



Reference: 20200222-L02_flood study[B].docx

Date: September 3, 2021

Urban Link
Level 10, 11-15 Deane Street
Burwood NSW 2134

Dear Sir,

**RE: 96-98 LETHBRIDGE STREET & 42-46 EVANS STREET, PENRITH
FLOOD STUDY REPORT**

INTRODUCTION

A residential development is proposed at the above site address in the form of a multi-unit residential development. Council has identified the lots within the proposed site as flood affected land by 1% AEP flood. A flood study has been undertaken, which is based on Council's TUFLOW model, to determine flooding condition and provide necessary mitigation measures to ensure the proposed development does not have any adverse impacts on other properties in the vicinity of the site.

This report should be read in conjunction with the Stormwater Concept Plan prepared by SGCE P/L, rev. A dated 25/11/2020.

REFERENCE DOCUMENTS

The following documents have been referenced in this report:-

1. Site survey prepared by ATS Land and Engineering Surveyors Pty. Ltd. ref. 9684-00 dated 04/12/2015;
2. Architectural drawings prepared by Urban Link Pty. Ltd., ref. 19107;
3. Penrith CBD Detailed Overland Flow Flood Study-Final Report prepared by Cardno, ref. W4735 dated 07/07/2015.
4. NSW Government "The Floodplain Development Manual – The management of Flood Liable Land" (2005);
5. Engineers Australia, *Australian Rainfall & Runoff*; and
6. Penrith City Council Design Guidelines 2013.

NATURAL & BUILT ENVIRONMENT

The site is made of eight (8) existing residential lots and currently has six (6) dwellings and its associated ancillaries. The site falls in the Local Government Area of the Penrith City Council.

The site is bounded by Lethbridge Street to the North, Evan Street to the West and adjoining properties in all other directions.

There is an existing drainage easement with concrete culvert traversing Lot 71/DP810706.

The site has a L-shape and is characterised by a sloping natural gradient from South and North to the easement, which forms a low-lying area along this easement towards Evan Street.

Figure 1 shows the location of the site.



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Figure 1 **Locality Plan**

PROPOSED DEVELOPMENT

The proposed development involves the construction of 128 new apartment units with basement car parking spaces as depicted on the architectural plans by Urban Link. Figure 2 below shows an extract of the site plan from the architectural drawings.

The development also proposed to retain the existing drainage culvert and existing trees around the site. The drainage of the system is proposed to avoid the tree protection zones in accordance with arborist's instructions and to tap into this culvert.

The design of the buildings has considered the results of this flood study as detailed in the following sections of the report.



Figure 2 Proposed Site Plan

FLOOD STUDY

Penrith City Council

It is advised that a flood study is required to determine how the proposed development can be built without any adverse impact on the flood behaviour in the floodplain and specifically in the surrounding vicinity of the site. The flood letters and the details, which are issued by Penrith City Council, are included in Appendix A3.

Objectives

The purpose of this flood study is to provide a detailed assessment of the flooding and to determine the impacts (if any) that the proposed development will have on the flooding within the site and its surroundings.

The flood study will also determine how the proposed building will be constructed without affecting the flood characteristics (i.e. flood level and impact on adjoining properties) by proposing mitigation measures.

In summary, the objectives are as follows:-

- Obtain the TUFLOW computer model that has been developed for the Penrith CBD Detailed Overland Flow Flood Study;
- Define design flood levels and depths for the catchment to establish a benchmark;
- Amend the model to include the proposed development and determine if the latter has an impact on the flooding;
- Propose mitigation measures to eliminate any impacts;

- Adopt these measures in the architectural plans and during construction; and
- Address the requirements of Council's DCP.

Hydraulic Modelling

Definition

The TUFLOW model used in the flood study was obtained from Penrith City Council by SGC.

Council's TUFLOW model used '2010-10-AD-iSP-w64' which is the previous version.

The model in this flood study uses version '2018-03-AC-iSP-w64' which is the newer version and is downloaded from TUFLOW's website. This study is run with HPC-solver which is a TUFLOW engine that allows for adaptive time-stepping, repeat time-stepping. It is stable and unlikely to create mass error. A grid size of 3m is used to match with council's issued model.

Proposed Buildings

The proposed buildings on site were modelled as high Manning's n area of 0.3 as they are proposed to block the flooding in accordance with AR&R 2019.

The buildings are raised to the adopted Flood Planning Level (FPL) which equals the 1% AEP flood level plus 500mm freeboard.

The critical duration for the 1% AEP storm event is the 2-hour storm burst.

Design Flood Modelling Results

Design flood modelling was undertaken for the 1% AEP design flood event. The Flood Planning Level (FPL) of the site and the proposed levels are noted in table 6.1 below:

Table 1 **XXX**

Flood Level Location	Council Flood Level (1% AEP)	Flood Level (1% AEP) This Study	FPL (1% AEP + 0.5m) (mAHD)	Proposed FFL (mAHD)	Complies
96-98 Lethbridge Street & 42-46 Evans Street, Penrith	34.80 (No.40 Evan)	34.9~35.50 (approximate)	35.30	36.00/ 36.55	Yes
	35.20 (No.42&44 &46 Evan)		35.50		
	35.30 (No.98 Lethbridge)		35.80		
	35.40 (No.96 Lethbridge & No.48 Evan)		35.90		
	35.50 (No. 35.50 Evan)		36.00		

Flood Mitigation Measures

The development proposes flood mitigation measures to account for the new building footprint, which has been incorporated into the TUFLOW model. Mitigation measures include proposed cut area to RL 34.00 and RL 34.50 with pits/pipes system and outlet connection to existing culvert traversing the subject site. Refer to Appendix A figure A2.6 for Flood Mitigation Plan.

DISCUSSION

Flooding occurs along the site because the in-ground drainage infrastructure is under capacity in 1% AEP storm event. This occurs when the capacity of the local infrastructure capacity is exceeded, and runoff is conveyed by the road network and through private properties.

The impact of proposed development can be described as following:

- 1 The proposed residential development does not have any adverse impacts on the flooding elsewhere in the floodplain. This can be seen in the flood impact map (difference between



post and pre site conditions). This also indicates that there is no change in the flood conveyance and no loss in flood storage;

- 2 There is a localised impact at the boundary with No. 94A Lethbridge Street at 20mm up to 40mm (particularly at the boundary) which can be considered negligible;
- 3 The proposed habitable areas are raised at or above the Flood Planning Level (FPL). Reference is made to the architectural plans for details;
- 4 There is no risk of basement carpark being flooded as the entry of to the basement levels from both Evan Street and Lethbridge Street are free from flooding;
- 5 The fencing around the perimeter of the site will have 300mm and up to 1.0m bottom part as permeable to allow the conveyance of overland flows (refer to figure A2.6);
- 6 The requirements of the DCP are implemented, including:
 - The development does not increase the flood hazard or risk to other properties;
 - All building structure and other components up to 1%AEP flood levels are to be flood compatible materials; and
 - The buildings are sited in the optimum position to avoid flood waters and allow evacuation.

In our opinion, the proposed buildings footprints do not displace the floodwaters in such a manner to impact on the flooding behaviour in terms of loss of flood storage, increase in velocity and risk.

CONCLUSIONS

A detailed investigation on the flooding behaviour has been undertaken for the proposed development at 96-98 Lethbridge Street & 42-46 Evans Street, Penrith, NSW.

Utilising the existing TUFLOW model received from Council, the study has determined the flood behaviour for the 1% AEP design storm. The primary flood characteristics reported for the design events considered include depths, levels and velocities.

The study looked into the impact of the proposed development on the overland flooding behaviour and its impact on the flood levels both upstream and downstream. The flood maps are included under Flood Mapping Appendix 1.

The study proposes mitigation measures that ensure that the development will not have any adverse impact on flooding behaviour in its vicinity. The proposed mitigation measures have been denoted in the discussion section and in the stormwater management plans prepared by SGC, ref. 20200222.

In our opinion, the proposed development should be accepted by council floodplain engineer.

Should you have any further queries or questions, please do not hesitate to contact the undersigned.

Yours faithfully,
For & on behalf of S&G Consultants Pty Ltd



A handwritten signature in blue ink, appearing to read 'S Haddad', is positioned above the printed name.

Sam Haddad
Director (Civil)
MIEAust CPEng NER



A1 Appendix 1

Flood Mapping



TITLE: Flood Depth & Water Level Contours - 1% AEP Existing Site Conditions		Legend — 0.1m Flood Level Contours Flood Depth (m) ■ 0.15 to 0.2 ■ 0.5 to 1 ■ 0.2 to 0.25 ■ 1 to 3.02 ■ 0.25 to 0.5	 www.sgce.com.au Engineering & Architecture SGC has made every attempt to ensure that the information in this map is correct at time of publication. SGC does not warrant or guarantee the accuracy of the information contained in this map.
FIGURE: Fig A1.3	REV: A		
<small>Filepath: X:\Flood Studies\PENRITH CBD OFS\14_Tufflow_Models\results\SGC\20200222\2020.11.20 Results 3 - 1m grid</small>			

Figure A 1.3 Flood Depth Existing



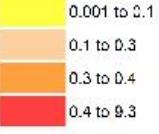
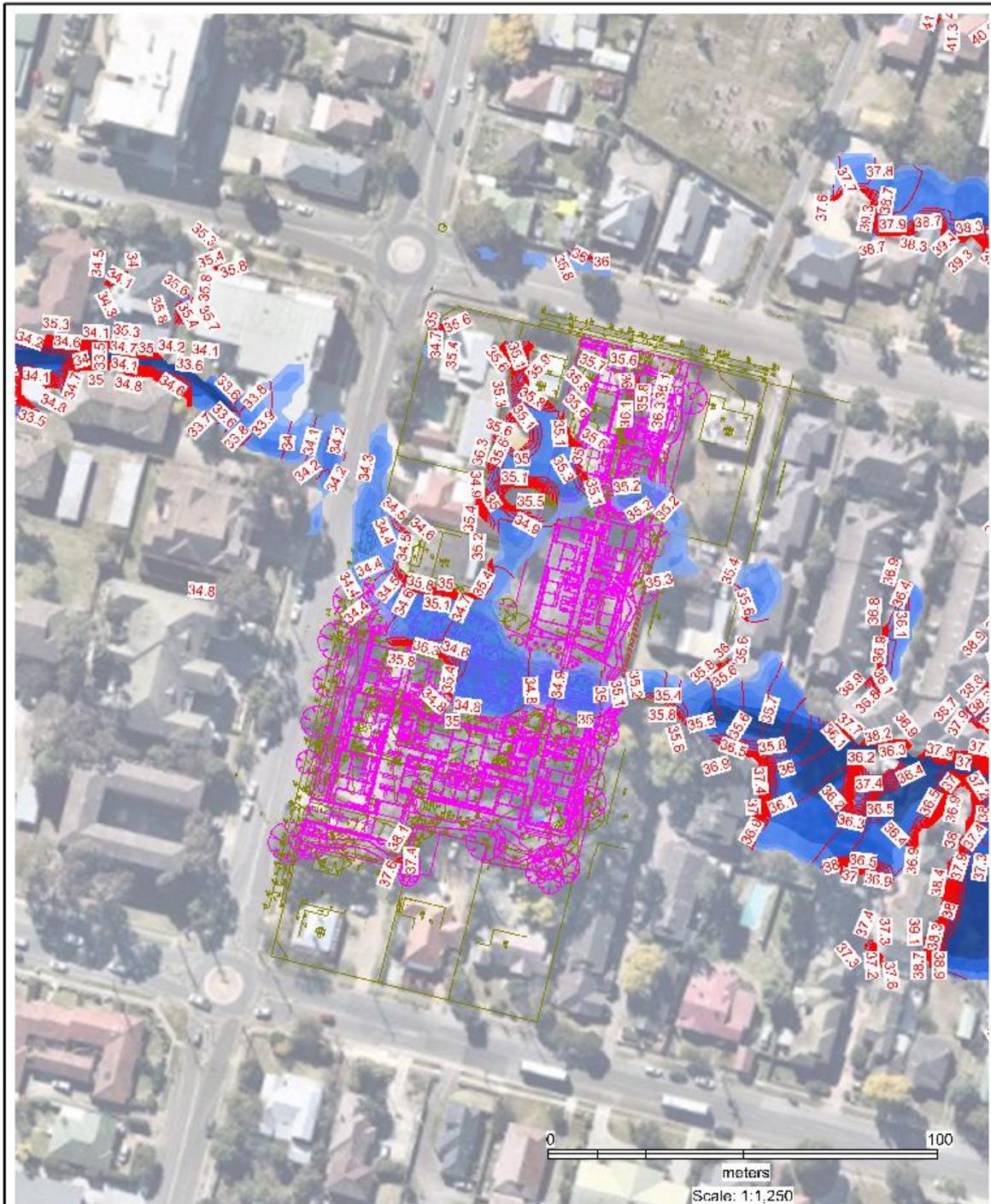
TITLE: Flood Velocity x Depth - 1% AEP Existing Scenario		Legend Velocity x Depth (m²/s) 	 www.sgce.com.au Engineering Works
FIGURE: <p style="text-align: center;">Fig A1.4</p>	REV: <p style="text-align: center;">A</p>		
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Figure A 1.4 Flood Velocity x Depth Existing



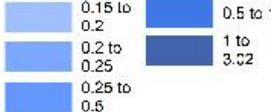
TITLE: Flood Depth & Water Level Contours - 1% AEP Proposed Scenario		Legend — 0.1m Flood Level Contours Flood Depth (m) 	 www.sgce.com.au Engineering & Architecture
FIGURE: <p style="text-align: center;">Fig A1.5</p>	REV: <p style="text-align: center;">A</p>		
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Figure A 1.5 Flood Depth Proposed



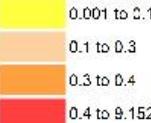
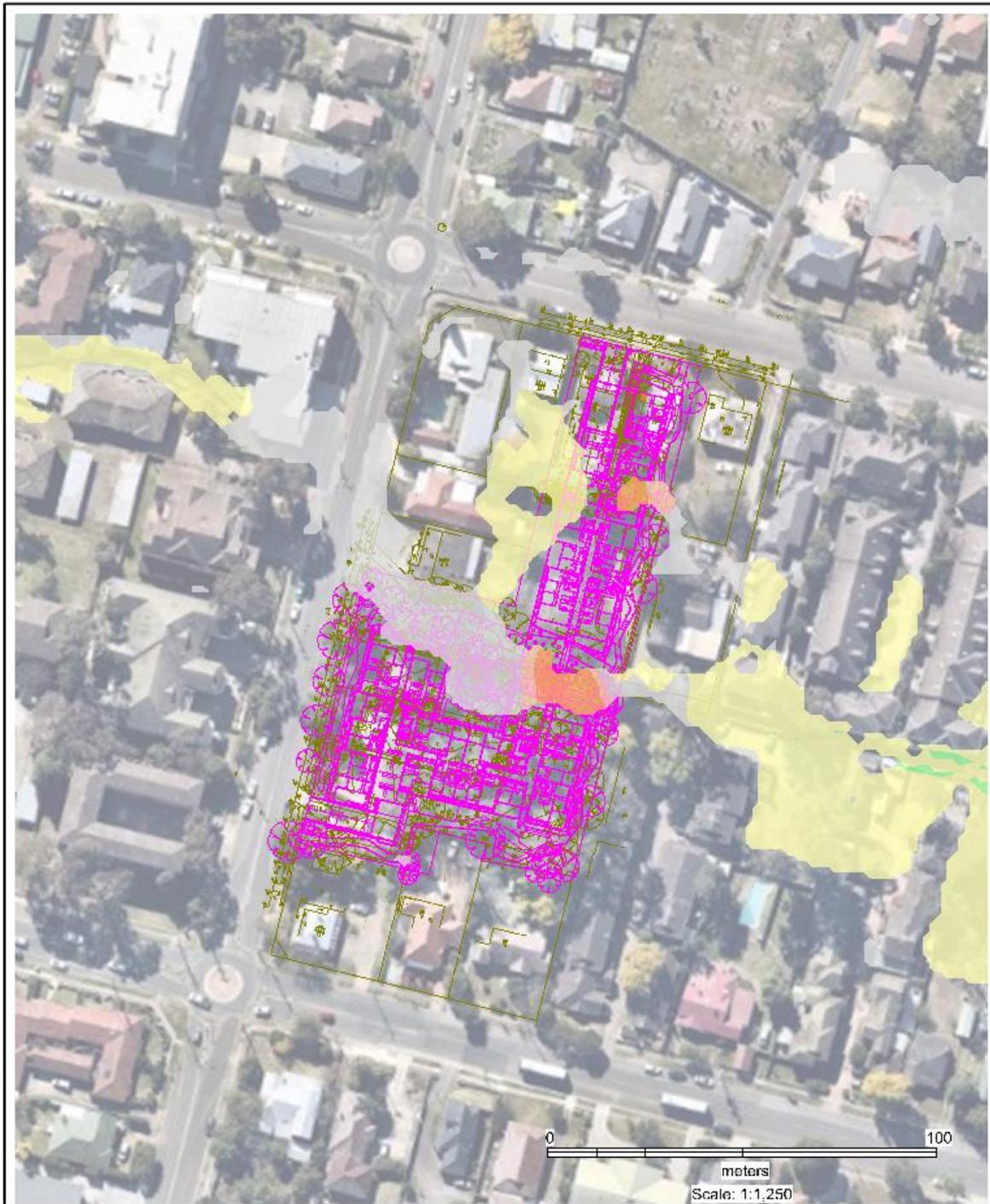
TITLE: Flood Velocity x Depth - 1% AEP Proposed Scenario		Legend Velocity x Depth (m/s)  <ul style="list-style-type: none"> 0.001 to 0.1 0.1 to 0.3 0.3 to 0.4 0.4 to 0.152 	 www.sgce.com.au 
FIGURE: <p style="text-align: center;">Fig A1.6</p>	REV: <p style="text-align: center;">A</p>		
<small>Filepath: X:\Flood Studies\PENRITH CBD OFS\14_Tufflow_Models\results\SGC\20200222\2020.11.20 Results 3 - 1m grid</small>			

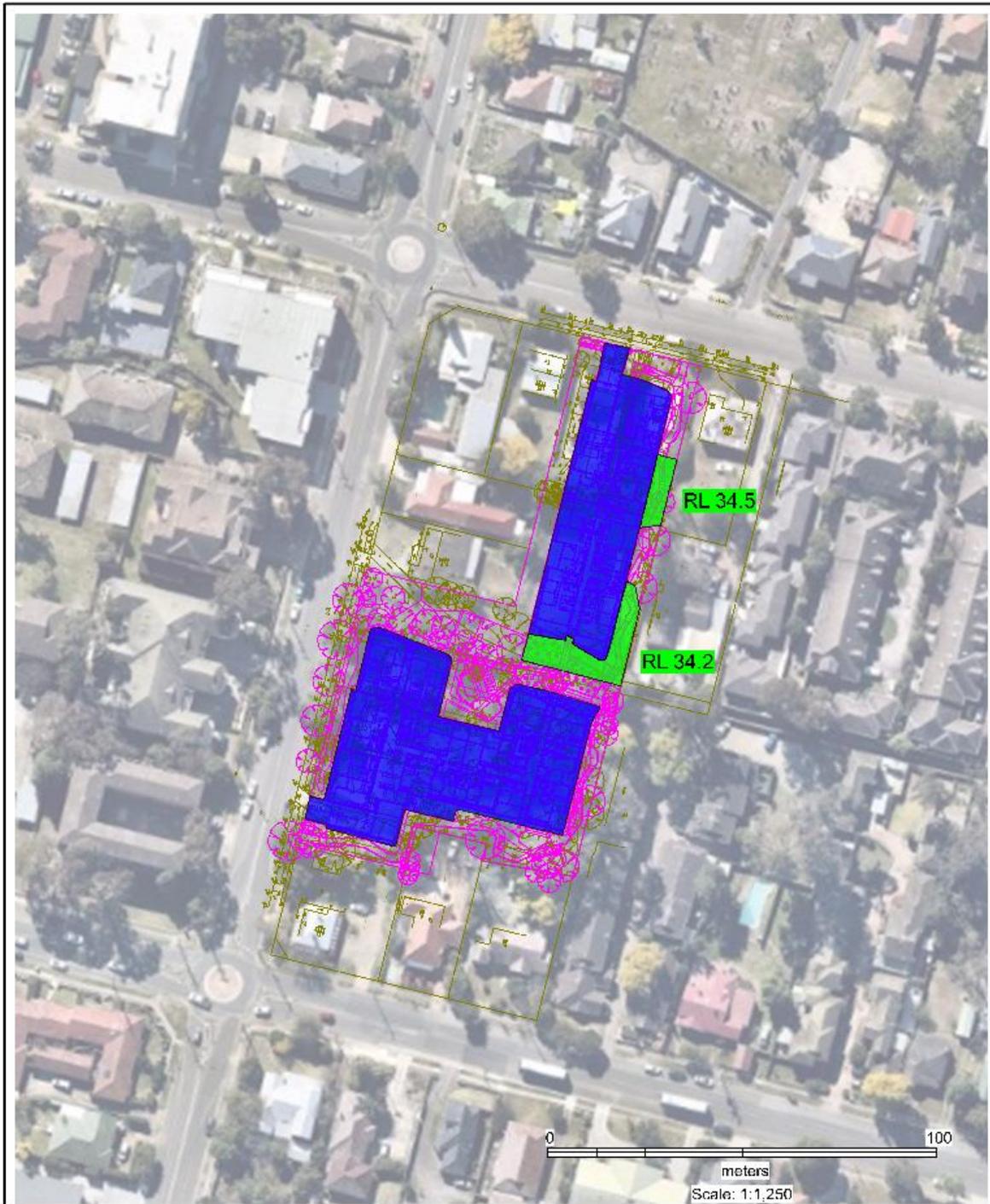
Figure A 1.6 Flood Velocity x Depth Proposed



TITLE: Flood Impact Map		Legend Difference (m) <table border="0"> <tr> <td> -0.5 to -0.25</td> <td> -0.01 to 0.01</td> <td> 0.05 to 0.1</td> </tr> <tr> <td> -0.25 to -0.1</td> <td> 0.01 to 0.025</td> <td> 0.1 to 0.2</td> </tr> <tr> <td> -0.1 to -0.01</td> <td> 0.025 to 0.05</td> <td> 0.2 to 0.24</td> </tr> </table>	 -0.5 to -0.25	 -0.01 to 0.01	 0.05 to 0.1	 -0.25 to -0.1	 0.01 to 0.025	 0.1 to 0.2	 -0.1 to -0.01	 0.025 to 0.05	 0.2 to 0.24	 www.sgce.com.au Engineering & More SGC has made every attempt to ensure that the information in this map is correct at time of publication. SGC does not warrant or guarantee the accuracy of the information contained in this map. <div style="text-align: right;">  </div>
 -0.5 to -0.25	 -0.01 to 0.01		 0.05 to 0.1									
 -0.25 to -0.1	 0.01 to 0.025	 0.1 to 0.2										
 -0.1 to -0.01	 0.025 to 0.05	 0.2 to 0.24										
FIGURE: Fig A1.7	REV: A											

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Figure A 1.7 Flood Impact



TITLE: Flood Mitigation Map		Legend  Proposed Building Blocking Flow Legend  Cut Areas	 www.sgce.com.au <small>SGC has made every attempt to ensure that the information in this map is correct at time of publication. SGC does not warrant or guarantee the accuracy of the information contained in this map.</small>
FIGURE: Fig A1.8	REV: A		

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Figure A 1.8 Flood Mitigation



A2 Appendix 2

Survey Plan

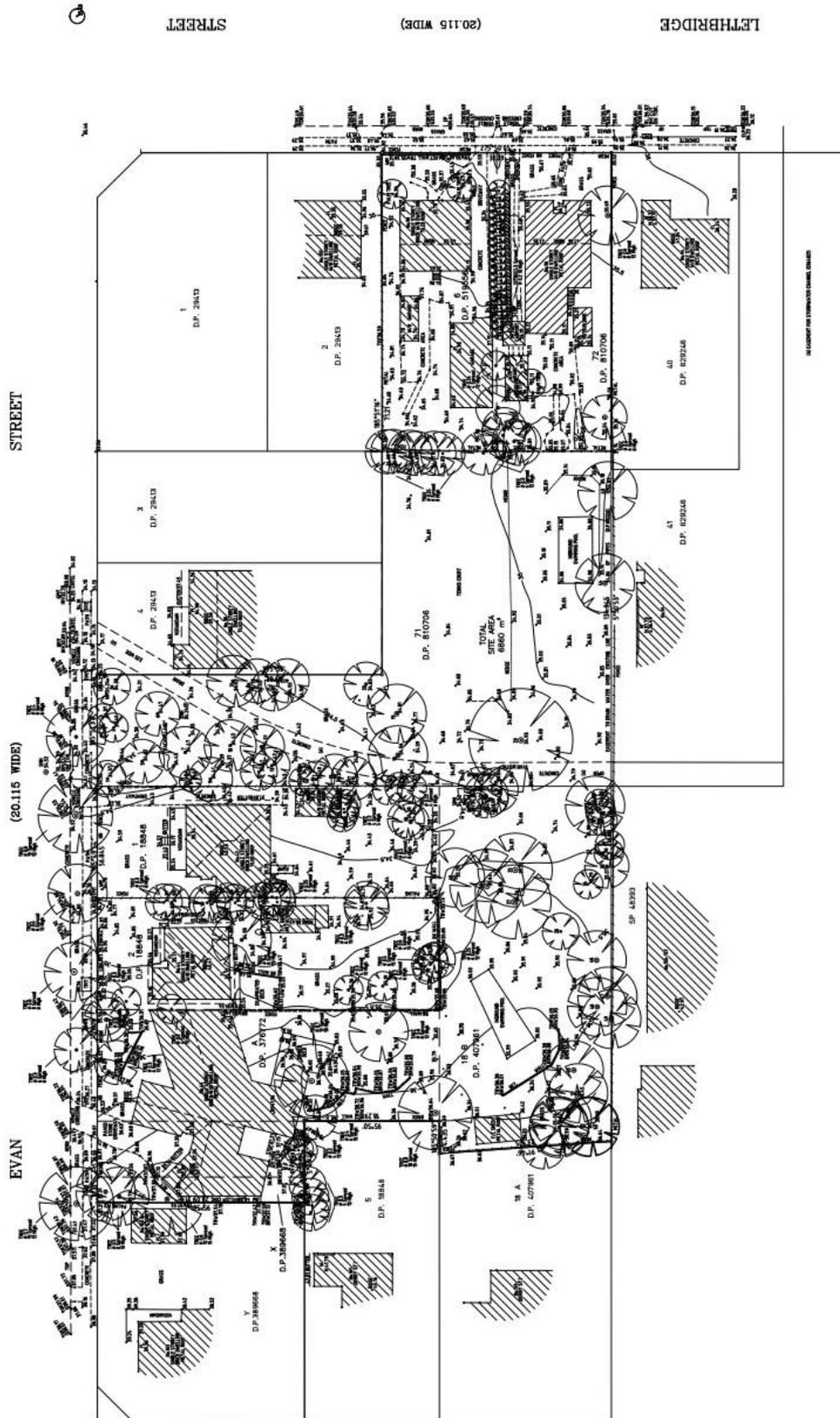


Figure A 2.1