

Alternatives, Adaptive Management and Monitoring in Watershed Management

TRCA Objective Based Approach

(Flood Risk Modeling, Mitigation and Planning to Inform Environmental Assessments)

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Outline

- TRCA's Jurisdiction
- Flood Plain Modelling and Mapping
- Risk Assessment and Flood Mitigation
- TRCA's Review Roles and Responsibilities
- Case Studies
- Integrated Watershed Management



TRCA's Jurisdiction

The TRCA's jurisdiction also extends into Lake Ontario to a point defined by the Territorial Divisions Act, R.S.O. 1980

3,467 km² 2,506 km² on land
961 km² water-based
(~ 850,000 acres)

5.9 Million

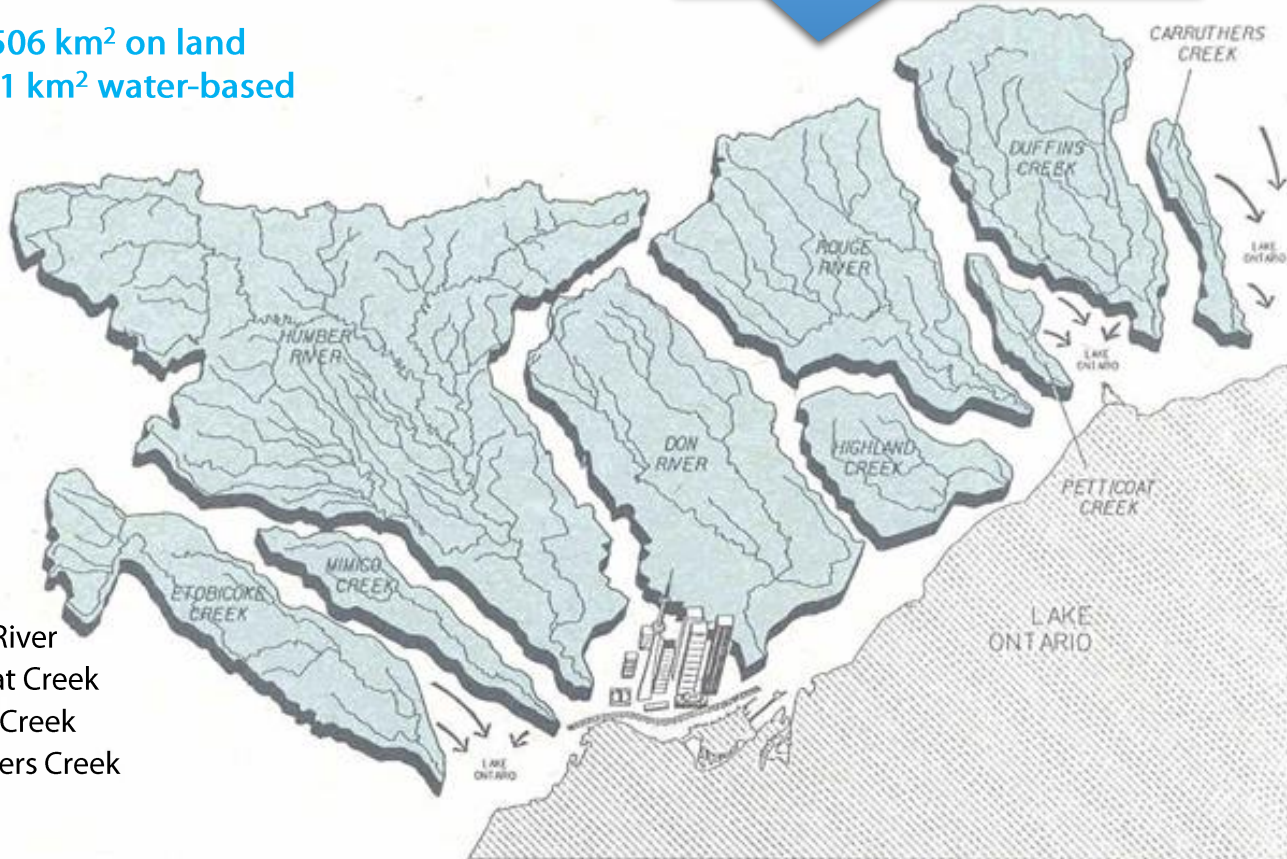
*2013 census, Statistics Canada

Greater Toronto Area Population*

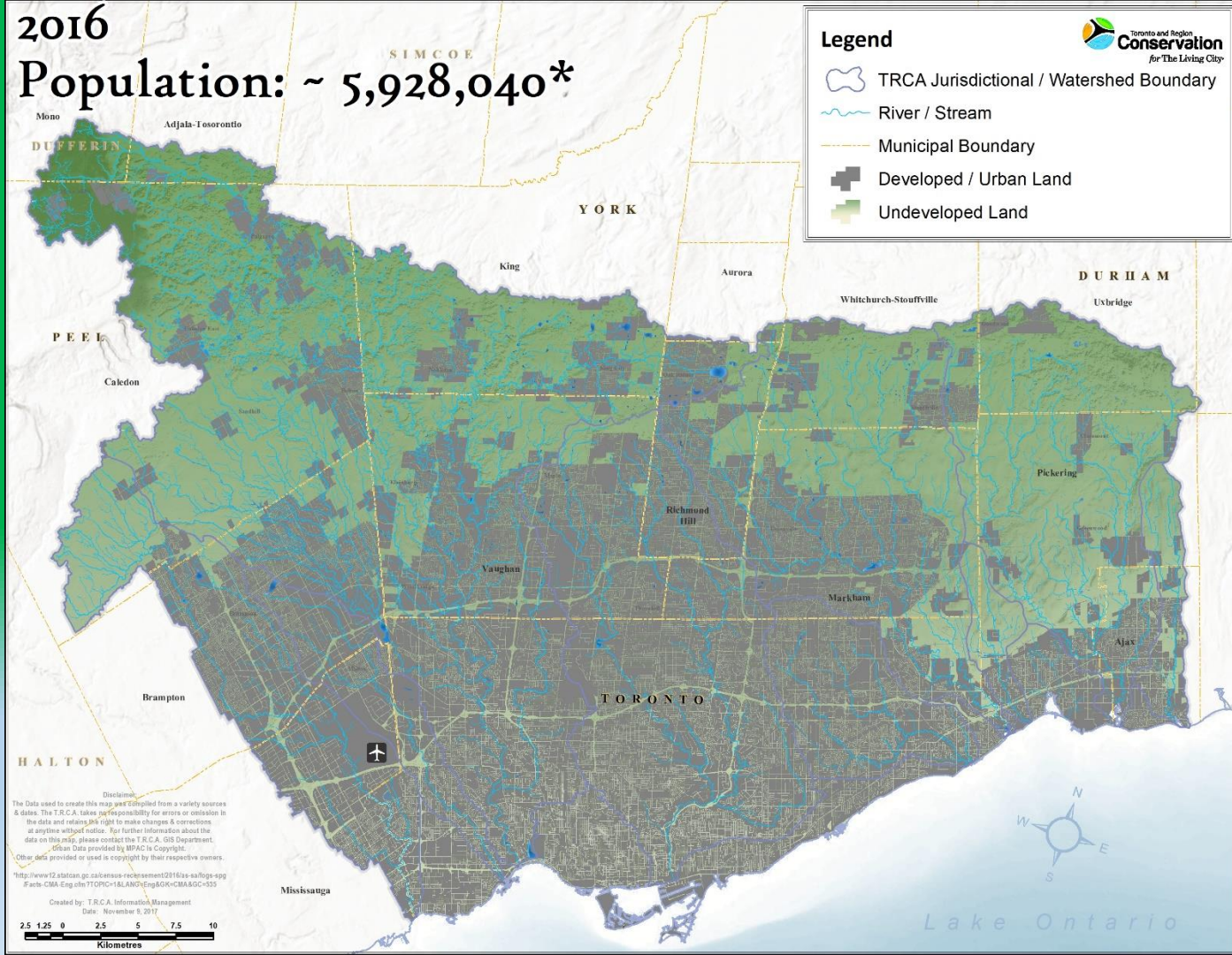
4th Largest city in
North America

9 Watersheds

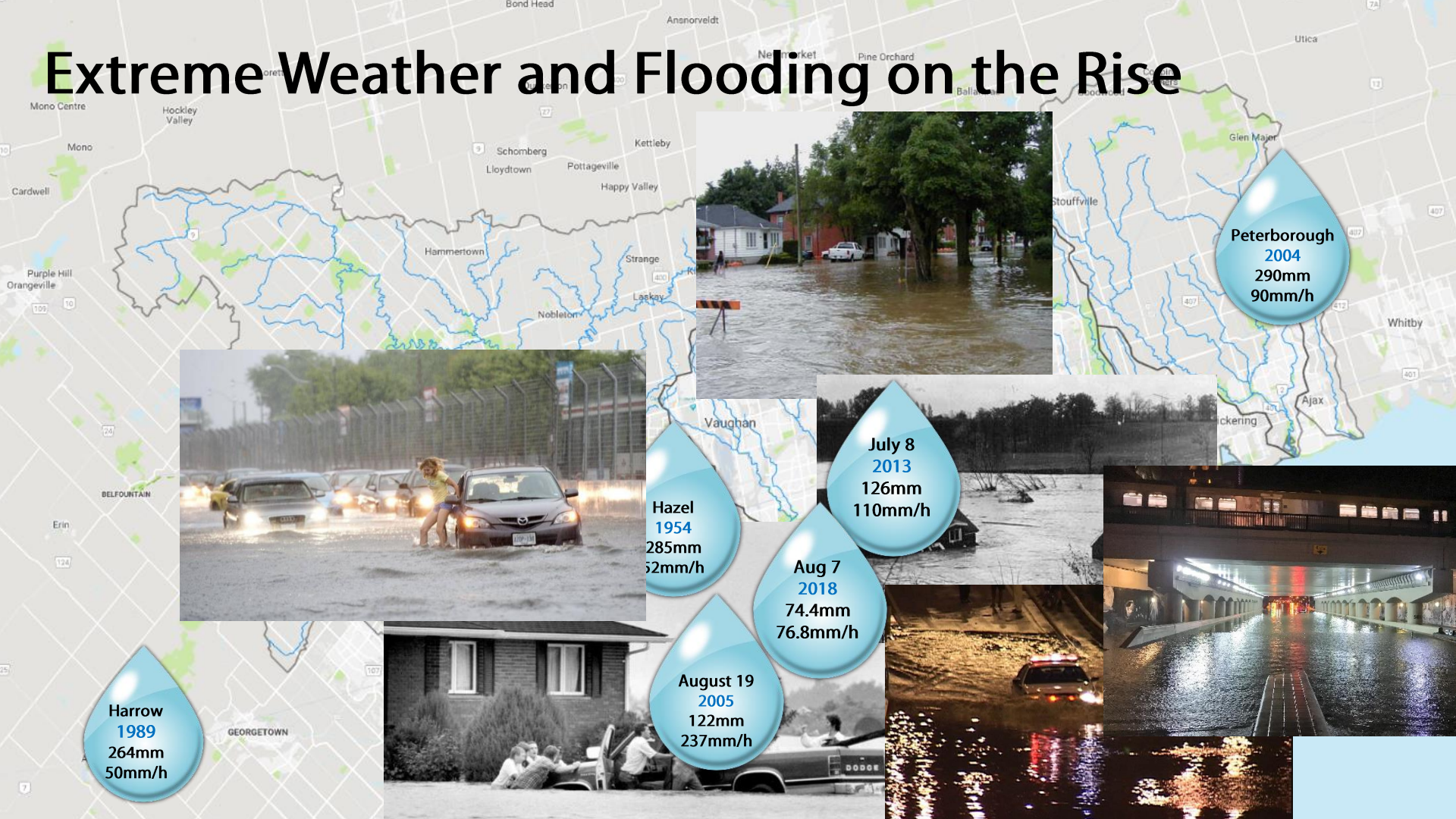
- Etobicoke Creek
- Mimico Creek
- Humber River
- Don River
- Highland Creek
- Rouge River
- Petticoat Creek
- Duffins Creek
- Carruthers Creek



2016 Population: ~ 5,928,040*

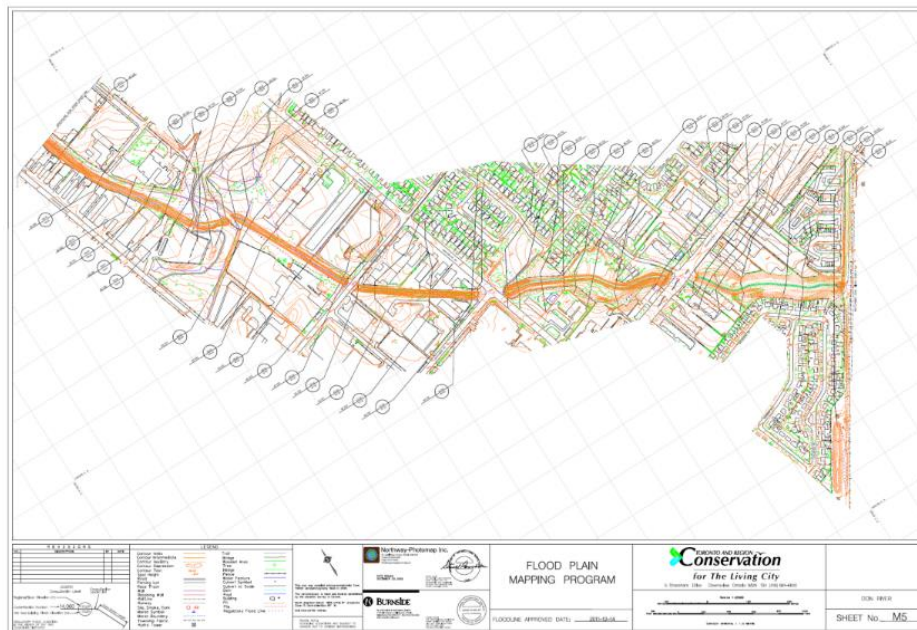
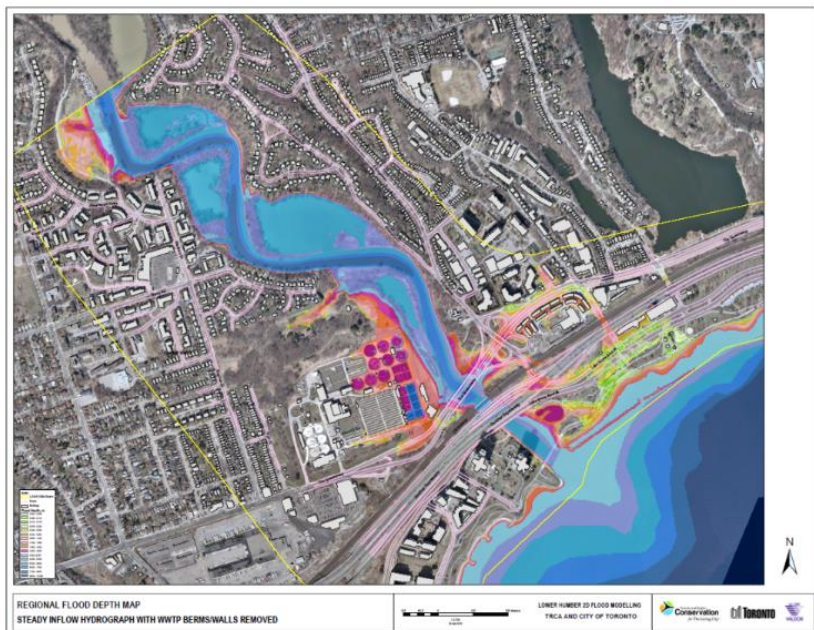


Extreme Weather and Flooding on the Rise

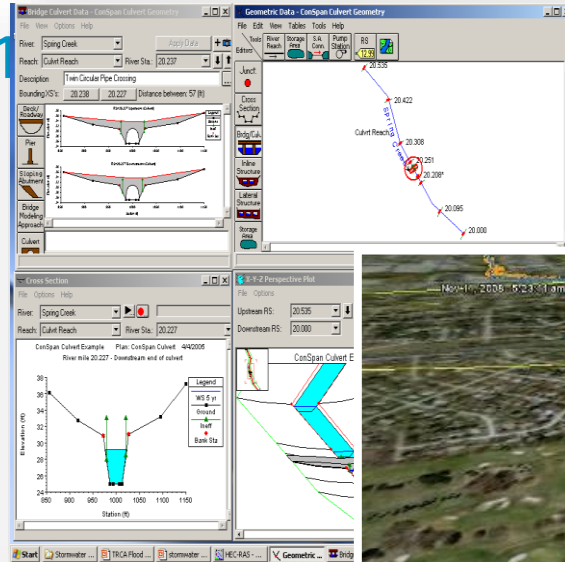


Floodplain Mapping – What is it?

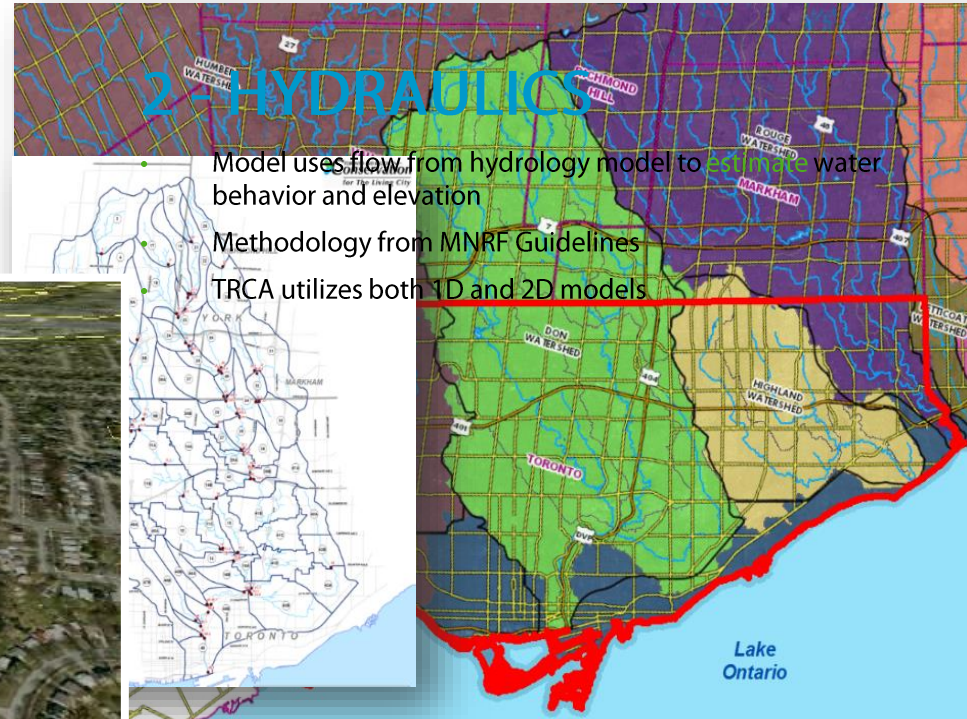
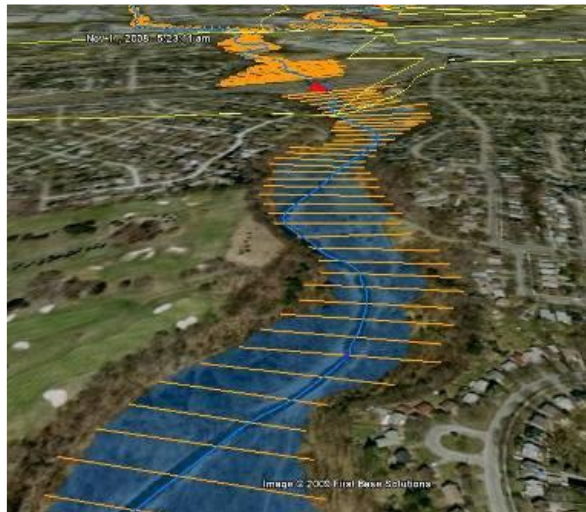
Floodplain Map: **Riverine flood extents** of a storm event – most commonly done for the Regulatory storm (either 100-yr storm or Regional storm such as Hurricane Hazel)



Floodplain Map Creation



Model
including existing
hydrology, meteorology



Model uses flow from hydrology model to
behavior and elevation water

Methodology from MNRF Guidelines
TRCA utilizes both 1D and 2D models

Hydraulic Model Set Up

Preparing Floodplain Maps

1D Modelling

- Flow is 1D and energy is conserved
- Utilizes cross-sections to represent ground and structures

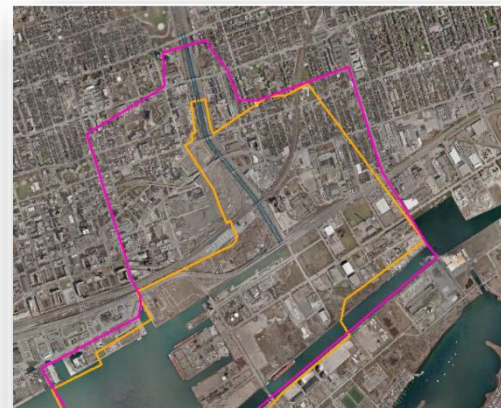
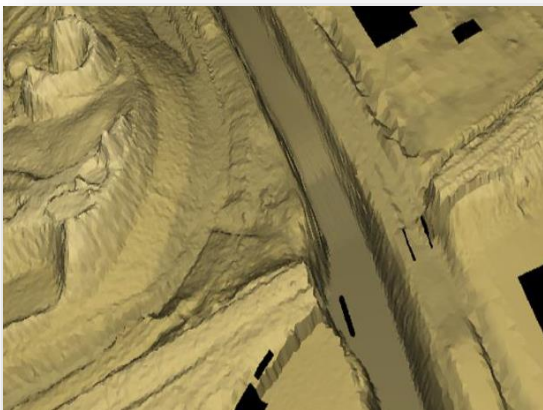


Boundary and Extents

- Model extents should be large enough to avoid boundary effects
- Model extents should contain flow (2D model)
- Boundary conditions should be appropriate

2D Modelling

- Flow is 2D and is fully hydrodynamic
- Dense network of grid or mesh describes ground
- User does not dictate flow direction
- Long run times due to complex calculations



What Floodplain Mapping Is Used For

Risk Assessments



Real Time Flood Forecasting Tools



Floodplain Land-Use Regulation



Watershed Planning and Ecology



Emergency Management

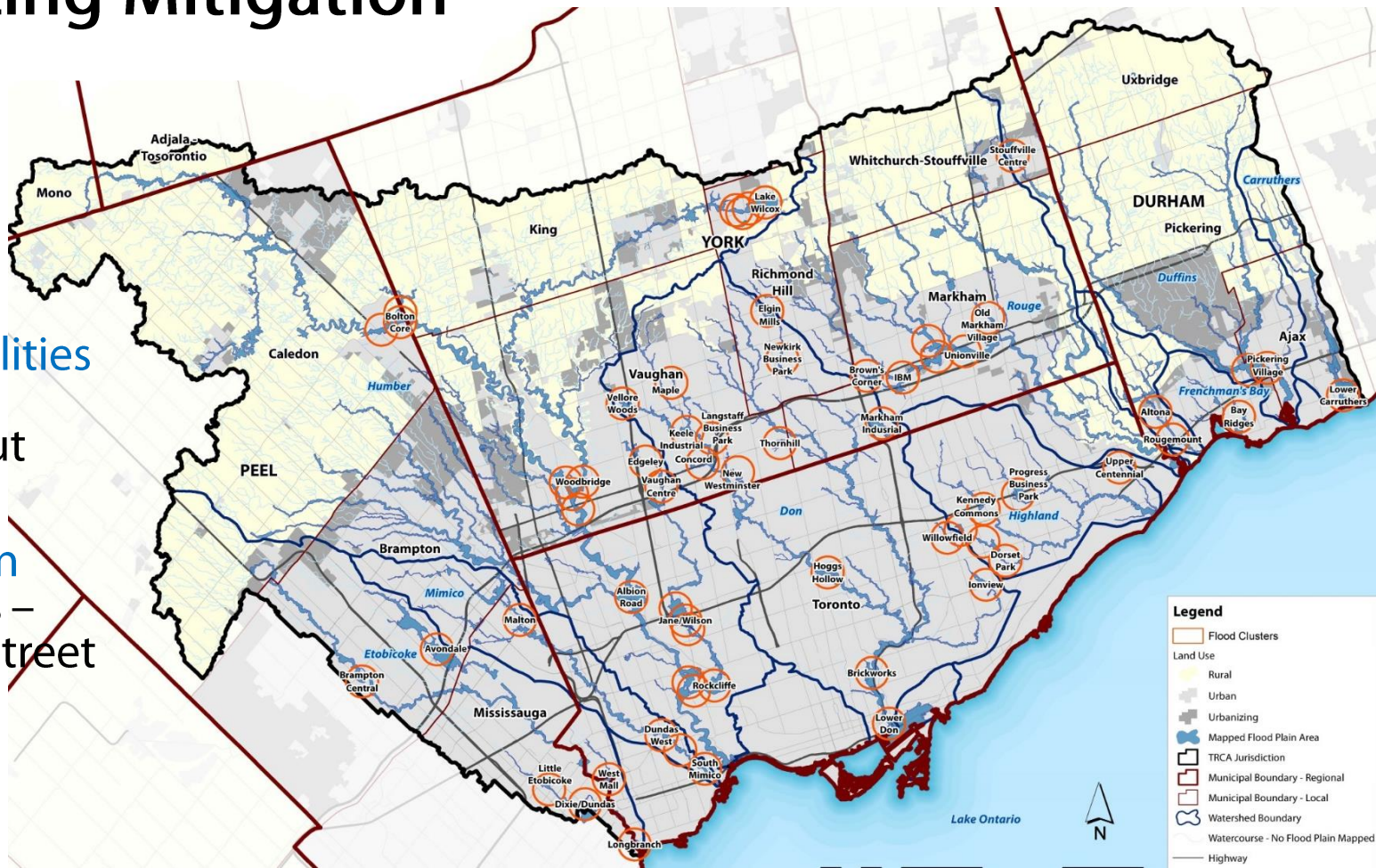


Flood Remediation



Prioritizing Mitigation

- Highly **dendritic** system
- Flood **vulnerabilities** are very spread out
- Scale of **mitigation** measures – block or street scale




Case Study – Dixie Dundas Mississauga

 City of Mississauga

 City of Toronto

 City of Brampton

 Town of Caledon

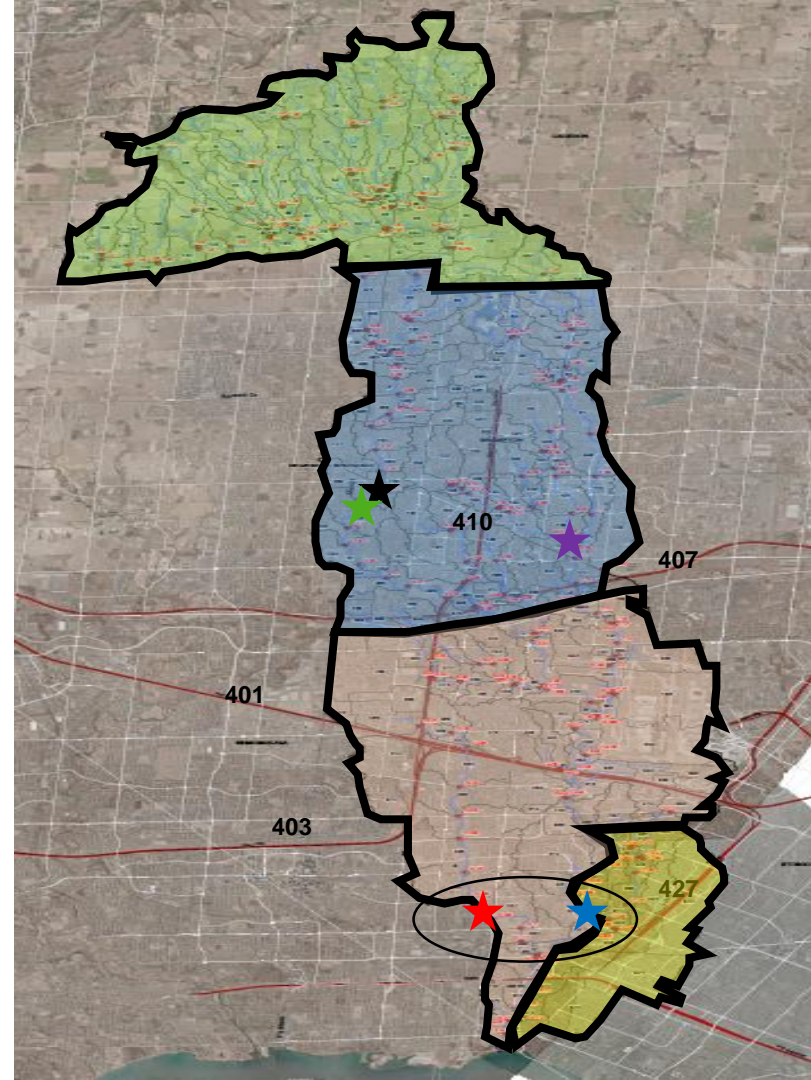
 Dixie Dundas/Applewood SPA

 Etobicoke Creek SPA

 Downtown Brampton SPA

 Bram East SPA

 Avondale SPA



2D Flood Modeling Results – Dixie Dundas Mississauga



Flood Risk Assessment - Dixie-Dundas Cluster

Regional Storm:

Affected residents = **1810**
Affected employees = **2876**
Buildings damaged = **69**
Building-related damages = **\$69.3mil**

Average-Annual:

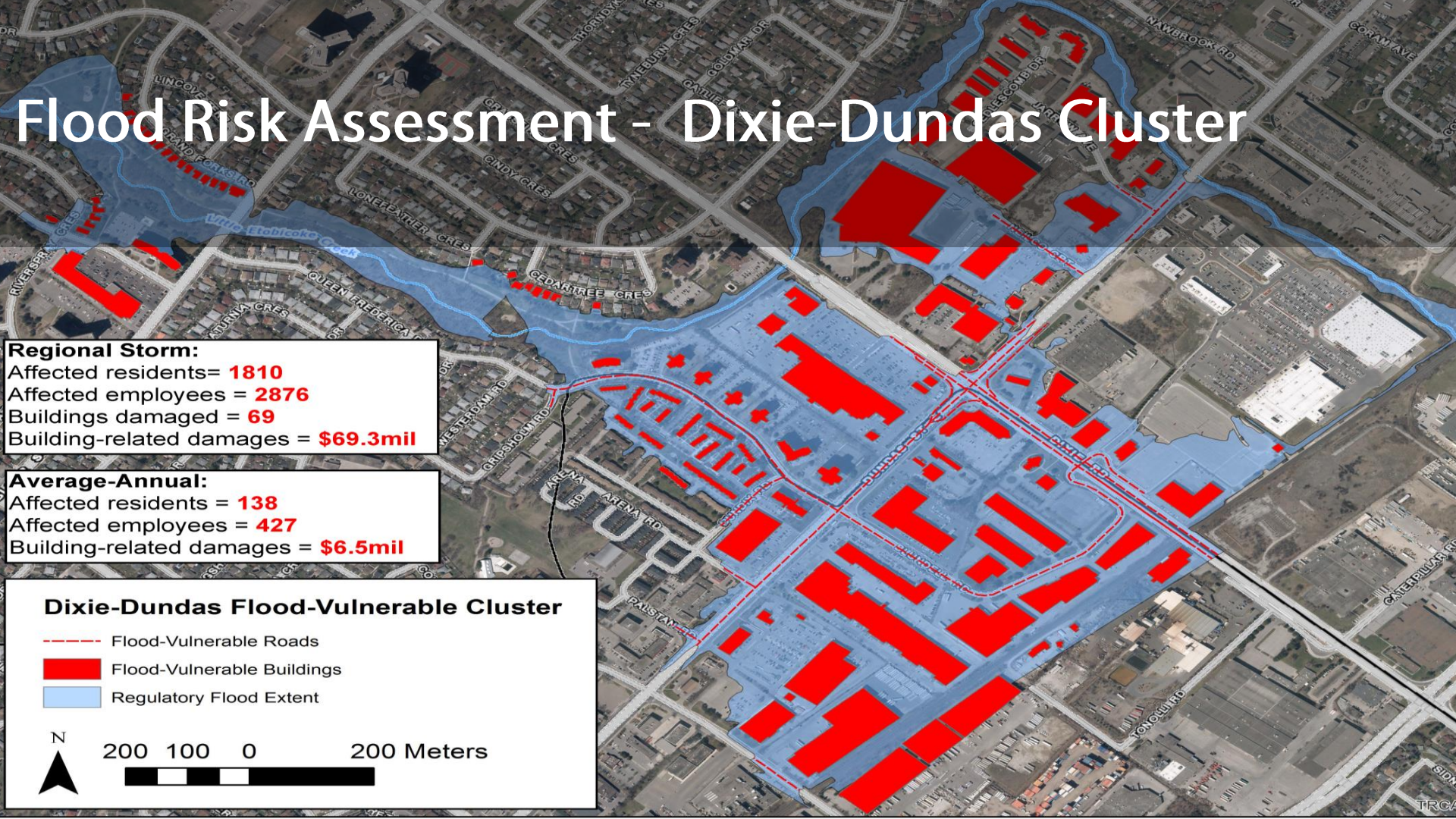
Affected residents = **138**
Affected employees = **427**
Building-related damages = **\$6.5mil**

Dixie-Dundas Flood-Vulnerable Cluster

- Flood-Vulnerable Roads
- Flood-Vulnerable Buildings
- Regulatory Flood Extent

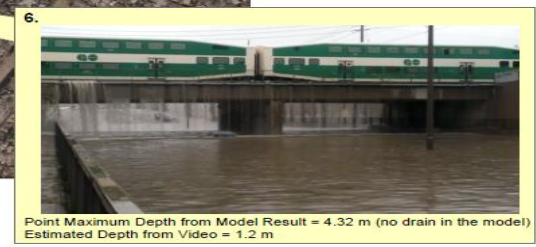


200 100 0 200 Meters



Model Validation

In the middle of the project (July 8, 2013) a storm greater than a 100 storm event hit the study area. Results from the model were validated







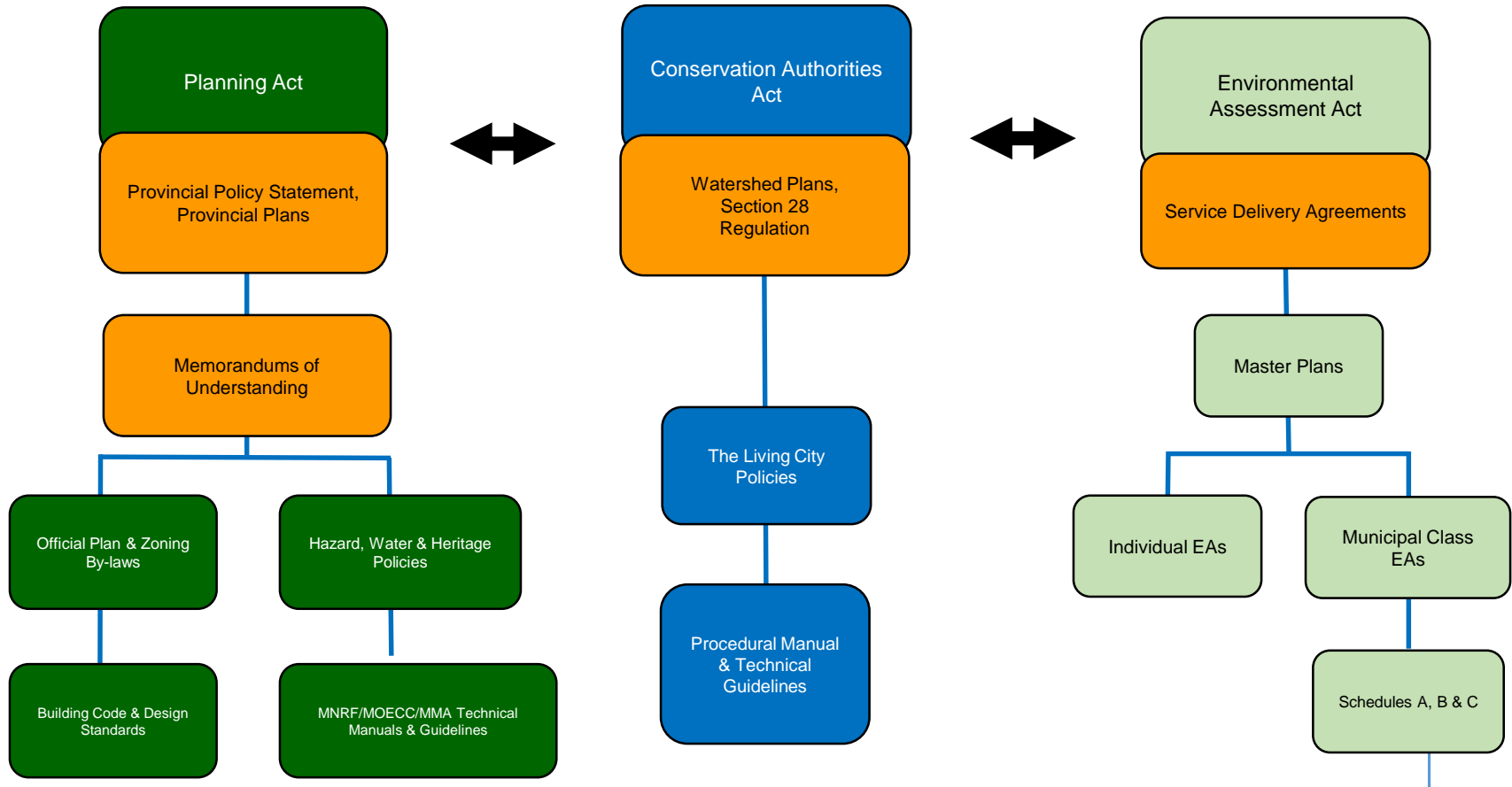
Next Steps - Flood Remediation Class Environmental Assessment

~~Flood Remediation Class Environmental Assessment~~

- Do Nothing Scenario/Structural Control
- Flood-prone lands/buildings
 - Floodplains
 - Site-specific storage (including creek naturalization)



TRCA's Review Roles & Responsibilities



Regulated Areas

Valley Corridor



Watercourse



Wetlands



Stream Corridor



Lake Ontario Shoreline



Area Adjacent to Wetlands



Policy Framework for Managing Flood Plains

PPS, 3.1 [Natural Hazards](#)

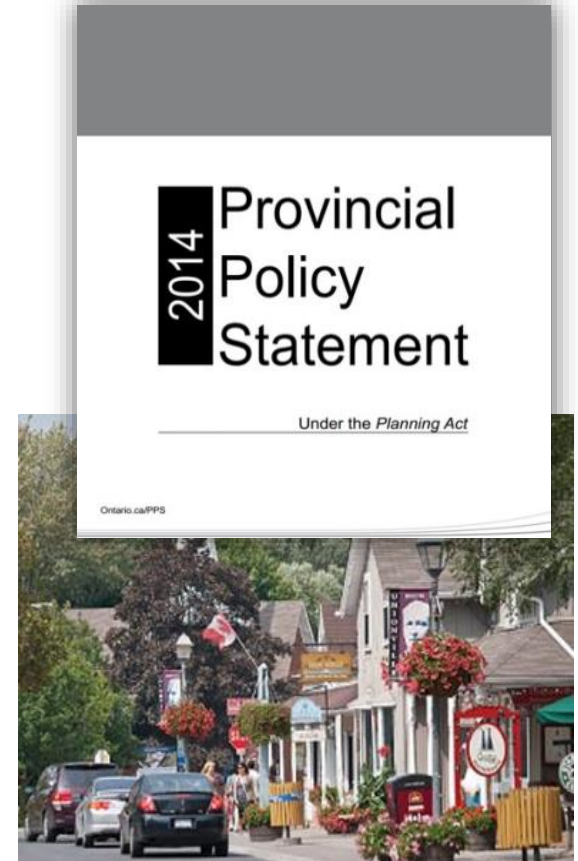
Flood Plain Management Approaches

One-Zone (primary; most restrictive)

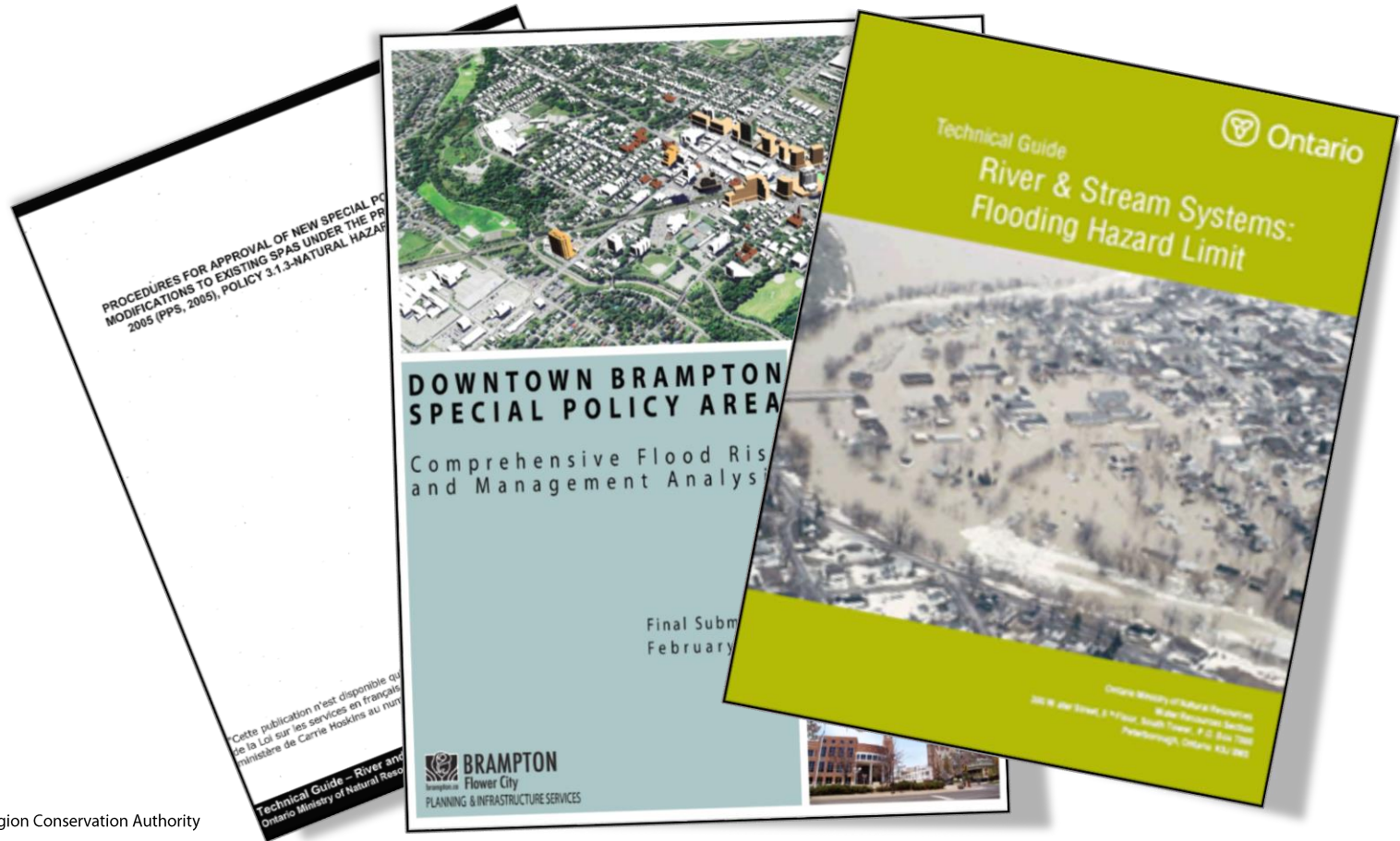
Two-Zone (exception; floodway-flood fringe)

Special Policy Areas (unique circumstances):

- historical communities in the flood plain
- limited scope of development and redevelopment to allow for continued social and economic viability and revitalization
- not intended for intensification
- approved by Ministers of Municipal Affairs and Housing and Natural Resources and Forestry



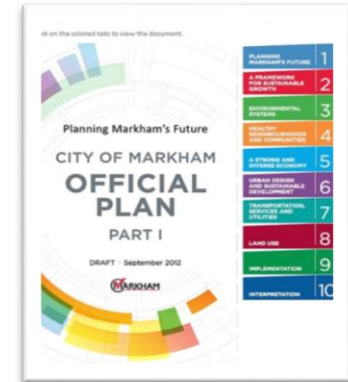
Special Policy Area Procedures



Policy Framework for Managing Flood Plains

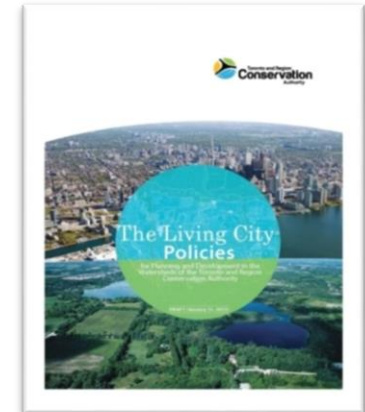
Municipalities

- Implemented through Official Plans and Zoning By-laws
- Policies tied to TRCA's roles and responsibilities
- Initiate comprehensive SPA reviews or amendments to SPA policies, boundaries or land use designations

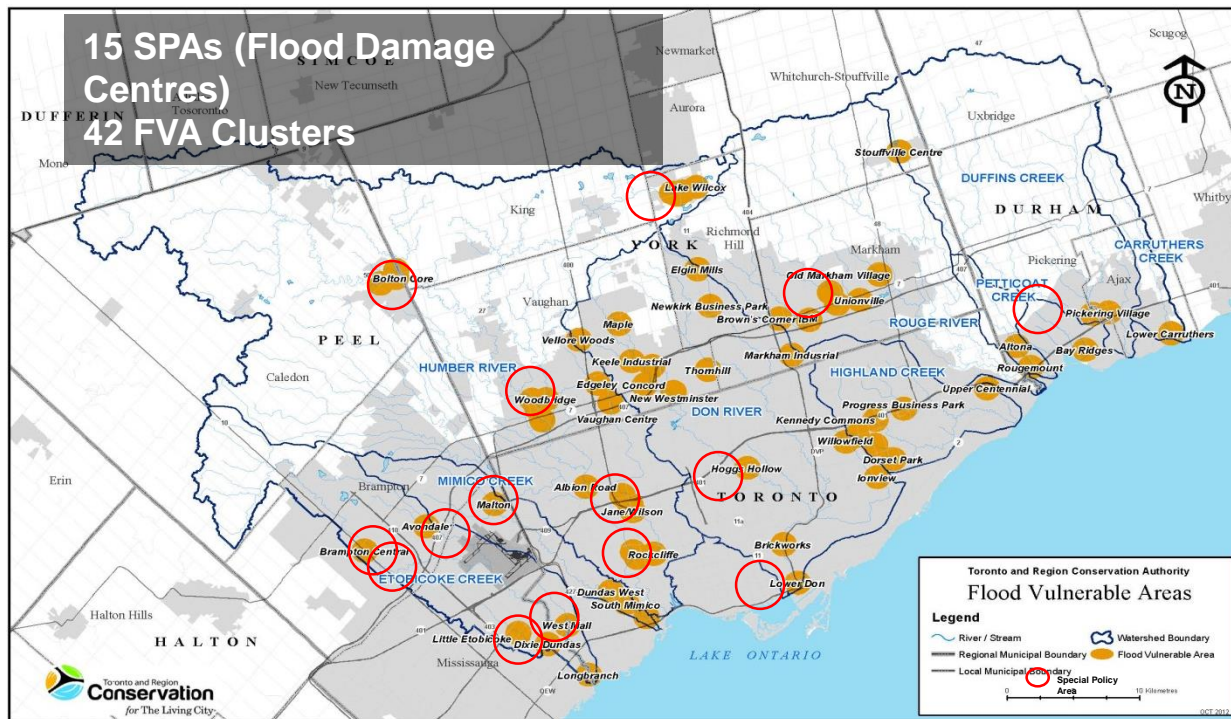


TRCA

- Delegated Provincial Interest - Natural Hazards
- Public Commenting Body - Planning Act, EA Act
- Regulator - Permits under CA Act
- Service Provider - MOUs
- Resource Management Agency
- Landowner



TRCA Jurisdiction



Redevelop, Remediate, Retrofit, Restore



Seizing Opportunities

River Corridor Renewal

Flood Remediation

Mitigate Access Risk

Green Corridor

Improved Water Quality

Improved Aquatic and Terrestrial Habitat

Recreation

Climate Change Adaptation

Opportunity for New
Development/Intensification

No Renewal

Risk to Public and Property from Flooding

Safe Access Impacted During Storm Events

No New Development

Minor Additions to Existing Buildings

Downtown Brampton Revitalization Studies



Strategic Redistribution of Permitted Development to Manage Flood Risk



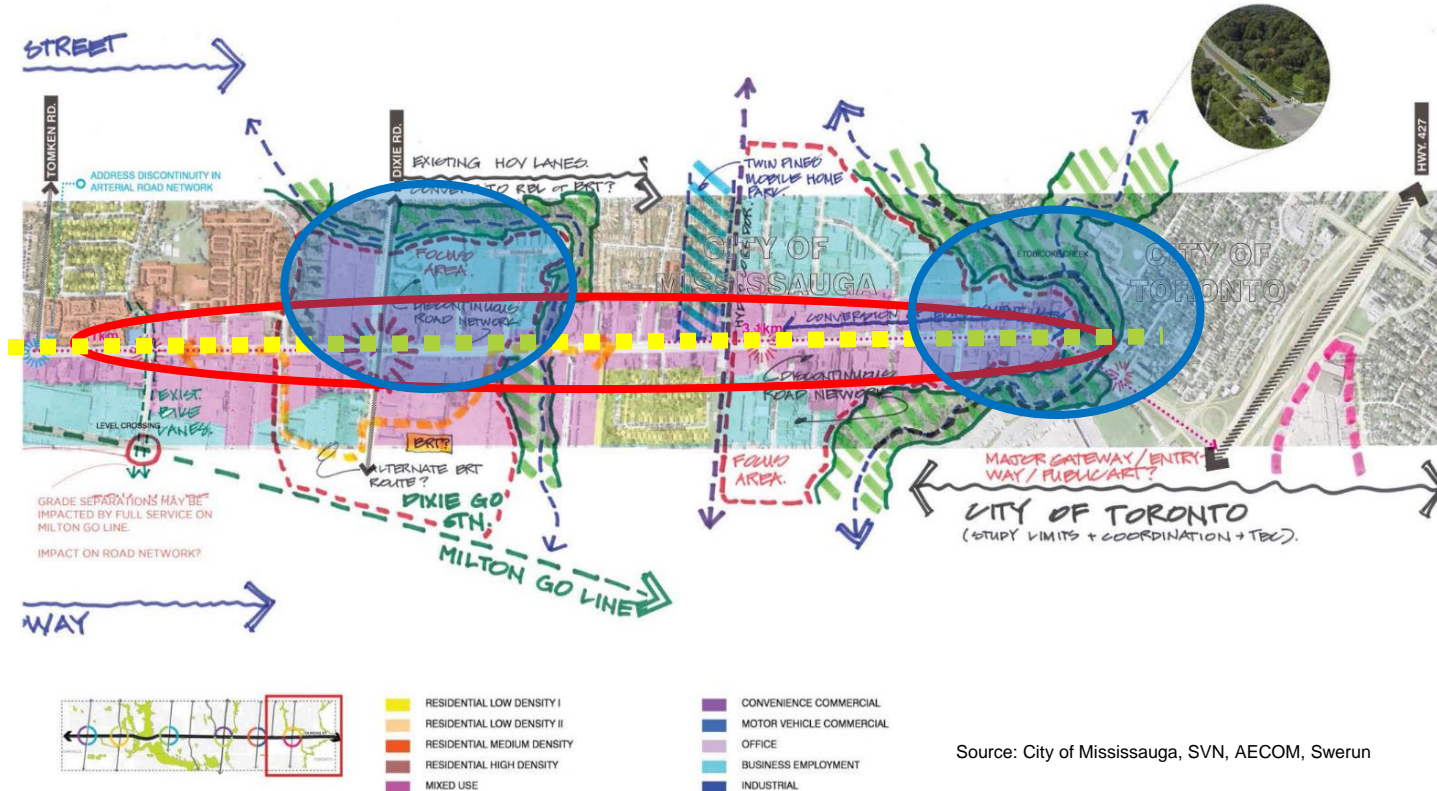
Source: The Planning Partnership

Vaughan Metropolitan Centre - Black Creek Renewal through Vaughan's New Downtown



Source: City of Vaughan

Dundas Connects Master Plan – Mississauga



Source: City of Mississauga, SVN, AECOM, Swerun

Dixie Focus Area Concept – Post-Flood Mitigation

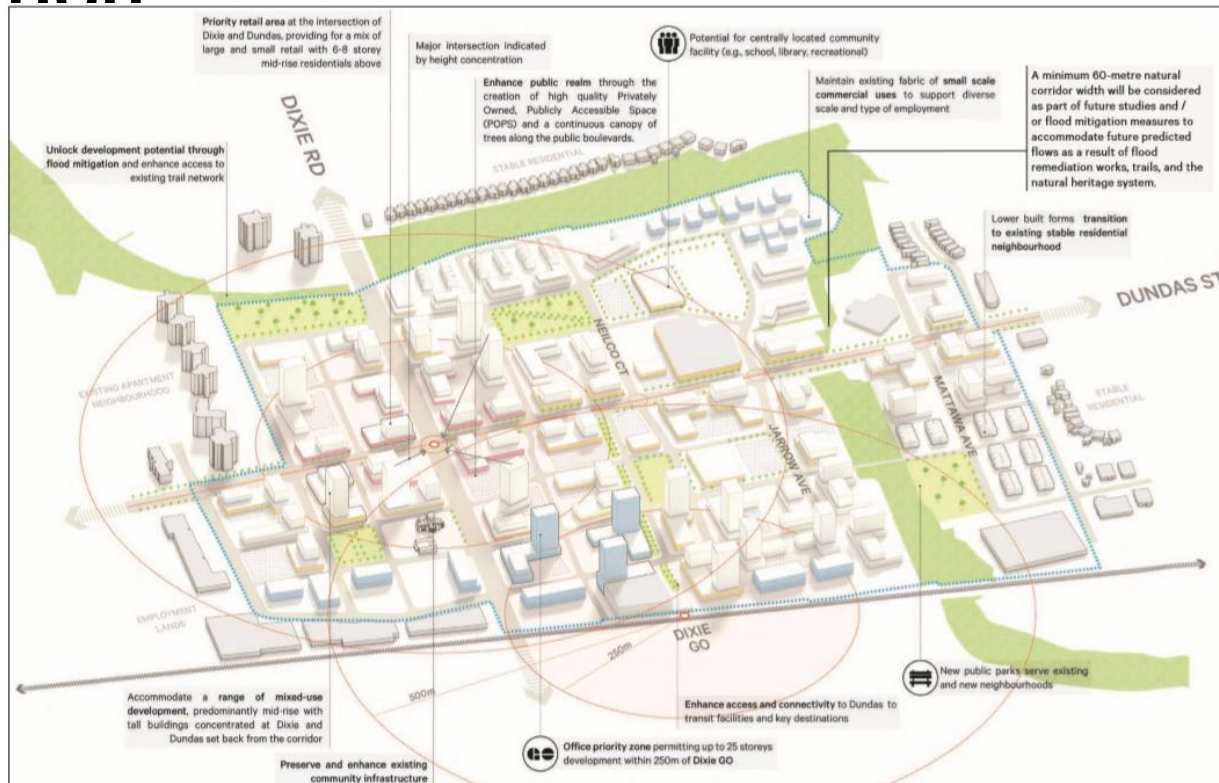
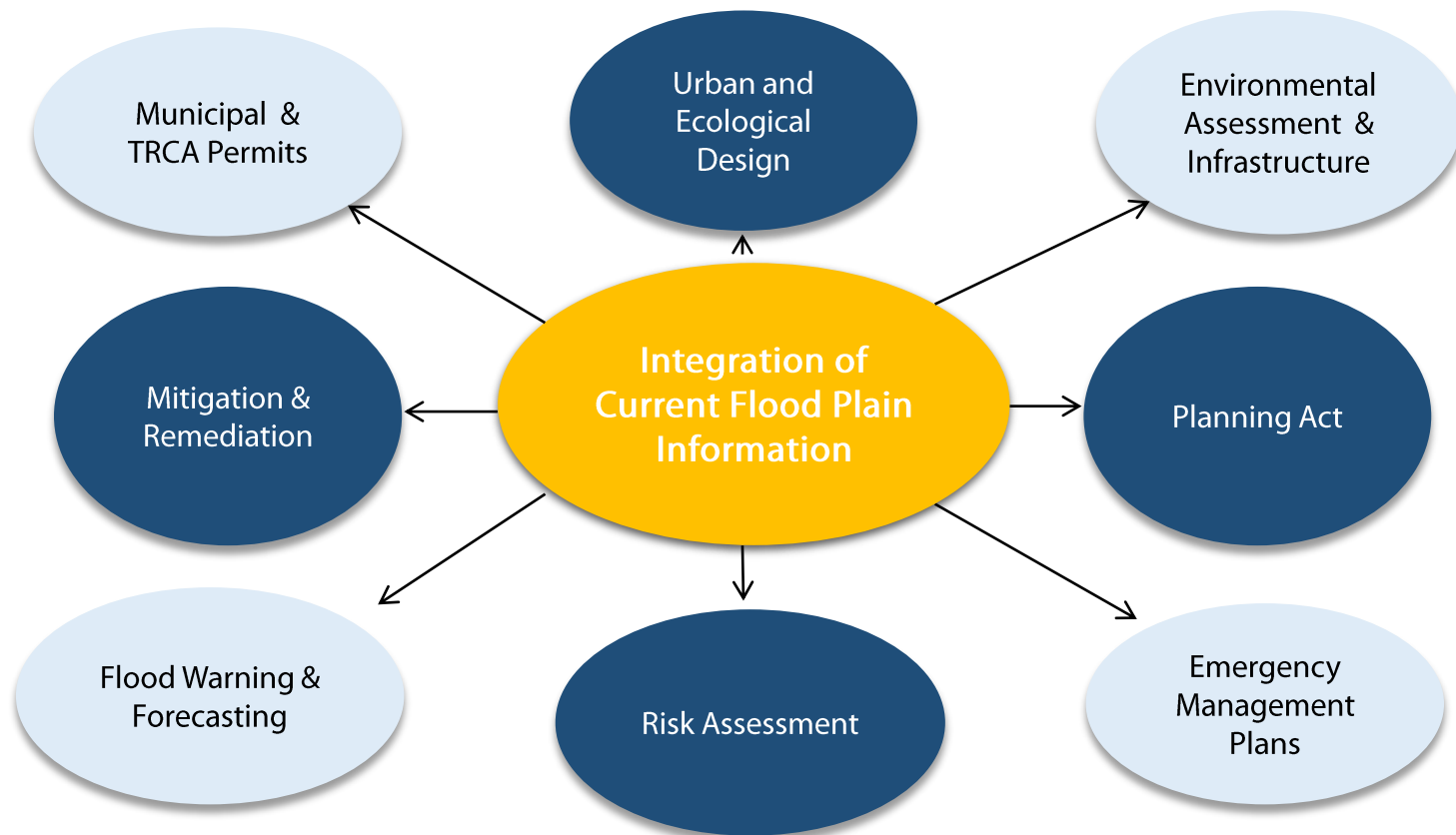


Figure 5-9. Conceptual Demonstration massing plan for the Dixie Focus Area

Dundas Street in the Future: Possible Concepts



Source: City of Mississauga, City of Tulsa



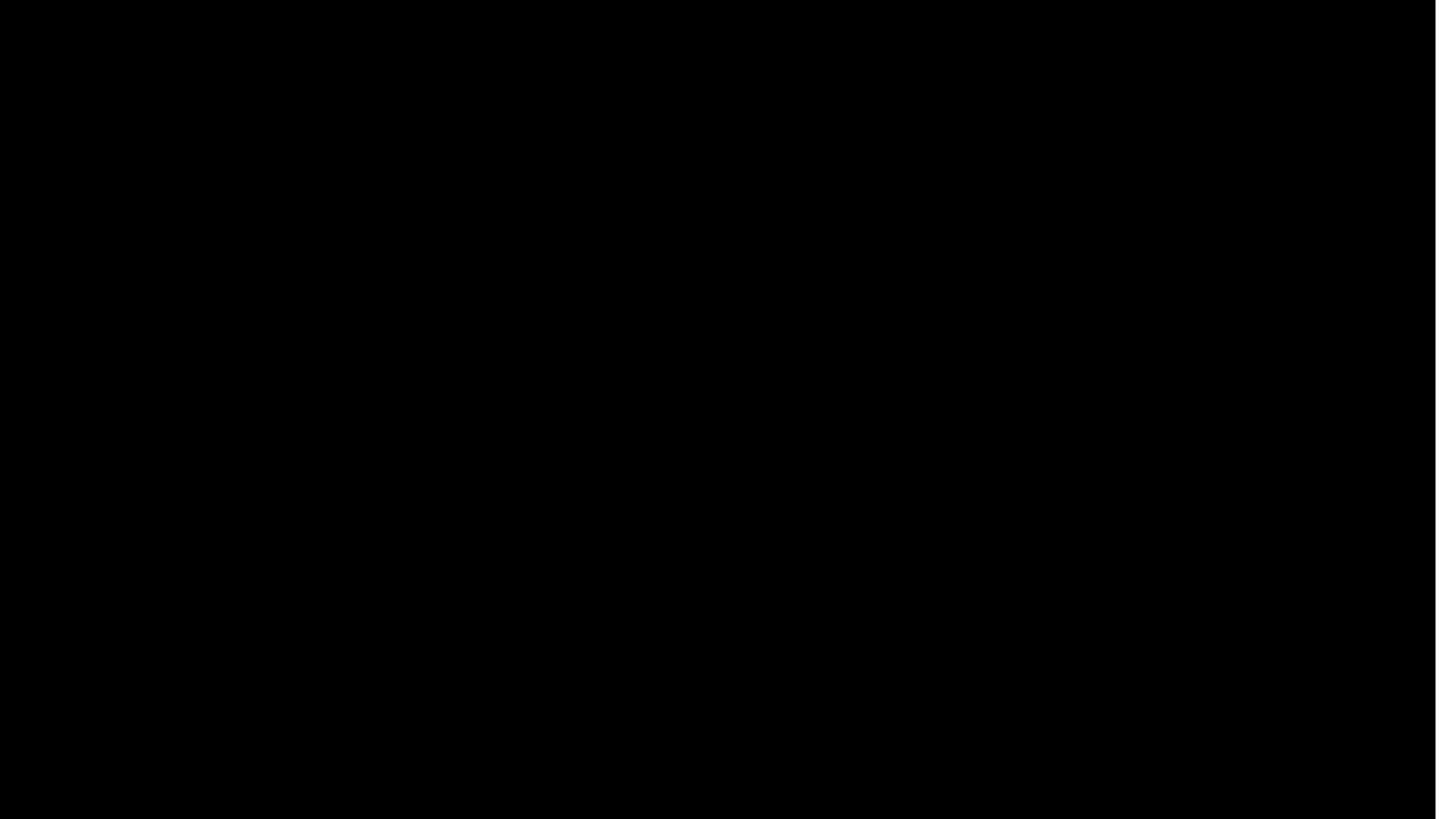
TRCA Planners, Ecologists & Engineers Integrate Watershed Science with Development, Infrastructure & Urban Design



We work with provincial & municipal partners & the development industry to
move from **RISK** to **RESILIENCY**
in a growing and intensifying city-region

Questions





Thank you!

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