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Balancing Level of Service and Flood Risk: Are we bound to oversize Municipal Stormwater Infrastructure?

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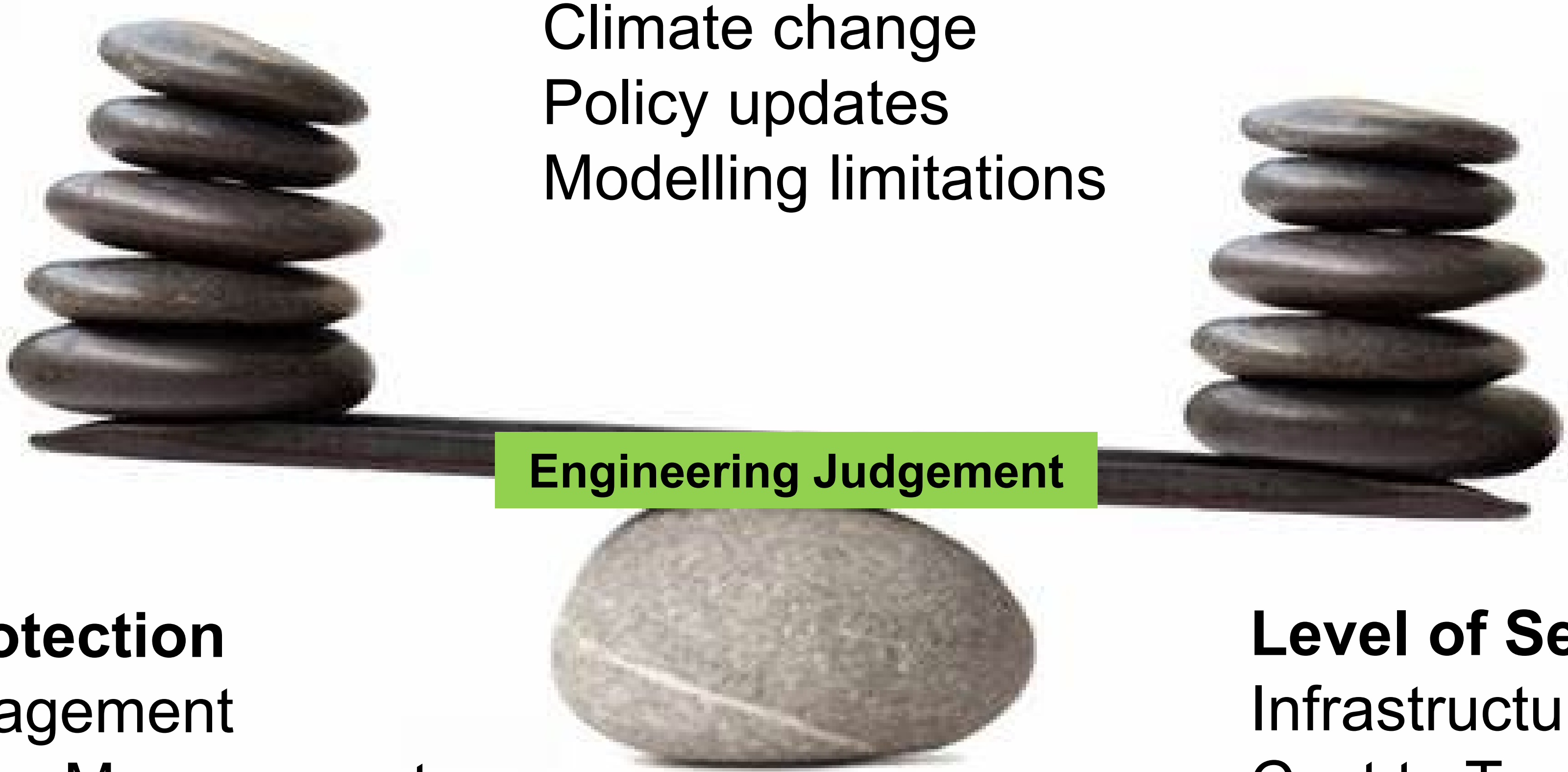
Outline

1. Background
2. Evolution of SWM Industry
3. Flood Mitigation Practices
4. Modelling Pilot Project
5. Infrastructure Costs
6. Lessons Learned / Next steps

Stoney Creek Flood Control Facility
London, ON

The Balance

Uncertainty
Climate change
Policy updates
Modelling limitations

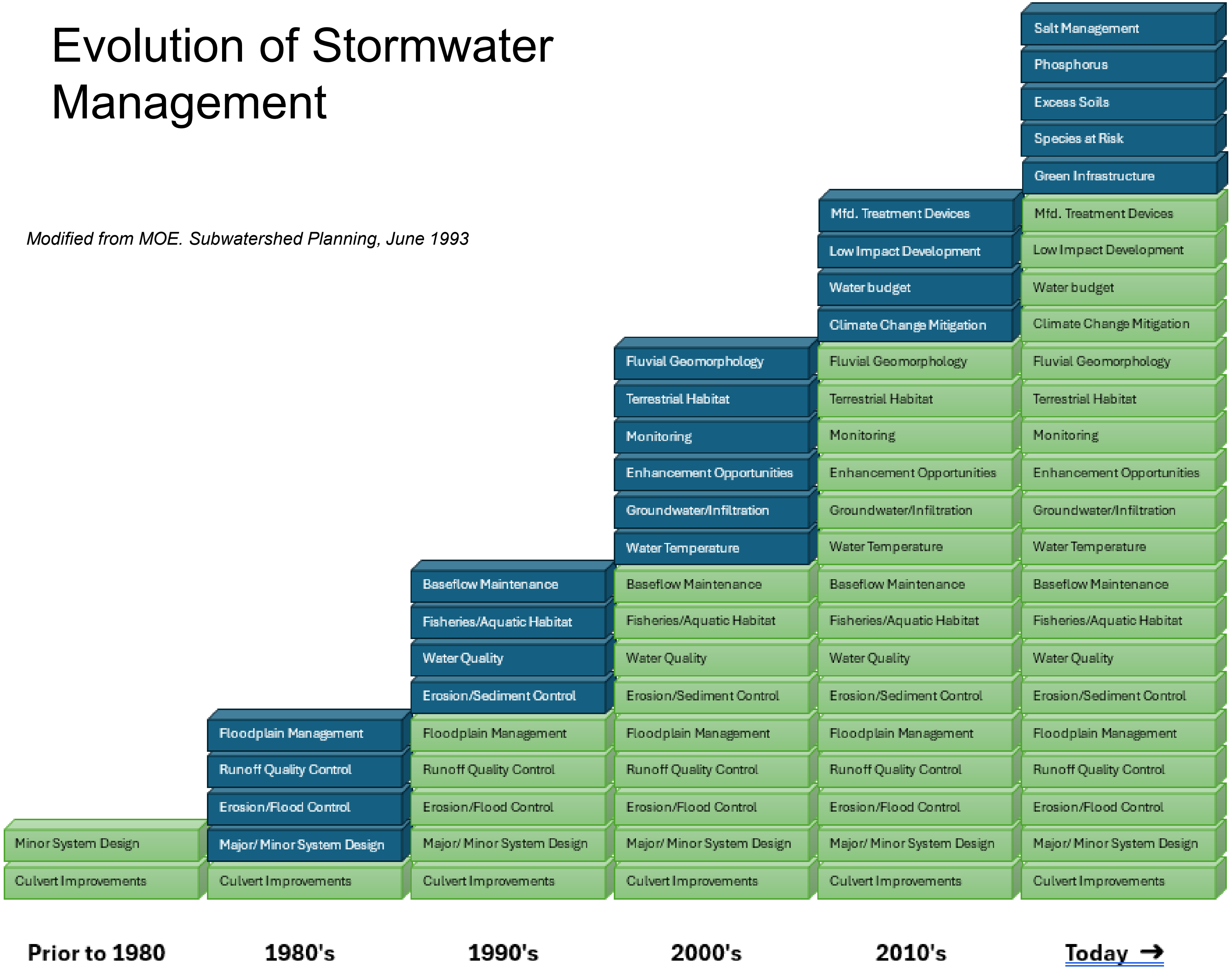


Flood Protection
Risk Management
Emergency Management
Land Use Policy

Level of Service
Infrastructure solutions
Cost to Taxpayers
Land Value/Usability

Evolution of Stormwater Management

Modified from MOE. Subwatershed Planning, June 1993



Evolution of SWM Practices

Rational Method (Minor System Design)

Floodplain Management (1D)

Ponds: Water Quality, Erosion, Sediment Control

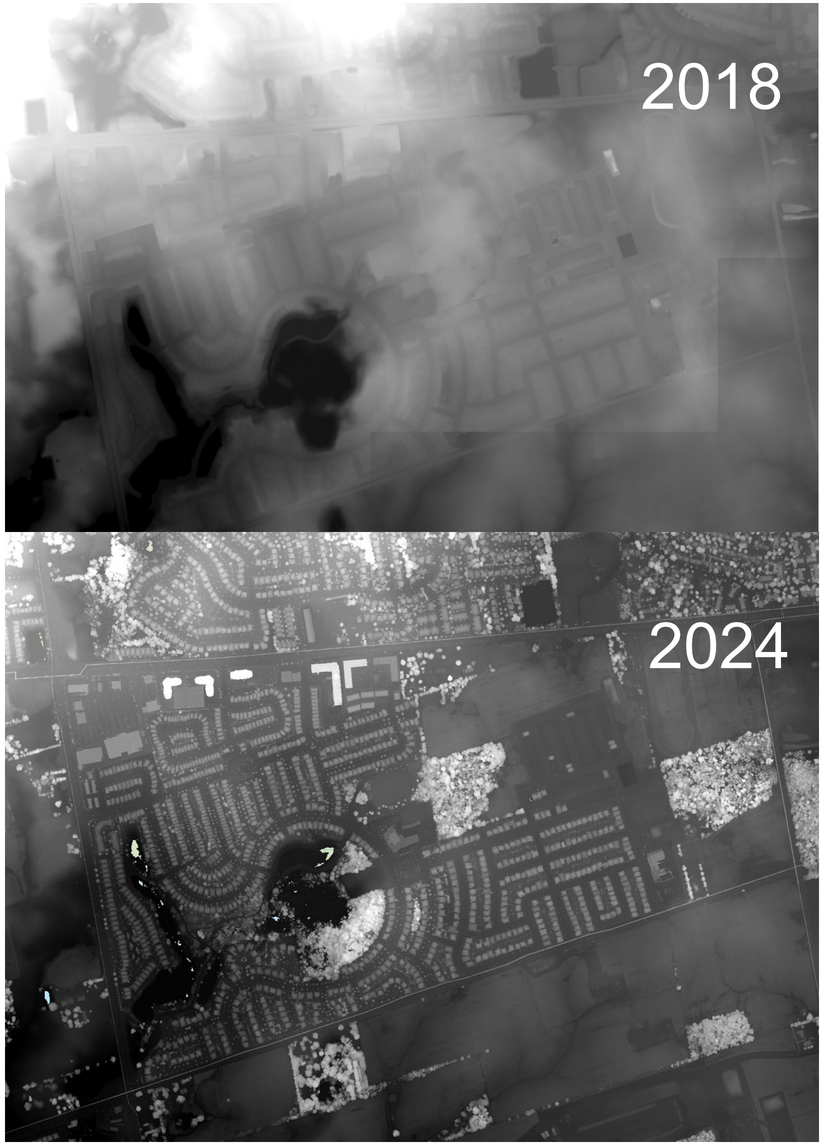
Integrated Urban Water Management

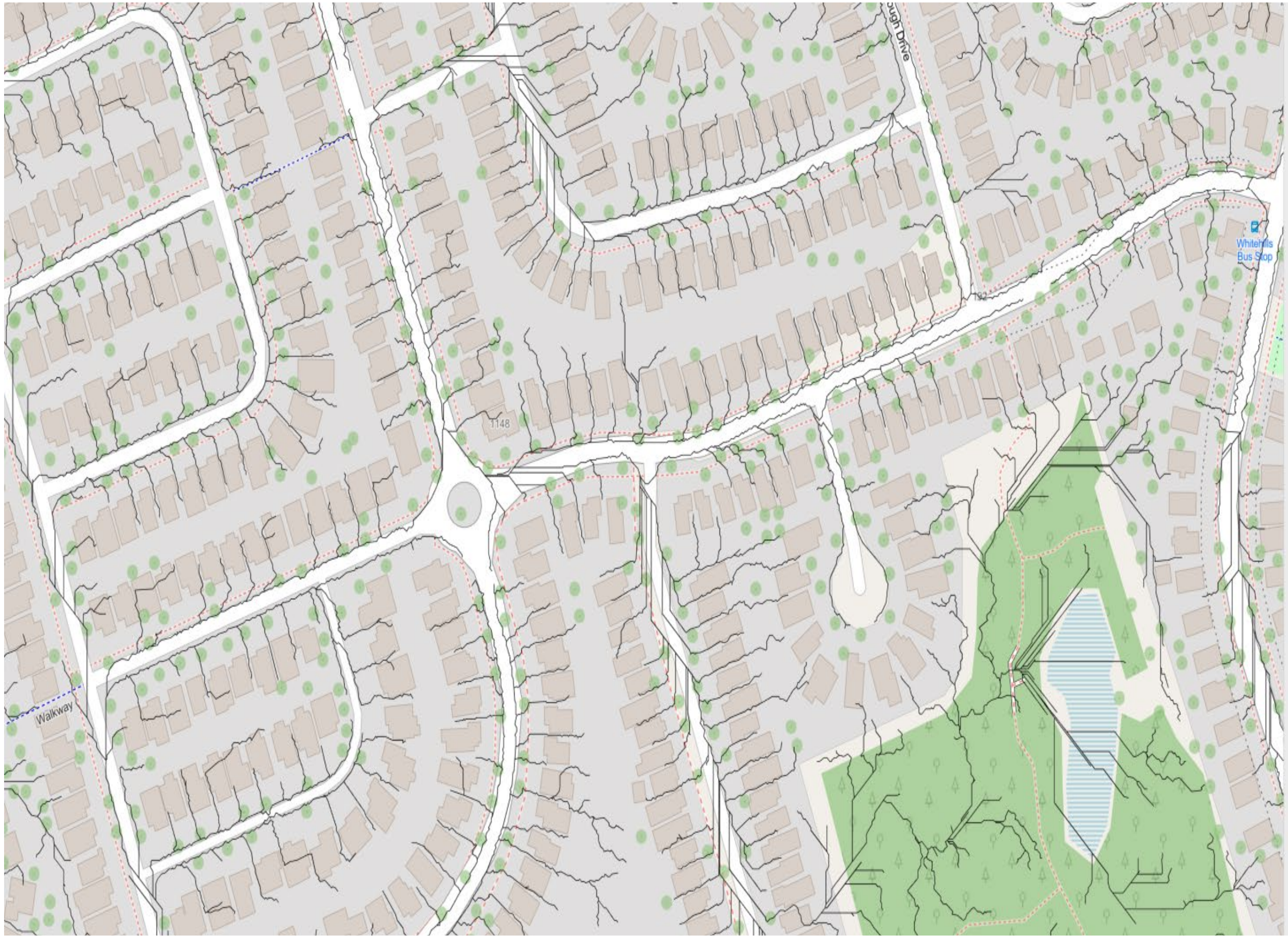
Low Impact Development, Climate Change

Advanced modelling (1D/2D), LiDAR

Machine Learning/ Artificial Intelligence

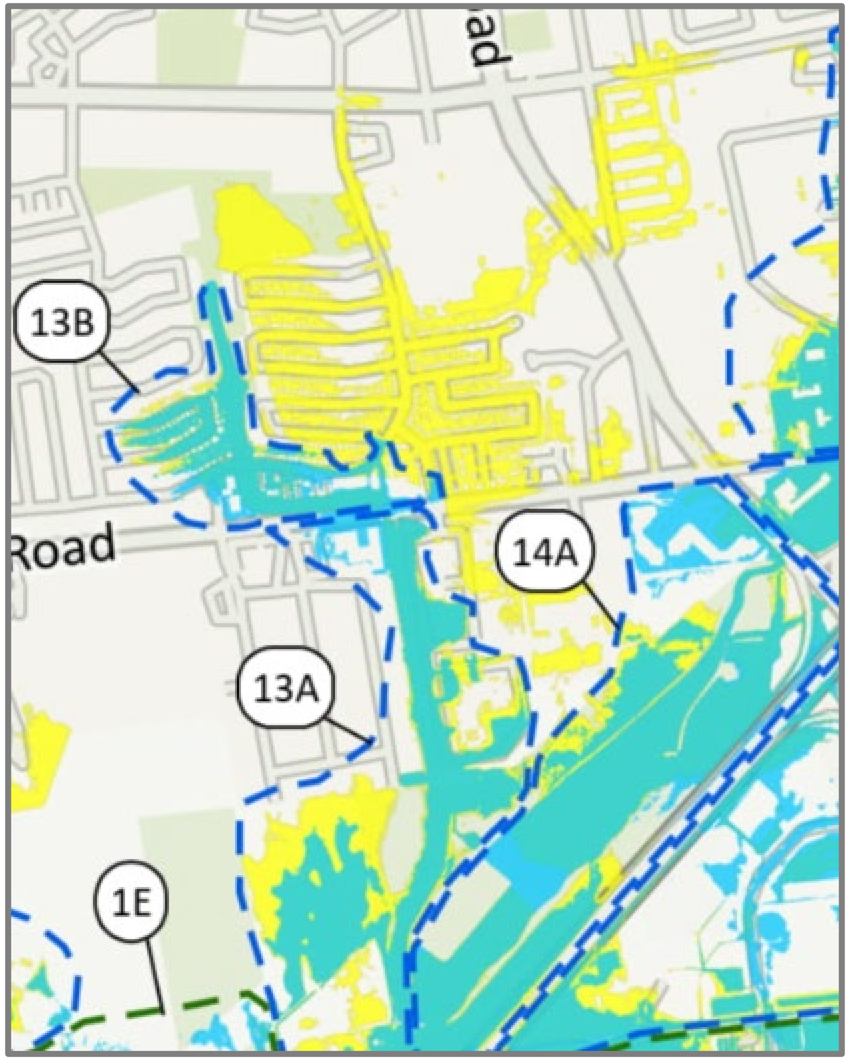
Flood Risk Management Projects: Overland Flow mapping





Advanced Modelling (1D vs 2D)

- Floodplain Defined based on 1D Model
- Floodplain Defined based on 2D Model
- Floodplain Defined based on Maximum of 1D and 2D Model
- Flood Inundation (1D Model)
- Flood Inundation (2D Model)

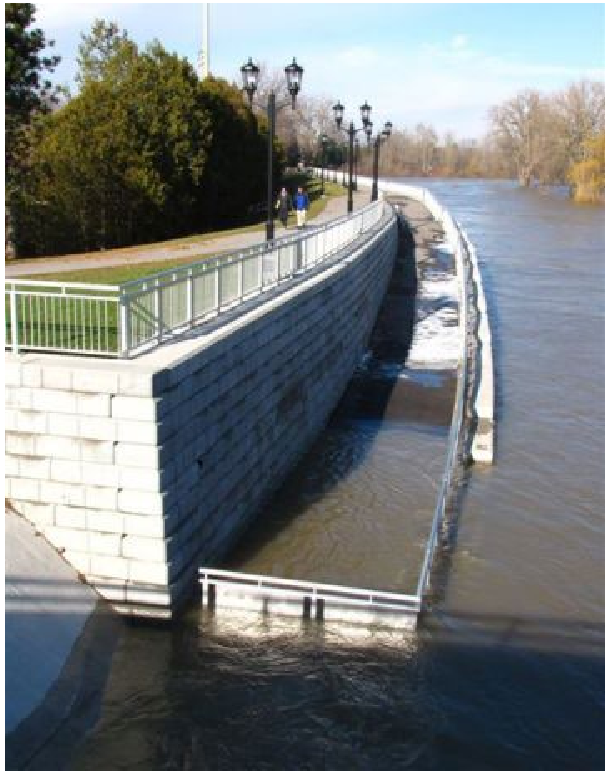


Flood Control: Uncontrolled vs. Controlled Flows

Fanshawe Dam & Reservoir

Culverts!

West London Dyke



Stormwater Management Ponds

Source: Upper Thames River Conservation Authority, https://thamesriver.on.ca/wp-content/uploads/FanshaweDam-brochure2011.pdf

Sustainable Infrastructure

Corporate Asset Management
(O. Reg. 588/17)
- SWM Inventory
- Lifecycle Budgets

+

Consolidated Linear **Infrastructure Environmental Compliance Approval**
(CLI-ECA)
- Operation and Maintenance
- Monitoring Plan

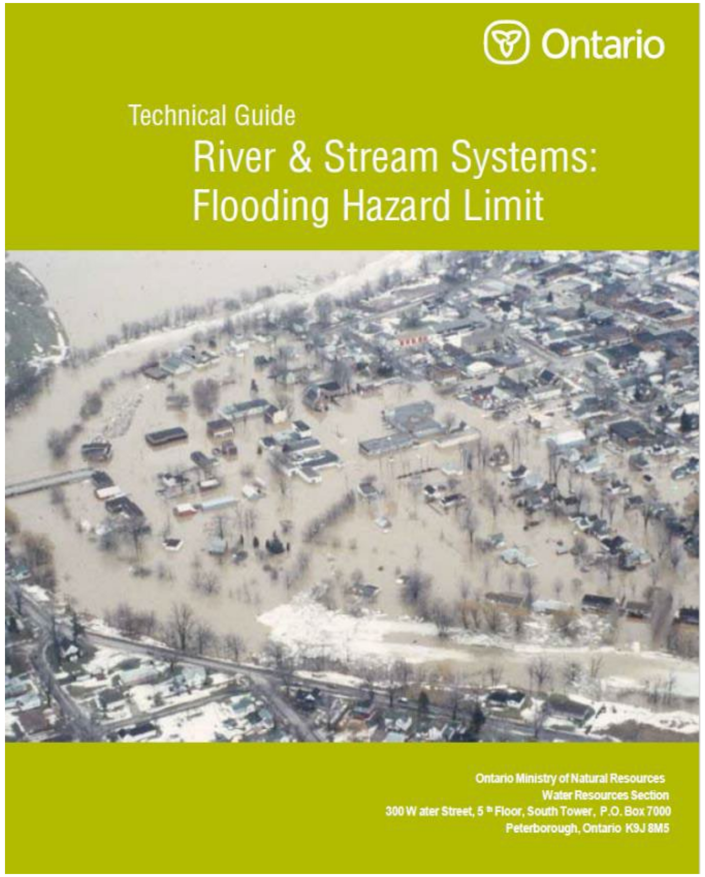
=

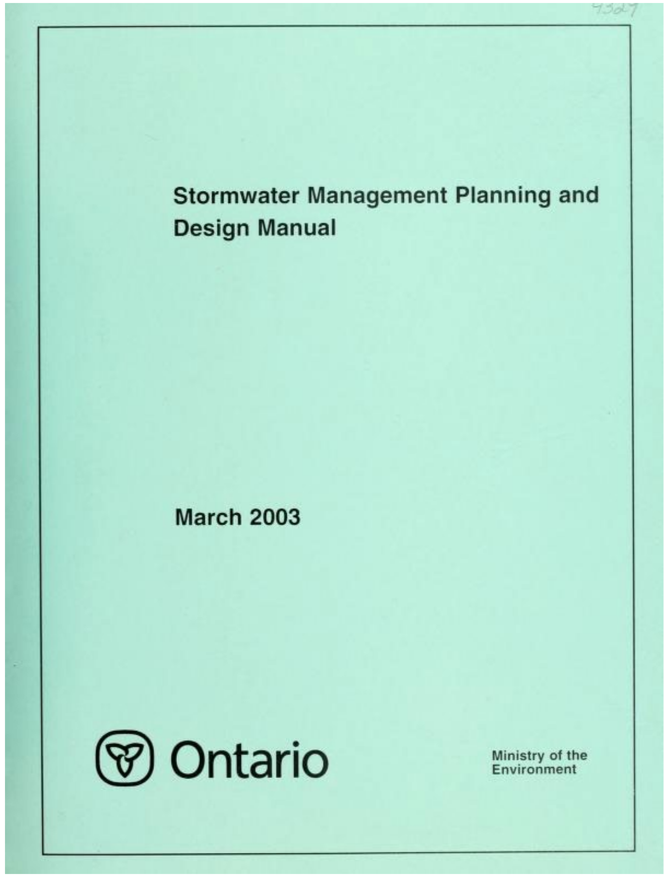
Sustainable and Reliable Municipal SWM Infrastructure

The 'Challenge'

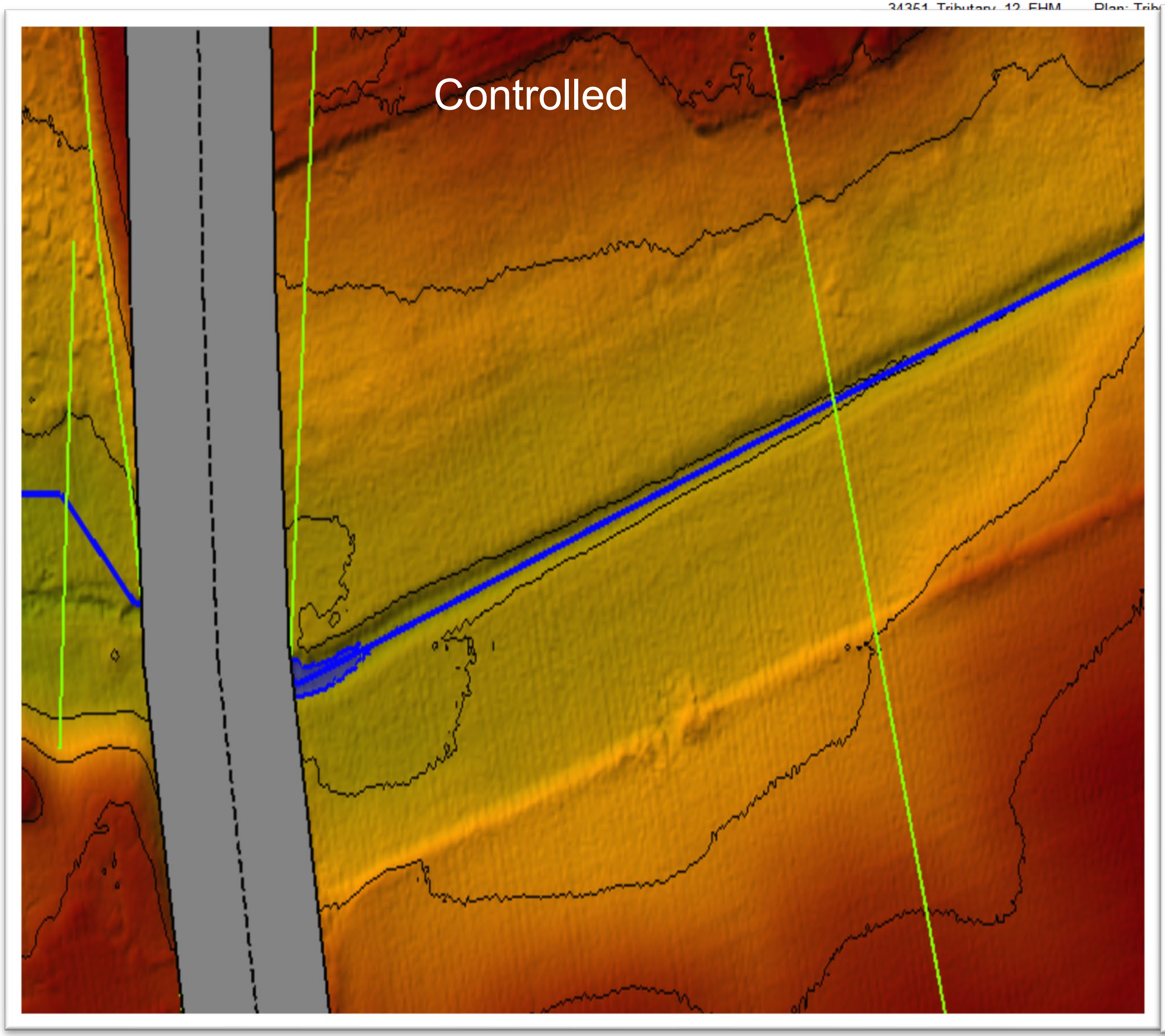
1. Gap between Guidelines and Industry Practices:
   - *Unregulated vs. Regulated* Flows for Flood Hazard mapping
   - *Uncontrolled vs. Controlled* Flows for municipal infrastructure sizing
   - *Dry access vs. safe access*
   - *Inconsistent credit* for infrastructure i.e.: stormwater management ponds

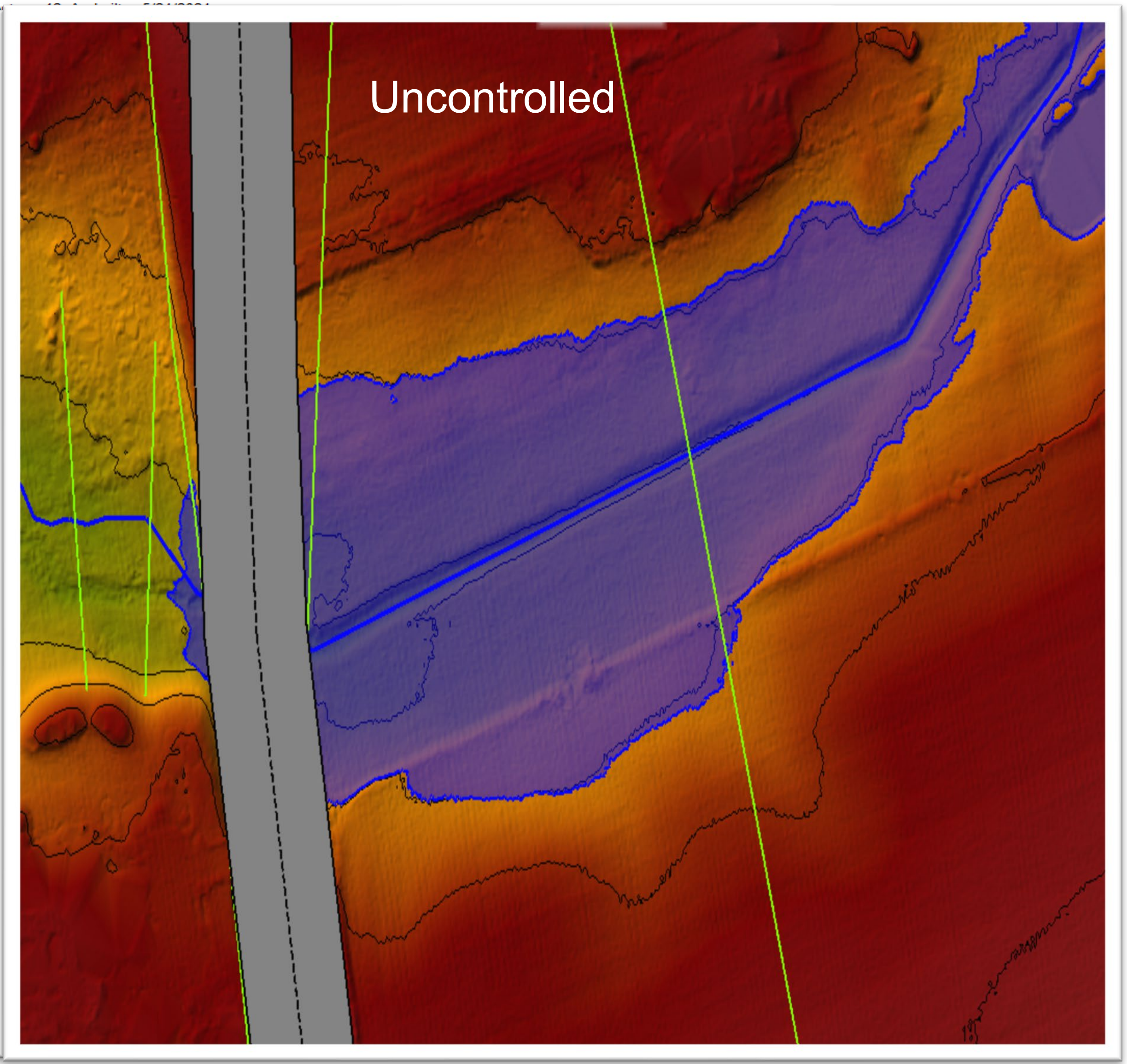
2. Lack of coordination between provincial agencies and conservation authorities:
   - Oversized infrastructure.
   - Increased spending by municipalities.





The ‘Challenge’

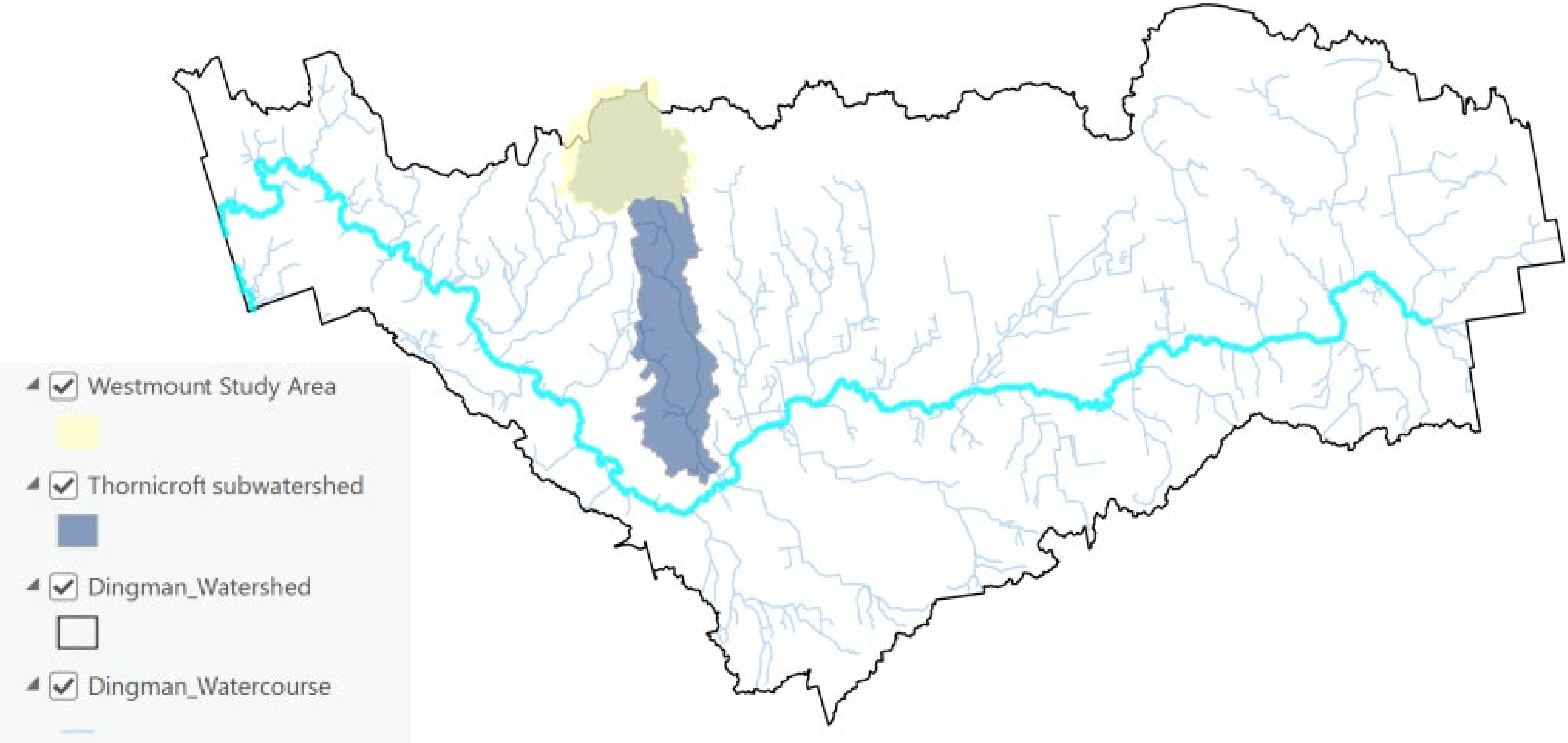




Modelling Project Objective

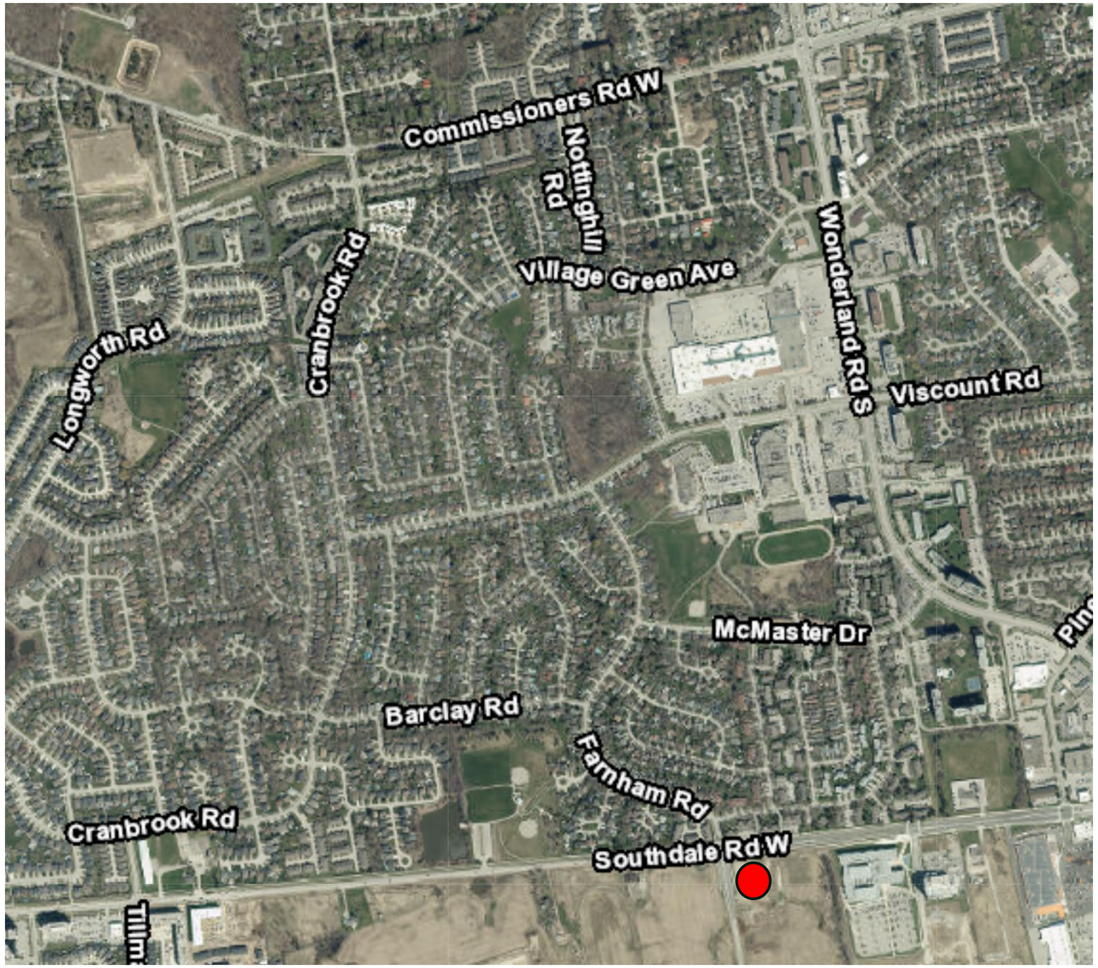
- Detailed headwater modelling as a means of flood risk mitigation
- Compare modelled vs monitored values
- Compare various models and results
- Determine a balance between risk, uncertainty and level of service

Pilot Project – Dingman Creek, Thornicroft Drain

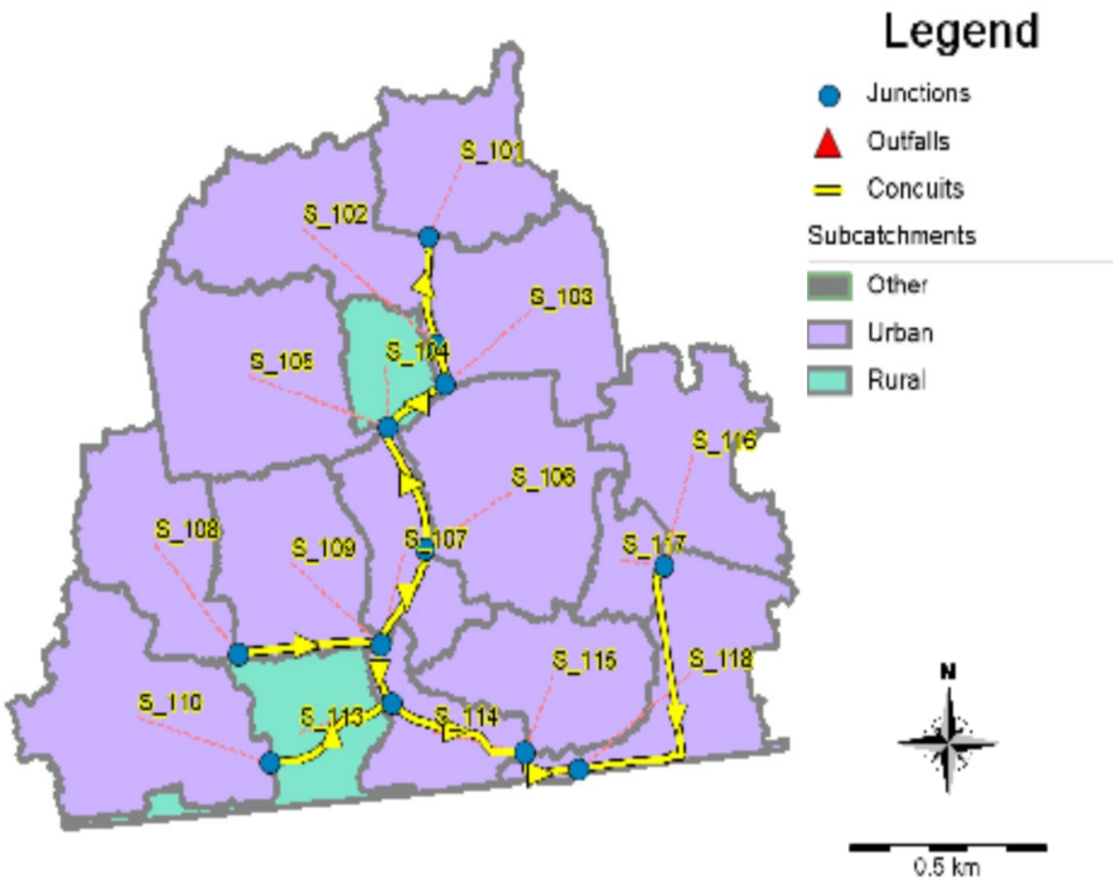


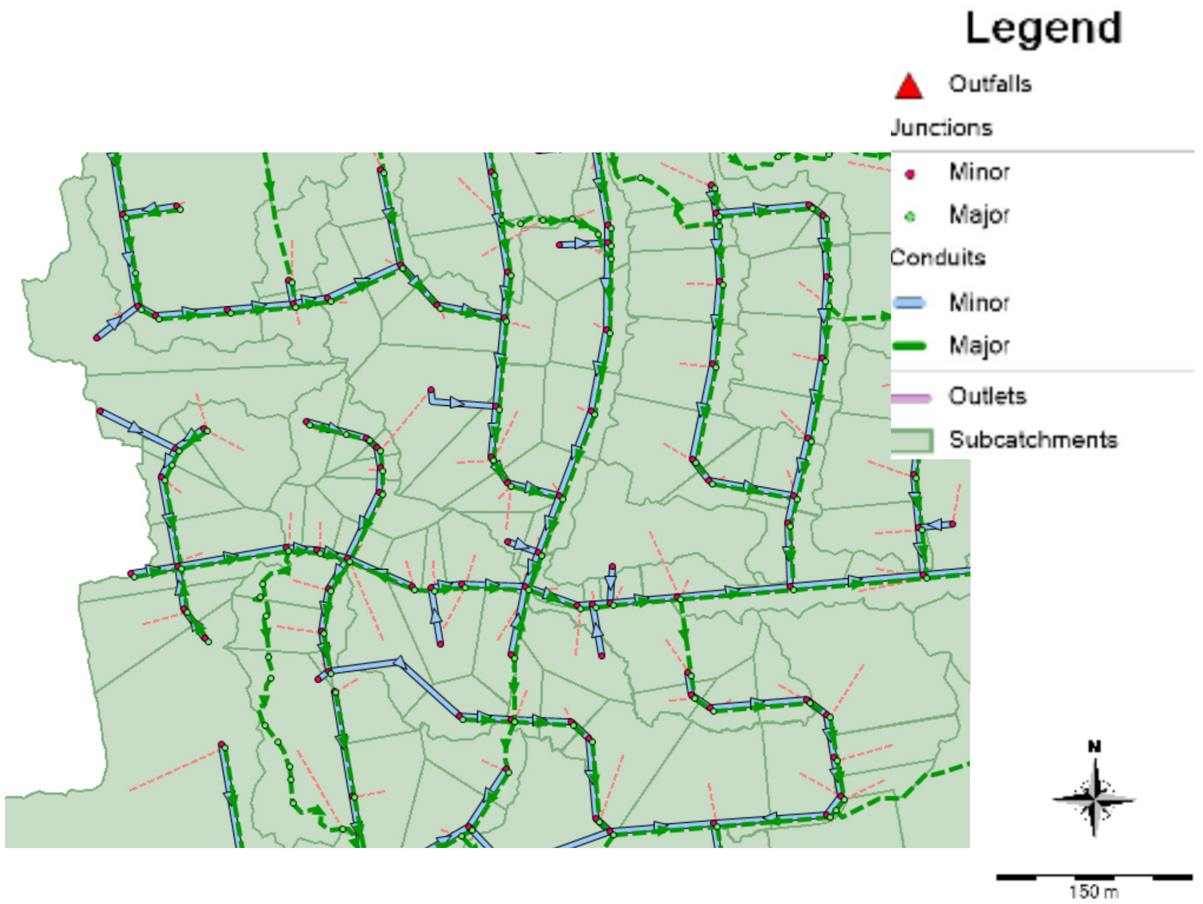
Urbanized Headwater Neighborhood 'Westmount'

- Urbanized neighborhood
- Built in the early 1970s
- Mostly piped stormwater conveyance (5-year design storm)
- Wet Pond treats 13% of the total headwater's drainage area
- Outlets to Thornicroft Drain

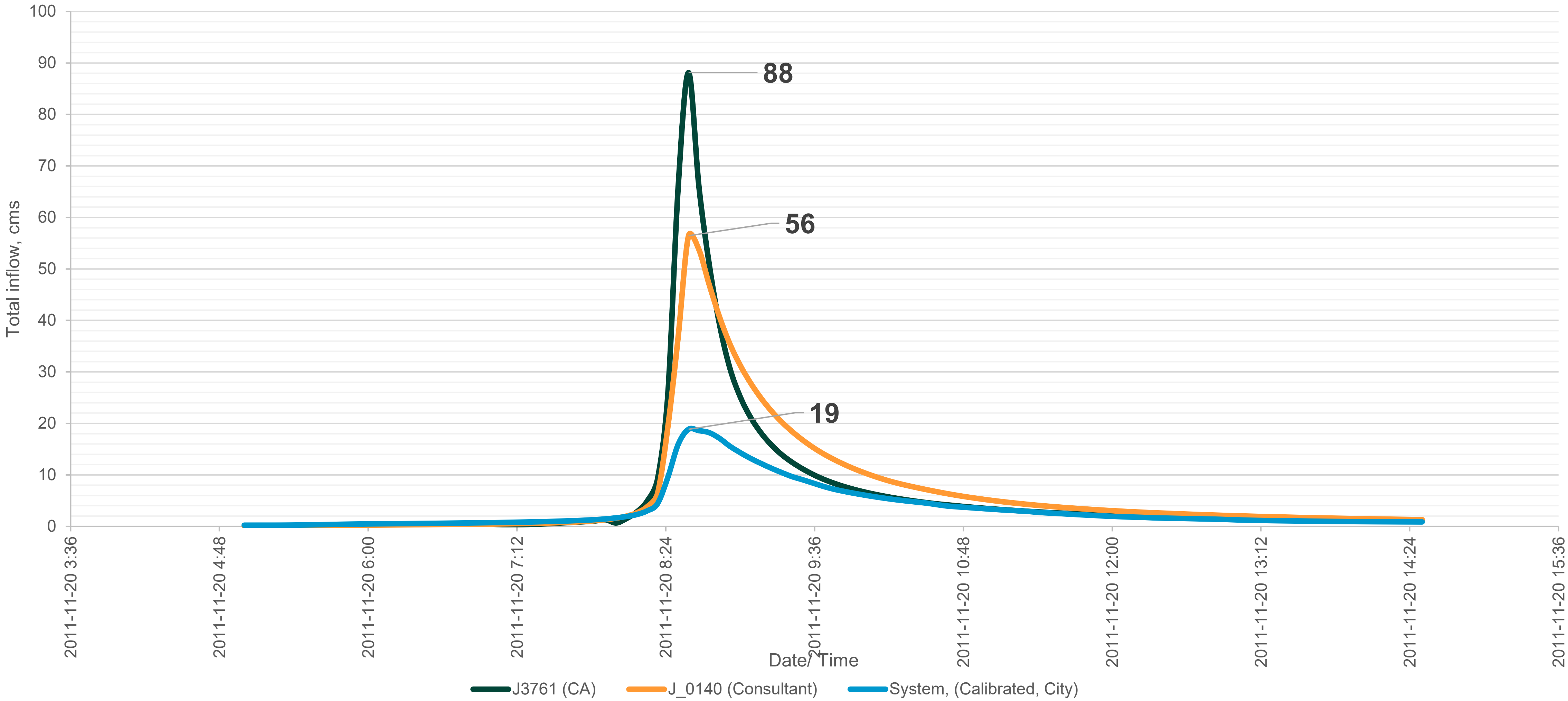


Drainage Area/ Modelling Scales

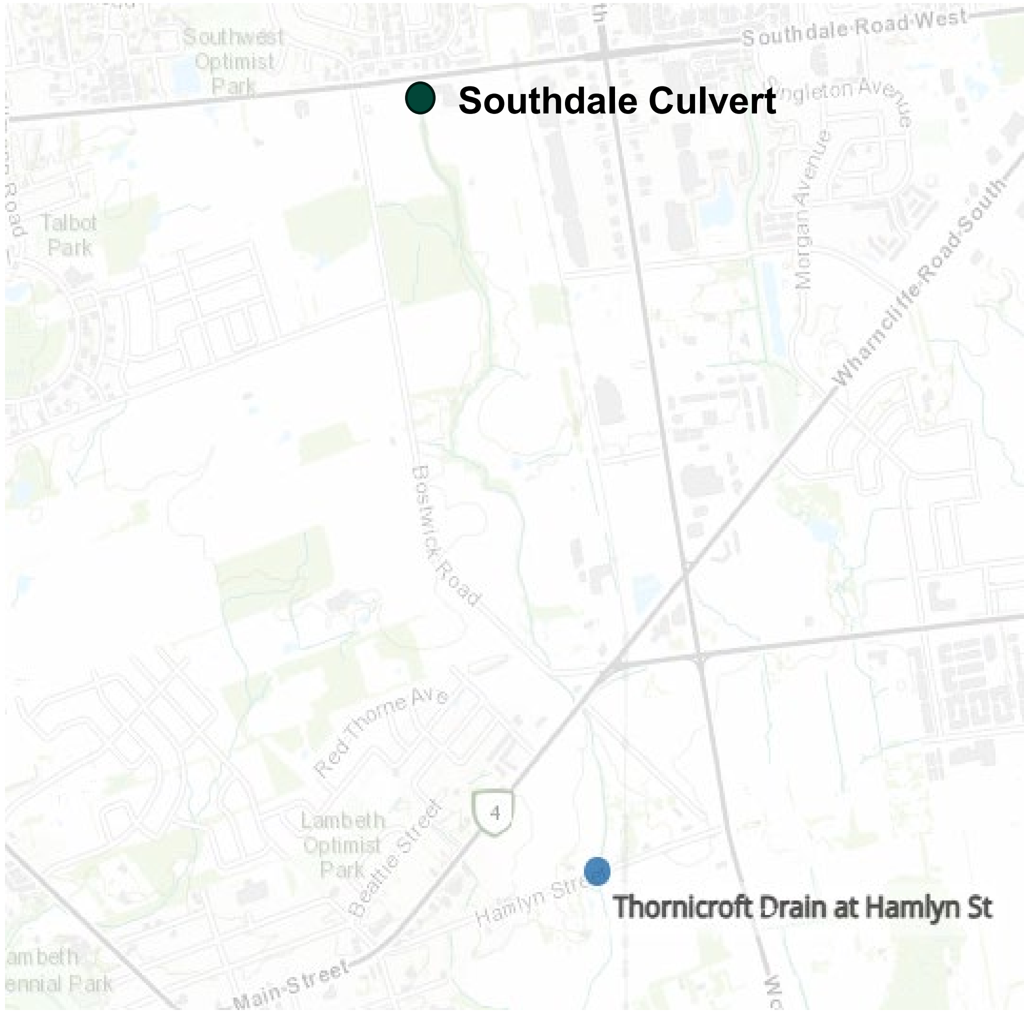


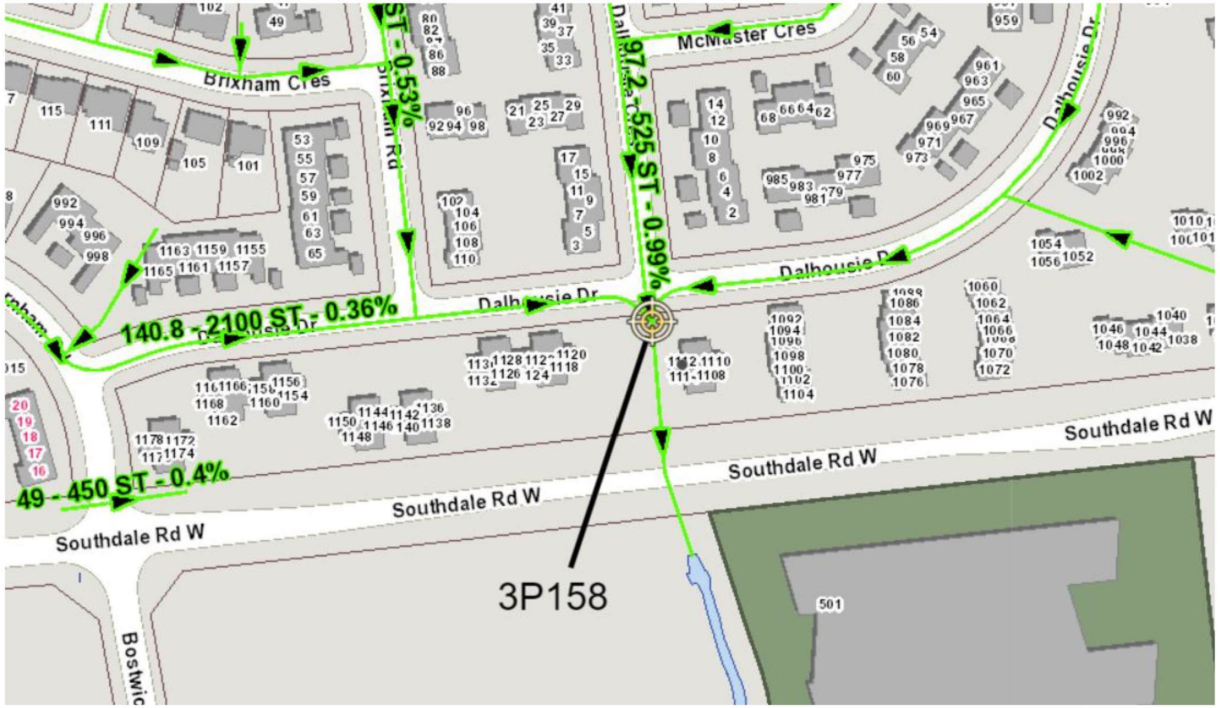


Varying Peak Flow Results (250yr Chicago 24hrs)

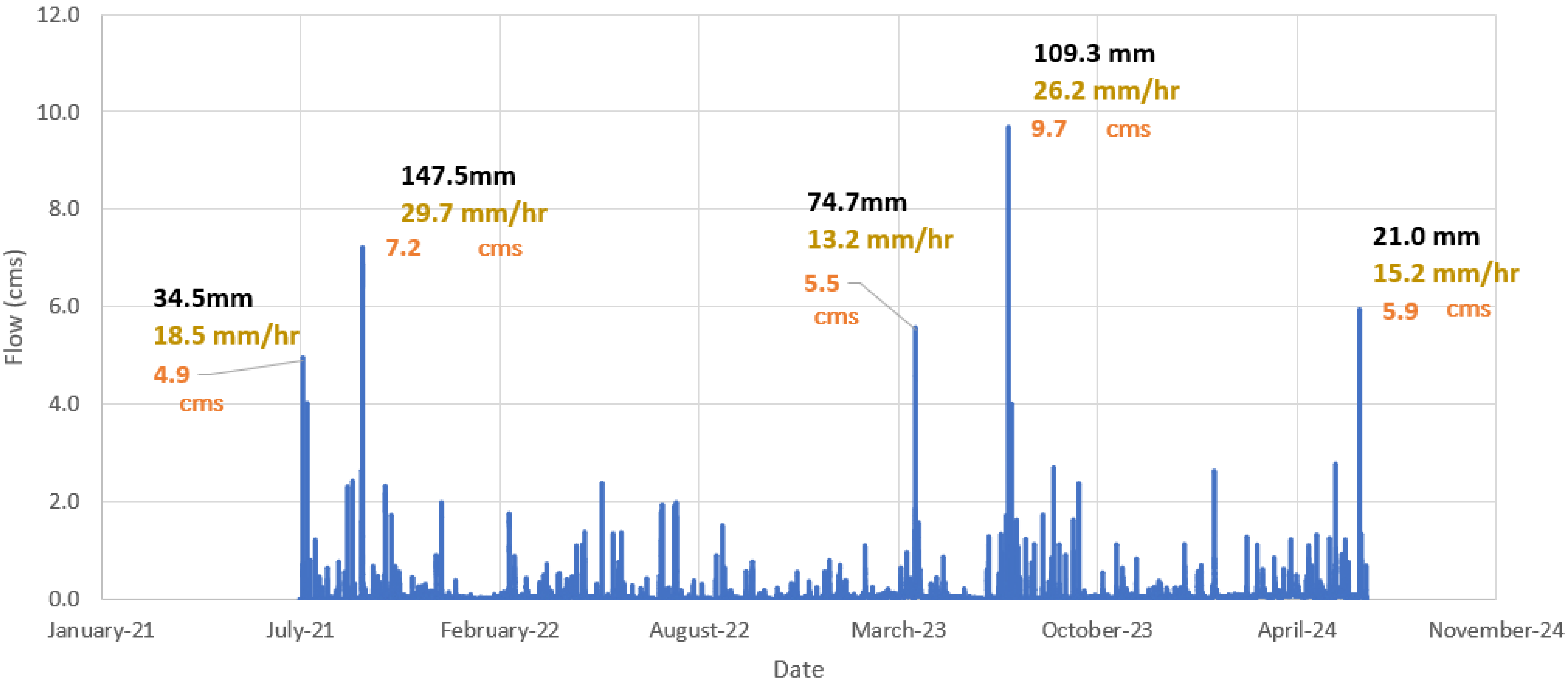


Monitored Peak Flows to Date





Southdale Rd – Monitored Flows (2021-2024)

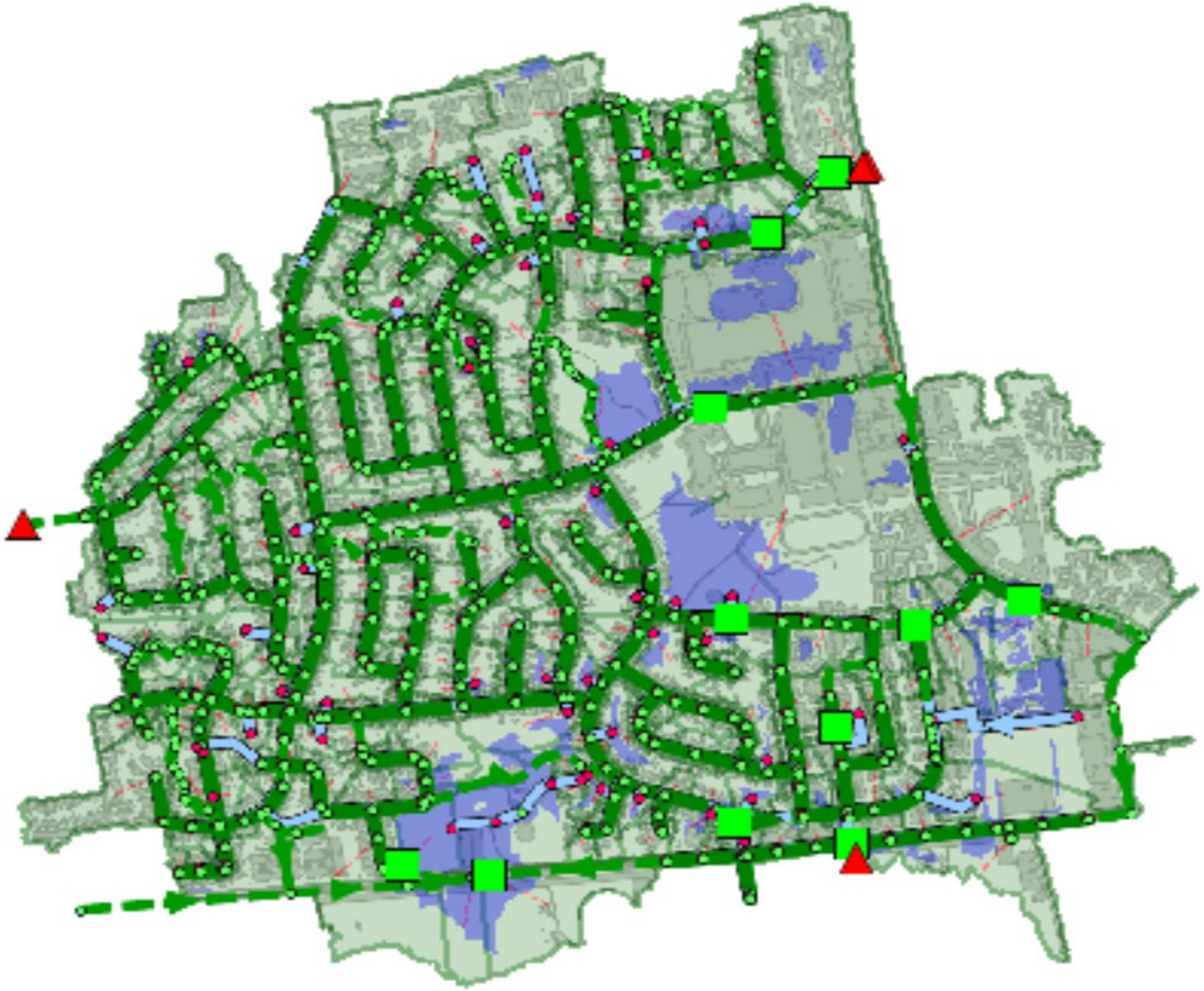


Modelling Approach Highlights

1. All models were set up in PCSWMM

2. PCSWMM Tools Used
   a) Watershed Delineation Tool
   b) Dual Drainage Creator
   c) Storage Creator

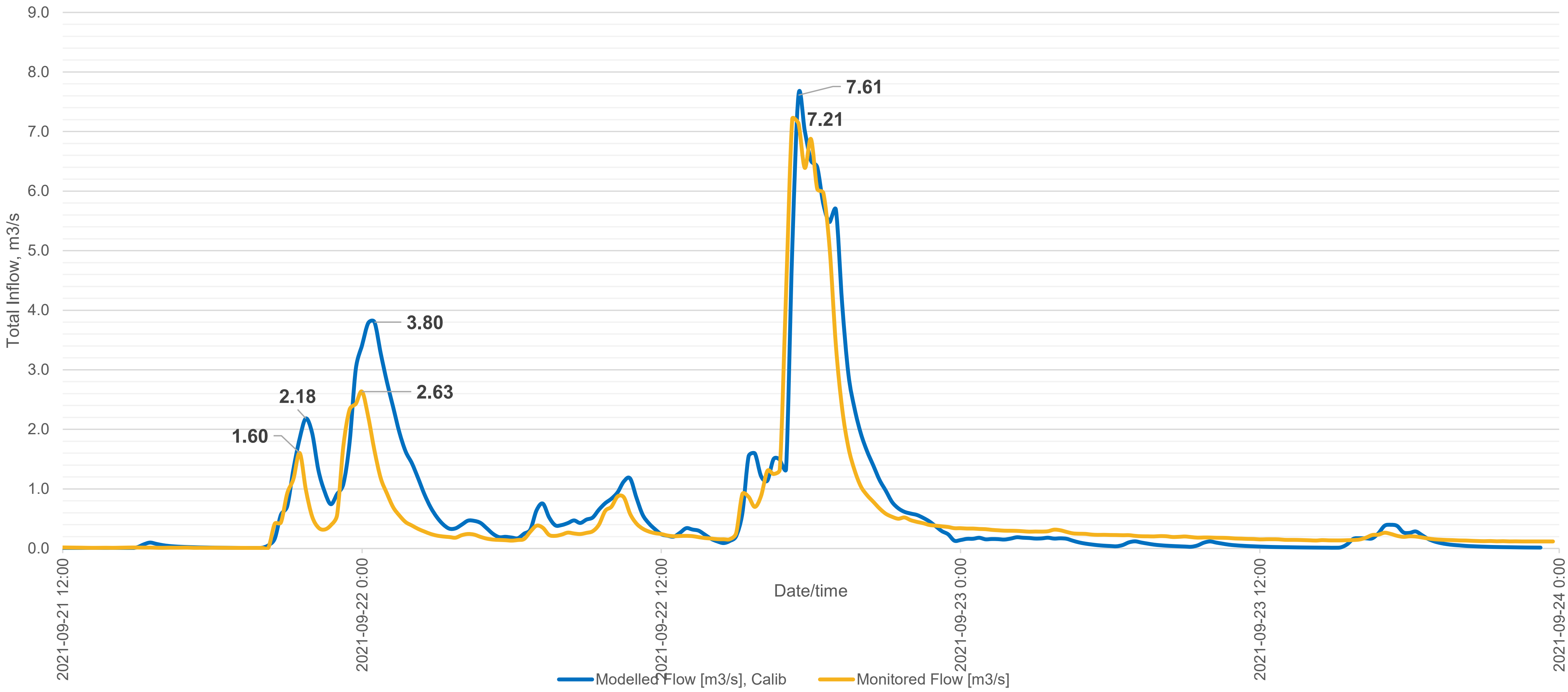
3. Modelled storage controls
   a) Catchbasins (outlet rating curve)
   b) Wet pond (pond storage curve, outlet rating curve)
   c) Pervious/ Impervious area storage (depression storage)



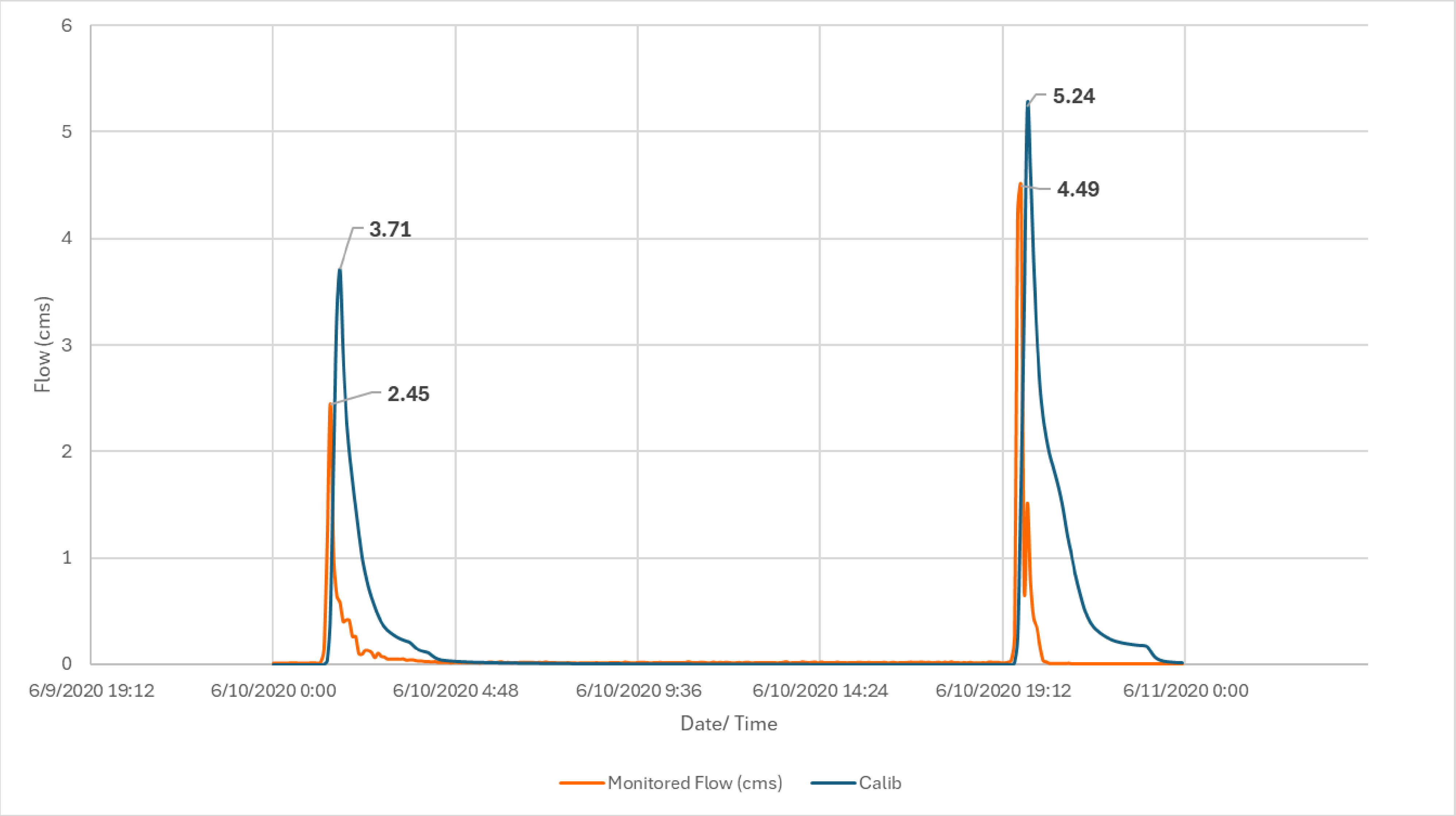
Adjusted Parameters for Calibration

1. Reduced imperviousness (80% of original value obtained from GIS)
2. Adjusted depression storage parameters
3. Reduced subcatchment width by 25%
4. Increased pipe roughness = 0.015 (Chow, 1959) for concrete sewers
5. Increased N perv to 0.30

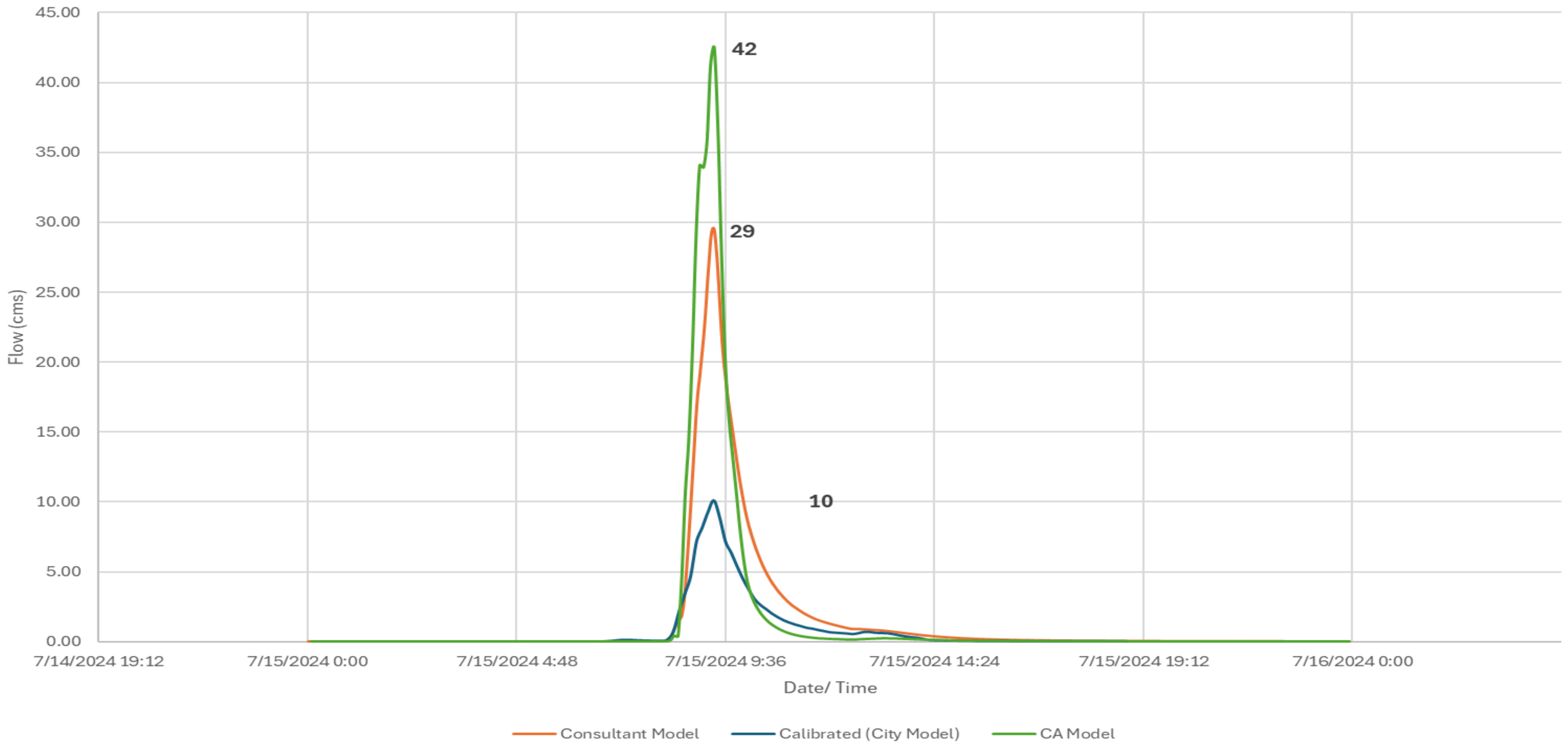
September 21, 2023 (Southdale Culvert)



June 10, 2020 (Storm Pipe, 3P158)



July 15, 2024 (Hamlyn St Culvert)



London CANADA

Infrastructure Costing

Project/ Tributary Name	Flow Capacity (cms)	Culvert Size (m x m)	Total Cost
White Oaks Drain	92	16.1 x 1.2	$5,000,000
Thornicroft Drain	60	12.8 x 3.4	$2,200,000
White Oak Tributary	38	4.2 x 1.8	$1,500,000
Trib 12	26	2.7 x 3	$1,400,000
Trib 12	26	2.4 x 1.8	$450,000
Anguish Drain	15	3.0 x 1.8	$250,000
Pebble Creek (Multi-use pathway)	<5	2.4 x 1.5	$200,000

Wrap up

Not financially sustainable to continue outdated practices and assumptions.

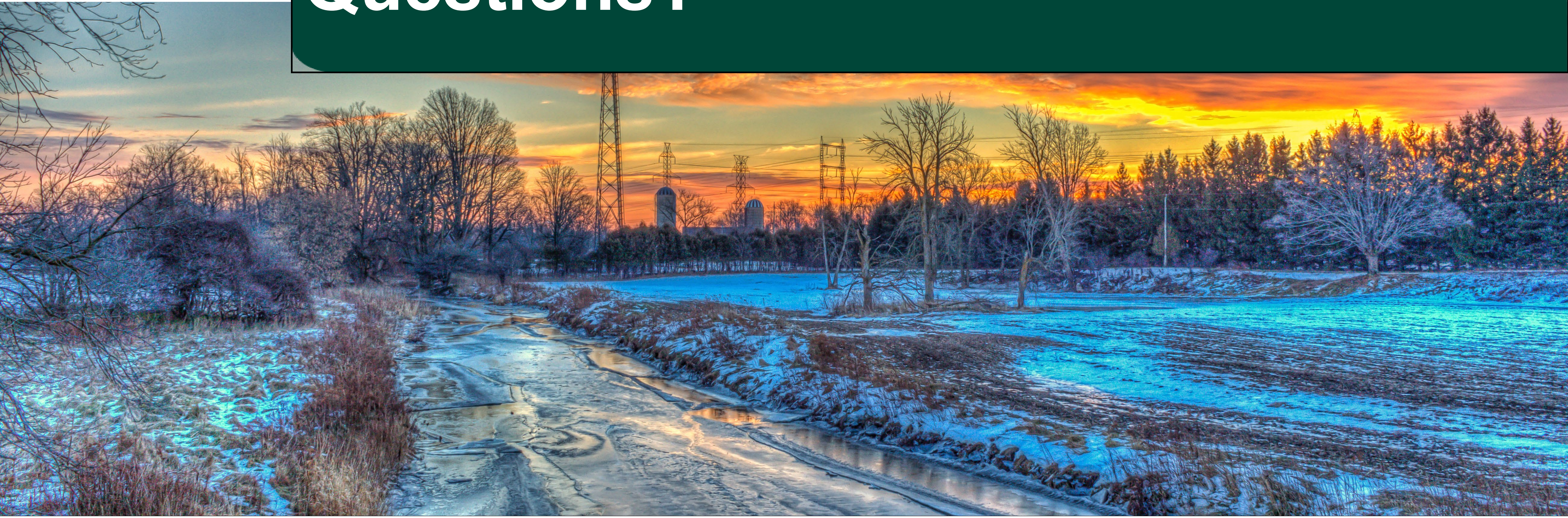
Ground-truthing, calibration, and **engineering judgement** are critical to apply to modelling.

Document work to be **defensible and reproducible** by other professionals.

Flexibility from CAs/Province to accept industry practices **or update guidelines** for flood infrastructure.

Source: Slide Team. https://www.slideteam.net/lesson-learned-icon-bulb-with-brain.html

Questions?



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