Engineering Value

Reference: 2019.0191-R01 [C]

Date: June 28, 2021

Design Cubicle P/L
44 Sorrell Street
North Parramatta NSW 2151

RE: RESIDENTIAL SUBDIVISION & DEVELOPMENT – 205-209 GRANGE AVENUE, MARSDEN PARK FLOOD STUDY REPORT

INTRODUCTION

A residential subdivision and residential flat building development is proposed at the above site, which is partially affected by mainstream flooding from Bells Creek.

REFERENCE DOCUMENTS

The following documents have been referenced in this report:-

1. Site survey prepared by TSS Total Survey Solutions dated 24/10/2017;
2. Proposed plan of subdivision prepared by Design Cubicle ref. 180916;
3. NSW Government "The Floodplain Development Manual – The management of Flood Liable Land" (2005);
4. Engineers Australia, Australian Rainfall & Runoff; and
5. Pre-DA meeting notes by Blacktown City Council dated 20/03/2019.

NATURAL & BUILT ENVIRONMENT

The site is located in a rural area in Marsden Park, approximately 40kms north west of Sydney CBD. The site falls in the Local Government Area of Blacktown City Council.

The site is bounded by similar adjoining rural properties to the West, to the South and to the East, and Grange Avenue to the North.

The site has a rectangular shape and is characterised by a natural gradient from West to East where a low-lying area can be shown within the site. The low-lying land continues upstream and downstream of the site and is characterised by series of dams and ponds used for farming purposes and eventually join Bells Creek. ***Figure 1*** shows the location of the site.

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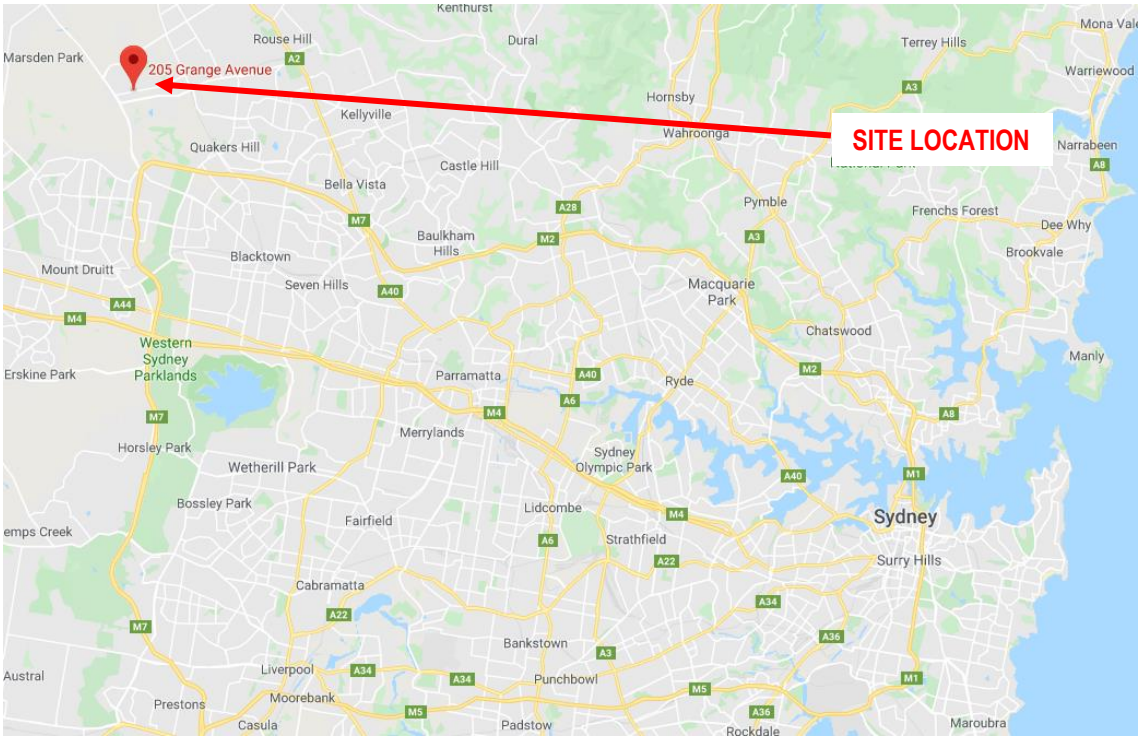

Figure 1 Locality Plan

Council's Requirements

Blacktown City 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.

This report should be read in conjunction with the stormwater and civil plans proposed for the Development Application.

A copy of Council's Floodplain Engineer's pre-DA notes is include below.

3. Flooding (Mainstream flooding & PMF)

i. The property is subject to State Environmental Planning Policy (Sydney Region Growth Centres) 2006. It is identified on the Development Control Map as "Flood Prone and Major Creeks Land". Clause 19 of the Growth Centres SEPP provides heads of consideration when a development application is lodged on land affected by "Flood Prone and Major Creeks Land". Furthermore Council's GIS flood map has also identified the land as flood affected by the PMF.

ii. The SEPP maps indicate the extent of flood prone land based on existing conditions at the time of preparing the precinct planning. Therefore, they may not include any changes resulting from subsequent development or infrastructure works. As a result, Council requires a flood study report. A pre vs post Flood Study is required to justify that there is no adverse impact to the neighbouring properties as a result of the development in a 1 in 100 year ARI flood. A flood model or flood model parameters (Boundary conditions/hydrographs) are available if needed to run a more localised model for the subject site, otherwise a full flood model can also be provided for a fee. This information can be obtained by contacting FloodAdvice@blacktown.nsw.gov.au

iii. The model is to be rerun with the 100year storm with 15% additional rainfall to allow for climate change. This level is the minimum habitable floor level with the addition of freeboard as below.

iv. Set the floor level to be the higher of, a minimum 500mm above the 1 in 100 year ARI with climate change or 225mm above finished ground level.

v. The proposed basement must be sealed and openings are not allowed in the basement below 0.5 m above the 1 in 100 year ARI with climate change.

vi. Any vehicular access to a basement garage must ramp up to a minimum of 0.5 m above the 1 in 100 year ARI flood level with climate change before ramping back down into the basement. Ramp to be designed to AS2890.

vii. A Flood Management Plan is also required. Detail how the site will be evacuated from the development; what will be the trigger for evacuation and how will this be communicated to the occupants of the sites before and during a flood event. Consider whether shelter-in-place or external evacuation is appropriate for the site.

viii. A separate application to Council may provide additional information to assist in flood assessment at this site such as catchment boundaries, or Aerial Laser Survey (ALS) for a fee. Email FloodAdvice@blacktown.nsw.gov.au for further information.

ix. Refer to Part A of DCP 2015 for developing on flood prone land controls.

x. The development sites are to be filled to a minimum of 500mm above the final 100 year flood level.

xi. A viable area E3 (typically minimum 250m2) is to be provided for the E3 land filled to the 100year + 0.5m and including a vehicular access ramp for future maintenance of the area. The fill need for this is to be modelled in the study. Maximum batter slope is 1V:4H and ramp typically 1:10 or 1:6.

xii. Provide an Australian Height Datum (AHD) survey signed (certified) by a registered surveyor of the whole subdivision. The survey plan will need to show the origin and level of the bench mark used.

xiii. Pipes & pits conveying flows across development lots at trapped low points are to be modelled with a 50% blockage factor. The critical 100 year ARI storm is to be used for the flood study.

xiv. Consider the fill ramps required to drive into the E3 land as a blockage;

xv. Provisional Hazard V x D <= 0.4 except where existing V x D > 0.4 whereas this value is not to be increased.

Figure 2 Pre-DA Notes

OBJECTIVES

The purpose of this flood study is to determine the extent of the flood affectation across the site due to the mainstream flooding from Bells Creek and to determine the measures (if any) that need to be implemented for the development not to have any adverse impact on the flooding characteristics and behaviour.

In summary, the objectives are as follows:-

- Prepare a detailed 2D flood model based on the TUFLOW model purchased from Council for the whole creek catchment and producing the flood levels across the site;
- Define design flood levels, velocities and depths for the catchment for the existing site conditions;
- Modify the site condition to post-development to predict the new flood levels, velocities and depths;
- Determine if the proposed development has any adverse impact on flooding;
- Propose mitigation measures; and
- Adopt these measures in the subdivision layout plan.

HYDROLOGY MODEL

A hydrologic model combines rainfall information with the whole bells creek characteristics to estimate a runoff hydrograph. For this study, A TUFLOW model is purchased from Blacktown City Council.

DESIGN RAINFALL

The TUFLOW model purchased from Blacktown City Council is to be run with the 1% AEP storm **with 20% additional rainfall to allow for climate change as per Council's pre-DA notes.**

HYDRAULIC MODEL

Definition

A hydraulic model converts runoff (traditionally from a hydrological model) into water levels and velocities throughout the major drainage/creek systems in the study area (known as the model 'domain', which includes the definition of both terrain and roughness). The model simulates the hydraulic behaviour of the water within the study area by accounting for flow in the infrastructure (ignored in this model) as well as potential overland flow paths, which develop when the capacity of the infrastructure is exceeded. It relies on boundary conditions, which include the runoff hydrographs produced by the hydrologic model and the appropriate downstream boundary.

A 2D hydraulic model was established for the study area. TULOW is a dynamic hydraulic modelling system developed by BMT WBM and is used in this study. TUFLOW is used world-wide and has been shown to provide reliable, robust simulation of flood behaviour in urban and rural areas through a vast number of applications.

CRITICAL DURATION

The critical duration is 6hr for the 1% AEP event as advised by Council Engineer from Flood Advice department.

2D MODEL SETUP

Two-dimensional (2D) hydraulic modelling was carried out to determine the flood behavior in the study area. A grid size (4.0m x 4.0m) was deemed necessary to define the extent of the flooding through the developed areas.

Model Terrain

A terrain grid (also referred to as a 'topographic' grid) was developed to represent ground elevations based on ALS data provided by LPI. For the proposed scenario, the design road contours as well as the proposed retarding basin and 250m2 E3 zone with driveway access have been overlaid on the existing natural ground floor for any changes of flood behaviour assessment.

BOUNDARY CONDITIONS

Based on Council's TUFLOW model, the tail water level set at the downstream for the scenario 1% AEP with 20% additional rainfall is 18.98.

DESIGN FLOOD MODELLING RESULTS

Design flood modelling was undertaken for the 1% AEP design flood event. The results are presented at the end of this report. The Flood Planning Level (FPL) is 0.5m above the 1% AEP flood levels across the site.

IMPACT ASSESSMENT AND FLOOD MITIGATION MEASURES

The impact of the proposed development is assessed in this study. The proposed development & road levels are set to be higher than the 1% AEP flood levels and are a complete blockage to the flooding. A flood impact map is also produced.

- **As part of flood mitigation measure, a 600m3 retarding basin is proposed within our site boundary to the South East of the proposed subdivision road in the E3 land. It will act as a flood storage for compensating the flood storage volume loss due to the proposed buildings, roads & 250m2 viable E3 land as requested by Council. Refer to Civil Works Plans 20190191 CW [E] SHEET C204 for more details.**

The results of the modelling incorporating flood mitigation measures indicate that the proposed development will have insignificant impacts to the existing water regime.

DISCUSSION

This section of the report provides a review of the results and discusses Council's requirement as stated in pre-DA notes.

1. The proposed subdivision does not have any adverse impacts on the flooding elsewhere in the floodplain, there is a minor flood changes (maximum 50mm) within the future E3 zone, however, this level of changes is too small and can be neglected; and
2. Provisional Hazard V x D has not been increased between the existing and proposed scenarios;
3. 600m3 flood storage basin is adequate as there is no adverse flooding impact on neighbouring properties due to the proposed development as shown in Figure A2.5.

In our opinion, the proposed subdivision incorporating proposed flood mitigation measure 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 205-209 Grange Avenue, Marsden Park.

Using a 2D 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 flood maps are included at the end of this report. The study addressed Council's requirements as per the DCP. In our opinion, Council should allow the proposed subdivision 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 & Principal Engineer (Civil)

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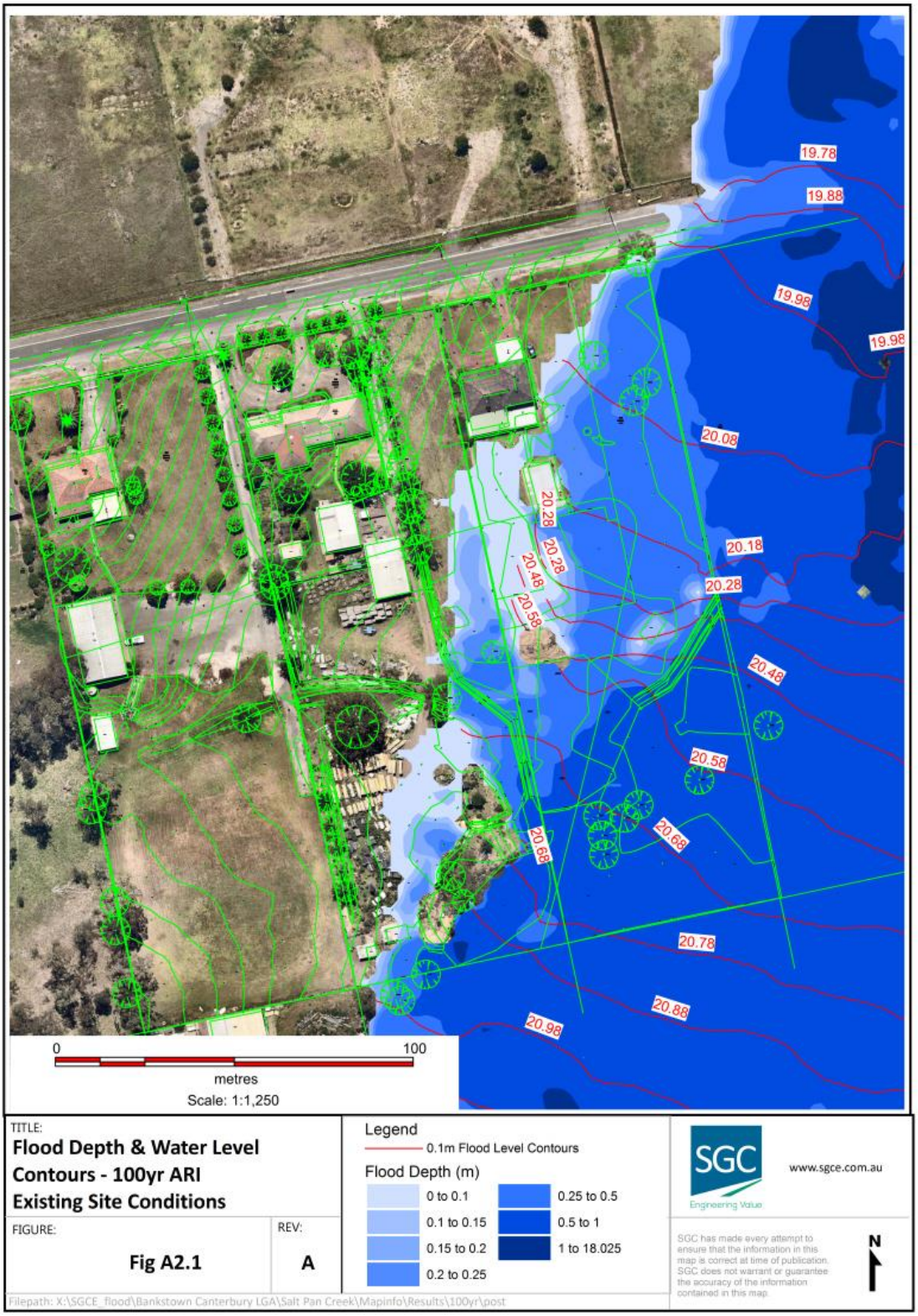

Figure A2.1 Flood Depth & Water Level Contours – 100yr ARI – Existing Site Conditions

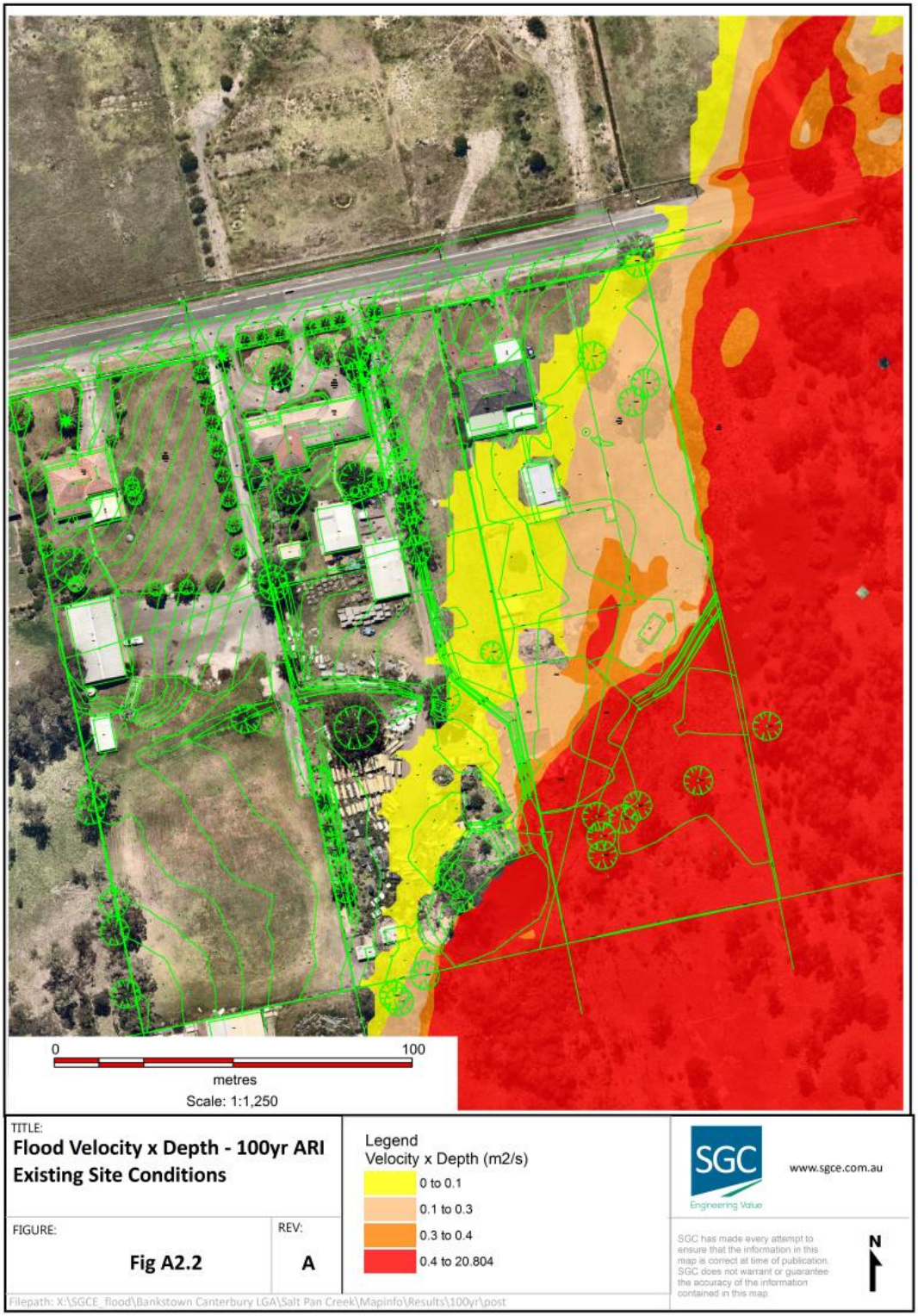

Figure A2.2 Flood Velocity x Depth – 100yr ARI – Existing Site Conditions

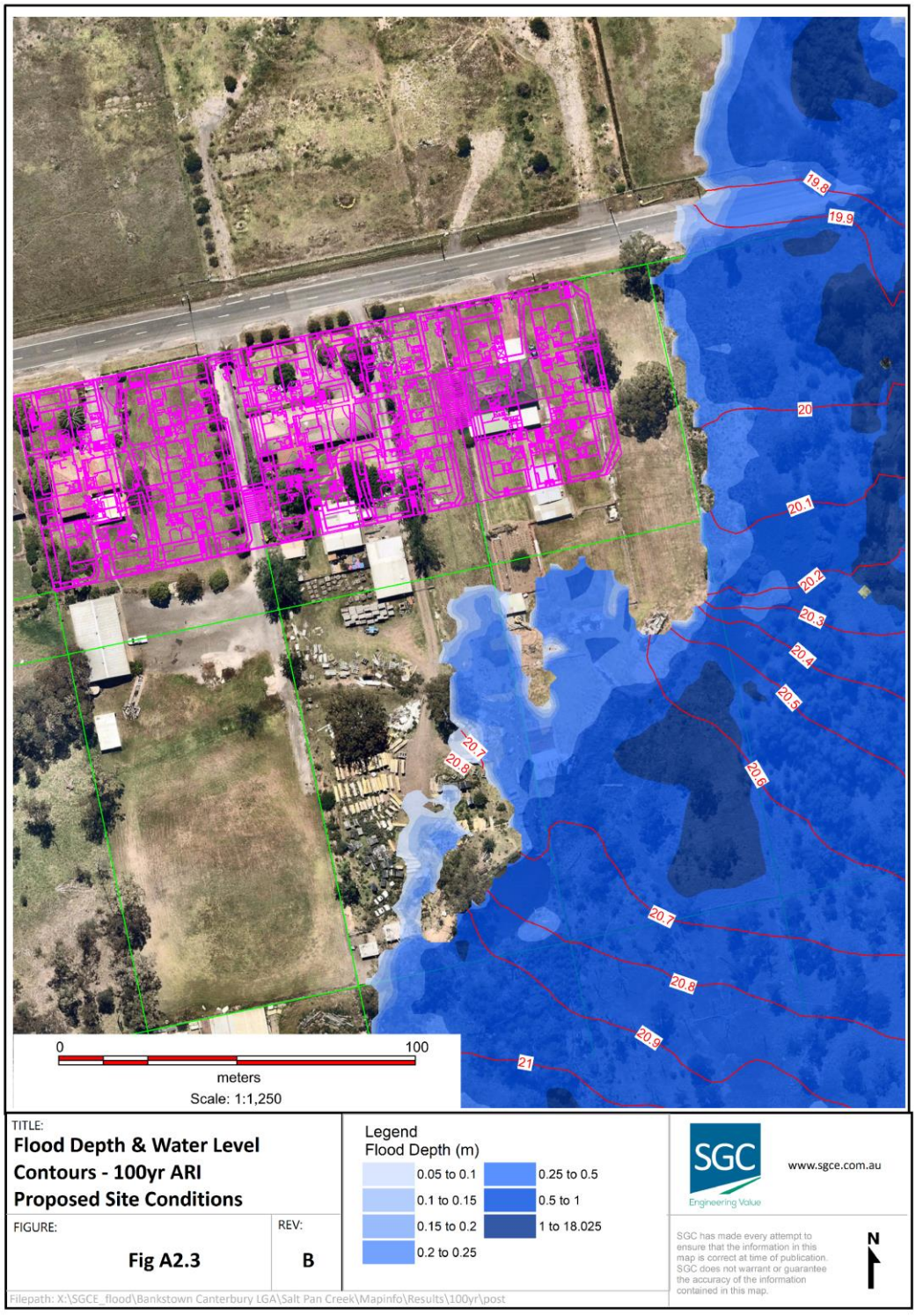

Figure A2.3 Flood Depth & Water Level Contours – 100yr ARI – Proposed Site Conditions

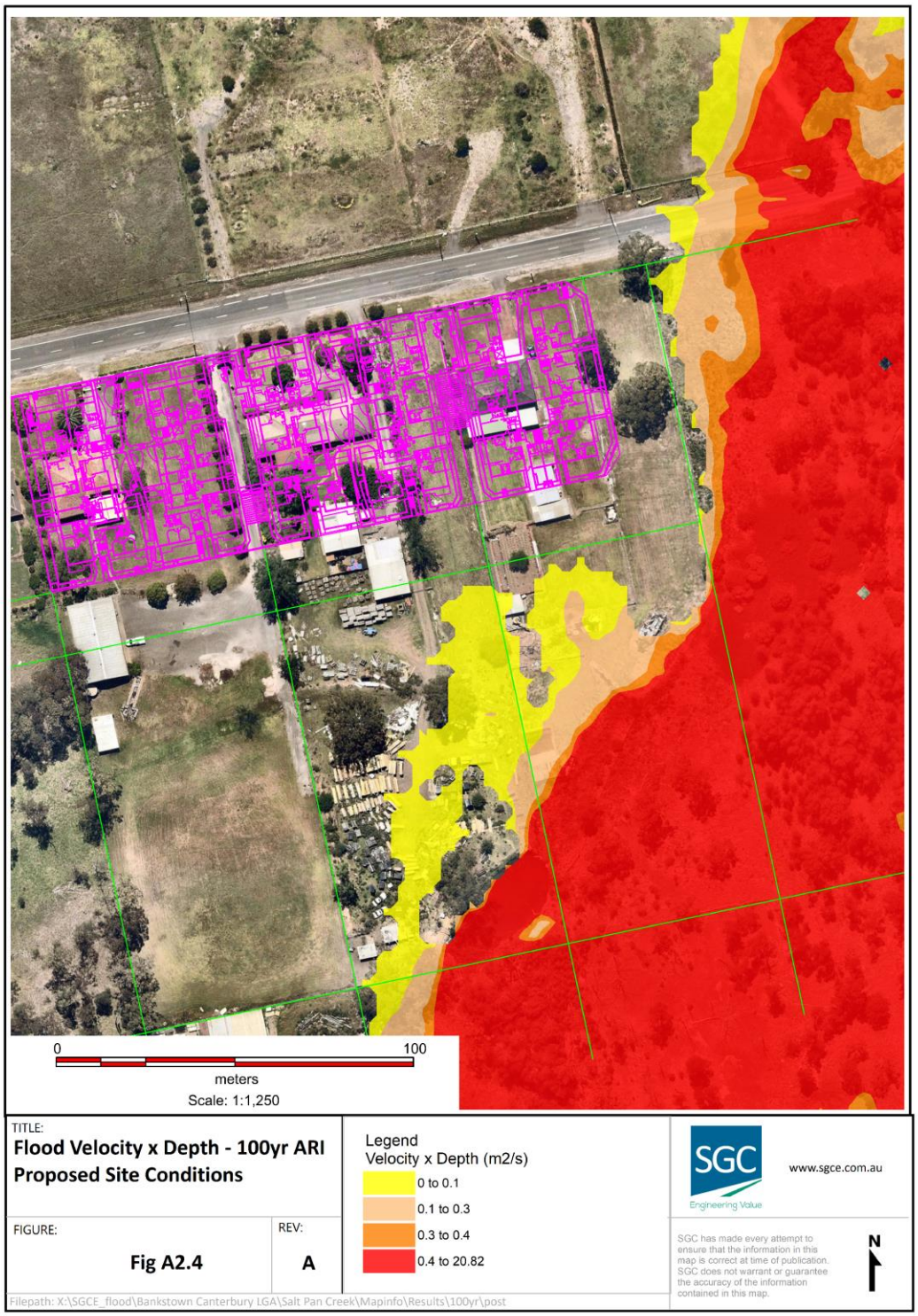

Figure A2.4 Flood Velocity x Depth – 100yr ARI – Proposed Site Conditions

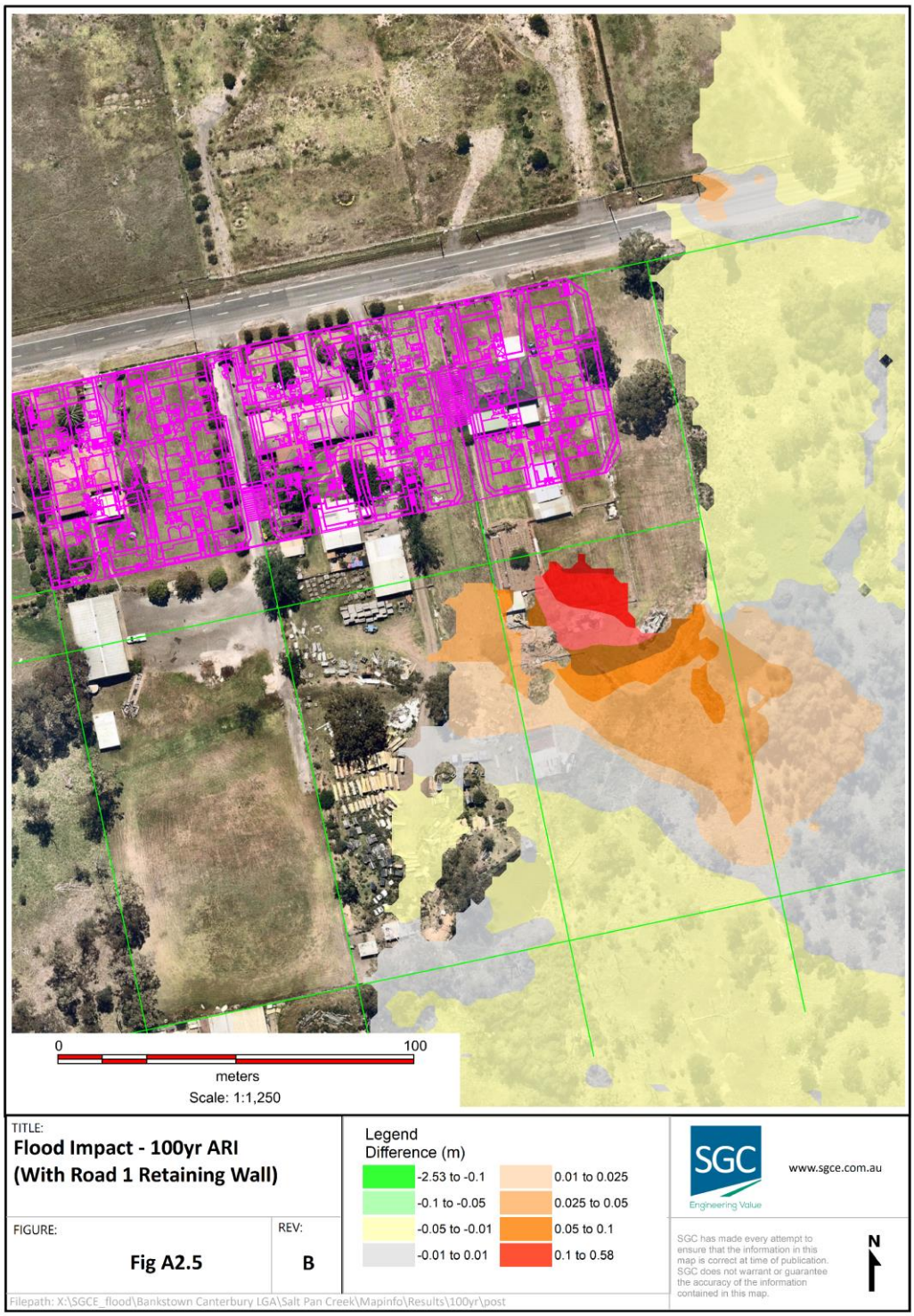

Figure A2.5 Flood Impact – 100yr ARI (with Road 1 Wall)

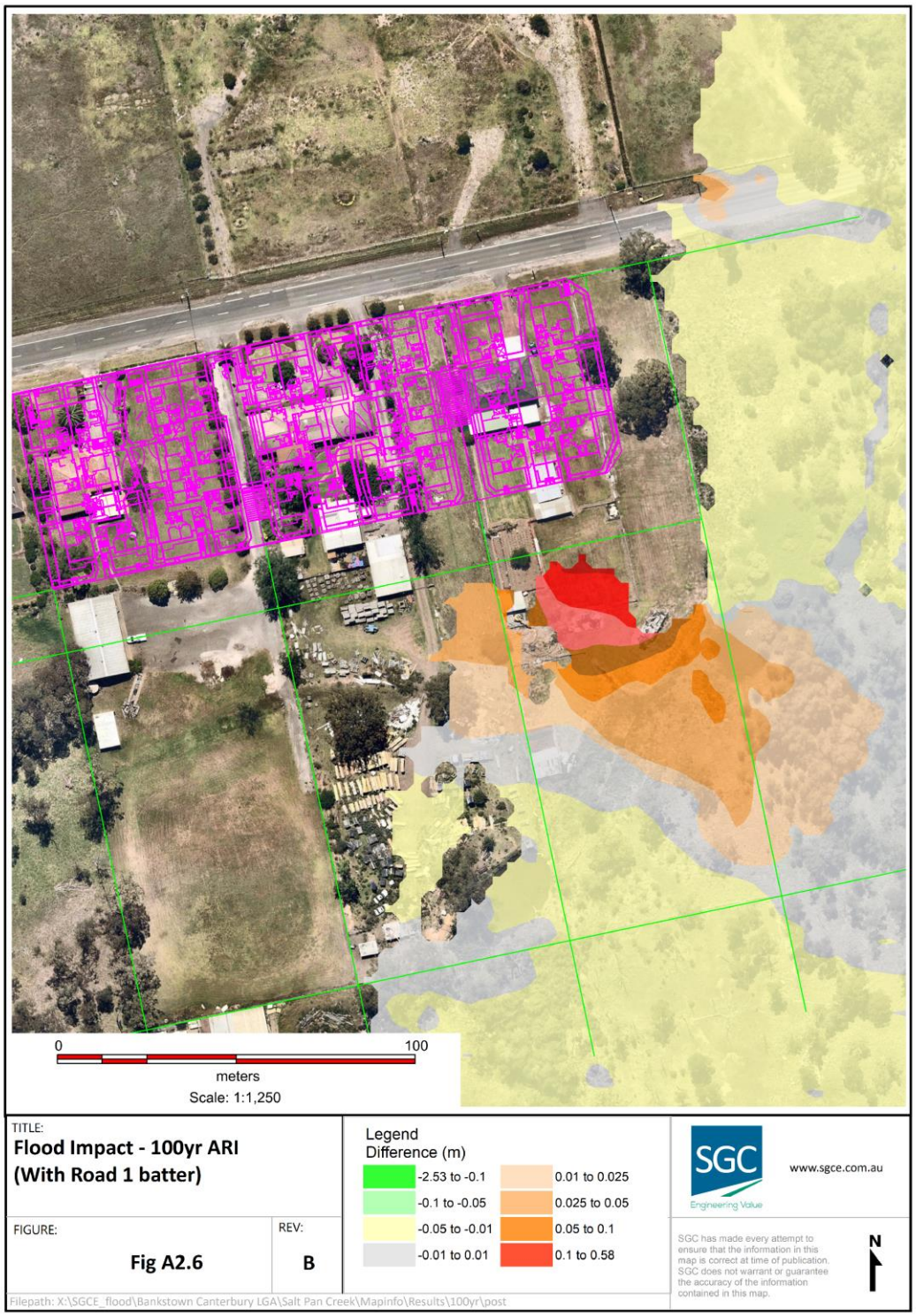

Figure A2.6 Flood Impact – 100yr ARI (with Road 1 batter)

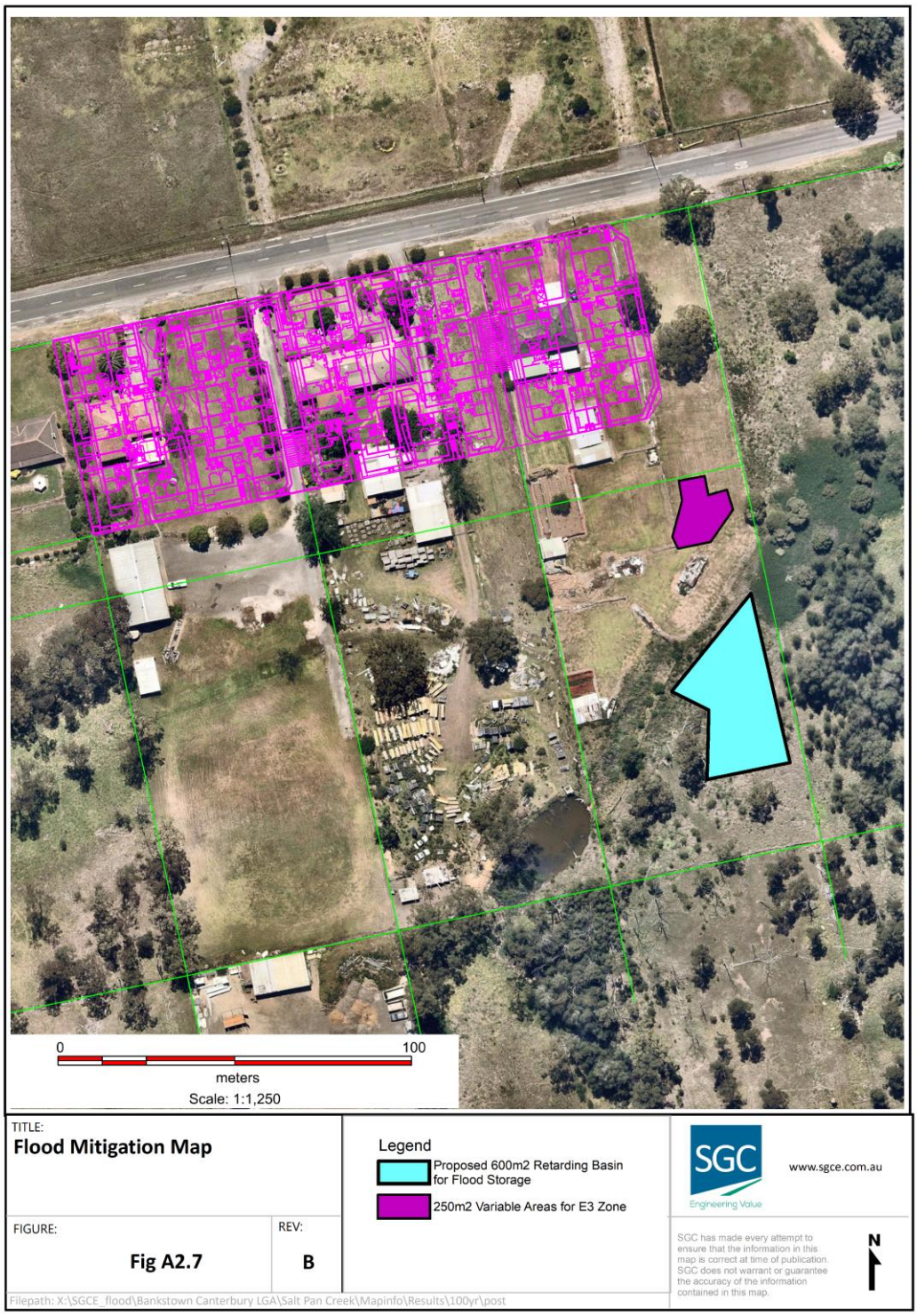

Figure A2.7 Flood Mitigation Map

Figure 3.0 Survey Plan

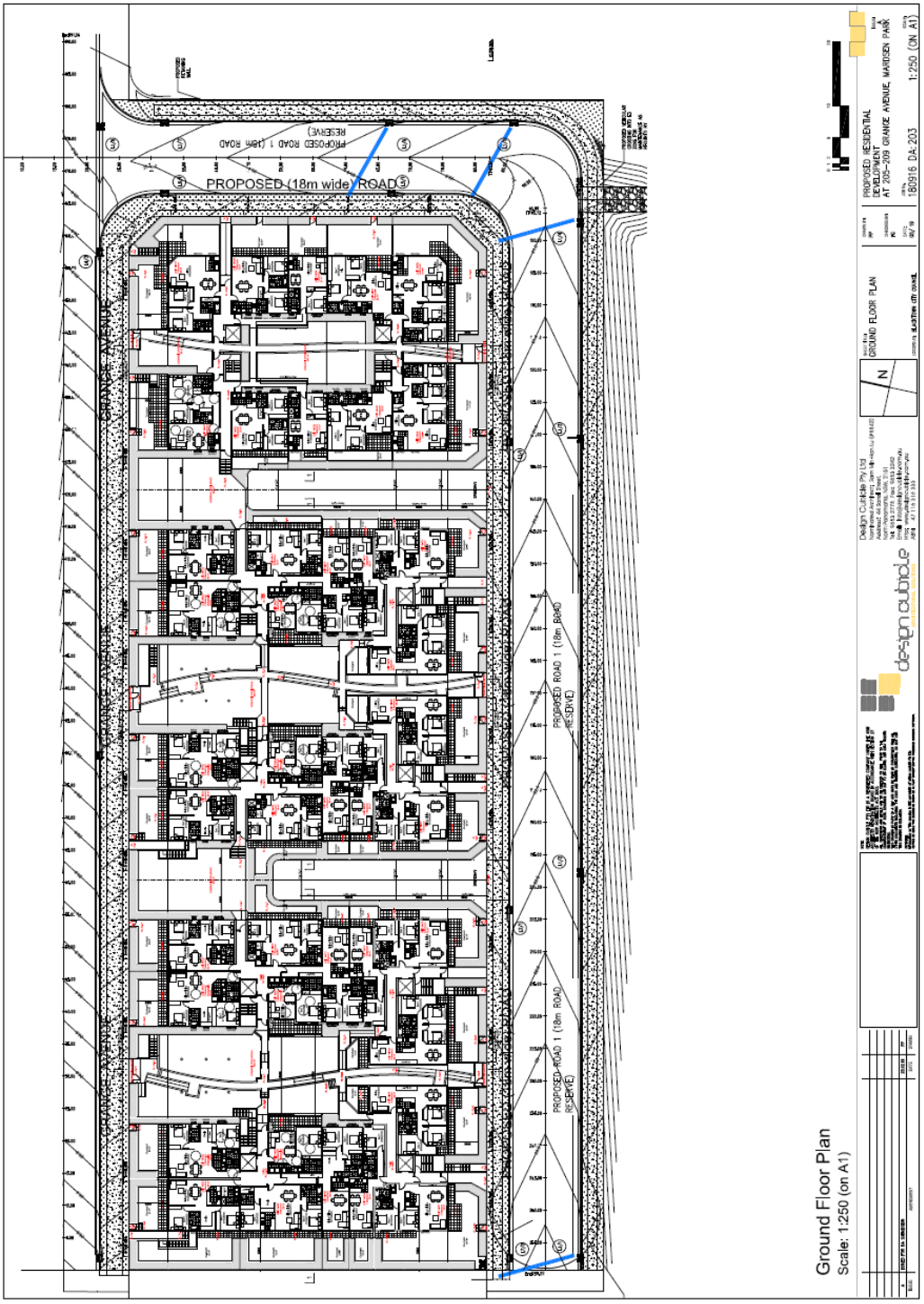

Figure 3.1 Architectural Plan

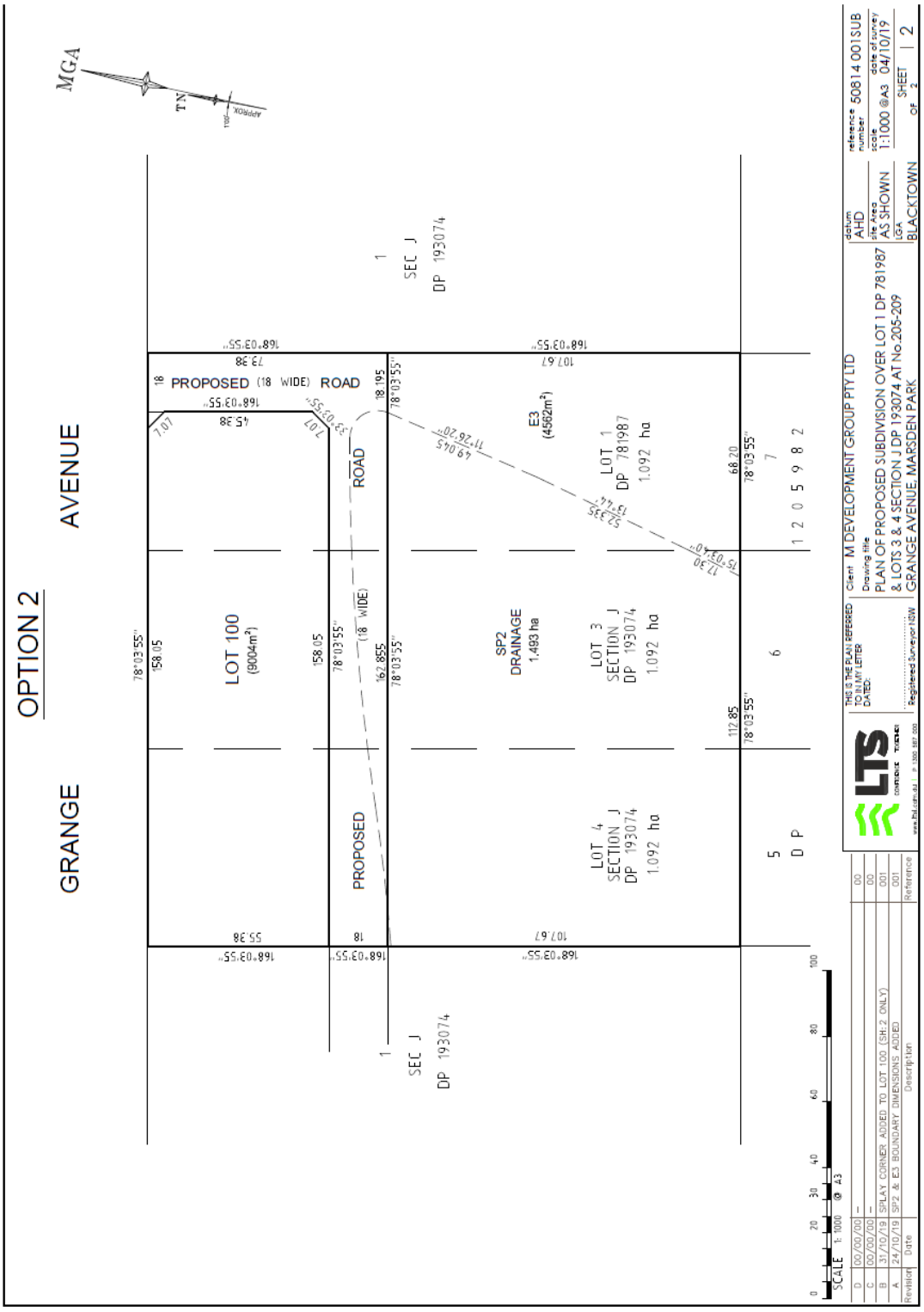

Figure 3.2 Subdivision Layout Plan