

# COMPARISON OF FLOOD SIMULATION RESULTS USING RAINFALL DATA SOURCED AT DIFFERENT TEMPORAL PATTERNS AND SPACIAL SCALES

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# Project Overview

- Assessing the flood prediction accuracy in Urban areas utilizing rainfall of different **spatial scales and temporal patterns**.
- Study Area :Geelong (Regional Australia).
- The change in climate causes increase in occurrence and severity of floods.
- Heavy stress on existing storm drainage systems.
- Flood prediction is difficult.
- Development of a1D/2D PCSWMM model.
- Point rain gauge data from **BoM**, alongside observed data used for model validation.



## Rainfall Data & Hydrology

**ARR 1987-** Only uses a single design storm pattern (Temporal)

**ARR 2016-** Ensemble of 10 design rainfall patterns (Temporal)

**Weather Radar rainfall data-**  
Obtained from BoM; (Spatial and Non-Uniform)

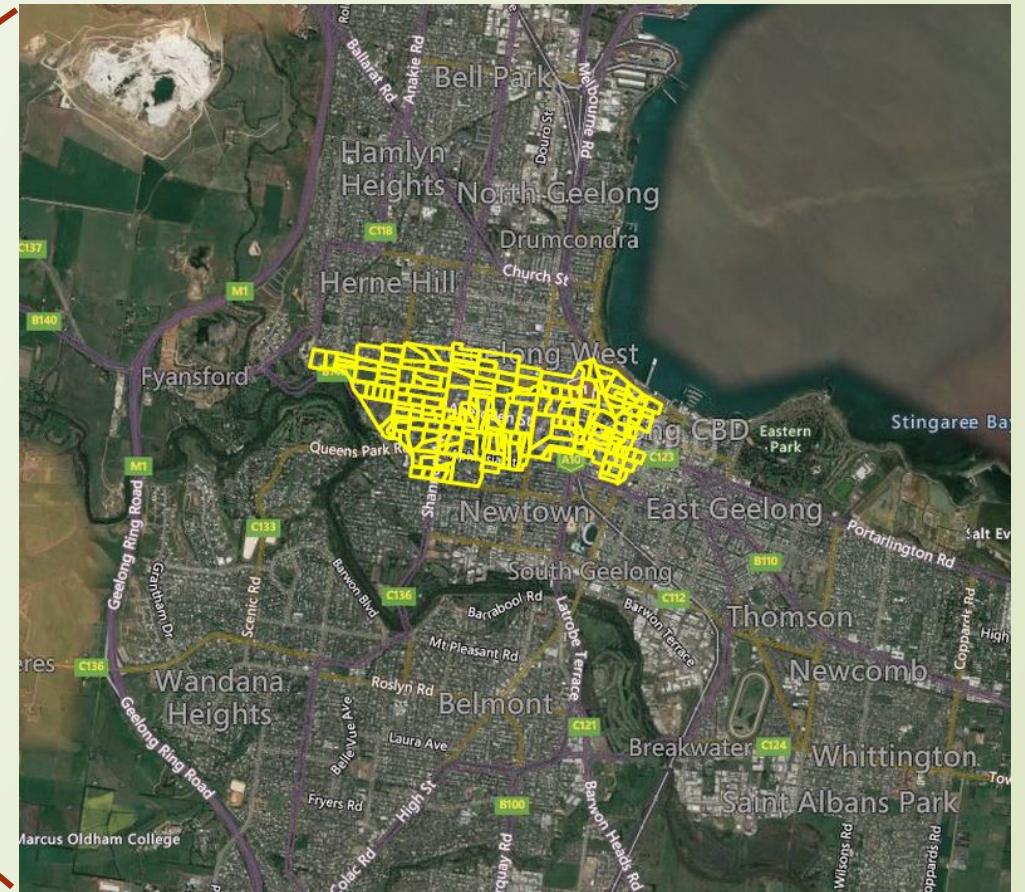
*\*ARR- Australian Rainfall and Runoff*



# Project Aims

- Compare the different approaches by the ARR 1987 and ARR 2016 in its capability to accurately predict flooding levels.
- Test the hypothesis that spatial, non-uniform (Radar) rainfall provides more realistic results.

# Study Area



- **Study Area** – Geelong
- **Population** – 268,277
- **Area** – 1,329 sqkm
- **Mean Max. temp** – 19.0°C
- **Mean Min. Temp** – 9.6°C
- **Annual rainfall** – 564 mm

# Study Catchment

- Cunningham Catchment (Geelong)
- **Catchment Area** – 402.3 Ha
- Frequent flood occurrence
- Photographic evidence for flooding will allow for model validation
- Main cause of Flooding □ Surcharging of Pipe network



# Historical Flood events under study

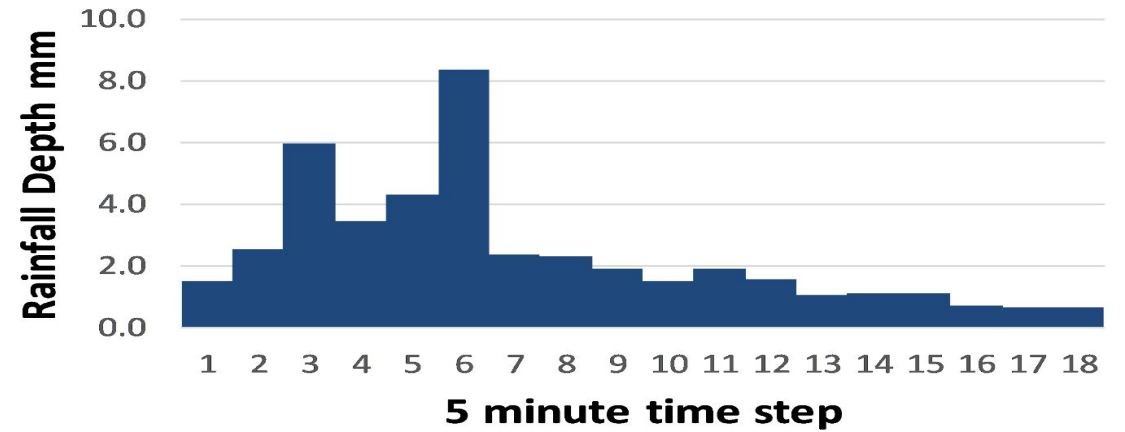
Date	Overview	Rainfall	Damages
18 <sup>th</sup> Feb 2014	<ul style="list-style-type: none"><li>Localized Storm</li><li>Weather Station recorded 33mm rainfall in 10 minutes</li></ul>	<ul style="list-style-type: none"><li>54 mm of rainfall over 24 hours</li></ul>	<ul style="list-style-type: none"><li>Property damage to several areas in Geelong</li></ul>
26 <sup>th</sup> Jan 2016	<ul style="list-style-type: none"><li>Twice the average rainfall for January</li><li>500 SES calls</li><li>150 homes flooded</li><li>Avalon Suffered 1% AEP storm event</li></ul>	<ul style="list-style-type: none"><li>41.6mm of rainfall in 1.5 hours</li></ul>	<ul style="list-style-type: none"><li>Millions in property damages</li><li>Minor Injuries</li></ul>
24 <sup>th</sup> Apr 2017	<ul style="list-style-type: none"><li>250 SES calls from Geelong</li><li>Statewide storm</li></ul>	<ul style="list-style-type: none"><li>44mm of rainfall in 24 hours</li></ul>	<ul style="list-style-type: none"><li>Water damage to several cars</li></ul>

- All 3 are exceeding 1 in 50 year storm events.*

# DESIGN RAINFALL PATTERNS USED

- ❑ 26<sup>th</sup> January 2016
- ❑ Same ARI and AEP as actual storm
- ❑ **ARR 1987** only considers one temporal pattern
- ❑ Ensemble of 10 temporal patterns **ARR 2016**


**ARR 1987 1.5hr 2% AEP (1:50 ARI)  
Hyetograph**






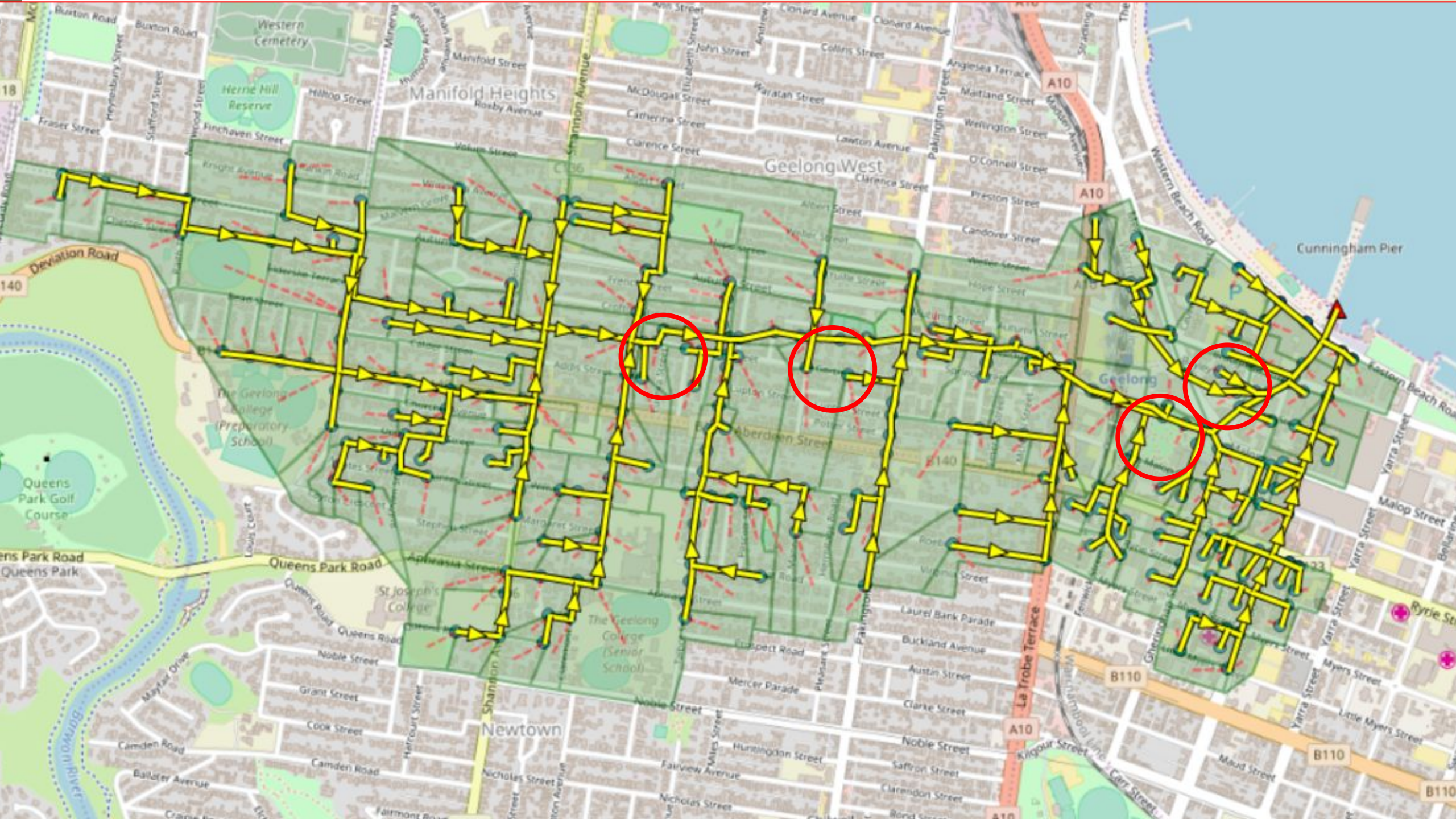
# Modelling

- **1D modelling** □ Provides hydrographs, HGL, times to peak and volumes of flow
- **1D/2D modelling** □ Flooding depths
- **Model validation** □ Compare 2D results with photographic evidence (Flood Inundation Simulations)
- Validated model to be compared against flooding levels to those in **ARR 1987, ARR 2016** and **Weather radar data**



PCSWMM  
MODEL





# 2D- Model Results (26<sup>th</sup> January 2016)



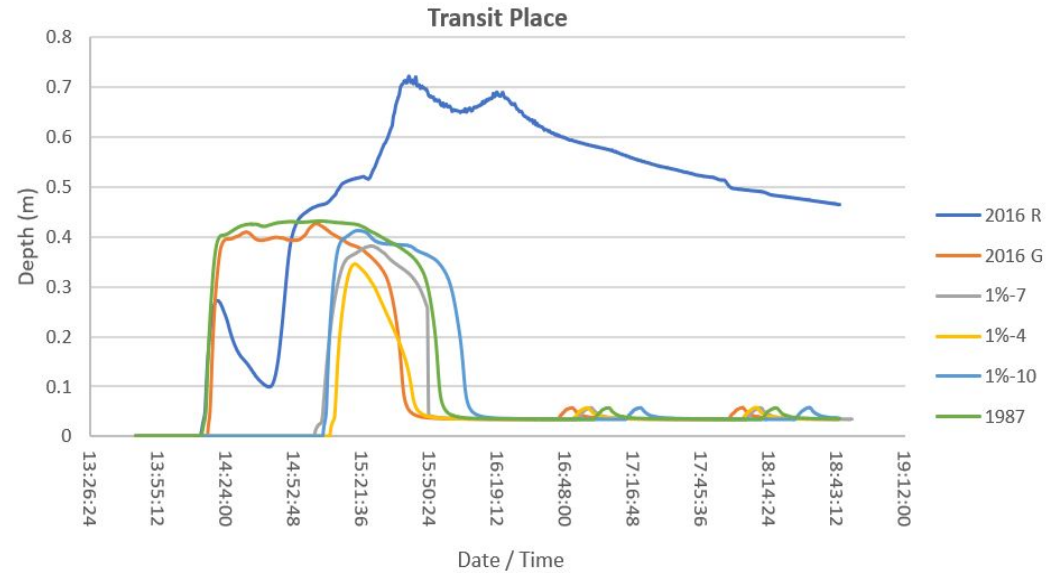
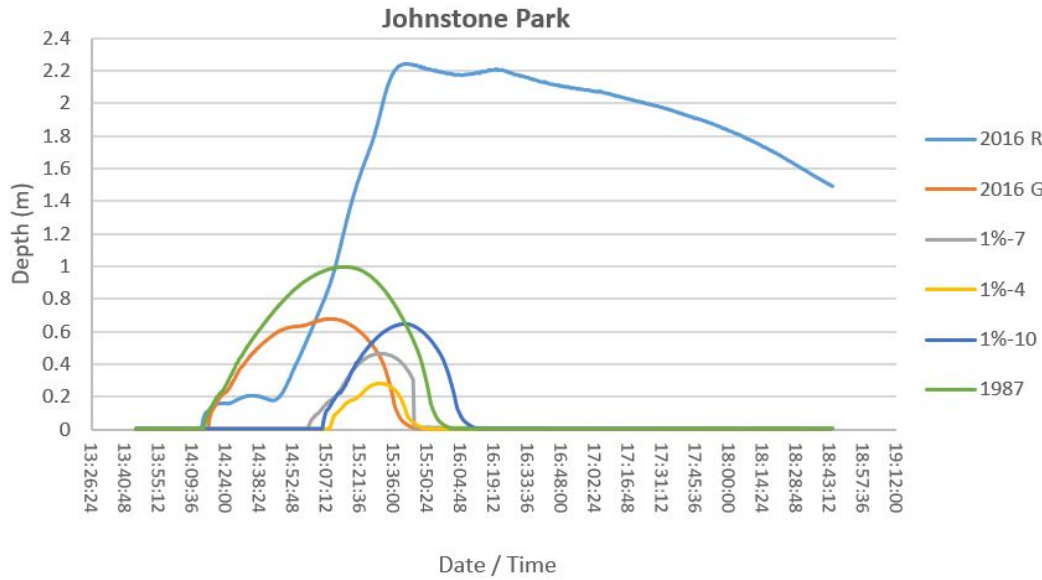
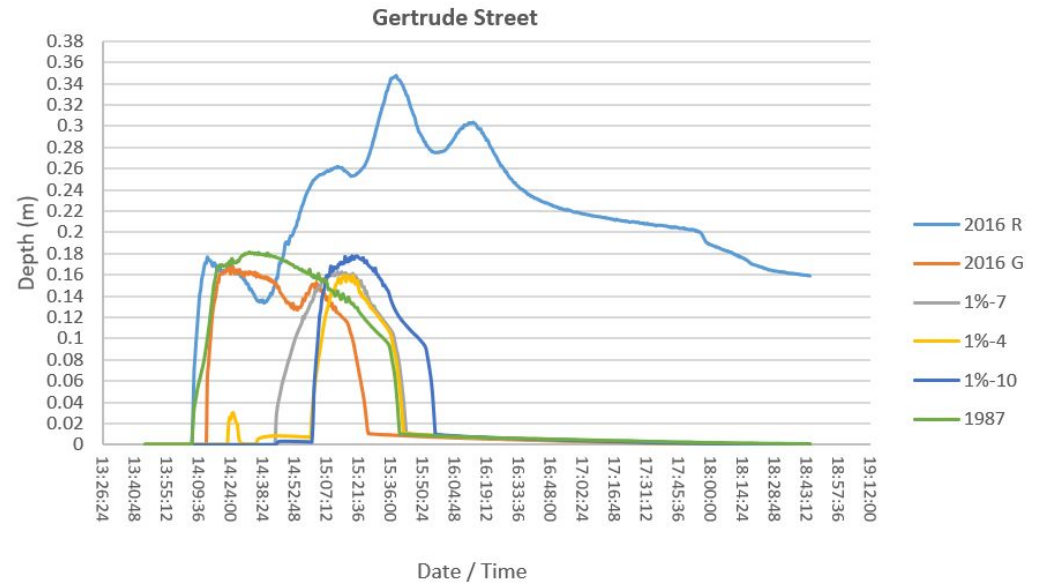
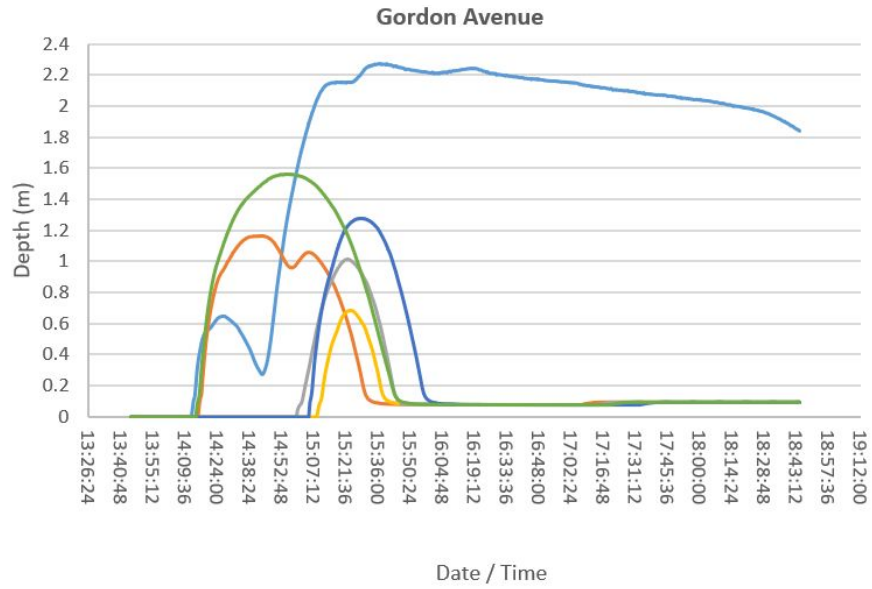
Actual flood inundation level  $\approx$  1.46m



Model flood inundation (Rain gauge) = 1.19m

Location	Observed,m	Point Rain gauge,m	ARR 1987,m	ARR 2016 Ensemble 10 (max),m	ARR 2016 Ensemble 7 (median),m	ARR 2016 Ensemble 4 (min),m	Radar Rainfall,m
<b>Gordon Avenue</b>	1.46	1.19	1.556	1.28	1.01	0.68	2.27
Johnstone Park	1.3	0.68	1.05	1.19	0.99	0.8	2.29
Transit Place	0.65	0.43	0.395	0.375	0.345	0.315	0.72
Gertude Street	-	0.17	0.24	0.24	0.22	0.21	0.347

Comparison of  
Flood depths and  
Peak timings (26<sup>th</sup>  
January 2016)





# DISCUSSION



- **Model is deemed to be validated and can be used for future work.**
- **Weather radar data** peaks significantly higher and discharges much slower.
- **ARR 2016** □ Delayed flood peaks and lower flooding levels.
- Rain gauge data and **ARR 1987** □ Similar in terms of flood depths and peak timings.



**PCSWMM FLOOD SIMULATION  
JOHNSTONE PARK AND GORDON AVENUE**



# CONCLUSION

- ❑ **2D flood simulation** ❑ **main tool to validate a model for ungauged catchments.**
- ❑ For ARR 2016, there is minimal guidance on modelling urban catchment flooding.
- ❑ ARR 2016 needs to include more front heavy loaded ensemble patterns.
- ❑ Weather radar data does not provide realistic results.



# ACKNOWLEDGEMENTS



- **City of Greater Geelong (CoGG) Council-** Open data for Subcatchments, pipes, pits and contours
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THANK YOU