NORTHERN BEACHES COUNCIL

GREENDALE CREEK FLOOD STUDY

VOLUME 2 – MAPPING APPENDICES

FINAL

wma water

JULY 2023

APPENDIX B. Catchment Photographs

Appendix B



Photo B1: Western Channel at The Kilns

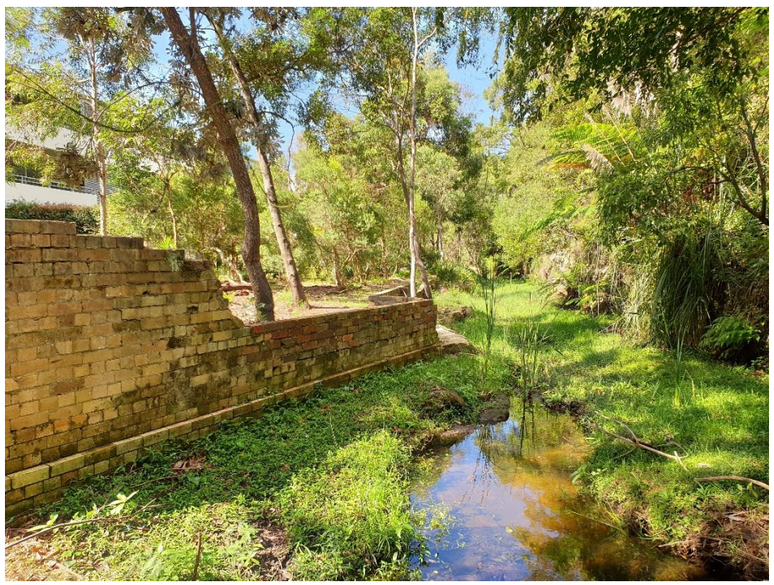


Photo B2: Western Channel at The Kilns



Photo B3: Western Channel at The Kilns



Photo B4: Western Channel at The Kilns



Photo B5: Western Channel at The Kilns



Photo B6: Inlet Pit at The Kilns



Photo B7: Eastern Channel at The Kilns



Photo B8: Eastern Channel at The Kilns

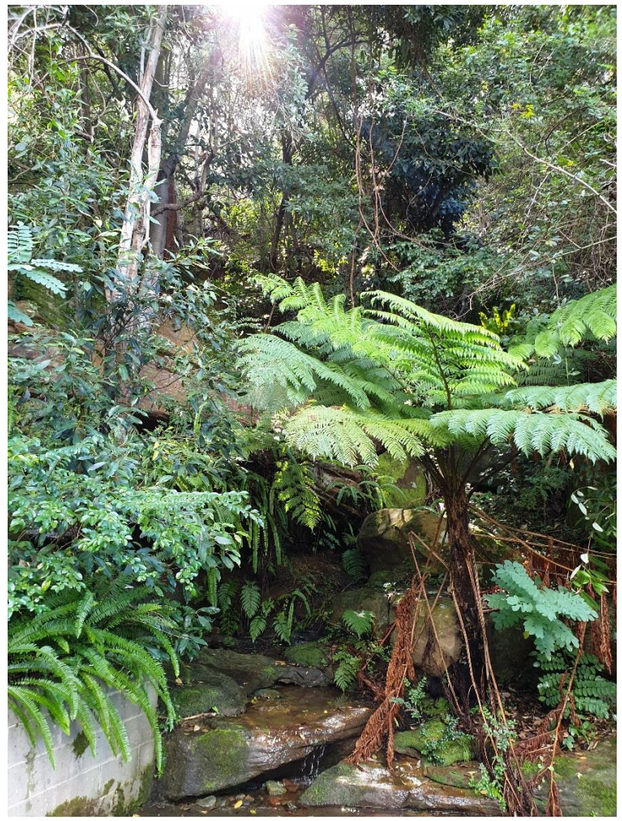


Photo B9: Eastern Channel at The Kilns



Photo B10: Inlet Pit at The Kilns (end of Eastern Channel)



Photo B11: Downstream Channel at The Kilns

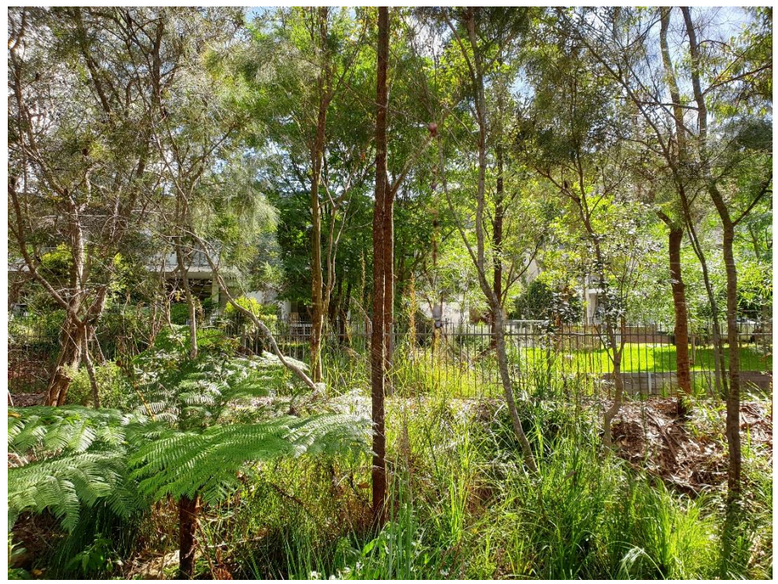


Photo B12: Downstream of The Kilns



Photo B13: Outlets downstream of The Kilns



Photo B14: The Kilns Downstream Channel through Property

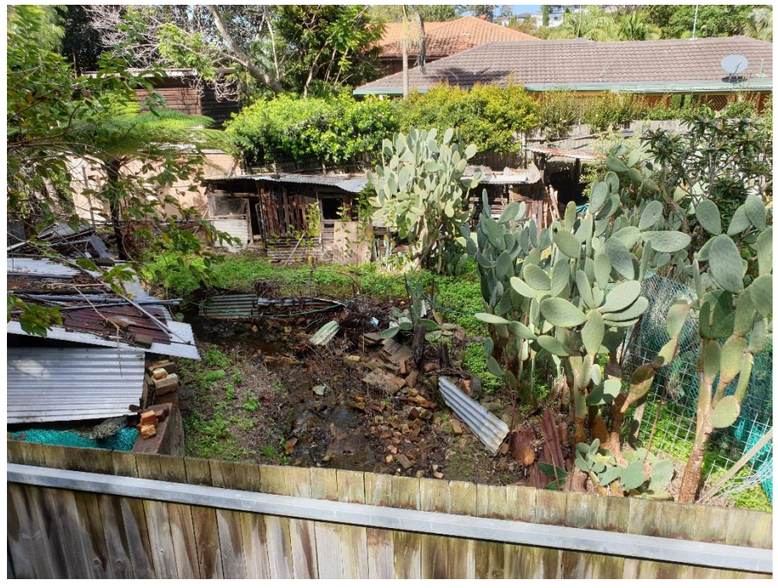


Photo B15: The Kilns Downstream Channel through Property



Photo B16 The Kilns Downstream Channel (Private Lane)

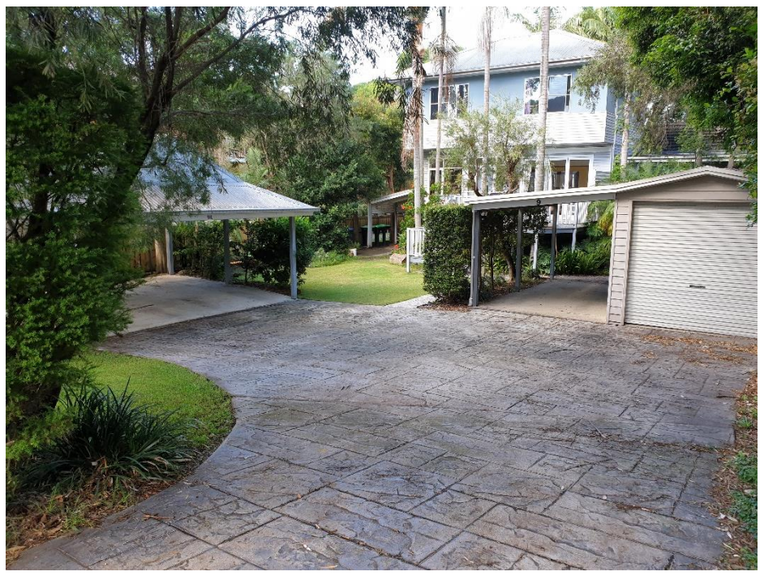


Photo B17: Overland flow path south of Gulliver Street



Photo B18: Gulliver Street looking south-east



Photo B19: Properties downstream of Gulliver Street



Photo B20: St Augustine's School (looking upstream from Gulliver Street)



Photo B21: Inlet in Stirgess Reserve (south side)



Photo B22: Brookvale Oval



Photo B23: Brookvale Oval



Photo B24: Pine Avenue



Photo B25: Inlet downstream of Winbourne Road



Photo B26: Outlet downstream of Winbourne Road



Photo B27: Open Channel Downstream of Winbourne Road



Photo B28: Culverts west of Harbord Road



Photo B29: Culverts under Harbord Road



Photo B30: Downstream outlet from Harbord Road



Photo B31: Inlet downstream of Winbourne Road



Photo B32: GPT Downstream Harbord Road



Photo B33: GPT Downstream Harbord Road

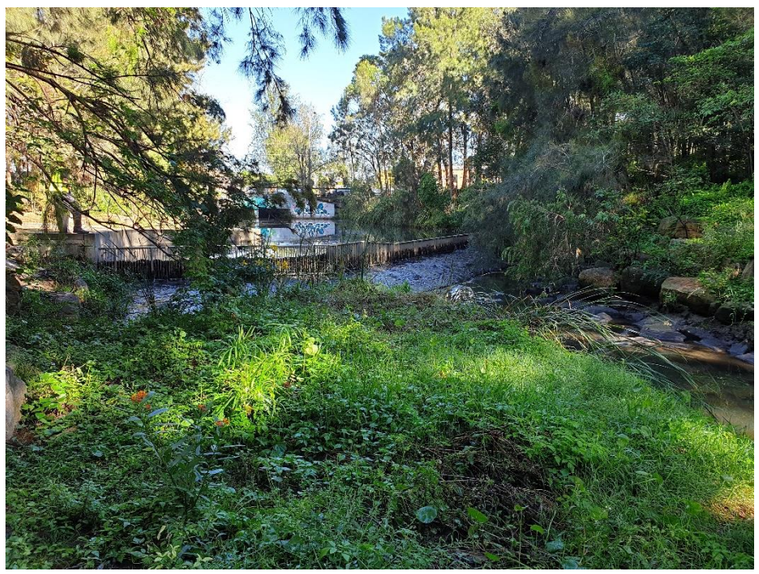


Photo B34: GPT Downstream Harbord Road



Photo B35: Eastern Pedestrian Bridge



Photo B36: Upstream Eastern Pedestrian Bridge



Photo B37: Rock Weir Looking Downstream

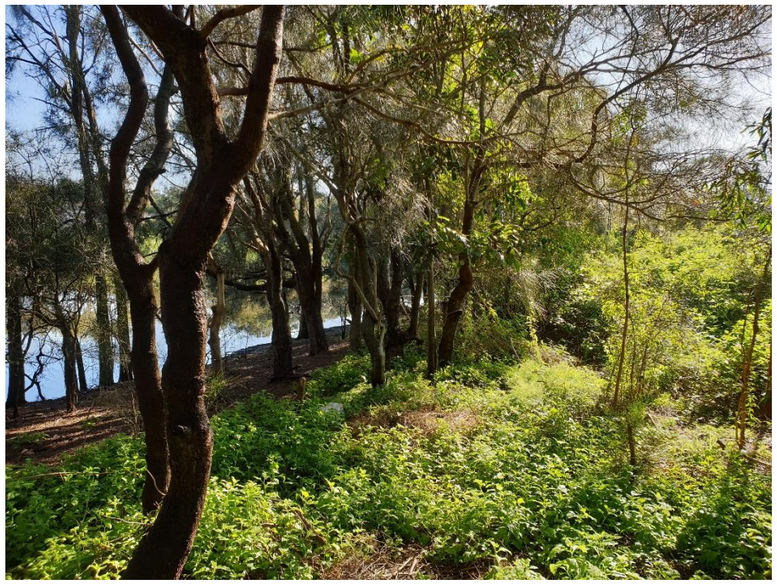


Photo B38: Overbank Area on Greendale Creek



Photo B39: Greendale Creek



Photo B40: Griffin Road Bridge



Photo B41: Curl Curl Lagoon Entrance

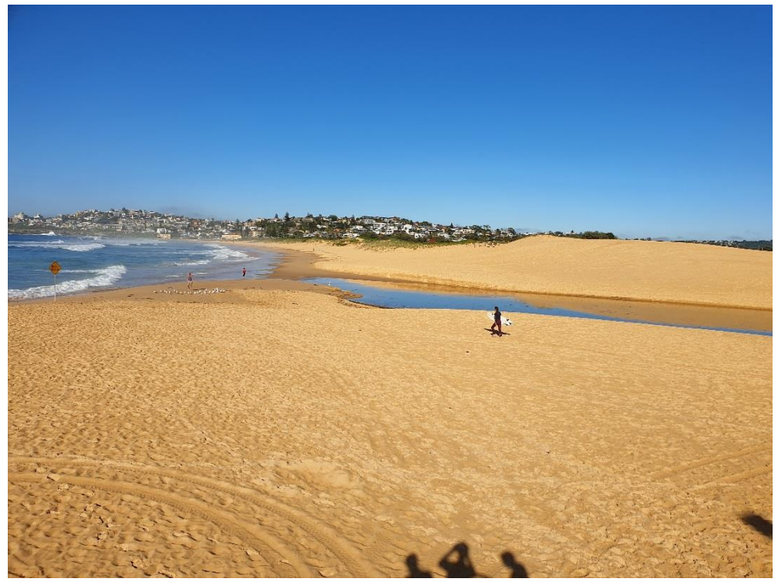
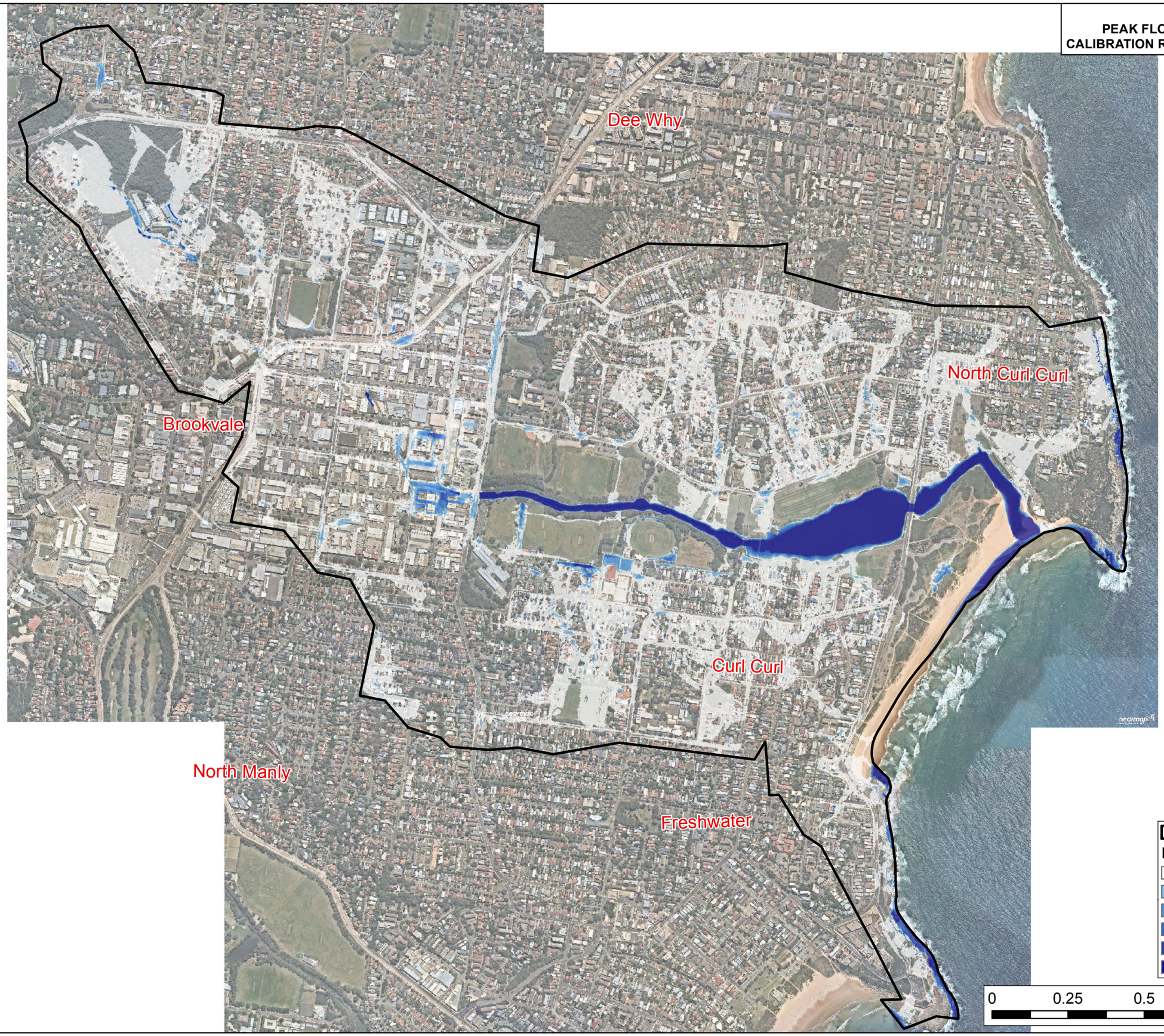


Photo B42: Curl Curl Lagoon Entrance

APPENDIX C. November 2018 Calibration Event Results

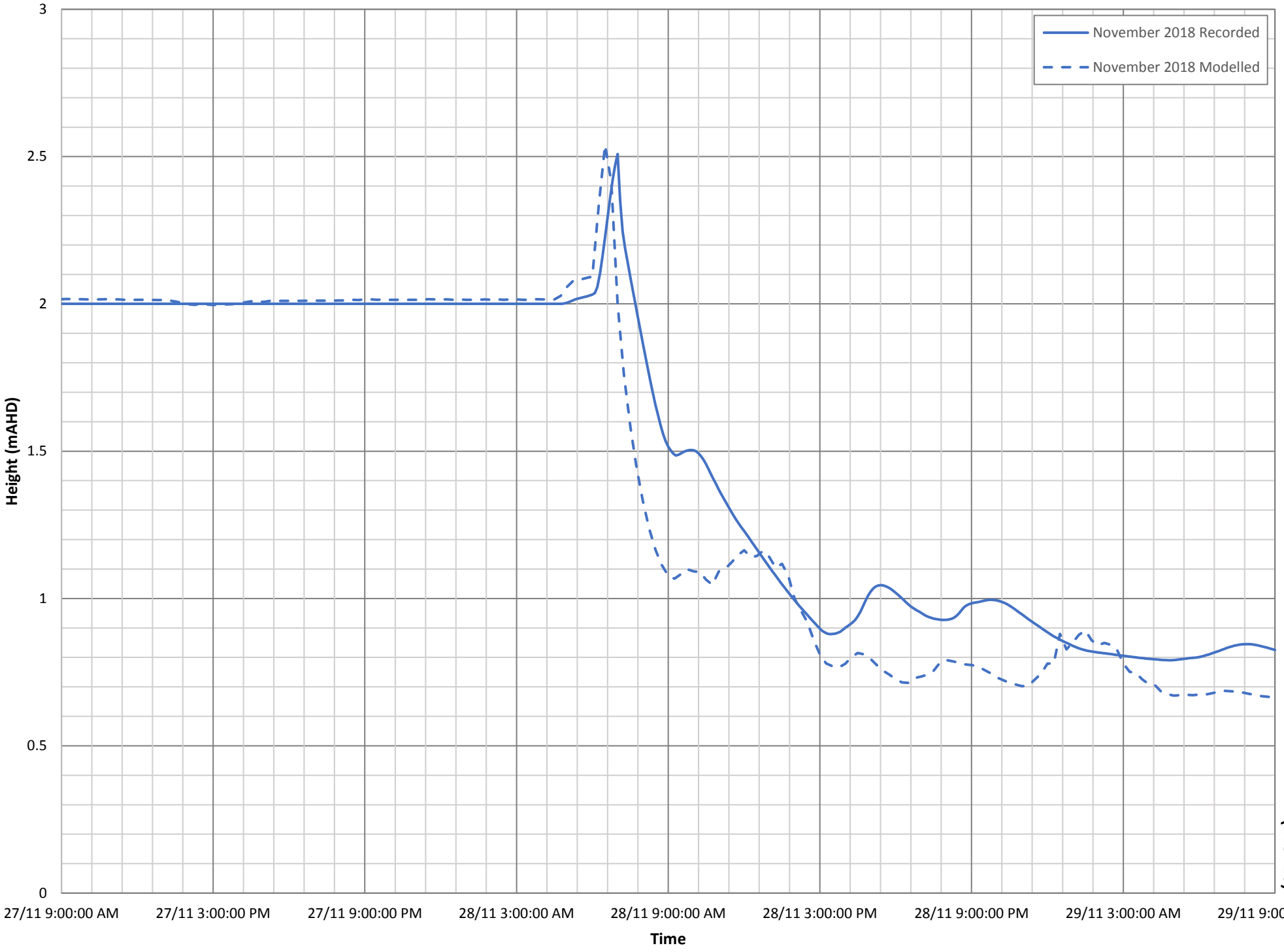
Appendix C

FIGURE C1
PEAK FLOOD DEPTHS AND LEVELS
CALIBRATION RESULTS NOVEMBER 2018



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_C\FigureC01_Calibration_Results_November_2018.mxd

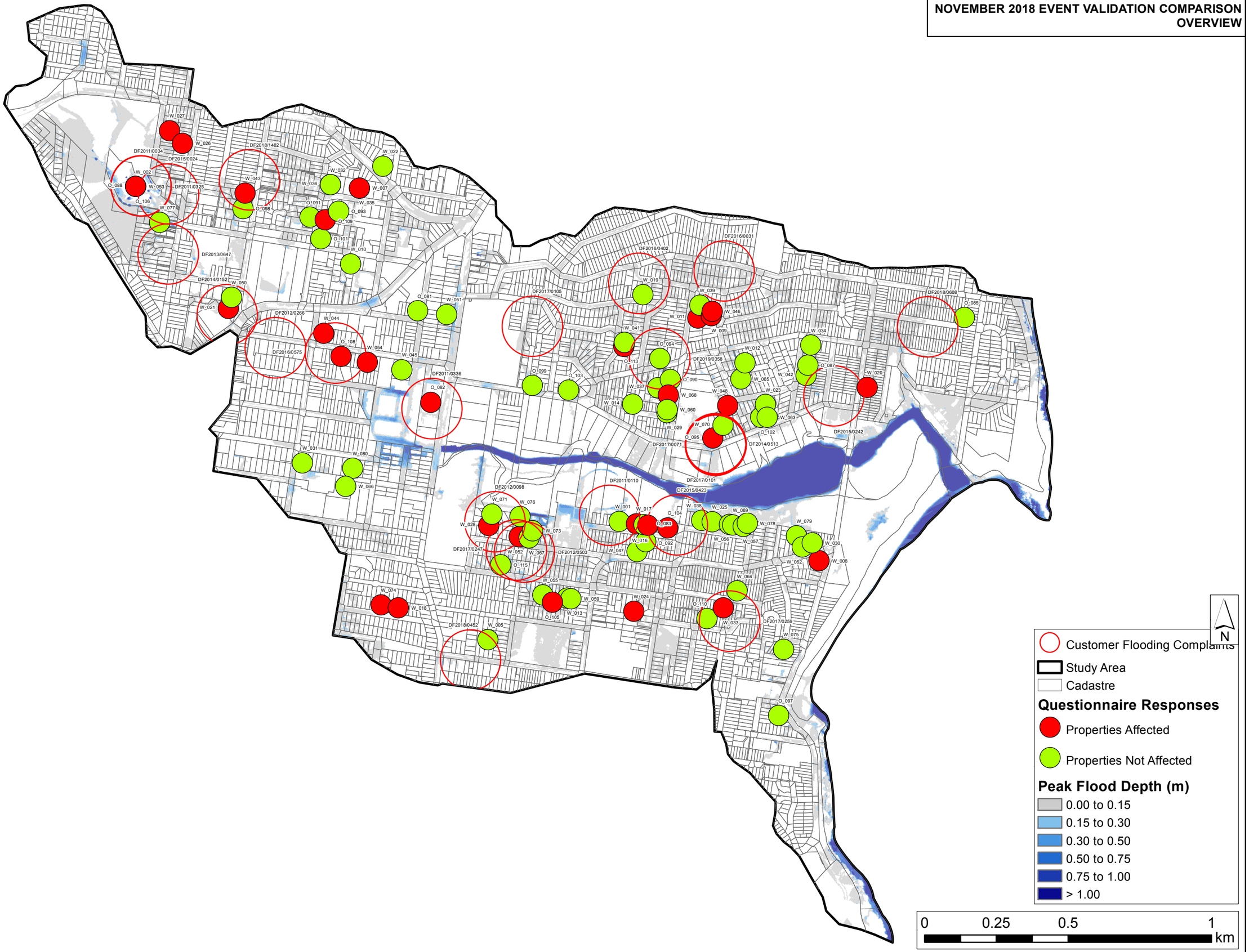
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FLOOD LEVEL HYDROGRAPH
CURL CURL LAGOON AT GRIFFIN ROAD BRIDGE
(213426)

FIGURE C2

FIGURE C3
NOVEMBER 2018 EVENT VALIDATION COMPARISON OVERVIEW



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_C\FigureC03_November_2018_Event_Validation_Comparison_Overview.mxd

APPENDIX D. Design Flood Depths, Levels and Velocities

Appendix D

FIGURE D1
PEAK FLOOD DEPTHS AND LEVELS
50% AEP EVENT

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Major Contour (5m Intervals)
Minor Contour (2.5m Intervals)
Peak Flood Depth (m)
0.00 to 0.15
0.15 to 0.30
0.30 to 0.50
0.50 to 0.75
0.75 to 1.00
> 1.00

0 0.25 0.5 1 km

J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_D\FigureD01_PeakFloodDepthsandLevels_50p_AEP_Event.mxd

FIGURE D2
PEAK FLOOD DEPTHS AND LEVELS
20% AEP EVENT

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Major Contour (5m Intervals)
Minor Contour (2.5m Intervals)
Peak Flood Depth (m)
0.00 to 0.15
0.15 to 0.30
0.30 to 0.50
0.50 to 0.75
0.75 to 1.00
> 1.00

0 0.25 0.5 1 km

J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_D\FigureD02_PeakFloodDepthsandLevels_20p_AEP_Event.mxd

FIGURE D3
PEAK FLOOD DEPTHS AND LEVELS
10% AEP EVENT

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Major Contour (5m Intervals)
Minor Contour (2.5m Intervals)

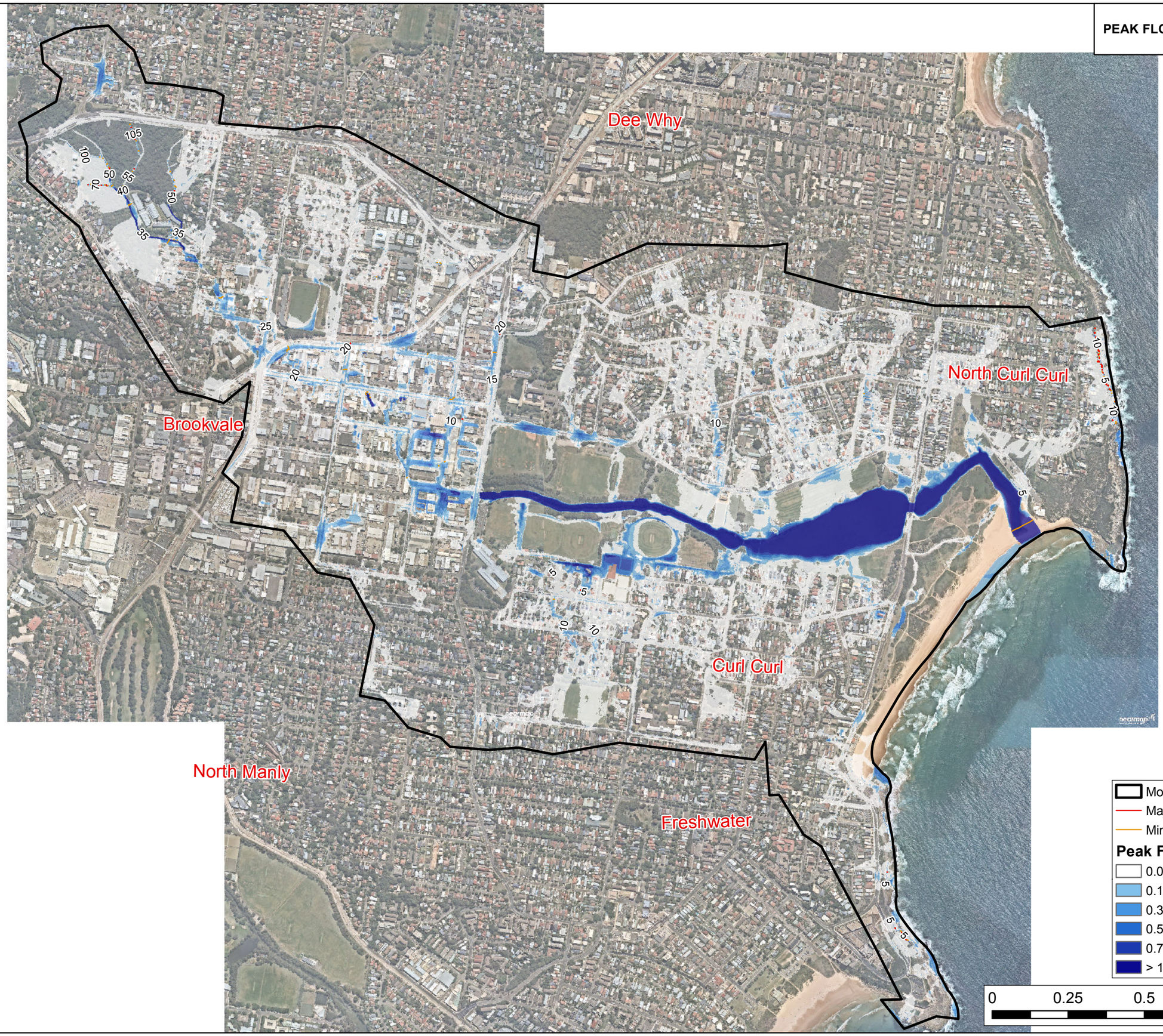
Peak Flood Depth (m)

0.00 to 0.15
0.15 to 0.30
0.30 to 0.50
0.50 to 0.75
0.75 to 1.00
> 1.00

0 0.25 0.5 1 km

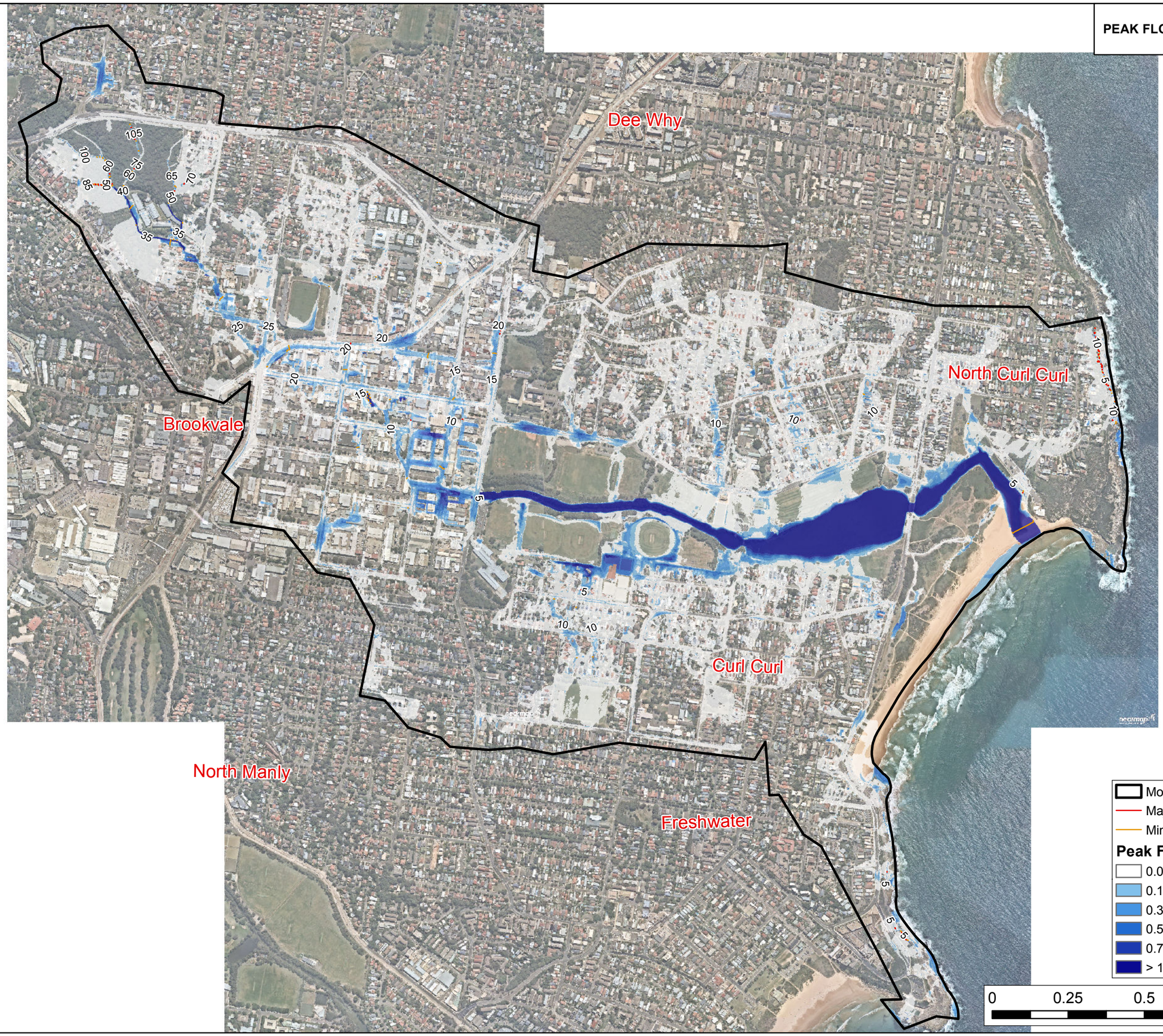
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FIGURE D4
PEAK FLOOD DEPTHS AND LEVELS
5% AEP EVENT



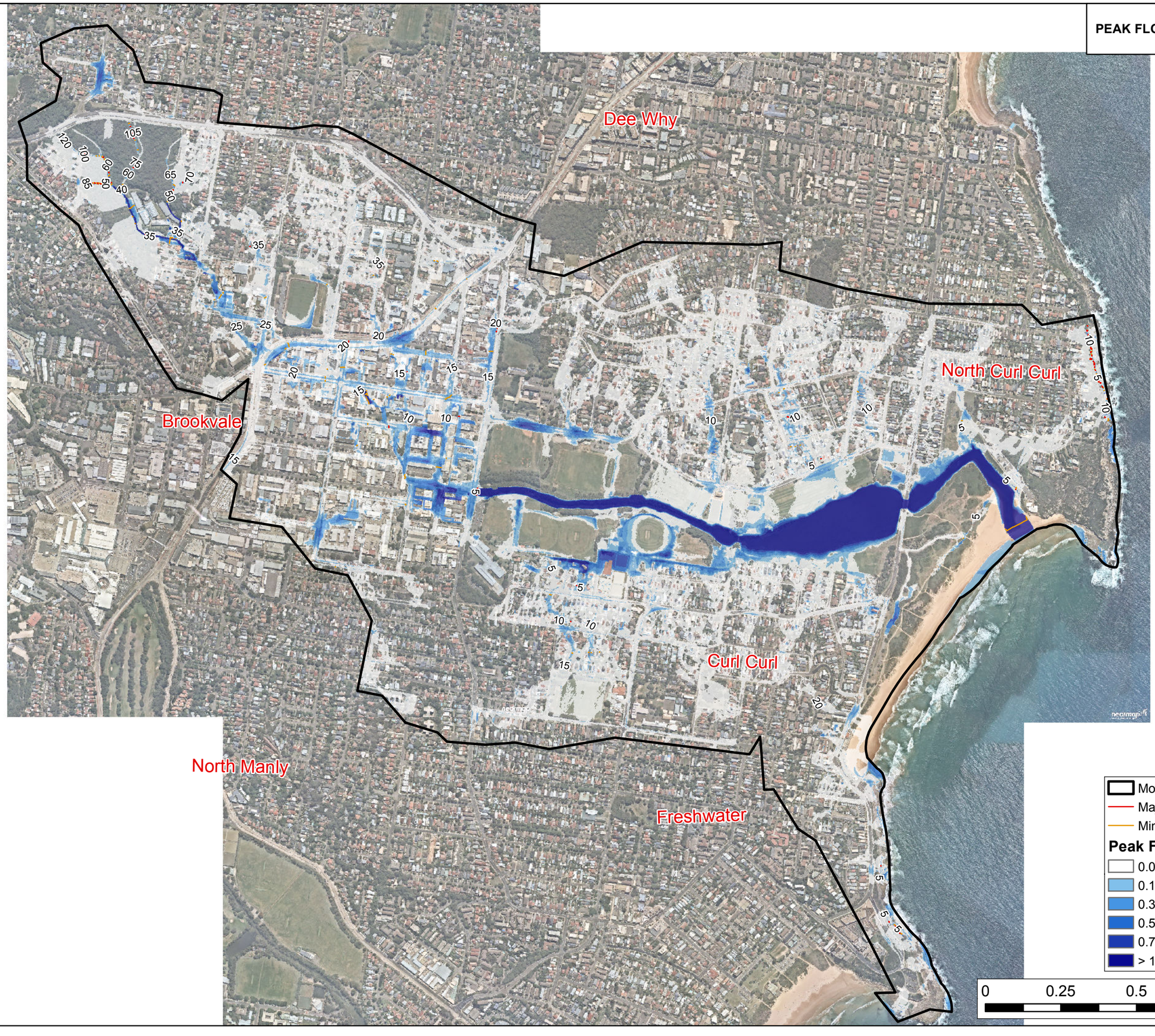
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FIGURE D5
PEAK FLOOD DEPTHS AND LEVELS
2% AEP EVENT



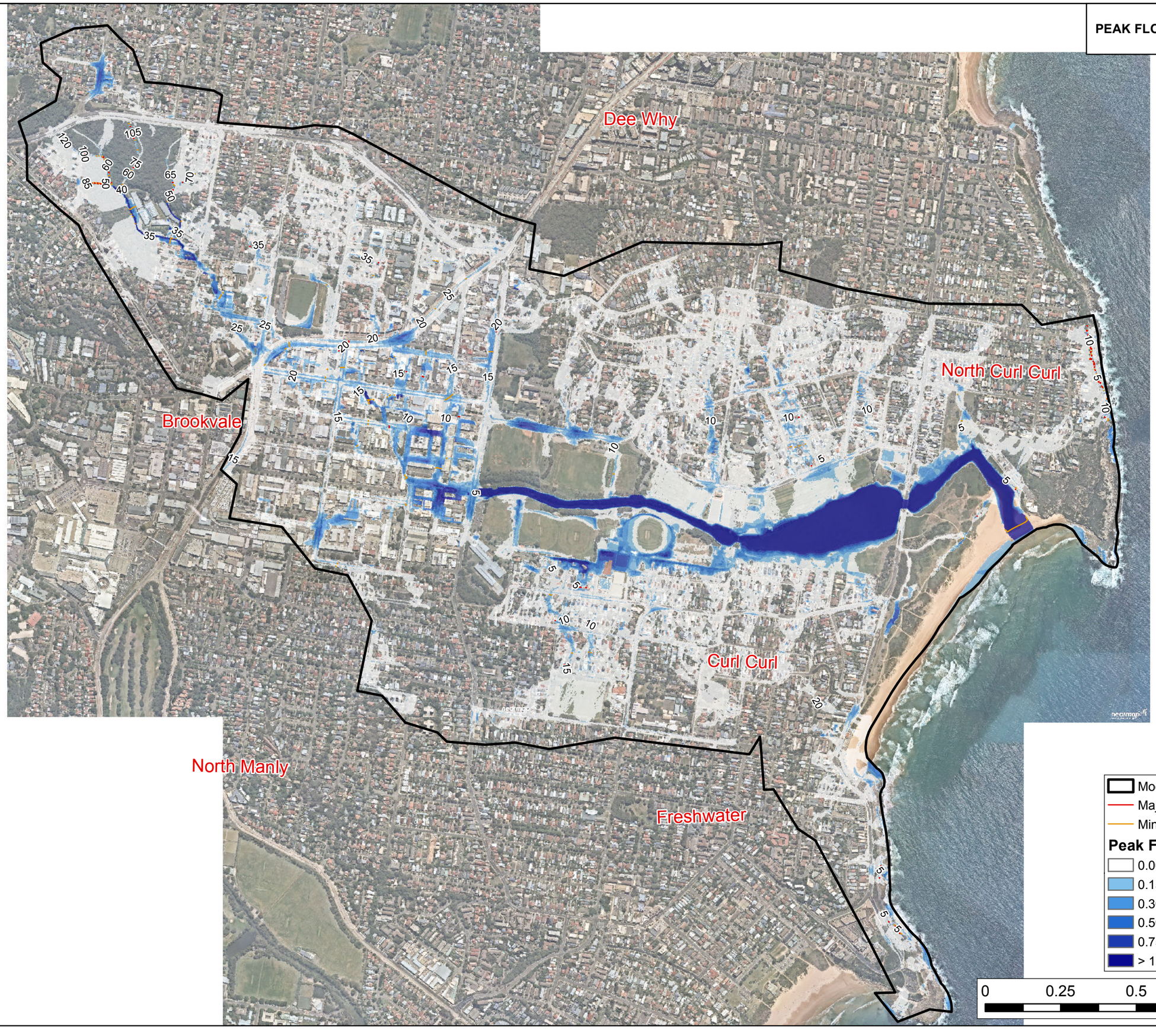
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FIGURE D6
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_D\FigureD06_PeakFloodDepthsandLevels_1p_AEP_Event.mxd

FIGURE D7
PEAK FLOOD DEPTHS AND LEVELS
0.5% AEP EVENT



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_D\FigureD07_PeakFloodDepthsandLevels_0.5p_AEP_Event.mxd

FIGURE D8
PEAK FLOOD DEPTHS AND LEVELS
0.2% AEP EVENT

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Major Contour (5m Intervals)
Minor Contour (2.5m Intervals)

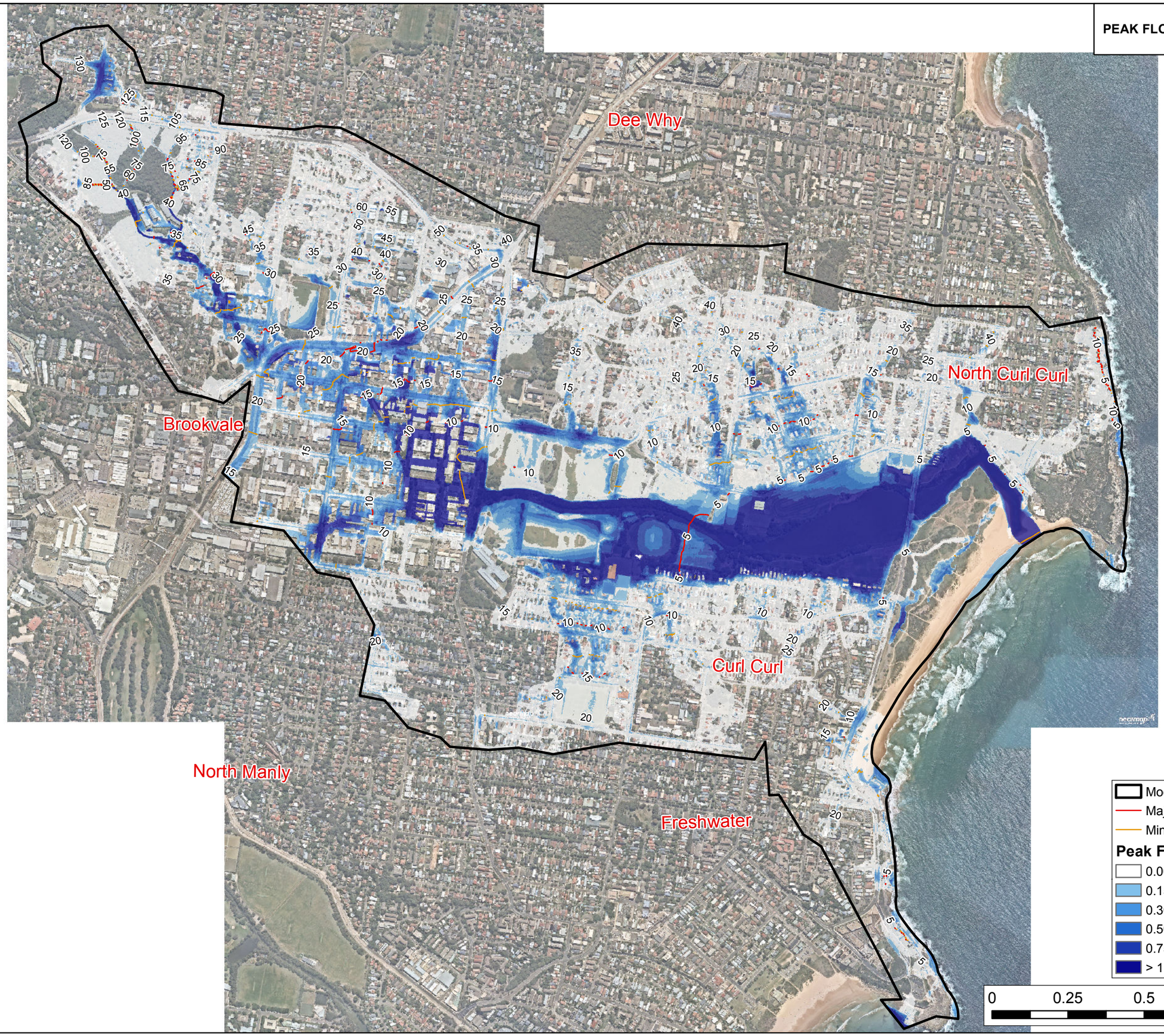
Peak Flood Depth (m)

0.00 to 0.15
0.15 to 0.30
0.30 to 0.50
0.50 to 0.75
0.75 to 1.00
> 1.00

0 0.25 0.5 1 km

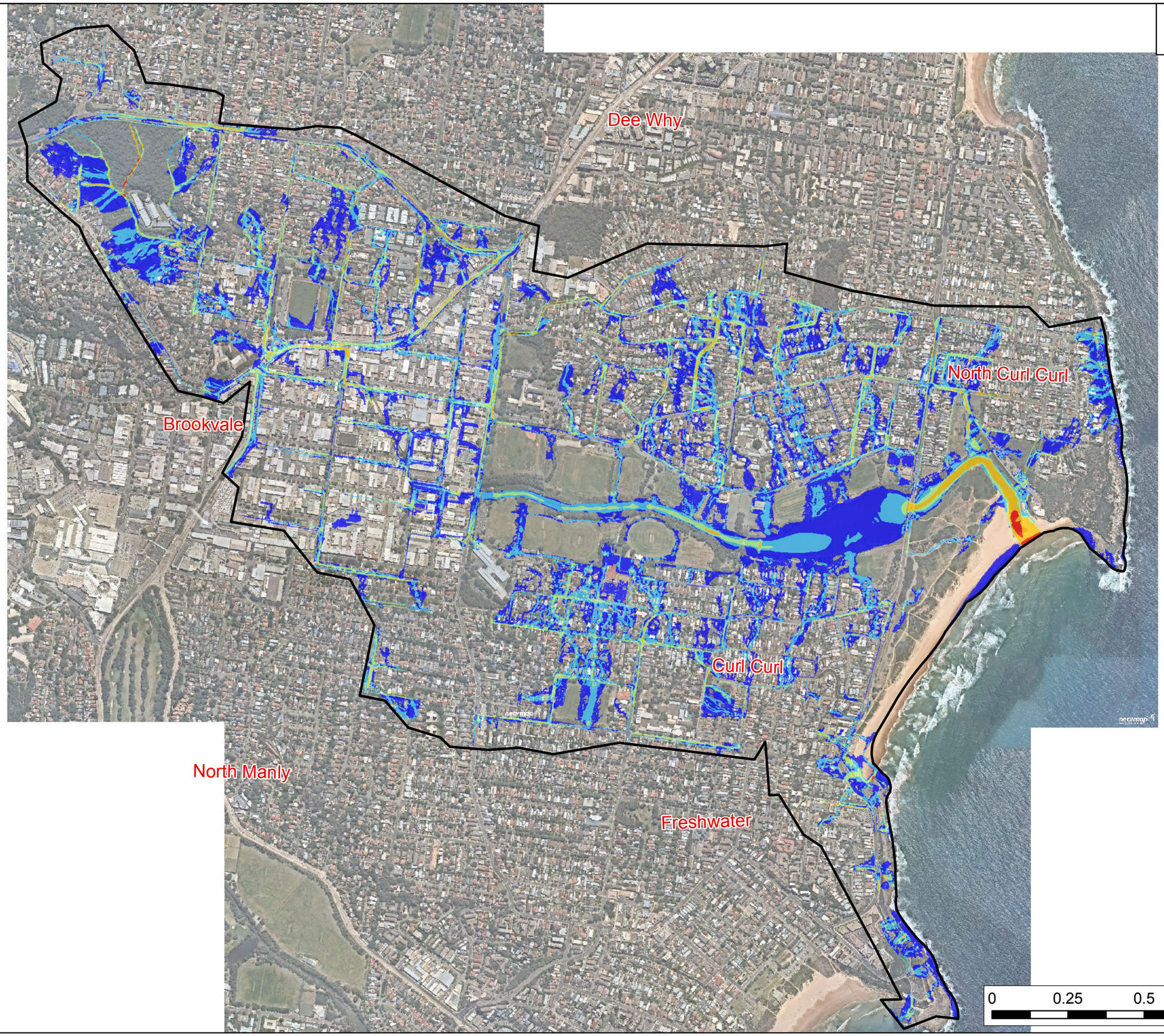
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FIGURE D9
PEAK FLOOD DEPTHS AND LEVELS
PMF EVENT



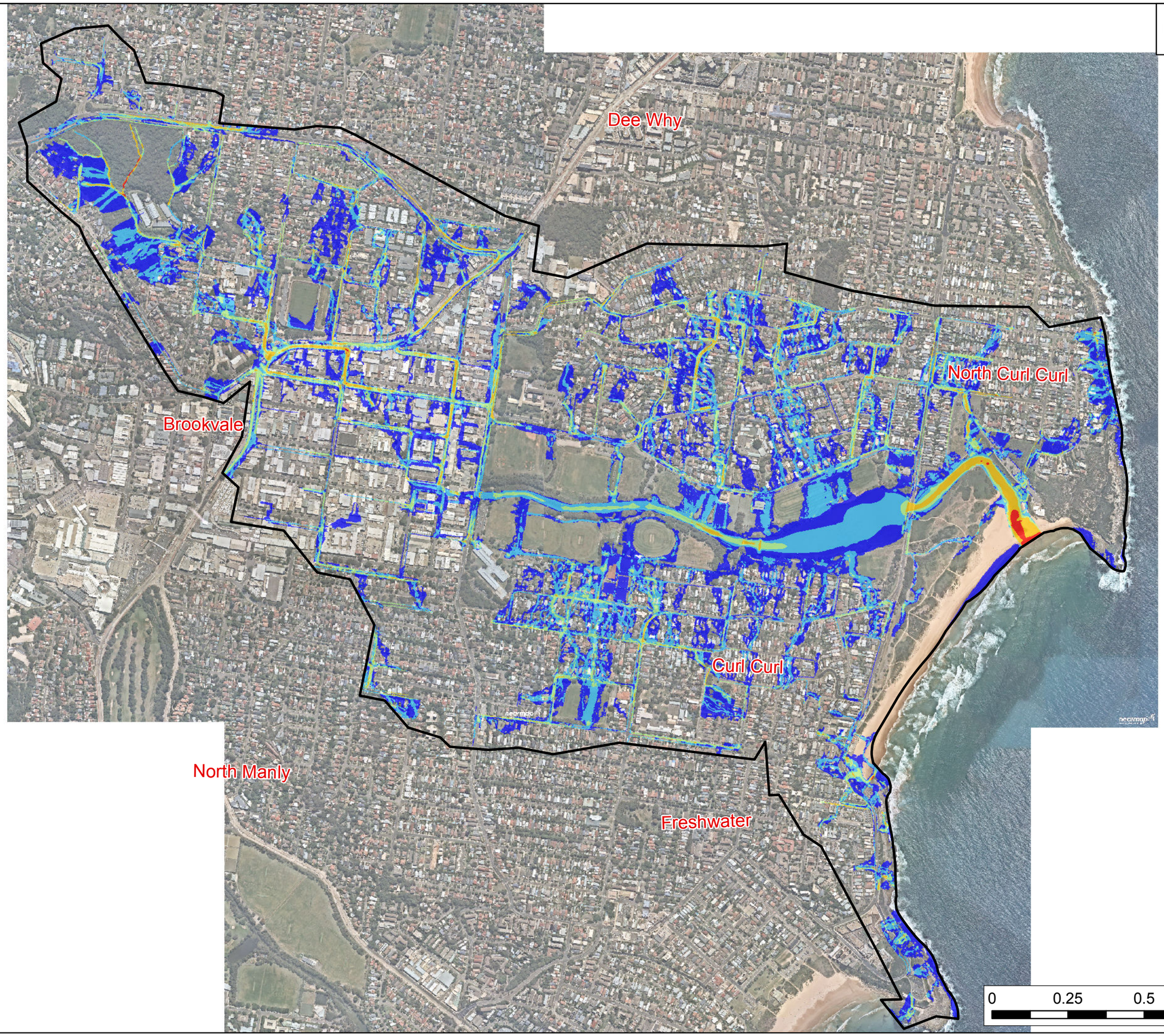
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FIGURE D10
PEAK FLOOD VELOCITIES
50% AEP EVENT



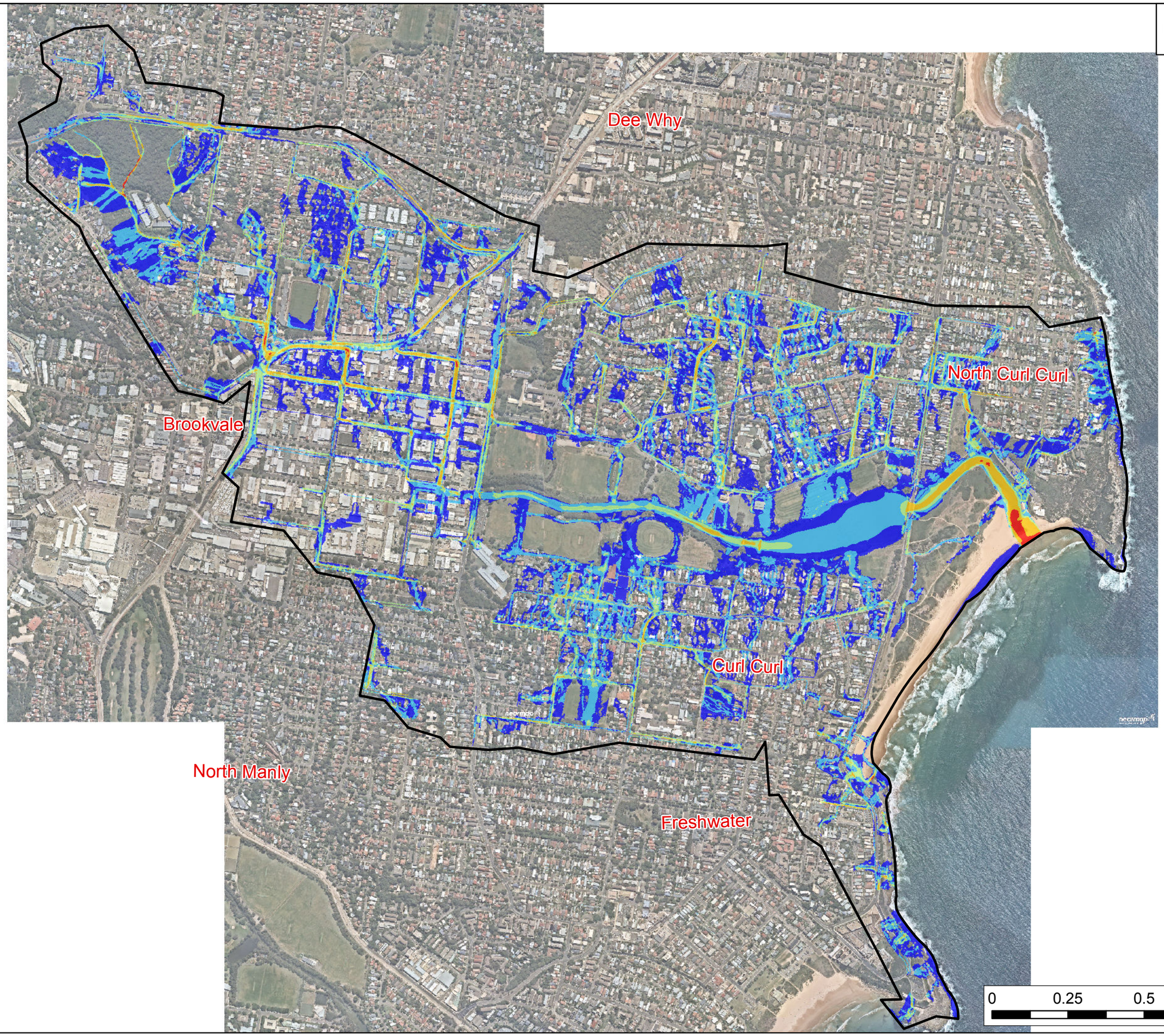
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FIGURE D11
PEAK FLOOD VELOCITIES
20% AEP EVENT



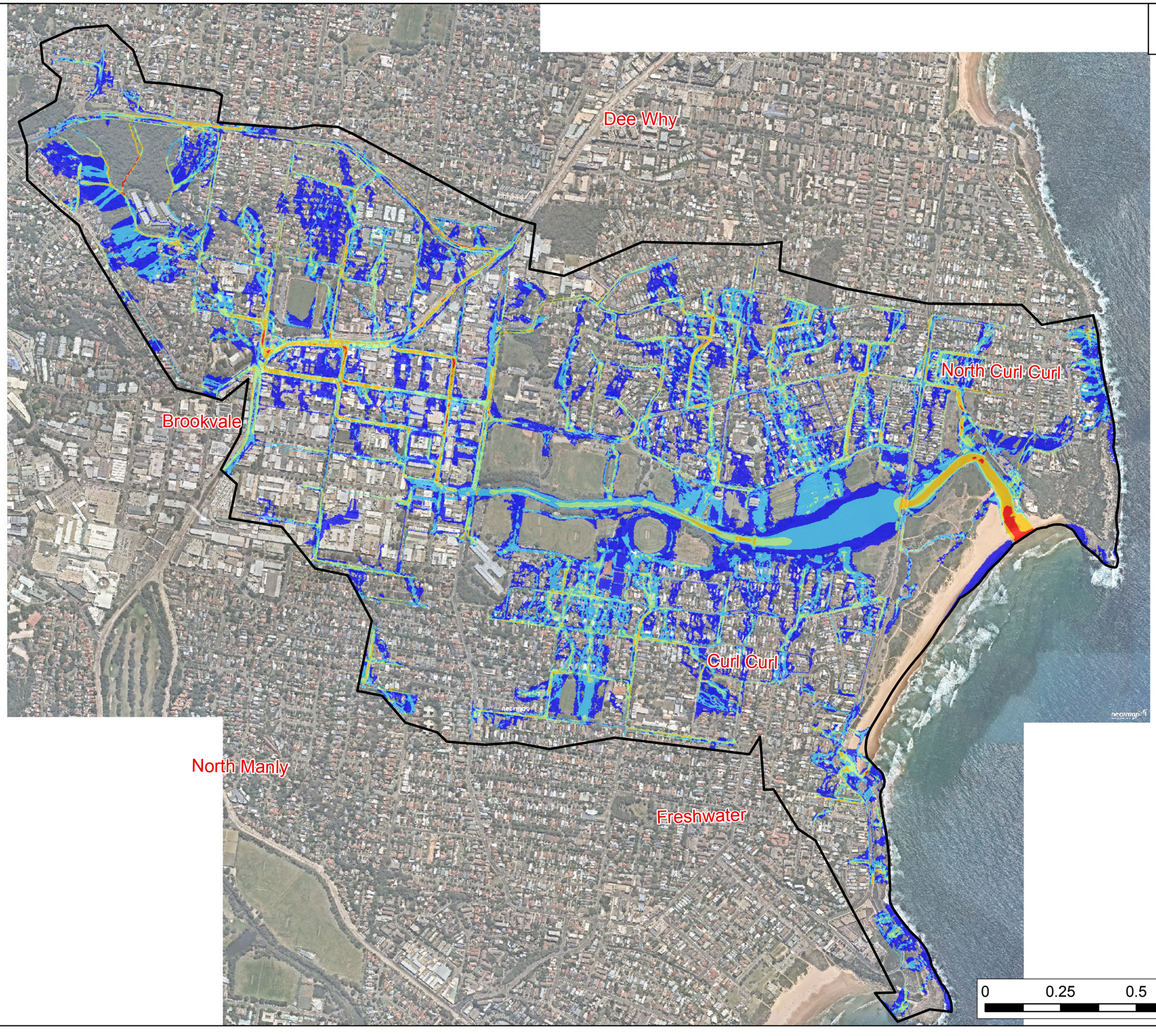
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FIGURE D12
PEAK FLOOD VELOCITIES
10% AEP EVENT



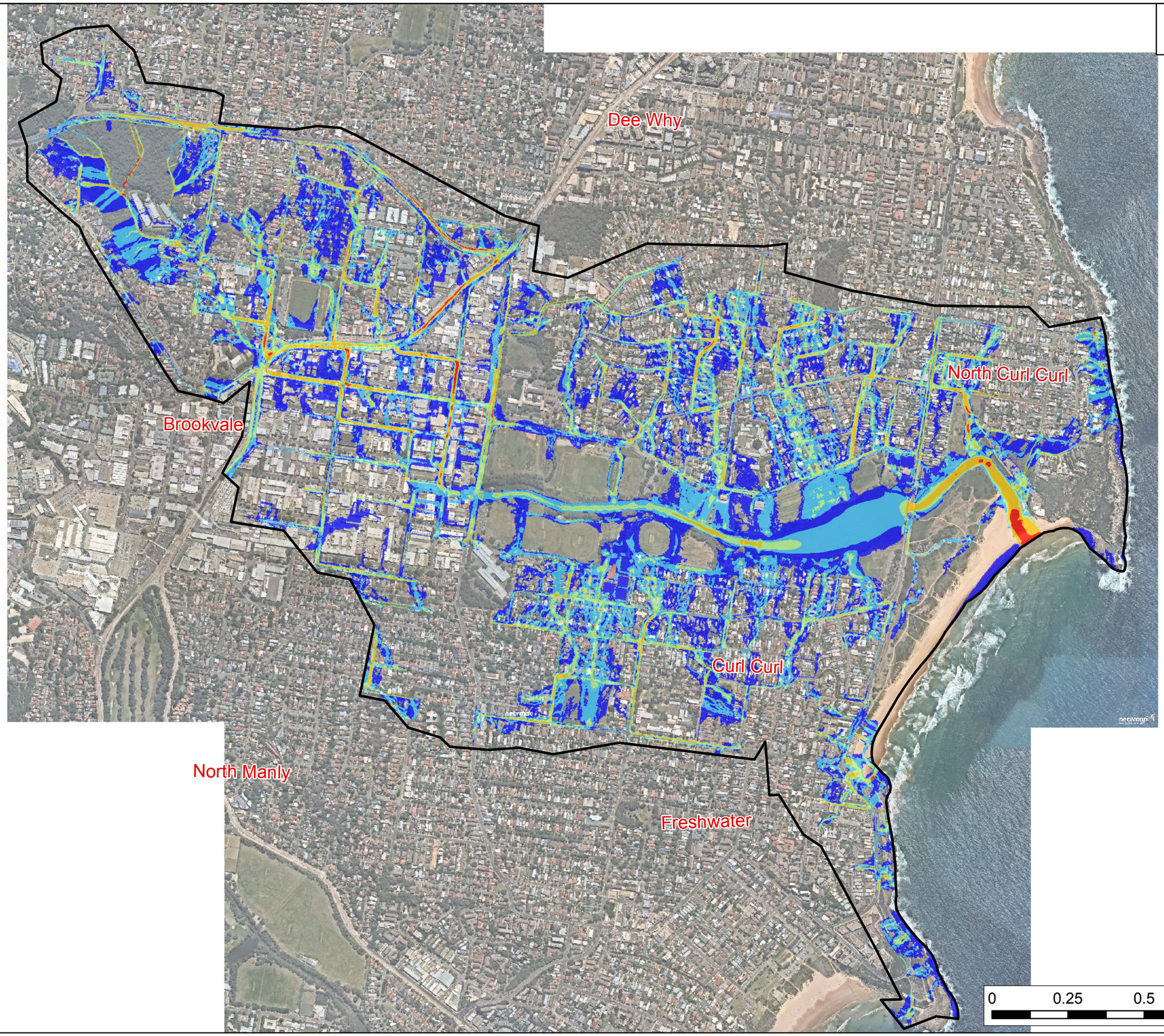
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FIGURE D13
PEAK FLOOD VELOCITIES
5% AEP EVENT



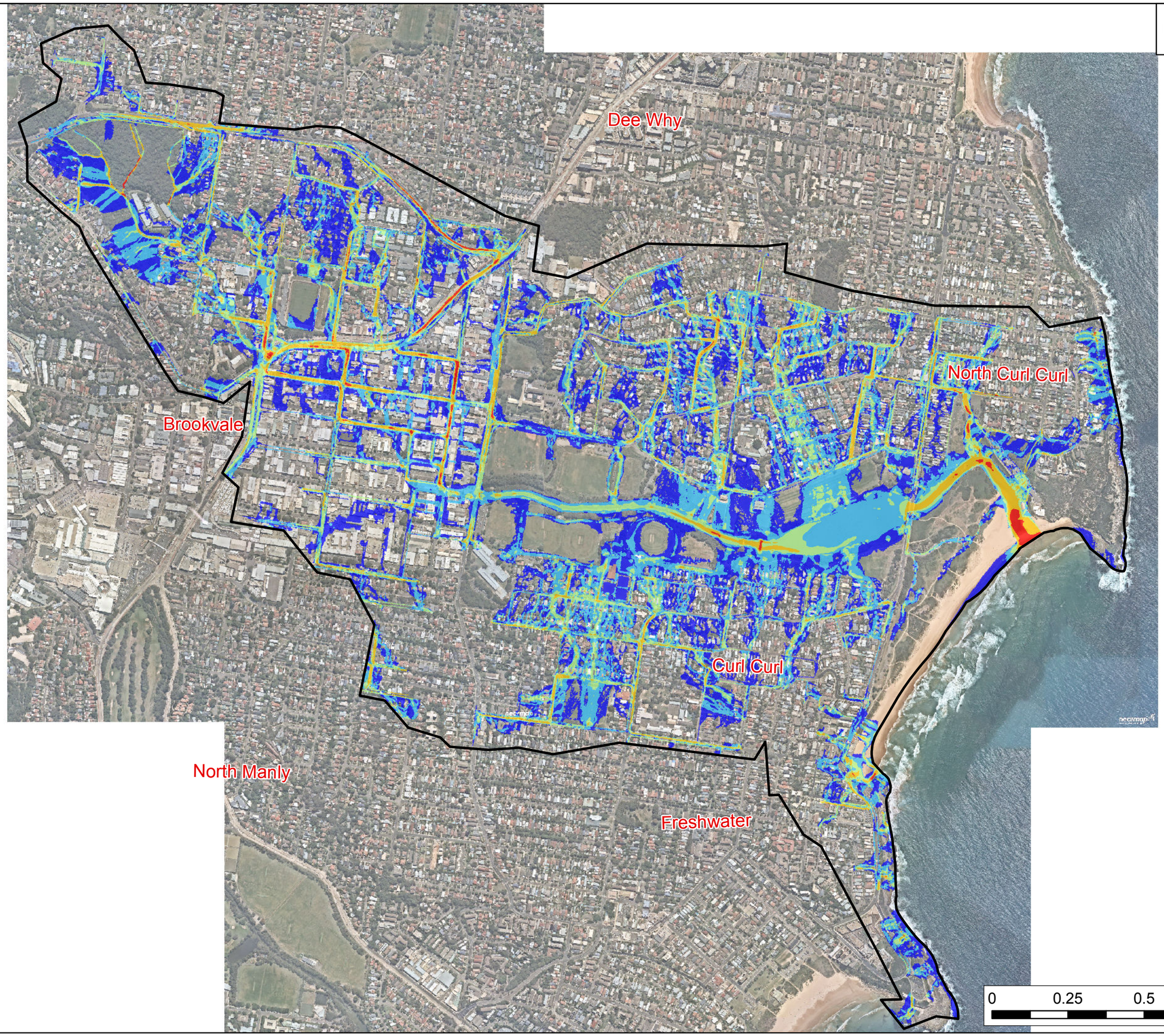
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FIGURE D14
PEAK FLOOD VELOCITIES
2% AEP EVENT



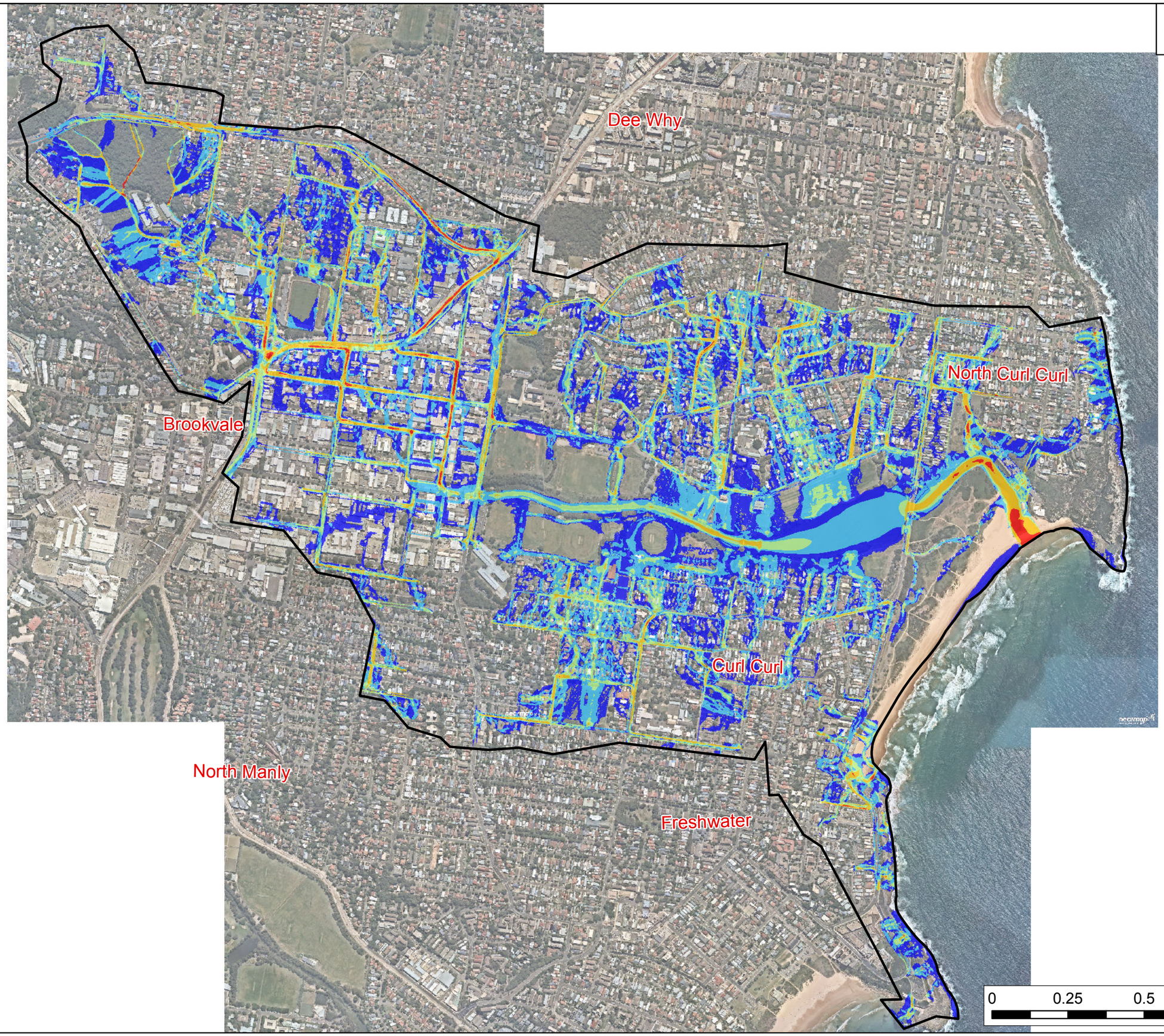
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FIGURE D15
PEAK FLOOD VELOCITIES
1% AEP EVENT



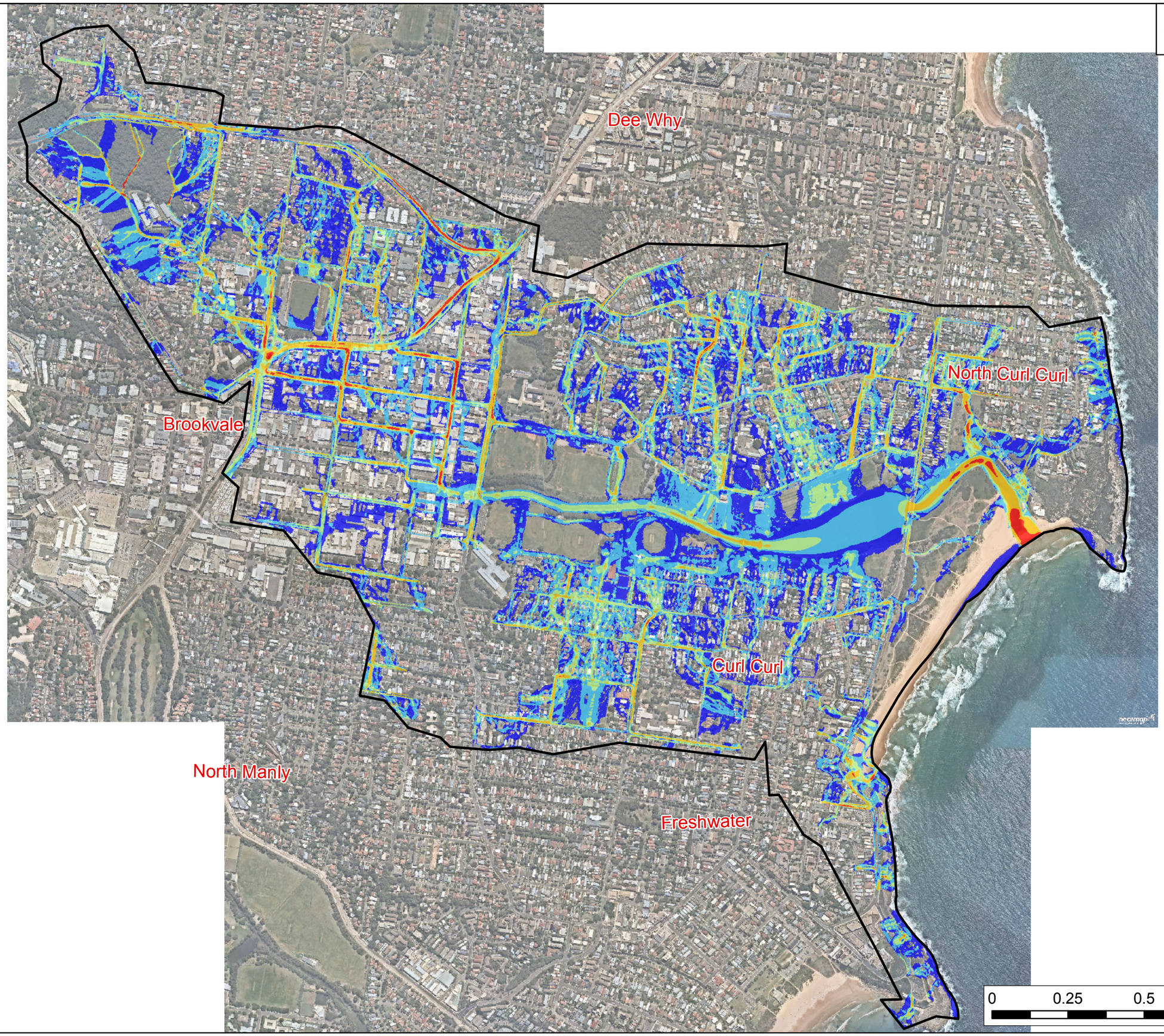
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FIGURE D16
PEAK FLOOD VELOCITIES
0.5% AEP EVENT



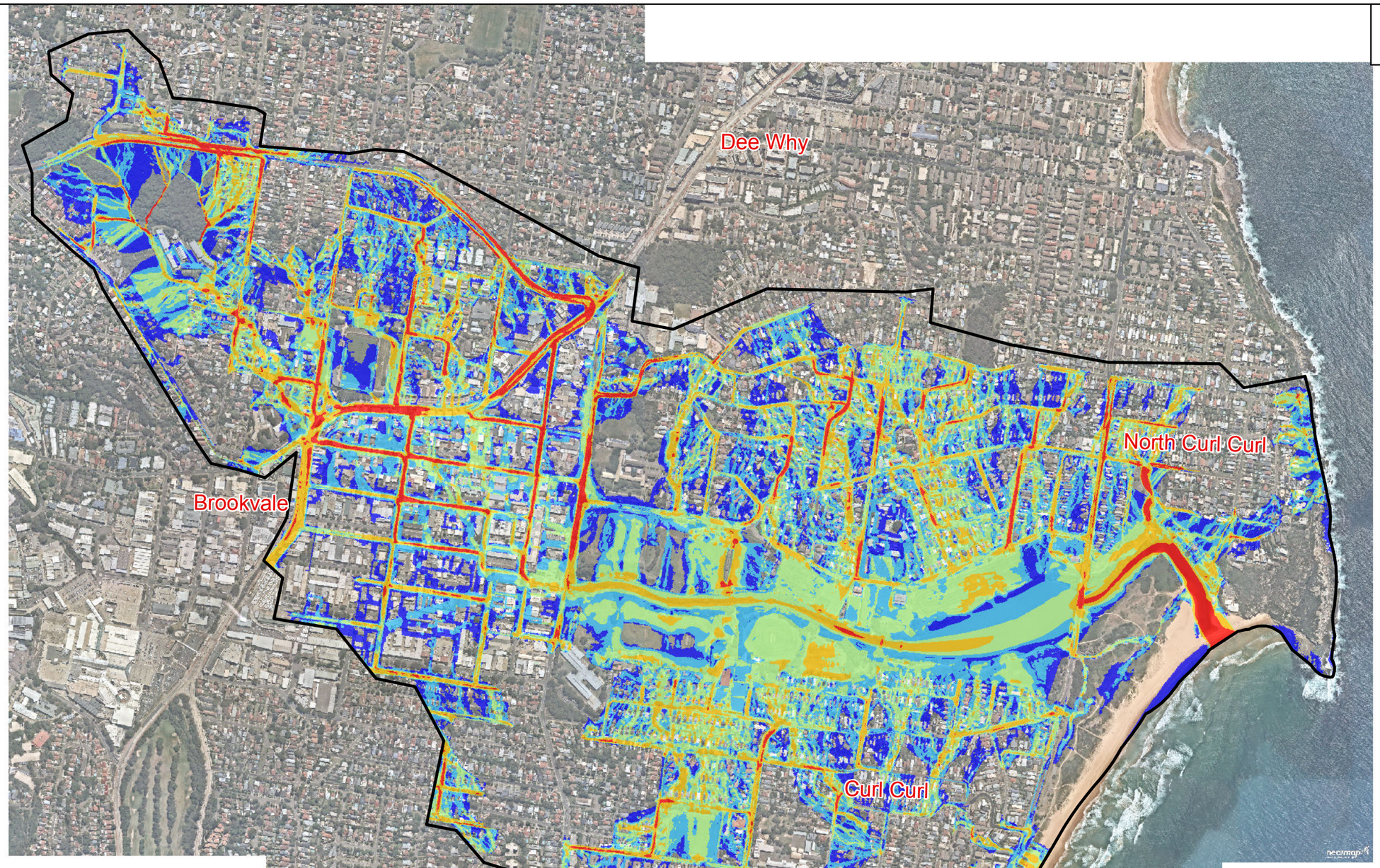
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FIGURE D17
PEAK FLOOD VELOCITIES
0.2% AEP EVENT



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_D\FigureD17_PeakFloodVelocities_0.2p_AEP_Event.mxd

FIGURE D18
PEAK FLOOD VELOCITIES
PMF EVENT

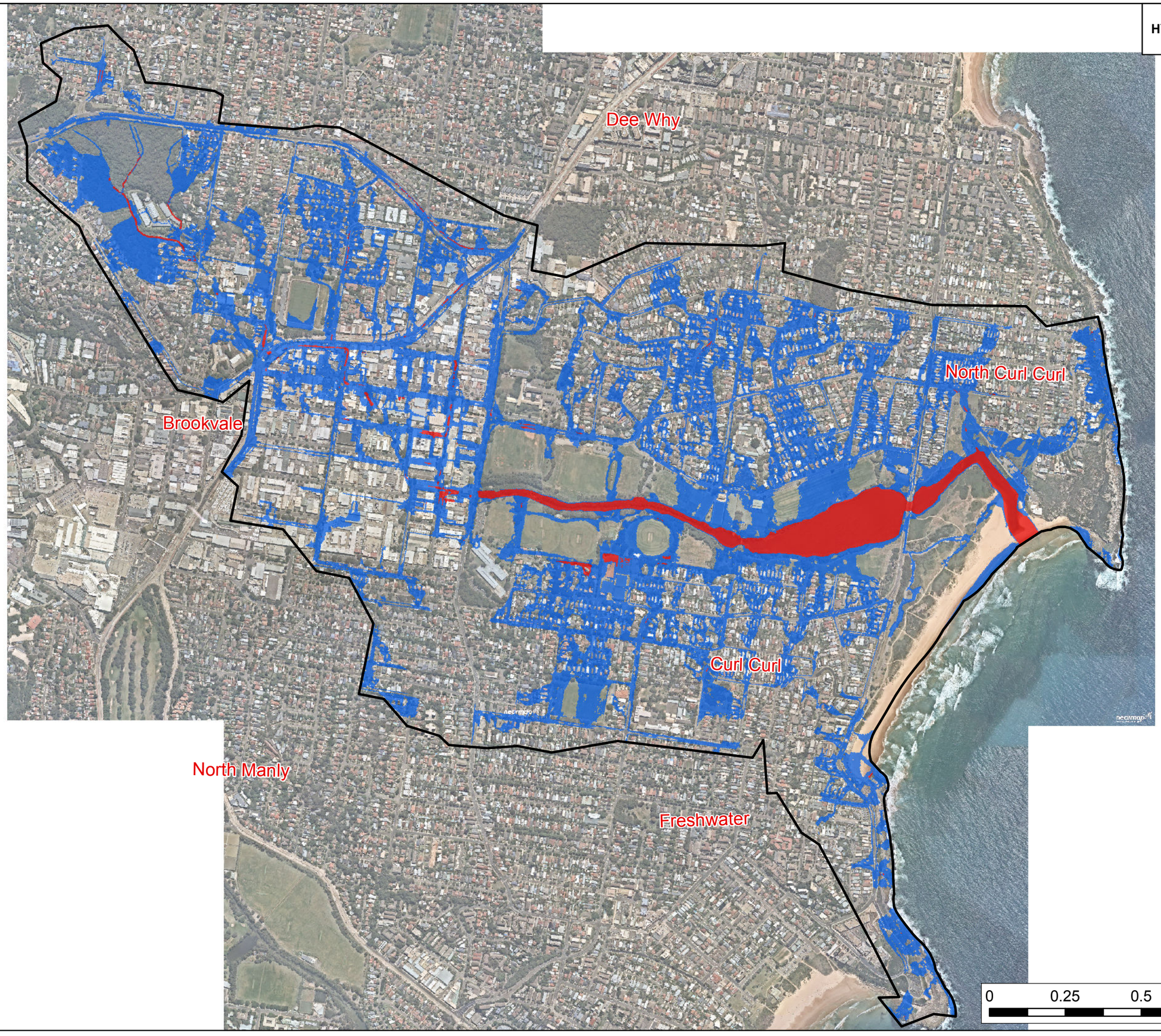


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APPENDIX E. Hydraulic Hazard and Flood Function

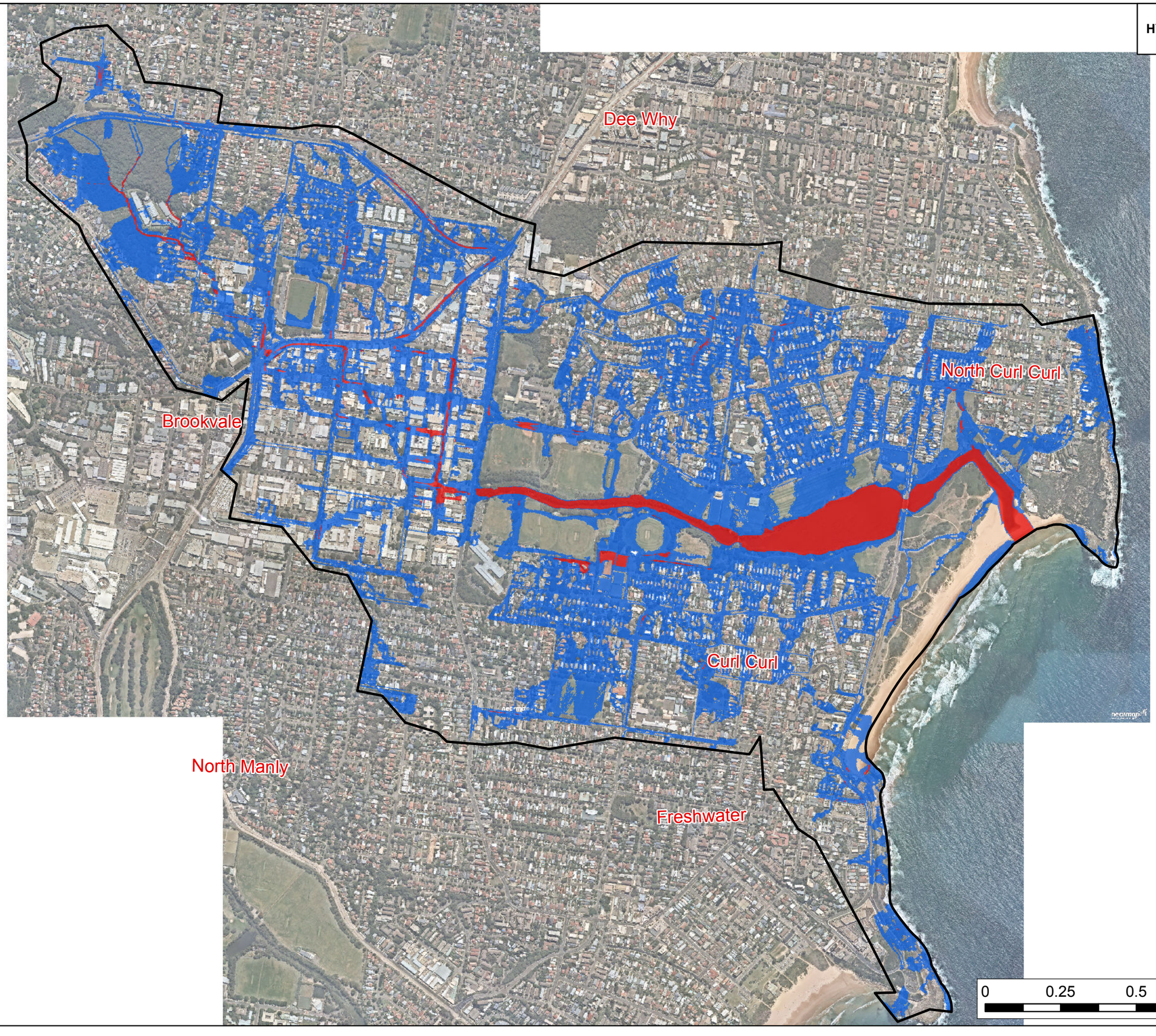
Appendix E

FIGURE E1
HYDRAULIC HAZARD (FDM)
5% AEP EVENT



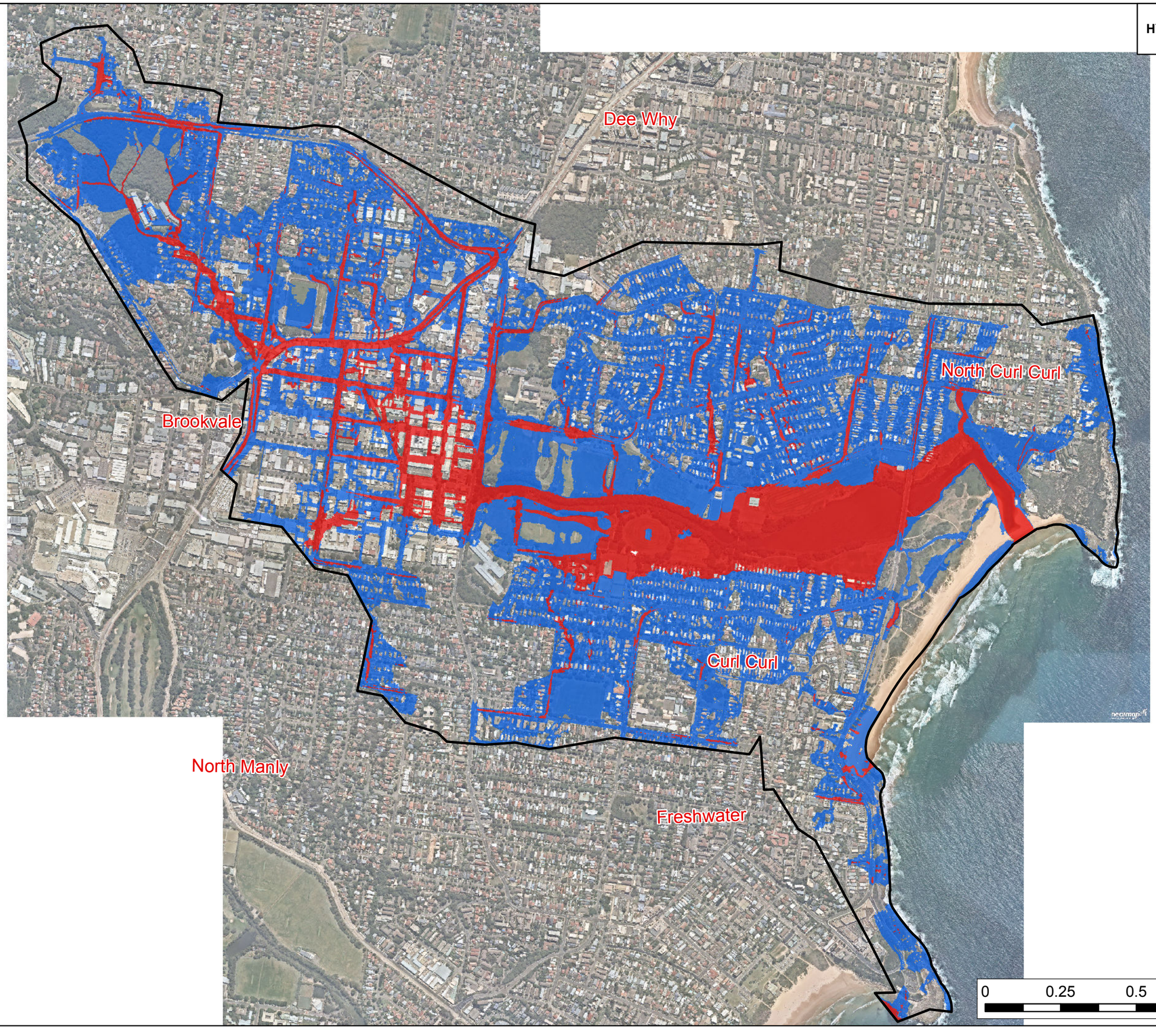
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FIGURE E2
HYDRAULIC HAZARD (FDM)
1% AEP EVENT



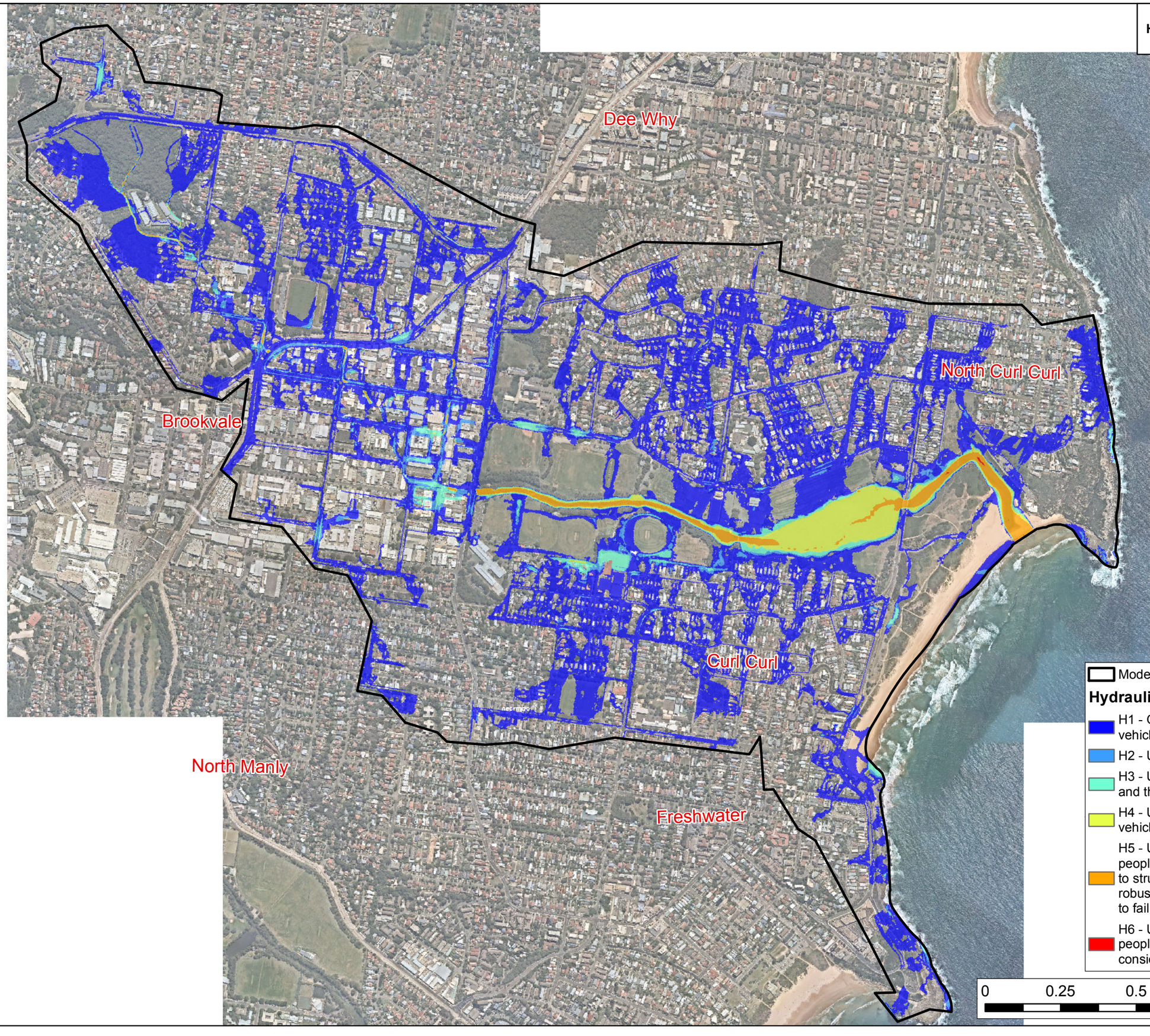
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FIGURE E3
HYDRAULIC HAZARD (FDM)
PMF EVENT



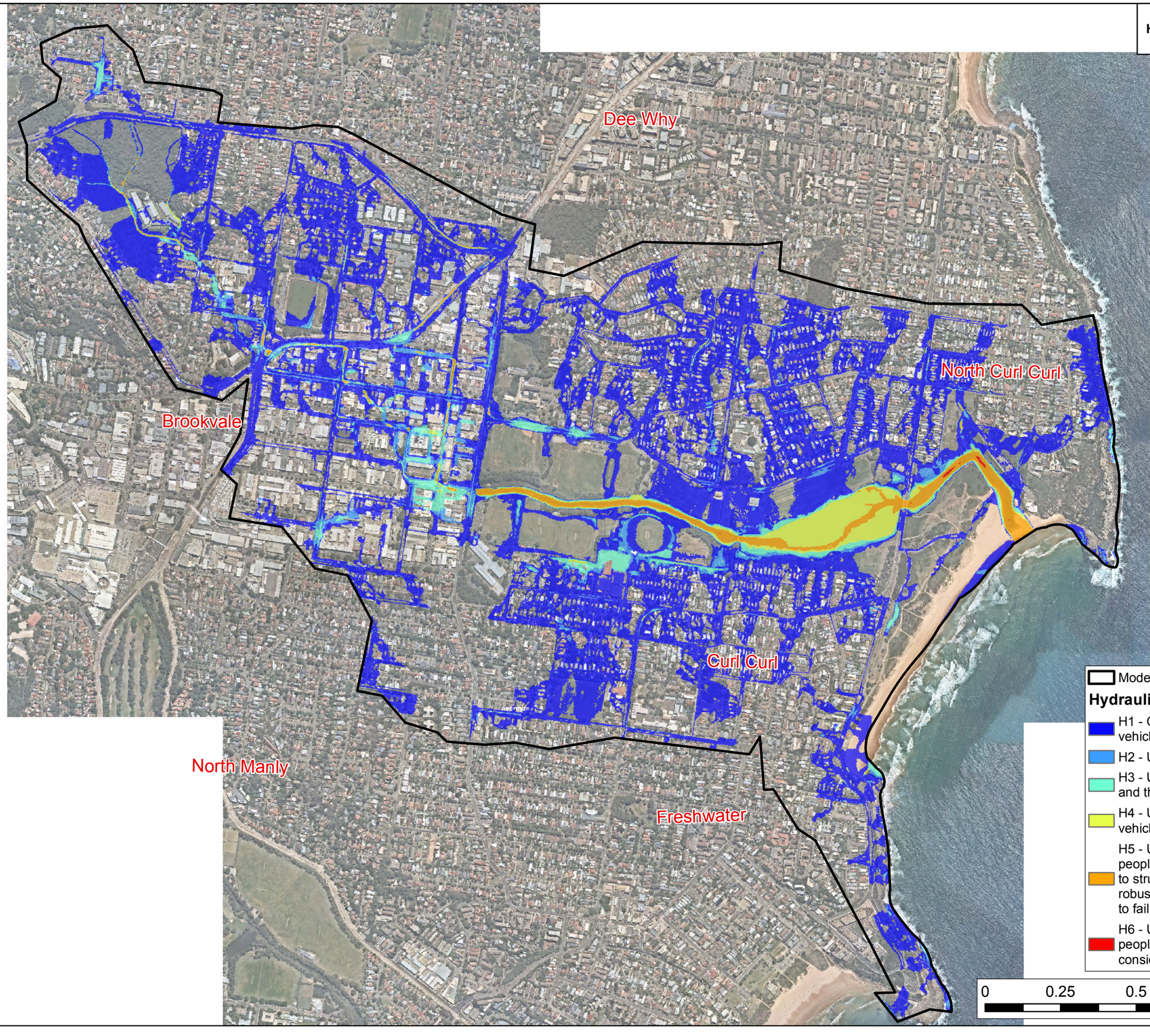
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FIGURE E4
HYDRAULIC HAZARD (ADR)
5% AEP EVENT



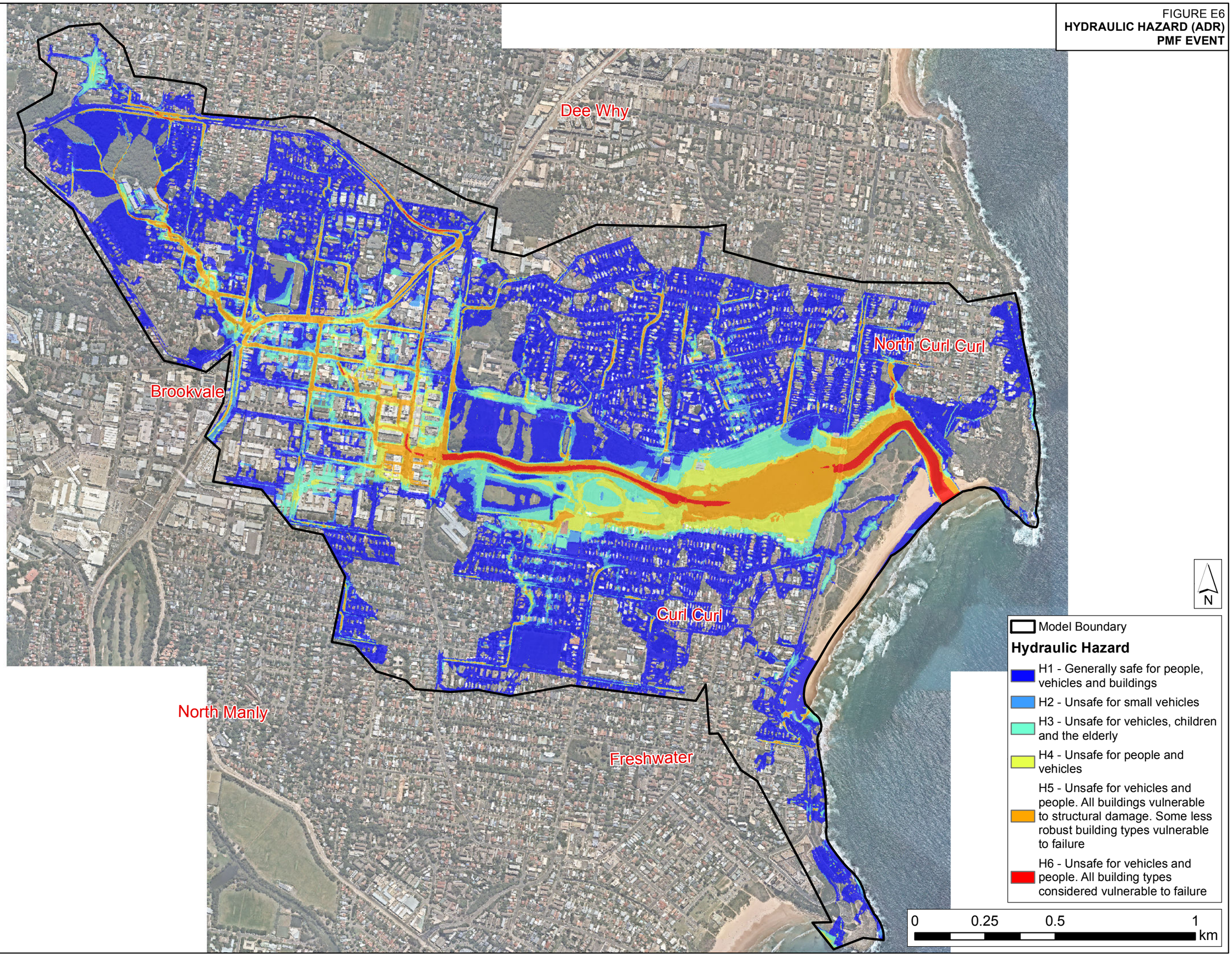
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FIGURE E5
HYDRAULIC HAZARD (ADR)
1% AEP EVENT



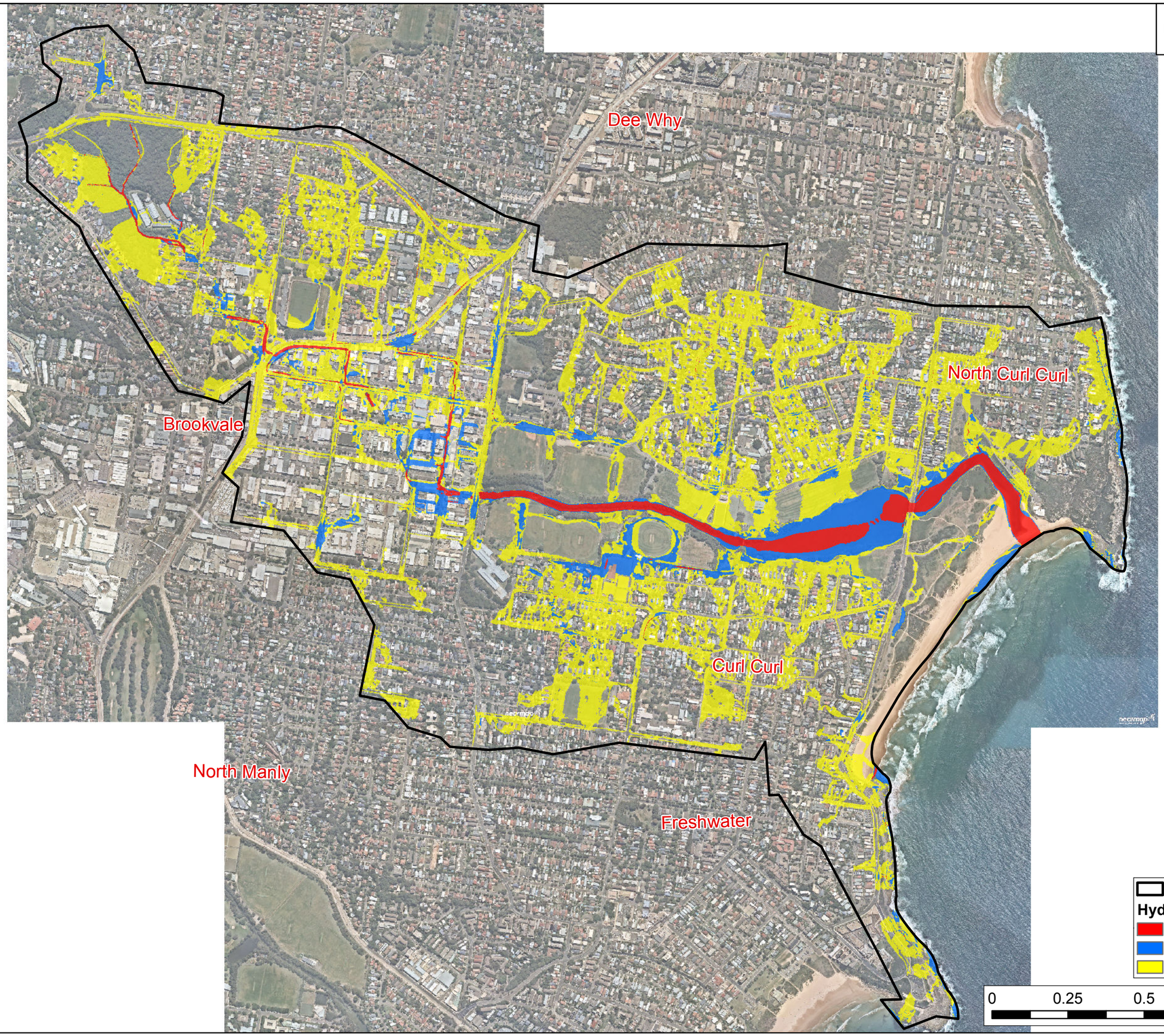
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FIGURE E6
HYDRAULIC HAZARD (ADR)
PMF EVENT



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_E\FigureE06_HydraulicHazard_ADR_PMF_Event.mxd

FIGURE E7
HYDRAULIC CATEGORIES
5% AEP EVENT



J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_E\FigureE07_HydraulicCategories_5p_AEP_Event.mxd

FIGURE E8
HYDRAULIC CATEGORIES
1% AEP EVENT

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

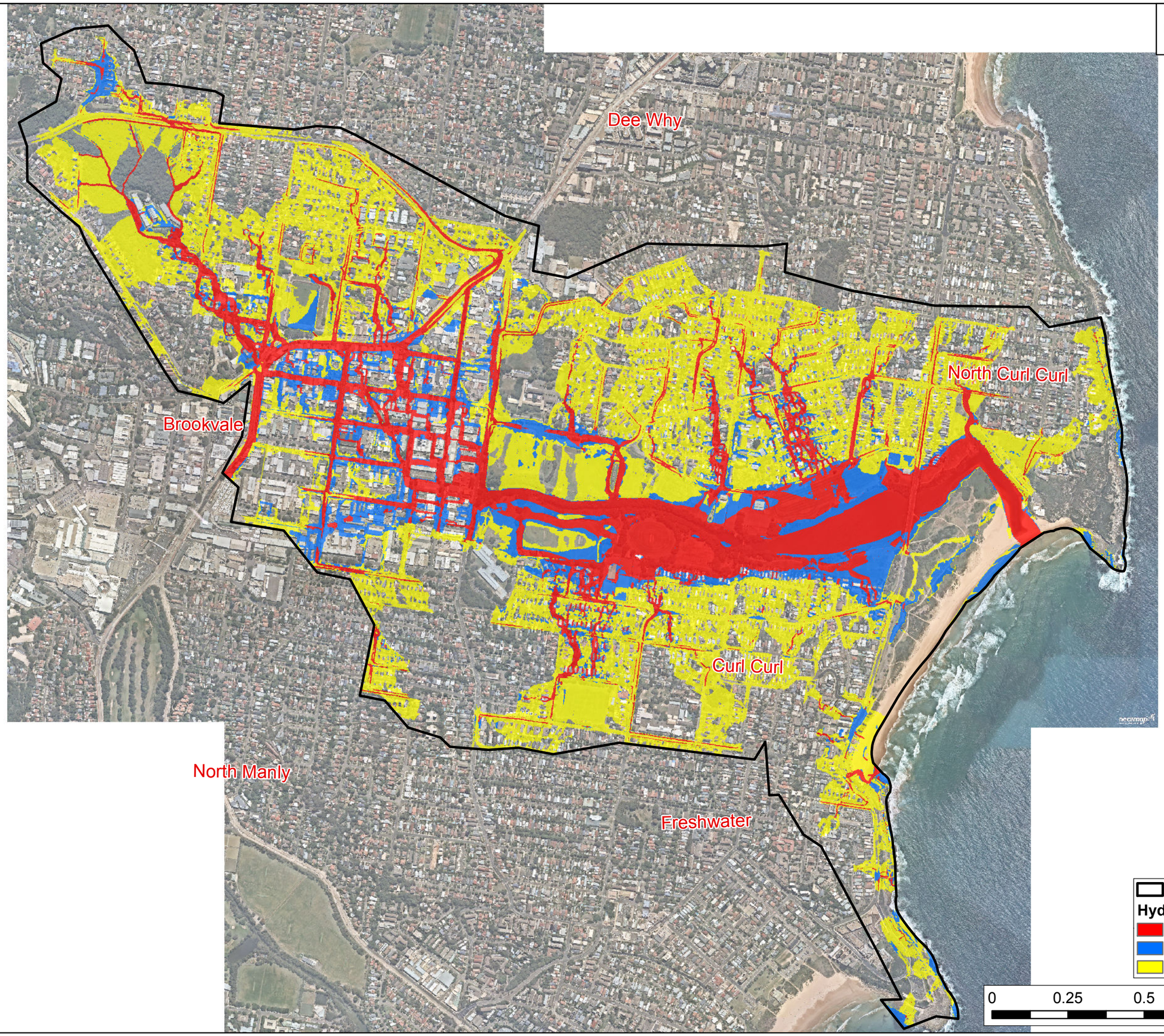
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Model Boundary
Hydraulic Categorisation
Floodway
Flood Storage
Flood Fringe

0 0.25 0.5 1 km

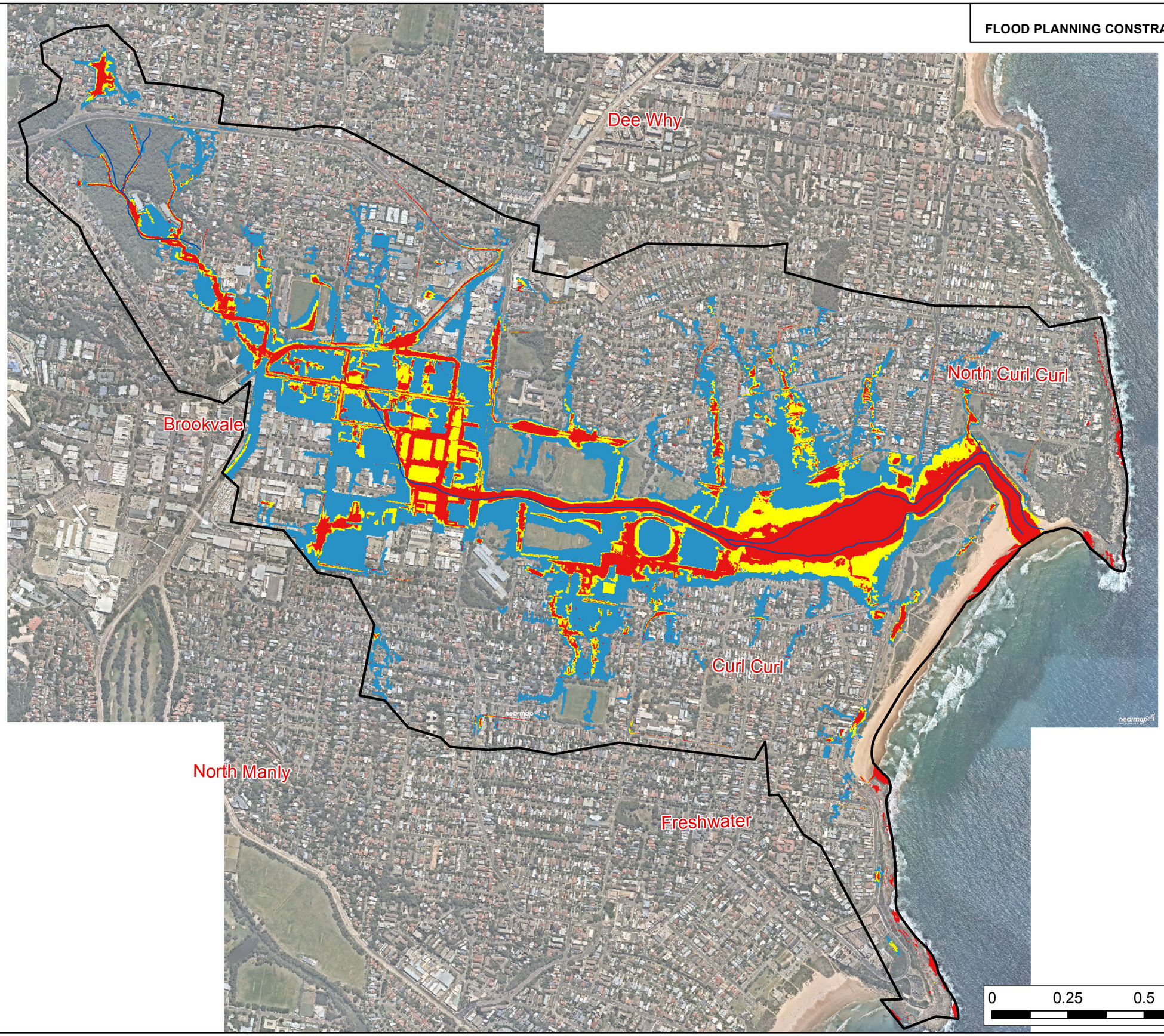
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FIGURE E9
HYDRAULIC CATEGORIES
PMF EVENT



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FIGURE E10
FLOOD PLANNING CONSTRAINT CATEGORY MAPPING



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APPENDIX F. Road Overtopping Information

Appendix F

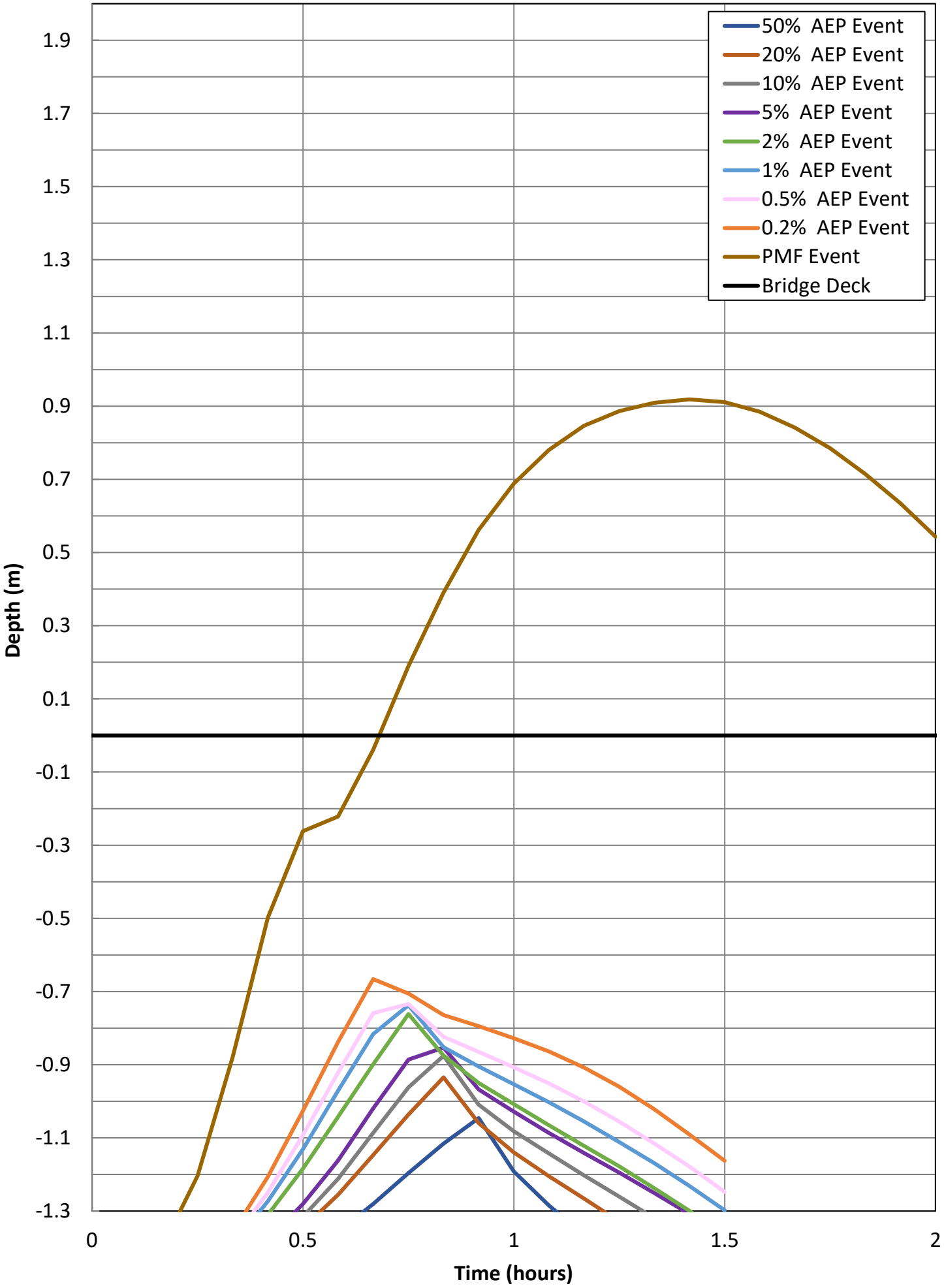
FIGURE F1
SES REPORTING LOCATIONS

Figure F10
SES9
McKillop Rd
Lee R
Warringah Rd
Dee Why
Figure F9
SES8
Federal Parade
Quirk St
Figure F8
SES7
Consul Rd
Pine Ave
Gulliver St
Headland Rd
Figure F7
SES6
Pittwater Rd
North Curl Curl
Robertson Rd
Winbourne Rd
Playfair Rd
Pitt Rd
Figure F6
SES5
Brookvale
Mitchell Rd
Sydenham Rd
Figure F3
SES2
Abbott Rd
Figure F2
SES1
Griffin Rd
Powells Rd
Ethel Ave
Harbord Rd
Figure F4
SES3
Wattle Rd
Amourin St
Figure F5
SES4
Bennett St
Adams St
Brighton St
Oliver St
Curl Curl
Carrington Parade
Wyadra Ave
North Manly
N
SES Reporting Locations
Model Boundary
0 0.25 0.5 1 km

J:\Jobs\118094\ArcGIS\ArcMaps\Appendix_F\FigureF01_SES_Reporting_Locations.mxd

FIGURE F2

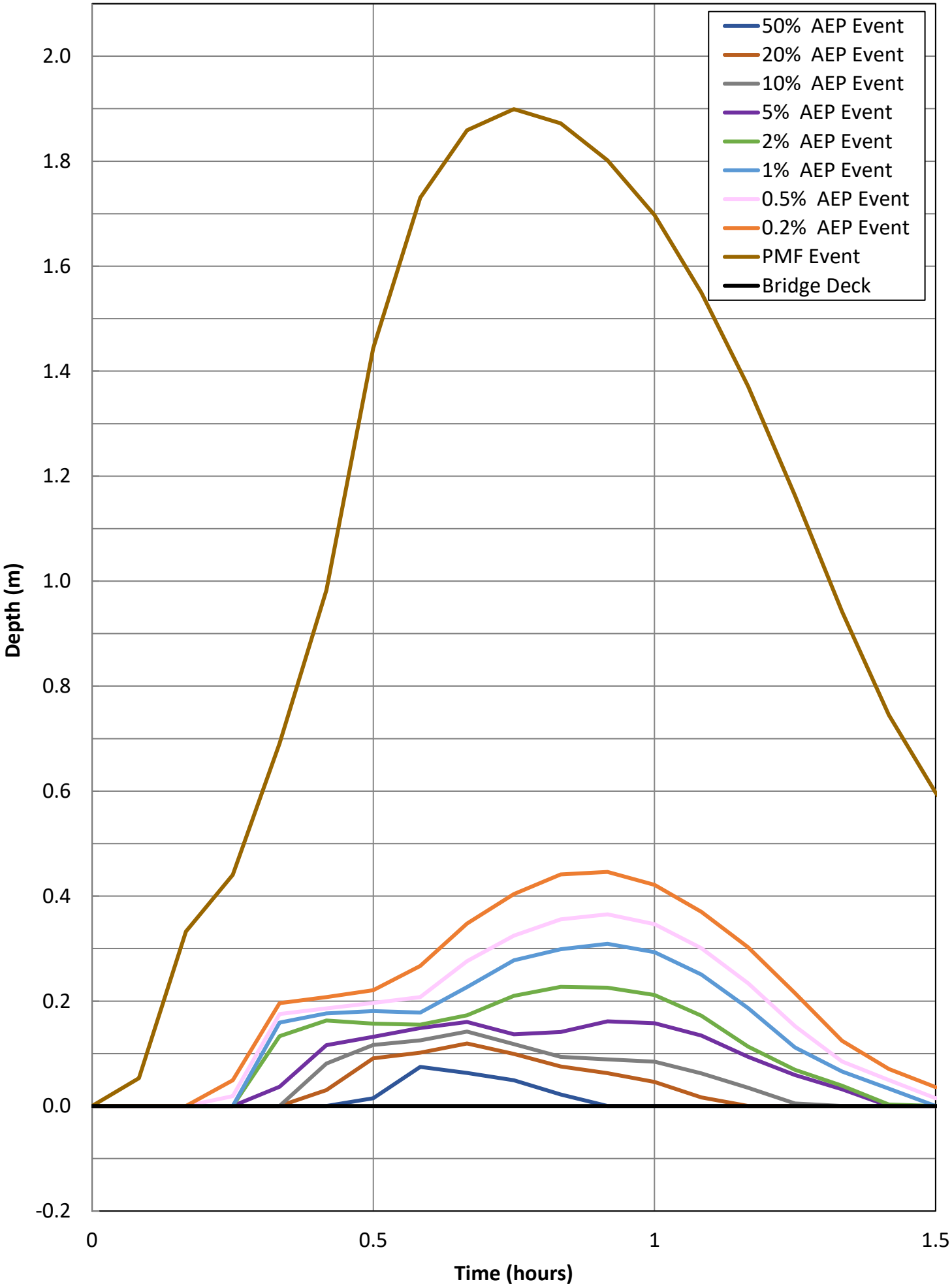
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES1 - GRIFFIN ROAD BRIDGE



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F3

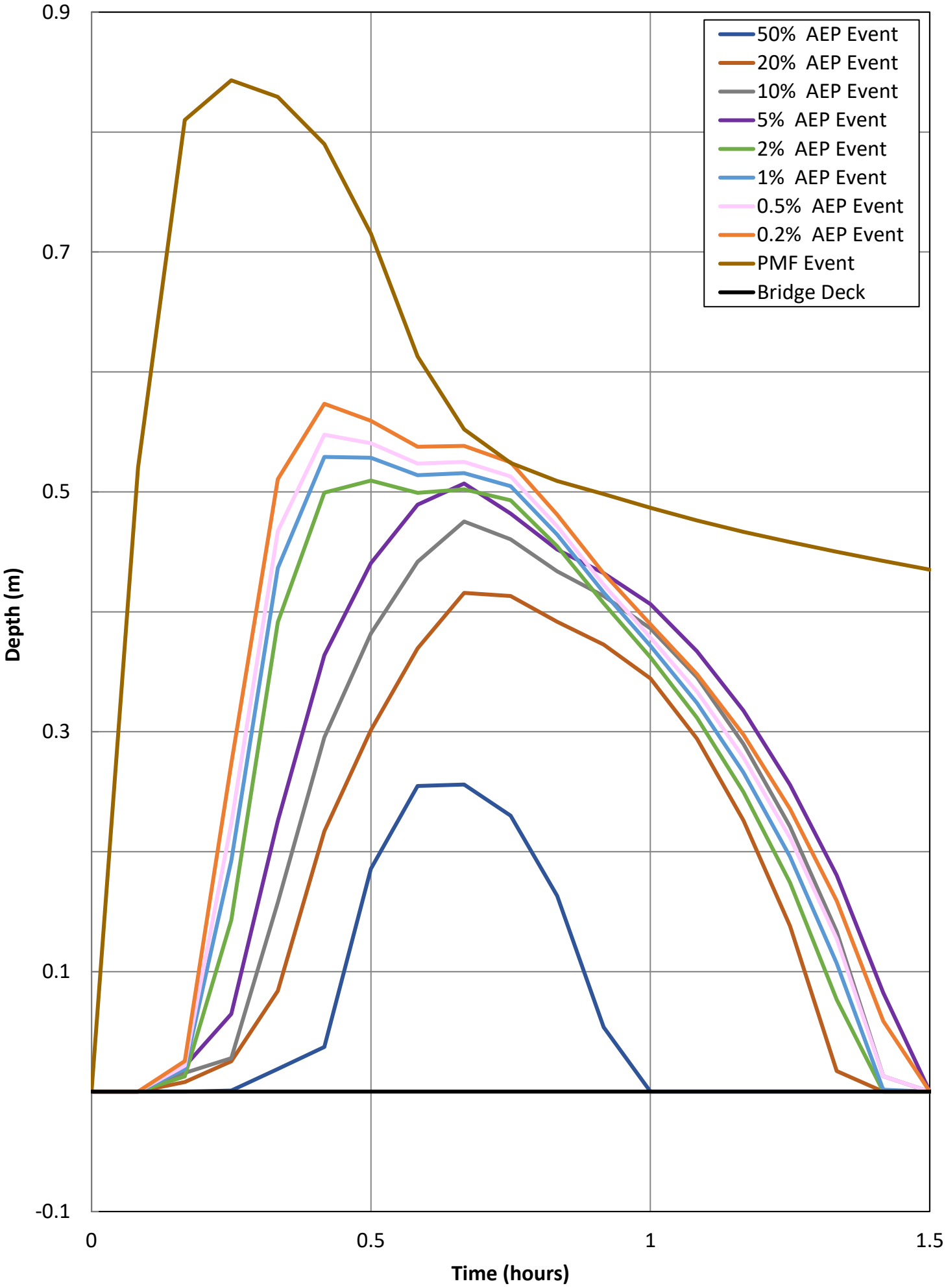
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES2 - HARBORD ROAD



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F4

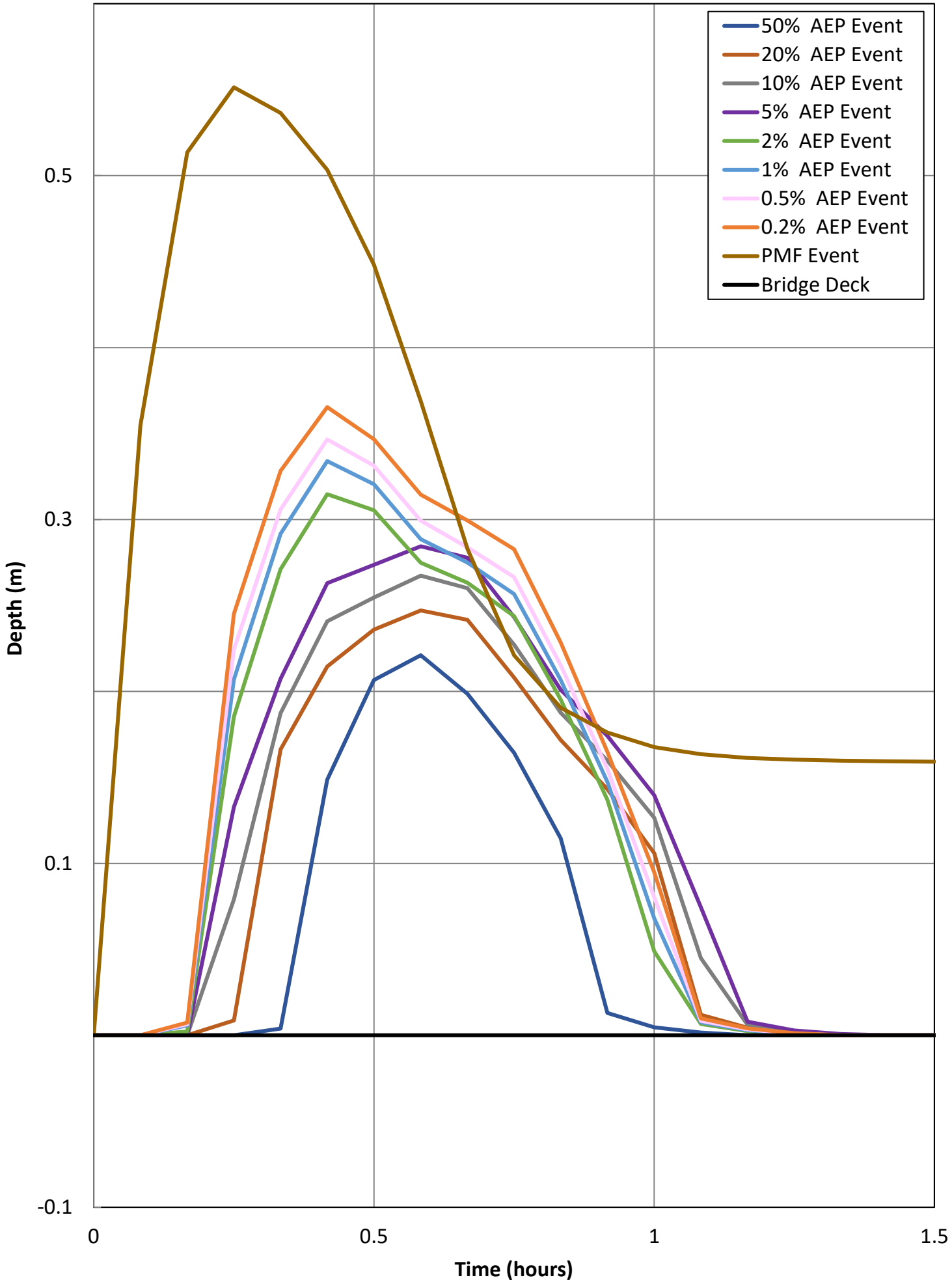
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES3 - MANUELA PLACE



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F5

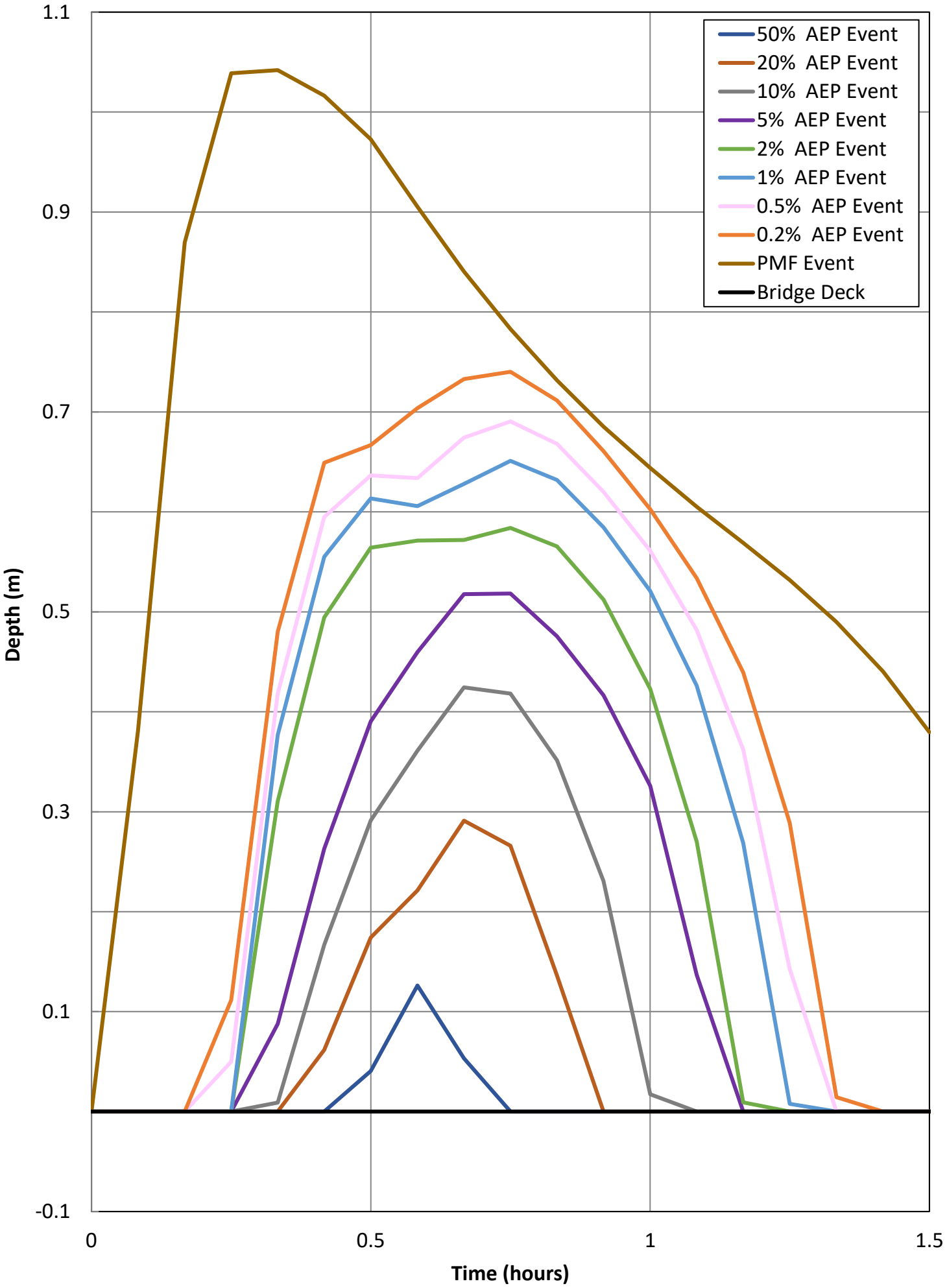
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES4 - BRIGHTON STREET



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F6

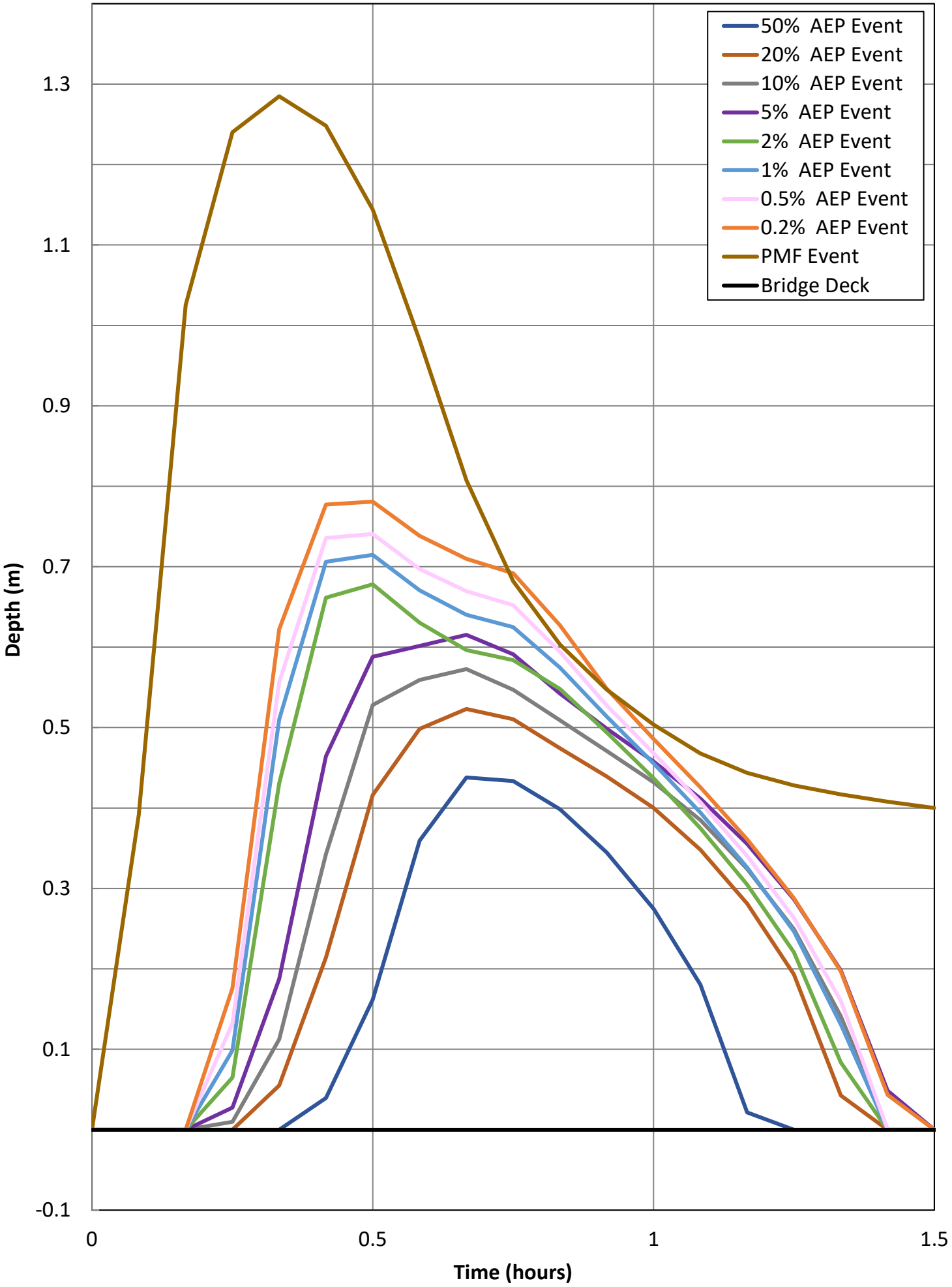
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES5 - ABBOTT ROAD



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F7

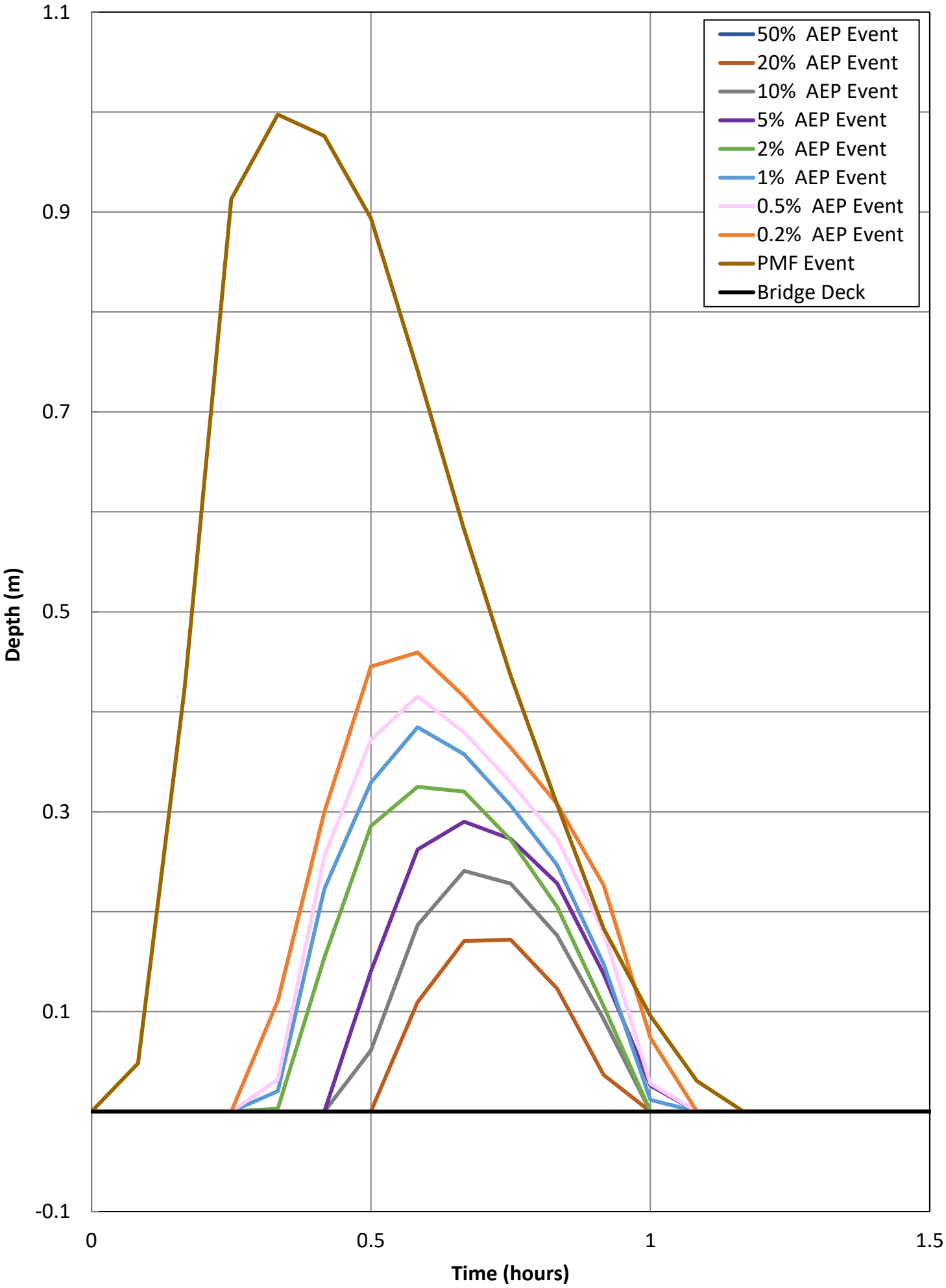
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES6 - PITTWATER ROAD



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FIGURE F8

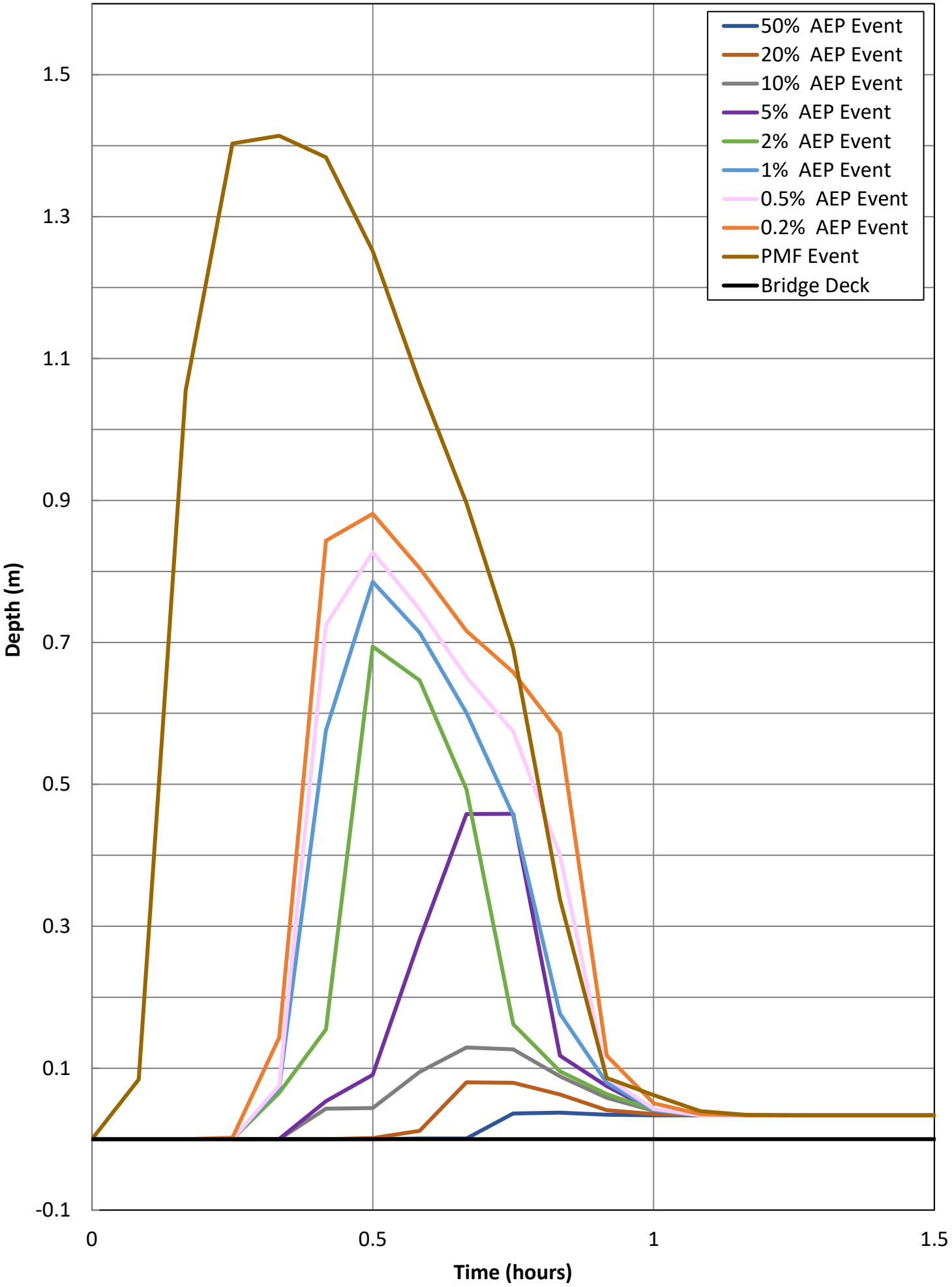
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES7 - GULLIVER STREET



J:\Jobs\118094\Hydraulics\Results_Reporting\TUFLOW_Flood_Level_Hydrographs_v03.xlsm

FIGURE F9

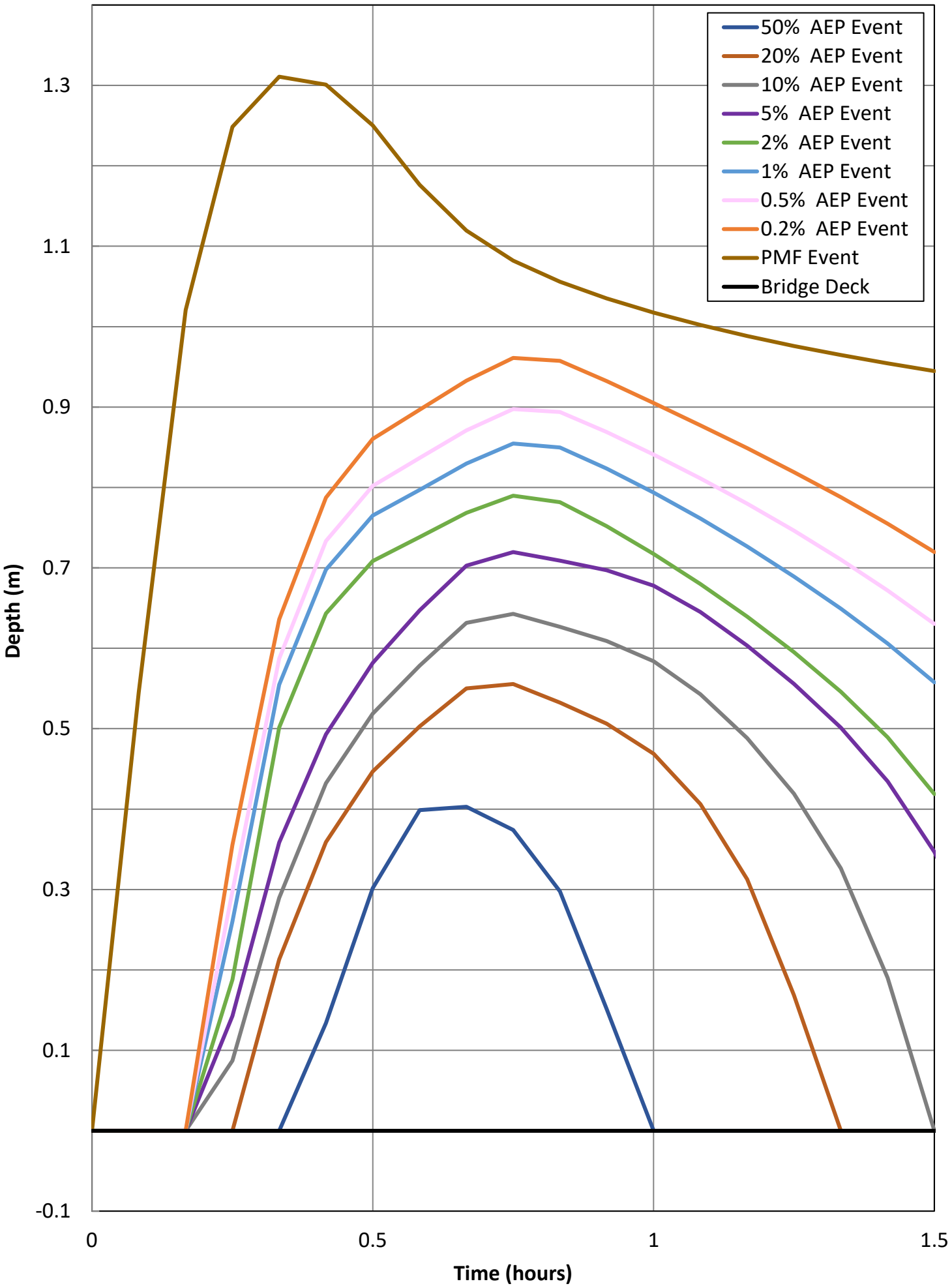
FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES8 - CONSUL ROAD



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FIGURE F10

FLOOD DEPTH ABOVE ROAD HYDROGRAPH
LOCATION SES9 - MCKILLOP STREET

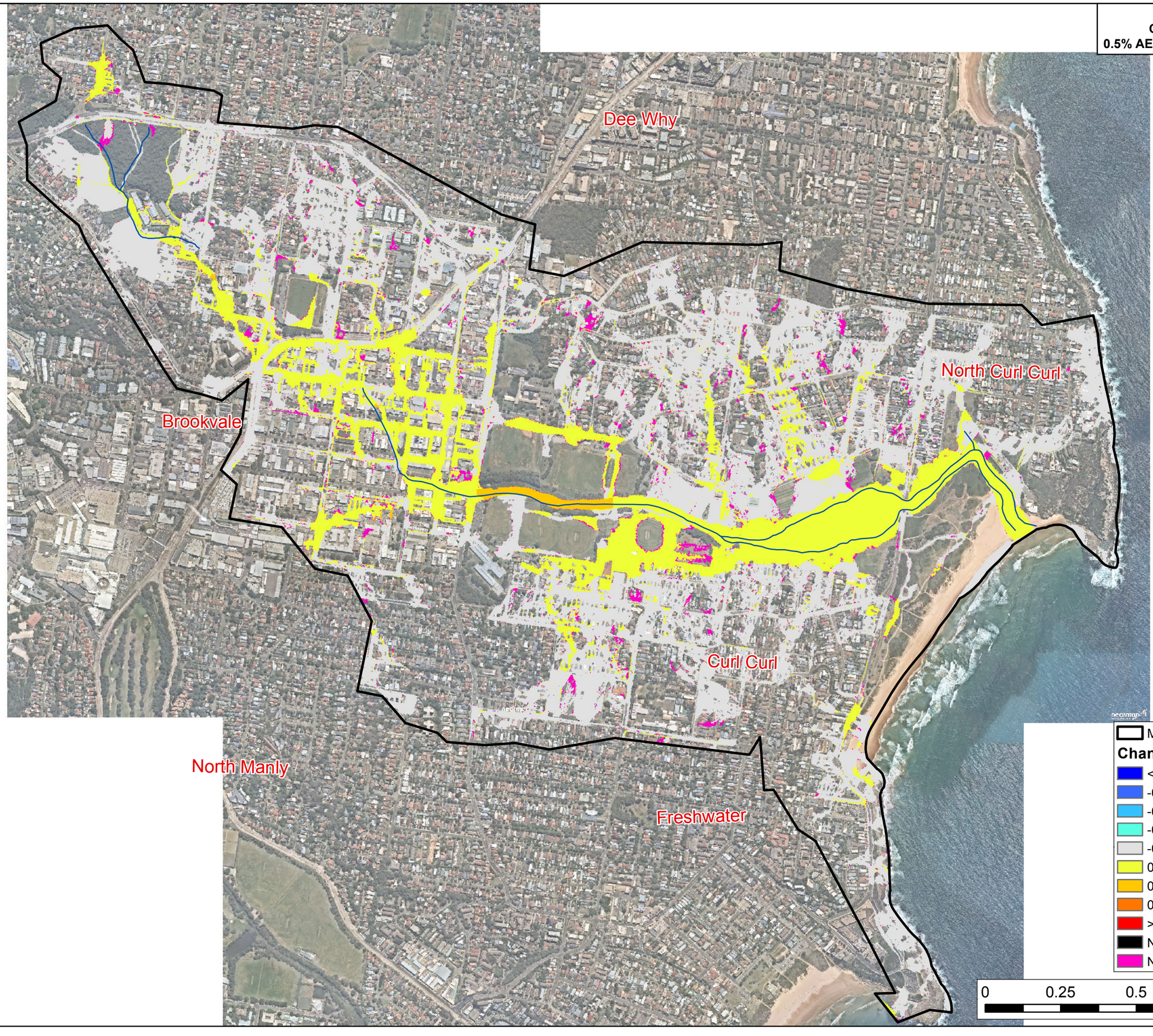


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APPENDIX G. Climate Change Impacts

Appendix G

FIGURE G1
CLIMATE CHANGE IMPACT
0.5% AEP VERSUS 1% AEP EVENT



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FIGURE G2
CLIMATE CHANGE IMPACT
0.2% AEP VERSUS 1% AEP EVENT

Dee Why
Brookvale
North Curl Curl
Curl Curl
North Manly
Freshwater

N

Model Boundary
Change in Flood Level (m)
< -0.5
-0.5 to -0.2
-0.2 to -0.1
-0.1 to -0.01
-0.01 to 0.01
0.01 to 0.1
0.1 to 0.2
0.2 to 0.5
> 0.5
No Longer Flooded
Newly Flooded

0 0.25 0.5 1 km

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FIGURE G3
CLIMATE CHANGE IMPACT
1% AEP EVENT WITH 0.4M SEA LEVEL RISE

Dee Why
Brookvale
North Curl Curl
Curl Curl
North Manly
Freshwater

N

Model Boundary
Change in Flood Level (m)
< -0.5
-0.5 to -0.2
-0.2 to -0.1
-0.1 to -0.01
-0.01 to 0.01
0.01 to 0.1
0.1 to 0.2
0.2 to 0.5
> 0.5
No Longer Flooded
Newly Flooded

0 0.25 0.5 1 km

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FIGURE G4
CLIMATE CHANGE IMPACT
1% AEP EVENT WITH 0.9M SEA LEVEL RISE

Dee Why
Brookvale
North Curl Curl
Curl Curl
North Manly
Freshwater

N

Model Boundary
Change in Flood Level (m)
< -0.5
-0.5 to -0.2
-0.2 to -0.1
-0.1 to -0.01
-0.01 to 0.01
0.01 to 0.1
0.1 to 0.2
0.2 to 0.5
> 0.5
No Longer Flooded
Newly Flooded

0 0.25 0.5 1 km

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FIGURE G5
CLIMATE CHANGE IMPACT
1% AEP EVENT WITH 10% INCREASE IN RAINFALL AND 0.4M SEA LEVEL RISE

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Change in Flood Level (m)
< -0.5
-0.5 to -0.2
-0.2 to -0.1
-0.1 to -0.01
-0.01 to 0.01
0.01 to 0.1
0.1 to 0.2
0.2 to 0.5
> 0.5
No Longer Flooded
Newly Flooded

0 0.25 0.5 1 km

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FIGURE G6
CLIMATE CHANGE IMPACT
1% AEP EVENT WITH 10% INCREASE IN RAINFALL AND 0.9M SEA LEVEL RISE

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

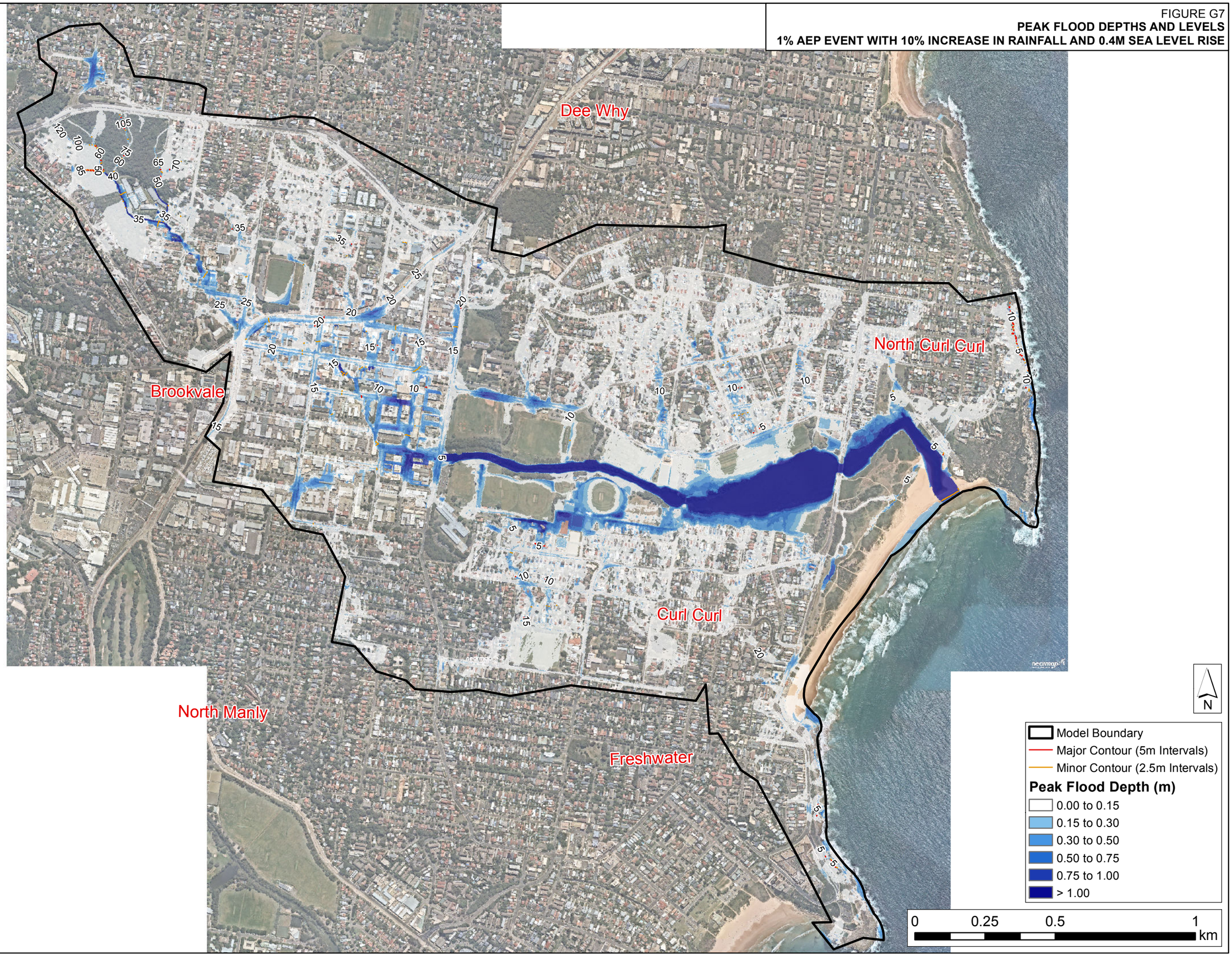
N

Model Boundary
Change in Flood Level (m)
< -0.5
-0.5 to -0.2
-0.2 to -0.1
-0.1 to -0.01
-0.01 to 0.01
0.01 to 0.1
0.1 to 0.2
0.2 to 0.5
> 0.5
No Longer Flooded
Newly Flooded

0 0.25 0.5 1 km

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FIGURE G7
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT WITH 10% INCREASE IN RAINFALL AND 0.4M SEA LEVEL RISE



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FIGURE G8
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT WITH 10% INCREASE IN RAINFALL AND 0.9M SEA LEVEL RISE

Dee Why
North Curl Curl
Brookvale
Curl Curl
North Manly
Freshwater

N

Model Boundary
Major Contour (5m Intervals)
Minor Contour (2.5m Intervals)

Peak Flood Depth (m)

0.00 to 0.15
0.15 to 0.30
0.30 to 0.50
0.50 to 0.75
0.75 to 1.00
> 1.00

0 0.25 0.5 1 km

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APPENDIX H. Community Consultation Material

Appendix H

northern beaches council

1 August 2019

Name
Title
Company
Address

Our Ref: 2019/190929

Dear Resident

Greendale Creek Flood Study – Community Survey

We have recently started the Greendale Creek Flood Study to help us better understand flood behaviour in this catchment. The study area includes parts of Brookvale, Curl Curl, North Curl Curl, Freshwater and Narraweena which drain to Curl Curl Lagoon.

The flood study builds on previous flood investigations and will assist in future land use planning and the evaluation of floodplain management options in the future.

We are seeking the community's help by asking for information and photos of any flooding or drainage problems you may have experienced.

If you have experienced or seen flooding in this catchment area please complete the short survey online at https://greendalecreek.questionpro.eu.

Alternatively, please use the hard copy included with this letter and return it by 1 September 2019 using the enclosed reply-paid envelope (no postage stamp required). All survey information is confidential and will be used only to assist this particular study.

A map of the study area is included in the attached community survey.

For further enquiries please contact me on 1300 434 434 or floodplain@northernbeaches.nsw.gov.au.

Yours sincerely

Duncan Howley
Team Leader Floodplain Planning & Response

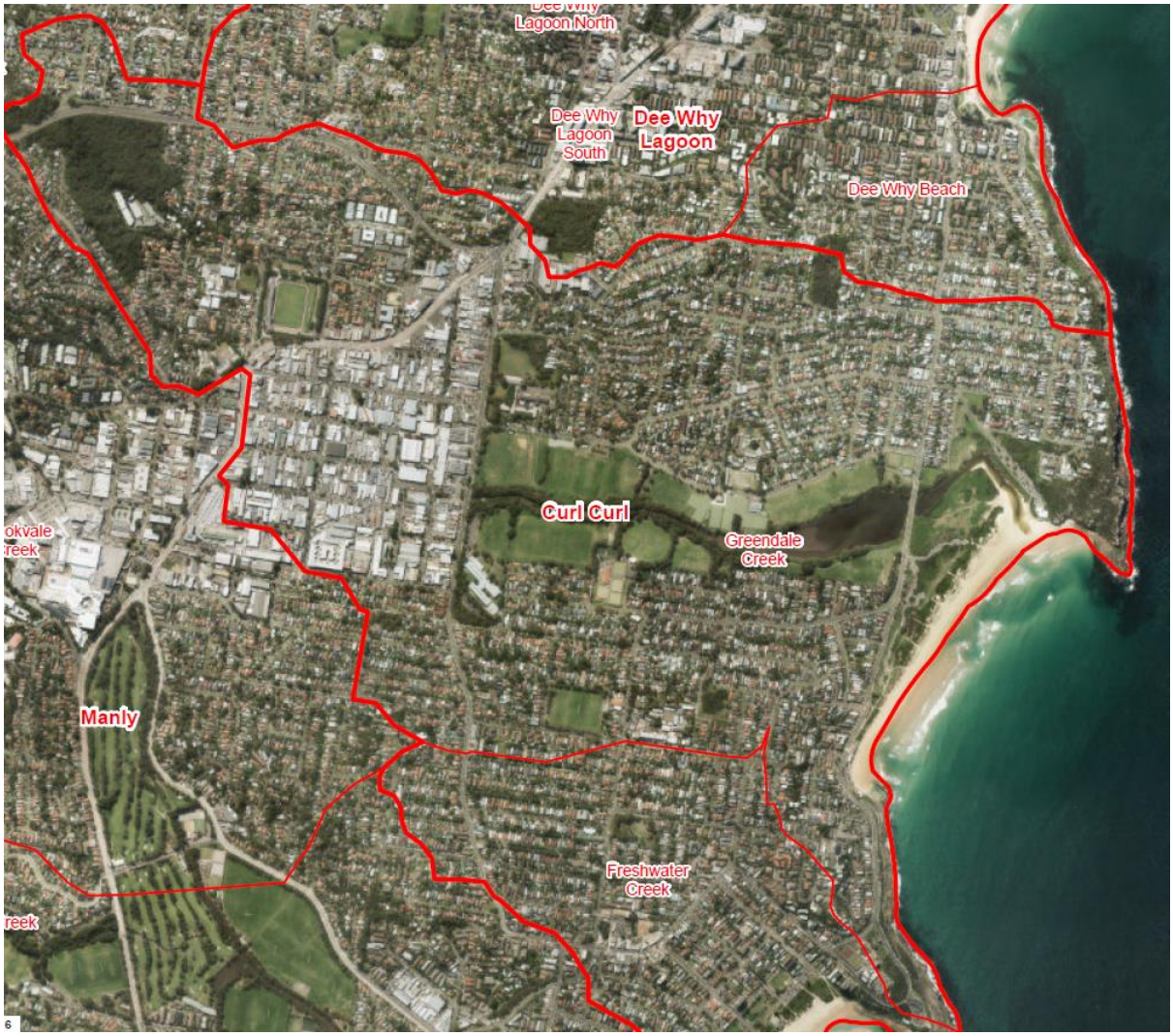
Greendale Creek Flood Study - Community Questionnaire: June 2019

Please complete and return this questionnaire by **31 July 2019**

Northern Beaches Council
Attn: Duncan Howley
PO Box 82
Manly NSW 1655

Alternatively, you can complete this questionnaire online at northernbeaches.nsw.gov.au:

Council is undertaking a flood study for the Greendale Creek catchment to better understand and plan for the risks of flooding. To assist us in determining where flooding occurs, please complete the questionnaire below about your experiences with flooding in the catchment. A map of the Greendale Creek catchment is included below.



1. **What is the address of your property within the catchment? (Please complete a separate survey for each property you own)**

_____

_____

2. **How long have you lived and/or worked in the Greendale Creek Catchment?**

   1-2 years

   3-5 years

   5-10 years

   10-20 years

   Over 20 years

3. **Have you ever experienced flooding due to uncontrolled floodwater/stormwater in this catchment?**

   ☐ Yes – my home

   ☐ Yes – my business

   ☐ No

4. **When did you experience the flooding?**

   Under a year ago

   1-3 years

   3-5 years

   5-10 years

   More than 10 years

5. **Which parts of your property was flooded:**

   ☐ Front yard

   ☐ Back yard

   ☐ Garage or shed

   ☐ Main building – below floor level

   ☐ Main building – above floor level

   ☐ Other: ___

6. **Did you notice any culverts or drains blocked during the flood?**

   ☐ Yes

☐ No

7. **Please specify where the blocked culvert or drain was located (if known)**

   Street:_____

   Suburb): ___

8. **Have you seen any other flooding in streets, parks or other public areas? Where was the flooding?**

   a. Street:_____

   b. Suburb: _____

9. **Do you have any additional information that would us assist with our Greendale Creek Flood Study?** (Please provide as much detail as possible):

_____
_____
_____
_____

10. **If you have any photos of past floods**, please attach with their approx. date. If you have videos please email them to floodplain@northernbeaches.nsw.gov.au

Contact Details (optional)

We may contact you to discuss some of the information that you have provided in this questionnaire.

First Name: ___

Last Name: ___

Address: ___

Email: ___

Daytime Phone: ___

Would you like to receive email updates on this project?

Thank you for your feedback.