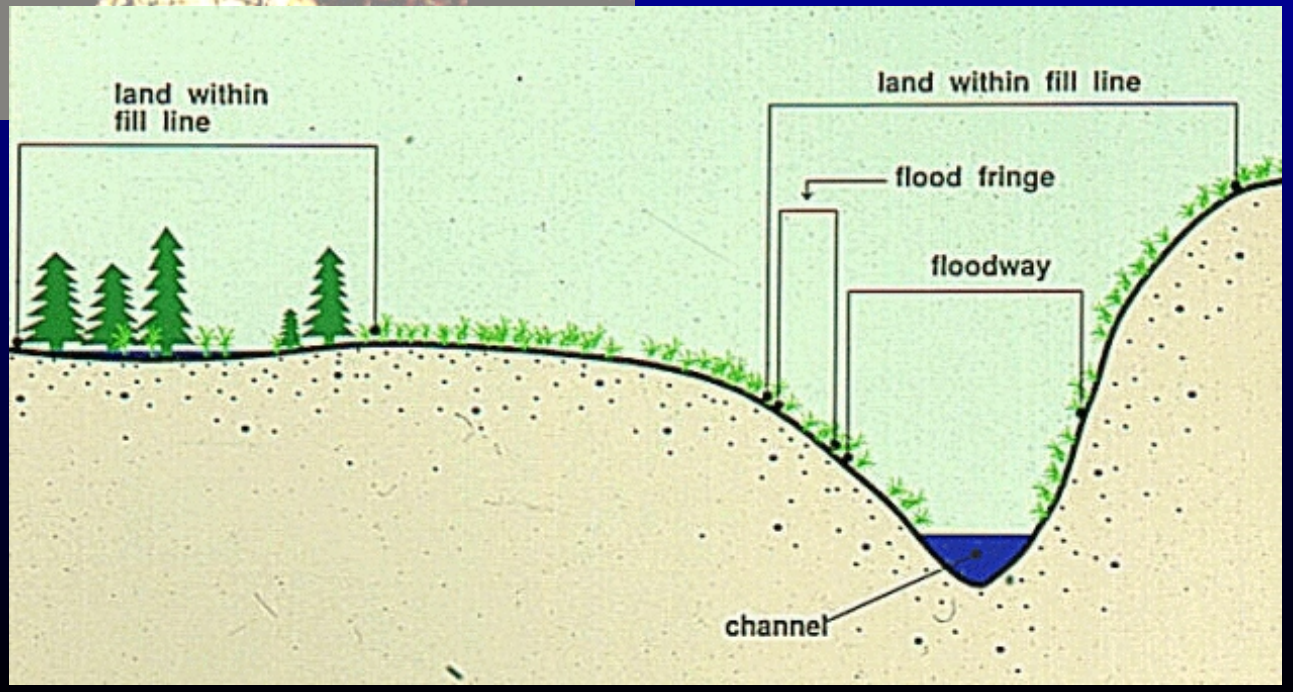


The CA also regulates steep slope and natural heritage areas by means of fill regulations

Fill and construction regulated areas offer another approach to hazard avoidance



Hazard Avoidance

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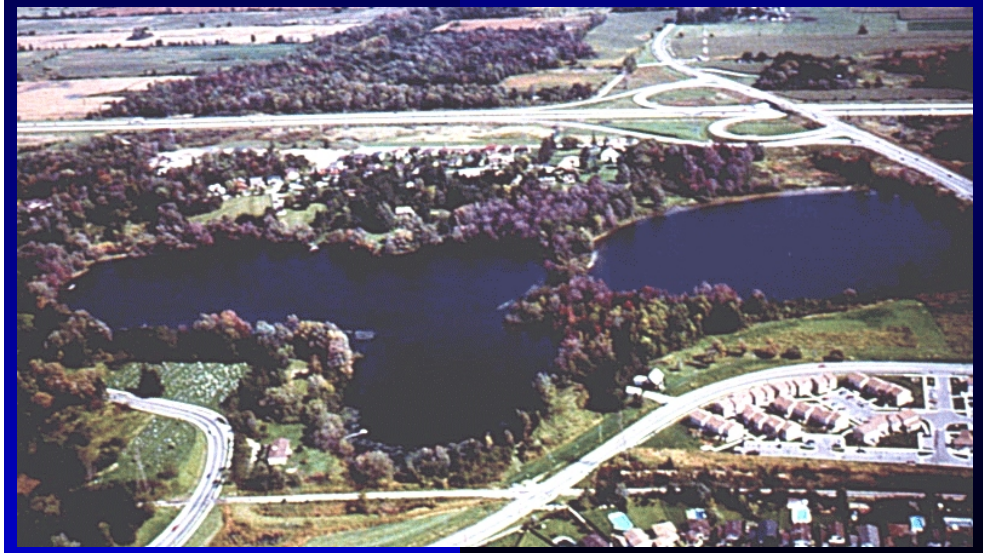
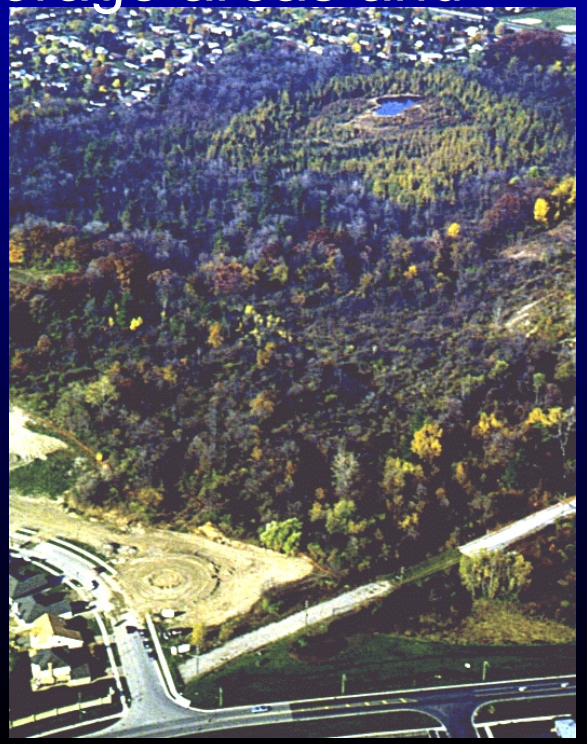
Land Acquisition

- Purchasing of flood prone properties controls development.
- Acquisition of wetlands has a dual benefit of protecting natural flood storage areas and natural heritage





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Upper Thames Programs and Services

Planning and Research - Research

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Planning and Research - Monitoring

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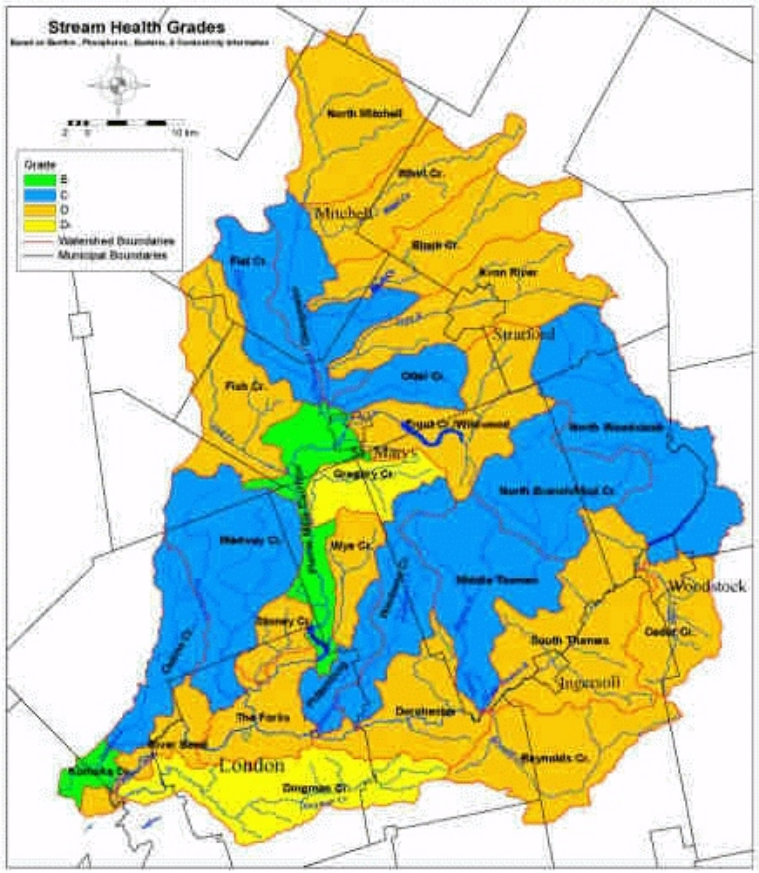
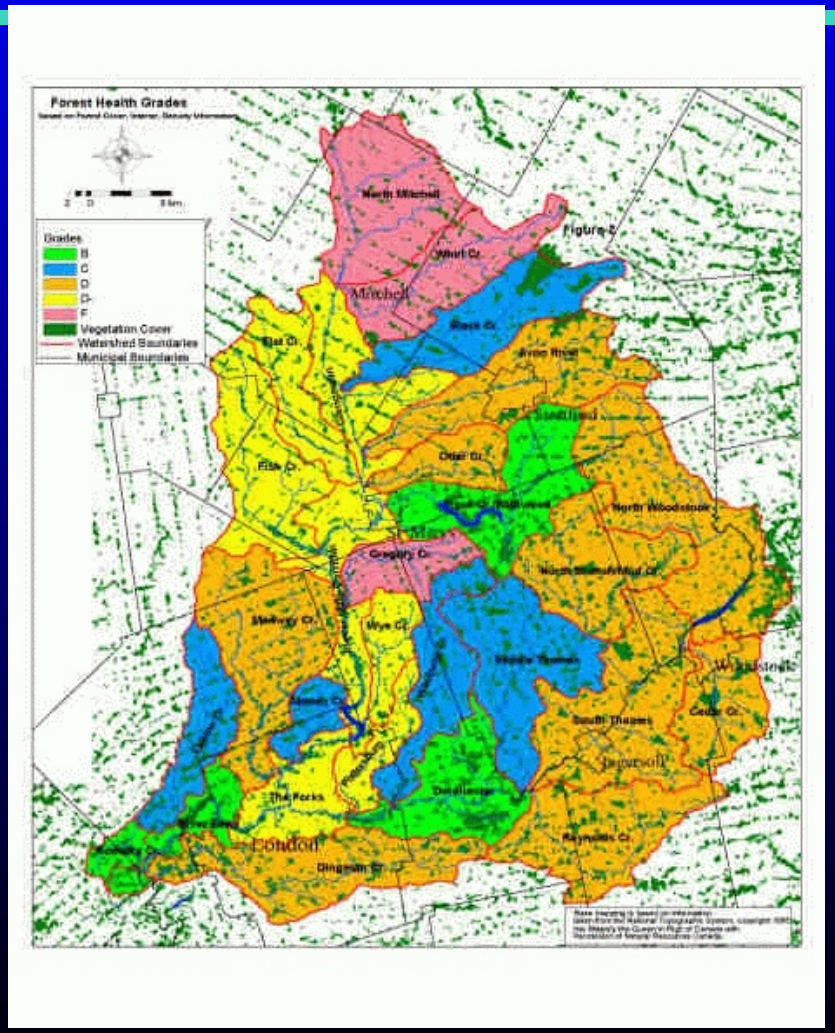
Upper Thames Programs and Services





Planning and Research - Watershed Planning

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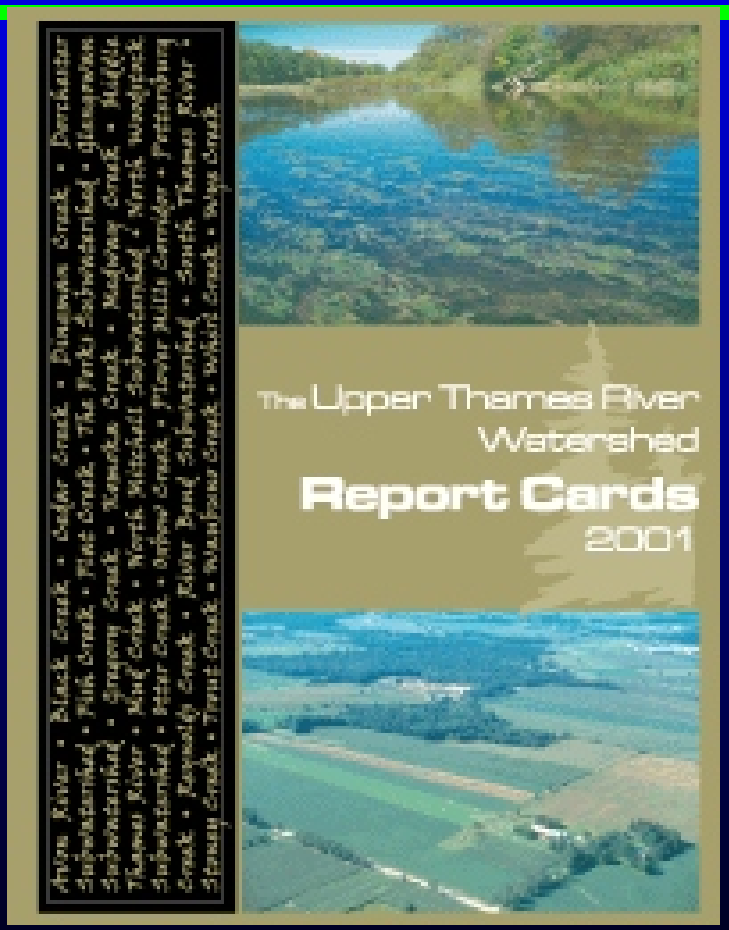
Upper Thames Programs and Services



Planning and Research -
Watershed Planning

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Upper Thames Programs and Services

- Agricultural Extension Services
- Forestry
- Ecosystem Restoration
- Clean Water Program

Conservation Services

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Upper Thames Programs and Services

Conservation Services - Tree Planting

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Upper Thames Programs and Services

- Considerations:
  - Natural hazards
  - Natural heritage
  - Servicing

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Upper Thames Programs and Services

- Planning for natural hazards
  - Managing risk associated with naturally occurring processes
    - Flood plains
    - Steep slopes
    - Erosion
    - Great Lakes shoreline
    - Wetlands (organic soils and to maintain attenuation)

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Upper Thames Programs and Services

- Planning for natural heritage:
  - Managing for the maintenance or enhancement of biological diversity
    - Wetlands
    - Woodlands
    - Threatened and endangered species and their habitat
    - Fish and fish habitat
    - Wildlife and wildlife habitat
    - Significant valleylands

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Upper Thames Programs and Services

- Servicing
  - Managing the servicing impacts from new development
    - Stormwater quantity control
    - Stormwater quality control
    - Infrastructure planning

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Upper Thames Programs and Services

- Inquiry Services
- Provide information and mapping to:
  - Lawyers
  - Real estate agents
  - Private landowners
  - Consultants
  - Surveyors
- Mapping Services
  - Flood plain information
  - Wetlands, woodlands other resource areas
  - GIS Services
  - Air photos
  - Ortho-imagery

Hydrology and Regulatory Services-
Environmental Planning

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Upper Thames Programs and Services

- Comment on Planning Act Applications
  - Official Plan Amendments
  - Zoning By-Law Amendments
  - Severances
  - Variances
  - Site Plan Applications
  - Plans of Subdivision
  - Plans of Condominium

Hydrology and Regulatory Services -
Environmental Planning

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Upper Thames Programs and Services

Corporate Services Division - Community Education

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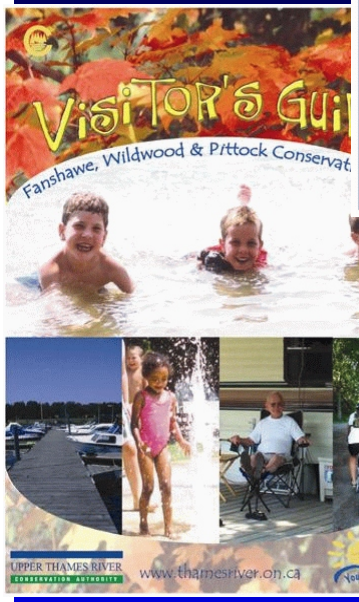
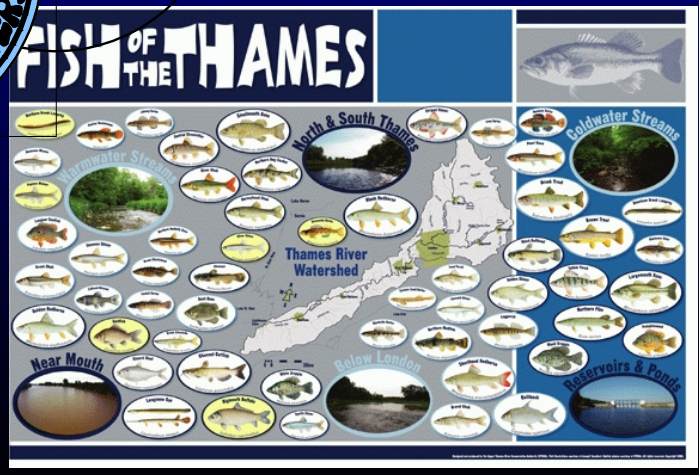
Upper Thames Programs and Services





Corporate Services - Marketing and Communications

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Upper Thames Programs and Services

Recreation Services

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Upper Thames Programs and Services

Property Management