**Reference:** **20220041-L02_flood letter[B].docx**

Date: April 29, 2022

Develotek
Attn: Robert Sargis
Level 10/97-99 Bathurst St,
Sydney NSW 2000

Dear Sir,

**RE: 15-19 NELSON STREET, CHATSWOOD – FLOOD STUDY**

## INTRODUCTION

A mixed-use development is proposed at the above site address. Willoughby 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.

## REFERENCE DOCUMENTS

The following documents have been referenced in this report:-

1. Site survey prepared by C&A Surveyors ref. 19232-21DET/ID dated 13/10/2021;
2. Architectural drawings prepared by DEM (Aust) Pty Ltd;
3. NSW Government "The Floodplain Development Manual – The management of Flood Liable Land" (2005);
4. Engineers Australia, *Australian Rainfall & Runoff*; and
5. Willoughby City Council Blue Gum Creek Flood Study Volume 1 – Report, Final Report.

## NATURAL & BUILT ENVIRONMENT

The site is made of four (4) existing residential lots and currently have four (4) separate buildings. The site falls in the Local Government Area of the Willoughby City Council.

The site is bounded by Gordon Ave to the North, a residential building to the East, Nelson St to the South and a residential building in part and a laneway in part to the West.

The site has an irregular shape and is characterised by a sloping natural gradient from South to North. Figure 1 shows the location of the site.

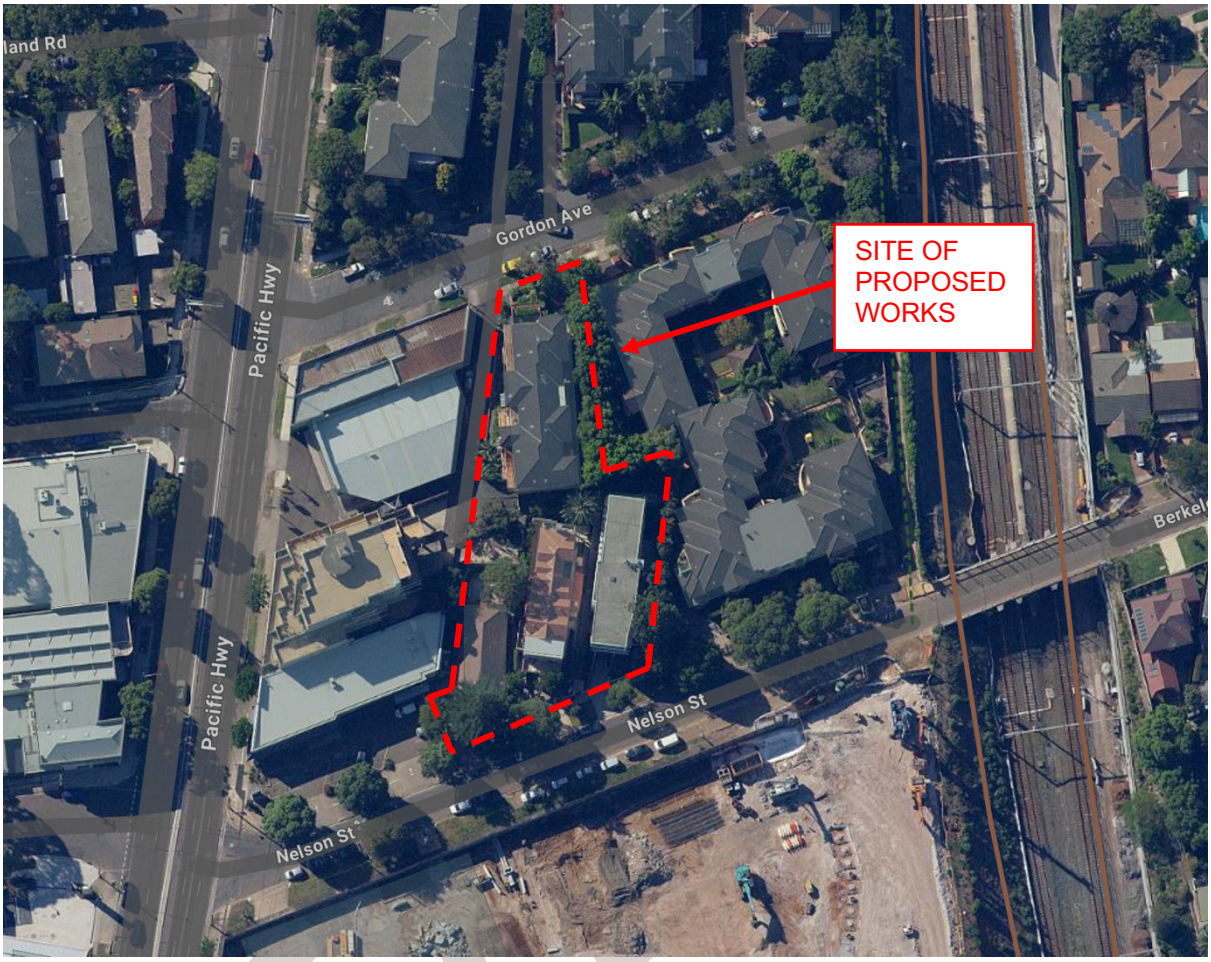


**Figure 1 Locality Plan**

## PROPOSED DEVELOPMENT

The proposed development involves the construction of a large mixed-use development as depicted on the architectural plans by DEM. Figure 2 below shows an extract of the site plan from the architectural drawings.

The development includes basement carparking levels, retail on ground floor, commercial on level 1 and multiple residential levels on top.

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

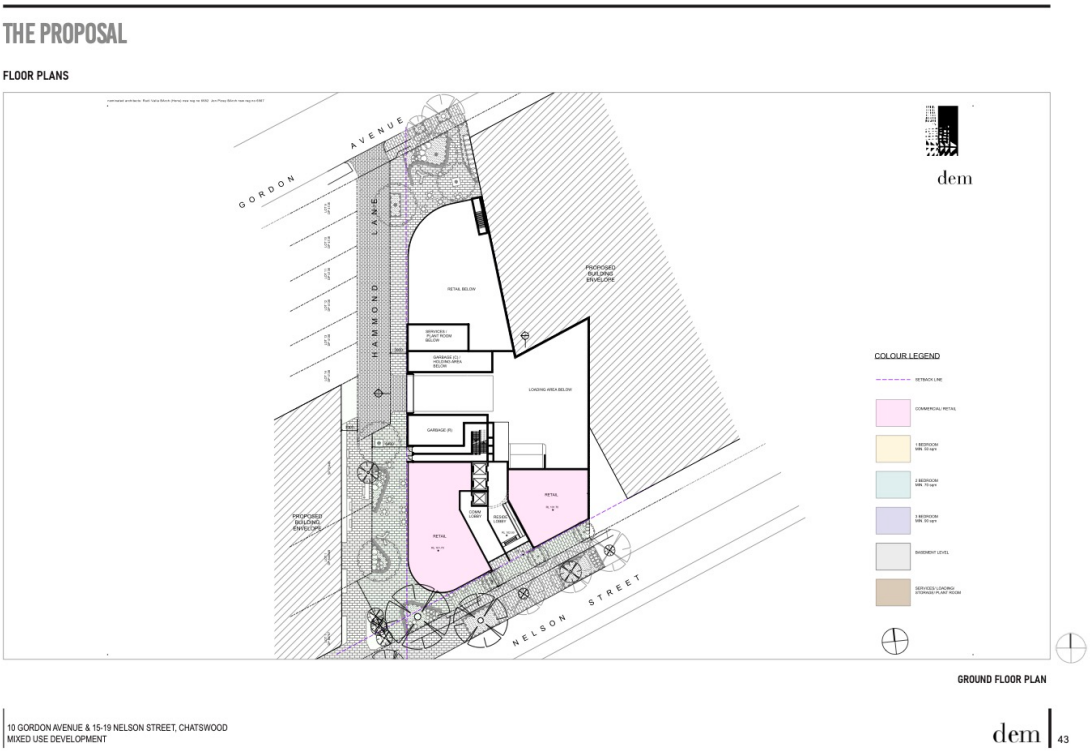


**Figure 2 Proposed Site Plan**

## FLOOD STUDY

### Willoughby 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.

### 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 XP-Storm capabilities of rain on grid. A range of rainfall events were simulated based on ARR2019. The rainfall data is included below for reference.

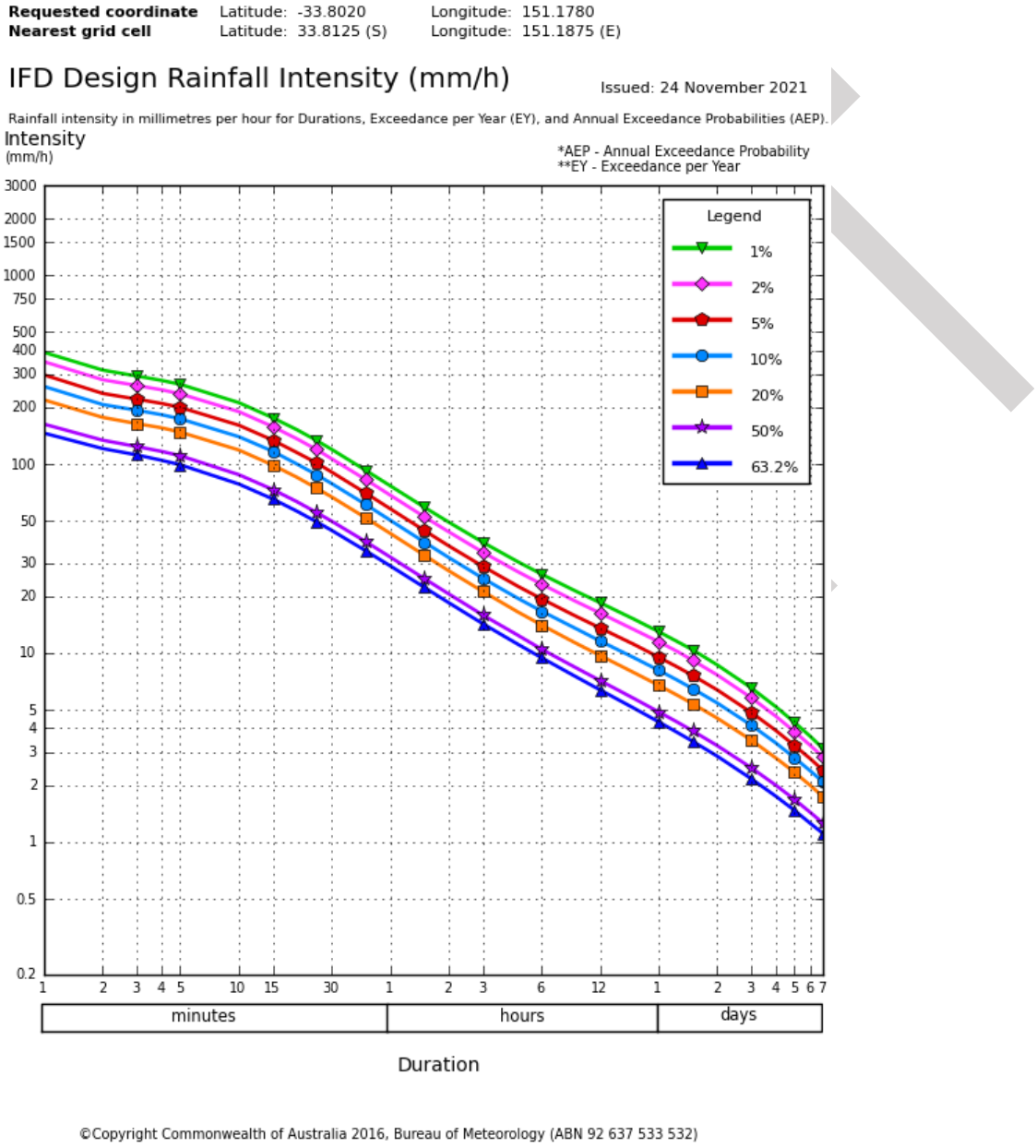


**Figure 3 Rainfall Data (source BOM)**

The highest median storm was determined and considered for the modelling. The critical storm burst is the 1% AEP 10min 6.

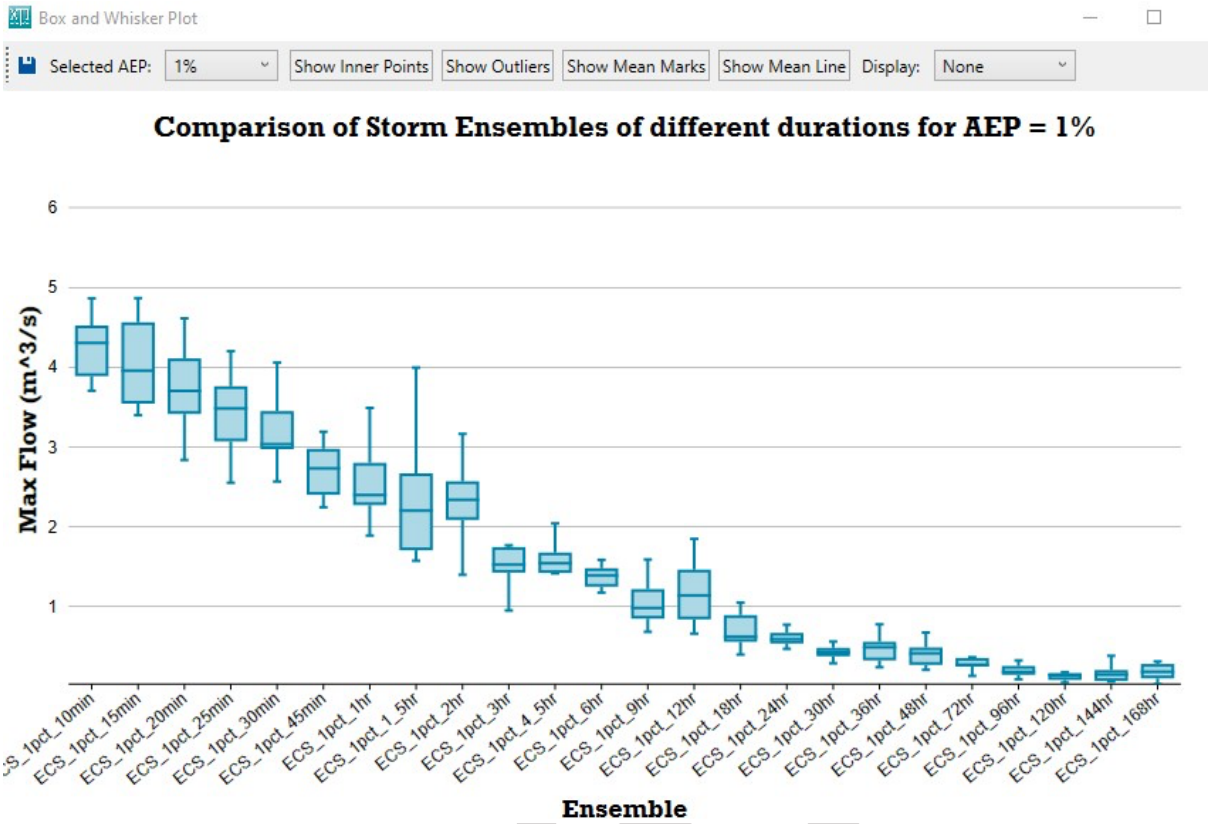


**Figure 4** **1% AEP Median Storm from XP Hydrology**

## Hydraulic Modelling

### Definition

The model a dynamically lined 1D/2D model using XP-STORM which uses TUFLOW for its 2D engine. A grid size of 5m x 5m is used in the study with a finer grid of 2x2m used around the site area as requested by Council.

### 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 1% AEP flood level plus 500mm freeboard. The crest of the basement driveway is set at 1% AEP flood level plus 300mm freeboard as required by council.

### 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 pipes are modelled with a Manning's roughness n = 0.014.

The pit/pipe infrastructure is modelled using the 1D capability of XP-Storm. The 1D pits are linked to the 2D terrain using the "link Crest to 2D" feature in the model. This allows the pits to surcharge into the 2D domain when the capacity of the 1D model is exceeded and for the water to flow back into the 1D model from the 2D domain once there is capacity in the 1D model.

## 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 BCC Engineering Guidelines.

**Table 1 2D Landuse Details**

| Landuse | Roughness |
|---|---|
| Building | 10 |
| Roads | 0.02 |
| Rail | 0.035 |
| Open Spaces | 0.08 |
| Water Bodies | 0.01 |
| Lots | 0.1 |

The existing building on site is also modelled as full obstructions (made inactive in the model grid). The existing and the proposed buildings within the site are similarly made inactive and block the flows completely.

## Downstream Boundary

The downstream boundary is set at the pedestrian culvert under the railway line just upstream of the oval. The boundary is set more than 300m downstream of the site and is more than 5m below the site level so that it has no impact on flooding regime at the site.

## Design Flood Modelling Results

Design flood modelling was undertaken for the 1% AEP design flood event. The results are presented in Appendix 1 of this report.

## Discussion

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

1. The site is not affected by flooding directly. The flows are confined to the street frontage;
2. The proposed habitable areas are raised at or above the Flood Planning Level (FPL). Reference is made to the recommendations below for details;
3. The basement entry driveway is provided with a crest set at the 1% AEP flood level plus 300mm freeboard; and
4. The requirements of the DCP should be implemented.

In our opinion, the proposed building can be constructed without changing flooding patterns around the site.

## Conclusions

A detailed investigation on the flooding behaviour has been undertaken in the vicinity of the proposed development at 15-19 Nelson Street and 10 Gordon Avenue, Chatswood.

Using a new model setup and built by SGC, 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 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*




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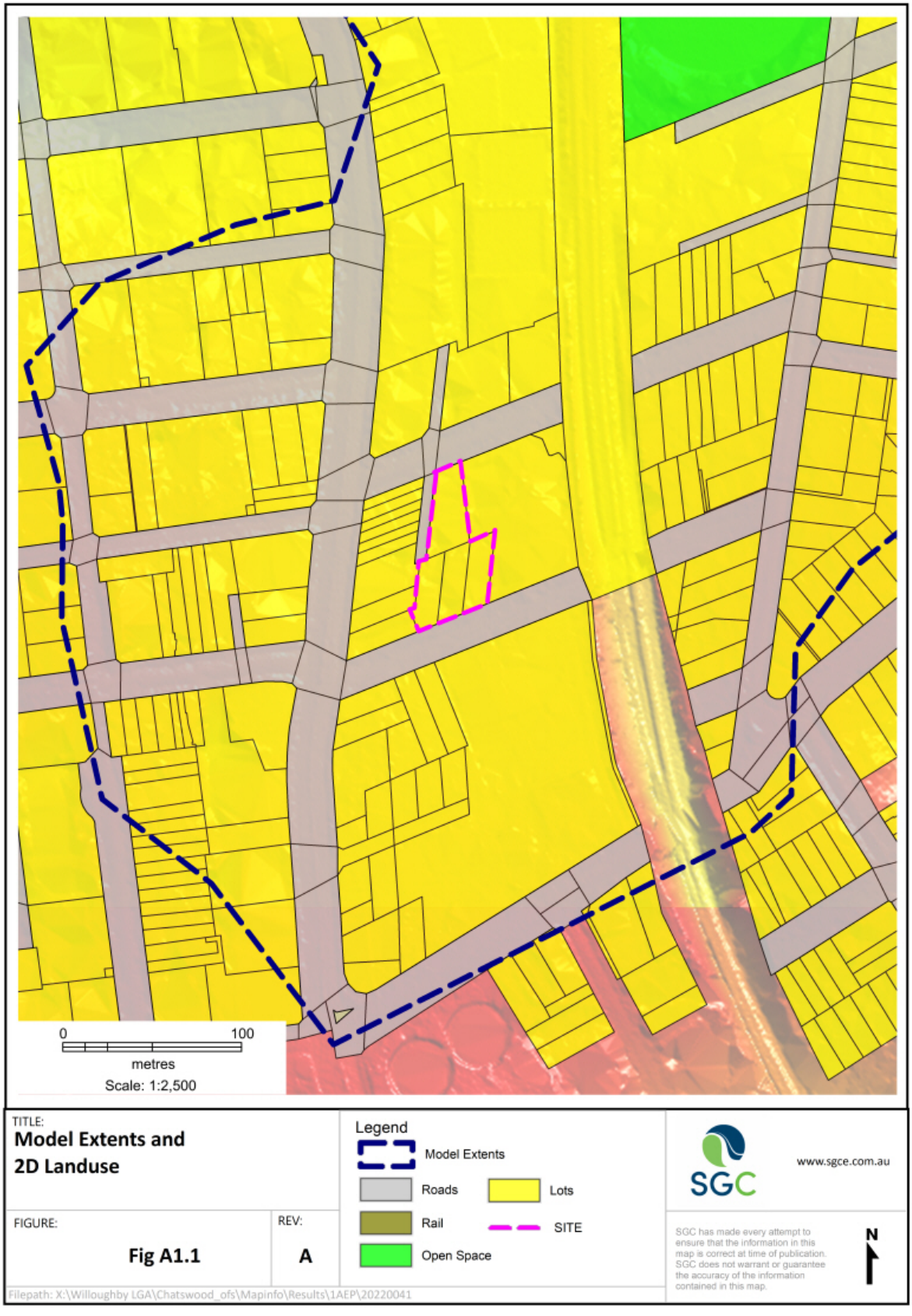


**Figure A 1.1 Model Extents & 2D Landuse**

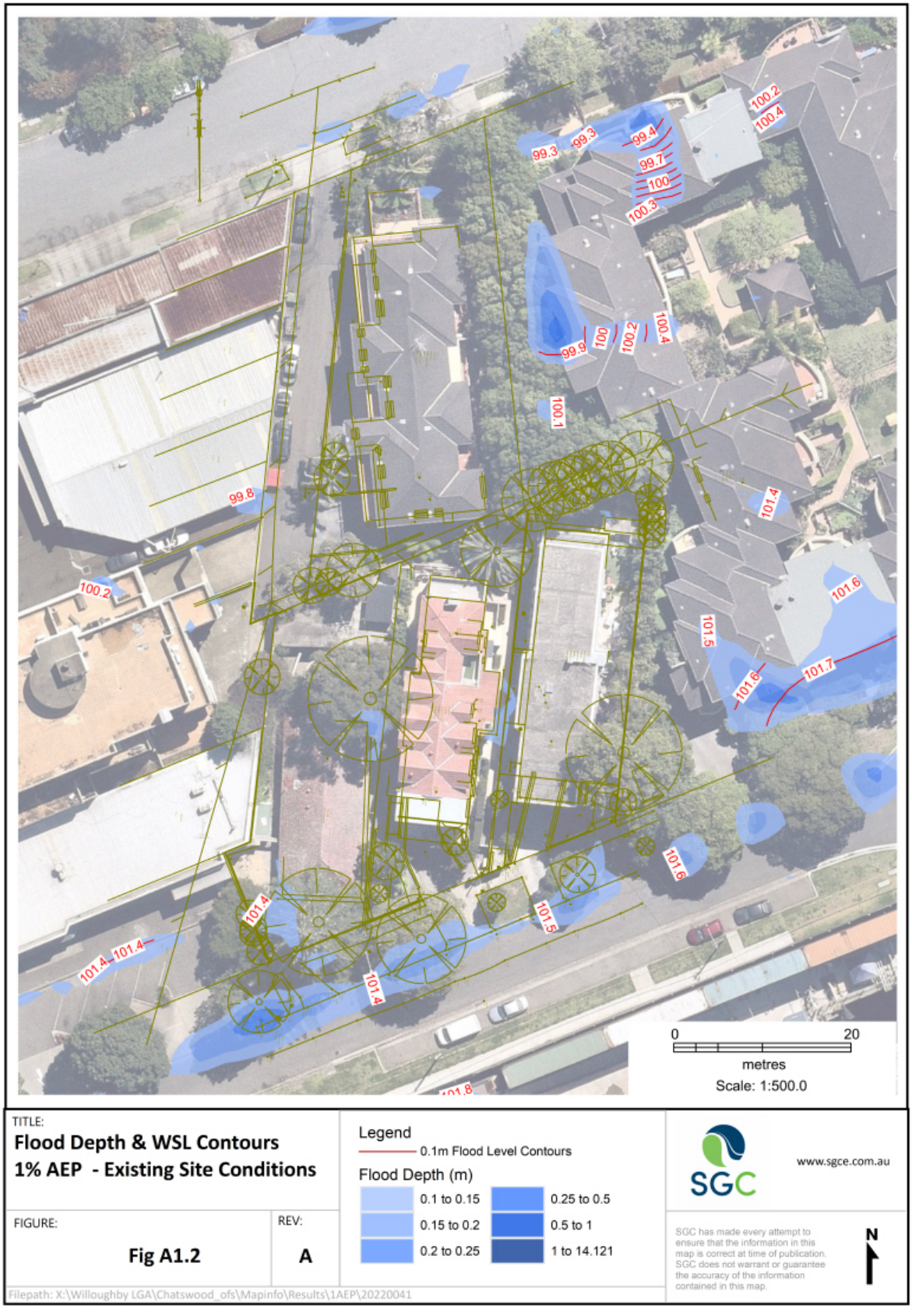


**Figure A 1.2 1% AEP Flood Depth & WSL – Base Scenario**

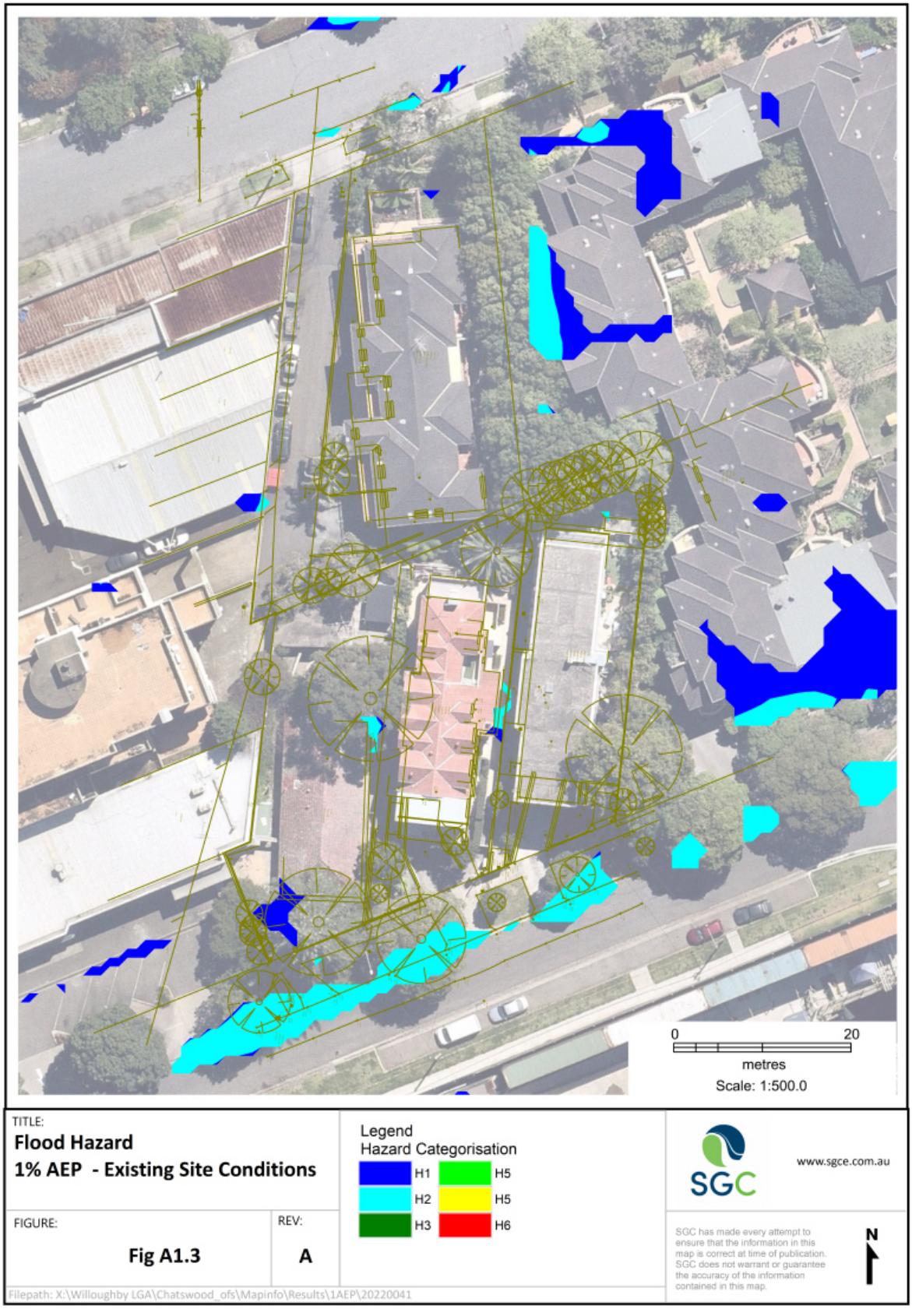


**Figure A 1.3 1% AEP Flood Hazard – Base Scenario**

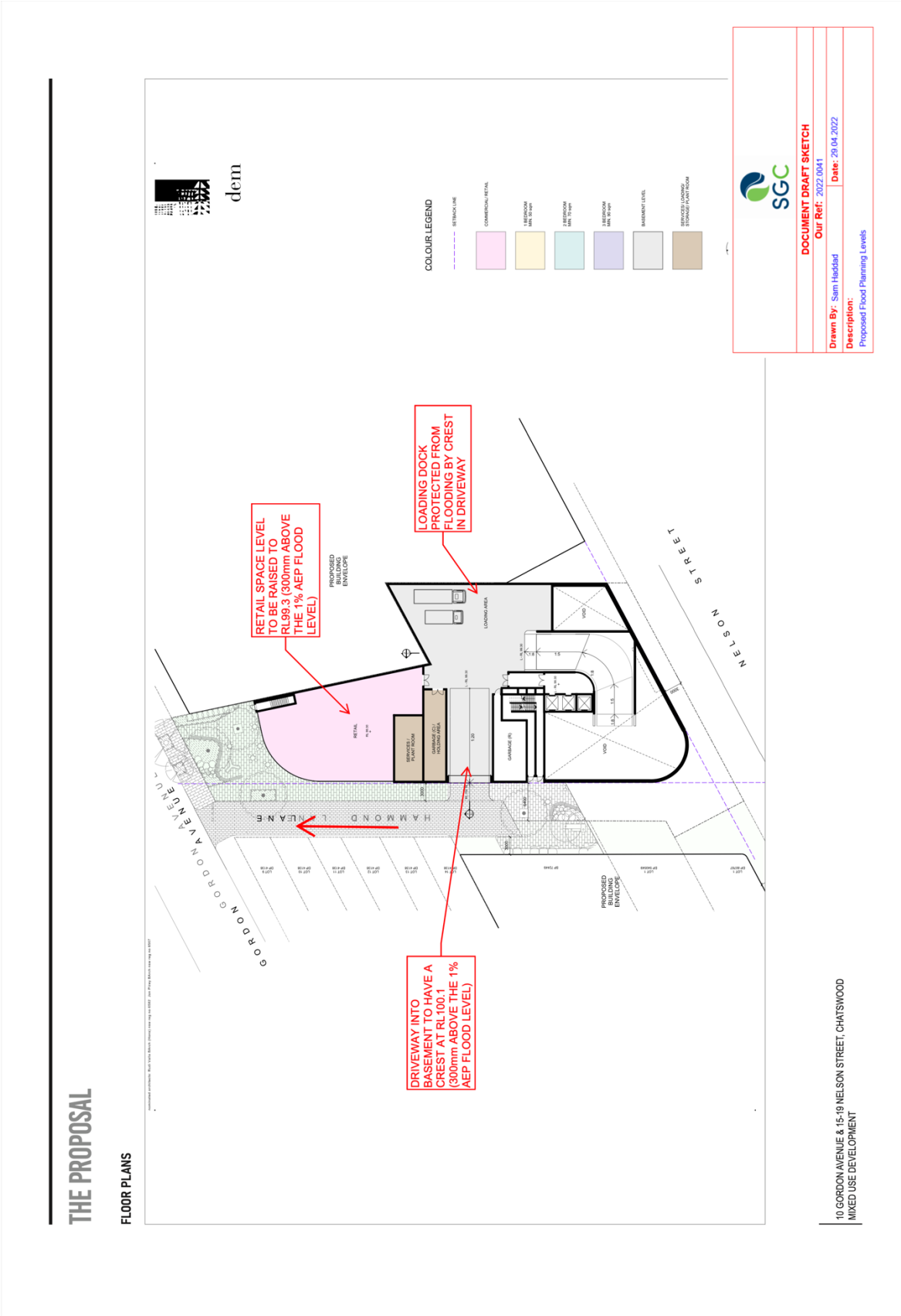


**Figure A 1.4 Proposed Flood Planning Levels – Lower Ground Floor**


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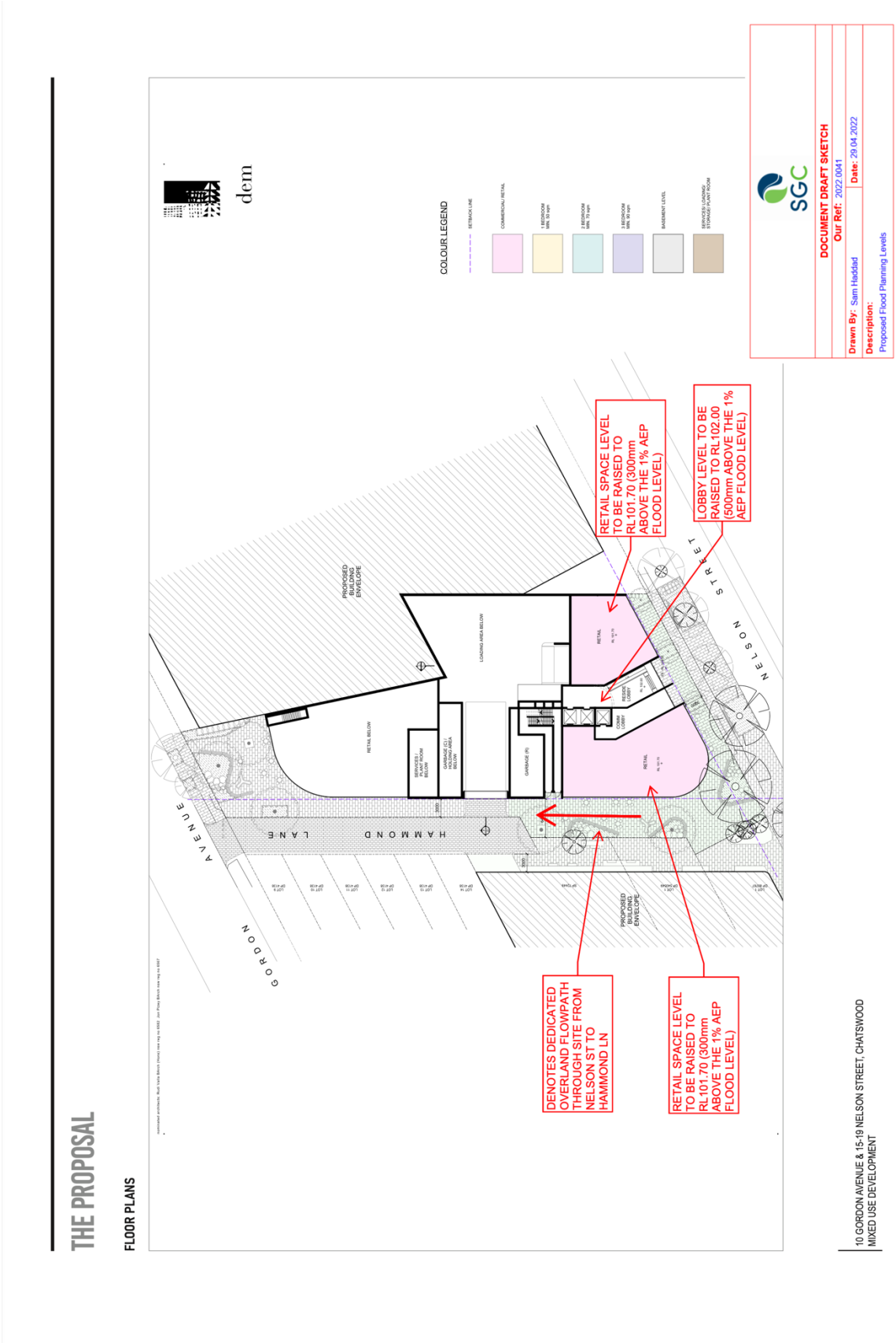


**Figure A 1.5 Proposed Flood Planning Levels – Ground Floor**

# A2 Appendix 2

*Survey Plan*





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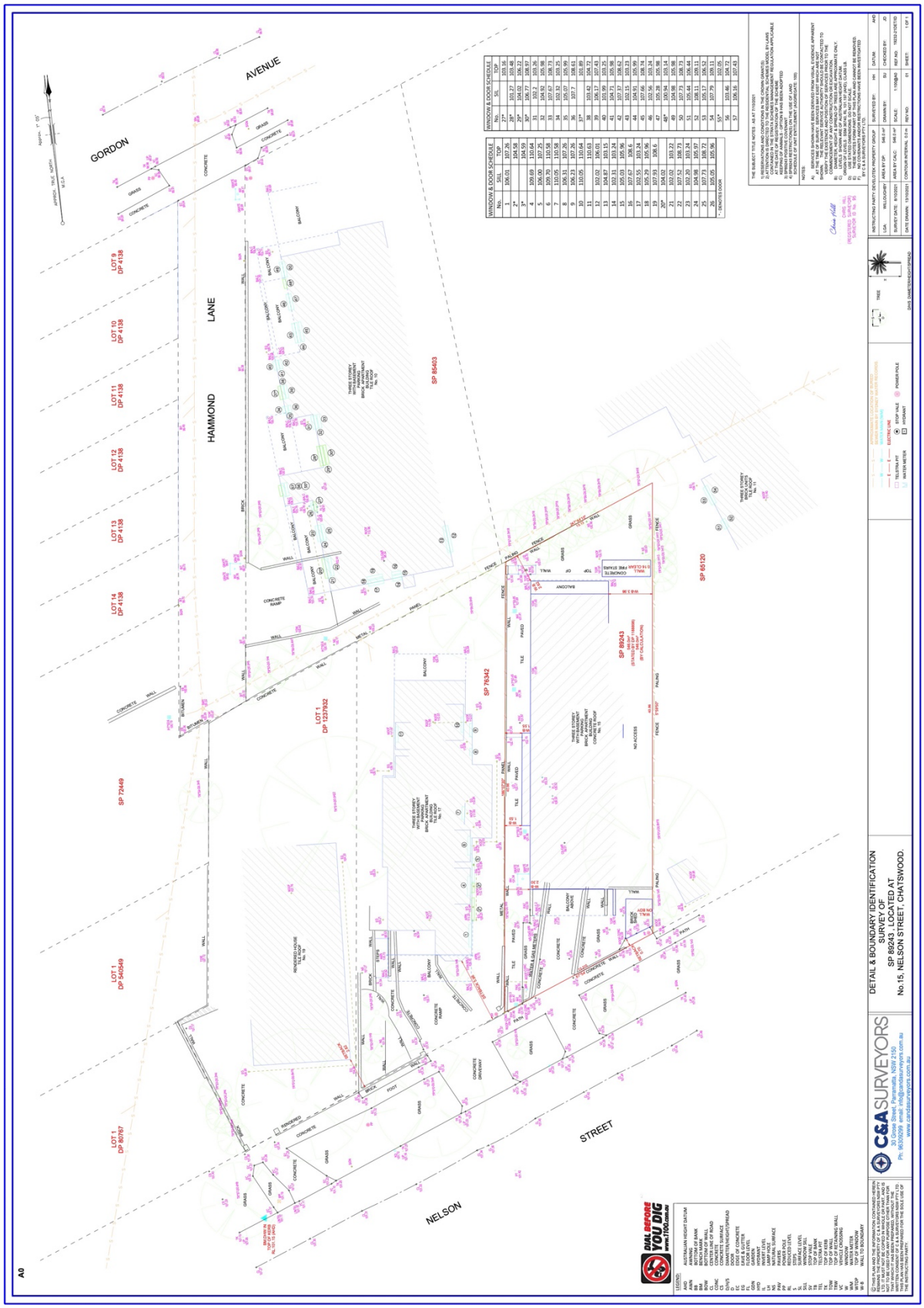


**Figure A 2.1 Survey Plan**

# A3 Appendix 3

*Architectural Plans*





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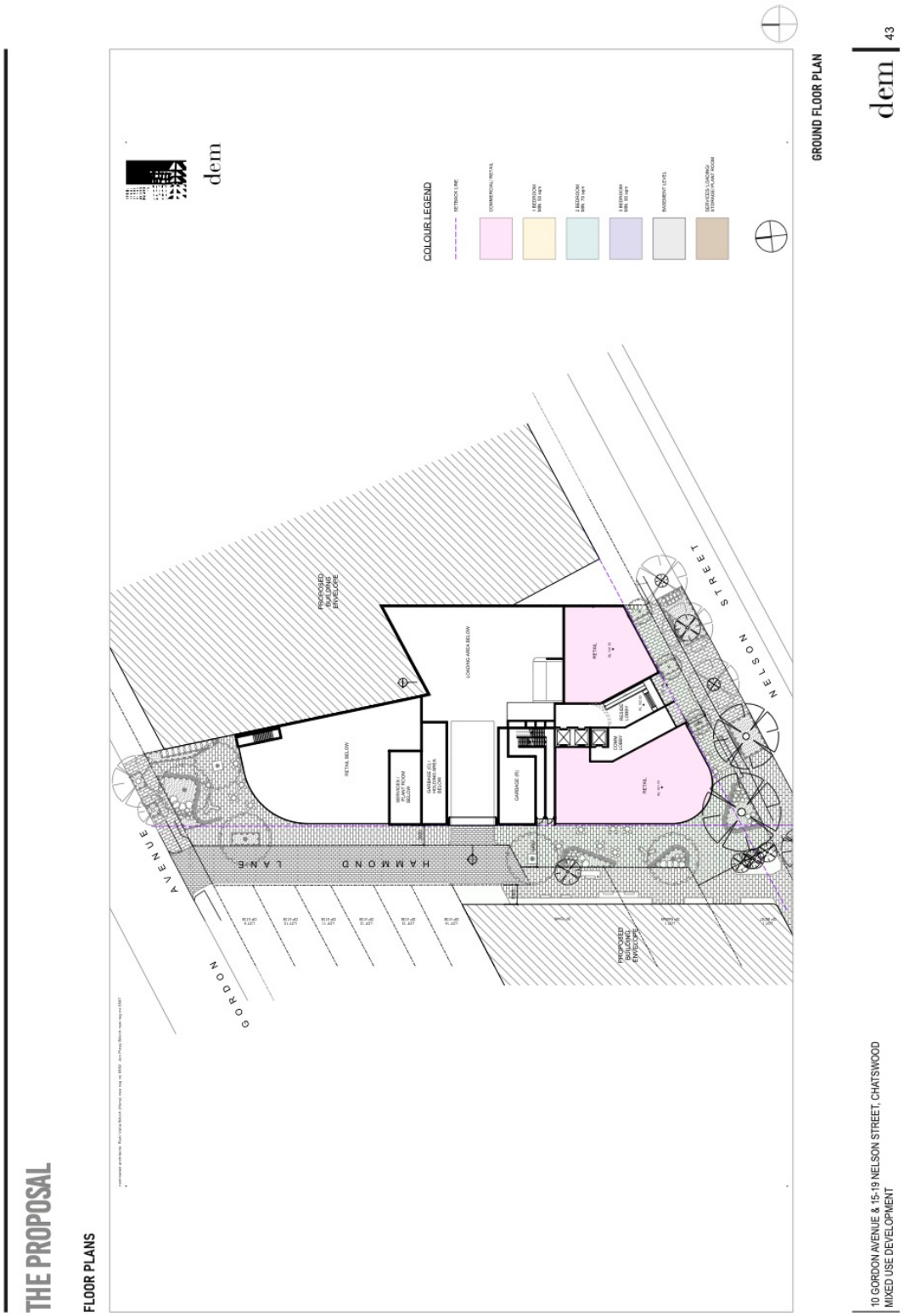


**Figure A 3.1 Architectural Plans – Ground Floor**