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

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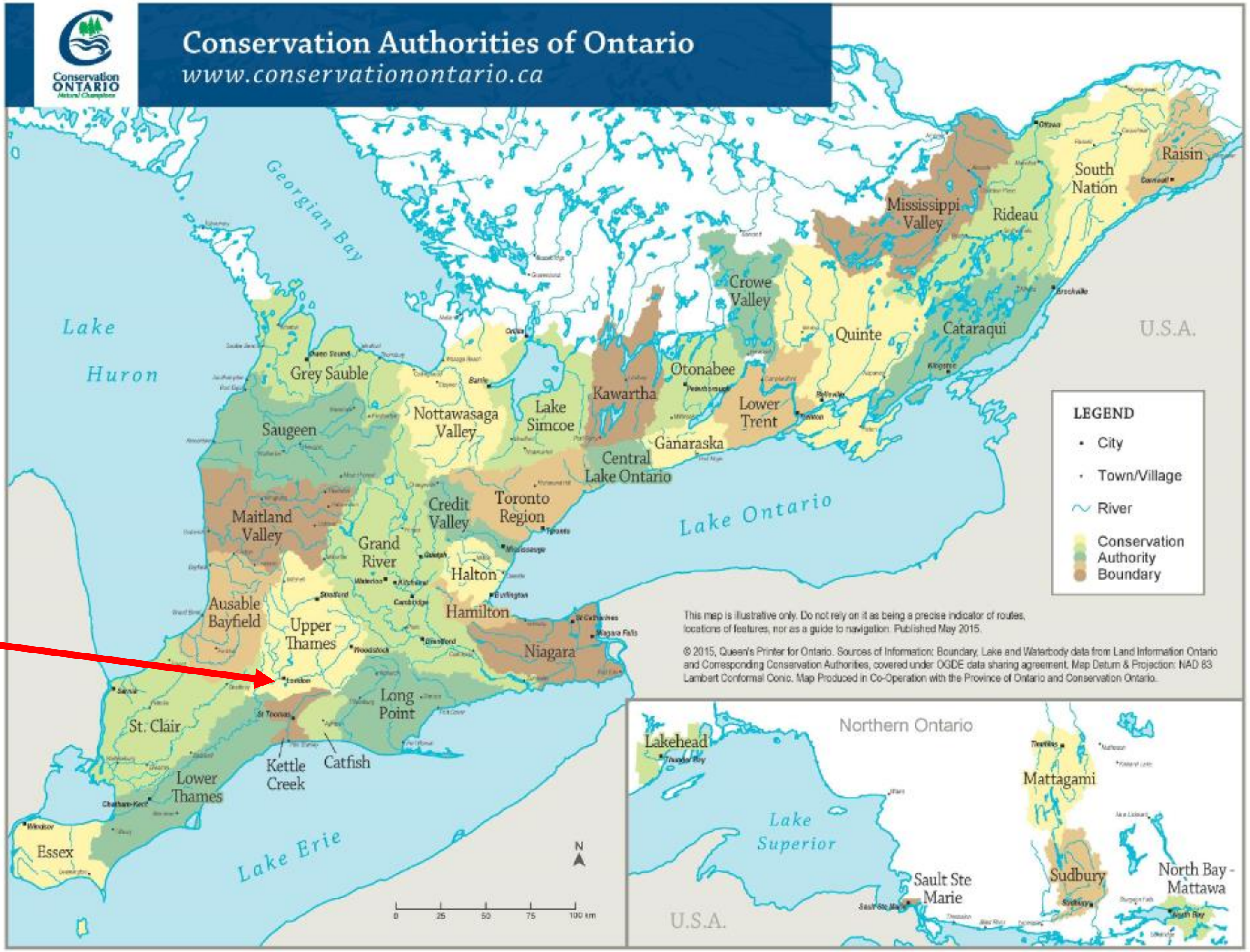
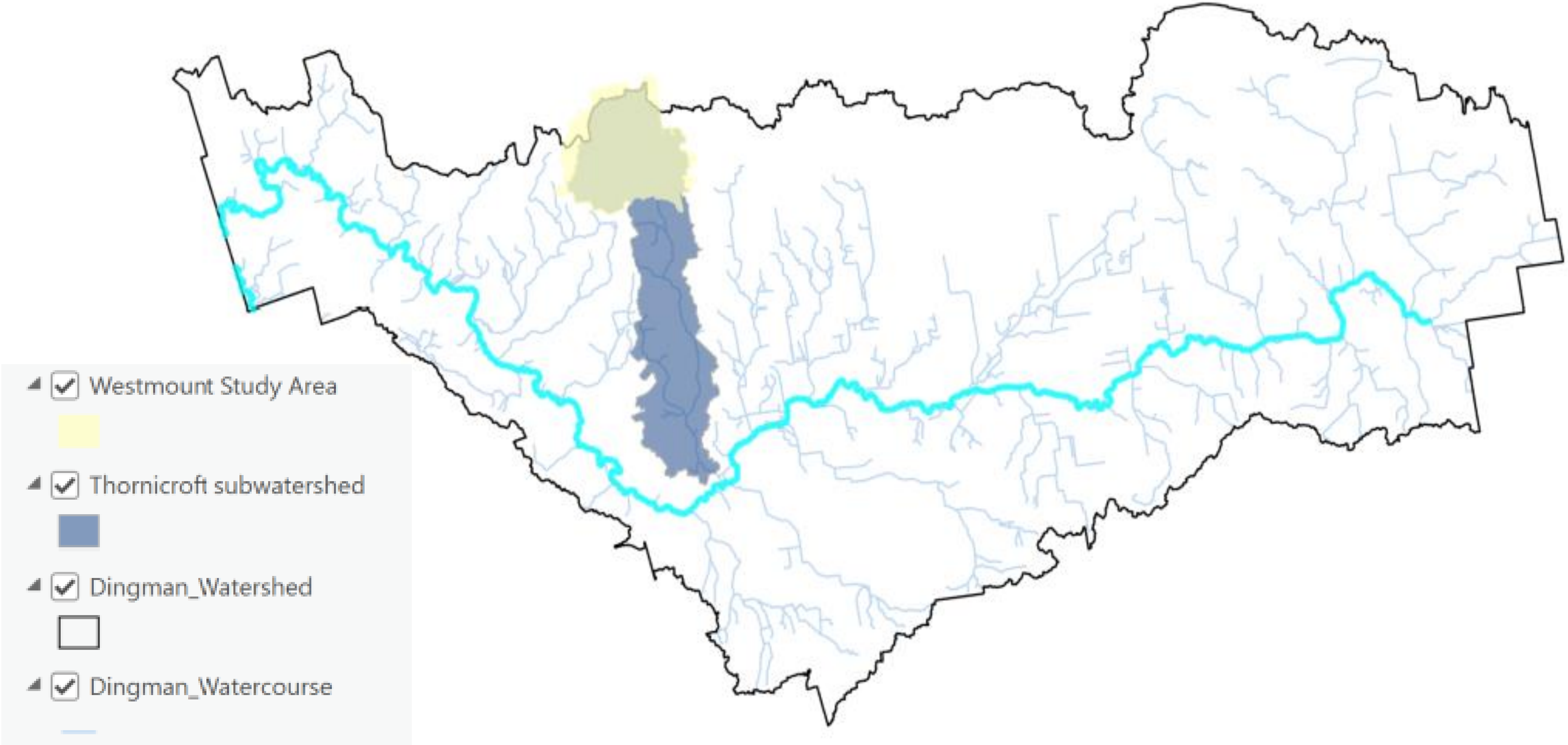
Outline

1. City of London
2. Study Area
3. Problem Statement
4. Modelling Approach and Results
5. Infrastructure Costs
6. Lessons Learned
7. Questions

Where is City of London?

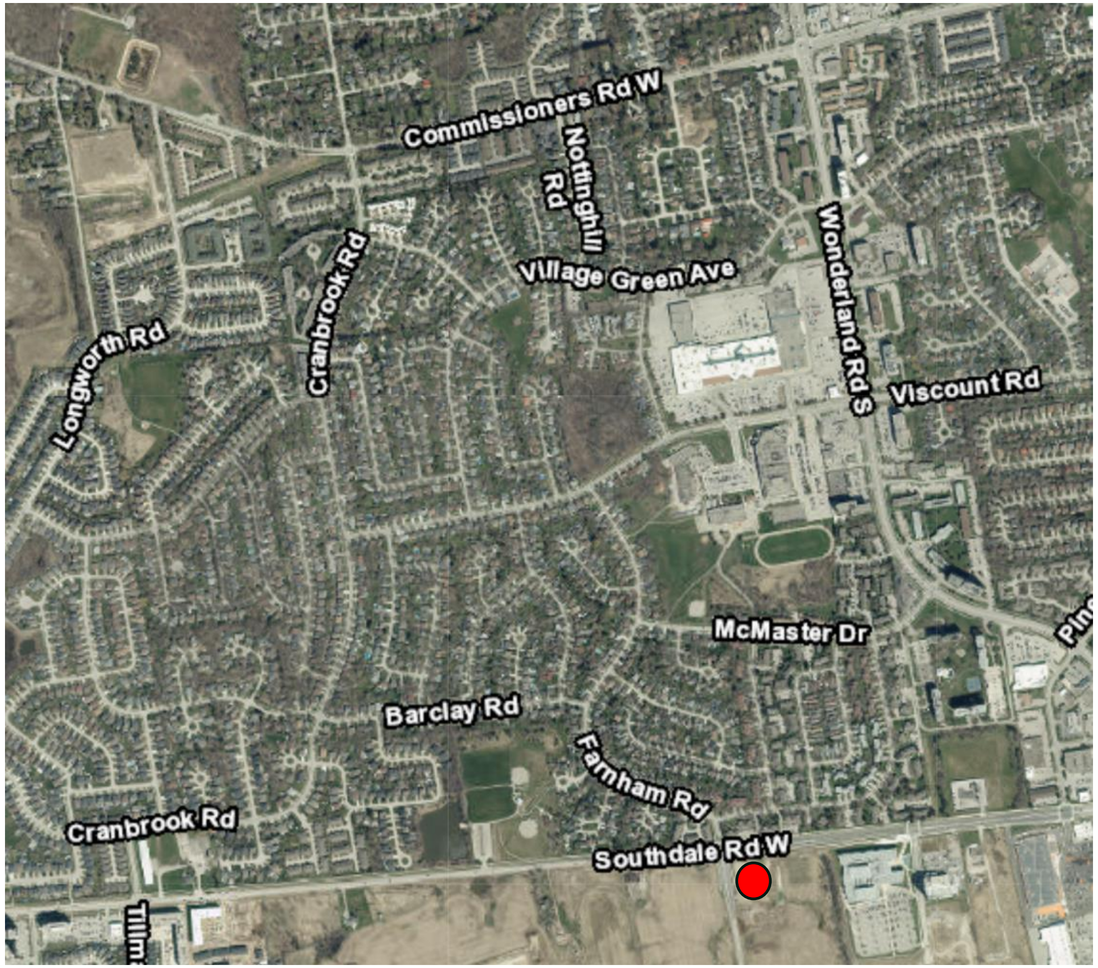


Pilot Project – Dingman Creek, Thornicroft Drain



Urbanized Headwater Neighbourhood ‘Westmount’

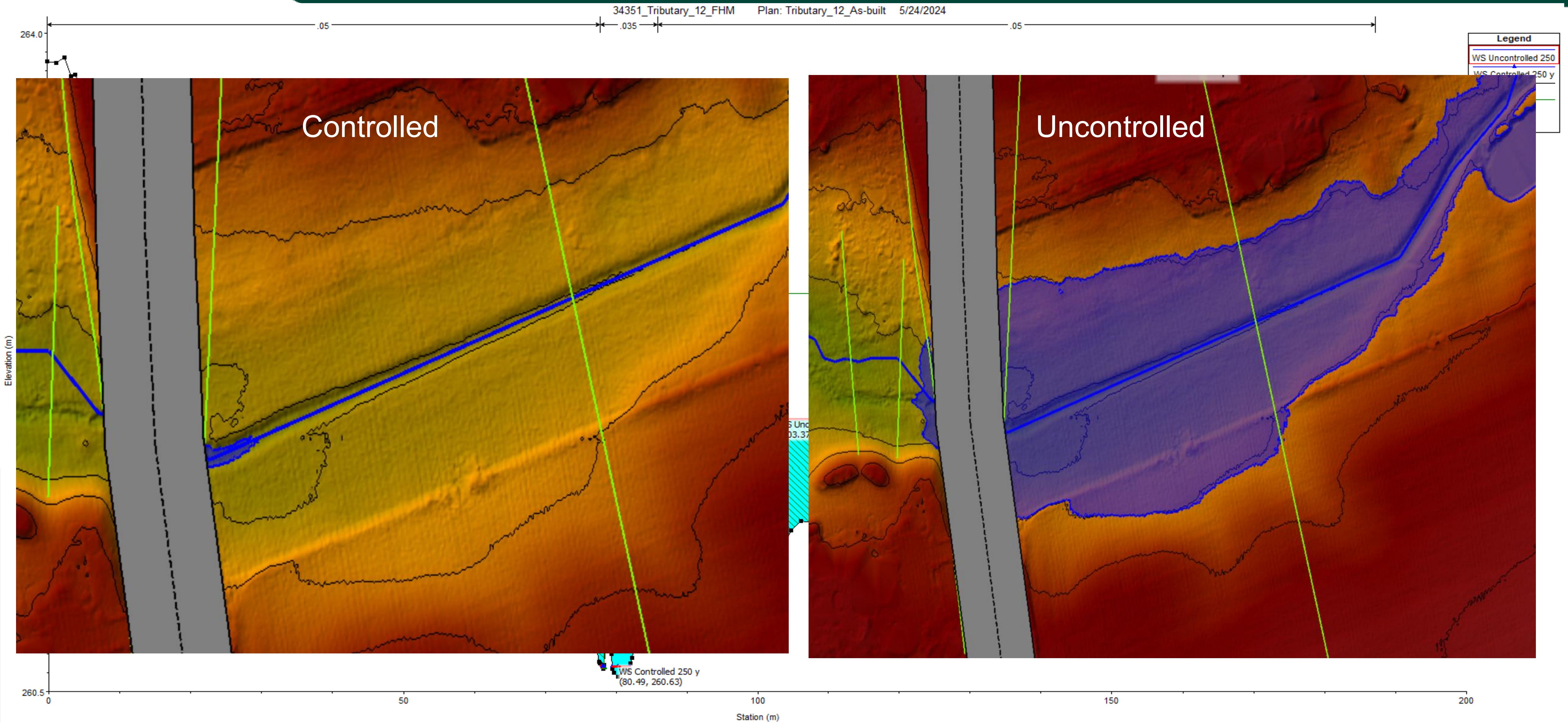
- Urbanized neighbourhood
- Built in the early 1970s
- Mostly piped stormwater conveyance (5-year design storm)
- Wet Pond treats 13% of the total headwater's drainage area
- Outlets to Thornicroft Drain



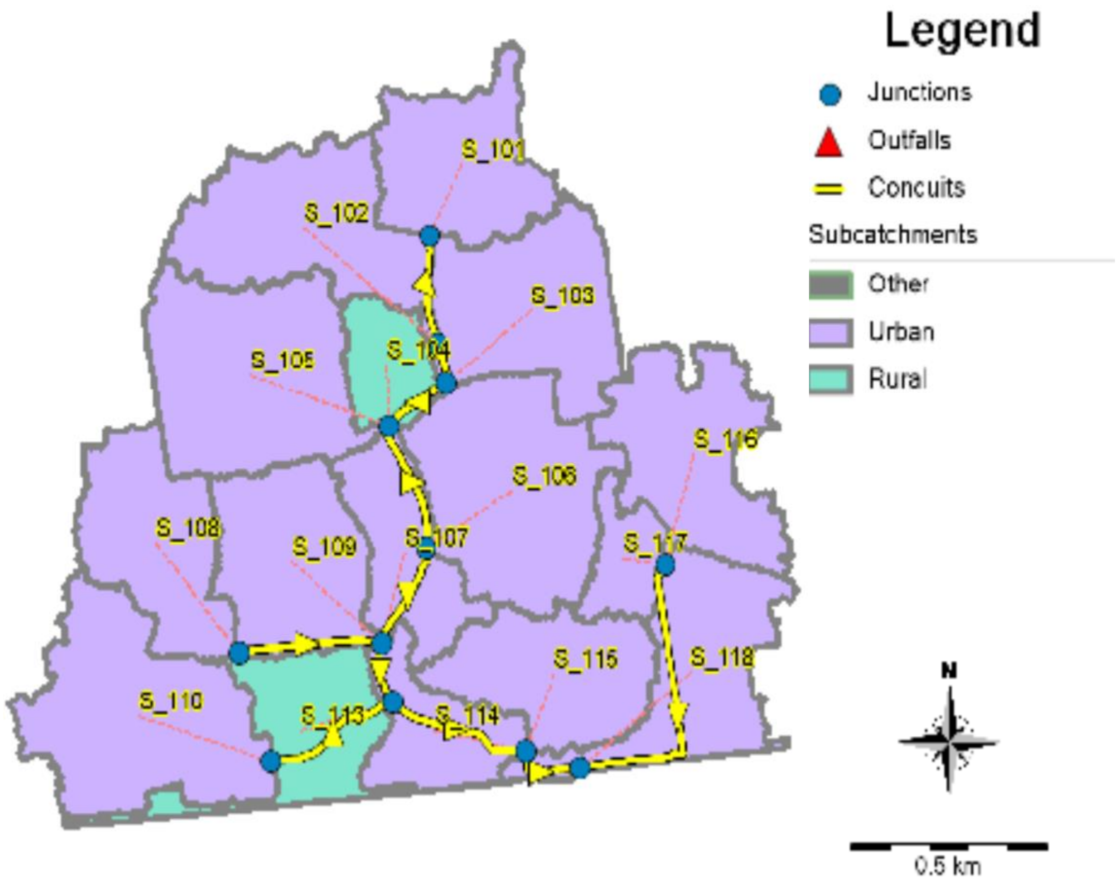
What is the purpose of this Pilot?

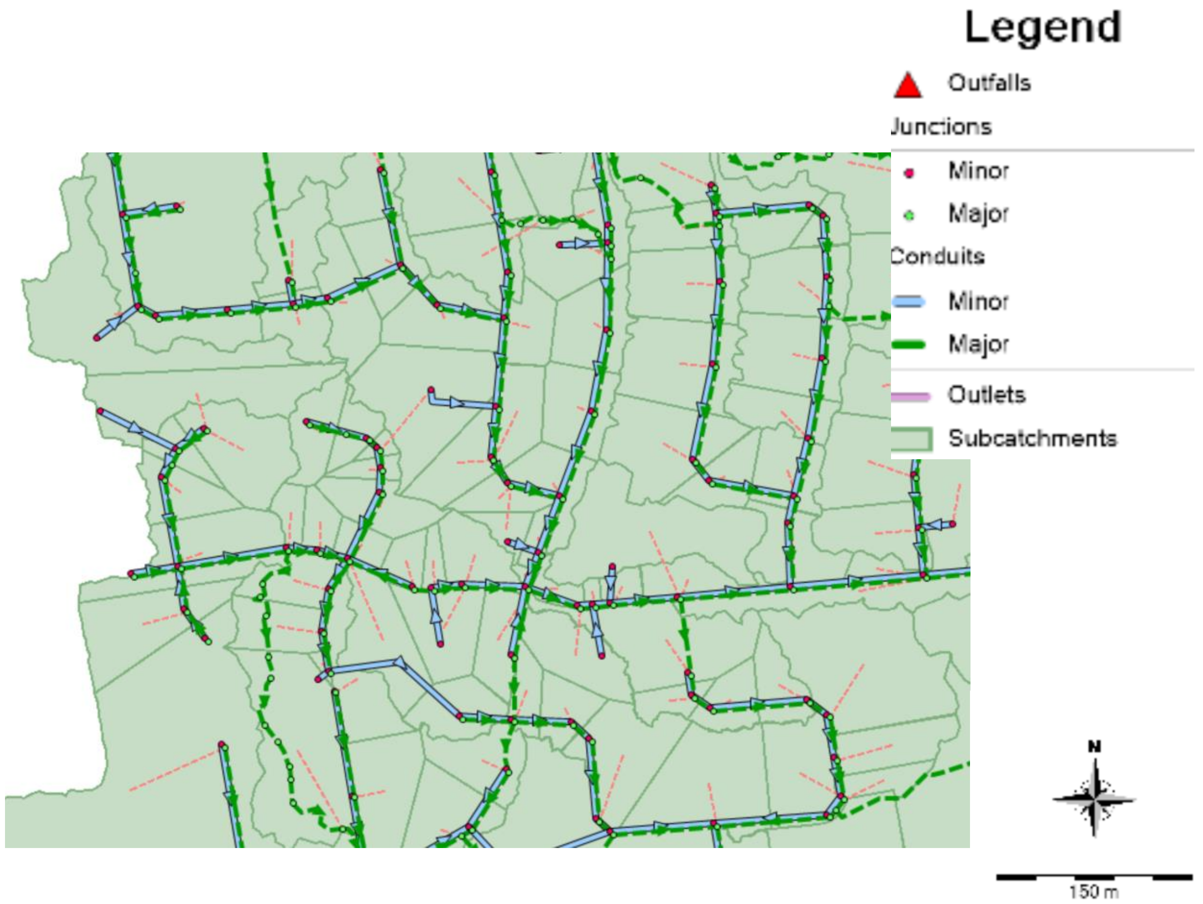
- Determine the ‘actual’ flows
- Investigate the varying range of peak flows
- Determine a balance between risk, uncertainty and level of service

Example Project

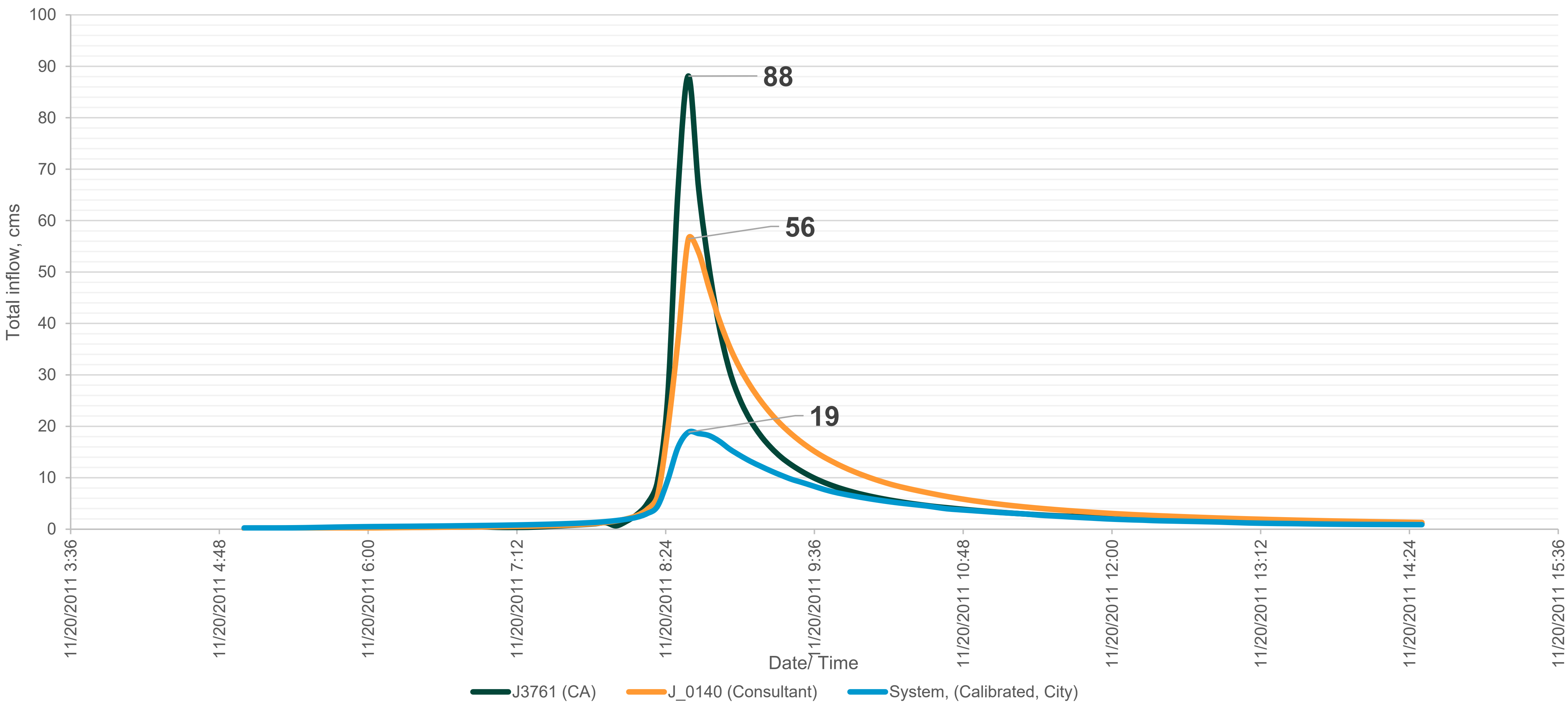


Drainage Area/ Modelling Scales

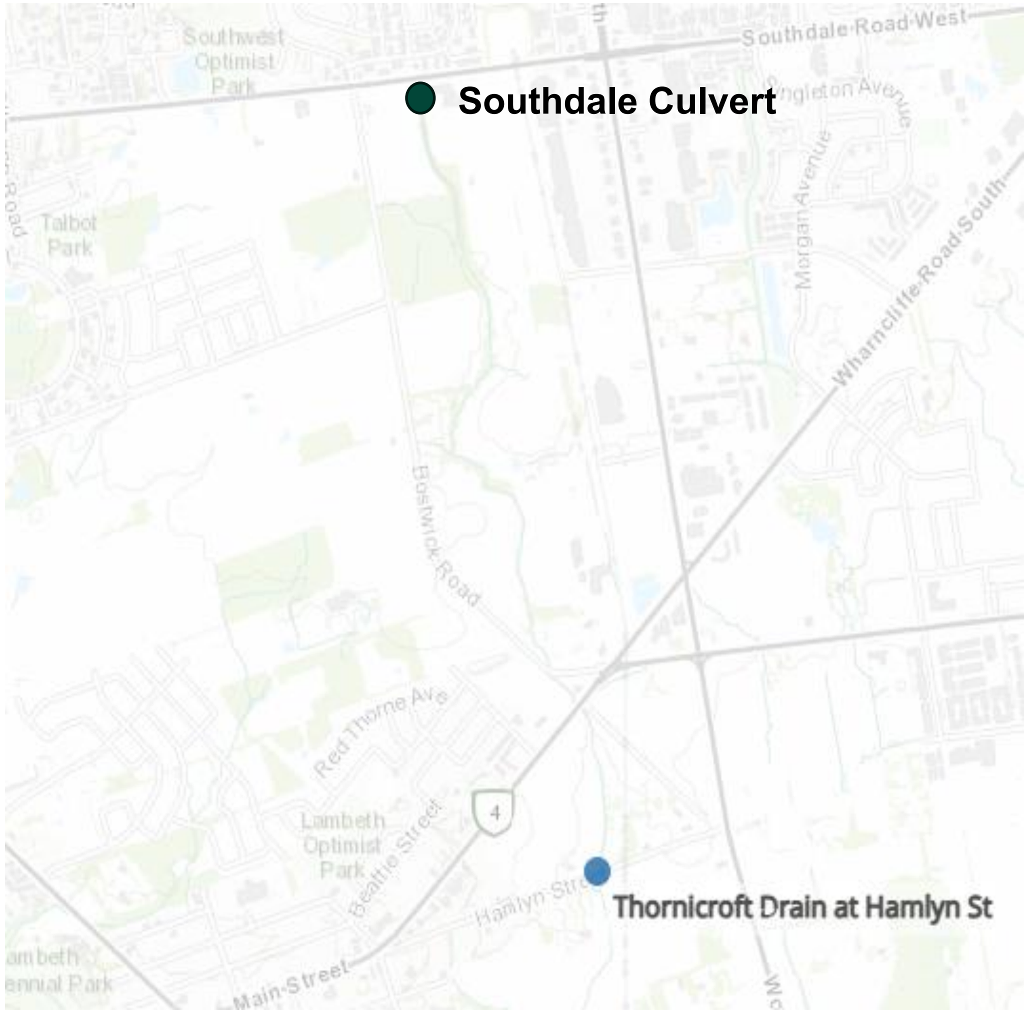


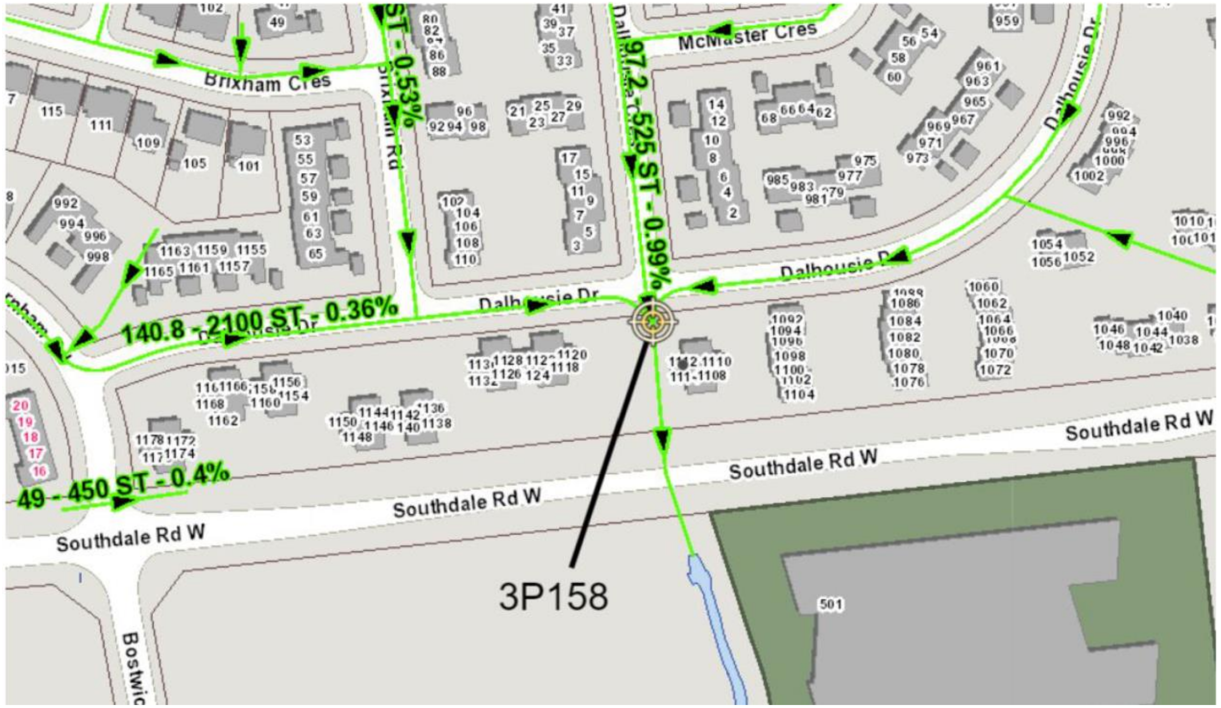


Varying Peak Flow Results (250yr Chicago 24hrs)

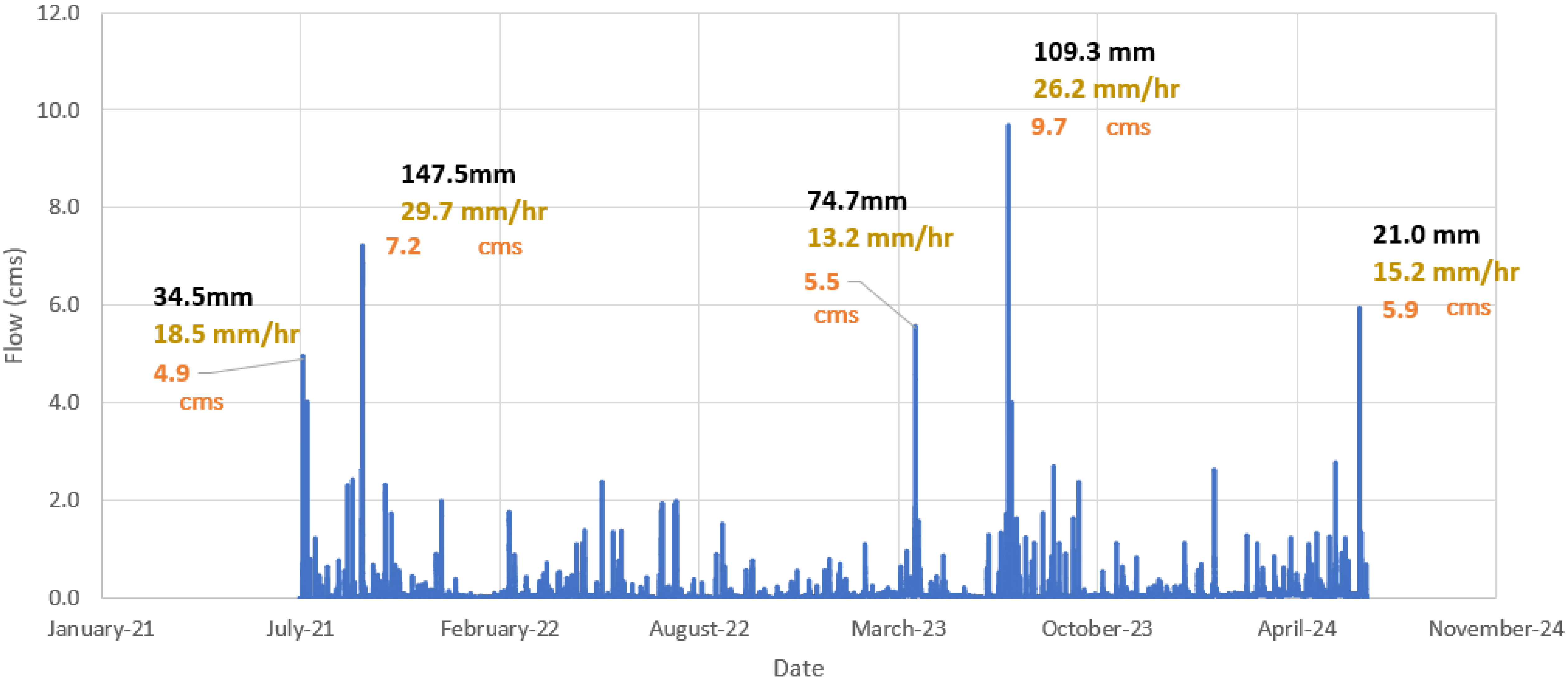


Monitored Peak Flows to Date



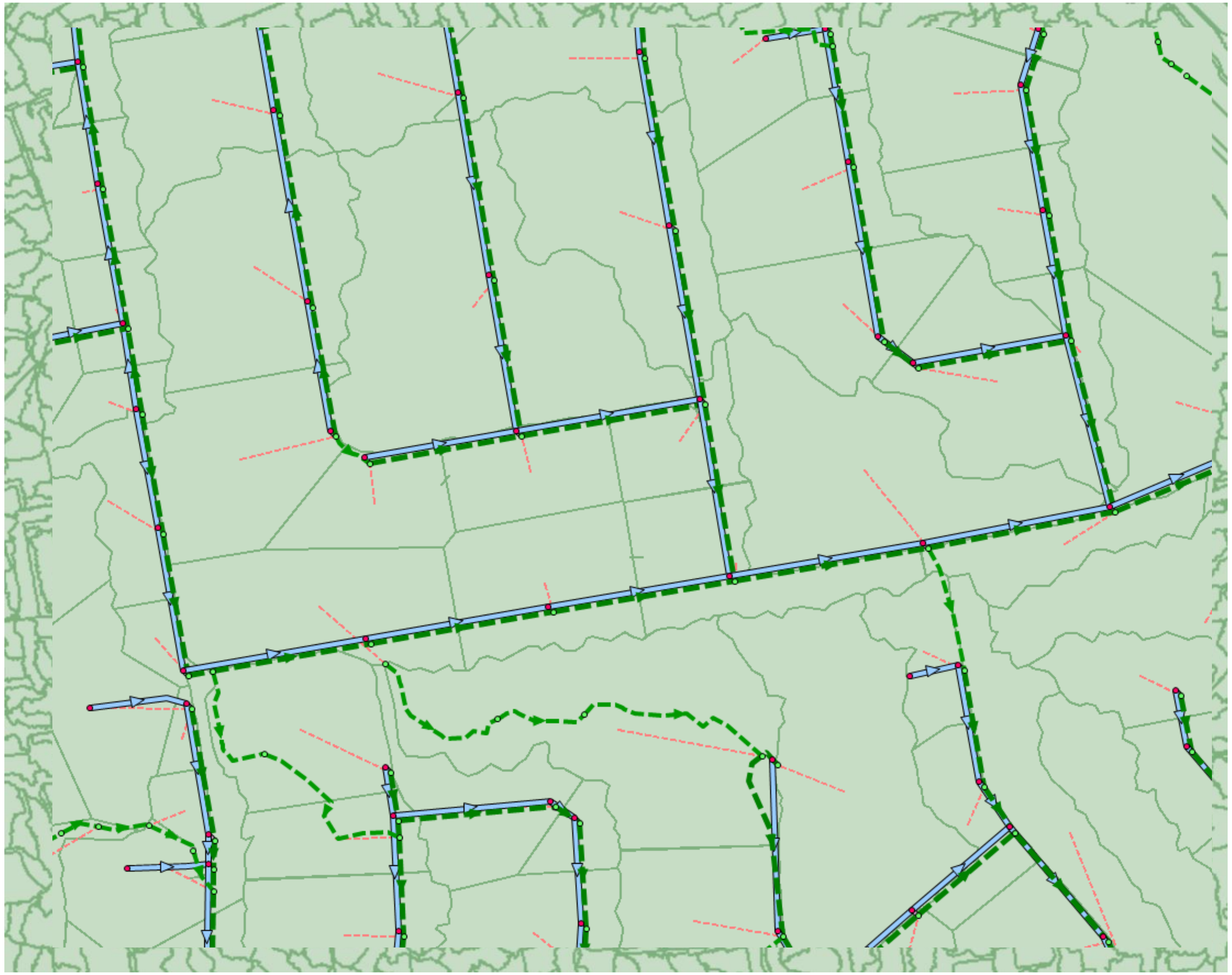


Southdale Rd – Monitored Flows (2021-2024)



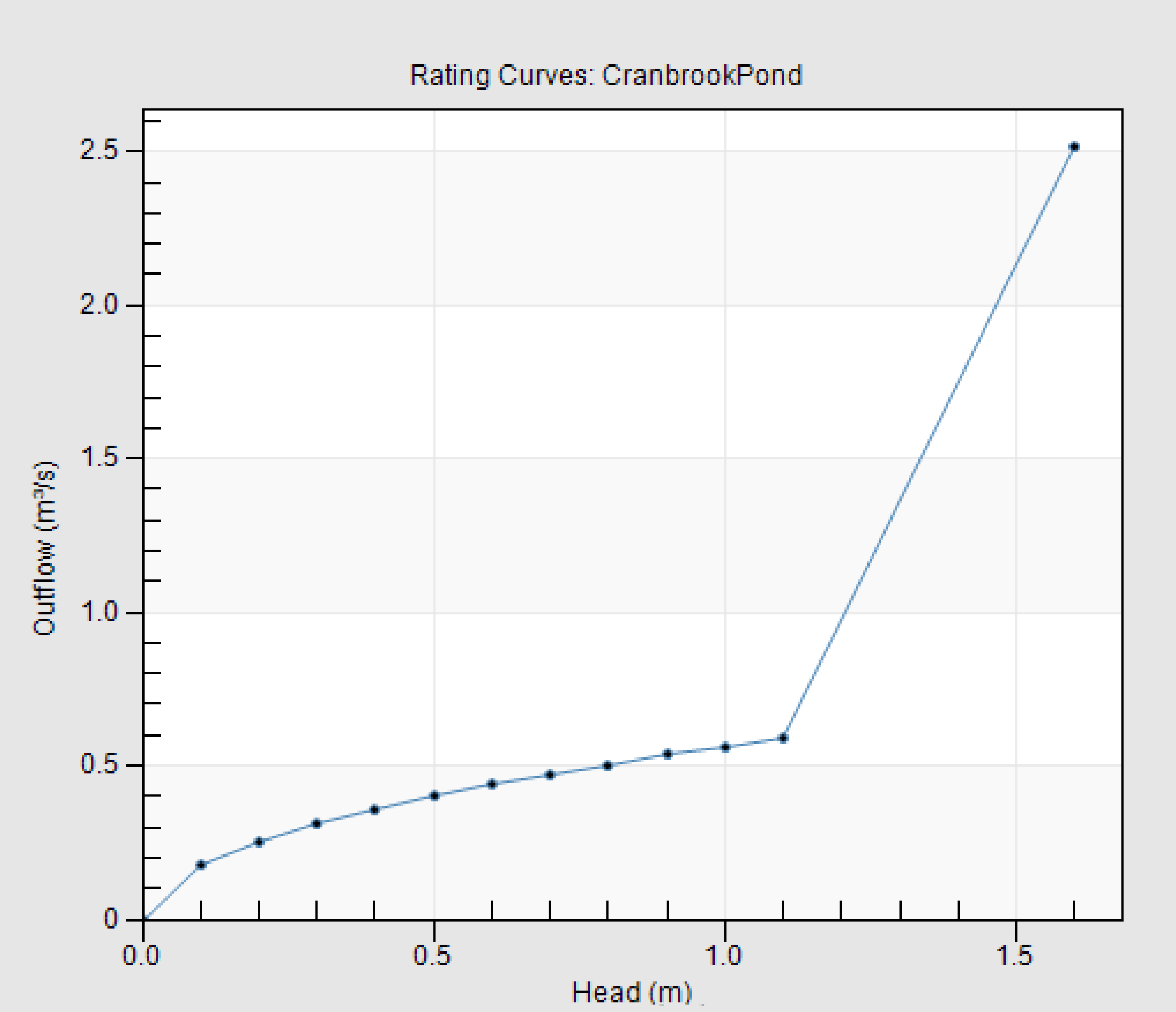
Modelling Approach Highlights

1. Imported minor system manholes/ pipes from InfoWorks into PCSWMM
2. Used Provincial DEM (2018) 0.5 x 0.5m resolution to build the dual drainage network
3. Used the Watershed Delineation Tool to discretize subcatchments
4. Further discretized to discrete points (i.e.: junction) using the Voronoi decomposition tool
5. Assigned subcatchment outlets as "node with lowest invert elevation within subcatchment".



Modelling Approach Highlights, Cont'd

1. Used the dual-drainage creator to design the major system network along the road network using a typical street profile
2. Modelled catchbasins as an outlet between the major and minor system nodes (i.e.: Single square herringbone)
3. Modelled SWM Pond as a Storage Node with a depth-area storage curve for the pond and head-discharge rating curve for the outlet.



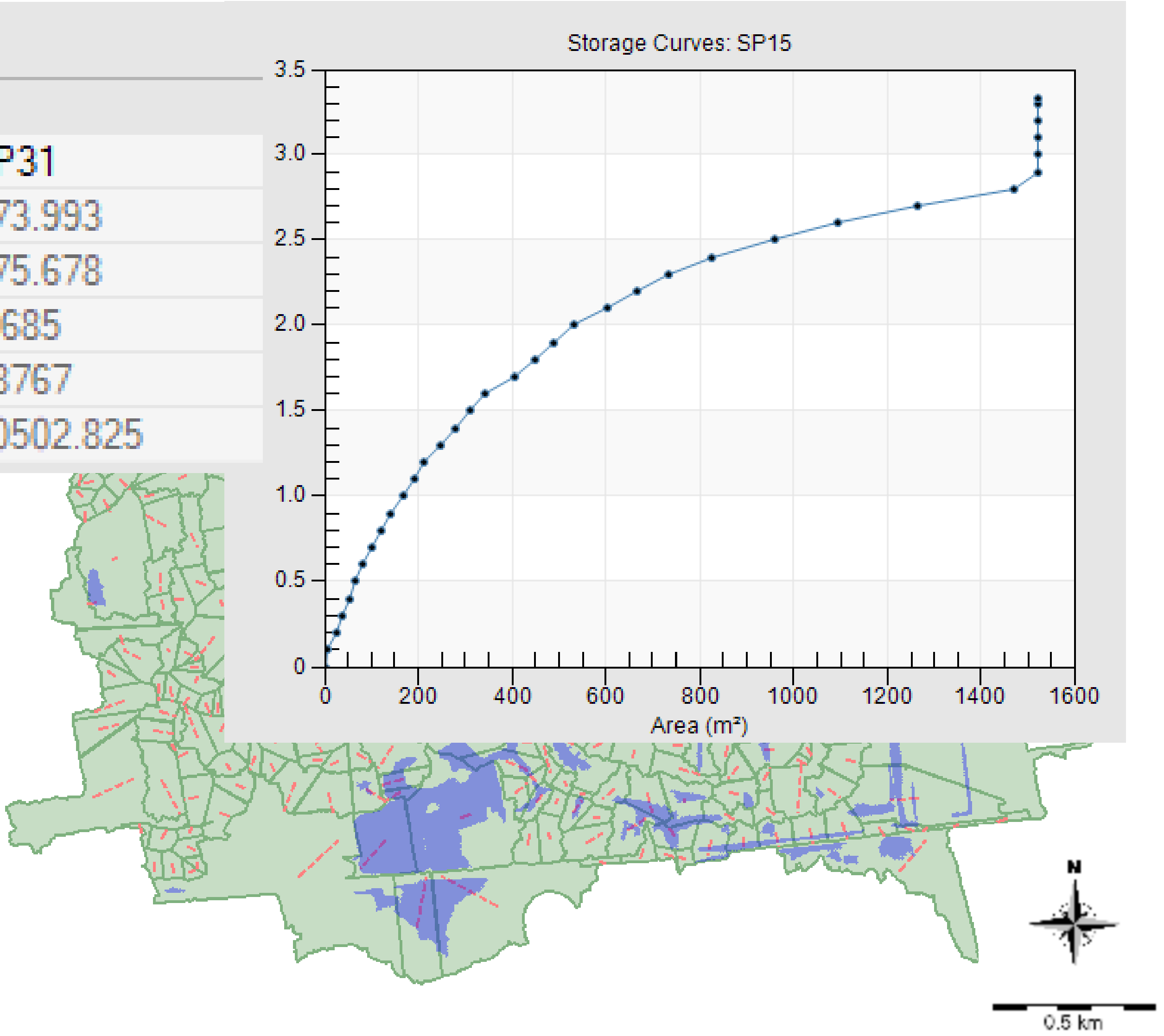
Modelling Approach – Depression Storage

- Modify default depression storage parameters for pervious and impervious areas
- Storage Creator Tool

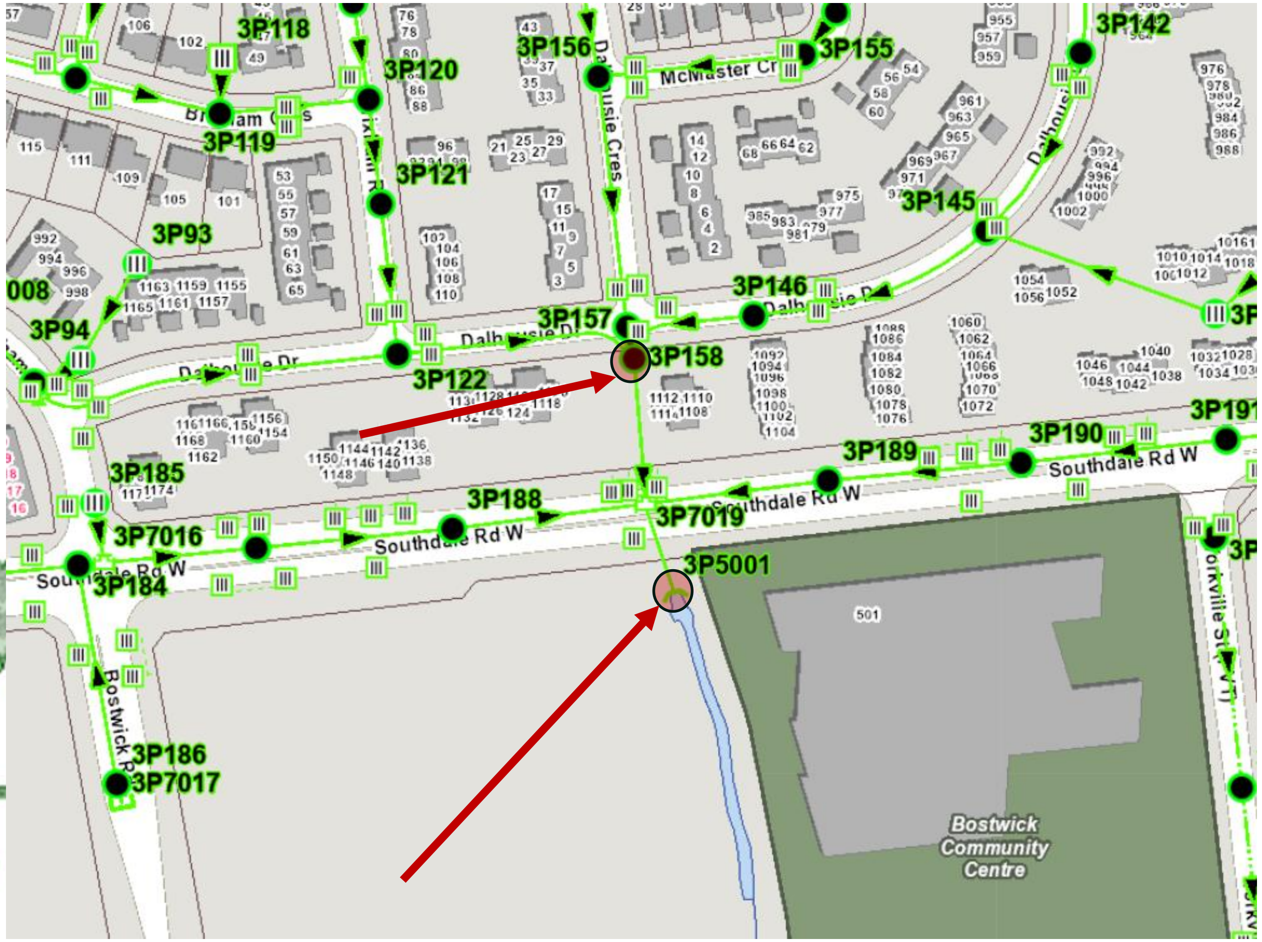
Storage polygons

Attributes

Name	SP31
Minimum Elev. (m)	273.993
Maximum Elev. (m)	275.678
Depth (m)	1.685
Area (m²)	48767
Volume (m³)	20502.825



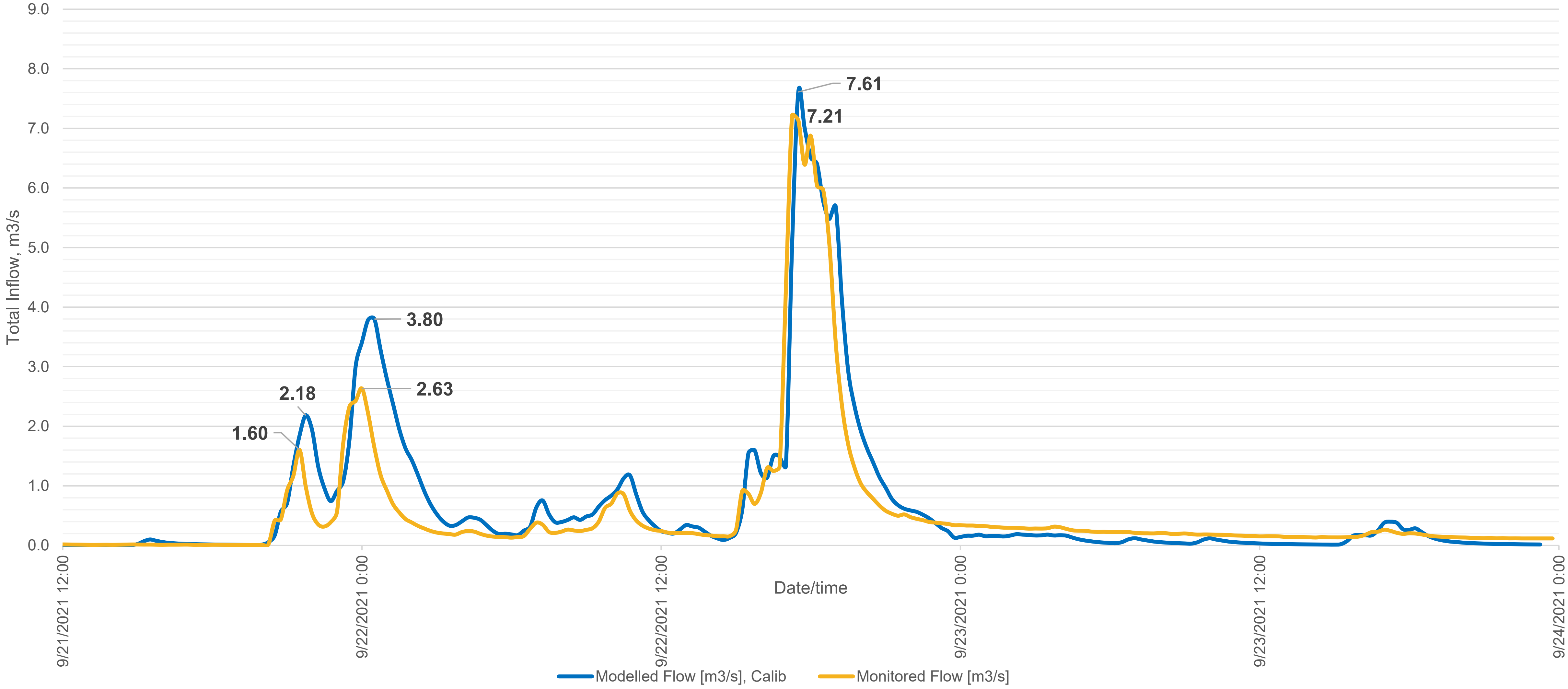
Outlet to Thornicroft



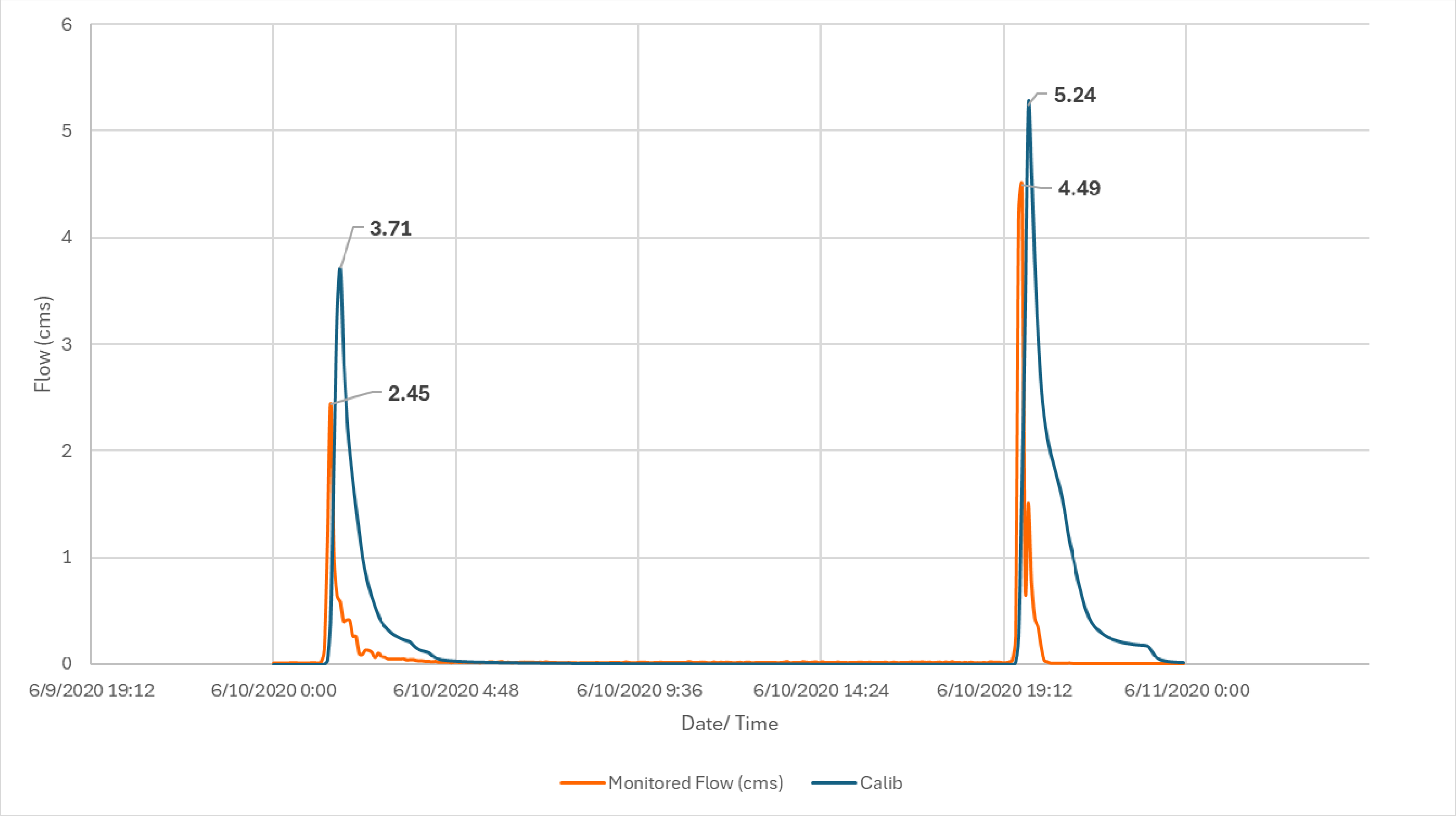
Adjusted Parameters for Calibration

- Reduced imperviousness by 20%
- Adjusted Depression Storage parameters
- Reduced subcatchment width by 25%
- Increased pipe roughness = 0.015 (Chow, 1959) for concrete sewers
- Increased N perv to 0.30
- Modified soil infiltration parameters for clay/ silt based on borehole data

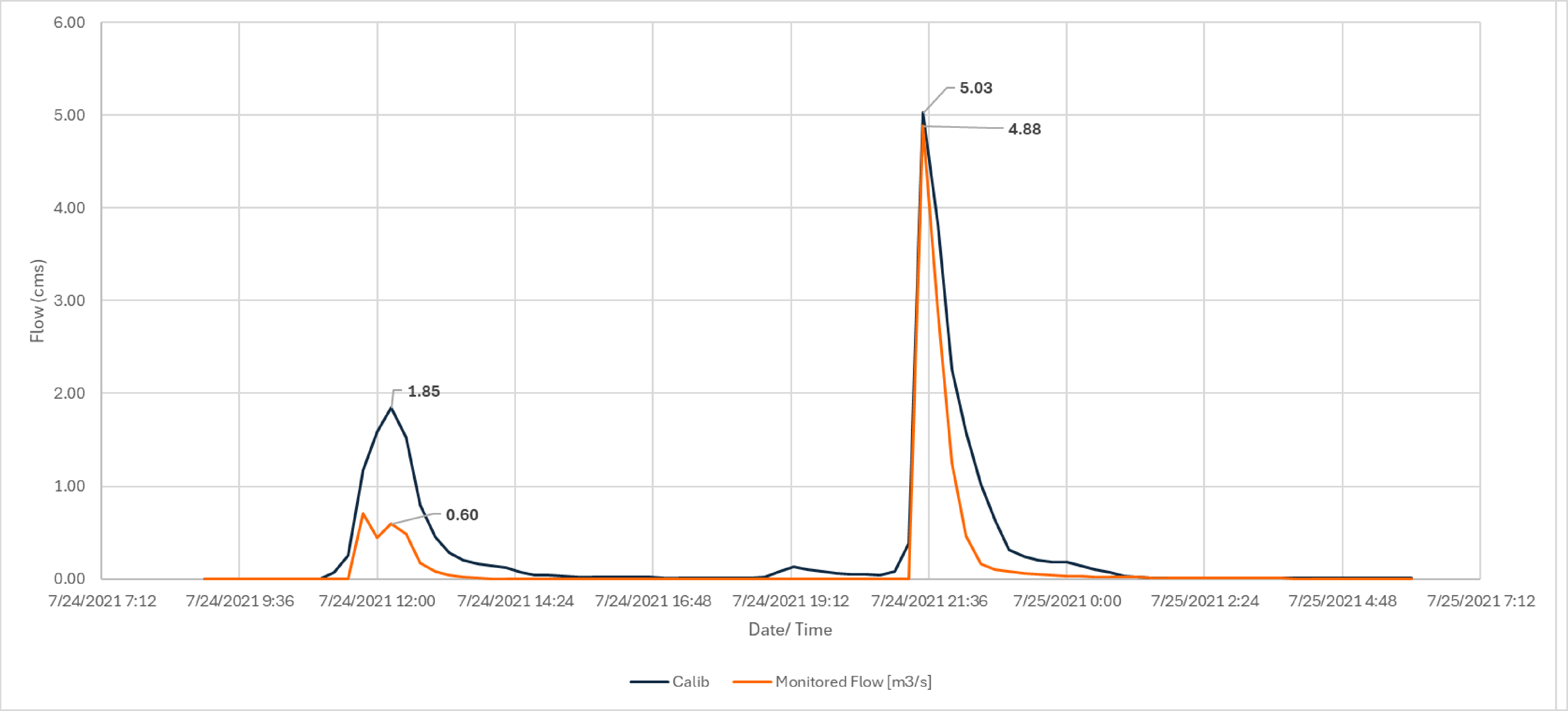
September 21, 2023 (Southdale Culvert)



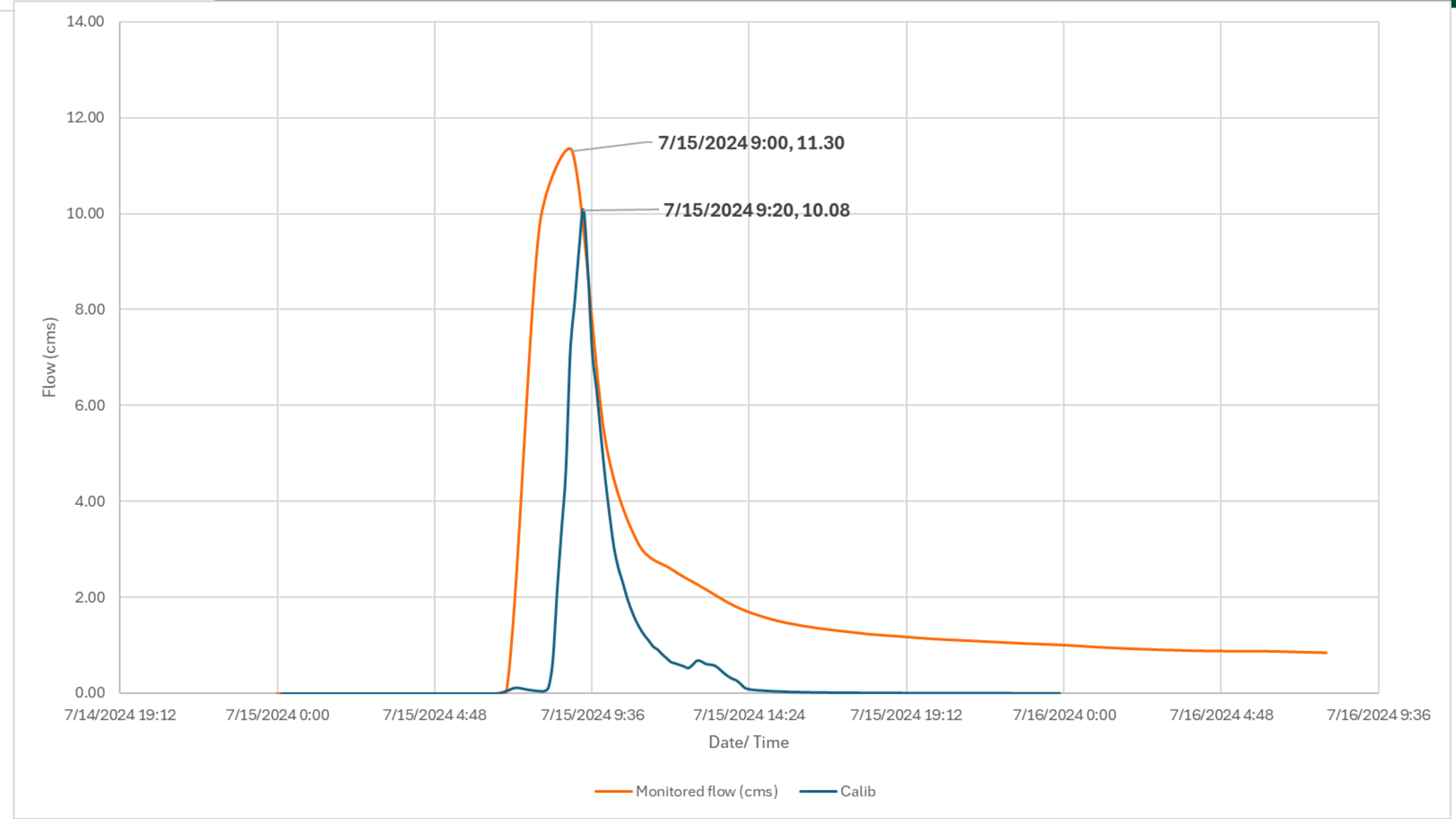
June 10, 2020 (Storm Pipe, 3P158)



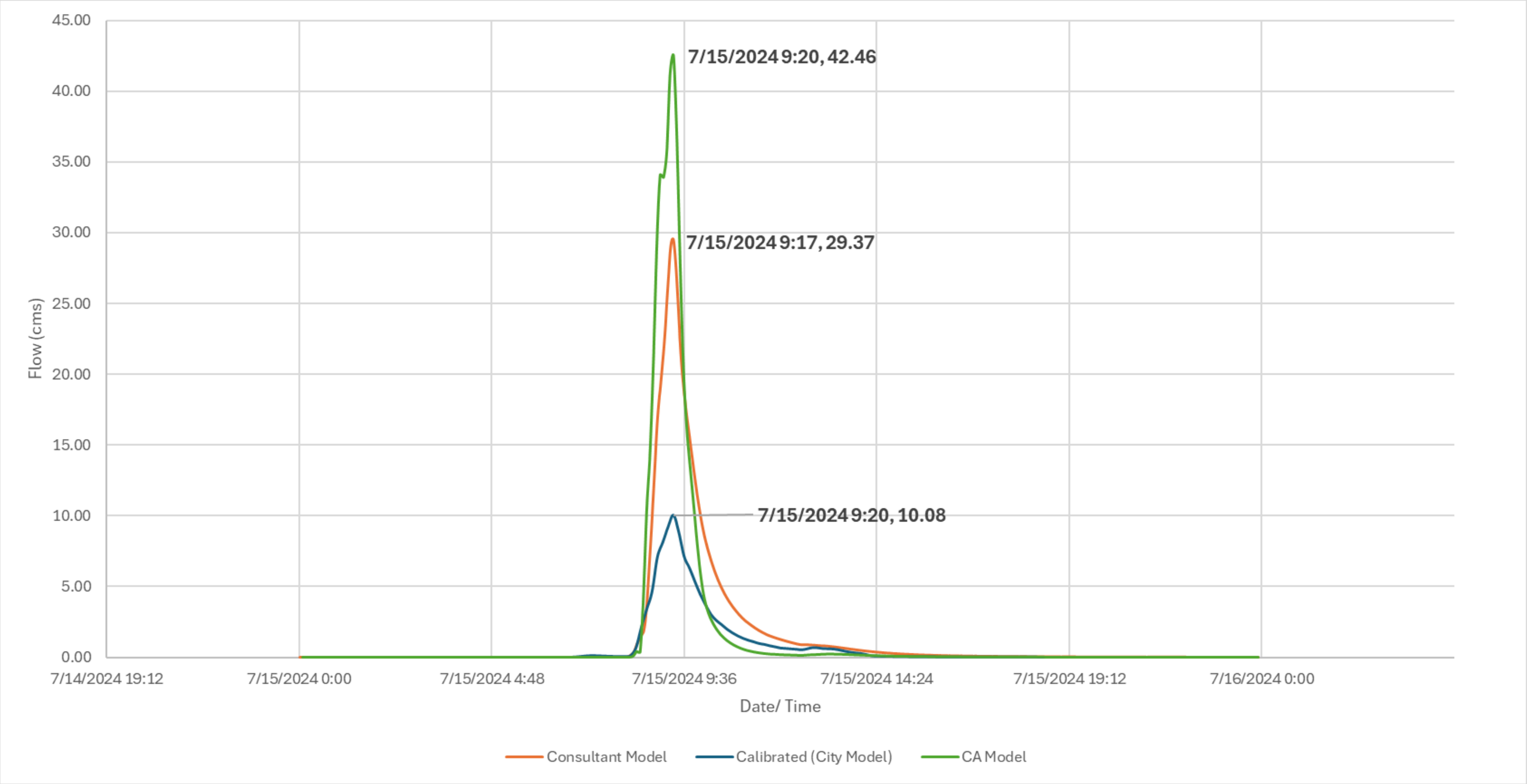
July 24, 2021 (Southdale Culvert)



July 15, 2024 (Hamlyn St Culvert)



July 15, 2024 Simulation



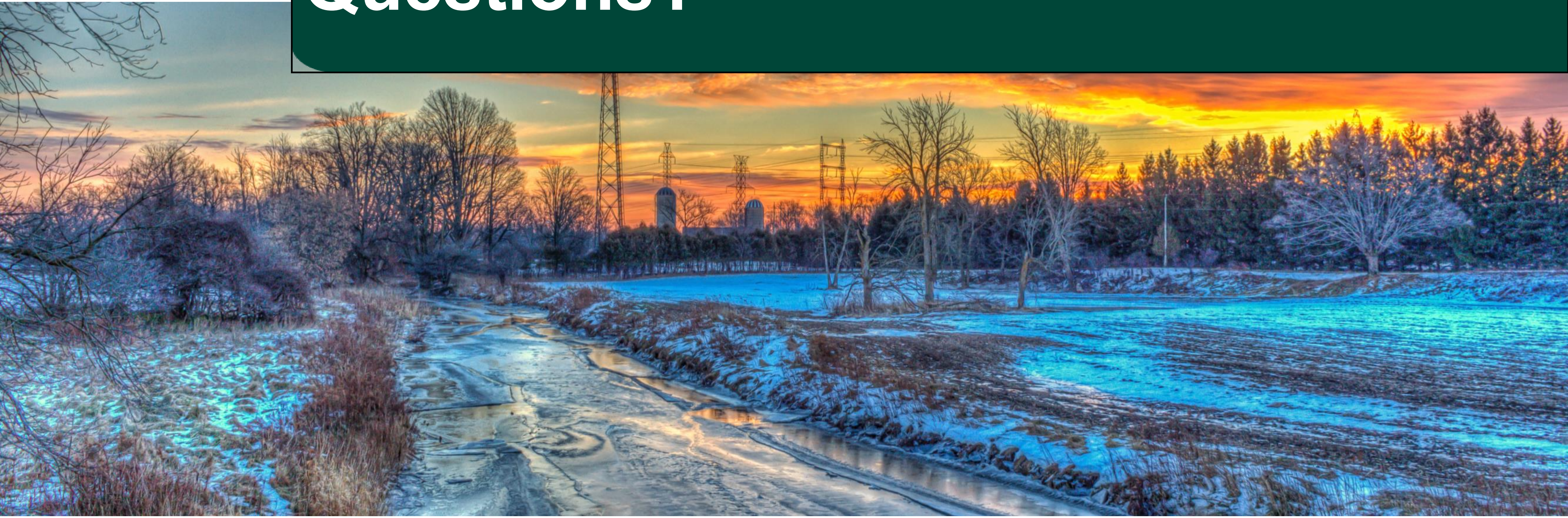
Infrastructure Costing

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

Lessons Learned/ Next Steps

- Balance modelling approaches
- Investing in flow monitoring of tributary areas
- Detailed modelling for areas where high flows are not observed
- Next steps – more detailed urbanized headwater models
- Policy updates to reflect area specific needs

Questions?



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