



**Manly  
Hydraulics  
Laboratory**

## **Wianamatta South Creek Flood Modelling Review**

**ACCC 18 July 2023**

Department of Planning and Environment

# Scope of work

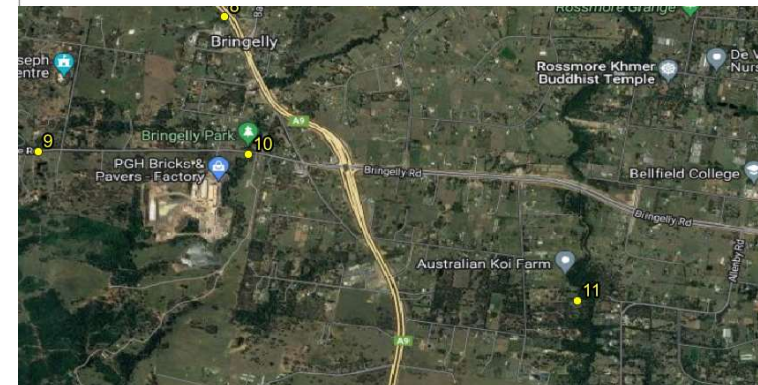
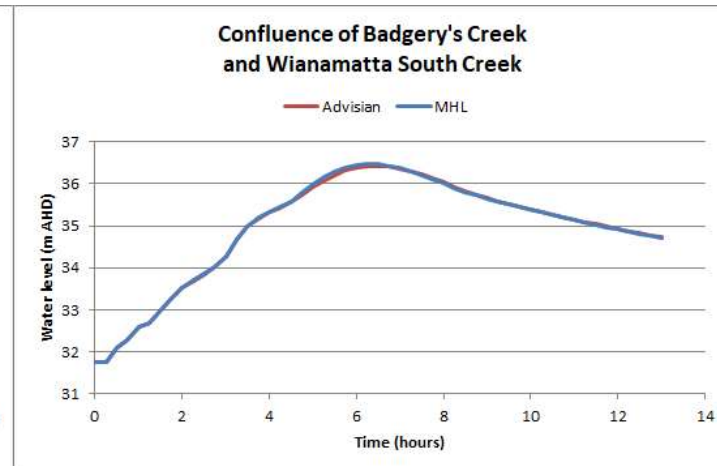
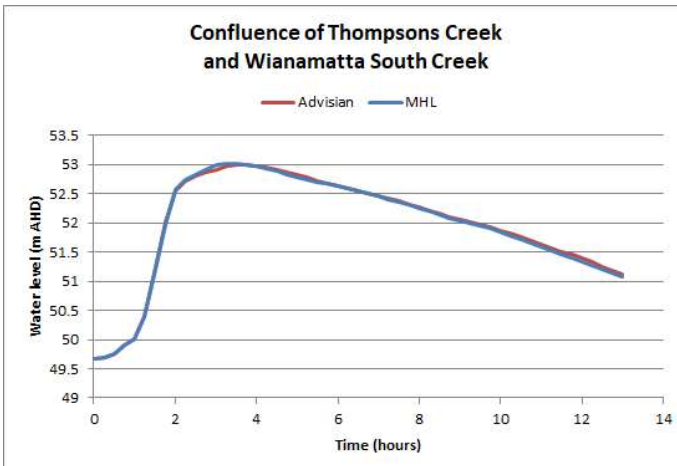
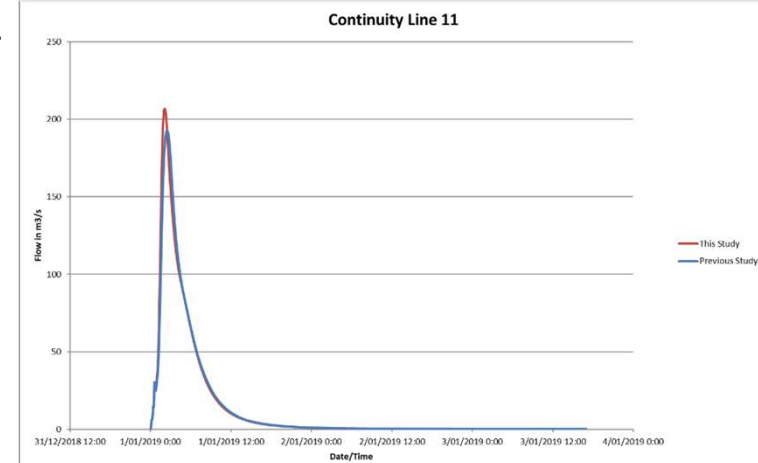
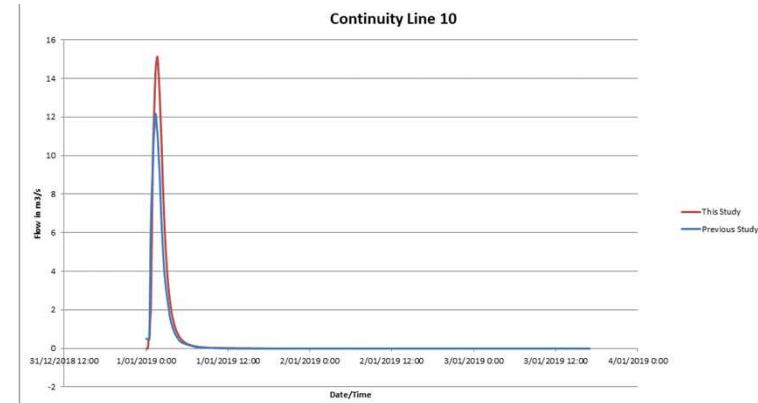
- Review the existing RMA model developed as part of the 2022 Flood Study and confirm its adequacy/accuracy;
- Simulate four (4) recent major flood events that occurred since 2019 (i.e. February 2020, March 2021, March 2022 and July 2022);
- Undertake flood mapping of the above-mentioned events;
- Compare the flood maps of each event with respect to flood mapping of design flood event (e.g. 1% or 5% AEP flood events);
- Summarise community consultation results;
- Discuss ground-truthing activities undertaken by Council;
- Discuss potential impacts of upstream development and climate change; and
- Summarise results of the study in a brief report.

# Model review summary

- Assess the appropriateness of the general model schematisation and model type used
- Examine model input files and provide confirmation of appropriateness for the investigation including:
  - Model extent
  - Model resolution
  - Model upstream and downstream boundary conditions
  - Key hydraulic structures (e.g. bridges or culverts)
  - Elevation data
- Review key model assumptions and methodologies including:
  - Roughness
  - Losses
  - Initial conditions
  - Key structures
  - Rainfall/flow inputs
  - DEM modifications
  - Storage factor and other hydraulic parameters
- Confirm the model has been appropriately calibrated/validated.
- Review model stability.
- Review of consistency between the XP-RAFTS and RMA results.

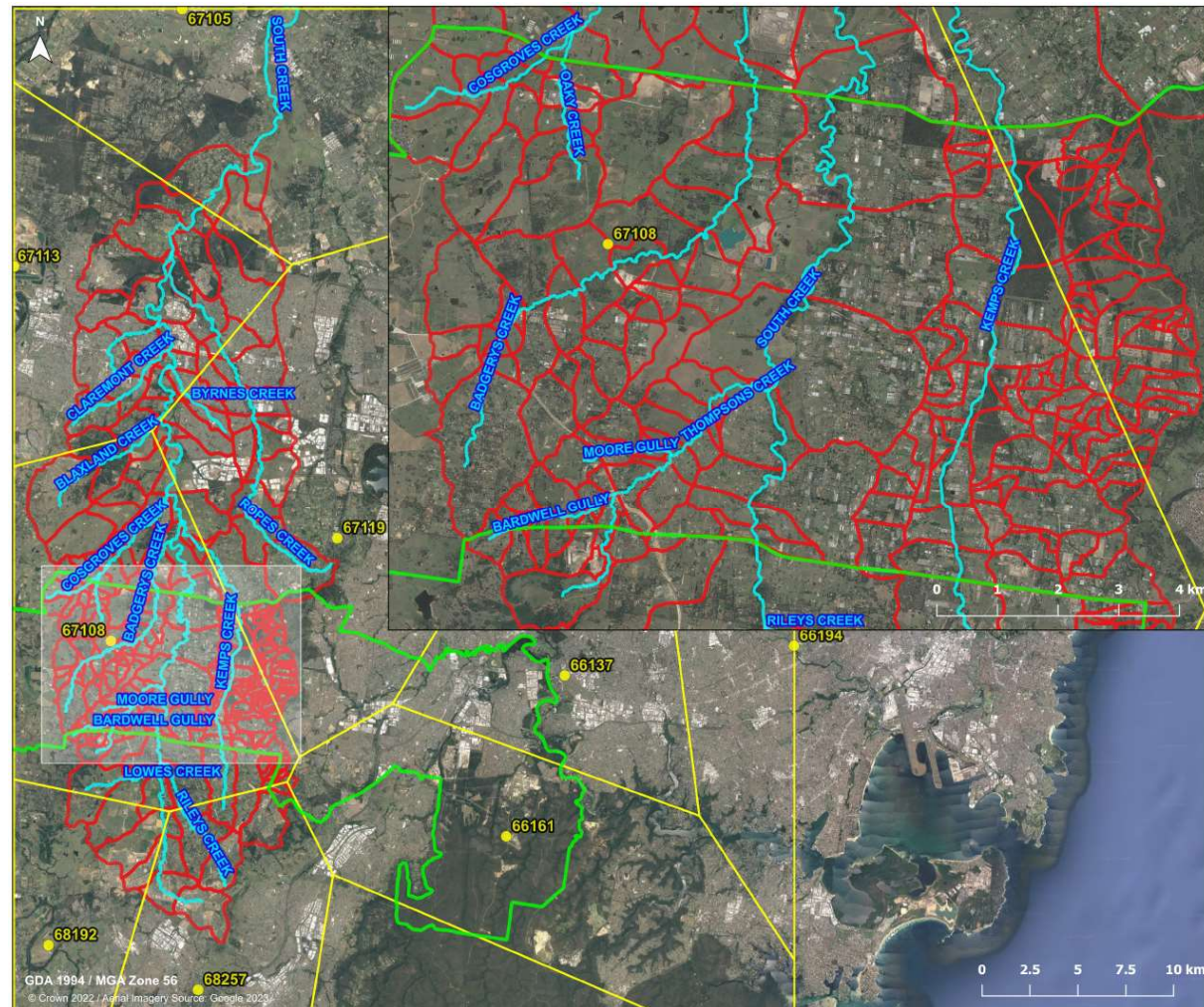
# Model review outcomes

- Model runtime is significant possibly due to elongated cell sizes
- TUFLOW typically preferred in recent years for flood studies
- Some discrepancies were observed between the hydraulic and the hydrologic model (e.g. 5 sub-catchments use local instead of total flow, 4 sub-catchments are missing from hydraulic model and a couple of sub-catchment inflows have been swapped)
- A couple of inflow hydrograph appear different by 5-10% when running the hydrologic model with no changes
- Despite discrepancies, levels appear consistent and model was adopted to run the recent historical events



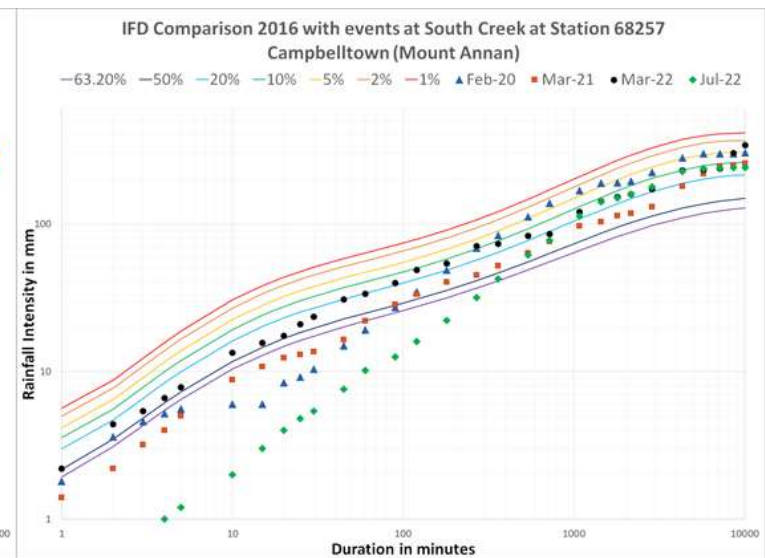
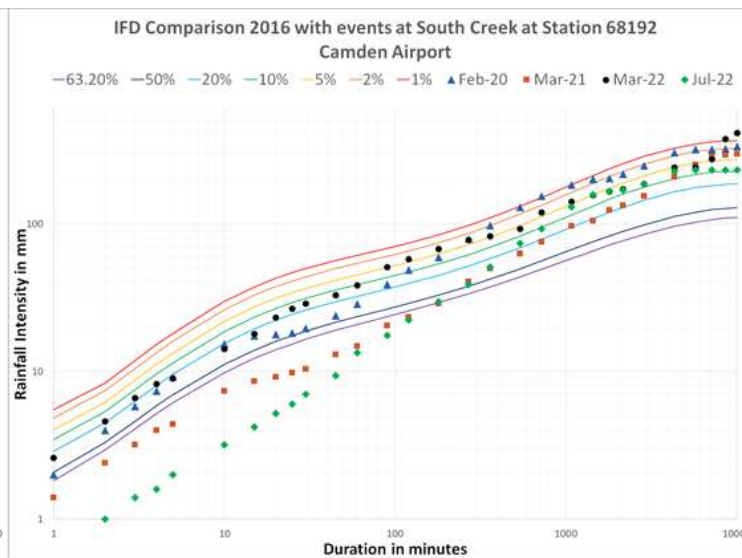
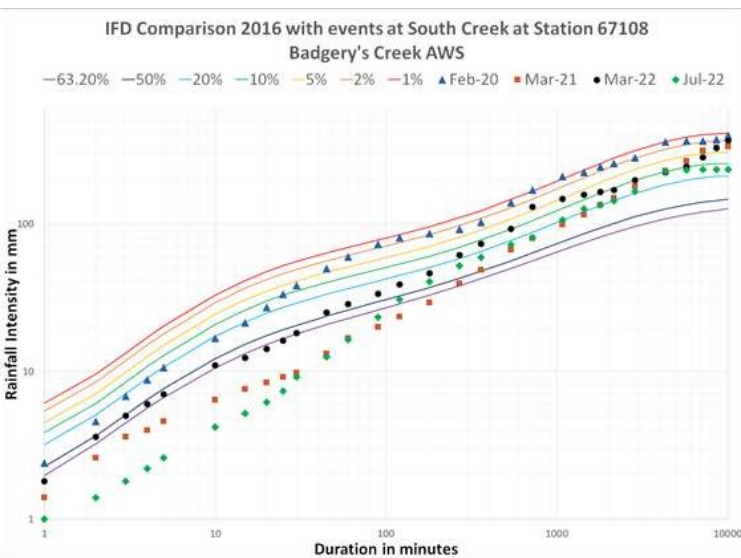
# Recent historical events modelling approach

- Rainfall data from February 2020, March 2021, March 2022 and July 2022 flood events were extracted at various BoM monitoring stations around the catchment
  - 67105 – Richmond RAAF
  - 67113 – Penrith Lakes AWS
  - 67119 – Horsley Park Equestrian Centre AWS
  - 67108 – Badgery's Creek AWS
  - 68192 – Camden Airport AWS
  - 68257 – Campbelltown (Mount Annan)
  - 66161 – Holsworthy Aerodrome AWS
  - 66137 – Bankstown Airport AWS
  - 68263 – Holsworthy Defence AWS
- Thiessen Polygon approach waws used to distribute rainfall
- Gauges 67108 covers the bulk of the Liverpool LGA catchment and 68192 and 68257 cover the upstream part of the catchment



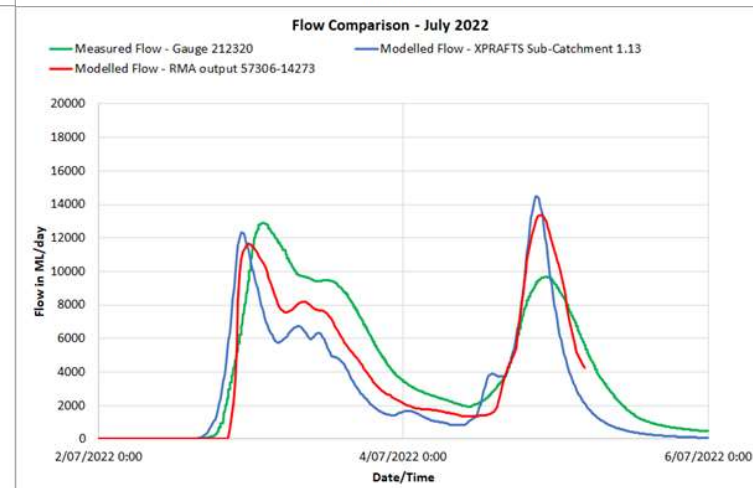
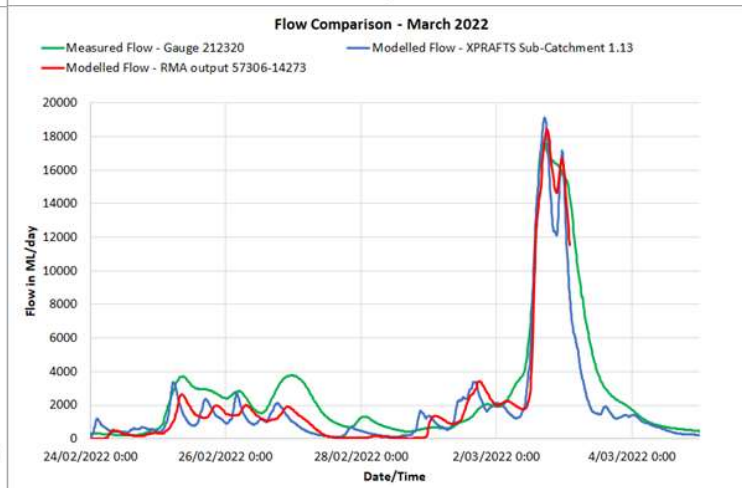
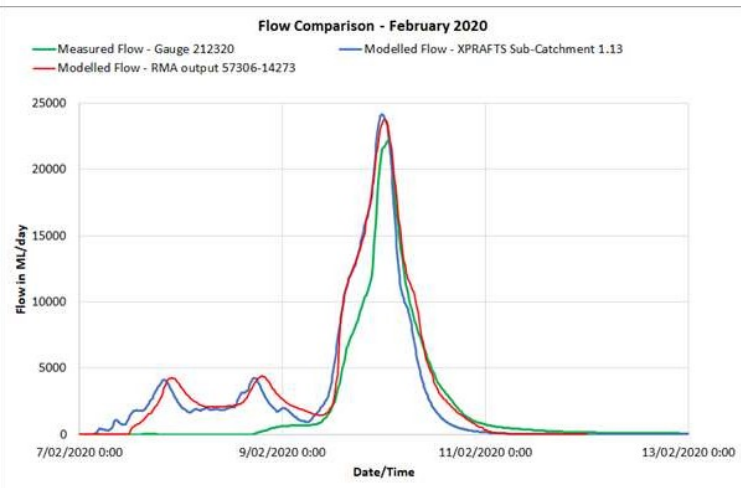
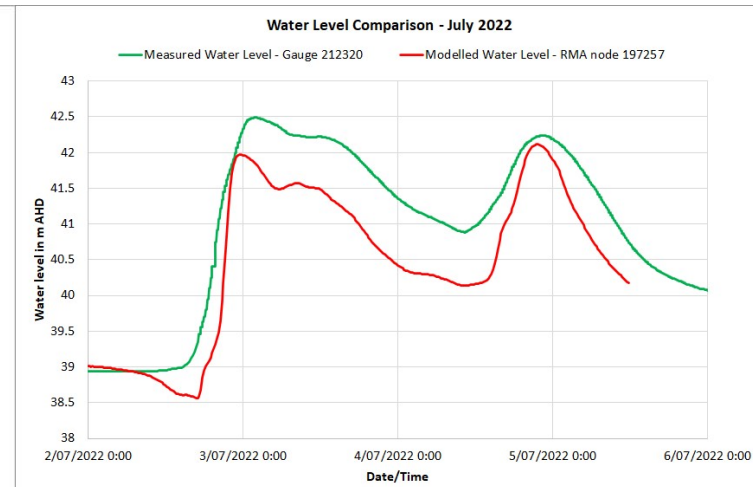
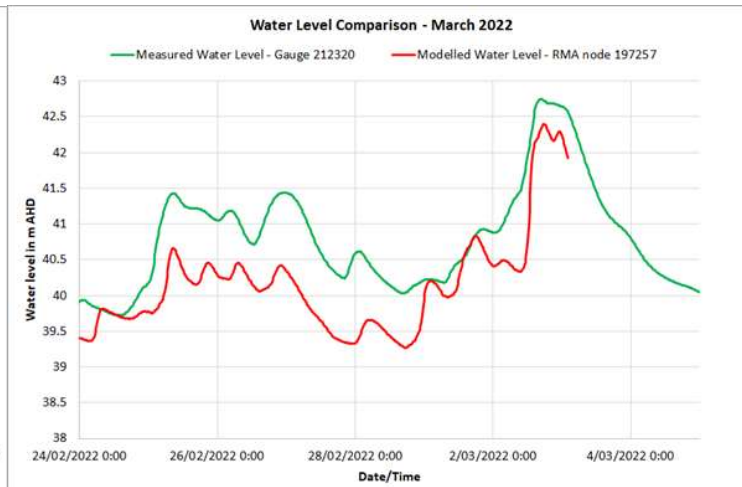
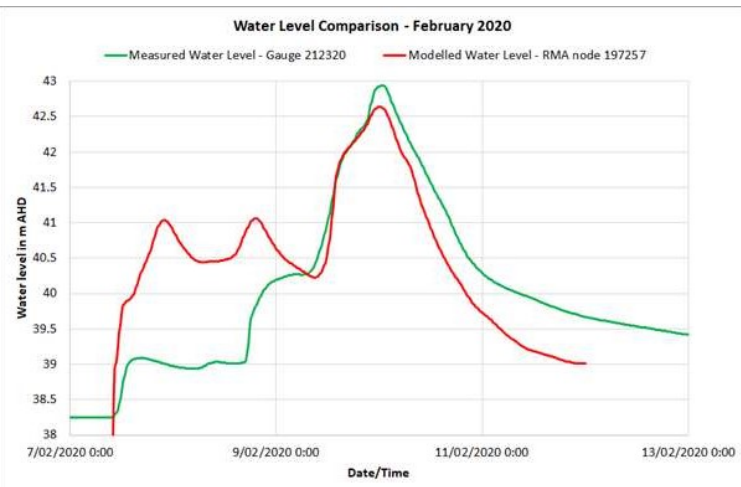
# Recent historical events description

- IFD of four events were created at the three main gauges
- Some differences between upstream and main catchment



# Recent historical events modelling results

Location (listed from south to north)	Peak Flood Level (mAHD)				
	20% AEP	5% AEP <sup>^</sup>	1% AEP <sup>^</sup>	0.2% AEP	PMF
U/S of Elizabeth Drive - Wianamatta South Creek	42.4	42.8	43.1	43.3	44.0



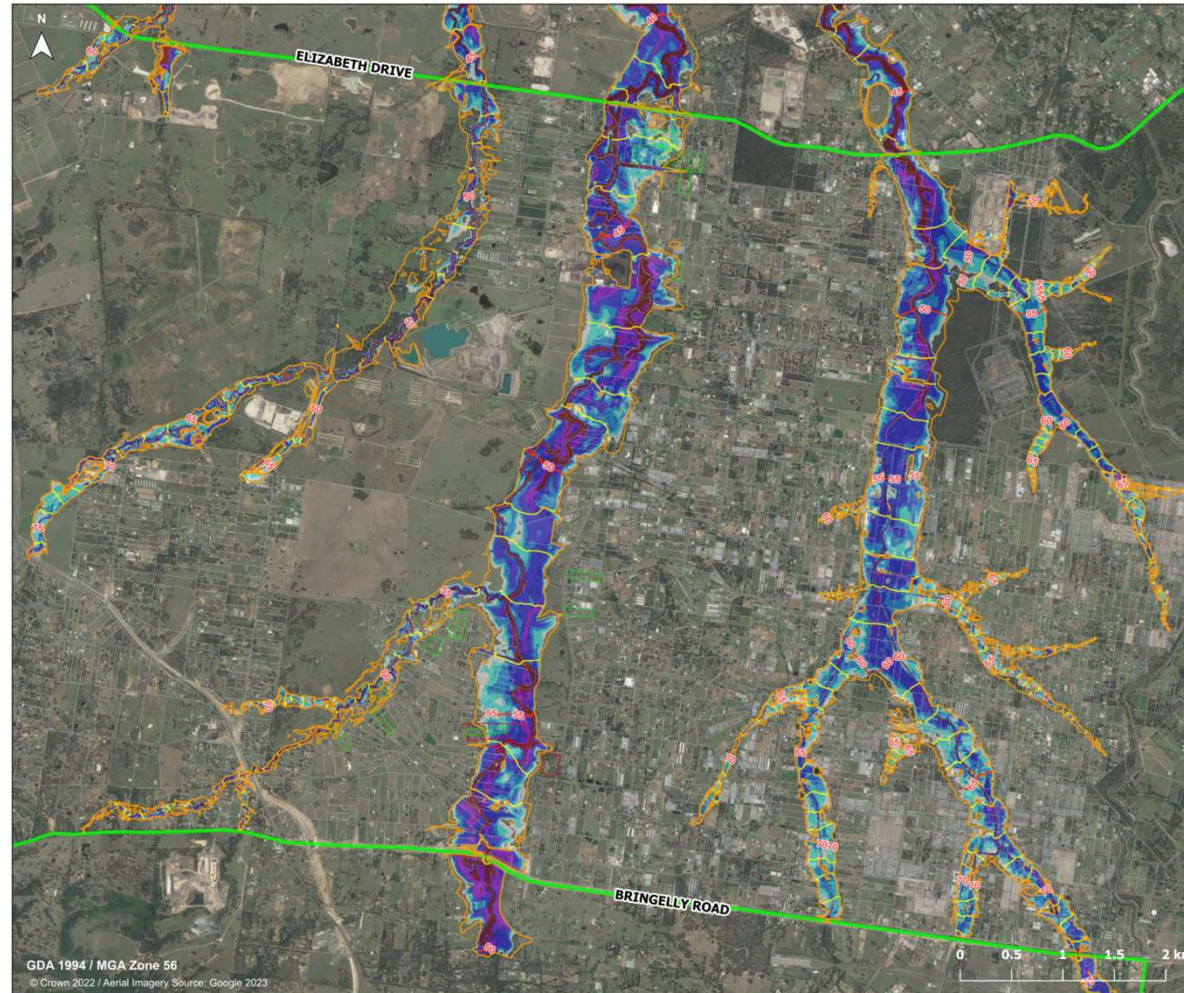
# Recent historical events modelling results (cont'd)

- Water level differences of 0.3-0.5m at peak which is the difference between a 5% and a 1% AEP flood event in the flood study
- Overall shape appears consistent
- Peak flow over-estimated for February 2020, fair match for March 2022 and underestimated for July 2022
- Stability issues for March 2021
- Differences can be due to calibration issues in hydrologic model, potential minor calibration issues in hydraulic model and significant uncertainties in rainfall data (e.g. localised storm cells not properly captured by rainfall gauges)



# Recent historical events modelling results

February 2020 vs.  
1% AEP event

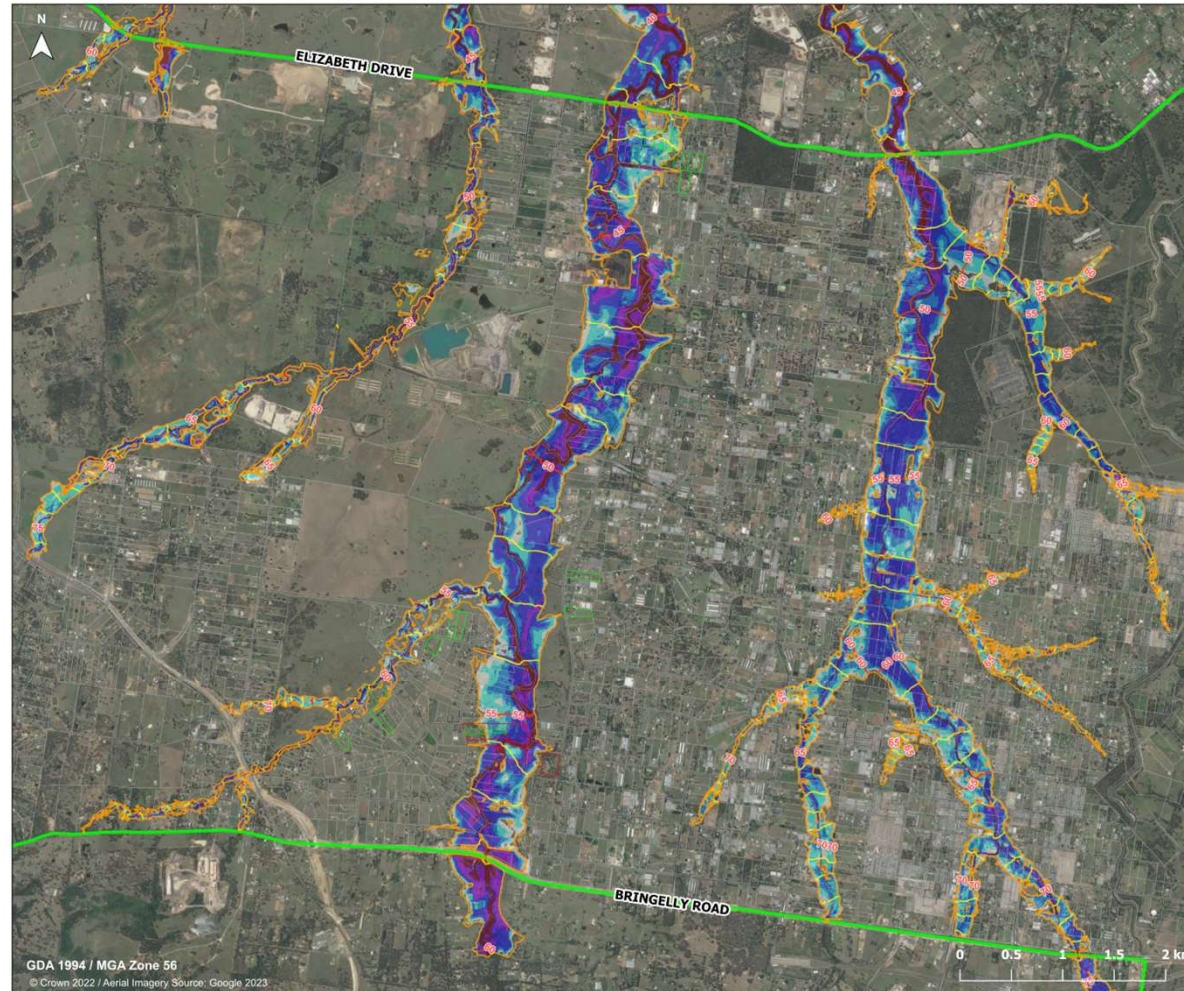


Attachment 2: February 2020 peak flood depths and levels

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# Recent historical events modelling results

February 2020 vs.  
5% AEP event

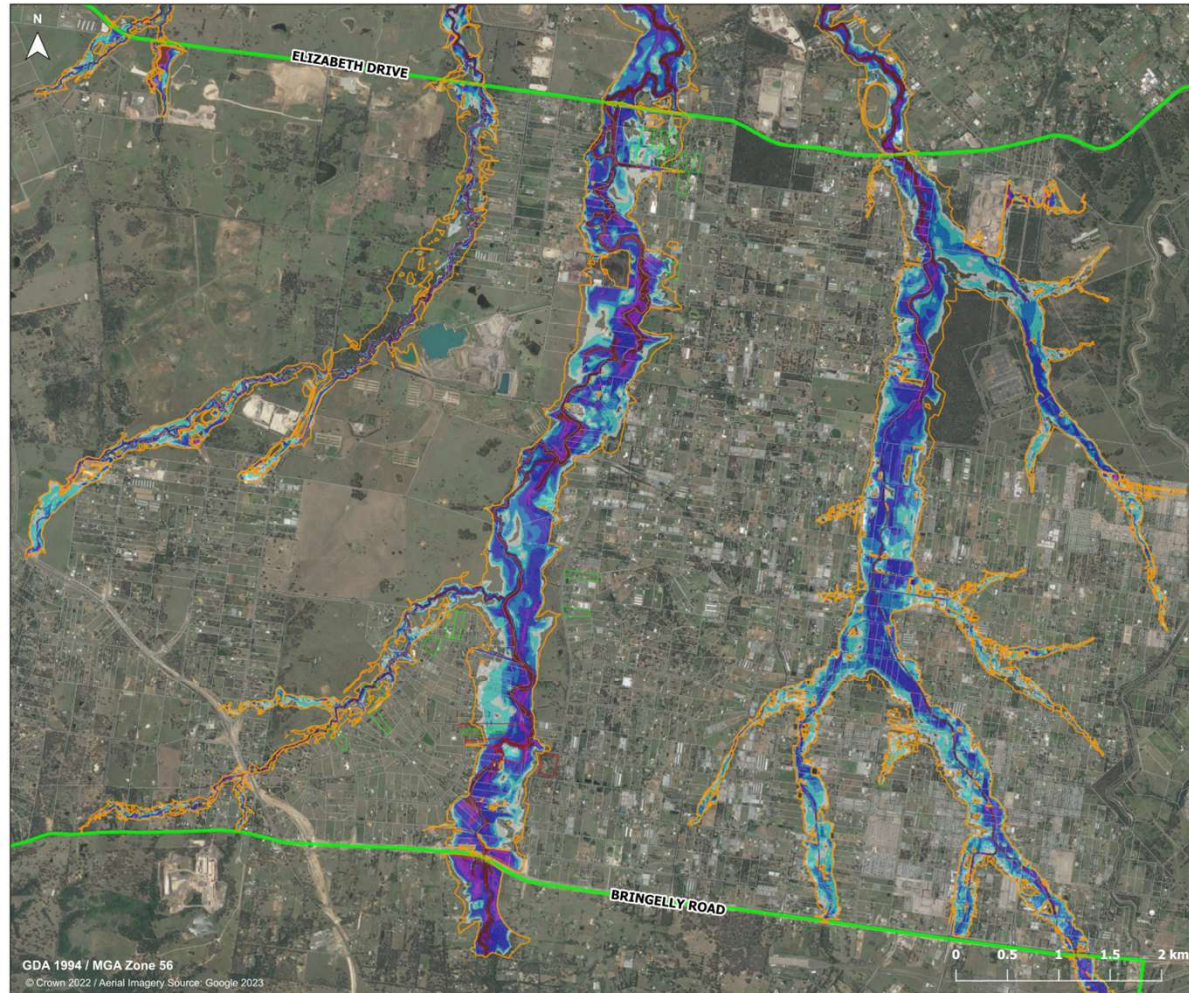


Attachment 2: February 2020  
peak flood depths and levels

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# Recent historical events modelling results

March 2022 vs.  
1% AEP event



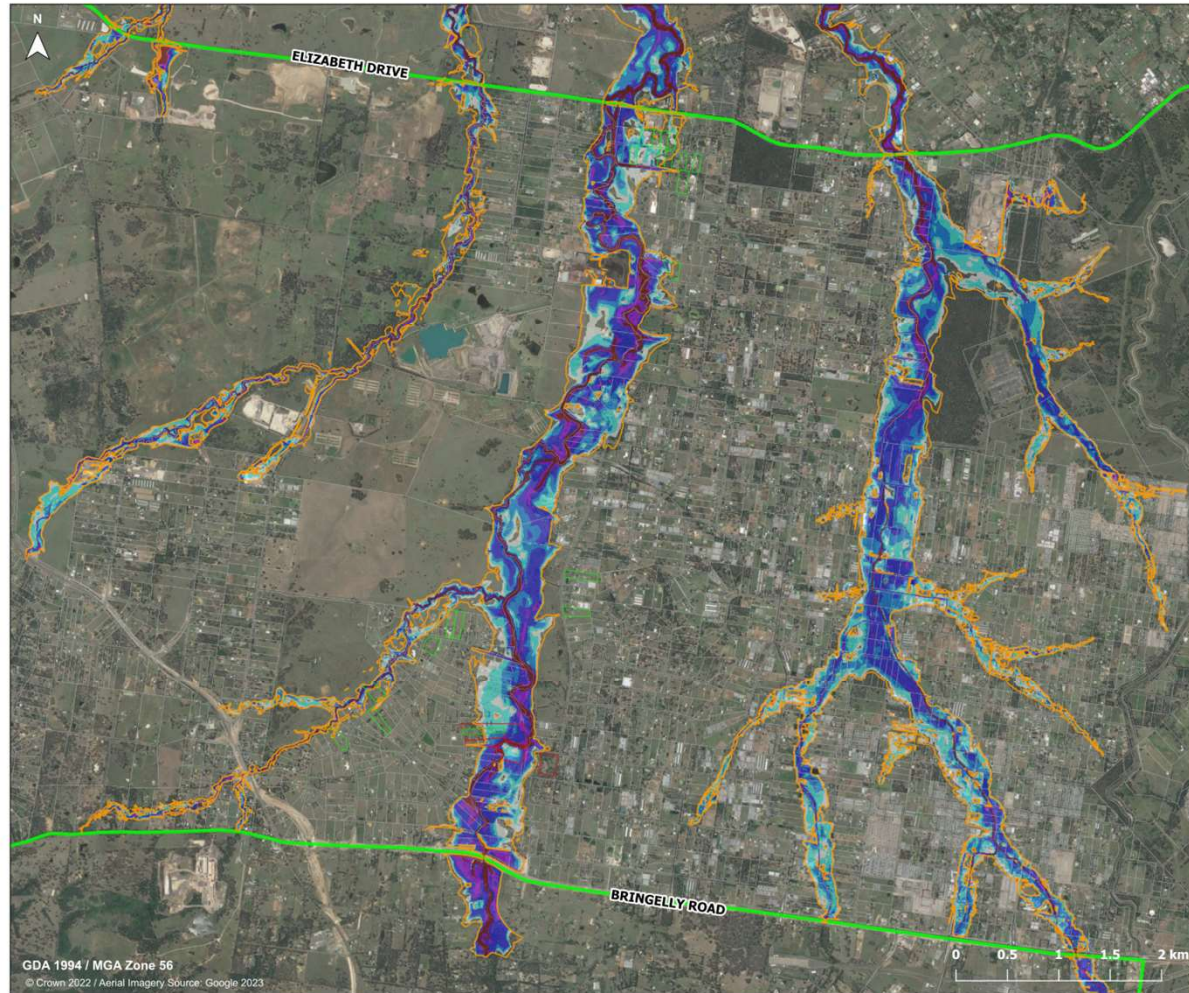
Attachment 2: March 2022  
peak flood depths and levels

- Legend**
- Cadastre
  - 1m contour
  - 5m contour
  - Depth (m)**
    - < 0.15
    - 0.15-0.30
    - 0.30-0.50
    - 0.50-1.00
    - 1.00-1.50
    - > 1.50
  - Liverpool LGA Boundary
  - 1% AEP Flood Extent
  - Property Affected by Flood**
    - No
    - Yes

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# Recent historical events modelling results

March 2022 vs.  
5% AEP event



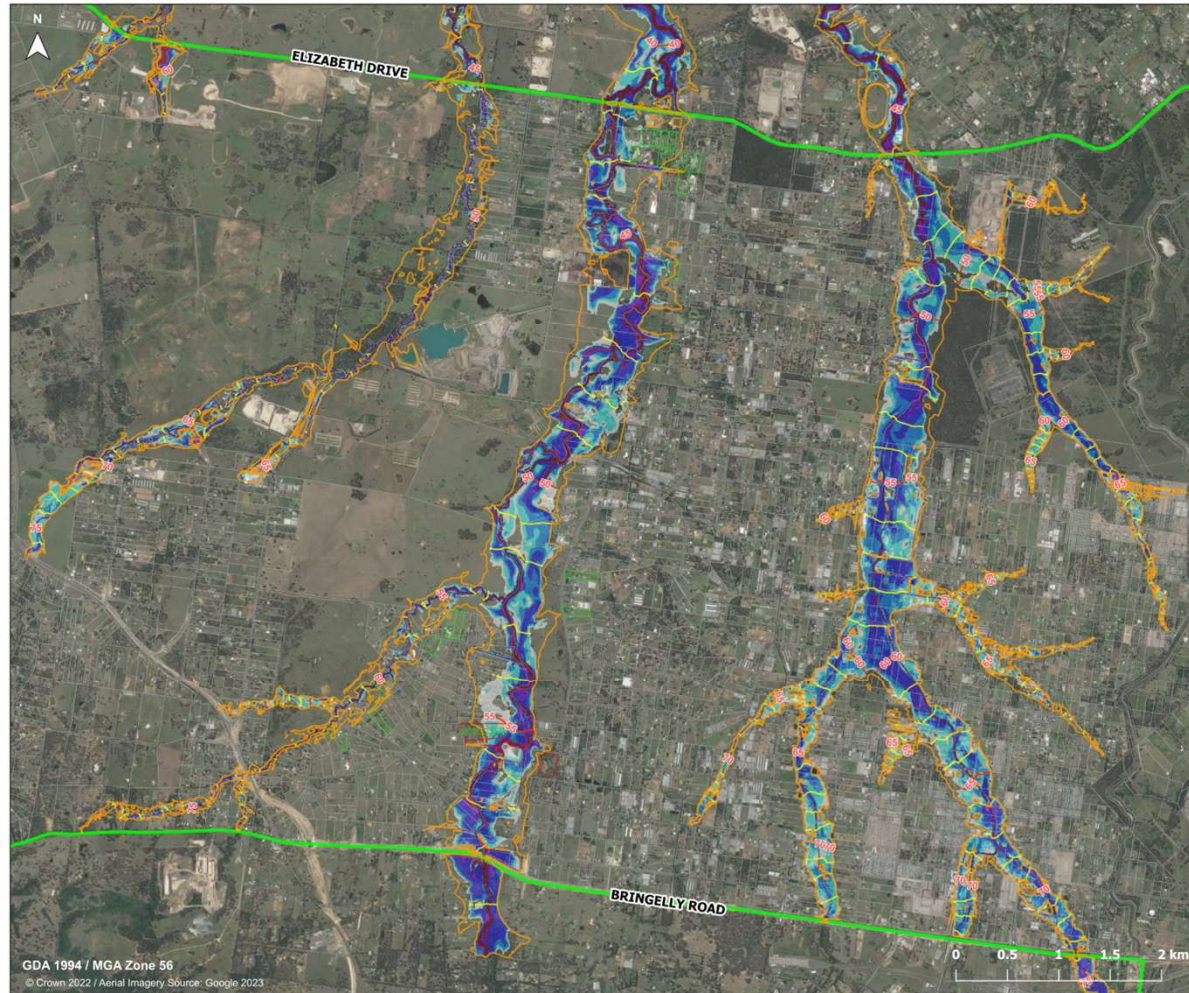
Attachment 2: March 2022  
peak flood depths and levels

- Legend**
- Cadastre
  - 1m contour
  - 5m contour
  - Depth (m)**
    - < 0.15
    - 0.15-0.30
    - 0.30-0.50
    - 0.50-1.00
    - 1.00-1.50
    - > 1.50
  - Liverpool LGA Boundary
  - 5% AEP Flood Extent
  - Property Affected by Flood**
    - No
    - Yes

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# Recent historical events modelling results

July 2022 vs.  
1% AEP event



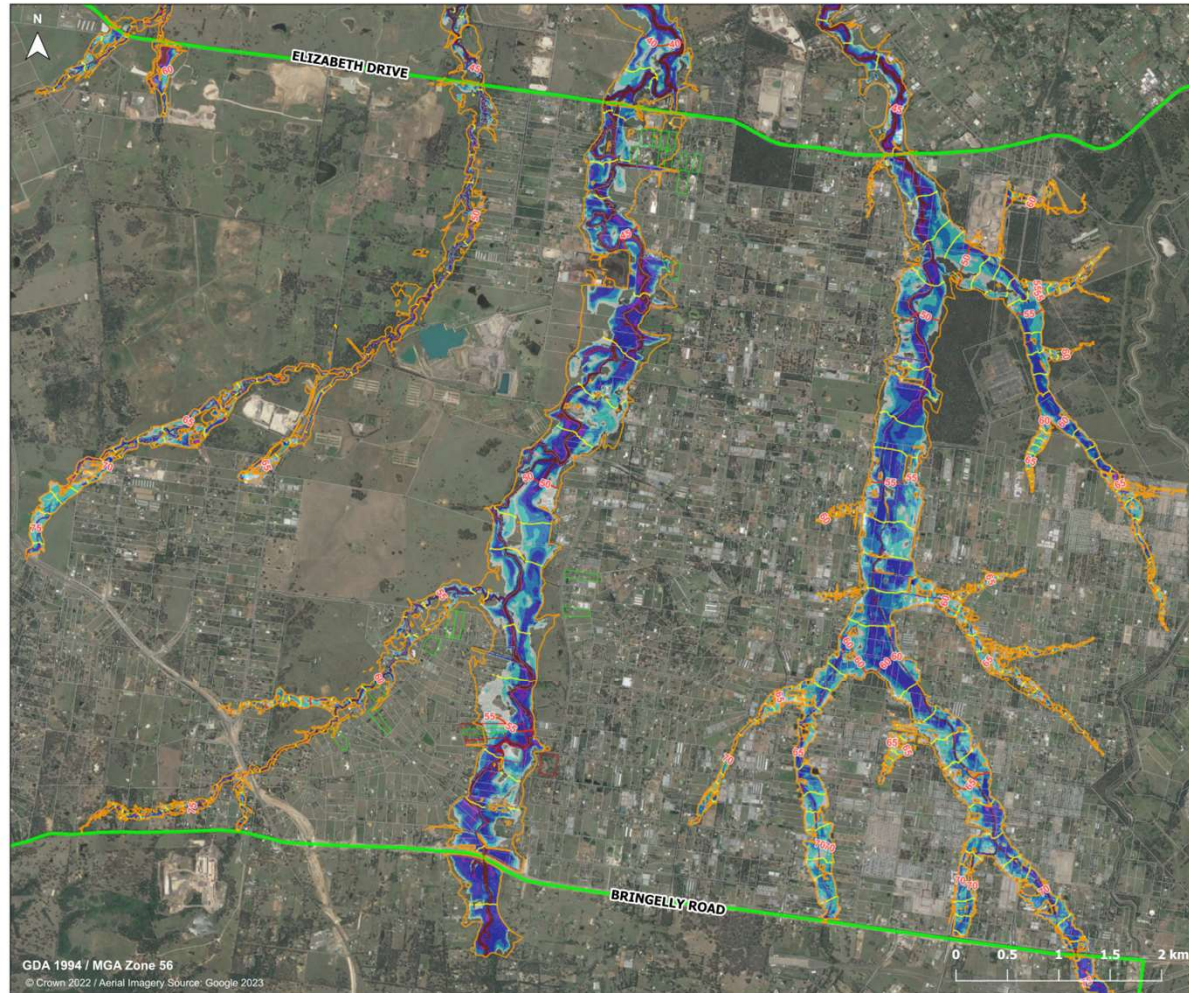
Attachment 2: July 2022 peak flood depths and levels

- Legend**
- Cadastre
  - 1m contour
  - 5m contour
- Depth (m)**
- < 0.15
  - 0.15-0.30
  - 0.30-0.50
  - 0.50-1.00
  - 1.00-1.50
  - > 1.50
- Liverpool LGA Boundary**
- 1% AEP Flood Extent
- Property Affected by Flood**
- No
  - Yes

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# Recent historical events modelling results

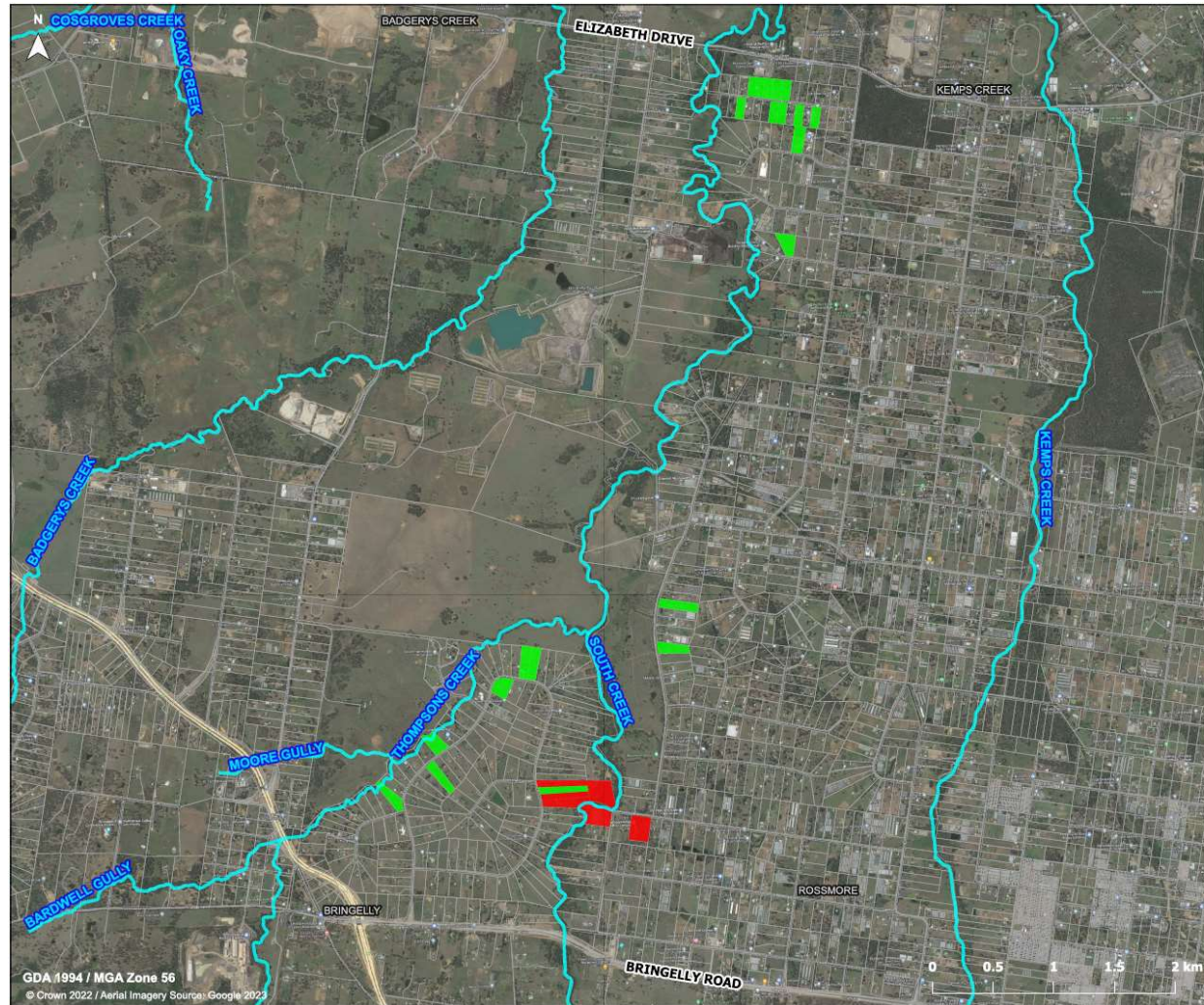
July 2022 vs.  
5% AEP event



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# Community consultation results

- Total of 26 respondents
- 4 respondents flood impacted by ~0.1-0.2m and 1 by ~0.5 m
- 20 out of 26 have lived there for 20+ years
- 3 respondents mentioned that development improved flood impact
- 3 respondents suggested road drainage would reduce flooding



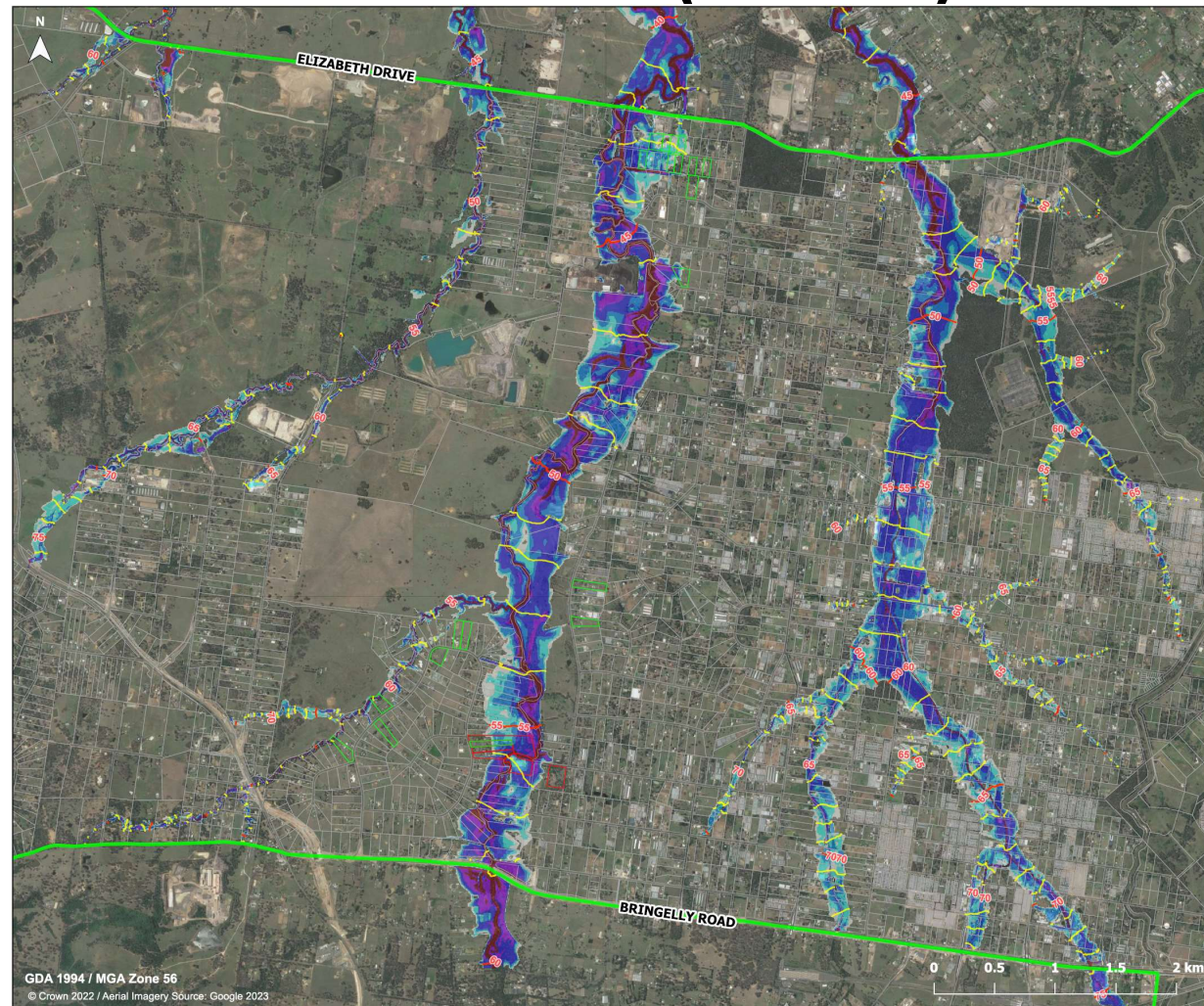
Attachment 3: Community questionnaire respondents

**Legend**  
Cadastrate  
**Property Affected by Flood**  
No  
Yes

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# Community consultation results (cont'd)

February 2020



Attachment 2: February 2020 peak flood depths and levels

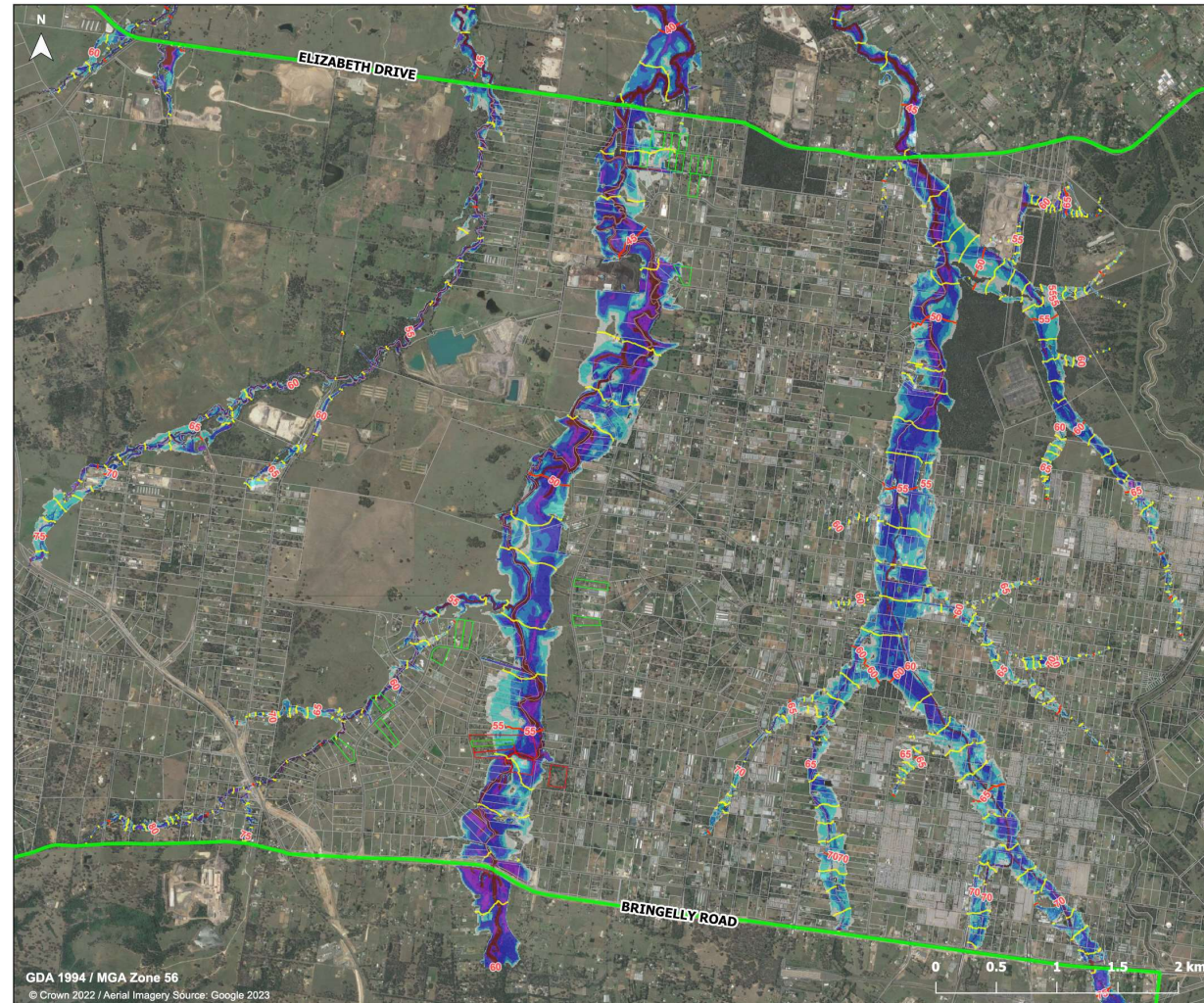
- Legend**
- Cadastre
  - 1m contour
  - 5m contour
- Depth (m)**
- < 0.15
  - 0.15-0.30
  - 0.30-0.50
  - 0.50-1.00
  - 1.00-1.50
  - > 1.50
- Livepool LGA Boundary**
- Livepool LGA Boundary
- Property Affected by Flood**
- No
  - Yes

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# Community consultation results (cont'd)

March 2022



Attachment 2: March 2022 peak flood depths and levels

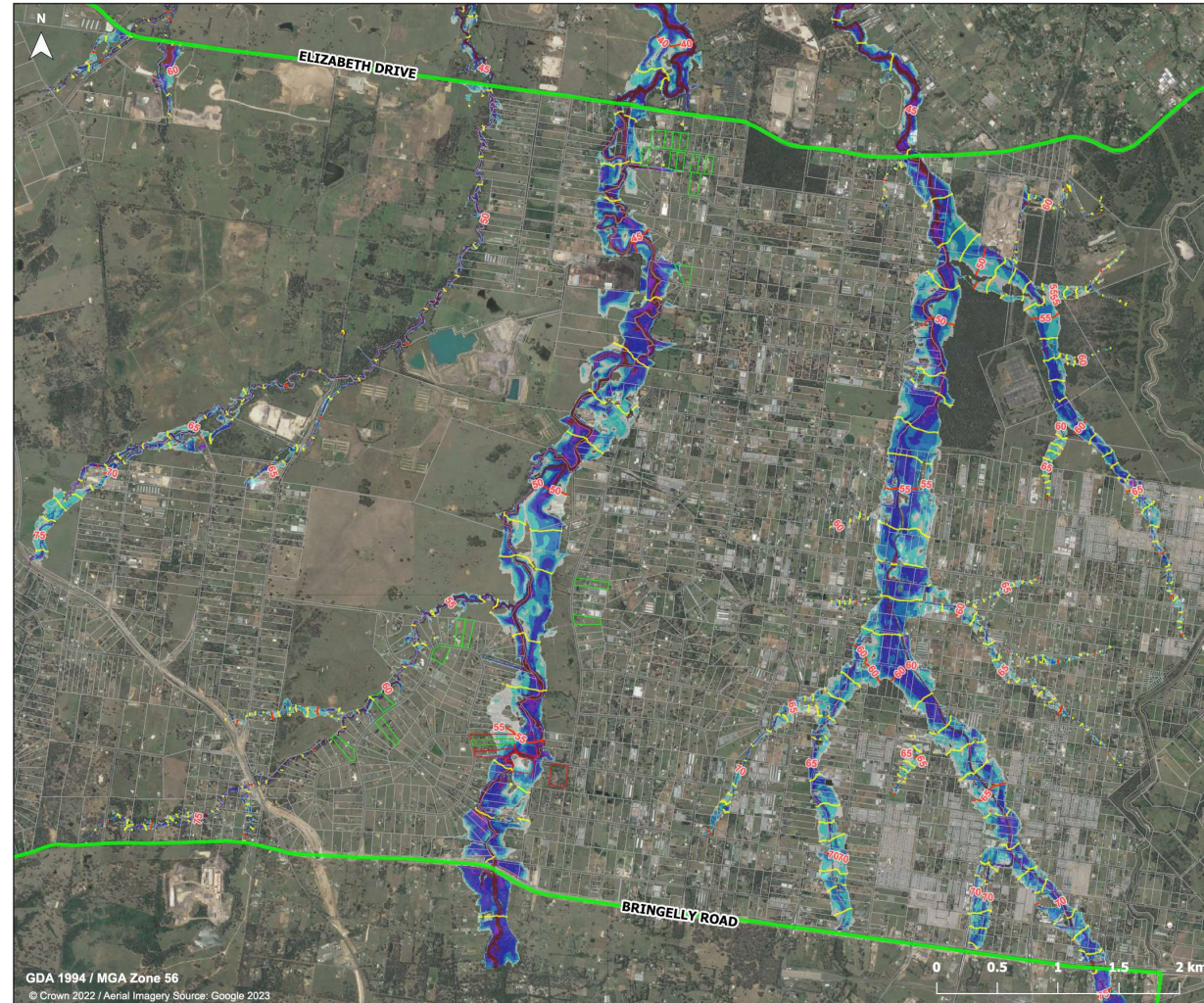
### Legend

- Cadastrate
- 1m contour
- 5m contour
- Depth (m)
  - < 0.15
  - 0.15-0.30
  - 0.30-0.50
  - 0.50-1.00
  - 1.00-1.50
  - > 1.50
- Livestock LGA Boundary
- Property Affected by Flood
  - No
  - Yes

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# Community consultation results (cont'd)

July 2022

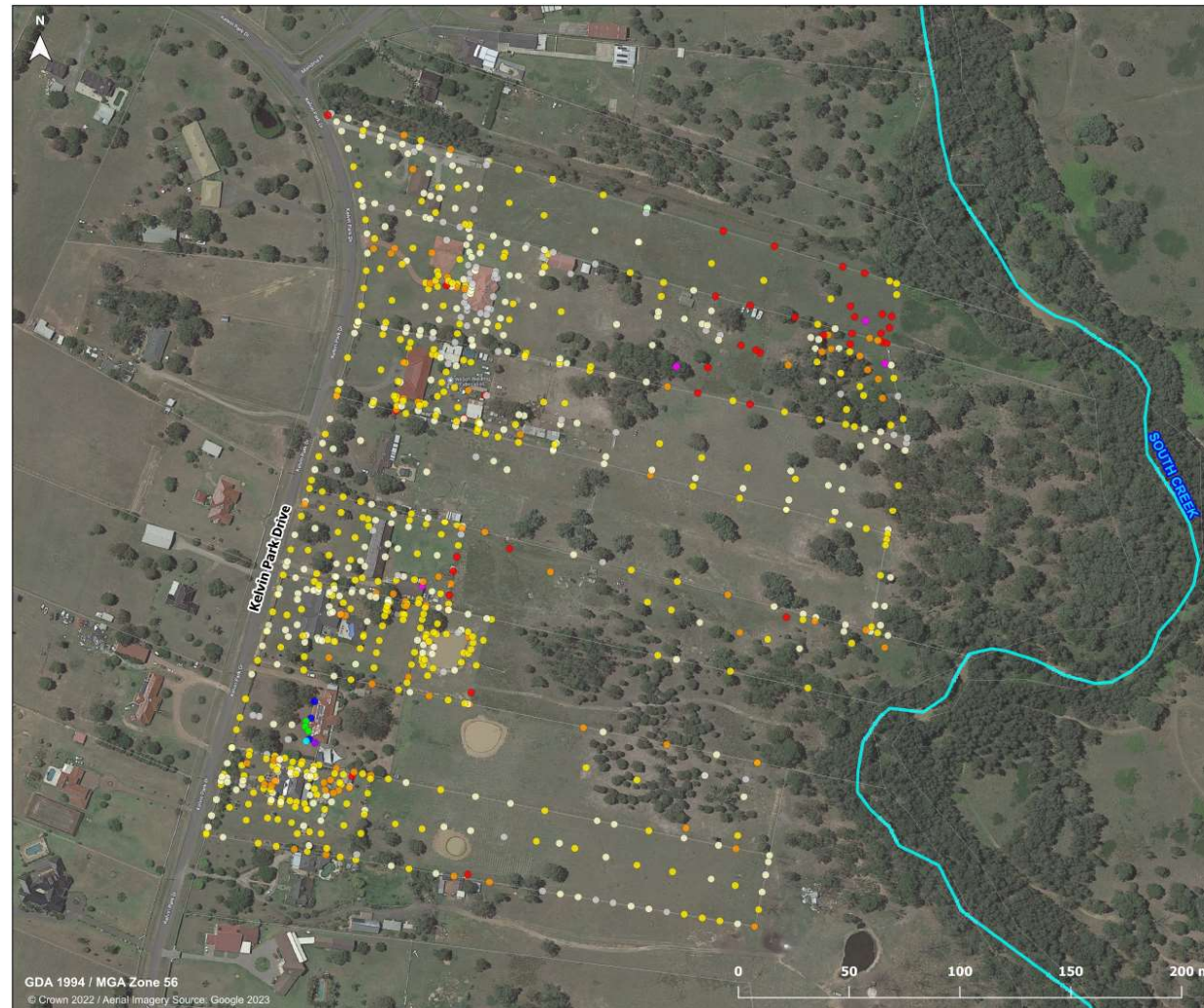


Attachment 2: July 2022 peak flood depths and levels

- Legend**
- Cadastral
  - 1m contour
  - 5m contour
- Depth (m)**
- < 0.15
  - 0.15-0.30
  - 0.30-0.50
  - 0.50-1.00
  - 1.00-1.50
  - > 1.50
- Liverpool LGA Boundary**
- Liverpool LGA Boundary
- Property Affected by Flood**
- No
  - Yes

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# Ground-truthing



Attachment 4:  
Ground-truthing along Kelvin  
Park Drive

### Legend

- Cadastre
- Difference Survey minus LiDAR data (m)
- < -0.3
- -0.3 to -0.2
- -0.2 to -0.15
- -0.15 to -0.1
- -0.1 to -0.05
- -0.05 to 0.05
- 0.05 to 0.1
- 0.2 to 0.3
- 0.15 to 0.2
- 0.2 to 0.3
- 0.3 to 0.35

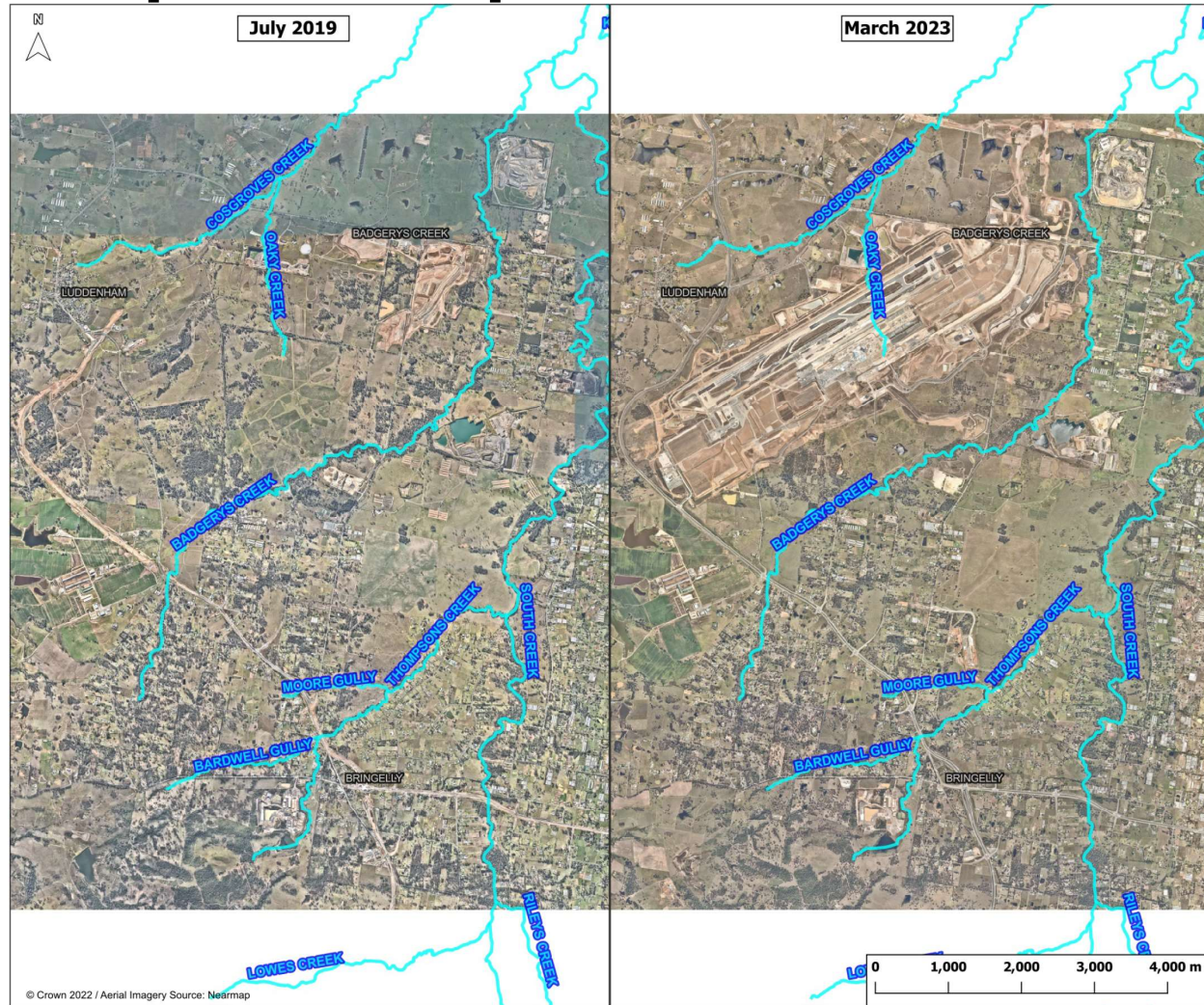
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# Climate change impact

- Increases in rainfall intensity by up to approximately 22% by 2090 for the East Coast area based on the Chapter 6 of the 2019 Australian Rainfall and Runoff guidelines.
- Such increase in rainfall intensity would increase the frequency of large event and the annual exceedance probability (AEP) of each storm will increase (e.g. a current 1% AEP (or 1 in 100 year) may become a more frequent 2% AEP (or 1 in 50 year) when including climate change with the same intensity of rainfall).
- This is therefore likely to increase flood risk in the Wianamatta South Creek catchment over time.

# Catchment development impact

- Major development occurred between July 2019 and present on the Western Sydney Airport site
- Based on AAJV presentation to Council, development would reduce flooding downstream of the airport site
- Confirmed by local residents observations



Attachment 5: Development of Western Sydney Airport precinct

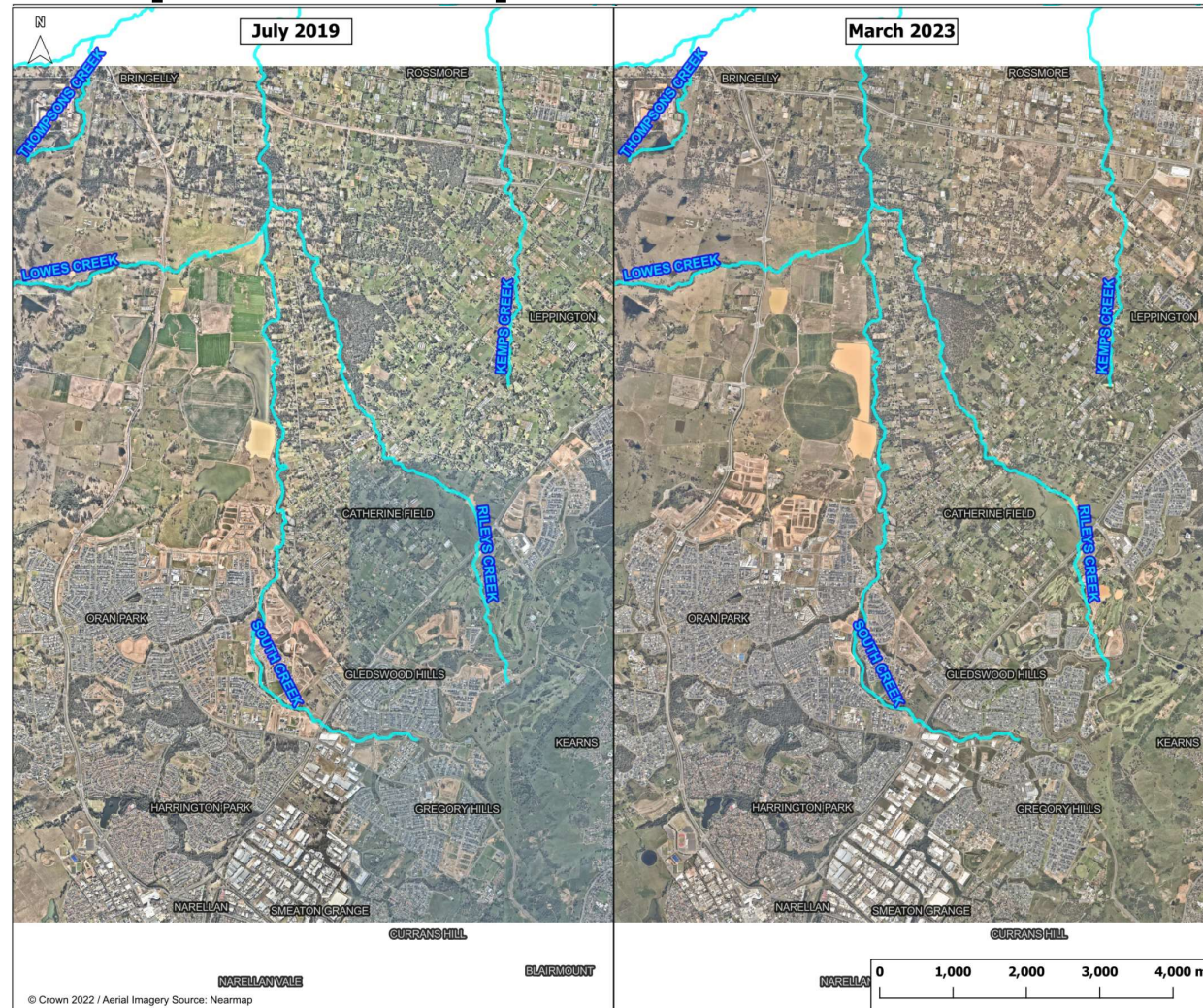
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# Conclusion

- Model is generally producing reasonable results
- Number of minor updates required in RMA model but unlikely to significantly change the results.
- RMA may require updates and optimisation to run more efficiently
- Hydrology requires calibration to provide better match with recorded data
- February 2020 was the largest event at WSC and is generally similar to a 5% AEP flood in the flood study but difference in extents between 5% and 1% AEP event can be minor along South Creek.
- There are some discrepancies between responses from residents and modelled results (e.g. reported flooded but not flooded in model and vice versa, modelled depth >> observed depth)
- Ground-truthing showed difference of ~0.15 m between model DEM and survey which is consistent with accuracy of LiDAR data
- Western Sydney Airport development reduced flood impact downstream of site and exact impact of the upstream development in Camden Council would require further investigations
- Climate change would increase frequency of intense events due to more intense rainfall

# Catchment development impact

- Significant developments occurred at upstream end of catchment
- Limited information on developments type (i.e. is it only developments that increase flooding or is there basins that reduce flooding?)
- Further assessment may be required



Attachment 5: Development upstream of Bringelly Road

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