Modelling Group
WATER NEW ZEALAND

Modelling Symposium

# Sub Catchment vs Rain on Grid Why Should We Care.

Presented by
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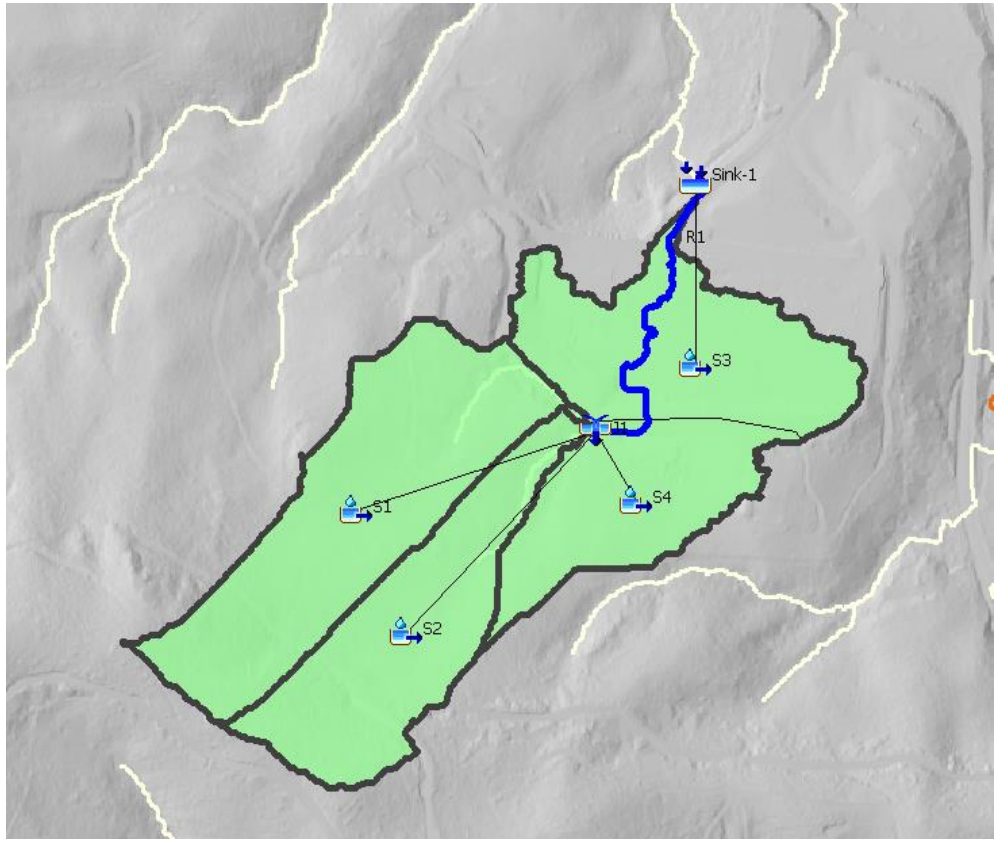
# Agenda

- What Rain on Grid (ROG) and sub-catchment methods are:
- Advantages and disadvantages
- Case study: Golden Mile
- Case study results: sub-catchment vs rain on grid

Focus of talk is on urban stormwater models – Infoworks ICM

# Sub-catchment vs Rain On Grid



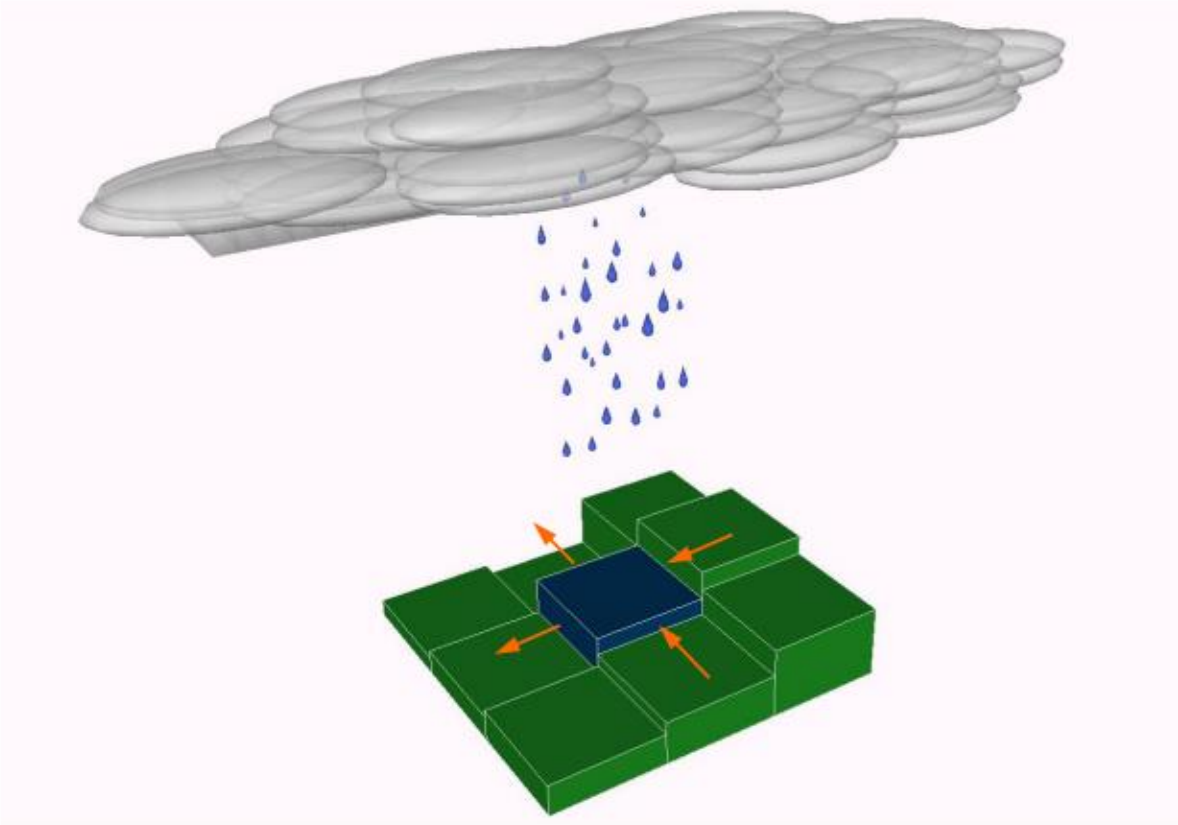



Figure 1 from Johnson, P (2015)

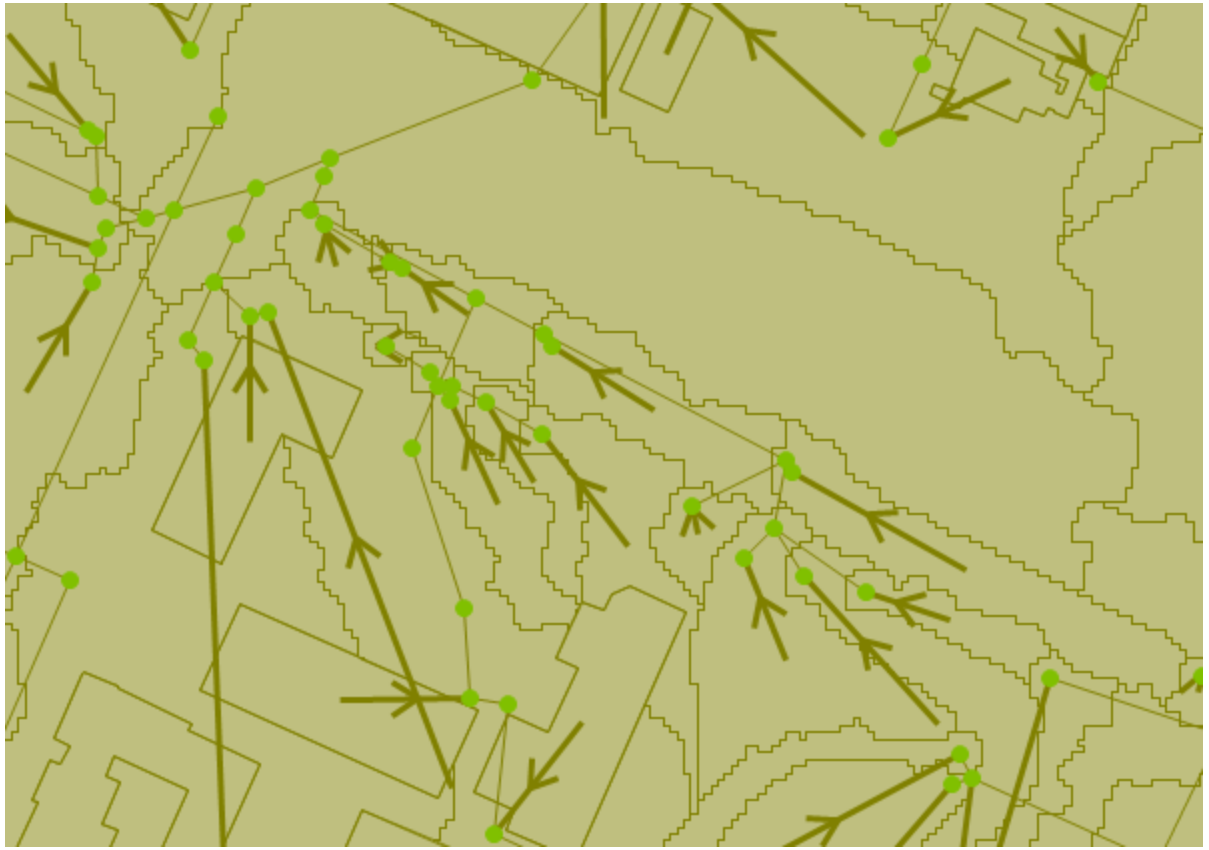
# Sub-catchment/Lumped

**Advantages:**

- Widely accepted in the industry, calibrated, and refined
- Multiple different hydrology methods available
- Fast runtimes. (mins instead of hours)
- Uncertainties averaged over each catchment
- More modelling software options/tie-ins to combined stormwater wastewater models.

**Disadvantages:**

- Reliant on how catchments are delineated
- Indirectly accounts for surface storage
- Applies water directly to the network
- Can be complex and difficult to update – Especially urban models
- Hydrology methods commonly used are not well refined for urban small catchments



# Rain on Grid

**Advantages:**

- No catchment delineation
- Cell by cell hydrology parameters
- Simpler model setup
- Potentially easier model maintenance
- Water starts on surface

**Disadvantages:**

- Reliant on accuracy of DEM
- 1D/2D interactions are reliant alignment between network and DEM
- Computationally intensive
- Less widely accepted in industry

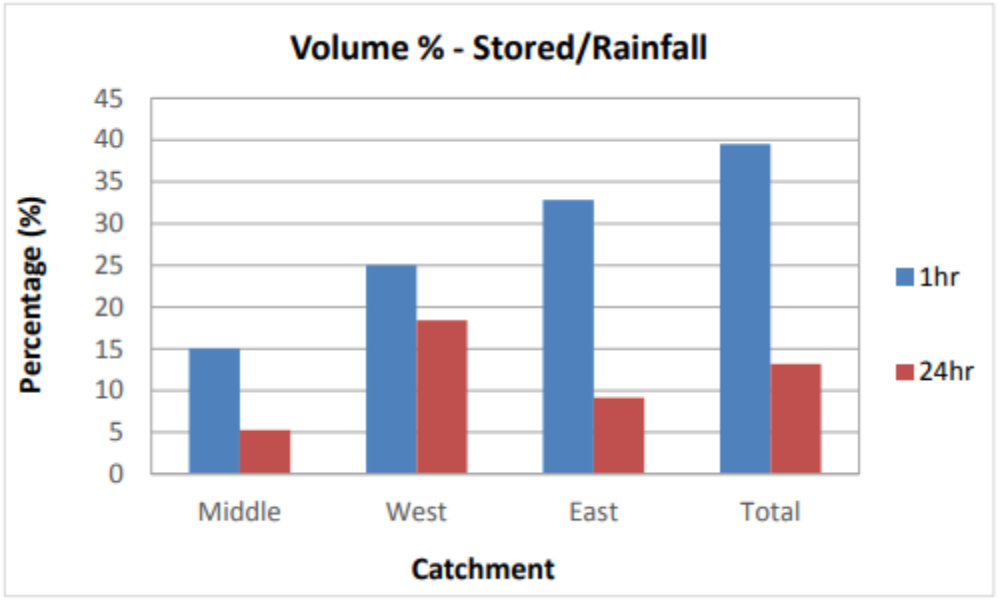



Figure 6 from Johnson, P (2015)

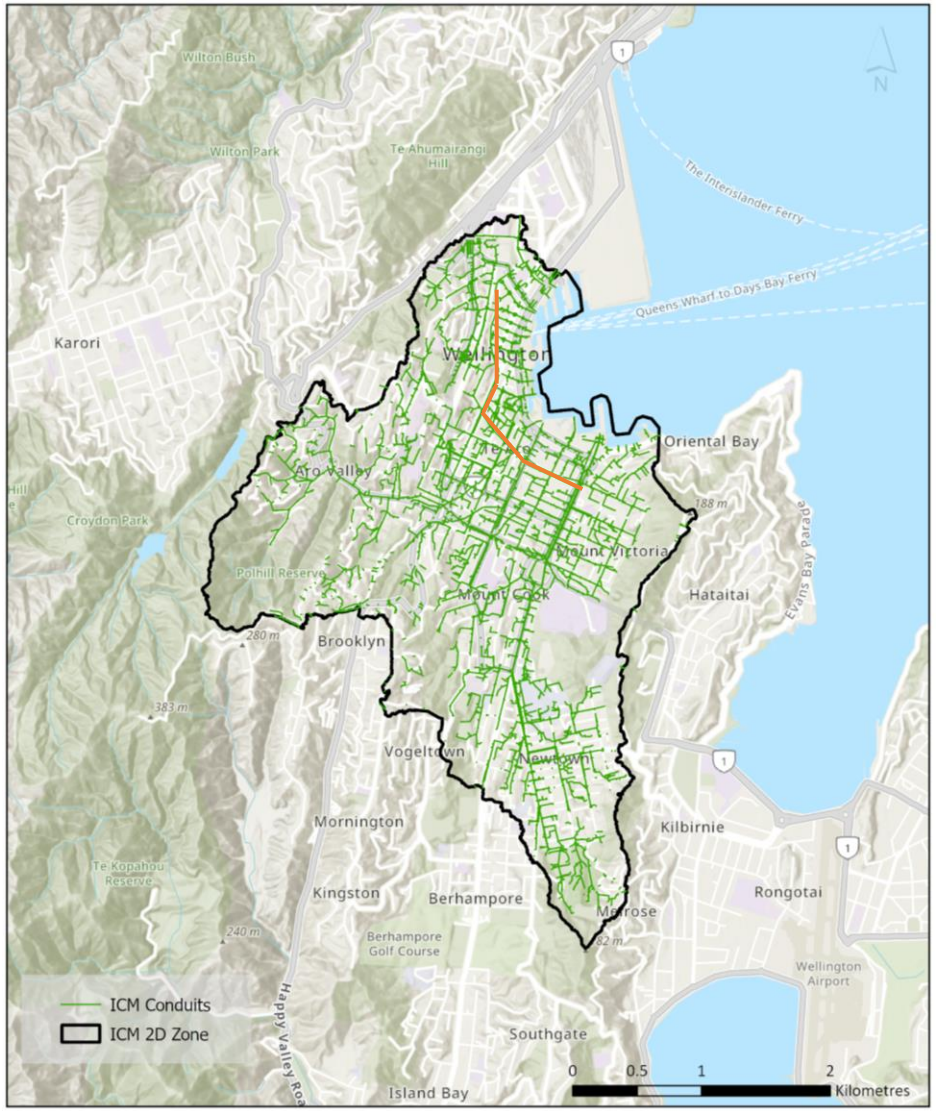
# Existing Southern CBD Model

- Wellington Water model for district plan mapping and catchment management

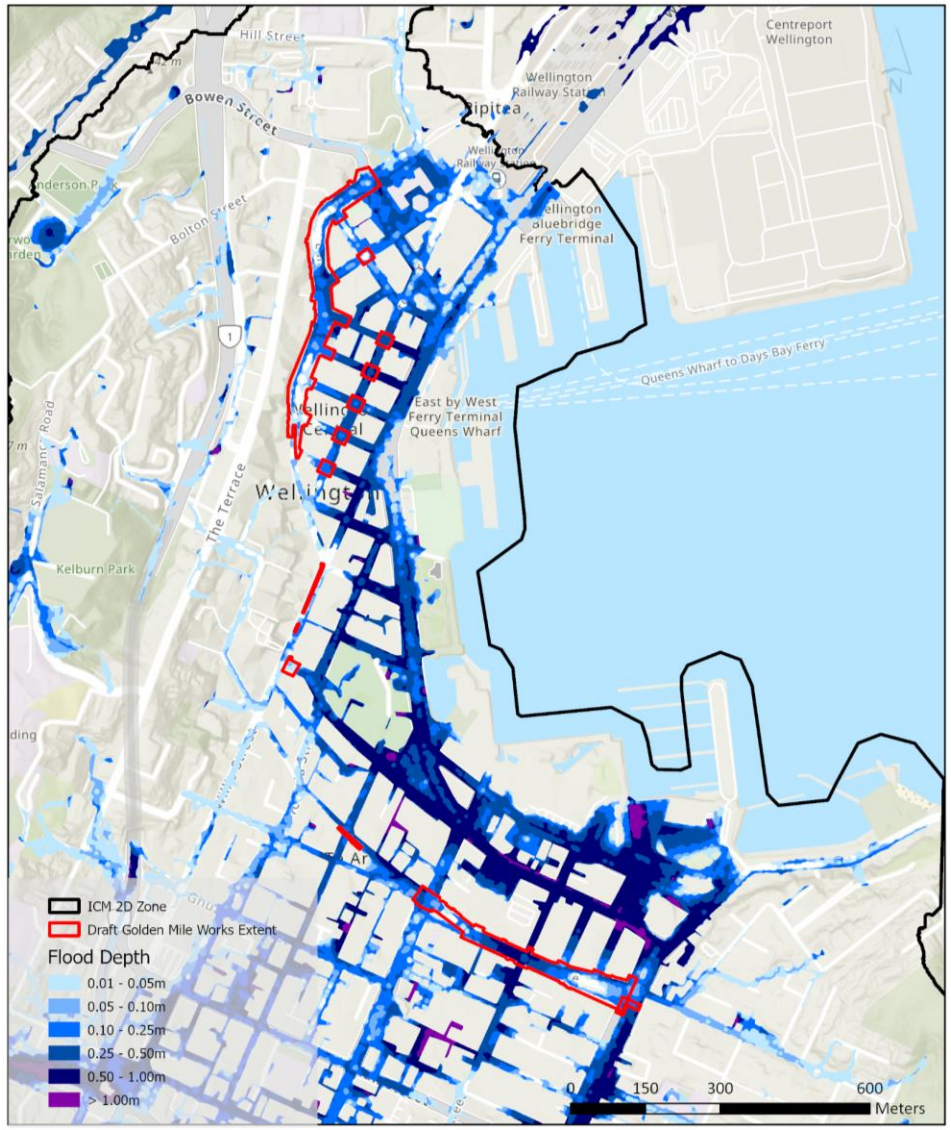
- Provides reliable and useful results

**Consists of:**

- 9000 Stormwater nodes
- 8000 Pipes
- 7000 Subcatchments
- 2-4m2 mesh cells (~3million cells)



# Golden Mile Extent



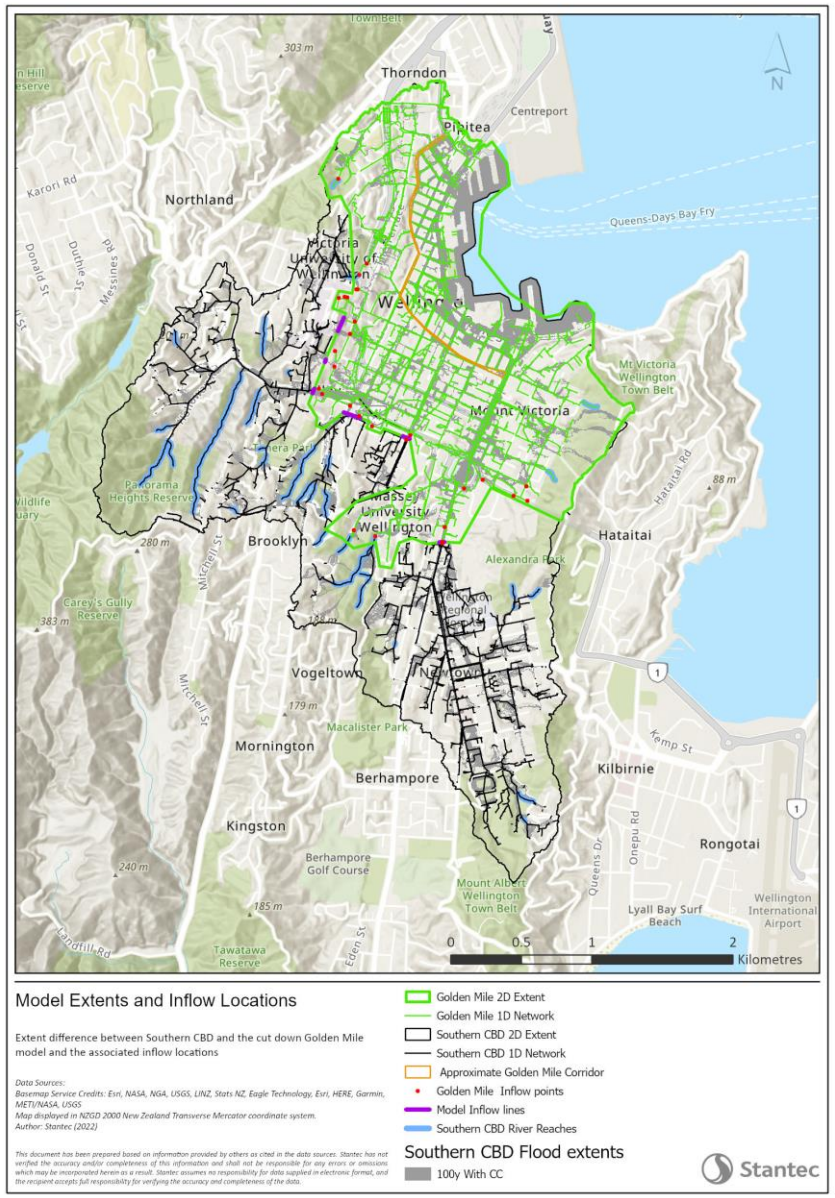

Wellington City Council Flooding Extents

# Golden Mile

# Conversion to Rain on Grid

**Process**

- Reduce 2D extent to focus area:
  - Reduced simulation times
  - Inclusion of road survey 0.1m resolution
- Inflow at key locations (1D and 2D)
- Update stormwater network following road surveys

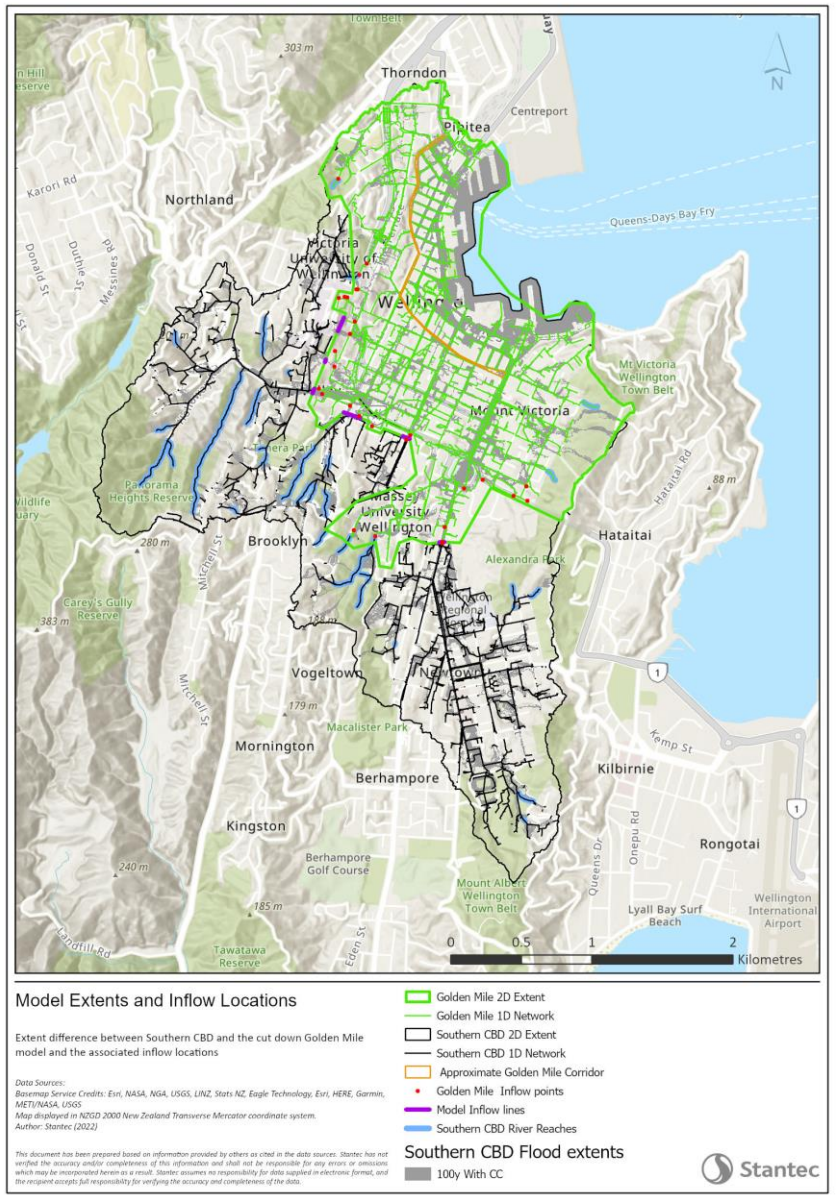


# Simulation Setup

**Two scenarios: baseline and design**

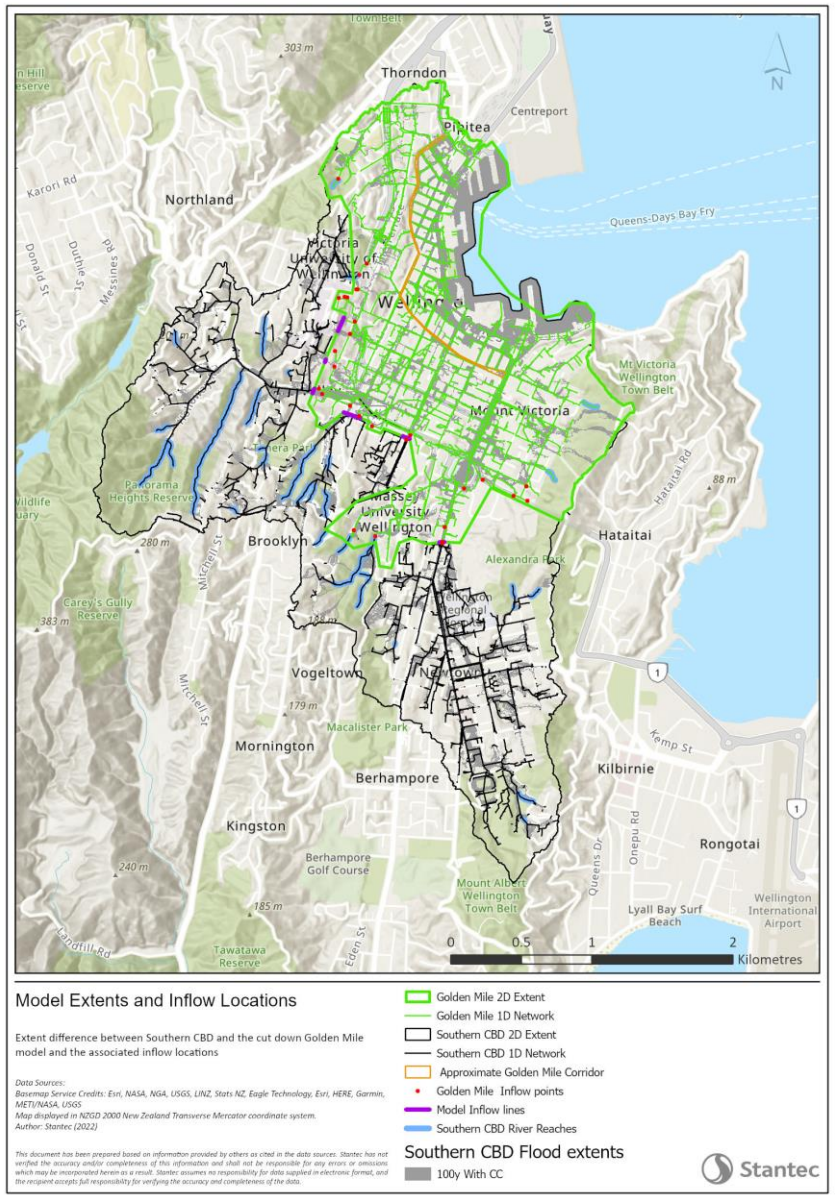
- 0.1m existing road survey – baseline
- 0.1m design surface stamped on top of road survey - design

- 2-4m mesh – following existing SCBD model
- Break lines added along road edges and kerbs
- Updated pipe network
- Nested rainfall - 100y with 20% for climate change
- 1m sea level rise

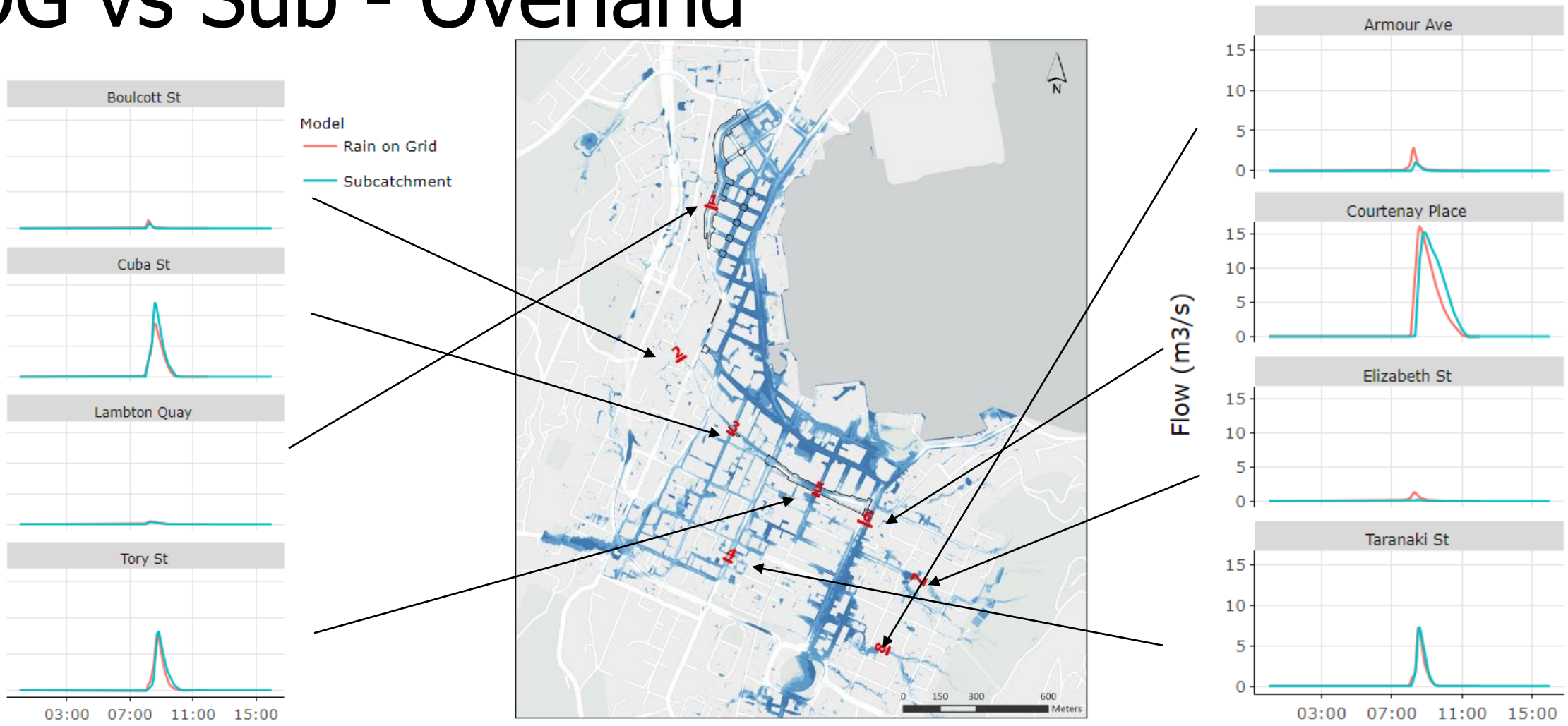


# QA

- Detailed check of baseline rain on grid setup with Wellington Water and Wellington City Council
- Main focus - water surface elevation differences



# ROG vs Sub - Overland



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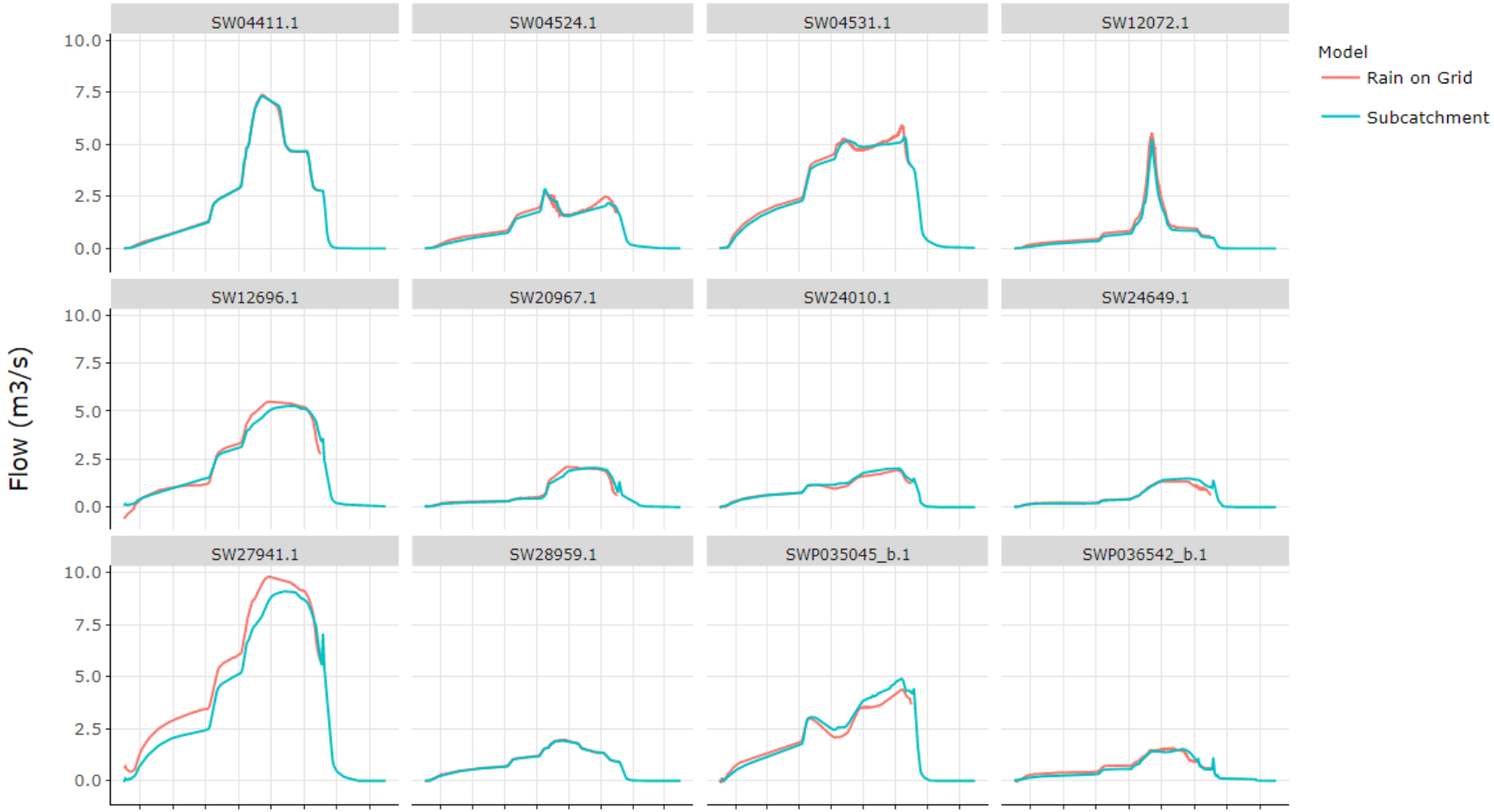

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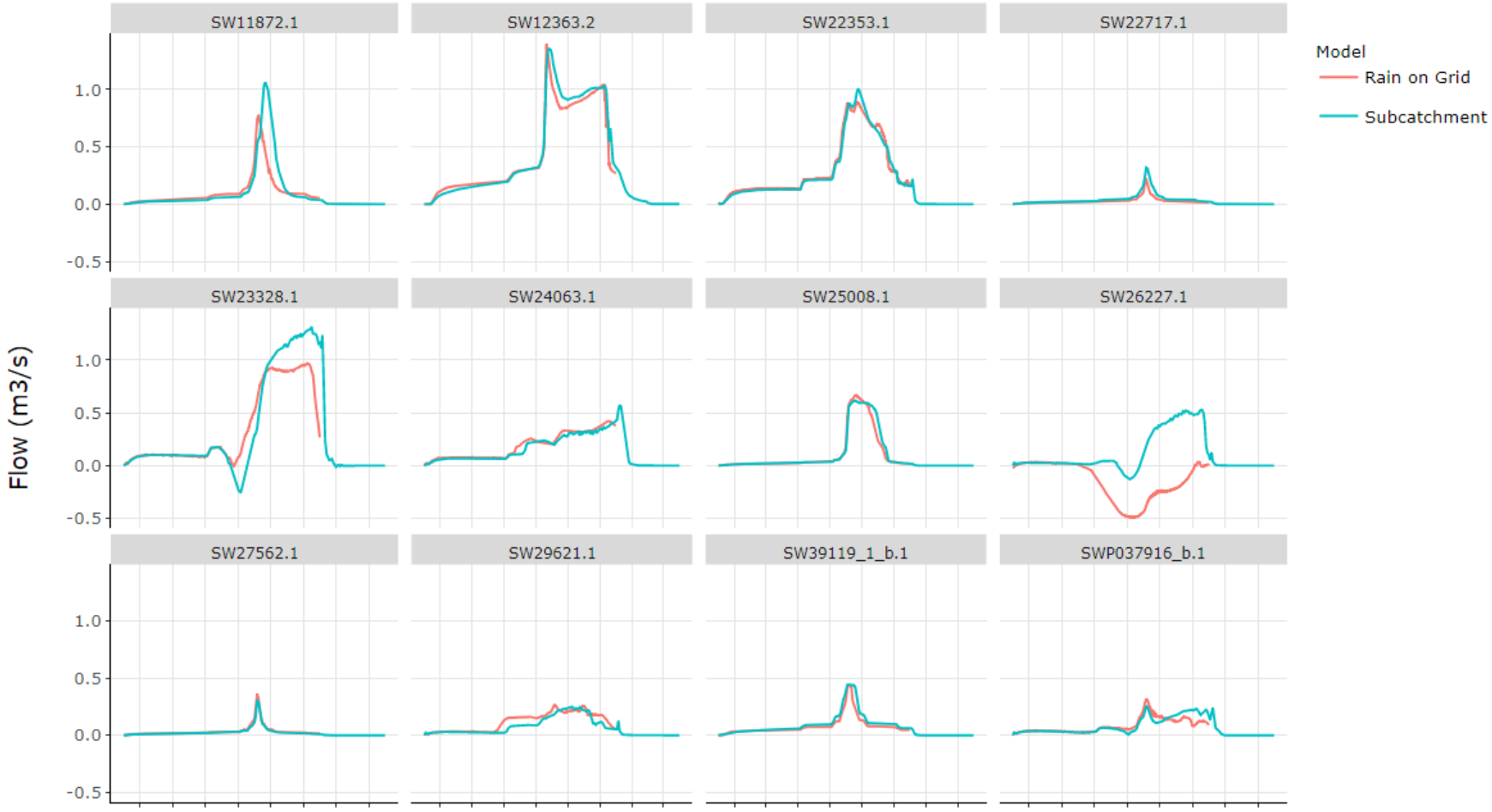
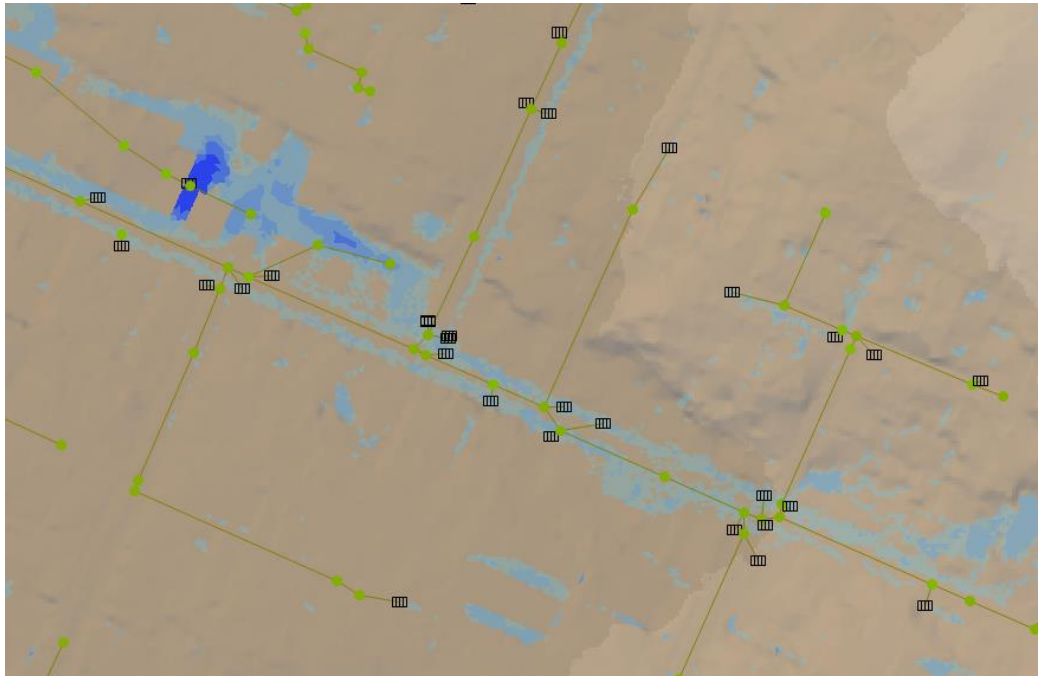
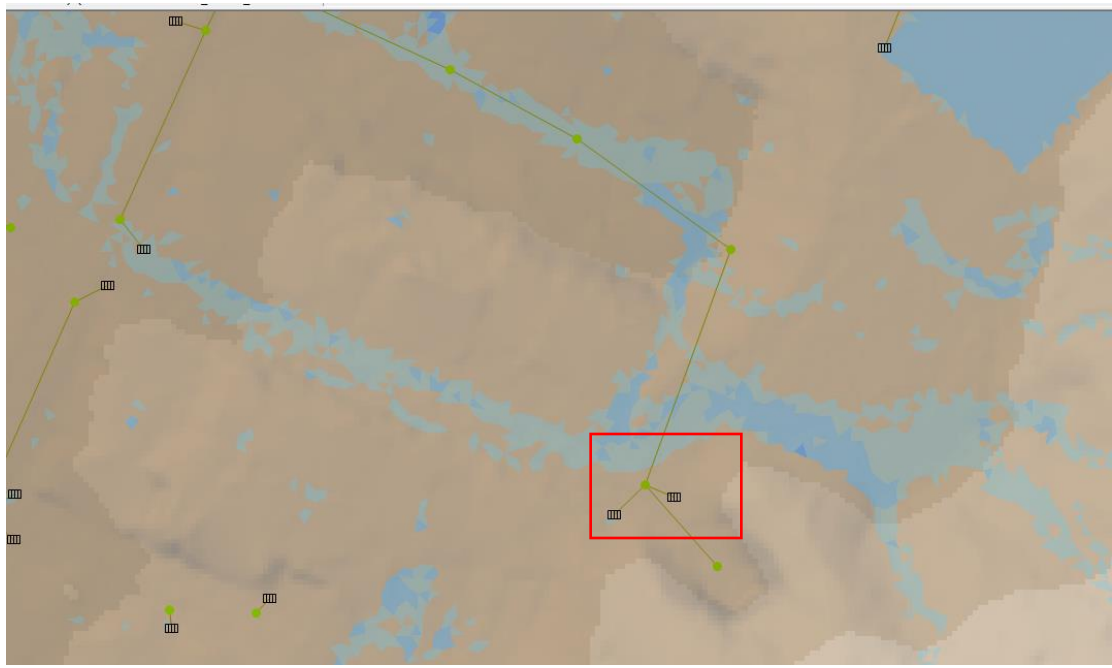


# ROG vs Sub - Pipes

# Sump Location vs Ground Model

- Water may miss getting into a sump
- Flow moving fast or over a sump may be realistic





# Fast Flow and Sumps

- Water may miss getting into a sump
- However, flow moving fast over a sump may be realistic
- Sub-catchment method drains to one location

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# Conclusions

ROG is becoming more commonplace

- Computational power increases
- Cloud processing
- More detailed ground models/DEM
- More detail in pipe networks/GIS
- More calibration and acceptance of methods
- Sub-grid sampling
- Can be used alongside/with sub-catchments

We were able to produce similar results for the Golden Mile model

It is not a replacement of the sub catchment approach but an alternative.

Both methods can produce accurate results and are useful. However, it is important to know limitations of each approach before use.

# References

Johnson, P. (2013). Comparison of direct rainfall and lumped-conceptual rainfall runoff routing methods in tropical North Queensland–a case study of Low Drain, Mount Low, Townsville.

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# Thank you!
# Questions? Patai?

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