PENRITH CITY COUNCIL

CRANEBROOK OVERLAND FLOW FLOOD STUDY

SEPTEMBER 2023

SUMMARY REPORT

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The Study has been adopted by Council in its Ordinary Meeting on 25 September 2023

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Penrith City Council
Penrith Civic Centre
601 High Street, Penrith
council@penrith.city
+61 2 4732 7777

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1 INTRODUCTION

The primary objective of the *Cranebrook Overland Flow Flood Study* was to define the nature of local catchment flooding in the suburbs of Cranebrook, Penrith and Cambridge Gardens in the Penrith City Council (**Council**) Local Government Area (**LGA**) for flood frequencies ranging between 0.5 Exceedances per Year (**EY**) and 0.2 per cent Annual Exceedance Probability (**AEP**), as well as for the Probable Maximum Flood (**PMF**). The definition of Nepean River flooding for a flood with an AEP of 1% that was originally defined as part of the *Nepean River Flood Study* (Advisian, 2018) was also refined in the study area as part of the *Cranebrook Overland Flow Flood Study*.

Figure 1 shows the extent of the study area which is roughly bounded by the Nepean River and Penrith Lakes to the west, existing rural type residential land to the north, the Northern Road and Richmond Road to the east and the Main Western Railway to the south.

The findings of the *Cranebrook Overland Flow Flood Study* will be used as the basis for preparing the future *Cranebrook Floodplain Risk Management Study and Plan* (***Cranebrook FRMS&P***) which will assess options for flood mitigation and prepare a plan of works and measures for managing the existing, future and continuing flood risk in the study area.

This Summary Report provides a brief overview of the data that were relied upon for the draft *Cranebrook Overland Flow Flood Study*, as well as the adopted study methodology and outcomes. Please refer to the draft report for a more detailed description of the information contained in this Summary Report.

2 FLOODPLAIN MANAGEMENT PROCESS

The *Cranebrook Overland Flow Flood Study* has been undertaken in accordance with the NSW State Government's Flood Prone Land Policy which is directed at providing solutions to existing flooding problems in developed areas and to ensuring that new development is compatible with the flood hazard and does not create additional flooding problems in other areas.

Under the Policy, the management of flood liable land remains the responsibility of local government. The State subsidises flood mitigation works to alleviate existing problems and provides specialist technical advice to assist councils in the discharge of their floodplain management responsibilities.

The Policy provides for technical and financial support by the Government through the following five sequential stages:

1.	Data Collection	Compilation of existing data and the collection of additional data.
2.	Flood Study	Determines the nature and extent of flooding.
3.	Floodplain Risk Management Study	Evaluates management options for the floodplain in respect of both existing and proposed development.

4.	Floodplain Risk Management Plan	Involves formal adoption by Council of a plan of management for the floodplain.
6.	Implementation of the Plan	Construction of flood mitigation works to protect existing development. Use of Local Environmental Plans to ensure new development is compatible with the flood hazard. Improvements to flood emergency management measures.

The *Cranebrook Overland Flow Flood Study* is jointly funded by Penrith City Council and the NSW Government, via the Department of Planning and Environment and constitutes the first and second stage of the Floodplain Risk Management process for this area and has been prepared for Penrith City Council to define flood behaviour under current conditions.

3 STUDY METHODOLOGY

The *Cranebrook Overland Flow Flood Study* involved the following activities:

- The forwarding of an *Information Sheet* and *Community Questionnaire* to approximately 7,800 residents and business owners in the study area. The *Information Sheet* and *Community Questionnaire*, a copy of which is contained in **Appendix A** of the draft report, introduced the study objectives and sought information on historic flood behaviour from the local community.
- The collection of flood data, details of which are set out in **Section 4.1** of this Summary Report.
- Development of computer models to represent the hydrologic response (i.e. conversion of rainfall to runoff) of the study area. The DRAINS software was adopted for the study, with different modelling approaches within the software used to simulate the hydrologic response of the predominately rural and urban parts of the study areas. The software generated discharge hydrographs resulting from both historic and design storms. Further discussion of the development of the hydrologic models can be found in **Chapter 3** of the draft report.
- Development of a computer model to represent the hydraulic response (i.e. conversion of runoff to depth, level and extent of flooding) of the study area. The TUFLOW two-dimensional modelling software was used for this purpose. Further discussion of the development of the hydraulic model can be found in **Chapter 4** of the draft report.
- Validation of the computer models to flood behaviour that was observed during storms that occurred in February 2012, January 2016 and February 2020. Further discussion on the model validation process can be found in **Chapters 3** and **4** of the draft report.
- Use of the validated computer models to define the nature of local catchment flooding for storms ranging between 0.5 EY and 0.2% AEP, as well as the PMF. The design storm input data were derived using the procedures set out in the 2019 edition of *Australian Rainfall and Runoff*. **Section 5.1** of this Summary Report provides a brief description of flood behaviour in the study area in a 1% AEP and PMF local catchment storm events. A more detailed description of local catchment flood behaviour for the range of assessed design storm events can be found in **Chapter 6** of the draft report.

- The computer models were also used to define the nature of Nepean River flooding in the study area for a 1% AEP flood (refer **Section 5.2** of the Summary Report for further discussion).
- Presentation of study results as diagrams showing indicative extents and depths of inundation, flood hazard vulnerability and the hydraulic categorisation of the floodplain into floodway, flood storage and flood fringe areas.
- Sensitivity studies to assess the effects on flood behaviour resulting from variations in model parameters such as rainfall losses, hydraulic roughness of the floodplain, the effects of a partial blockage of hydraulic structures and increases in rainfall intensity associated with future climate change.
- Derivation of Flood Planning Levels and corresponding Flood Planning Area for the study area (refer **Section 5.3** of this Summary Report for further discussion).

4 DATA COLLECTION

4.1 Available Data

The data relied upon for the purpose of the *Cranebrook Overland Flow Flood Study* included:

- LiDAR survey data that were captured in July 2021 and used to define ground levels in the study area.
- The dimensions and alignment of the existing stormwater drainage network were taken from detailed survey that was captured in July 2020 and November 2020, and supplemented by detailed design drawings where required.
- Historic rainfall data recorded at two nearby rain gauges that are operated by the Bureau of Meteorology and one nearby rain gauge that is operated by Sydney Water.
- Historic river level data at the nearby WaterNSW operated *Nepean River at Penrith* (Gauge No. 212201) stream gauge.
- Photographs showing flood behaviour that was observed in parts of the study area during storms that occurred on 9 February 2012, January 2016 (day not specified), 21 March 2017, 7 February 2020 and 9 February 2020 (copies of which are contained in **Appendix C** of the draft report).

4.2 Previous Investigations

The following flooding investigations have been undertaken in the immediate vicinity of the study area:

- *Cranebrook Local Hydraulics Specification Study (*Bewsher Consulting, 2002*)*
- *Boundary Creek Erosion Site Investigation* (Patterson Britton & Partners, 2006)
- *Penrith Overland Flow Flood "Overview Study"* (Cardno Lawson Treloar, 2006)
- *Penrith Lakes 2012 Water Management Plan: Stage 1* (Penrith Lakes Development Corporation, 2012)
- *Penrith CBD Detailed Overland Flow Flood Study* (Cardno, 2015)
- *Nepean River Flood Study* (Advisian, 2018)

- *Peach Tree and Lower Surveyors Creek Flood Study* (Catchment Simulations Solutions, 2019)
- *Penrith Lakes Water Management Plan: Stage 2* (Penrith Lakes Development Corporation, 2020)
- *Penrith CBD Floodplain Risk Management Study and Plan* (Molino Stewart, 2020)
- *Emu Plain Overland Flow Flood Study* (BMT, 2020)

Section B1.1 of **Appendix B** of the draft report contains a summary of the above studies and a description of how they informed the *Cranebrook Overland Flow Flood Study*.

4.3 Community Consultation

To assist with data collection and promotion of the study to the community, an *Information Sheet* and *Community Questionnaire* were distributed by Council in September and December 2020 to residents and business owners in the study area. A copy of the *Information Sheet* and *Community Questionnaire* is contained in **Appendix A** of the draft report, while the responses to the *Community Questionnaire* are summarised in **Appendix B**.

Council advised that approximately 7800 *Information Sheets* and *Community Questionnaires* were distributed to residents and business owners in the study area, with a total of 472 responses received by the closing date of submissions (a response rate of about six per cent).

Of those that responded, about 20% noted that they had observed flooding in or adjacent to their property. The respondents provided information on flooding that occurred in the following months:

- March 1978;
- January 1983;
- November 1985;
- August 1986;
- July 1988;
- August 1990;
- 1995 (month not specified);
- March 2005;
- February 2012;
- January 2016; and
- February 2020.

Information on historic flooding patterns obtained from the responses assisted with “ground-truthing” the results of the hydraulic modelling.

The draft flood study report was placed on public exhibition for a period of 28 days commencing on 6 April 2023. As part of the public exhibition process, Council hosted a public information session with the Consultant presenting the draft study to the community at the Cranebrook Neighbourhood Centre on 20 April 2023. Members of the public were also able to contact Council throughout the exhibition period to ask questions.

At the close of the public exhibition period, 14 formal submissions had been made to Council. Responses to the 14 submissions were prepared by both Council and the Consultant.

5 STUDY RESULTS

5.1 Local Catchment Flood Behaviour

Figure 2 (3 sheets) attached to this Summary Report shows the indicative extent and depth of inundation in the study area resulting from a 1% AEP local catchment storm event, while **Figure 3** (3 sheets) shows similar information for the PMF.

The 1% AEP storm event represents a storm that has a 1 per cent (or 1 in 100) chance of occurrence in any given year. **Figure 2** shows that the capacity of the existing piped stormwater drainage system in the study area is exceeded in a 1% AEP storm event and as a result stormwater runoff generally flows above-ground in a westerly direction along overland flow paths towards the Nepean River and Penrith Lakes. **Figure 2** shows that abovementioned overland flow paths run through existing development at a number of locations throughout the study area.

The PMF represents the largest possible flood event that could conceivably occur and is used to define the upper limit of flooding. **Figure 3** shows that the depth of inundation through existing development increases to greater than 1 m in a PMF at numerous locations in the study area and the extent of land that is inundated in the lower-lying flatter portions of the study area is increased significantly when compared with the 1% AEP local catchment flood behaviour shown on **Figure 2**.

5.2 Nepean River Flood Behaviour

The computer models developed as part of the *Cranebrook Overland Flow Flood Study* were used to define 1% AEP flood behaviour in the study area should a local catchment storm event occur at the same time as a flood in the Nepean River.

Figure 4 shows the indicative extent and depth of inundation in the study area resulting from the combination of local catchment and Nepean River flooding in a 1% AEP storm event. The results of the TUFLOW model that was developed as part of the *Cranebrook Overland Flow Flood Study* show that floodwater originating from the river will back up Boundary Creek where it will flow in a northerly direction across Andrews Road to Lake Cranebrook.

It is noted that the findings of the *Cranebrook Overland Flow Flood Study* differ to those presented in the *Nepean River Flood Study* (Advisian, 2018) due to the incorporation of hydraulic structures such as transverse drainage culverts and water level control weirs, as well as the incorporation of updated topographic data in the more recent hydraulic modelling.

5.3 Flood Planning Information

The combination of Nepean River and local catchment flooding discussed in **Section 5.2** of this Summary Report was used as the basis for defining Flood Planning Levels and the corresponding Flood Planning Area for the study area. After consideration of the study results and the findings of sensitivity studies which are outlined in **Sections 6.5** and **6.6** of the draft report, the Flood Planning Levels were defined as the peak 1% AEP flood level plus a freeboard allowance of 500 mm, with the Flood Planning Area defined as the extent of land which lies below these levels. **Figure 5** (3 sheets) shows the extent of the Flood Planning Area in the study area. Specific flood related controls would apply to development that is proposed within the extent of the Flood Planning Area.

LAKE B
LAKE A
CASTLEREAGH ROAD
CREEK
RICKABY'S
DURALIA LAKE CATCHMENT
VINCENT ROAD
THE NORTHERN ROAD
LLANDILO
BLUE MOUNTAINS CITY COUNCIL
RIVER
DURALIA LAKE
CRANEBROOK LAKE
CRANEBROOK
BOUNDARY ROAD CATCHMENT
BOUNDARY ROAD
NORTH POND
STILLING BASIN
NEPEAN
CASTLEREAGH
MIDDLE BASIN
NEPEAN ST
SOUTH CREEK
CRANEBROOK ROAD SOUTH CATCHMENT
QUARANTINE LAKE
REGATTA LAKE
WATERSIDE LAKES
JORDAN SPRINGS
PENRITH CITY COUNCIL
FINAL BASIN
OLD CASTLEREAGH ROAD
PENRITH LAKES LOCAL CATCHMENT
ANDREWS ROAD
BLACKTOWN CITY COUNCIL
CASTLEREAGH ROAD
CAMBRIDGE GARDENS
ANDREWS ROAD CATCHMENT
LAPSTONE
CREEK
EMU PLAINS
NEPEAN RIVER LOCAL CATCHMENT
BOUNDARY
CREEK
WERRINGTON DOWNS
RICHMOND ROAD
DUNHEVED ROAD
PENRITH
BOUNDARY CREEK CATCHMENT
COREEN AVE
CAMBRIDGE PARK
RAILWAY
MAIN
WESTERN
NEPEAN RIVER AT PENRITH (GS 212201)
RIVER
TREE
CREEK
PARKES ST
SOUTH CREEK
NORTH PENRITH CATCHMENT
PEACH
NEPEAN
WERRINGTON
CREEK
SOUTH CREEK
RAILWAY
MAIN
WESTERN

N

300 0 300 600 900 m

Scale: 1:30,000

LEGEND

- Study Catchments
- Stormwater Drainage System
- Approximate Extent of Penrith Lakes
- Penrith Lakes Outlet Structures
- WaterNSW Stream Gauge

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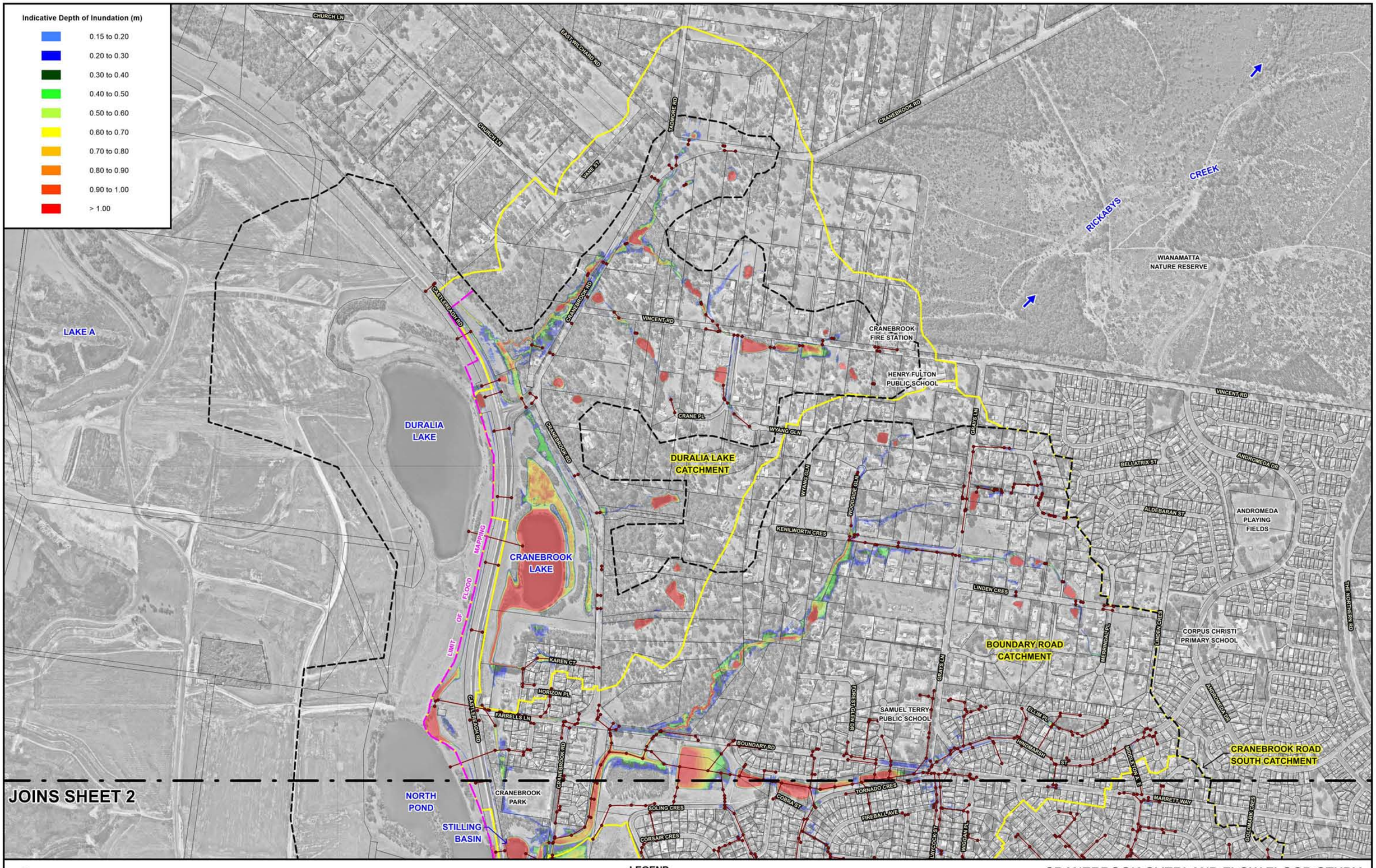
CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 1

CATCHMENT PLAN



N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

Note.
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 2 m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

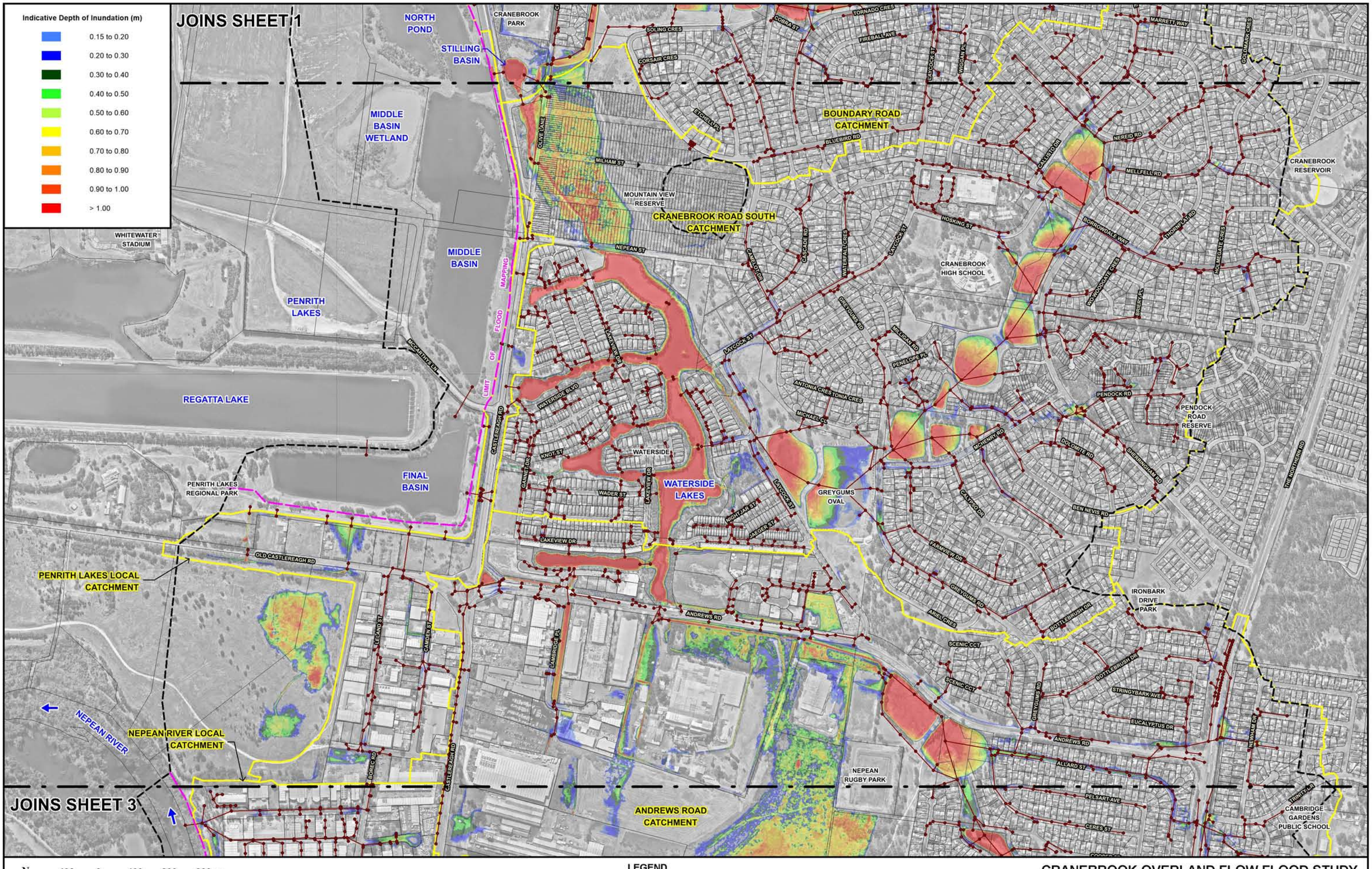
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 2
(Sheet 1 of 3)

TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - 1% AEP



CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 2
(Sheet 2 of 3)

TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - 1% AEP

JOINS SHEET 2

ANDREWS ROAD CATCHMENT

BOUNDARY CREEK CATCHMENT

NEPEAN RIVER LOCAL CATCHMENT

NORTH PENRITH CATCHMENT

PENRITH WATER RECYCLING PLANT

HICKEYS LANE RESERVE

PENRITH WEIR

WEIR RESERVE

RON MULOCK OVAL

PARKER STREET RESERVE

KINGSWOOD PARK PUBLIC SCHOOL

CAMBRIDGE GARDENS PUBLIC SCHOOL

ST DOMINICS COLLEGE

PENRITH SELECTIVE HIGHSCHOOL

ANELDRIVA PARK

PATERSON OVAL

ALLSOPP OVAL

KINGSWOOD CEMETERY

NEPEAN RIVER AT PENRITH (GS 212201)

MAIN WESTERN RAILWAY

GREAT WESTERN HWY

Indicative Depth of Inundation (m)

	0.15 to 0.20
	0.20 to 0.30
	0.30 to 0.40
	0.40 to 0.50
	0.50 to 0.60
	0.60 to 0.70
	0.70 to 0.80
	0.80 to 0.90
	0.90 to 1.00
	> 1.00

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

Note.
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LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- WaterNSW Stream Gauge

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 2
(Sheet 3 of 3)

TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - 1% AEP

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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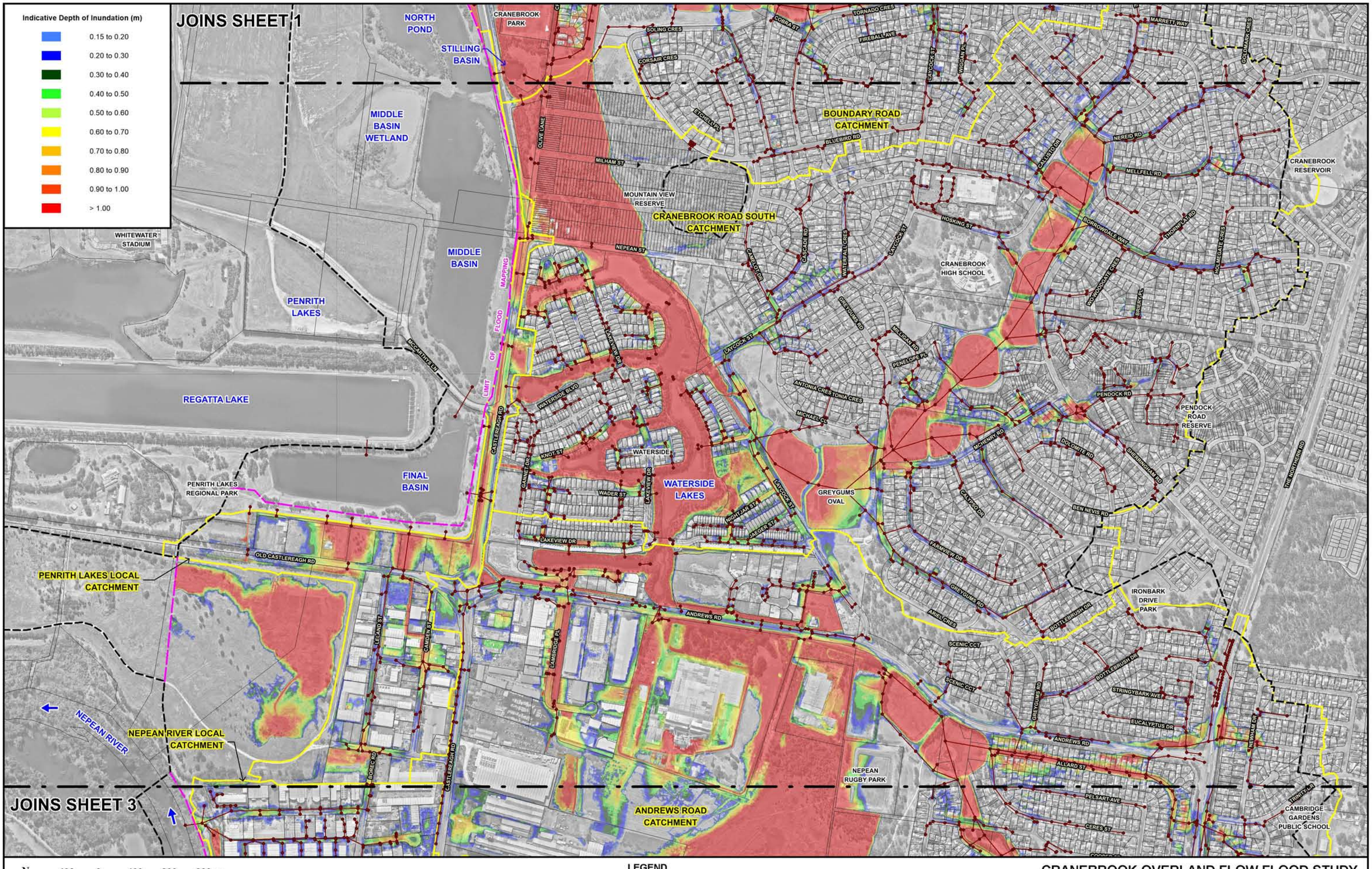
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday

CRANEBROOK OVERLAND FLOW FLOOD STUDY
SUMMARY REPORT

Figure 3
(Sheet 1 of 3)

TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - PMF


Indicative Depth of Inundation (m)
0.15 to 0.20
0.20 to 0.30
0.30 to 0.40
0.40 to 0.50
0.50 to 0.60
0.60 to 0.70
0.70 to 0.80
0.80 to 0.90
0.90 to 1.00
> 1.00
JOINS SHEET 1
JOINS SHEET 3
NORTH POND
STILLING BASIN
MIDDLE BASIN WETLAND
MIDDLE BASIN
FINAL BASIN
WHITEWATER STADIUM
PENRITH LAKES
REGATTA LAKE
PENRITH LAKES REGIONAL PARK
PENRITH LAKES LOCAL CATCHMENT
NEPEAN RIVER LOCAL CATCHMENT
NEPEAN RIVER
FLOOD MAPPING LIMIT OF
CRANEBROOK PARK
BOUNDARY ROAD CATCHMENT
CRANEBROOK ROAD SOUTH CATCHMENT
MOUNTAIN VIEW RESERVE
CRANEBROOK HIGH SCHOOL
CRANEBROOK RESERVOIR
PENDOCK ROAD RESERVE
WATERSIDE LAKES
WATERSIDE
GREYGUMS OVAL
IRONBARK DRIVE PARK
NEPEAN RUGBY PARK
ANDREWS ROAD CATCHMENT
CAMBRIDGE GARDENS PUBLIC SCHOOL
SOLING CRES
CORSAIR CRES
COBRA ST
TORNADO CRES
FIREBALL AVE
MARRETT WAY
EICHELA PL
BLUEBIRD RD
OLIVE LANE
MILHAM ST
NEPEAN ST
HOSKINS ST
NEREID RD
MELLFELL RD
BORROWDALE WAY
THORNFLAT RD
MOLMEGATE CRES
WOMBADGATE CRES
SHEERY PL
LAYCOCK ST
CASCADE RD
WATERFALL CRES
CRESTOMERE RD
MILMOAN RD
PENELOPE PL
ANTONIA CRESTONIA CRES
MICHAEL CL
PENDOCK RD
MCHENRY RD
DOLOMITE RD
SHERRINGHAM RD
THE NORTHERN RD
CALYPSO DR
BEN NEVIS RD
FARMVIEW DR
GREYGUMS RD
ARIEL CRES
BOTTLEBRUSH DR
SCENIC CCT
STRINGYBARK AVE
EUCALYPTUS DR
NEWMAN DR
ALLARD ST
PELSART AVE
CERES ST
TRINITY DR
CASTLEREAGH RD
WATERSIDE BLVD
LAKEVIEW DR
KNOT ST
GANNET DR
WADER ST
NIGHTJAR ST
JAEGER ST
OLD CASTLEREAGH RD
LELAND ST
GARDEN ST
LAMBRIDGE PL
ANDREWS RD
BOREC RD
MACARTHURS LN
N
100 0 100 200 300 m
Scale: 1:10,000
Lyall & Associates
Note.
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LEGEND
Study Catchments
Modelled Stormwater Network
Two-Dimensional Model Bounday
CRANEBROOK OVERLAND FLOW FLOOD STUDY
SUMMARY REPORT
Figure 3
(Sheet 2 of 3)
TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - PMF

JOINS SHEET 2

ANDREWS ROAD CATCHMENT

NEPEAN RIVER LOCAL CATCHMENT

BOUNDARY CREEK CATCHMENT

PENRITH WATER RECYCLING PLANT

HICKEYS LANE RESERVE

KINGSWOOD PARK PUBLIC SCHOOL

CAMBRIDGE GARDENS PUBLIC SCHOOL

PENRITH WEIR

WEIR RESERVE

NEPEAN RIVER AT PENRITH (GS 212201)

RON MULOCK OVAL

PARKER STREET RESERVE

ANELDRIVA PARK

PATERSON OVAL

ALLSOPP OVAL

ST DOMINICS COLLEGE

PENRITH SELECTIVE HIGHSCHOOL

KINGSWOOD CEMETERY

NORTH PENRITH CATCHMENT

MAIN WESTERN RAILWAY

GREAT WESTERN HWY

Indicative Depth of Inundation (m)

	0.15 to 0.20
	0.20 to 0.30
	0.30 to 0.40
	0.40 to 0.50
	0.50 to 0.60
	0.60 to 0.70
	0.70 to 0.80
	0.80 to 0.90
	0.90 to 1.00
	> 1.00

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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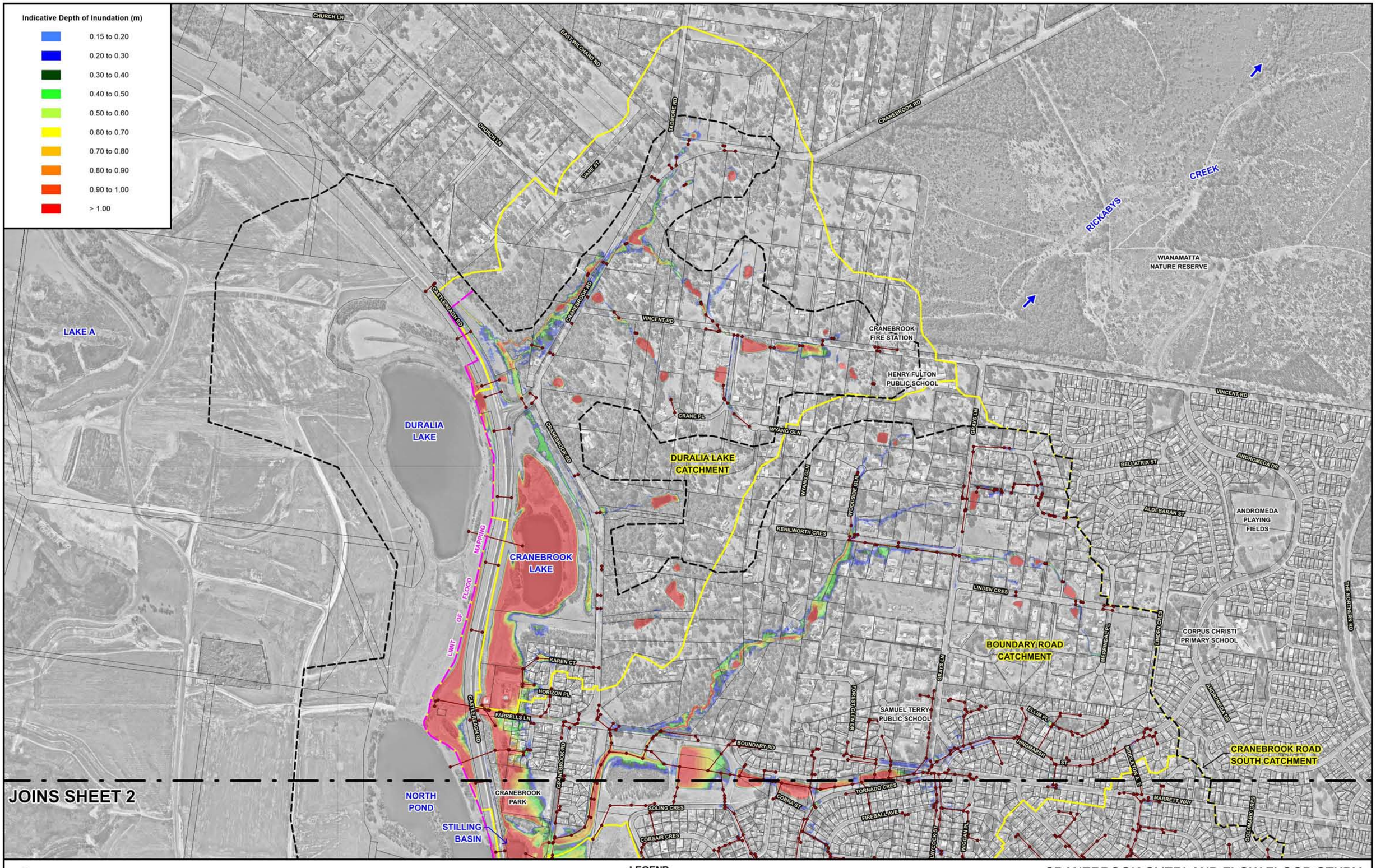
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- WaterNSW Stream Gauge

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 3
(Sheet 3 of 3)

TUFLOW MODEL RESULTS
LOCAL CATCHMENT FLOODING ONLY - PMF



N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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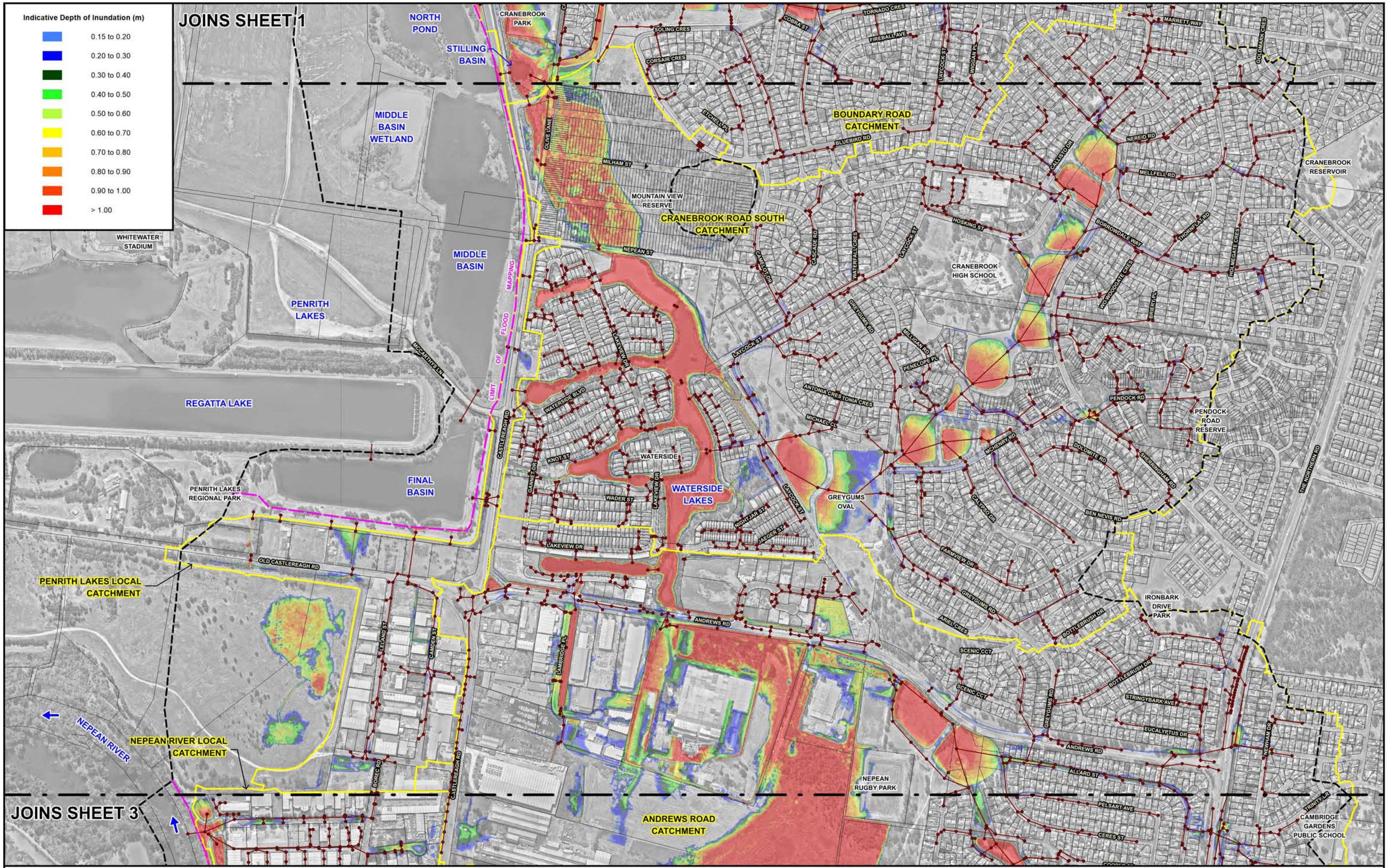
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 4
(Sheet 1 of 3)

TUFLOW MODEL RESULTS
ENVELOPE OF LOCAL CATCHMENT AND NEPEAN RIVER FLOODING - 1% AEP



N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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LEGEND
- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Boundary

CRANEBROOK OVERLAND FLOW FLOOD STUDY
SUMMARY REPORT

Figure 4
(Sheet 2 of 3)

TUFLOW MODEL RESULTS
ENVELOPE OF LOCAL CATCHMENT AND NEPEAN RIVER FLOODING - 1% AEP

JOINS SHEET 2

ANDREWS ROAD CATCHMENT

NEPEAN RIVER LOCAL CATCHMENT

BOUNDARY CREEK CATCHMENT

PENRITH WATER RECYCLING PLANT

HICKEYS LANE RESERVE

PENRITH WEIR

WEIR RESERVE

RON MULOCK OVAL

PARKER STREET RESERVE

KINGSWOOD PARK PUBLIC SCHOOL

CAMBRIDGE GARDENS PUBLIC SCHOOL

PATERSON OVAL

ALLSOPP OVAL

ANELDRIVA PARK

PENRITH SELECTIVE HIGHSCHOOL

ST DOMINICS COLLEGE

KINGSWOOD CEMETERY

NORTH PENRITH CATCHMENT

NEPEAN RIVER AT PENRITH (GS 212201)

MAIN WESTERN RAILWAY

GREAT WESTERN HWY

LIMIT OF FLOOD MAPPING

Indicative Depth of Inundation (m)

	0.15 to 0.20
	0.20 to 0.30
	0.30 to 0.40
	0.40 to 0.50
	0.50 to 0.60
	0.60 to 0.70
	0.70 to 0.80
	0.80 to 0.90
	0.90 to 1.00
	> 1.00

N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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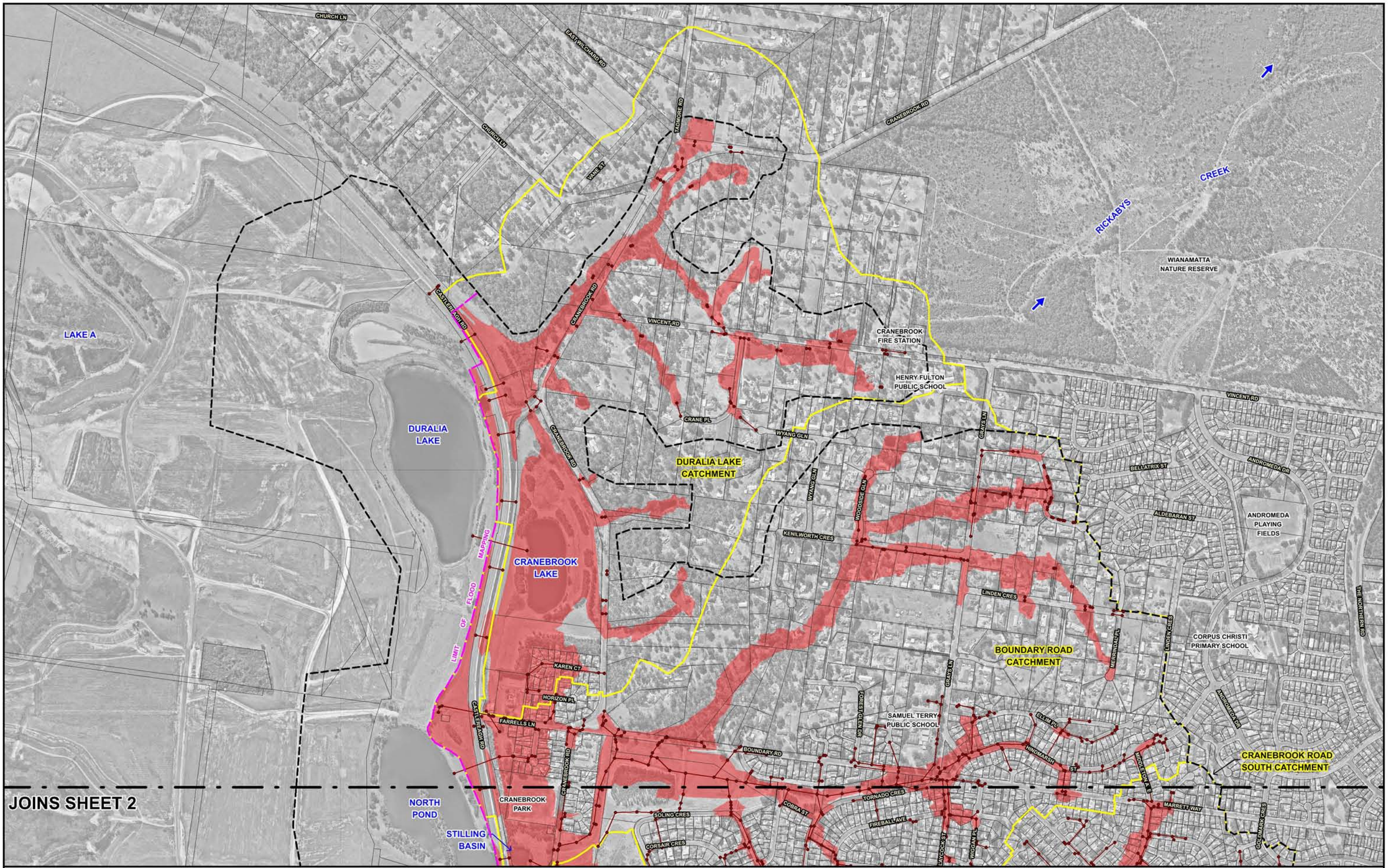
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- WaterNSW Stream Gauge

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 4
(Sheet 3 of 3)

TUFLOW MODEL RESULTS
ENVELOPE OF LOCAL CATCHMENT AND NEPEAN RIVER FLOODING - 1% AEP



N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

Note.

The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 2 m grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

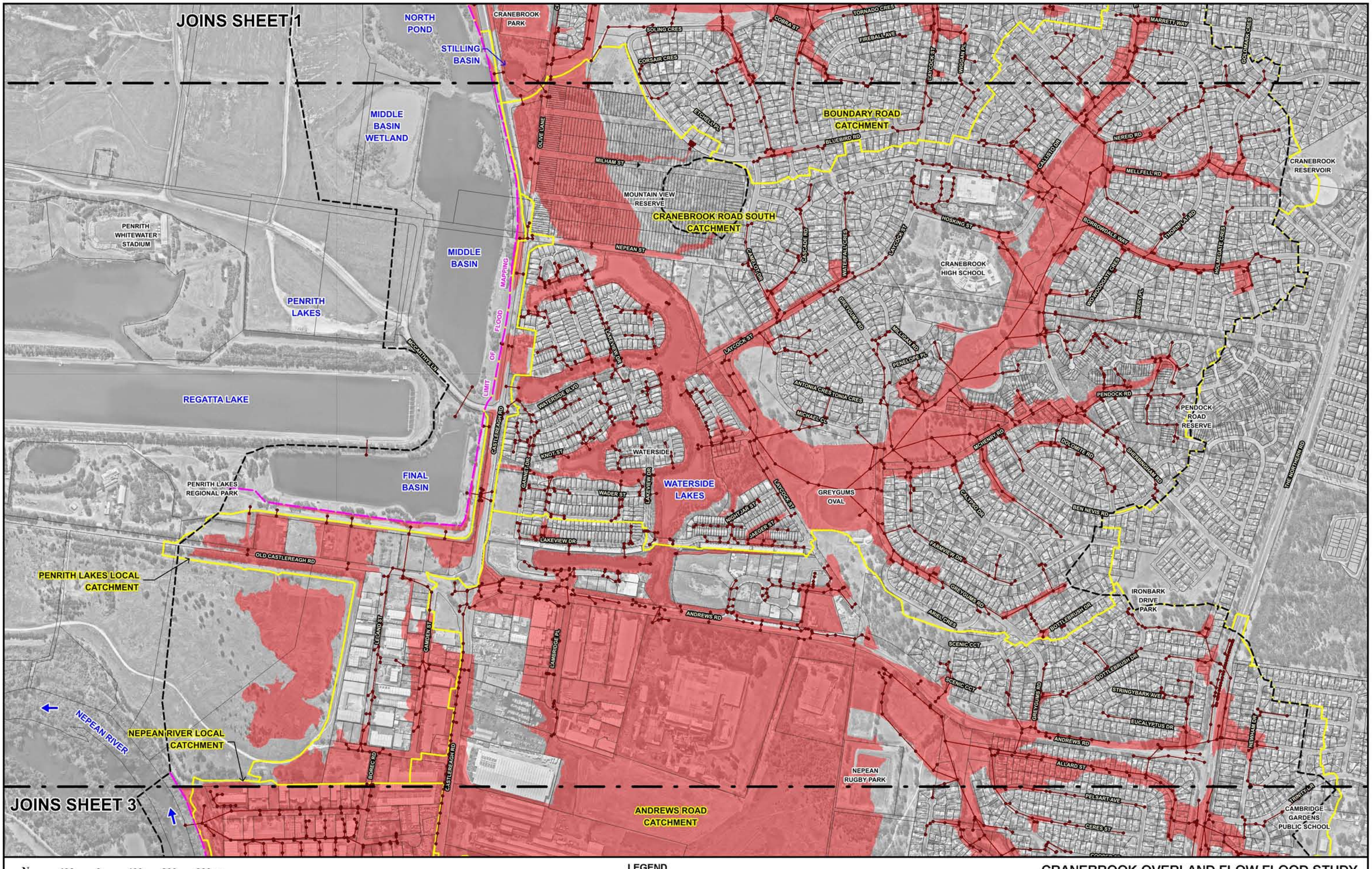
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- Flood Planning Area

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 5
(Sheet 1 of 3)

FLOOD PLANNING AREA



N

100 0 100 200 300 m

Scale: 1:10,000

Lyall & Associates

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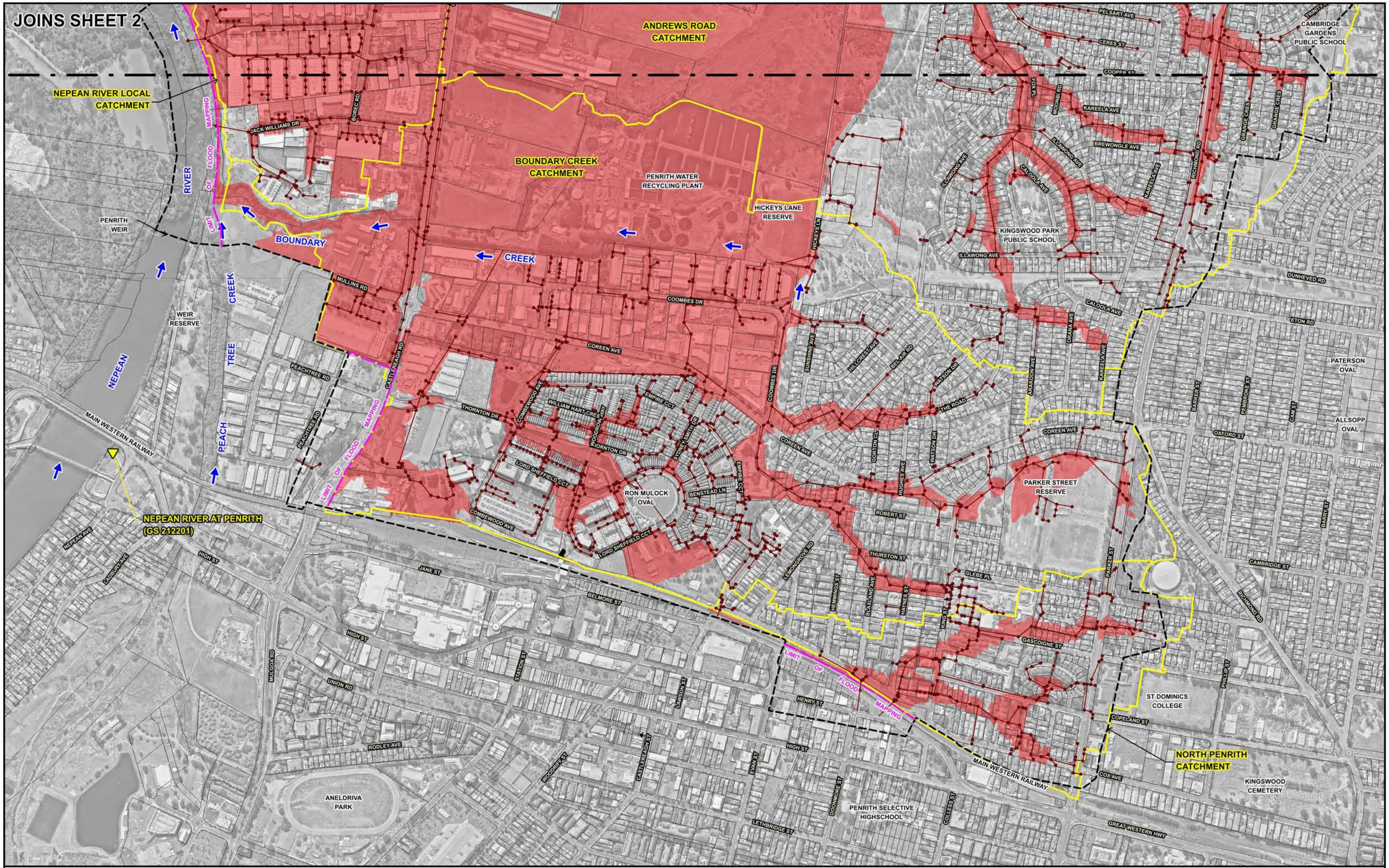
LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- Flood Planning Area

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 5
(Sheet 2 of 3)

FLOOD PLANNING AREA


JOINS SHEET 2
ANDREWS ROAD CATCHMENT
NEPEAN RIVER LOCAL CATCHMENT
BOUNDARY CREEK CATCHMENT
PENRITH WATER RECYCLING PLANT
HICKEYS LANE RESERVE
PENRITH WEIR
BOUNDARY
CREEK
WEIR RESERVE
NEPEAN
RIVER
PEACH TREE CREEK
LIMIT OF FLOOD MAPPING
KINGSWOOD PARK PUBLIC SCHOOL
CAMBRIDGE GARDENS PUBLIC SCHOOL
PATERSON OVAL
ALLSOPP OVAL
PARKER STREET RESERVE
RON MULOCK OVAL
NEPEAN RIVER AT PENRITH (GS 212201)
MAIN WESTERN RAILWAY
ST DOMINICS COLLEGE
NORTH PENRITH CATCHMENT
KINGSWOOD CEMETERY
PENRITH SELECTIVE HIGHSCHOOL
ANELDRIVA PARK
GREAT WESTERN HWY
JACK WILLIAMS DR
MULLINS RD
COOMBES DR
COREEN AVE
THORNTON DR
PEACHTREE RD
CASTLEREAGH RD
LORD SHEFFIELD CCT
COMBEWOOD AVE
JANE ST
BELMORE ST
HIGH ST
UNION RD
MULGOA RD
STATION ST
LAWSON ST
HENRY ST
COPELAND ST
COX AVE
THE ROAD
ROBERT ST
THURSTON ST
GLEBE PL
GASCOIGNE ST
PARKER ST
CAMBRIDGE ST
RICHMOND RD
OXFORD ST
ETON RD
DUNHEVED RD
ILLAWONG AVE
CALOOLA AVE
KARELA AVE
BREWONGLE AVE
PELSART AVE
CERES ST
COOPER ST
ORANA AVE
ARAKOON AVE
RODLEY AVE
LETHBRIDGE ST
WOODRIFF ST
CASTLEREAGH ST
DOONMORE ST
COLLESS ST
EVAN ST
NEPEAN AVE
LADBURY AVE
BARKER ST
PEMBROKE ST

N

100 0 100 200 300 m

Scale: 1:10,000

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Lyall & Associates

LEGEND

- Study Catchments
- Modelled Stormwater Network
- Two-Dimensional Model Bounday
- WaterNSW Stream Gauge
- Flood Planning Area

CRANEBROOK OVERLAND FLOW FLOOD STUDY SUMMARY REPORT

Figure 5
(Sheet 3 of 3)

FLOOD PLANNING AREA