Reference: **20210226-L02_flood letter [B].docx**

Date: December 6, 2021

Caz Build
Attn: Mr. Frank Catanea

Dear Sir,

RE: 143 STAFFORD STREET, PENRITH – FLOOD STUDY

INTRODUCTION

A residential development is proposed at the above site address in the form of a multi-dwelling development. Penrith City Council requires a flood study to be undertaken to determine if the proposal has any adverse impacts on the flooding regime in the vicinity of the site.

This report should be read in conjunction with Penrith council's flood letter to SGC which references the study that the model is based on.

REFERENCE DOCUMENTS

The following documents have been referenced in this report:-

1. Site survey prepared by Richard Hogan & CO. ref. 21277 revision A dated 127/04/2021;
2. Architectural drawings prepared by Obrien design + drafting (Issue A);
3. NSW Government "The Floodplain Development Manual – The management of Flood Liable Land" (2005);
4. Engineers Australia, Australian Rainfall & Runoff;
5. Penrith Development Control Plan 2014 Volume 1;
6. Penrith Development Control Plan 2014 Volume 2; and
7. Penrith CBD Floodplain Risk Management Study and Plan, Molino Stewart 2020.

NATURAL & BUILT ENVIRONMENT

The site is made of one existing residential lot and currently has two single storey brick dwellings and their associated ancillaries, and one metal and hardboard shed. The site falls in the Local Government Area of the Penrith City Council.

The site is bounded by residential developments to the North, East, and West and Stafford Street to the South.

The site has a rectangular shape and is characterised by a sloping natural gradient from North West to South East.

Figure 1 shows the location of the site.

Figure 1 Locality Plan

PROPOSED DEVELOPMENT

The proposed development involves the construction of multi dwelling development that includes seventeen units as depicted on the architectural plans by Obrien design + drafting. Figure 2 below shows an extract of the site plan from the architectural drawings.

The design of the dwelling 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

Council 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 vicinity of the site.

The flood levels and hazard classification across the site have been provided by Council at the request of the client. The issued flood letter and the details are included in Appendix 3 of this letter. The letter demonstrates 1% AEP overland flow flood levels are RL41.80m AHD and RL41.70m AHD for 143 and 145 Stafford Street respectively.

Objectives

The purpose of this flood study is to establish the Flood Planning Levels for the proposed development. It also provides a comparison of pre vs post flood results and determines measures that need to be implemented for the development not to have any adverse impacts on the flooding characteristics.

In summary, the objectives are as follows:-

- Prepare a dynamic 1D/2D computer model based on existing site conditions for 1% AEP;
- Define design flood levels, depths and hazards for the catchment for the existing site conditions;
- Modify the site conditions to post-development to predict the new flood levels, depths and hazards for 1% AEP;
- Determine if the proposed development has any adverse impact on flooding;
- Propose mitigation measures; and
- Adopt these measures in the architectural plans and during construction.

Hydrology

The hydrological modelling was carried out using TUFLOW and is based on the rain on grid method.

Hydraulic Modelling

Definition

The model a dynamically lined 1D/2D model using TUFLOW. A grid size of 2m x 2m is used in the study.

Proposed Buildings

The proposed buildings on site were modelled as inactive area as they are proposed to fully block the flooding.

The buildings finish floor level to be the adopted Flood Planning Level (FPL) which equals the 100-yr ARI flood level plus 300mm freeboard as stated in the council advice letter.

The critical duration for the 1% AEP storm event is the 10 min pattern 10 storm burst.

1D Model Setup

Stormwater drainage pits and pipes are represented in the model as 1-Dimensional elements which are dynamically linked to the water conveyed across the elevation grid. The model uses the TUFLOW setup for Penrith CBD received from council with as proposed changes to the 1D network.

2D Model Setup

The 2D model is setup around the 1D model and covers the extents of the flooded areas/extents to ensure that the flows are captured. The 2D roughness values used in the model are tabulated below in accordance with the TUFLOW model for Penrith CBD.

Table 1 2D Landuse Details

Landuse	Roughness
Light Vegetation	0.03
Medium Vegetation	0.05
Dense Vegetation	0.1
Residential	0.1
Open Water	0.03
Fences	0.015
Open Channel	0.020

The existing buildings around the site area are modelled as full obstructions (made as fill in the model grid). The existing and the proposed buildings within the site are similarly raised as fill and block the flows completely.

Discussion & Recommendations

This section of the report provides a review of the results and discusses Council's requirements as stated in the DCP.

1. The maximum flood level has been noted to be RL41.75 AHD. The proposed habitable floor levels are at minimum RL42.30, which is higher than the flood planning level.
2. Fencing to the rear of townhouses 8, 9, 16 & 17 to have minimum 300mm gap at the bottom and the rear of the site;
3. Flood Planning requirements under section 3.5 of Penrith DCP 2014 should be implemented;
4. The impact to the neighbours shown in Appendix 1 (Figures 1.7) indicates that there is no increase in flood levels for 141 & 147 Stafford Street and 134-136 Derby Street.
5. A flood mitigation measure has been proposed which includes (Appendix 1 – Figure 1.8):
    a. 250mm cut at the rear landscape area to accommodate overland flow path and this is done away from the existing trees to be retained; and
    b. Landscape area at the rear of townhouse 8, 9, 16 & 17 to be kept at natural surface level.

In our opinion, the proposed building footprint does 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 in the vicinity of the proposed development at 143 Stafford Street, Penrith.

Using the established Penrith CBD model, the study determined the flood behaviour for the 1% AEP design flood. The primary flood characteristics reported for the design events considered include depths, levels and velocities. The study has also defined the Provisional Flood Hazard for flood-affected areas.

The impact of the proposed development was assessed and was found to be negligible in the adjoining sites. The flood maps are included under Appendix 1. The study addressed Council's requirements as per the DCP. In our opinion, Council should allow the development in its current proposal.

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

Yours faithfully

S&G Consultants Pty Limited

Sam Haddad

Director (Civil)

MIEAust CPEng NER

A1 Appendix 1

Flood Mapping

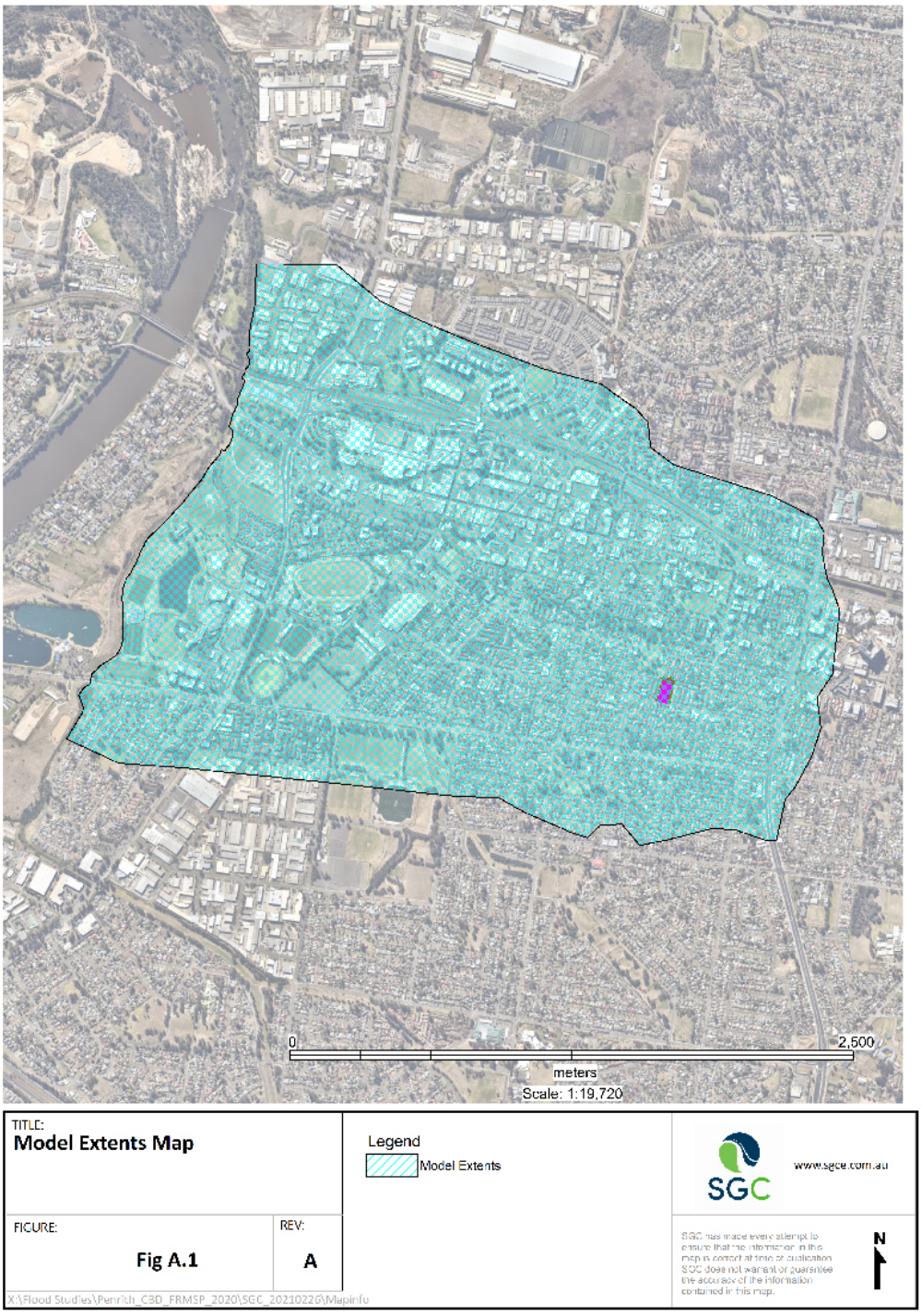

Figure A 1.1 Model Extents & Catchment Plan

Figure A 1.2 2D Land Use

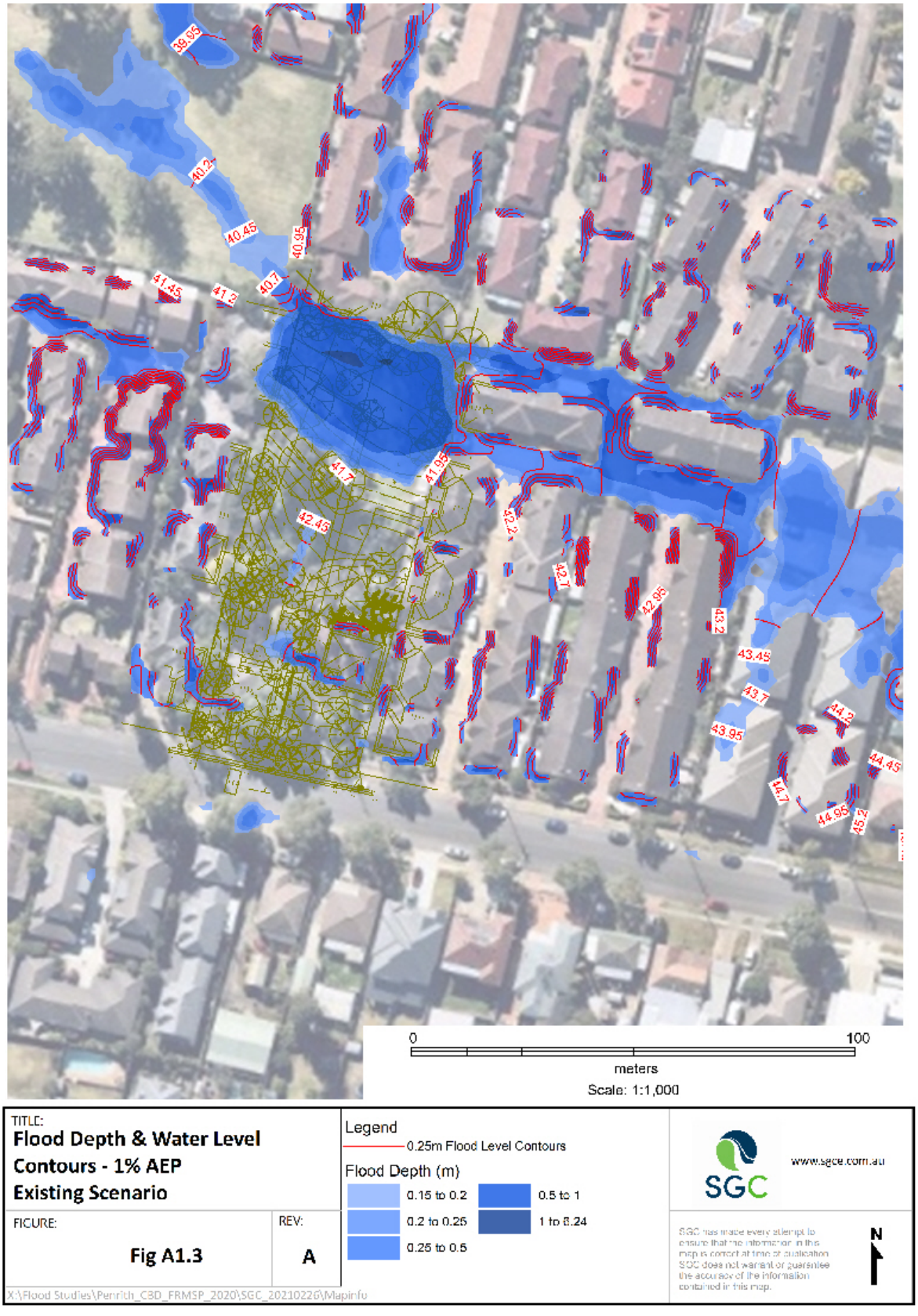

Figure A 1.3 1% AEP ARI Flood Depth & WSL – Base Scenario

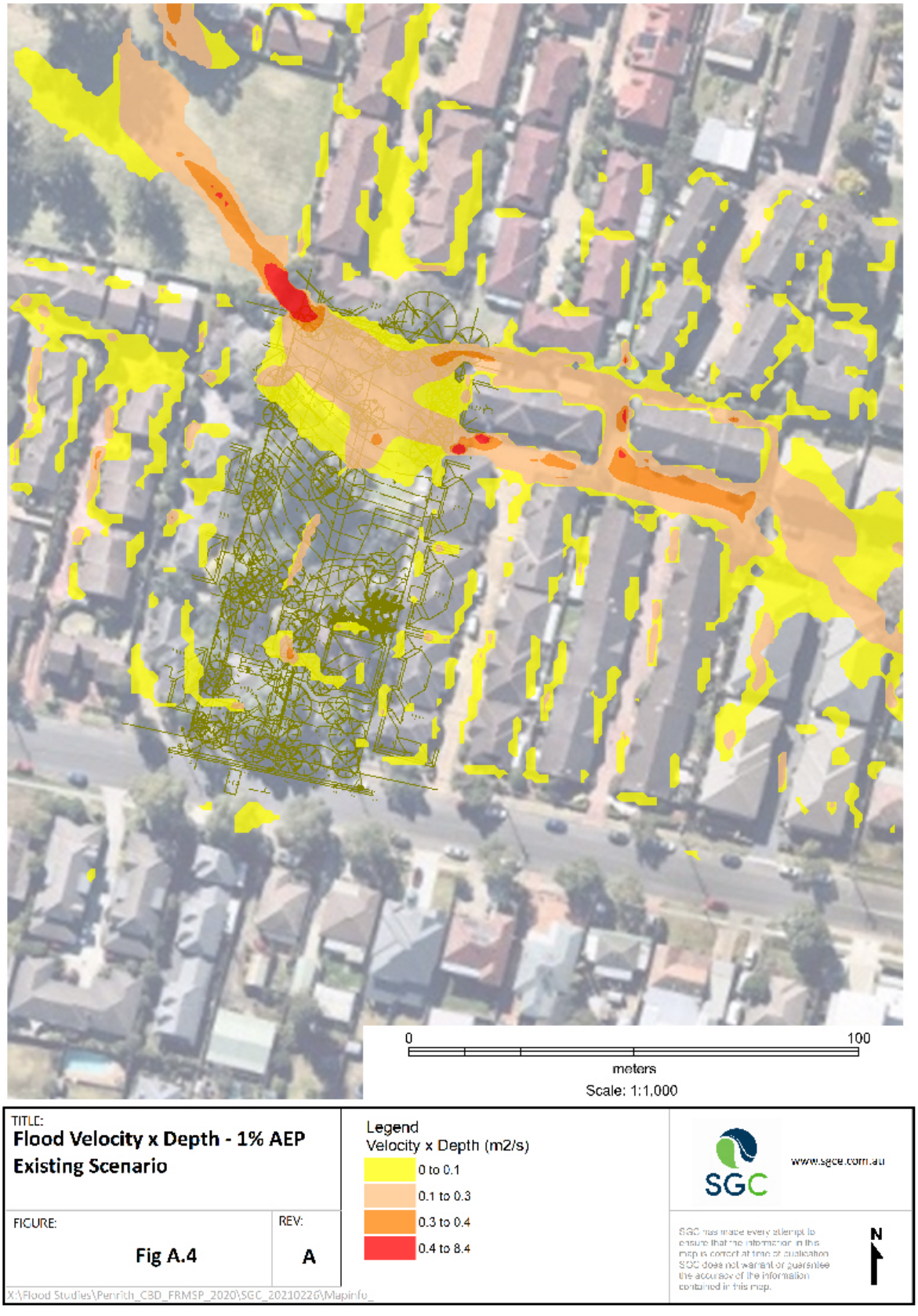

Figure A 1.4 1% AEP ARI Flood Hazard – Base Scenario

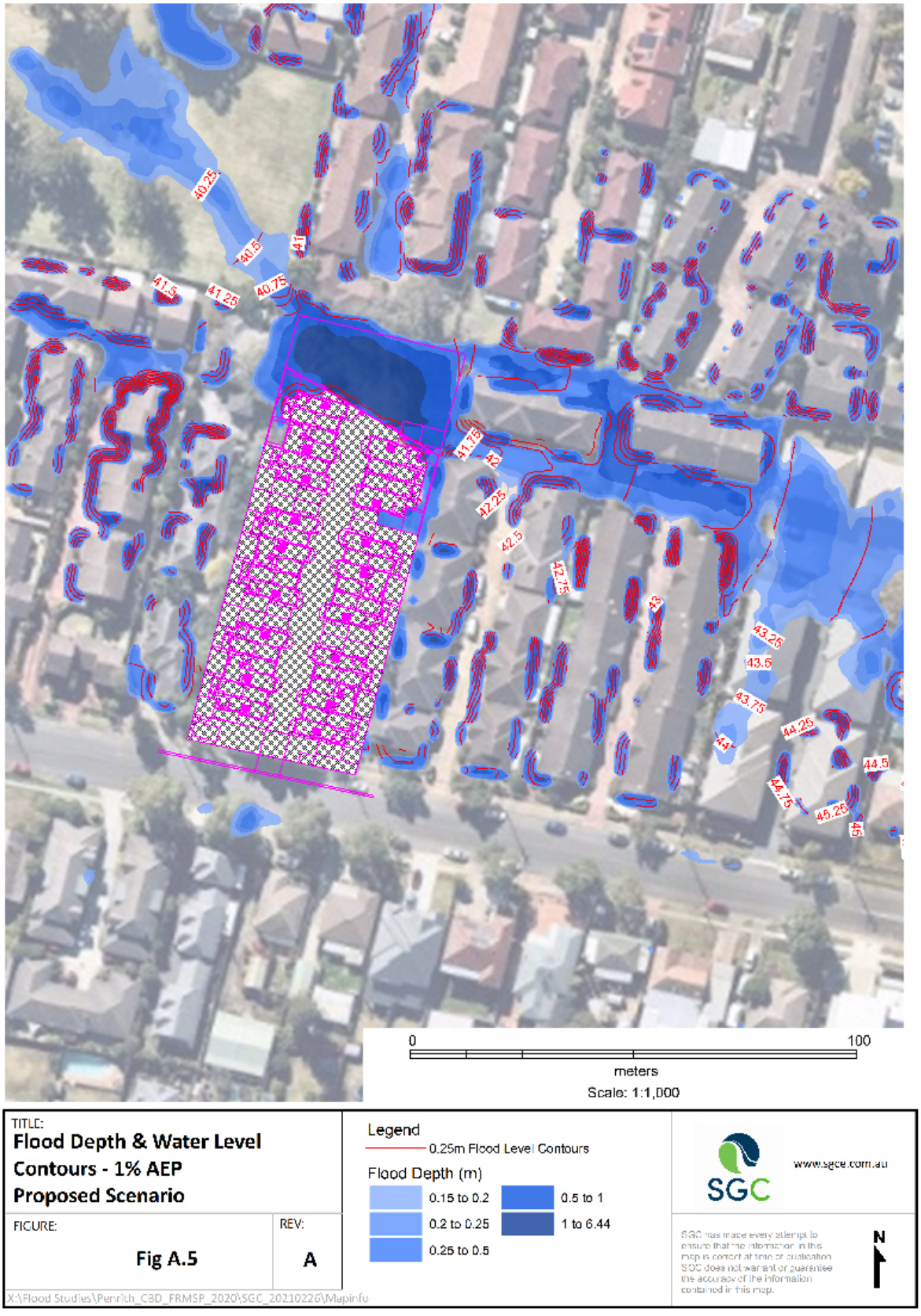

Figure A 1.5 1% AEP ARI Flood Depth & WSL – Proposed Scenario

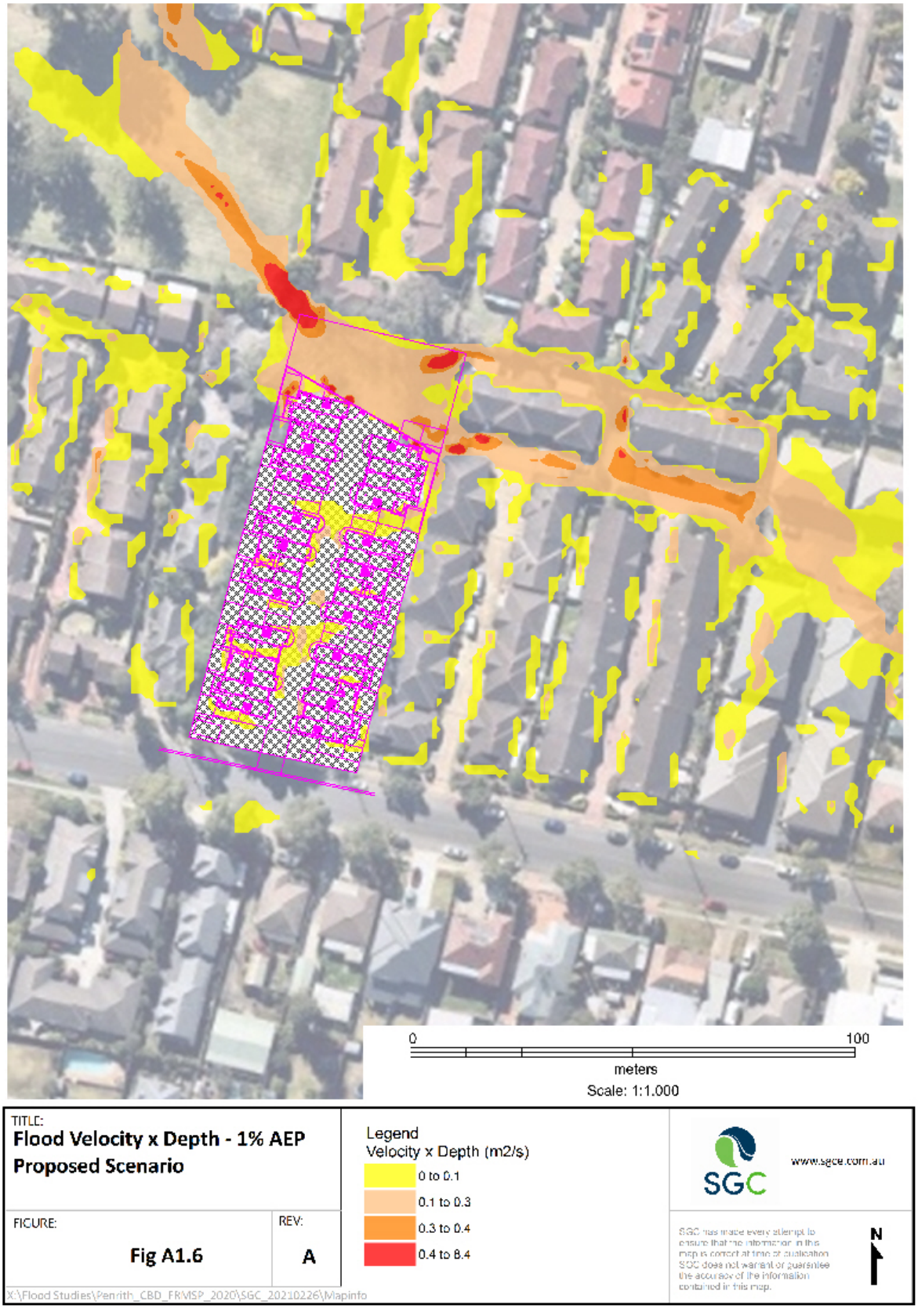

Figure A 1.6 1% AEP ARI Flood Hazard – Proposed Scenario

Figure A 1.7 1% AEP ARI Flood Impact

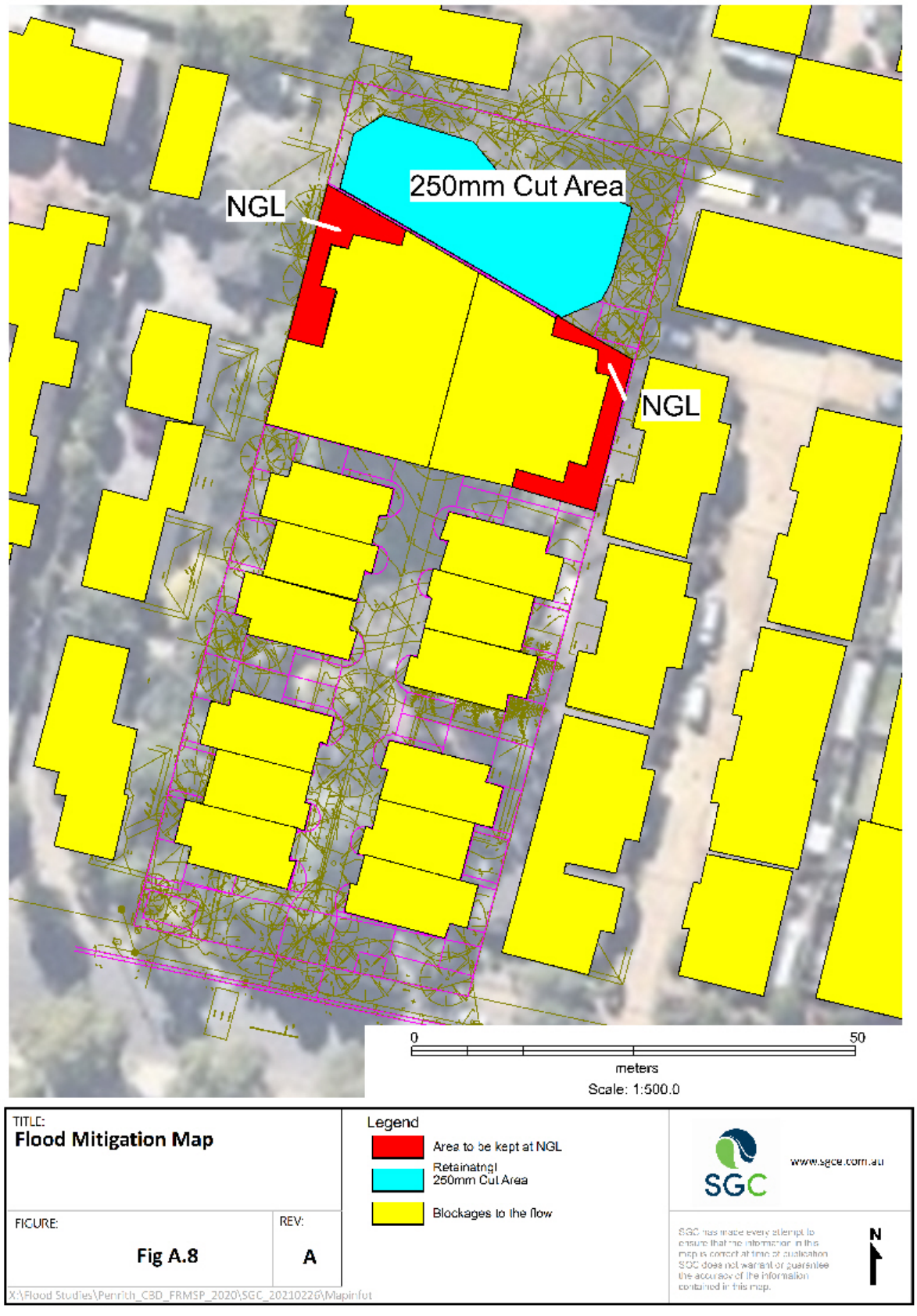

Figure A 1.8 Proposed Mitigation Measures

A2 Appendix 2

Survey Plan

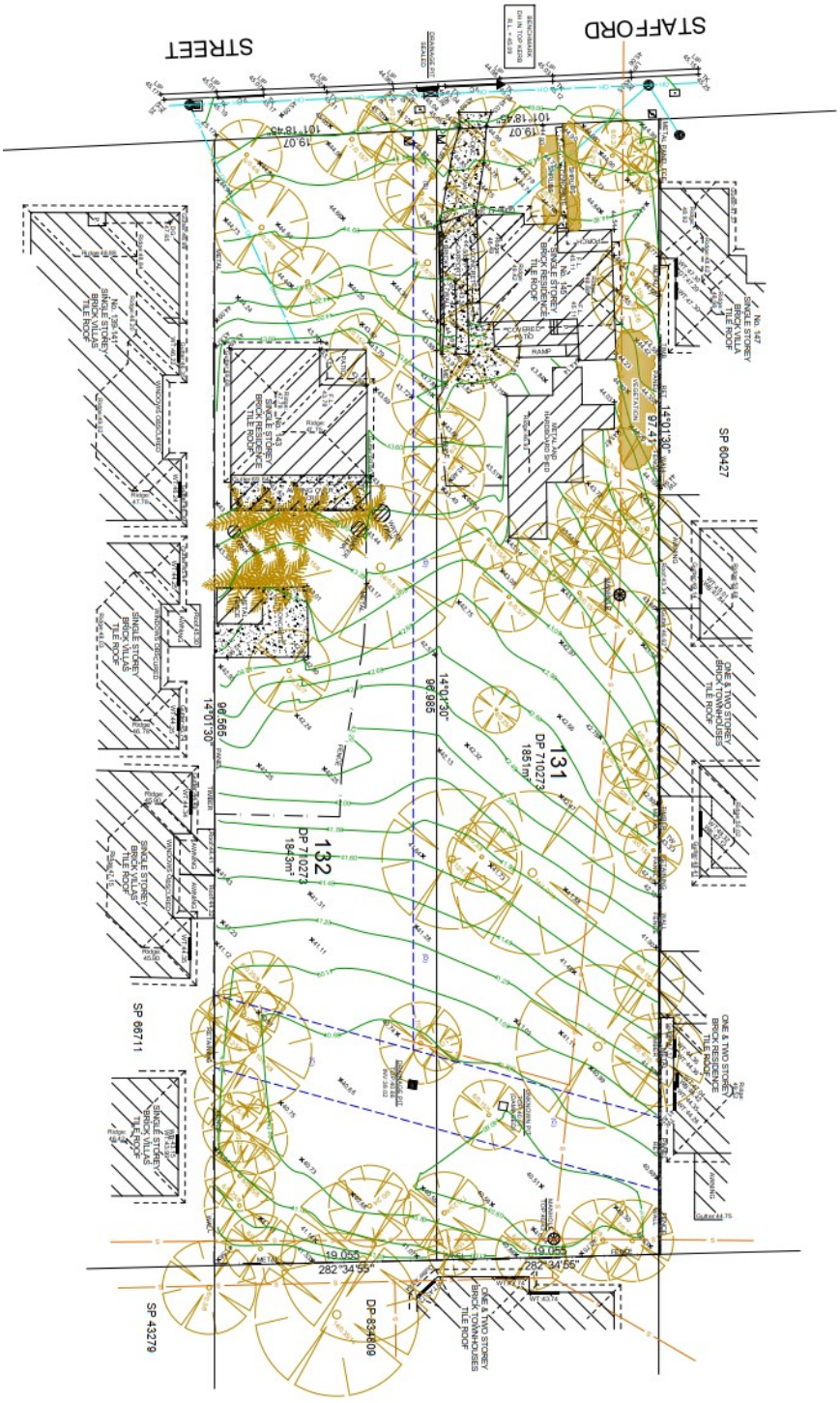

Figure A 2.1 Survey Plan

A3 Appendix 3

Flood Information Letter – Penrith City Council

Our reference: ECM 949071
Contact: Dr Elias Ishak
Telephone: 4732 7579

18 March 2021

Mr Darren Letty
1/27 Lawson Street
PENRITH NSW 2750

Dear Mr Letty

Flood Level Enquiry
Lot 131 DP 710273 No. 145 Stafford Street Penrith
and
Lot 132 DP 710273 No. 143 Stafford Street Penrith

Please find enclosed Flood Level information for the above property.

Should you require any further information please do not hesitate to contact me on 4732 7579

Yours sincerely

Dr Elias Ishak
Senior Engineer – Floodplain Management

Penrith City Council
PO Box 60, Penrith
NSW 2751 Australia
T 4732 7777
F 4732 7958
penrithcity.nsw.gov.au

PENRITH
CITY COUNCIL

Flood Information
Lot 132 DP 710273 - No. 143 Stafford Street Penrith

Date of issue: 18 March 2021

The 1%AEP local overland flow flood level affecting the above property is estimated to be RL41.8m AHD.

Property less than 0.5m above the 1% AEP flood level is subject to Penrith Development Control Plan 2014 Section C3.5 Flood Planning. The Penrith Development Control Plan 2014 is available from Council's website www.penrithcity.nsw.gov.au.

Definitions

AEP – *Annual Exceedance Probability* – the chance of a flood of this size occurring in any one year.
AHD – *Australian Height Datum* – A standard level datum used throughout Australia, approximately equivalent to mean sea level.

Legend

	Extent of 1% AEP local catchment overland flow path. Generally depths less than 150mm is not shown.

Notes:

1. The contours shown above in yellow numbering are at 0.5m intervals and are based on Aerial Laser Scanning (ALS) Survey undertaken in 2002. The contour levels are approximate and for general information only. Accurate ground levels should be obtained by a Registered Surveyor.
2. The flood level is based on current information available to Council at the date of issue. The flood level may change in the future if new information becomes available. The 1% AEP flood is the flood adopted by Council for planning controls. Rarer and more extreme flood events will have a greater effect on the property.
3. Council's studies are reflected in flood mapping for the City which show properties potentially affected by overland flows in excess of 150mm.
4. This property is shown on Council's flood mapping as potentially so affected.
5. Council imposes flood related development controls where, in its opinion, such controls are justified. Such controls may or may not be imposed with respect to this property in the event of an application for development consent.
6. If a development proposal is submitted with respect to this property, Council will consider the possibility of flood or overland flow in the context of the application. Council may impose a requirement that the applicant for development consent carry out a detailed assessment of the possible overland water flows affecting the property (a flood study) and/or may impose other controls on any development designed to ameliorate flood risk.
7. You are strongly advised if you propose to carry out development upon the property, that you retain the assistance of an experienced flooding engineer and have carried out a detailed investigation.
8. Council accepts no liability for the accuracy of the flood levels (or any other data) contained in this certificate, having regard to the information disclosed in Notes "1" to "4". As such you should carry out and rely upon your own investigations.

Penrith City Council
PO Box 60, Penrith
NSW 2751 Australia
T 4732 7777
F 4732 7958
penrithcity.nsw.gov.au

Dr Elias Ishak
Senior Engineer – Floodplain Management

PENRITH
CITY COUNCIL

Flood Information
Lot 131 DP 710273 - No. 145 Stafford Street Penrith

Date of issue: 18 March 2021

The 1%AEP local overland flow flood level affecting the above property is estimated to be RL41.7m AHD.

Property less than 0.5m above the 1% AEP flood level is subject to Penrith Development Control Plan 2014 Section C3.5 Flood Planning. The Penrith Development Control Plan 2014 is available from Council's website www.penrithcity.nsw.gov.au.

Definitions

AEP – *Annual Exceedance Probability* – the chance of a flood of this size occurring in any one year.
AHD – *Australian Height Datum* – A standard level datum used throughout Australia, approximately equivalent to mean sea level.

Legend

	Extent of 1% AEP local catchment overland flow path. Generally depths less than 150mm is not shown.

Notes:

9. The contours shown above in yellow numbering are at 0.5m intervals and are based on Aerial Laser Scanning (ALS) Survey undertaken in 2002. The contour levels are approximate and for general information only. Accurate ground levels should be obtained by a Registered Surveyor.
10. The flood level is based on current information available to Council at the date of issue. The flood level may change in the future if new information becomes available. The 1% AEP flood is the flood adopted by Council for planning controls. Rarer and more extreme flood events will have a greater effect on the property.
11. Council's studies are reflected in flood mapping for the City which show properties potentially affected by overland flows in excess of 150mm.
12. This property is shown on Council's flood mapping as potentially so affected.
13. Council imposes flood related development controls where, in its opinion, such controls are justified. Such controls may or may not be imposed with respect to this property in the event of an application for development consent.
14. If a development proposal is submitted with respect to this property, Council will consider the possibility of flood or overland flow in the context of the application. Council may impose a requirement that the applicant for development consent carry out a detailed assessment of the possible overland water flows affecting the property (a flood study) and/or may impose other controls on any development designed to ameliorate flood risk.
15. You are strongly advised if you propose to carry out development upon the property, that you retain the assistance of an experienced flooding engineer and have carried out a detailed investigation.
16. Council accepts no liability for the accuracy of the flood levels (or any other data) contained in this certificate, having regard to the information disclosed in Notes "1" to "4". As such you should carry out and rely upon your own investigations.

Penrith City Council
PO Box 60, Penrith
NSW 2751 Australia
T 4732 7777
F 4732 7958
penrithcity.nsw.gov.au

Dr Elias Ishak
Senior Engineer – Floodplain Management

PENRITH CITY COUNCIL

Figure A 3.1 Flood Letter – Penrith City Council

A4 Appendix 4

Architectural Plans

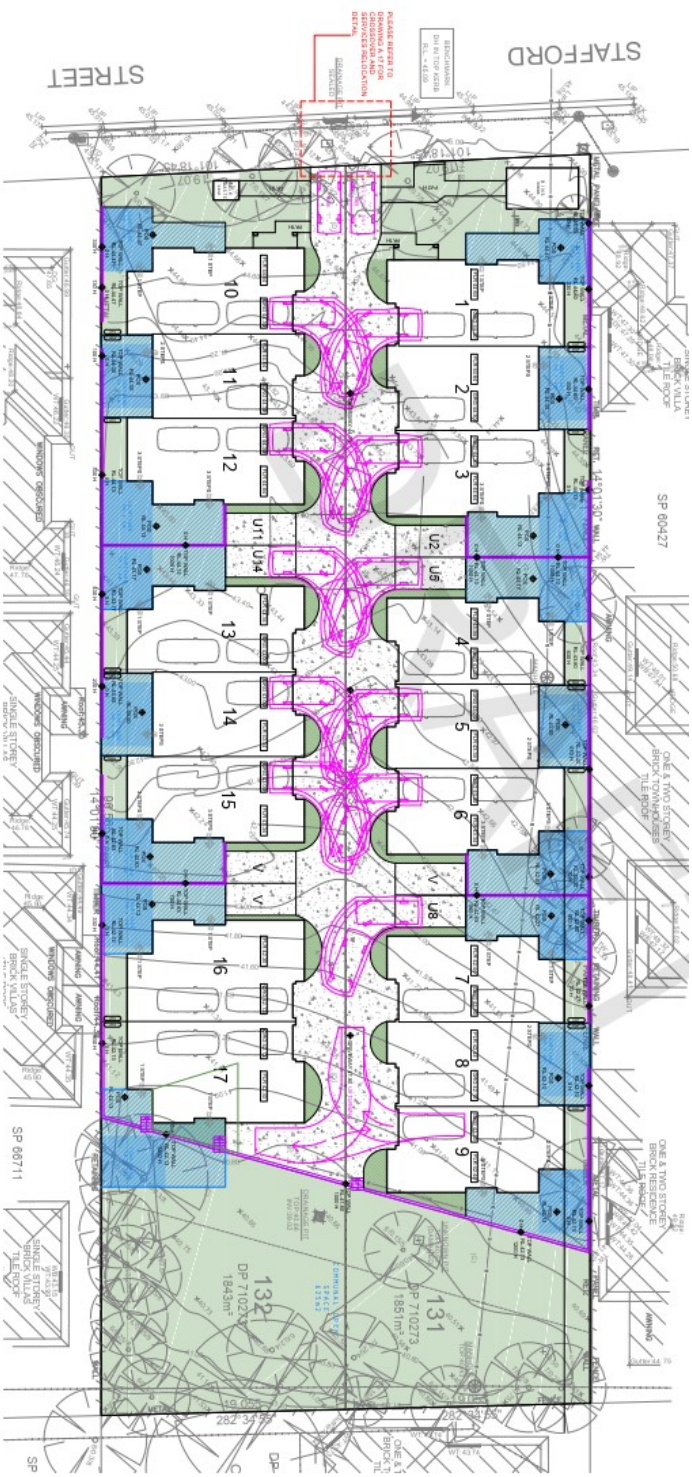

Figure A 4.1 Ground Floor Plan