

Appendix A. Historic Rainfall Data

Figure A-1 Cumulative Rainfall – 6 – 7 February 2010 Storm

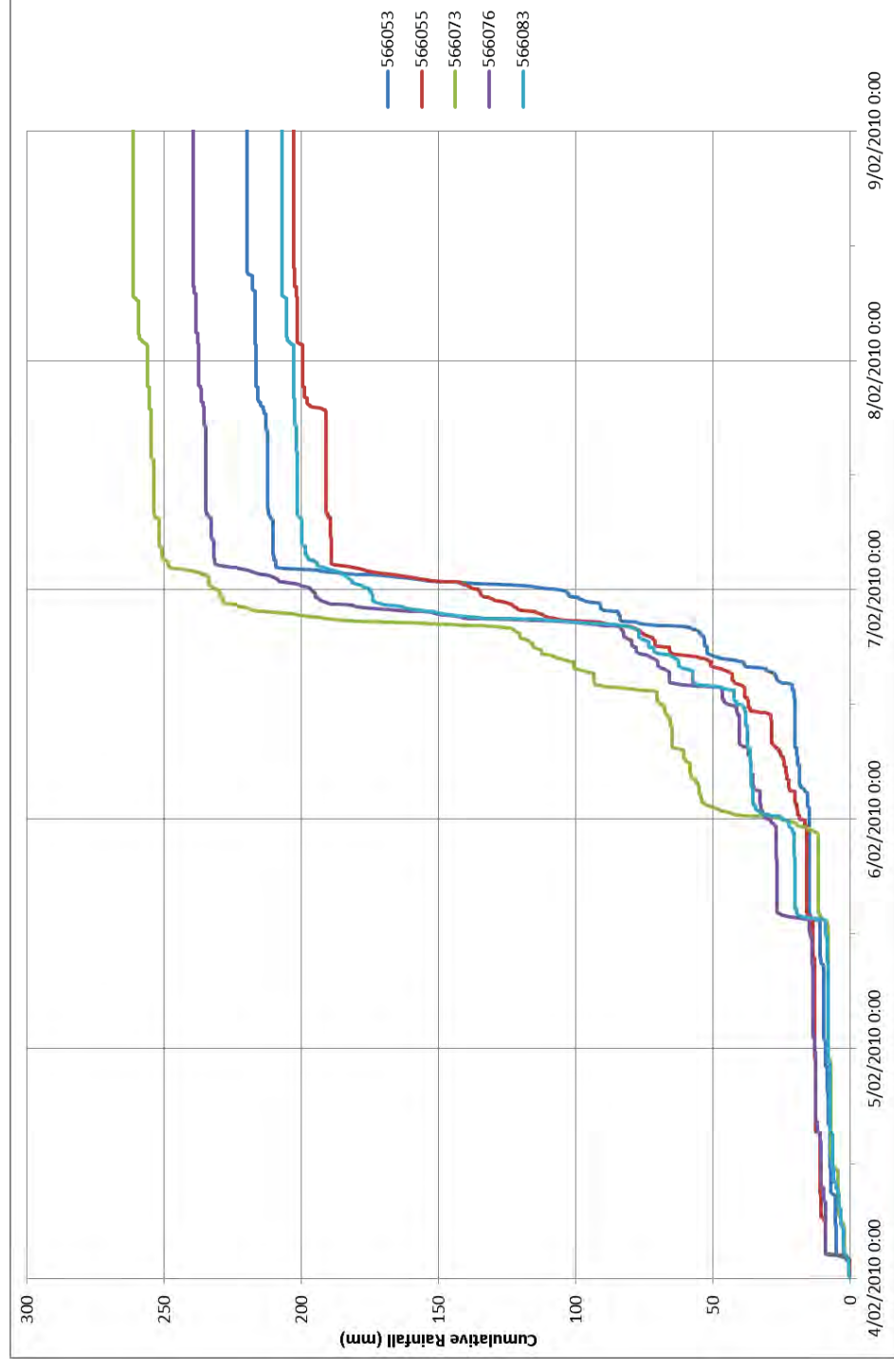


Figure A-2 Cumulative Rainfall - 10 June 1991 Storm

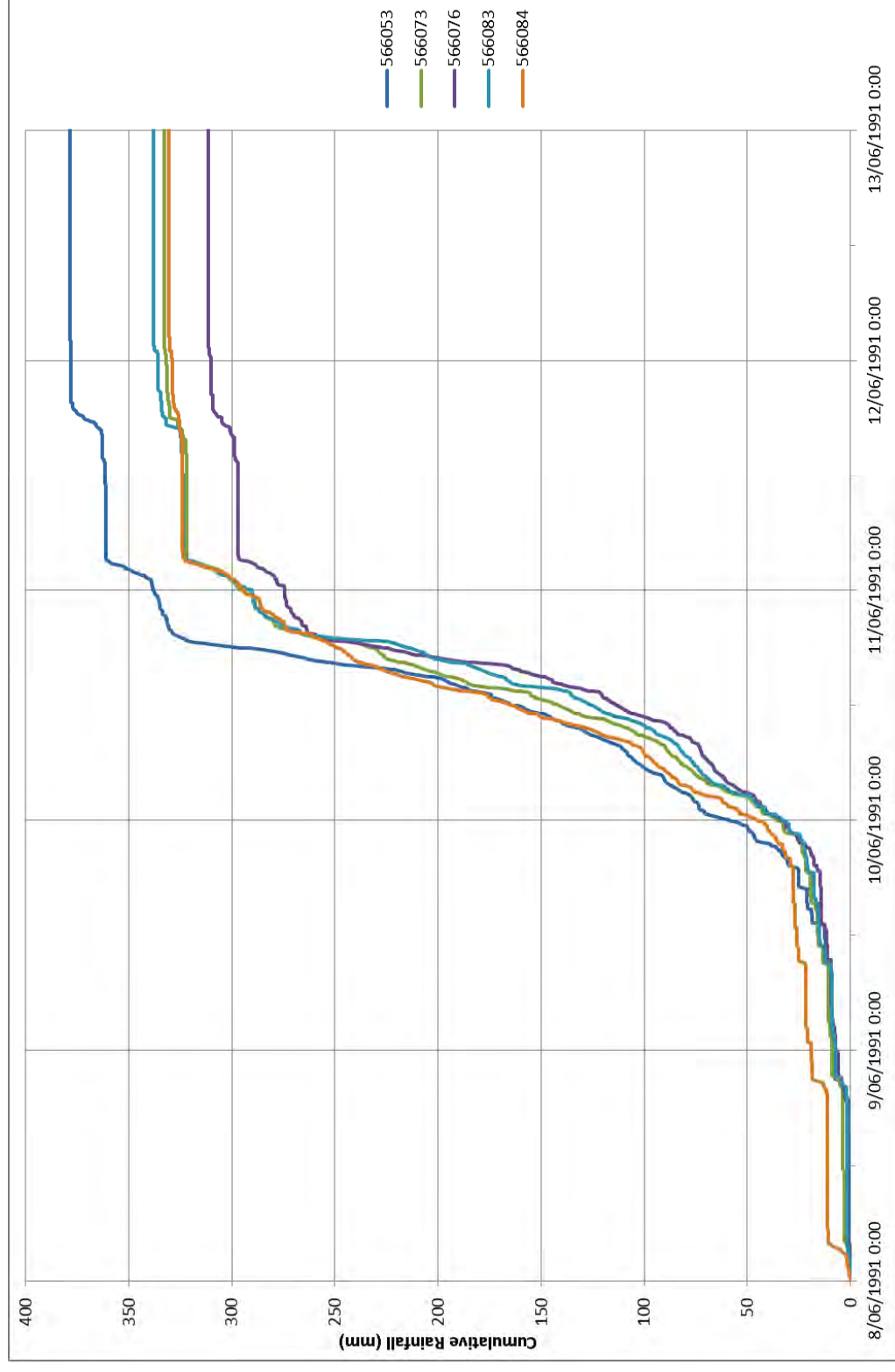
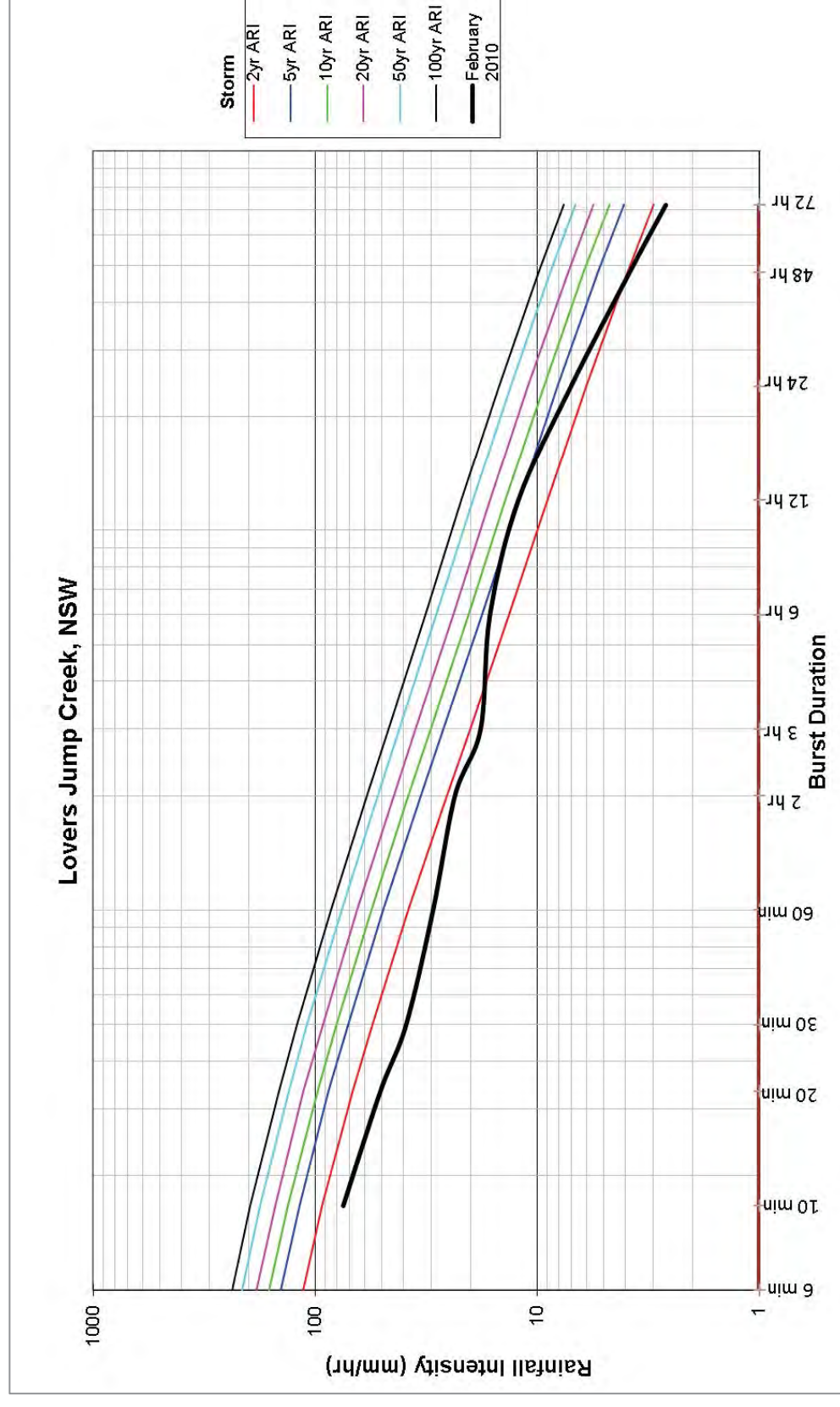


Figure A-3 Comparison of recorded rainfall versus Design IFD (ARR 1987) – 6 February 2010 Storm



Appendix B. Community Consultation

Lovers Jump Creek Flood Study - Community Bulletin

January 2015



JACOBS

This Community Bulletin has been issued to inform Ku-ring-gai residents of the Flood Study being prepared for the Lovers Jump Creek catchment. It is the first in a series of Bulletins planned to inform residents. Ku-ring-gai Council has engaged consultants Jacobs to undertake the Flood Study.

The purpose of the study is to develop an understanding of existing flooding behaviour in the Lovers Jump Creek catchment. This will enable potential flooding trouble spots to be identified for future management to reduce the impact of flooding on the community, and assist in managing future development in the area.

Community engagement, comprising both community consultation and community involvement, is an integral part of the study. The aim of this Bulletin is to inform the community of the study and invite residents to provide information on their views and experiences with flooding in the area. Council has also provided a Questionnaire on flooding. This may assist you sharing any information on local flooding with Council.

The management of flood prone land is primarily the responsibility of Council and follows a number of stages as set out below:

Floodplain Risk Management Process



*For more information contact Ku-ring-gai Council on (02) 9424 0000
or visit www.kmc.nsw.gov.au*

The Study Area

The Lovers Jump Creek Catchment includes parts of Turramurra, North Turramurra, Wahroonga, North Wahroonga and Warrawee, and is bounded by the Pacific Highway to the south, Grosvenor Street and Cleveland Street to the west and Ku-ring-gai Avenue and Bobbin Head Road to the east. The Creek and several tributaries drain to the north to join Cowan Creek at Bobbin Head. The flood study will investigate flooding in the main creeks, minor watercourses and in overland flow paths.

The Flood Problem

Past development alongside watercourses and flow paths place a risk to people and properties in the case of a flood event. The location and terrain of the study area means that flash flooding may occur during intense rainstorms. The speed at which the flooding occurs means that there is usually no time for damage reduction measures to be put in place, or for evacuation to be undertaken as required. The Lovers Jump Creek Catchment is one of Ku-ring-gai's most significantly flood affected areas.

Lovers Jump Creek Catchment



Have you experienced flooding?

How you can help!



Some of the most important information for the study is collected from residents and local business operators. We would be very interested to receive records of flooding in your area including photographs, observations of flooding in the catchment or some comments on your experience. You can help us with this information by completing the **Questionnaire** issued with this Bulletin in the mail. It is also available for completion online at:

www.kmc.nsw.gov.au/floodrisk.

*For more information contact Ku-ring-gai Council on (02) 9424 0000
or visit www.kmc.nsw.gov.au*

Objectives of the Study

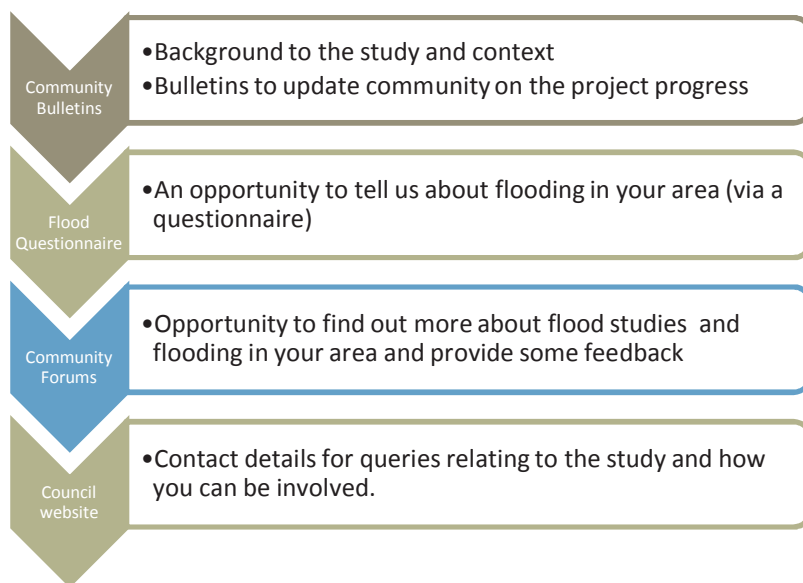
- 1) Understand the current flooding patterns in the study area
- 2) Construct a computer flood model which can be used to simulate the size and extent of potential future floods.
- 3) Identify potential problem areas for further investigation.

Floodplain Advisory Committee

A Floodplain Advisory Committee is being formed which includes representatives from State Agencies, Emergency Services, the community, local business and Council. The Committee will meet regularly to oversee and guide the flood study and overall floodplain risk management process. Interested community members will have a chance to join the Committee in 2015. A separate invitation will be mailed seeking expressions of interest to join the committee. A notice will also be placed in local newspapers.

How can you get involved?

Engagement of the community in the floodplain risk management process is very important to Council. We will be providing a number of opportunities for the community to have input to the floodplain risk management plan. These are outlined below.



Council's floodplain risk management website is currently being updated and will be ready in early 2015. Details on floodplain risk management can be found at: www.kmc.nsw.gov.au/floodrisk.

Timeframes

The study is due for completion at the end of 2015.

Lovers Jump Creek Flood Study Questionnaire



JACOBS

We need your help!

Ku-ring-gai Council has engaged consultants Jacobs to conduct a Flood Study of the Lovers Jump Creek Catchment and would like to receive feedback from the community on a number of issues and topics related to flooding in your area. The purpose of the study is to build a computer flooding model to develop an understanding of existing flooding behaviour in the catchment. This will enable potential flooding trouble spots to be identified for future management to help reduce the impact of flooding on the community, and assist in managing future development in the area.

Community engagement, comprising both community consultation and community involvement, is an integral part of the study. The aim of this questionnaire is to inform the community of the study and invite residents to provide information on their views and experiences with flooding in the area. The information that you provide will improve the flood model being developed.

If you cannot answer any question, or do not wish to answer a question, then leave it unanswered and proceed to the next question. **Your input to this important study will be greatly appreciated. Any information that you provide will be treated as confidential. Specific information on the respondents or their responses will not be made available or reported on.** If you need additional space, please add sheets.

Your contact details would be appreciated in case we need to follow up on some details or seek additional comment, and will be treated with confidentiality. Can you please also mark the location of your residence/business with a clear dot on the attached plan. Please note that providing these details is **optional**.

Name:

Email:

Telephone:

Address:

If you would prefer to provide a letter with your comments or respond to this questionnaire by speaking to Council by telephone, this would also be welcomed. To discuss any aspects of this questionnaire, please call

Greg White, Ku-ring-gai Council

Phone 9424 0000

Fax 02 9424 0213 or

Email floodriskmanagement@kmc.nsw.gov.au

More information on floodplain risk management in Ku-ring-gai available at www.kmc.nsw.gov.au/floodrisk.

Please complete the Questionnaire within three weeks of receiving it and post in the reply paid envelope provided to:

Ku-ring-gai Council
Locked Bag 1056, Pymble NSW 2073

OR scan and email to floodriskmanagement@kmc.nsw.gov.au

Place a tick in the relevant box or write answers.

Question		Question and Answer
1.	<input type="checkbox"/> <input type="checkbox"/>	<p>Do you own or rent your residence in the study area?</p> <p>Own</p> <p>Rent</p> <p>How long have you lived in the study area?years.</p>
2.	<input type="checkbox"/> <input type="checkbox"/>	<p>Do you own or manage a business in the study area?</p> <p>Yes</p> <p>How long has it operated in the study area?years.</p> <p>No (go to Question 4)</p>
3.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>What kind of business?</p> <p>Home based business</p> <p>Shop/commercial premises</p> <p>Others, please write type of business</p>
4.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>Are you aware of flooding in the study area?</p> <p>(Please tick one)</p> <p>Aware</p> <p>Some knowledge</p> <p>Not aware</p> <p>Information such as photographs of flooding and comments on your experiences would be invaluable to the study. Comments can be written in the space at the end of this questionnaire. If you wish to send in photos, we will make copies and return them to you.</p>
5.		<p>Do you know of any flood liable locations in the study area? Please describe or mark on the map provided.</p>

Question	Question and Answer		
6.	<p>Have you ever experienced any flooding in your area?</p> <p>Flooding may have occurred during the following dates as a result of significant rainfall. Did floodwaters affect your house, property or street?</p> <p>What level or depth did the flooding reach, and where? For example you could say - up to second step at front of house or 0.1m deep in garage or 1m above creek bank at rear of property.</p>		
	Date	Location (please tick more than one if needed)	Flood level or depth and location
	Feb 2010 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Jun 1991 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Feb 1990 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Jul 1988 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Apr 1988 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Nov 1984 <input type="checkbox"/>	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Other date	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Other date	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	
	Other date	<input type="checkbox"/> House <input type="checkbox"/> Property/yard <input type="checkbox"/> Street	

Question		Question and Answer
7.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>Do you have any information on flooding on your property? (You can tick more than one box). Please write any descriptions at the end of the questionnaire</p> <p>(a) No information (b) Own experience (c) Information from Council (d) Photographs (e) Other</p>
8.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>Was vehicle access to/from your property via local roads disrupted due to floodwaters during the worst flooding?</p> <p>Not affected Minor disruption (roads flooded but still driveable) Access cut off</p>
9.		<p>Do you wish to comment on any other issues associated with the development of the Flood Study? Please add comments at the back of the questionnaire.</p>
10.	<input type="checkbox"/> <input type="checkbox"/>	<p>Do you wish to remain on the mailing list to receive further details, such as Newsletters or Community Bulletins on the Flood Study?</p> <p>Yes (please provide contact details in the space provided on page 1 of this document.) No</p>





Community bulletin – December 2015

You are receiving this newsletter because you have previously expressed interest in receiving updates on the Lovers Jump Creek Flood Study. This is the second bulletin about the Study.

If you no longer wish to receive these updates, please email floodriskmanagement@kmc.nsw.gov.au or call 9424 0912.

The Lovers Jump Creek Flood Study

In 2014 Ku-ring-gai Council engaged consulting firm Jacobs to undertake the Lovers Jump Creek Flood Study. The purpose of the Study is to develop an understanding of current flood behaviour in the catchment and identify potential flooding trouble spots. The Study will help Council strategically address these potential issues and flooding impacts. This will also help us better plan development in the area.

The Study is guided by Council's Floodplain Advisory Committee which is made up of Councillors, community members, government agencies and Council officers.

The management of flood-prone lands is primarily the responsibility of councils and the management process includes a number of standard stages:



Results of the community workshop - 21 October 2015

Thank you to all the local residents who attended the community workshop held at Council Chambers in October. Your knowledge and experience of local flooding are an important source of information and very much appreciated.

Presentations were given by Sophia Findlay, Council's Water and Catchments Program Leader and Jacobs project manager, Lih Chong. Initial modelling and mapping results were also presented.

Karl Sullivan from the Insurance Council of Australia discussed how flood study results are used by insurers to refine their pricing and provide fairer insurance outcomes for residents.

The workshop gave residents an opportunity to have their questions answered and us a valuable chance to talk to you about the Study.



Preliminary Study results

During October and November we spent several days in the field inspecting key locations and validating results from preliminary flood modelling. We also followed up on feedback from the workshop.

Our focus was on checking whether the model accurately represented the terrain and features on site as this can influence flood behaviour. The site inspection indicated that only minor adjustments to the model were needed in a few locations and that the model's configuration and performance were reliable.

What's next for the Study

Your feedback from the previous flood study questionnaire and the community workshop has been incorporated into the Study. It has helped to improve the flood modelling.

The study is progressing with modelling of potential flood events including the 1% annual exceedance probability (AEP) flood, formerly referred to as the '100-year flood'. Mapping is being produced which will characterise flood behaviour, such as flood depth, flood levels and flood hazard. The mapping and other outcomes from the Study will guide Council's planning processes and the State Emergency Service's (SES) emergency response preparation.



More opportunities for community feedback

The project team will keep you informed with further email bulletins. The next bulletin will include dates and locations of the public exhibition of the Draft Flood Study Report for Lovers Jump Creek.

The public exhibition is your chance to review the outcomes of the study and provide feedback. In the meantime,

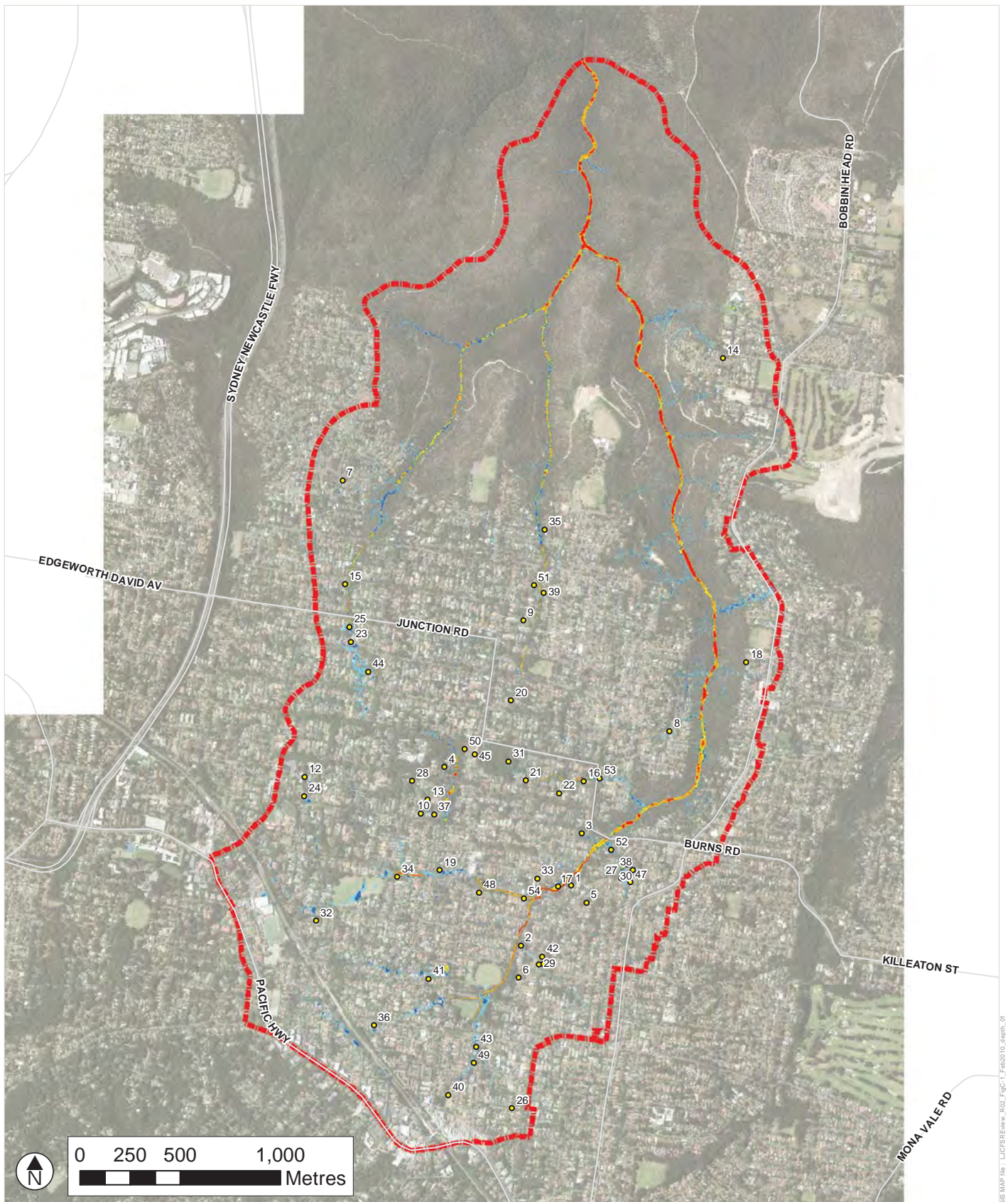
please check Council's floodplain risk management web page at www.kmc.nsw.gov.au/floodrisk for further updates.

If you have any questions in the meantime, please don't hesitate to email us at floodriskmanagement@kmc.nsw.gov.au

Kind regards,

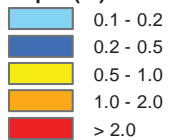
The Flood Study team at Ku-ring-gai Council

Appendix C. Questionnaire Responses and Verification of Model Flood Behaviour



Legend

Depth (m)



Yellow dot: Questionnaire Respondents

Thick grey line: Main Road
Red dashed line: Study Area

NOTES: Flood Depths < 0.1m filtered out.
Refer to Appendix C for questionnaire response ID and calibration notes.

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A3

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GDA 1994 MGA Zone 56

TITLE Questionnaire Response Locations and February 2010 Event Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	FIGURE C-1	1	1
CHECK	DATE			
AH	21/02/2018			

Table C-1 Analysis of Questionnaire Responses

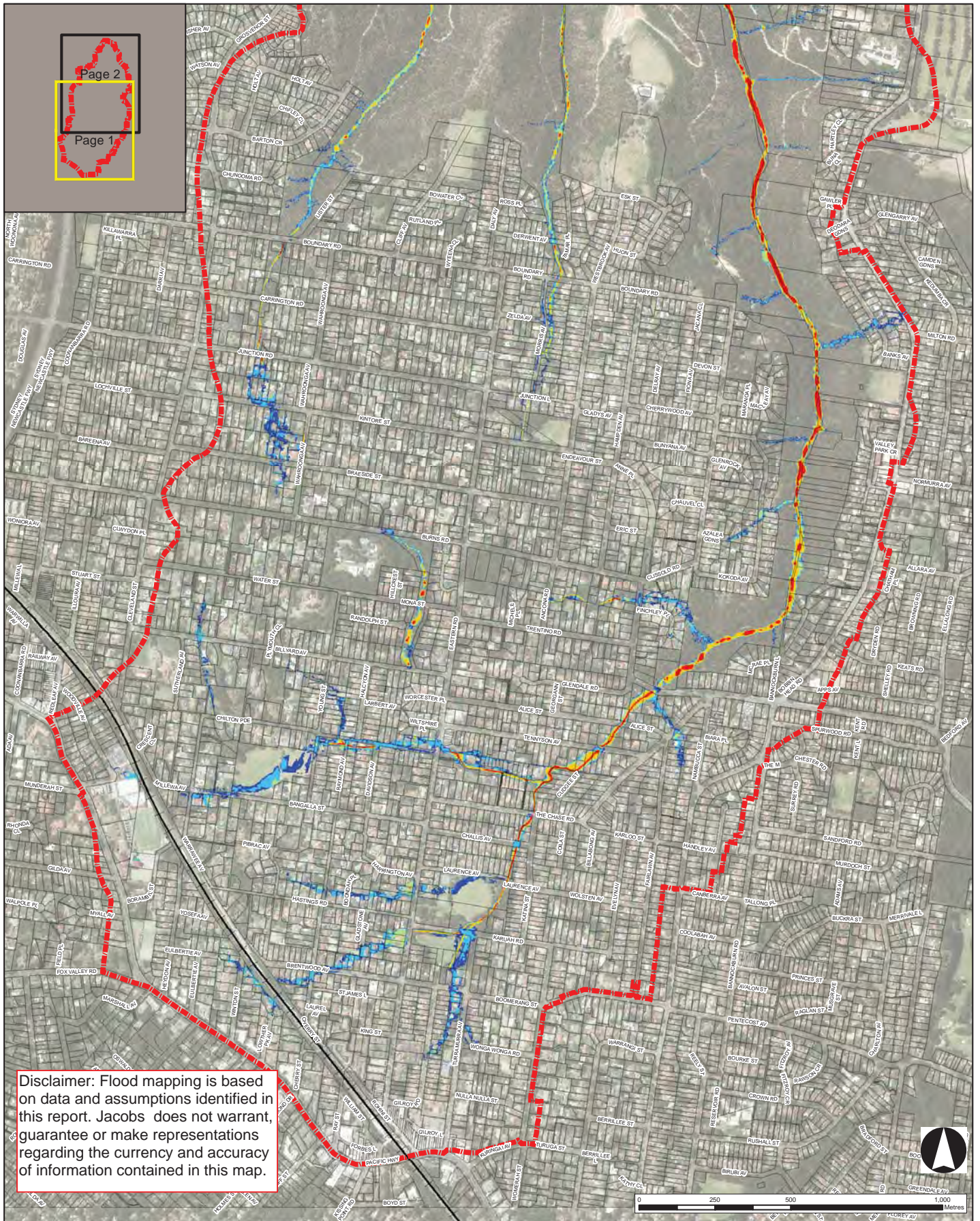
Key:

1970	Year of event specified only
Apr-87	Year and month of event
Nov-84	Event listed in questionnaire

Flood Event	Respondents Experiencing Flooding	Daily Rainfall depth (mm)*	Comment
1970	1		
1975	1		
Nov-84	2	233.6	
Apr-87	1	46.4	
Oct-87	1	114	
Feb-88	1	100	
Apr-88	7	194.2	
Jun-88	1		probably the Jul-88
Jul-88	6	178.6	
Feb-90	7	231.8	214.4mm next day
Jan-91	1	78	
Feb-91	1	27	
Jun-91	6	253.4	102mm the previous day
Apr-93	1	23	
Apr-98	1	128.6	
2006	1	77.8	
Feb-10	8	197.6	
Mar-11	1	175	
Jun-13	1	61.4	
Oct-14	1	71.6	
Nov-14	1	5	
Dec-14	2	77	
Jan-15	3	100	

* BOM rainfall station at Kissing Point Road, Turramurra, Station 066158

Appendix D. Flood Depth Mapping



Disclaimer: Flood mapping is based on data and assumptions identified in this report. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

Legend

	Study area
	Cadastral
	Railway
	Peak Flood Depth (m)
	0.1 - 0.2
	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	> 2.0

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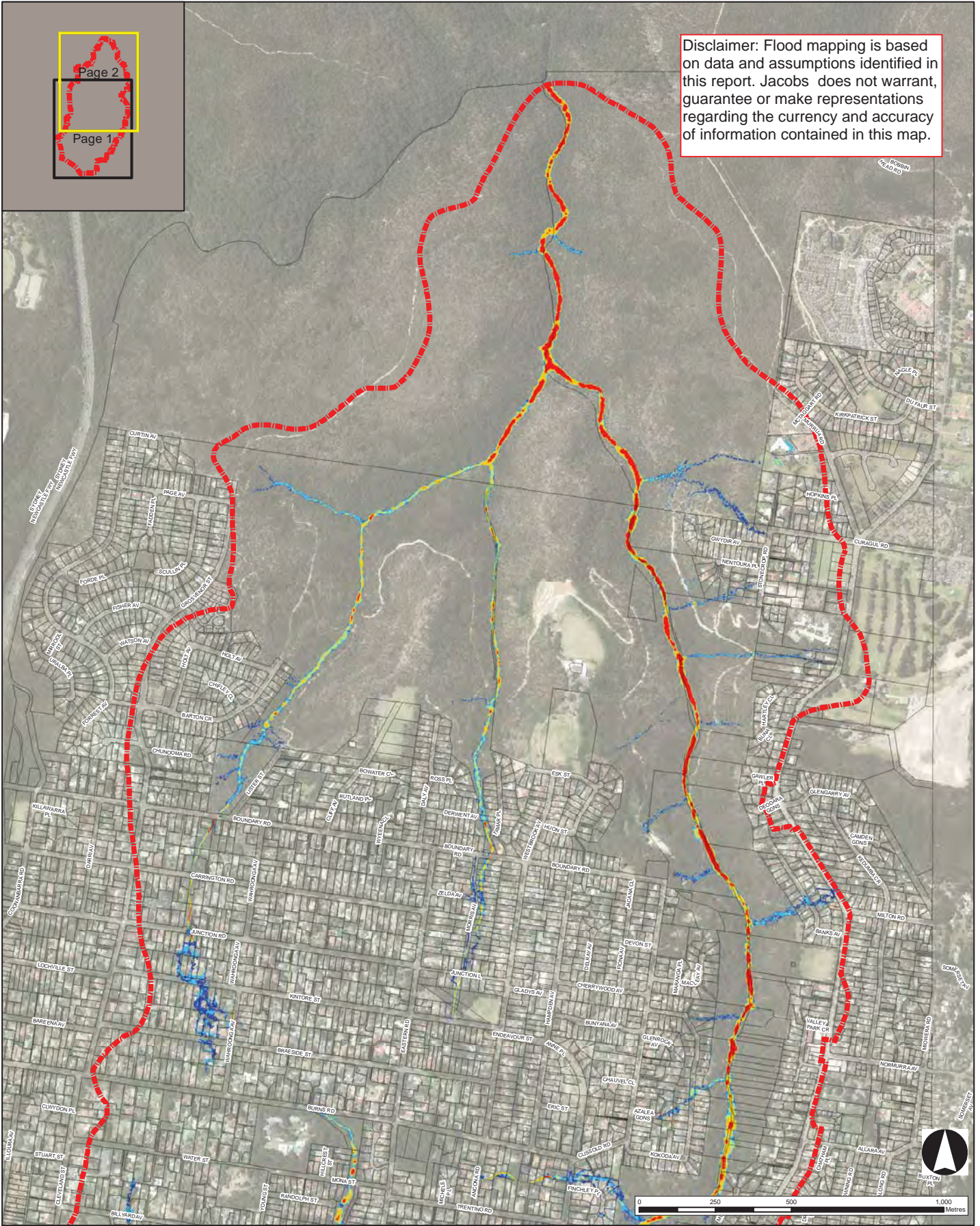
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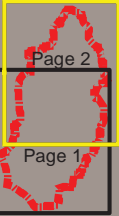
TITLE 20% AEP Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN LC	PROJECT # IA159900	MAP # Map D-1	REV VER 1 1
CHECK AH	DATE 21/02/2018		1:12,000 A3



Disclaimer: Flood mapping is based on data and assumptions identified in this report. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.



Legend

- Study area
- Cadastre
- Railway
- Peak Flood Depth (m)
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0



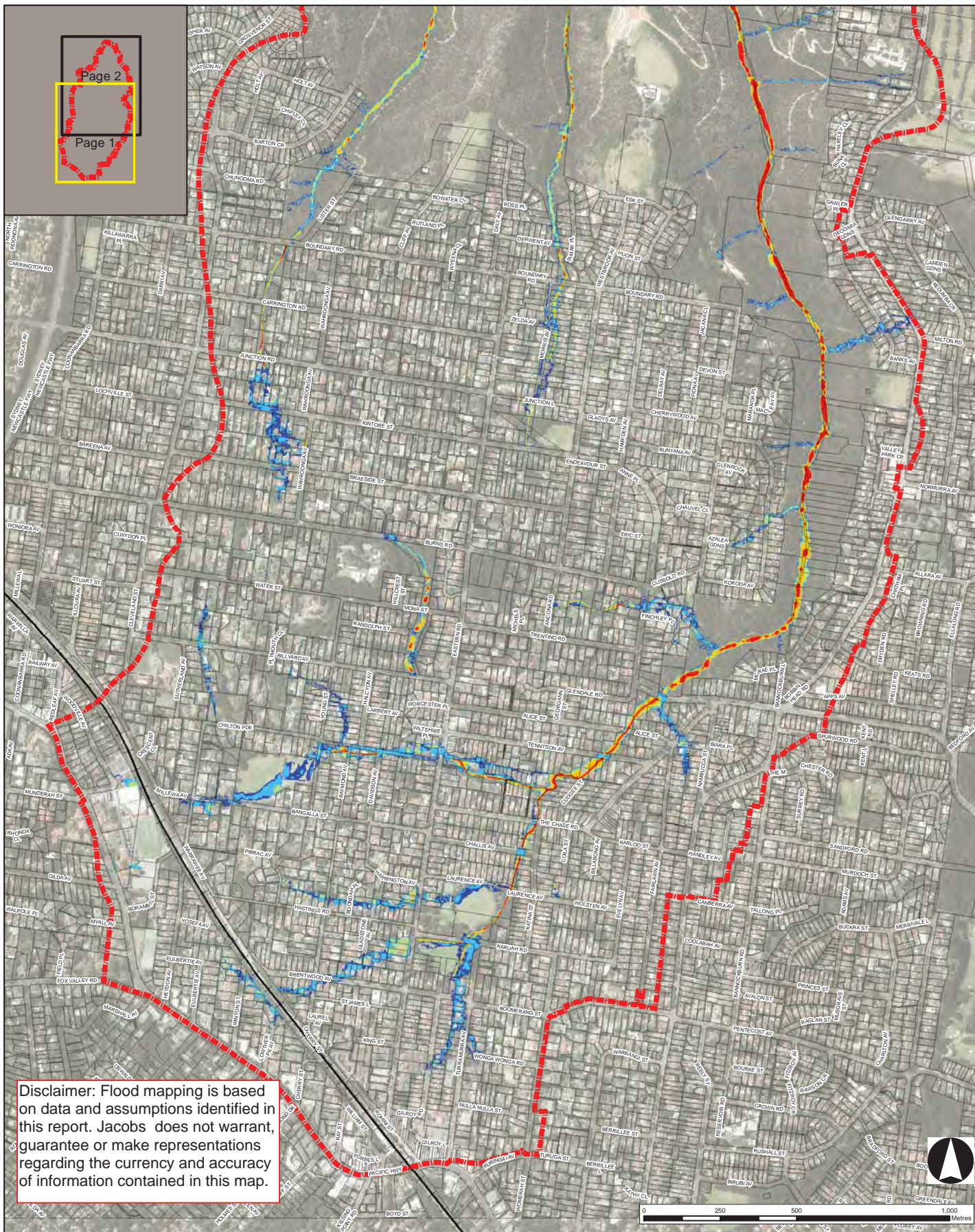
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TITLE 20% AEP Event Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
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CHECK	DATE			
AH	21/02/2018			1:12,000 A3



Disclaimer: Flood mapping is based on data and assumptions identified in this report. Jacobs does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

Legend

- Study area
- Cadastre
- Railway
- Peak Flood Depth (m)**
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- > 2.0

JACOBS

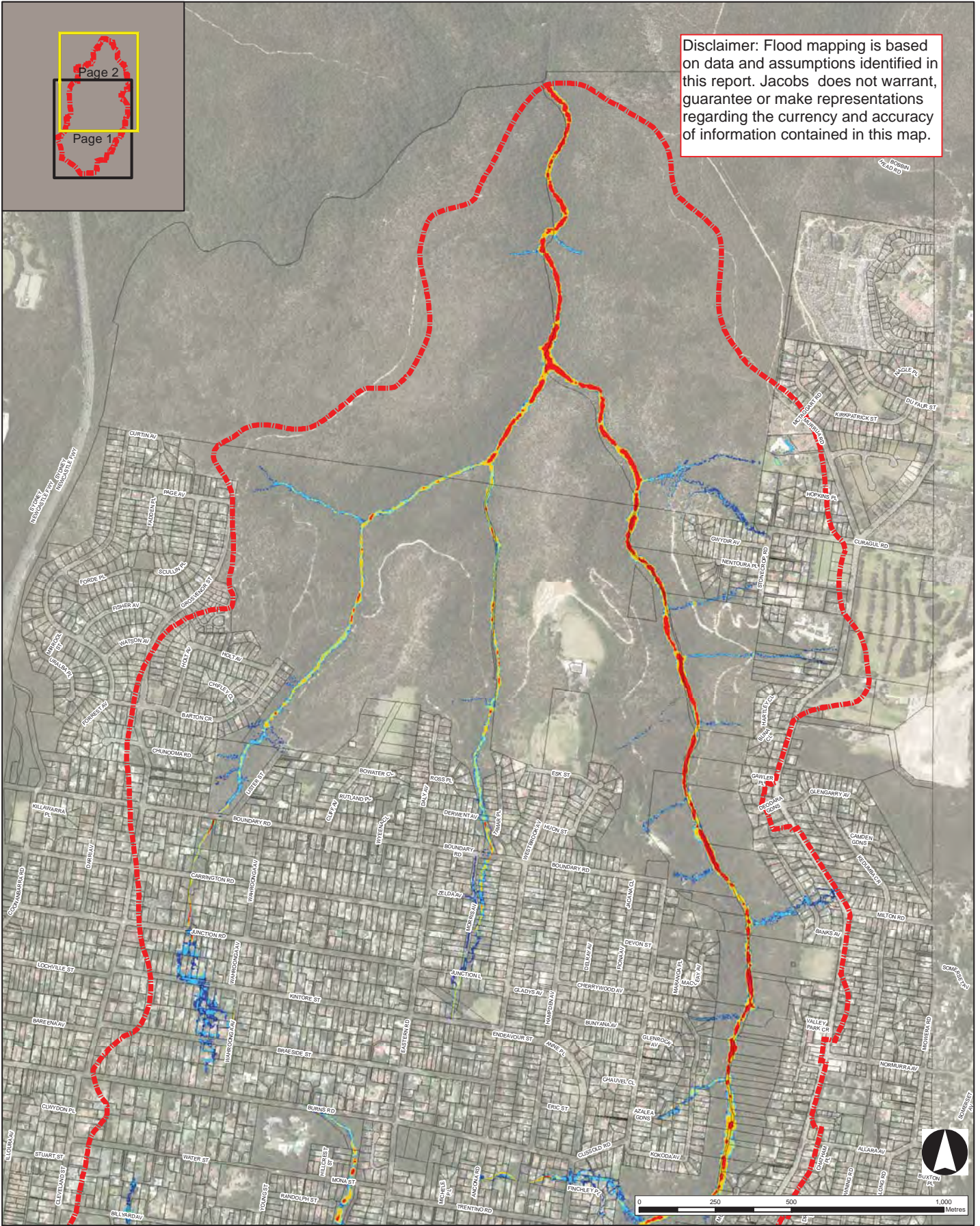
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TITLE 10% AEP Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
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CHECK	DATE			
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Legend

- Study area
- Cadastre
- Railway
- Peak Flood Depth (m)
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0

JACOBS

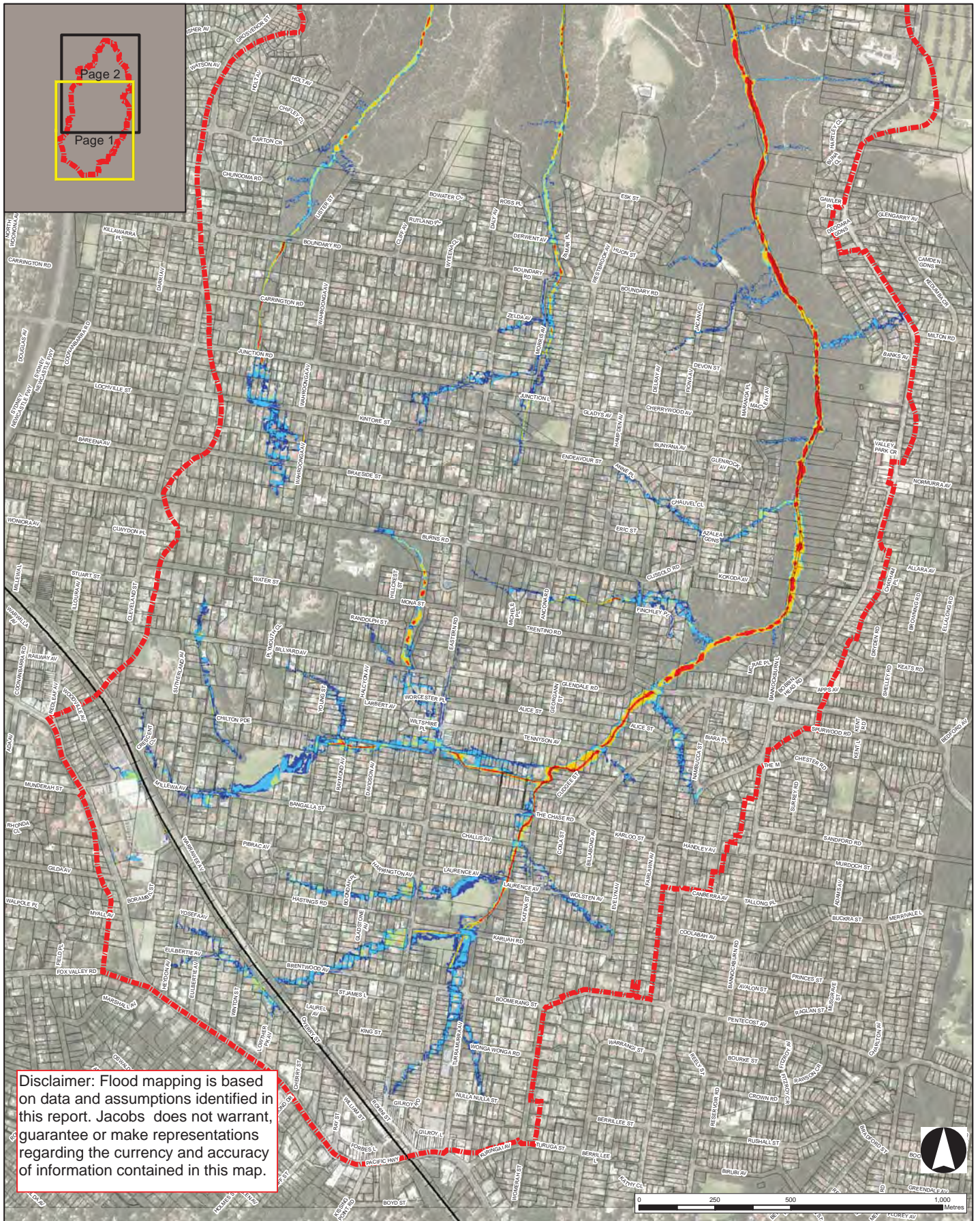
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TITLE 10% AEP Event Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-2	1	1
CHECK	DATE			
AH	21/02/2018			1:12,000 A3



Legend

- Study area
 - Cadastre
 - Railway
- Peak Flood Depth (m)**
- 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0

JACOBS

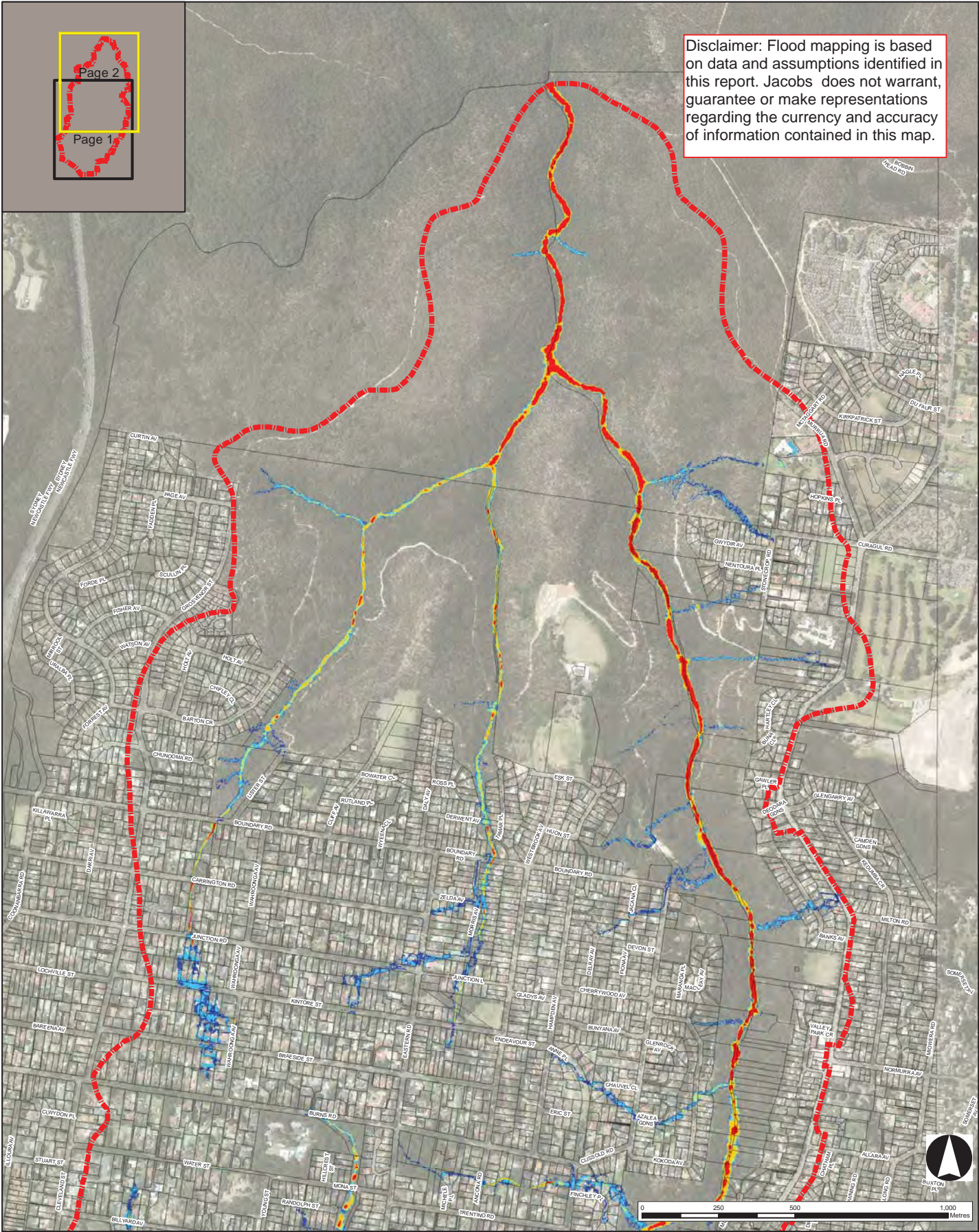
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TITLE 5% AEP Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-3	1	1
CHECK	DATE			
AH	21/02/2018			1:12,000 A3



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Legend

- Study area
- Cadastral
- Railway
- Peak Flood Depth (m)
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0



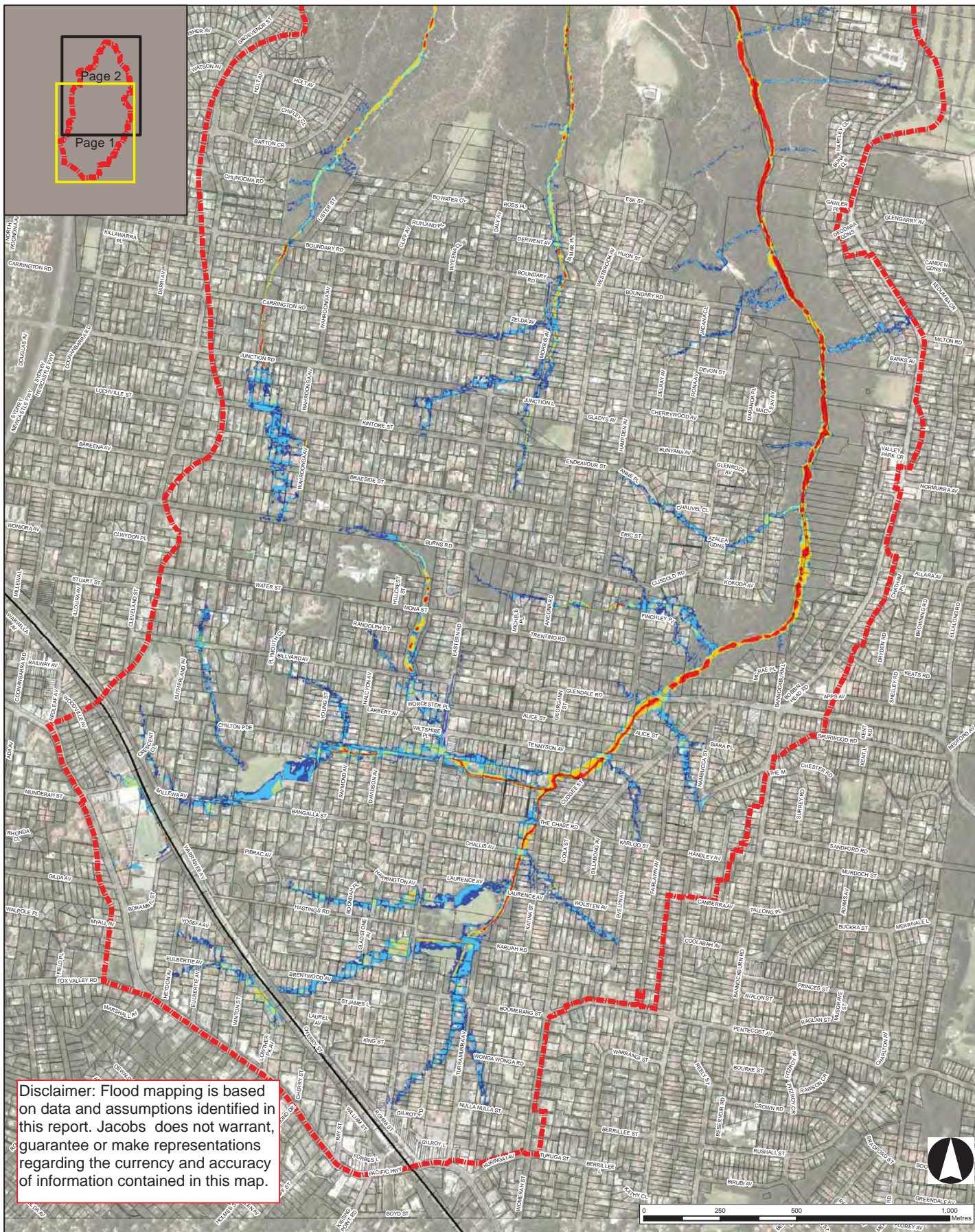
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TITLE 5% AEP Event Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-3	1	1
CHECK	DATE			
AH	21/02/2018			1:12,000 A3



Legend

	Study area
	Cadastral
	Railway
	Peak Flood Depth (m)
	0.1 - 0.2
	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	> 2.0

JACOBS

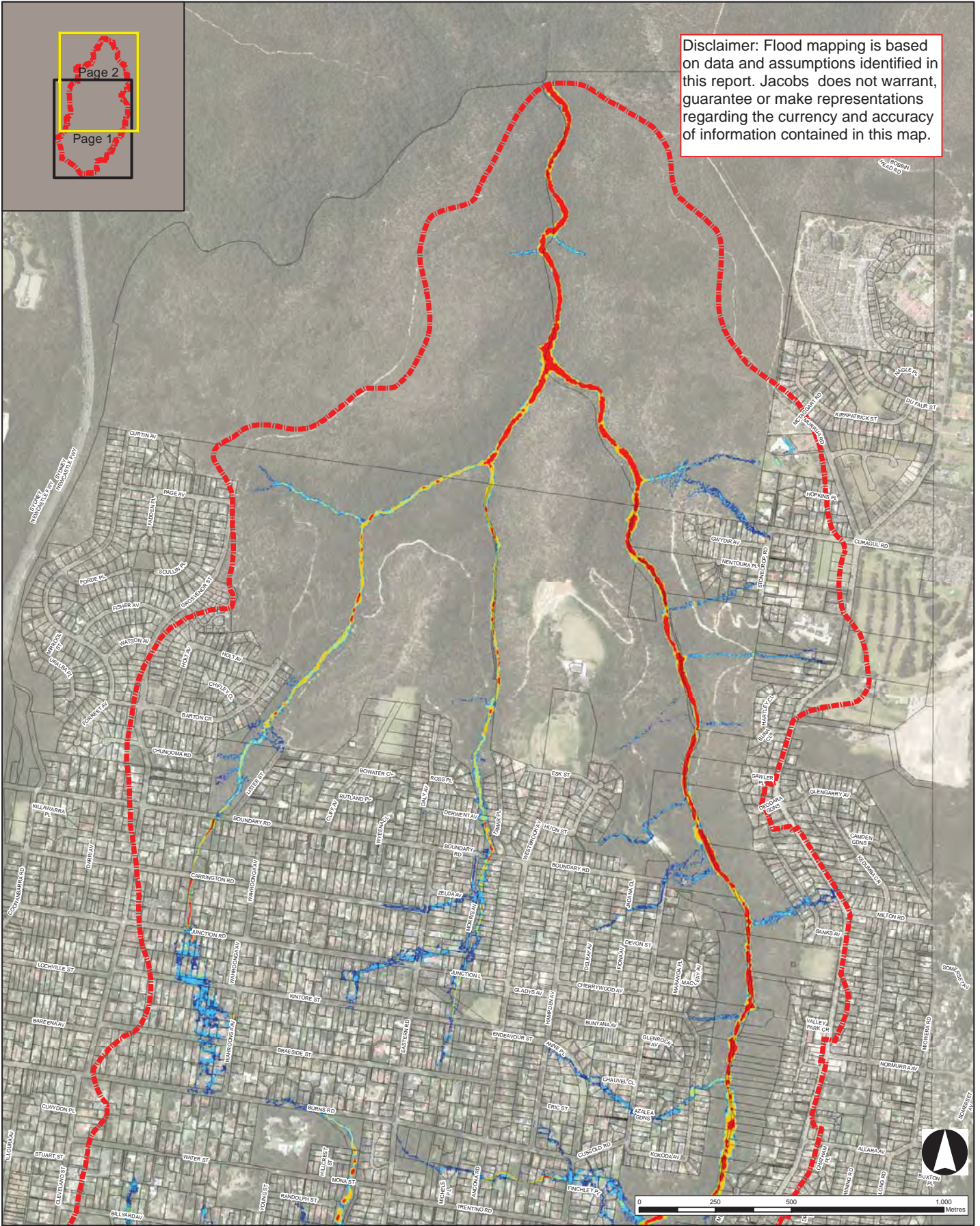
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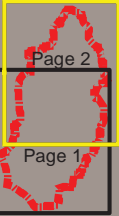
TITLE 2% AEP Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

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CHECK AH	DATE 21/02/2018		1:12,000 A3



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Legend

- Study area
- Cadastral
- Railway
- Peak Flood Depth (m)
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0



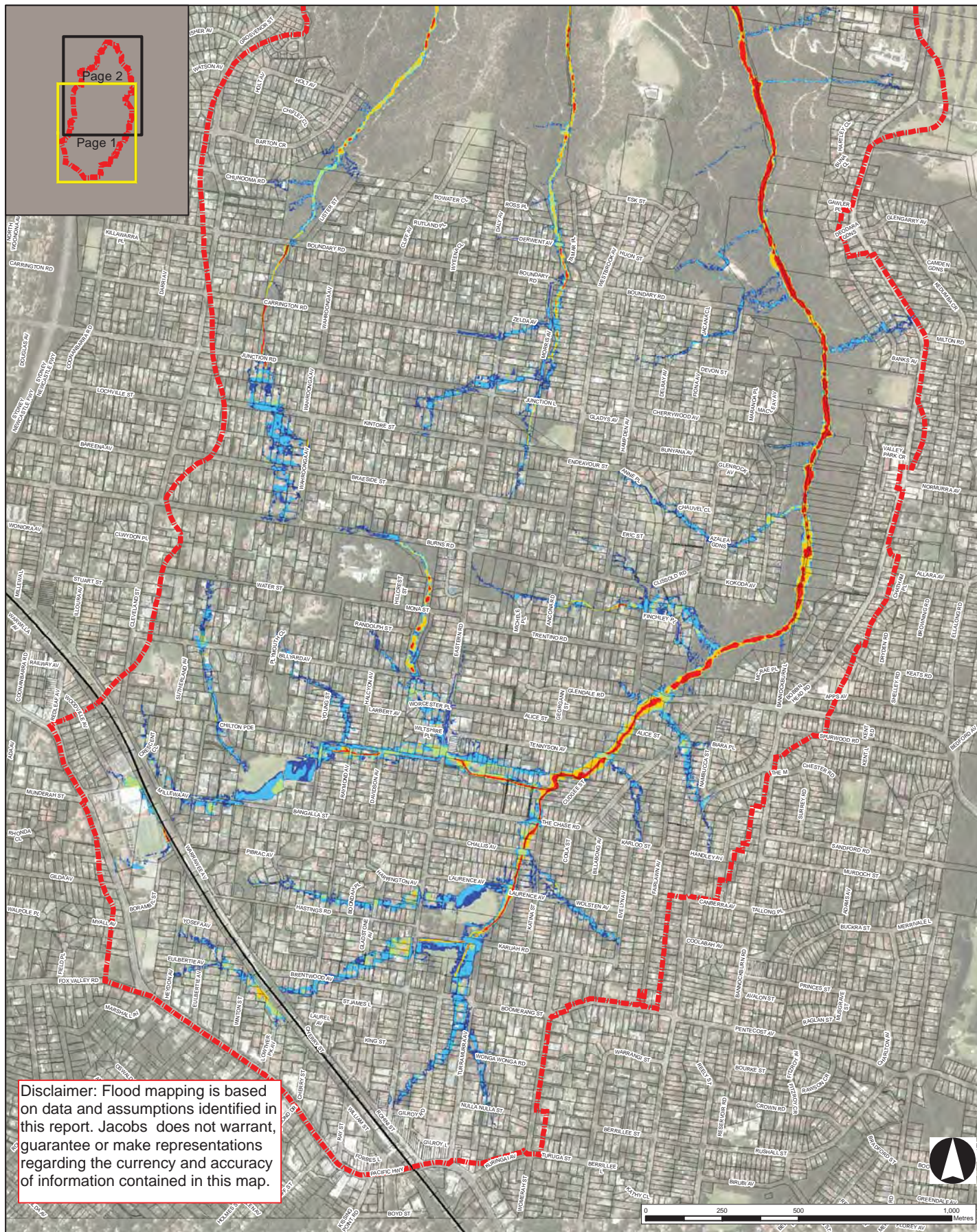
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TITLE 2% AEP Event Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-4	1	1
CHECK	DATE			
AH	21/02/2018			1:12,000 A3



Legend

	Study area
	Cadastral
	Railway
	Peak Flood Depth (m)
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	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	> 2.0

JACOBS

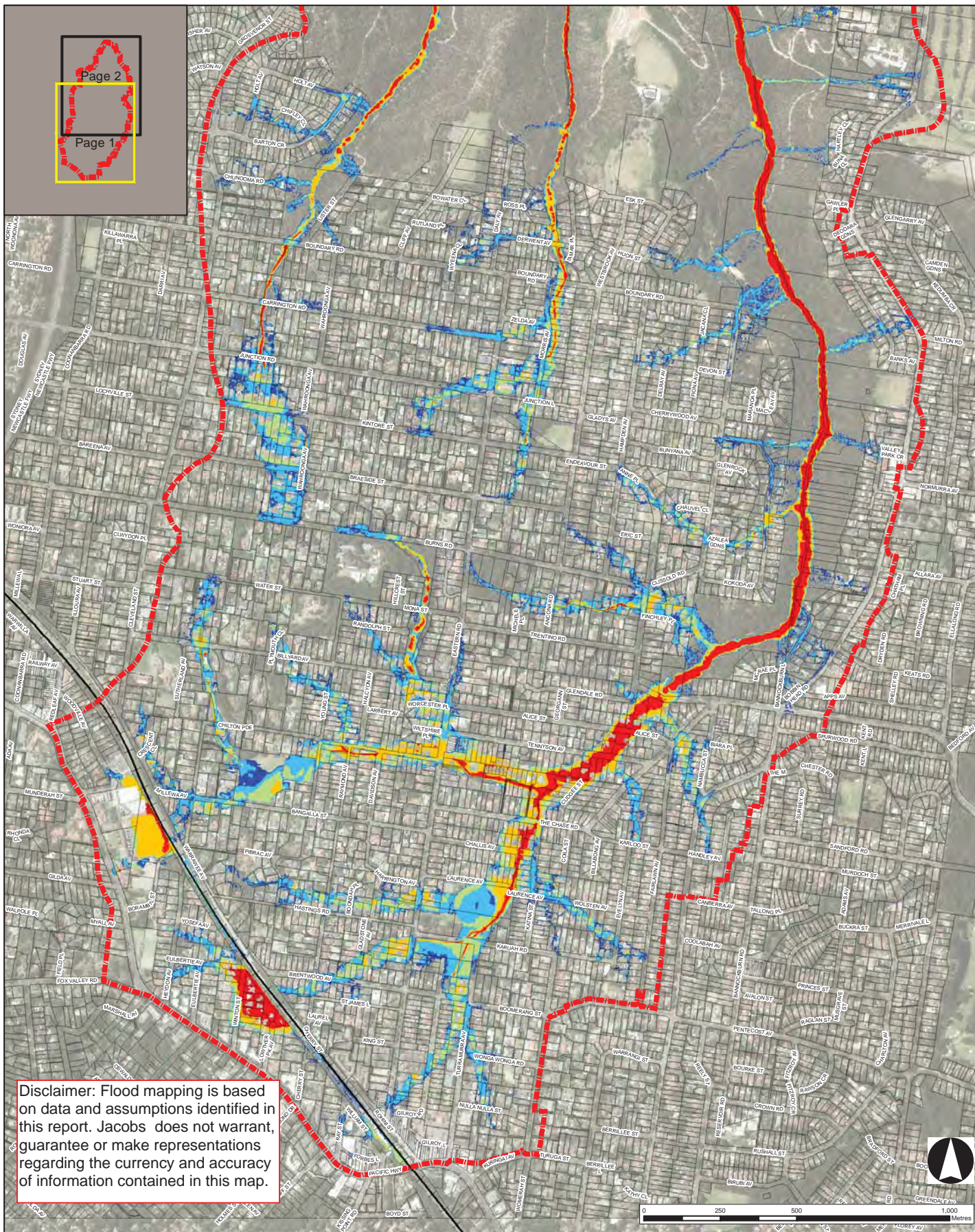
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TITLE 1% AEP Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-5	1	1
CHECK	DATE			
AH	21/02/2018			1:12,000 A3



Legend

	Study area
	Cadastral
	Railway
	Peak Flood Depth (m)
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	0.2 - 0.5
	0.5 - 1.0
	1.0 - 2.0
	> 2.0

JACOBS

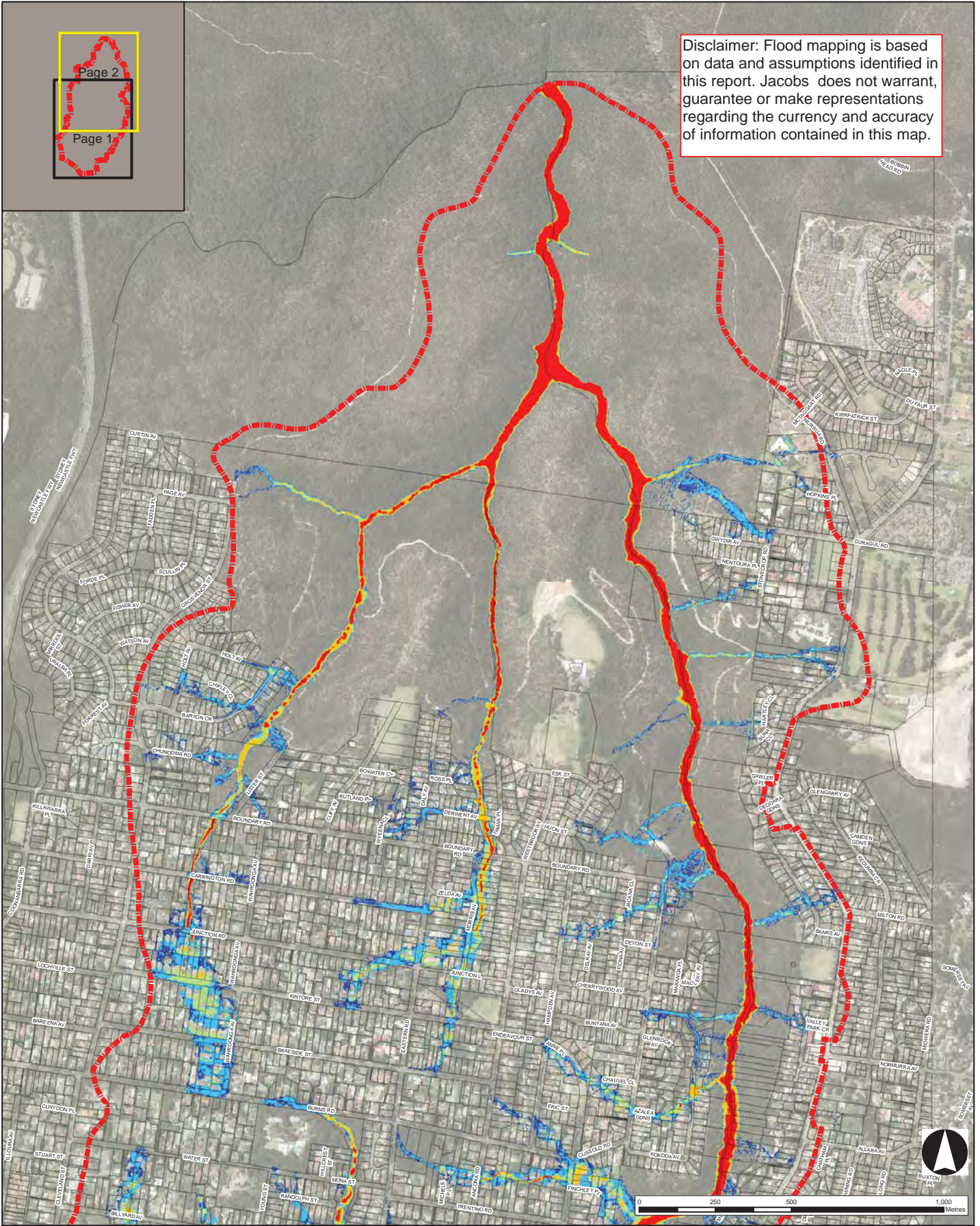
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TITLE PMF Event
Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN LC	PROJECT # IA159900	MAP # Map D-6	REV VER 1 1
CHECK AH	DATE 21/02/2018		1:12,000 A3



Legend

- Study area
- Cadastral
- Railway
- Peak Flood Depth (m)
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 2.0
 - > 2.0



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TITLE PMF Event Peak Flood Depth

PROJECT Lovers Jump Creek Flood Study Review

DRAWN	PROJECT #	MAP #	REV	VER
LC	IA159900	Map D-6	1	1
CHECK	DATE			
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