A Combined Water/Sewerage/Drainage Model – Why would you do that?

VICTORIA State Government

CH2M Beca

urban water solutions

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Melbourne Water

Whole of Water Cycle Pilot Model Project

Why combine models?

Model development

Challenges and Limitations

Future of combined models

Whole of Water Cycle Pilot Model Project - Objectives

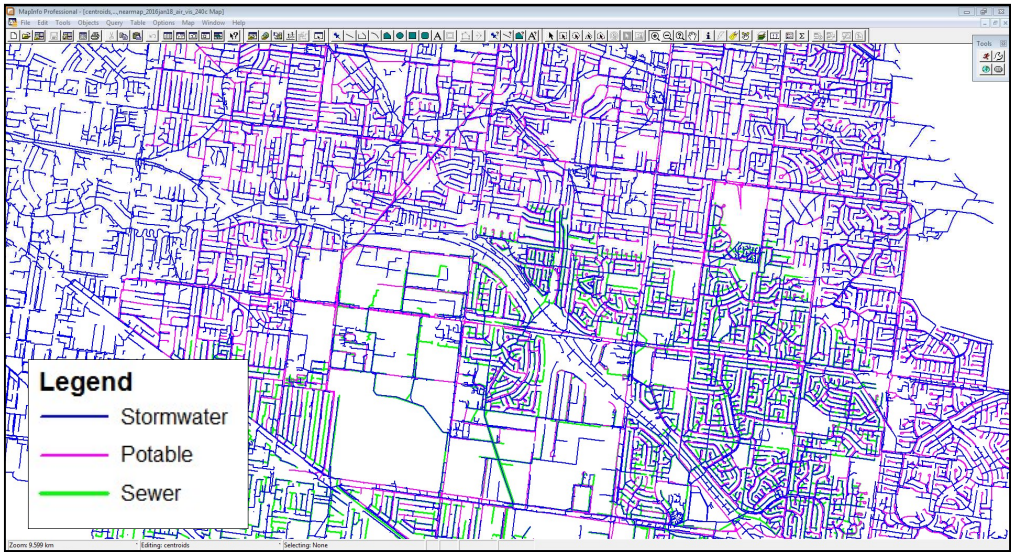
- Investigate the capabilities of InfoWorks ICM to simulate water movement within a property
- Investigate the benefits and challenges to modelling water supply, sewerage and drainage in a single model
- Develop a pilot strategic model representing the urban water cycle

Why combine models of different systems?

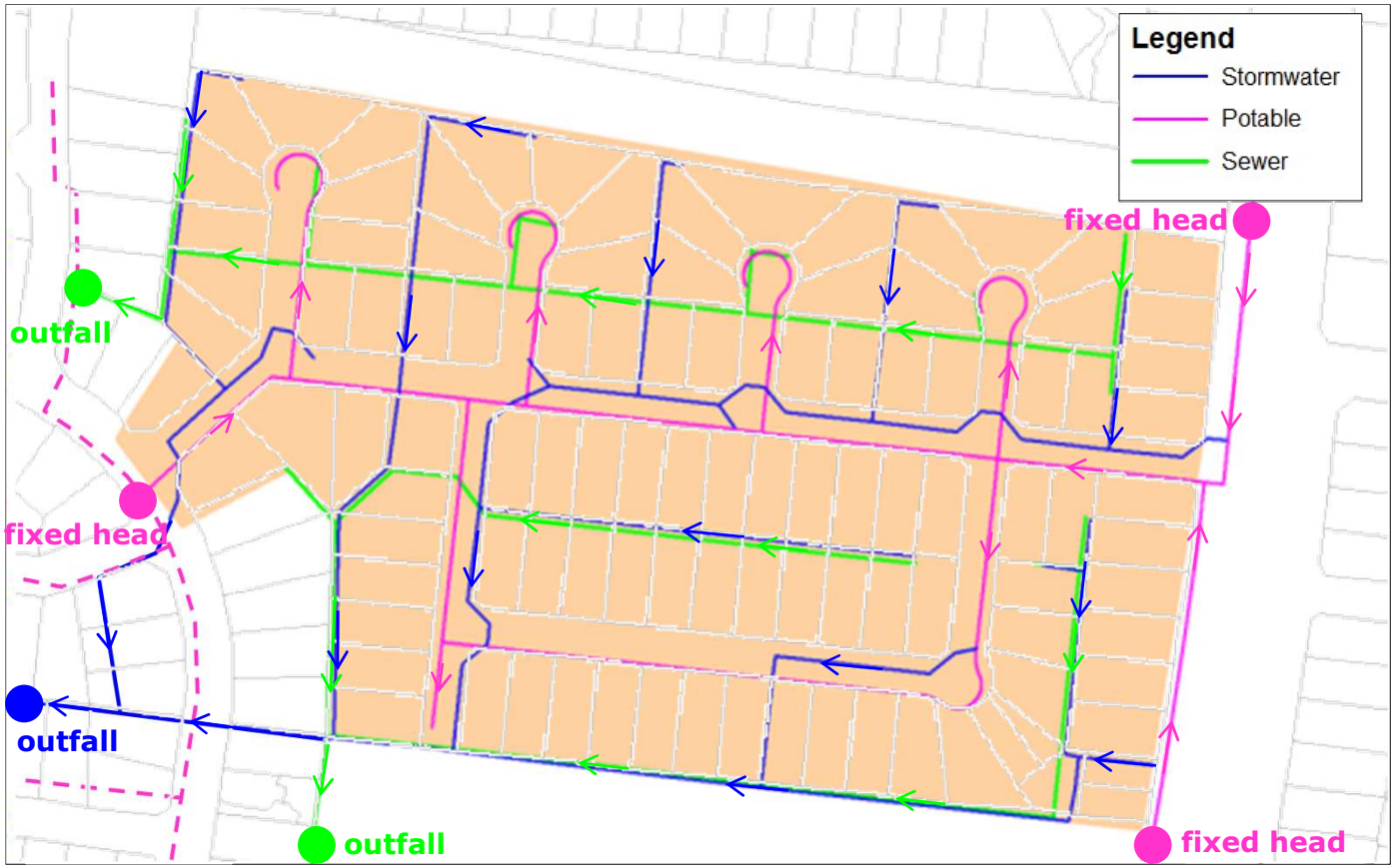
- Understanding of interactions between systems
- More transparent inputs
- Better alignment of modelling assumptions
- Reduced modelling effort

Combining Hydraulic Models – where to start?

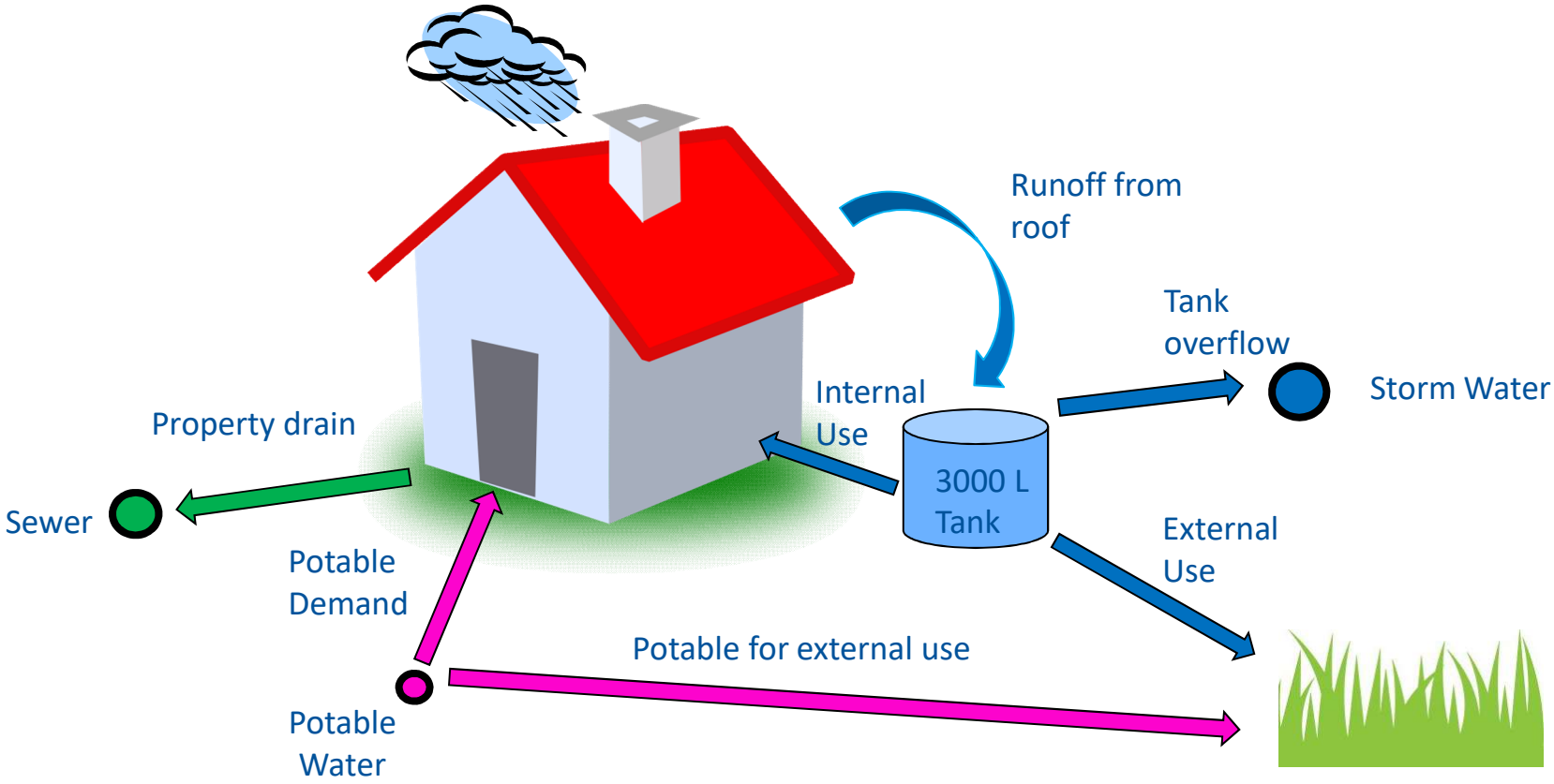
- Staged approach: 100 property model
- Overlaid all datasets – stormwater, potable, sewer
- Reviewed systems to look for a simple pipe layout
- Potable system layout main driver for selection of pilot area



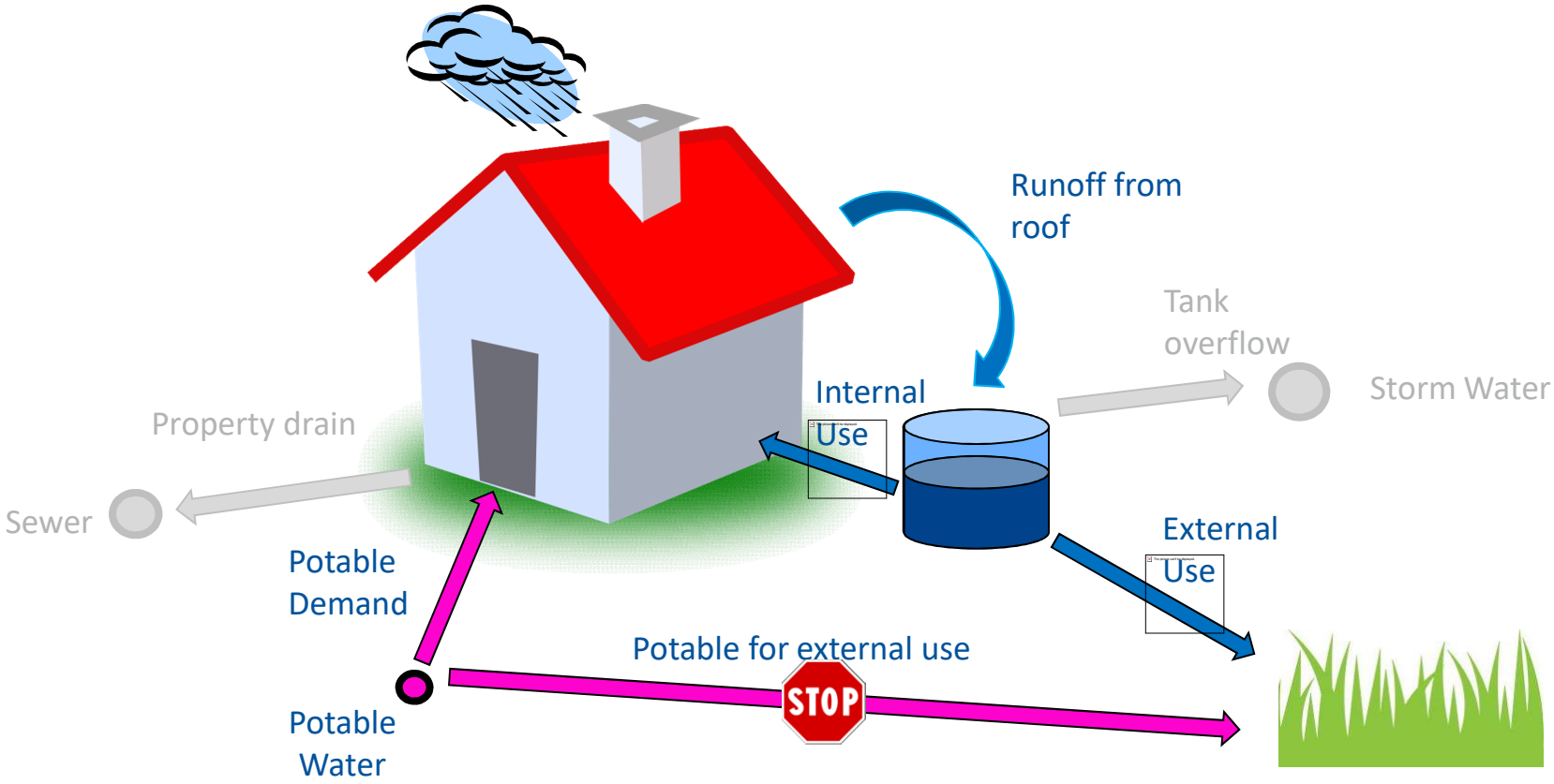
100 Property Hydraulic Model Set-up



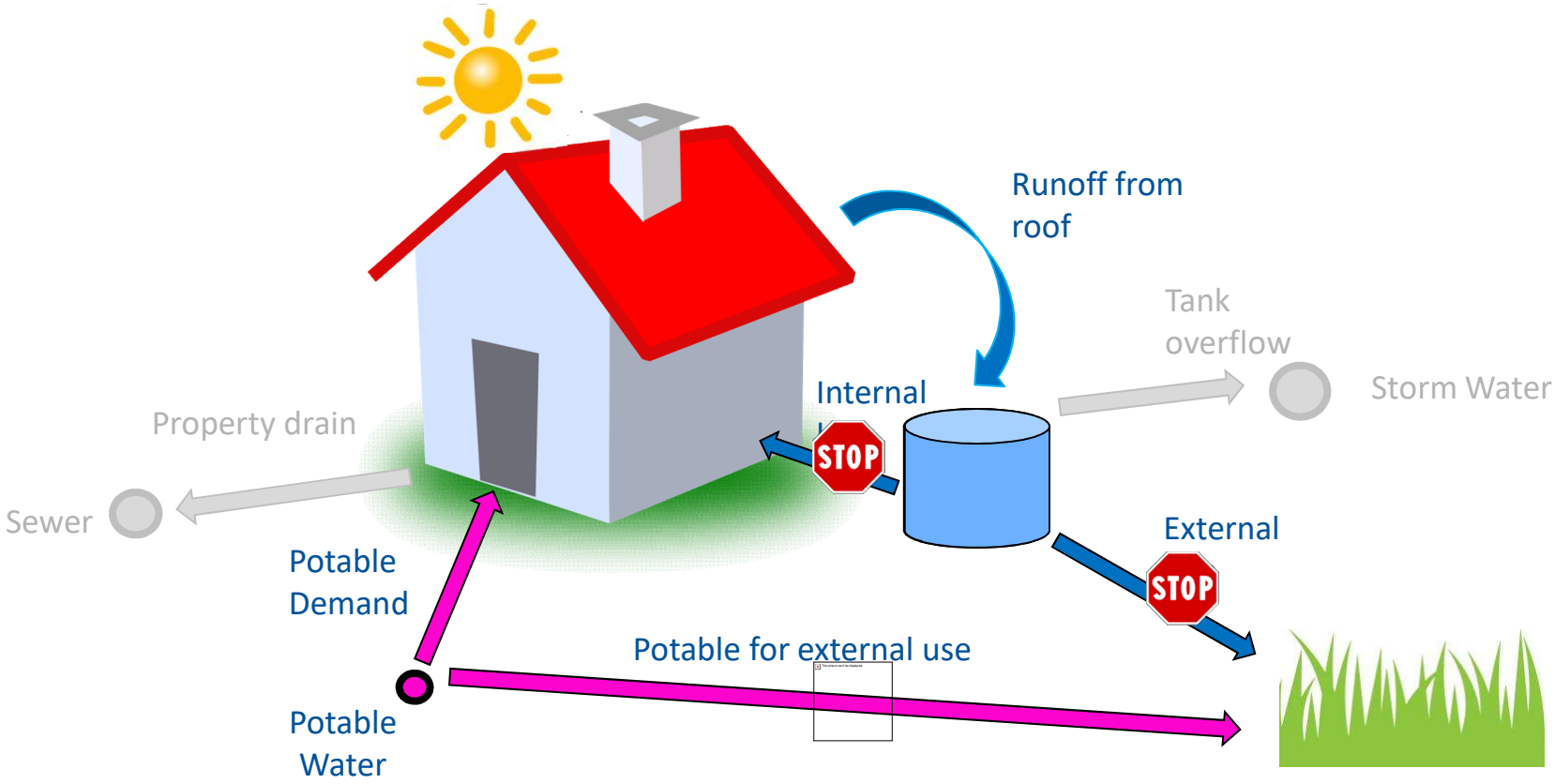
Household Water Cycle Set-up



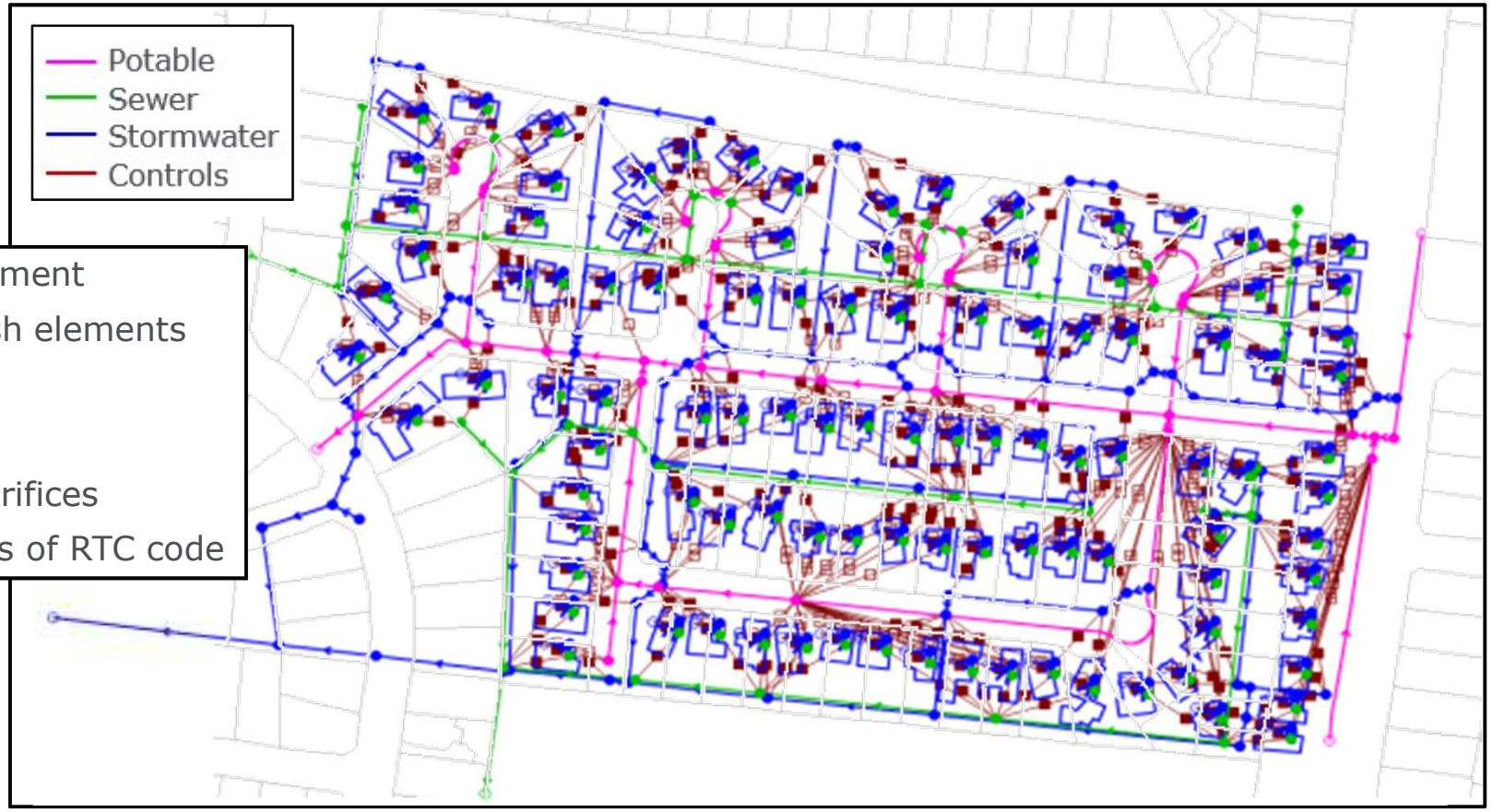
Household Water Cycle Set-up



Household Water Cycle Set-up

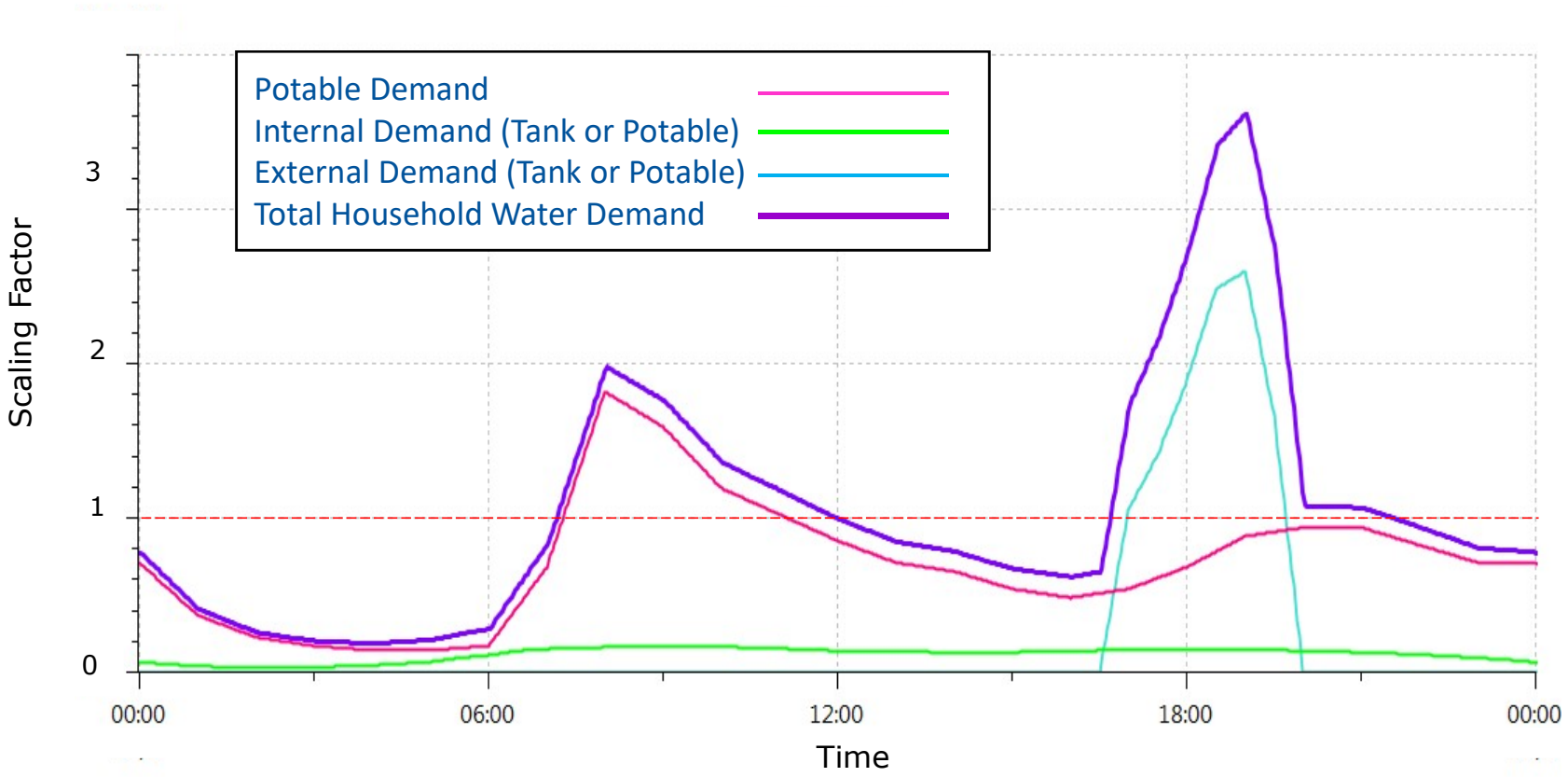


100 Property Model - Household Water Cycle Configuration



- 10 ha catchment
- 40,000 mesh elements
- 460 nodes
- 145 pipes
- 712 weirs/orifices
- 1,200+ lines of RTC code

100 Property Model - Household demand profiles

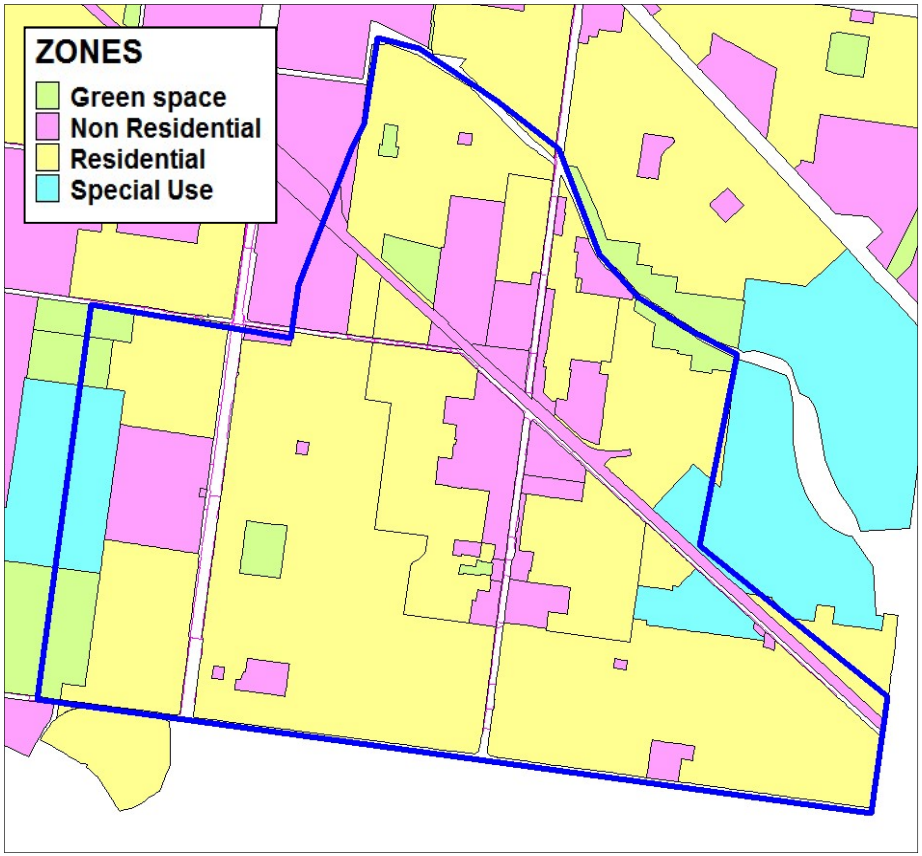


100 Property Model Testing

- ✓ DWF simulation confirmed all demands and outflows balance
- ✓ WWF simulation confirmed that runoff from roof flowed to RWT
- ✓ Confirmed rainwater was correctly drawn from RWT for internal and external usage
- ✓ Confirmed that the RWT overflowed into stormwater network when full
- ✓ Confirmed that the model was suitably balances and did not generate excessive mass error

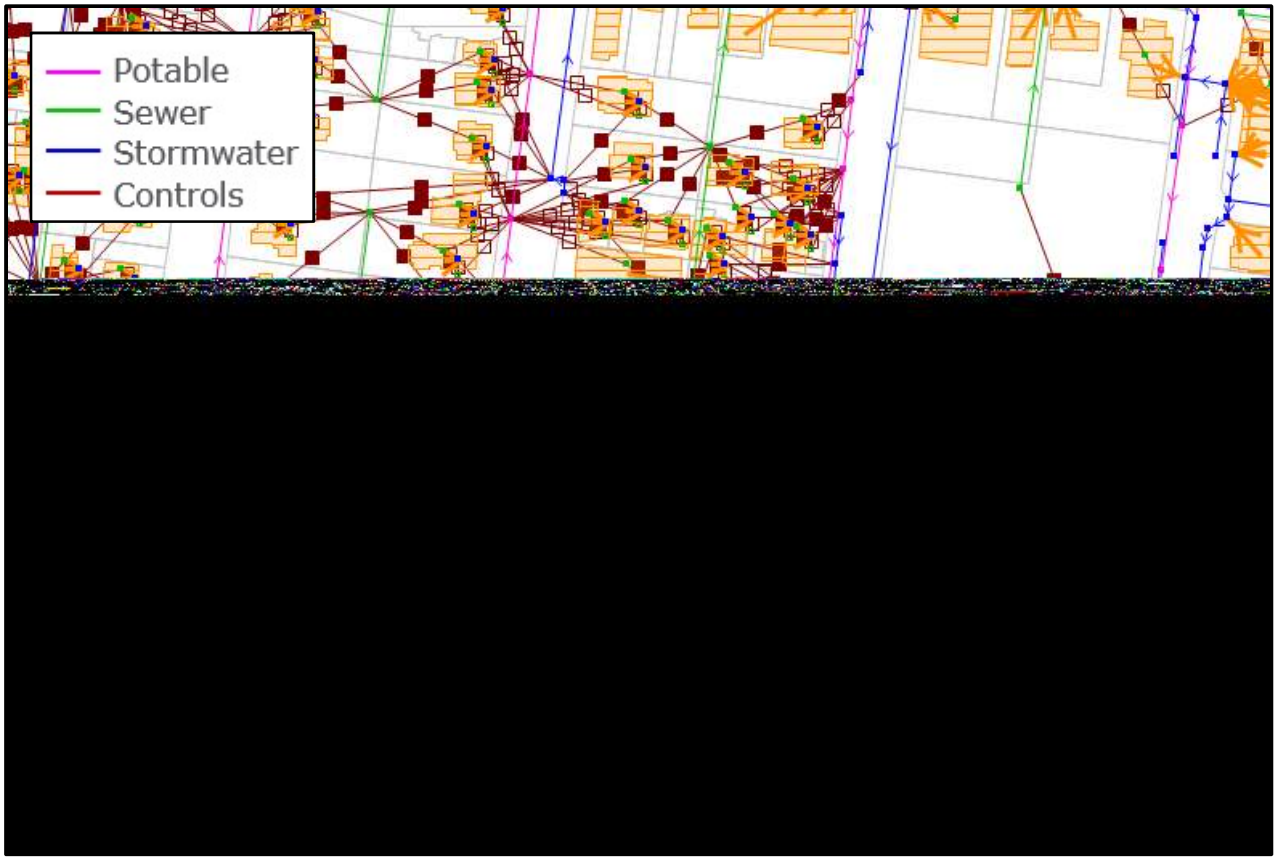
Scaling up the model to 5,000 property

- Potable water network as starting point
- Mixed land use
- No water cycle assumed for non-residential properties. The runoff from the roof has been connected directly to the stormwater network.
- Non-residential buildings assigned same demand pattern as residential buildings

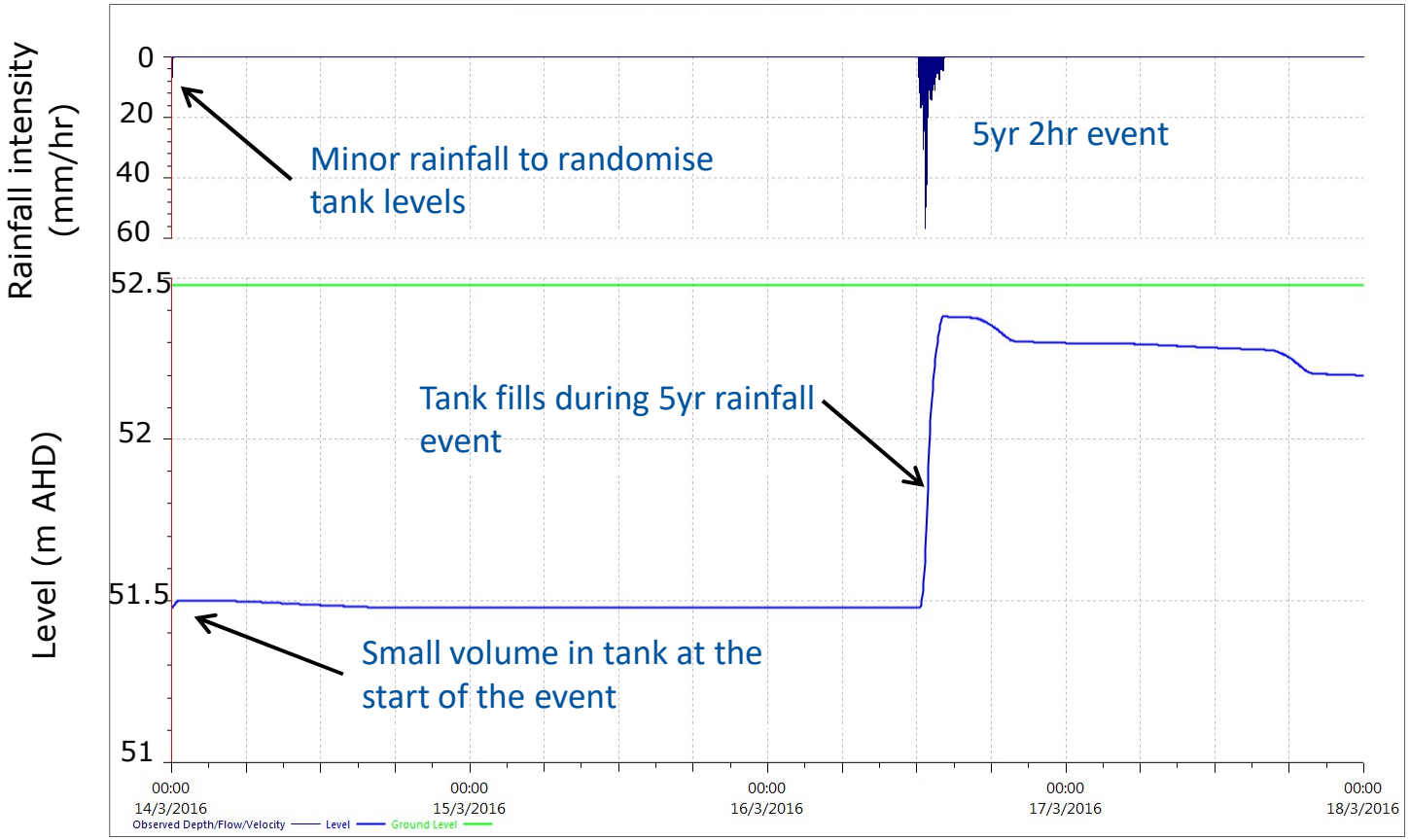


5,000 Property Model - Household Water Cycle Model Configuration

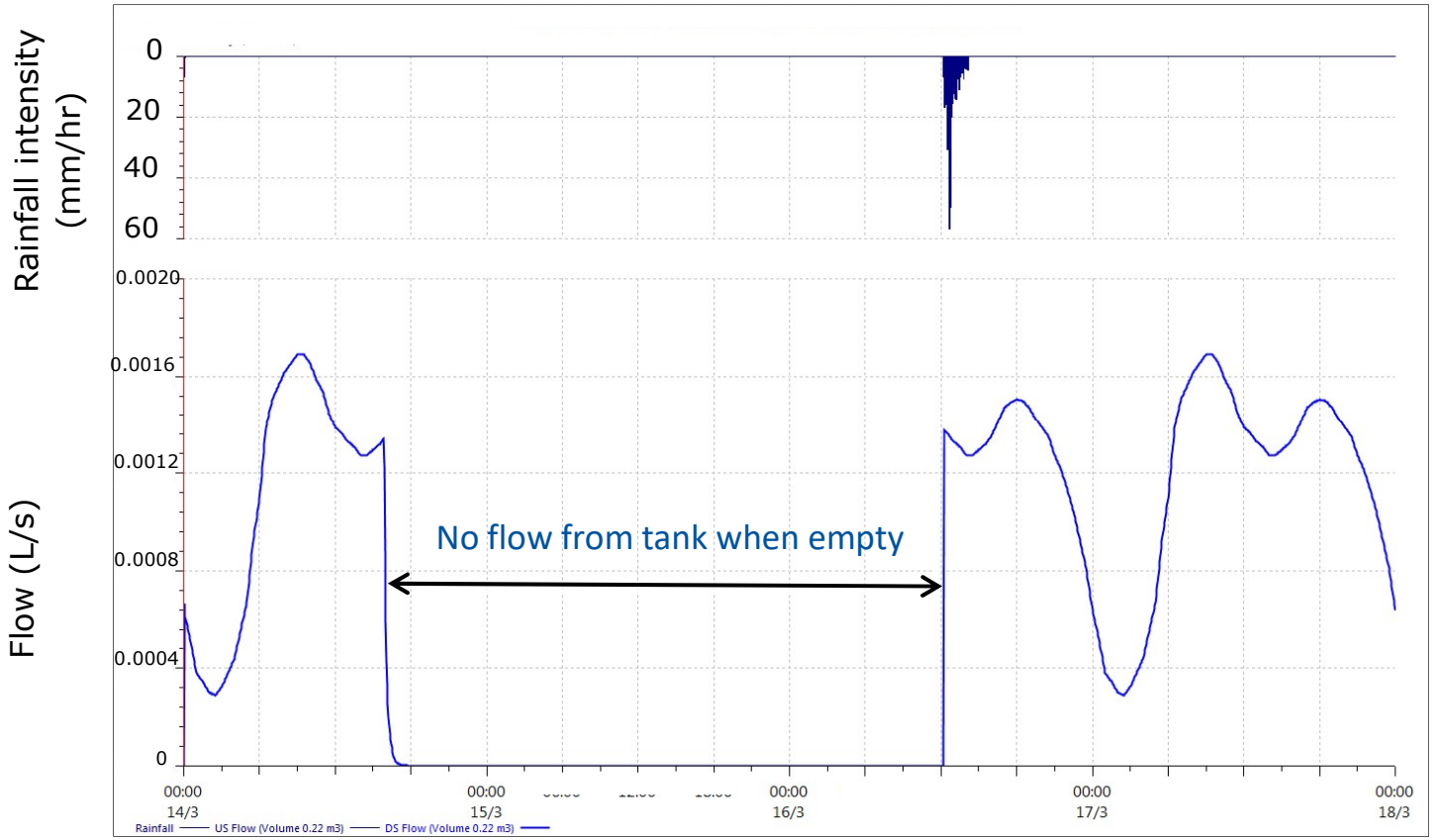
- 680 ha catchment
- 1.1m mesh elements
- 23,197 nodes
- 8,160 pipes
- 35,215 weirs/orifices
- 59,838 lines of RTC code



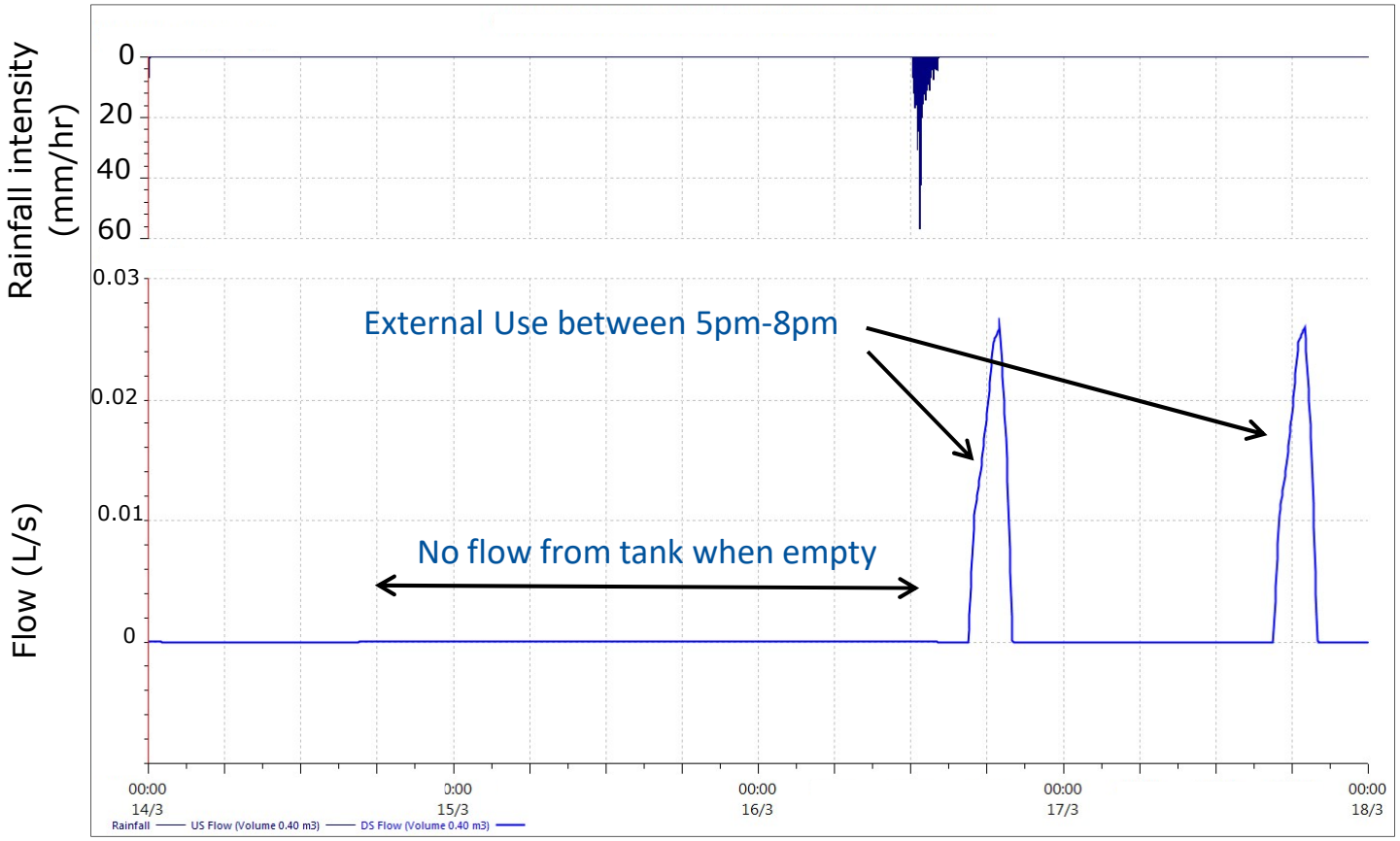
5,000 Property Model Testing – Level in RWT



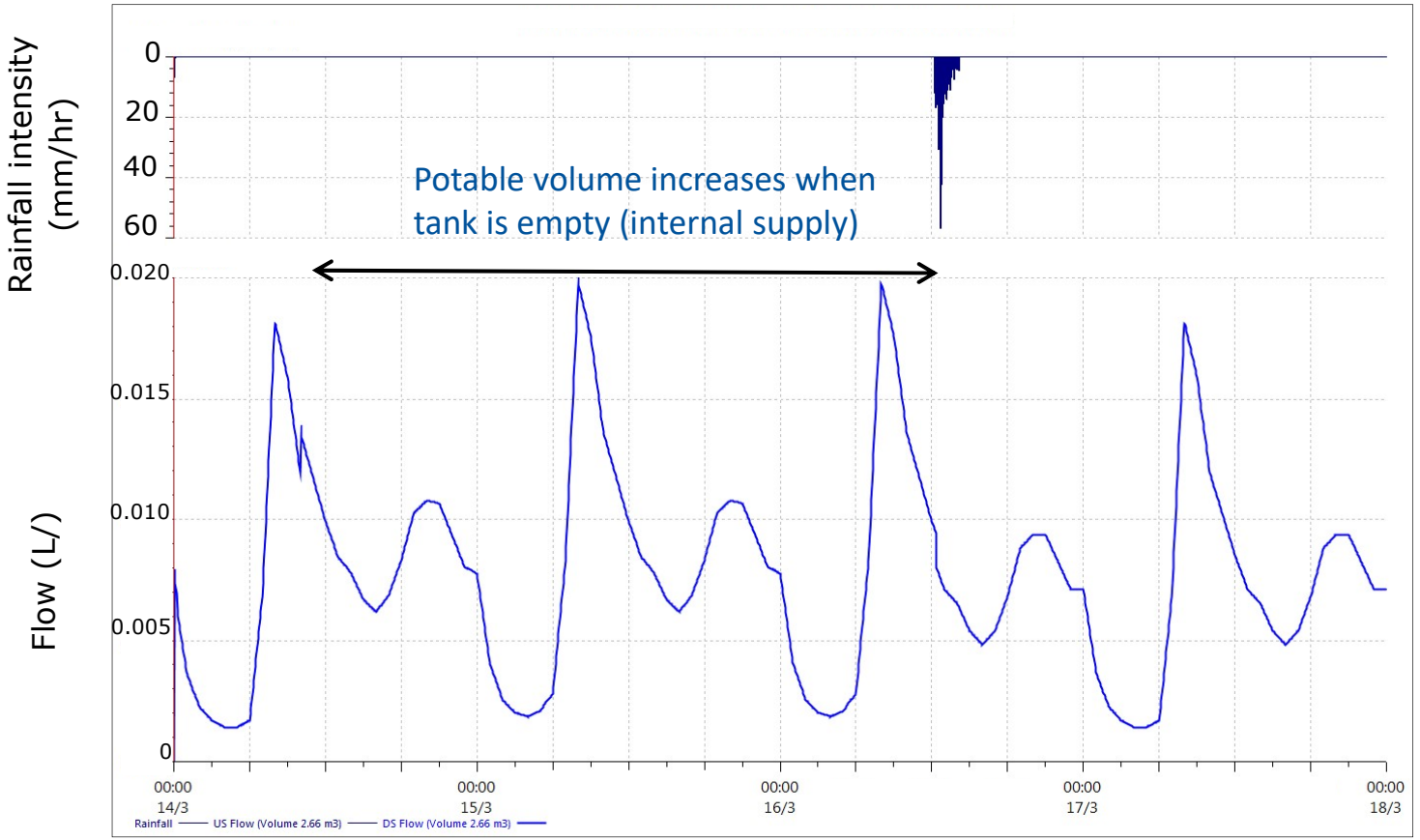
5,000 Property Model Testing – Internal House Supply from RWT



5,000 Property Model Testing – External Use Supply from RWT

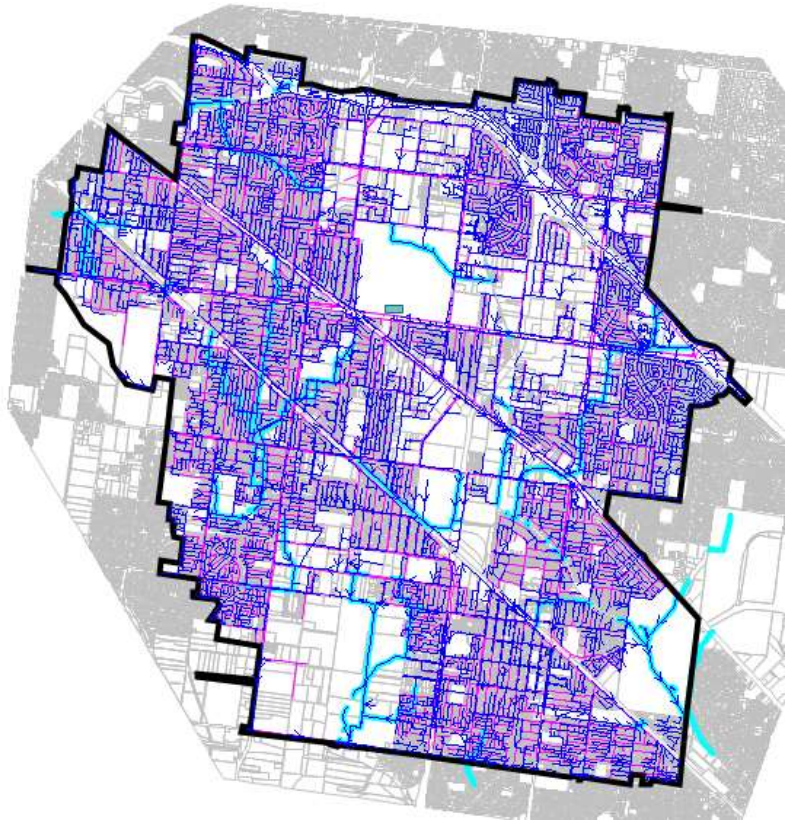


5,000 Property Model Testing – Potable Demand



Scaling up the model to 27,000 property

- Model scaled up to approximately 27,000 properties
- Difficulties in setting potable water network boundaries
- Complications in replicating the potable water network behaviour
- External drainage catchments approximated
- Complexity in scaling up RTC rules



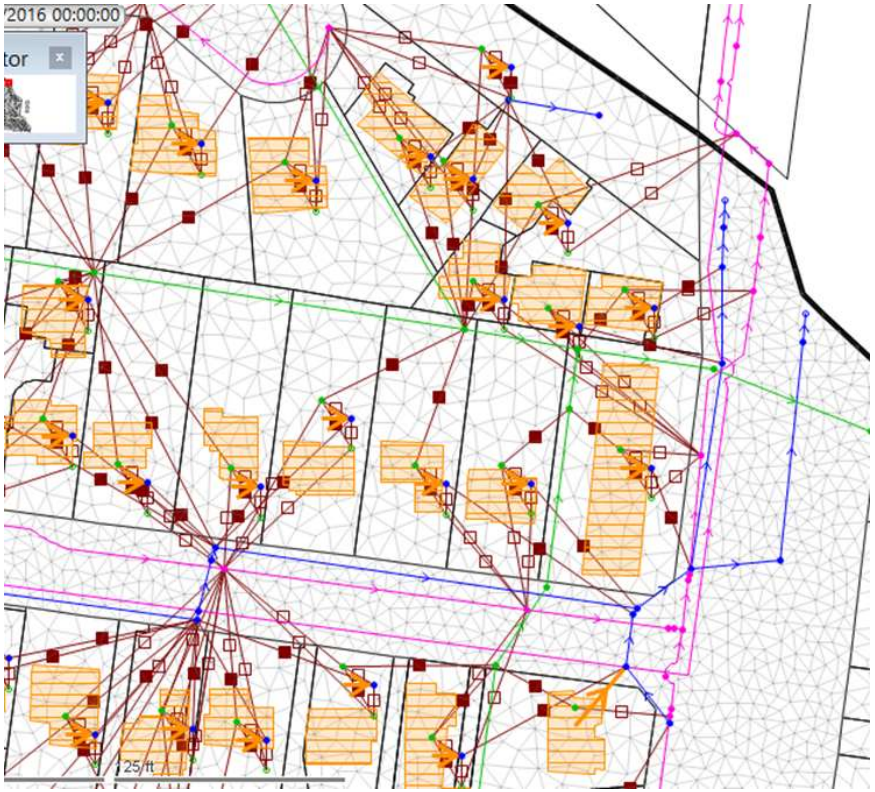
27,000 Property Model – Run times

All simulations run with 2s timestep on a GPU computer

Run Name	Simulation duration (hours)	Run time (hours)
Final Drainage Model 5y2h	3.5	3
Final Combined Model 5y2h	3.5	13
Final Drainage Model 100y2h	3.5	5
Final Combined Model 100y2h	3.5	16

Challenges and Limitations

- Water supply system difficult to model
- Controls becomes cumbersome > 5,000 lots
- Selection of model extent critical
- Limited stormwater system data
- Different approach to flood modelling
- Different design criteria for systems



The Future???

Changes made to software – updates to RTC loading

Recent developments in other software

MW investigating Rain-on-Mesh stormwater modelling approach

Questions

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