



CIVIL

## Floodplain and Stormwater Management Report

*for*

### 2-4 Guess Avenue, Wolli Creek

*for FPD Pty Ltd*

## Activity Schedule

Date	Revision	Issue	Prepared By	Approved By
24.07.19	1	Draft Issued for Client Review	SAN, AC	SAN
26.07.19	2	Draft Incorporating Flooding	NM, GB	GB
29.07.19	3	Issued for Approval	SAN, AC, NM, GB	SAN, GB

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# 1. Introduction

Northrop Consulting Engineers have been engaged by File Planning (FDC) on behalf of Bayside City Council to prepare a Stormwater Management Strategy and Flood Assessment in support of a rezoning proposal for 2-4 Guess Avenue, Wolli Creek.

The subject site (the site) includes numbers 2 and 4 Guess Avenue (Lots 101 and 102 DP808944 respectively) which are currently zoned RE1 Public Recreation and are designated for acquisition by Council for public purpose. Council have resolved that they no longer require the site for public purpose and are seeking to submit a Planning Proposal to amend the Rockdale LEP to re-zone the site as B4 Mixed Use and remove the Land Acquisition order.

The investigations for this report focused on the following:

- Identify the location and size of existing stormwater services within the vicinity of the site.
- Identify stormwater connection points for the subject site.
- Identify specific stormwater requirements for development under the proposed zonings within Bayside Council.
- Undertake a flood impact assessment.
- Identify floodplain risk management options.

The purpose of this report is to demonstrate that it is feasible to implement Council's stormwater and floodplain management objectives. The options presented herein are not intended to limit the investigation of other suitable detailed design responses at Development Application stage.

## 1.1 Current Site Conditions

### Subject Site

The site occupies an area of approximately 7765m<sup>2</sup> and is bounded by Arncliffe Street to the south east, Guess Avenue to the south west and Mount Olympus Boulevard to the north west. The site is retained along Arncliffe Street to a level approximately 800mm above the footpath level, and is mostly flush on the Guess Avenue boundary.

At the time of writing 2 Guess Avenue was occupied by a truck spare parts business, while 4 Guess Avenue had already been vacated, demolished, and excavated well below the existing street level on Mount Olympus Boulevard. Figures 1 below shows the site aerial image and surrounds.

The subject site is located within the Wolli Creek Development Area as presented in Figure 2, therefore the development must comply with the requirements presented in Section 2.6.2 "Special Precincts – Wolli Creek Redevelopment Area" of "Rockdale Technical Specification Stormwater Management, 2011".

### Site Topography

The site falls from north to south from RL4.8m AHD to RL1.6m AHD, approximately 3.2m difference in elevation between the Mount Olympus Boulevard boundary and the Arncliffe Street boundary.





**Figure 1: Site Aerial Image (Source: Nearmaps)**

### **Existing Stormwater Infrastructure**

There are several existing stormwater lines passing adjacent to the site, with existing pits on Mount Olympus Boulevard, Guess Avenue and Arncliffe Street. The site generally drains to Arncliffe Street where there are several existing connections to the street drainage network. The street drainage network drains south under Arncliffe St, through lot 57 via a 600mm pipe in an easement, before discharging into the Bonnie Doon Channel then the Cooks River. The pipe sizes and conditions must be further investigated during the detailed design stage for any proposed development.

### **Future Stormwater Infrastructure**

According to the 'Stormwater Drainage Plan – sheet 2 for the Project "Wolli Creek road and drainage upgrades"' five existing kerb inlet pits on Arncliffe Street are proposed to be demolished. Two new pits are proposed, and the stormwater drainage will be directed to a 600Hx1200W box culvert to then discharge into Bonnie Doon Channel.

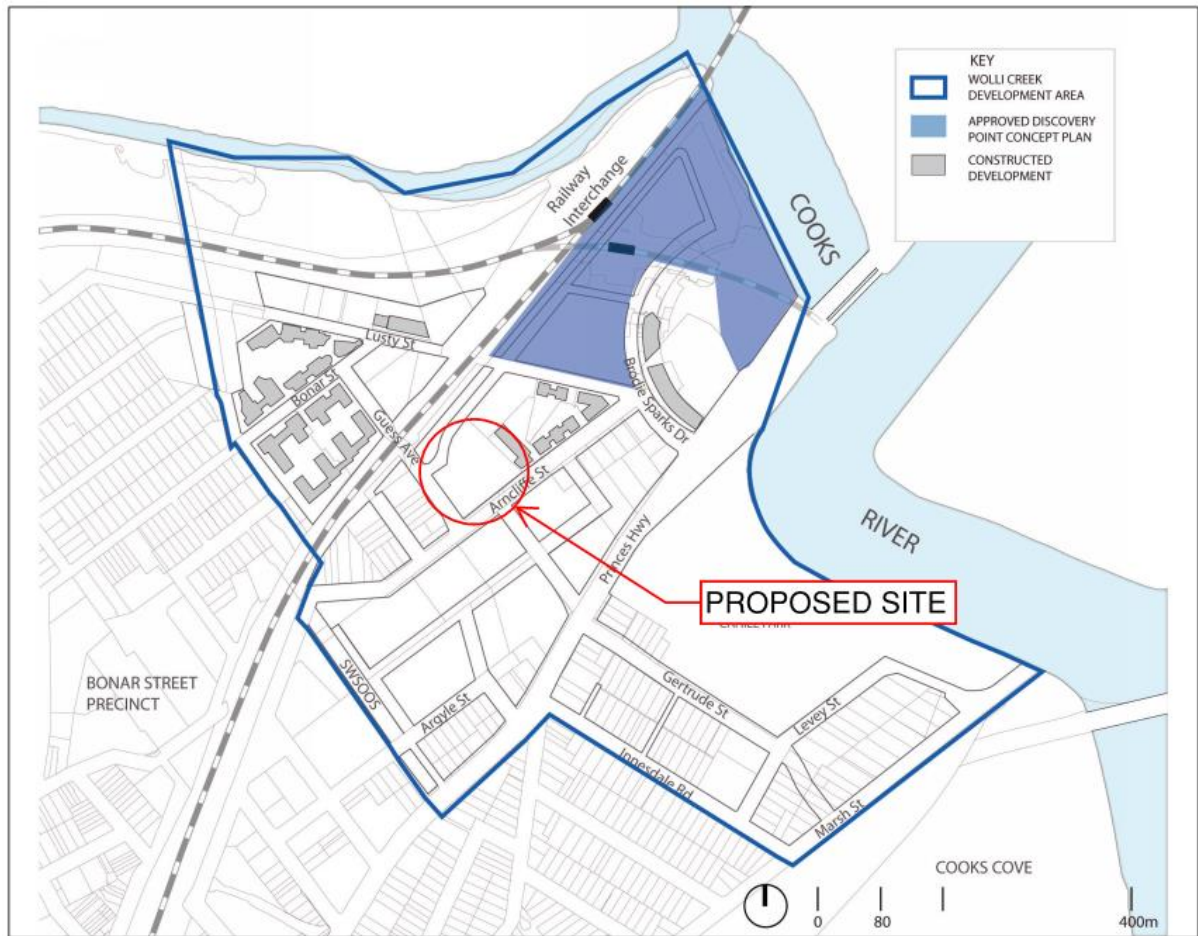


Figure 2: Wolli Creek Redevelopment Area. (Source: Rockdale DCP 2011)



An indicative configuration of the proposed development, prepared by SJB Architects, dated 19 July 2019, is presented in Figure 3. The proposed development would consist of a large public open space, 2 residential buildings with retail tenancy at ground floor with outdoor seating.



## 2. Methodology

Our assessment has been undertaken through:

- Liaison with Bayside Council and review of their policies.
- Site visit undertaken on 12<sup>th</sup> Feb 2019.
- Review of supplied design documentation.
- Review and modification of the Bonnie Doon, Eve Street/ Cahill Park Pipe and Overland 2D Flood Study (WMAWater, 2017) TUFLOW model supplied by Bayside Council.
- Preparation of concept flood storage topography and stormwater management strategies.
- Reporting.

Consideration has been given to the following documents.

- Urban Design Report, 2 & 4 Guess Avenue, Wolli Creek (SJB Architects, 2019).
- Bonnie Doon, Eve Street/ Cahill Park Pipe and Overland 2D Flood Study (WMAwater, 2017).
- Rockdale Development Control Plan (Bayside Council, 2011).
- Rockdale Technical Specification – Stormwater Management (Bayside Council, 2011).
- Flood Advice Letter by Bayside Council and dated the 7th of November 2018.
- Australian Rainfall and Runoff 2019 (AR&R 2019).
- NSW Government Floodplain Development Manual (NSW Government, 2005).
- Water Management Act 2000 No. 92 (NSW Government, 2019).
- Directions for Planning Proposals issued under Section 9.1(2) of the EP&A Action (Section 4.3 Flood Prone Land) – previously referred to as Section 117 directions.



### 3. Proposed Stormwater Management Strategy

Northrop has performed desktop investigations with regards to Council's stormwater management requirements, and preliminary calculations of catchment flows and stormwater management device sizing. The requirements and a conceptual stormwater management strategy for the proposed development scenario, and the requirements for the development are presented below, and summarised in Appendix A.

#### 3.1 Stormwater Quantity Management

##### Major/ Minor Drainage Systems

The major/minor approach to stormwater drainage is the recognised drainage concept for urban catchments within Bayside Council.

The minor drainage system is comprised of below ground pit and pipe network and is designed to control nuisance flooding and enable effective stormwater management for the site. Council's Engineering Design Specifications section 2.6.2 requires the minor drainage system to be designed for the 5%AEP storm. It will be possible to drain the podium and roof runoff from the site during this event, however as street drainage is flooded during the 5%AEP event (refer to Section 4), it may not be possible to drain surrounding on-grade areas through the piped system.

The major drainage system incorporates overland flow routes through proposed hardstand, car parking and landscaped areas. According to "Rockdale Technical Specification – Stormwater Management" (2011) Section 2.6.2; overland flow routes are [to be] designed to cater for flows between the 5%AEP and 1%AEP storms with a minimum of 200 mm freeboard between this level and any habitable areas. Overland flow paths should be designed such that there are no trapped low points around the proposed buildings, however it should be noted as above the site may be flooded in larger rainfall events, which may cause some inundation of overland flow paths.

Further catchment and pipe network modelling will be required for the site to suitably size the major/minor drainage network during the design phase of the project.

##### On-site Stormwater Detention

According to "Rockdale Technical Specification – Stormwater Management" (2011) Section 2.6.2 this site does not require On-site Retention or Detention. A Section 7.11 contribution is required to provide for drainage augmentation.

The post-development scenario proposes a larger landscaped area than the pre-development scenario, therefore decreasing peak flows.

##### Connection to Council's System

It is necessary to consider two scenarios for the proposed connection to Council's network: (a) before the construction of the drainage network proposed by AT&L; and (b) after the upgrades proposed by AT&L and presented in Appendix B of this report.

- Scenario A - There are several pits that could be possible connection points along Arncliffe Street, providing opportunity for multiple discharge locations.
- Scenario B – Considering the system proposed by AT&L, the site could be connected to the proposed pit A/6 (refer to drawing C071 in Appendix B) on the corner of Guess Avenue and Arncliffe Street, or to pit B/1 (refer to drawing C071 in Appendix B) on Arncliffe Street, however these pipes may require upgrades to cater for the flows coming from the site. The Stormwater Design proposed by AT&L should be reviewed to ensure the assumptions on

which it is based, (in particular the assumed percentage of impervious area for the subject site), are congruent with the new proposed use for the site.

In both scenarios, there are feasible options to provide a legal point of discharge.

### 3.2 Stormwater Quality Management

#### Pollution Reduction Targets

According to “Rockdale Technical Specification – Stormwater Management” (2011) Section 7.5.2, large redevelopments are required to achieve the following reduction in pollutants, presented in **Table 1**, compared to the same development if no stormwater treatment measures were implemented:

**Table 1 - Pollutant reduction targets**

Pollutant	Reduction Target
Gross Pollutants	90 %
Total Suspended Solids	80 %
Total Phosphorus	55 %
Total Nitrogen	40 %

This reduction in pollutant loads can be achieved via a variety of different treatment devices including, but not limited to:

- Pit filter baskets.
- Reuse tanks.
- Gross-pollutant traps.
- Proprietary media filtration devices.
- Or bioretention basins.

Proprietary devices are generally more expensive but can be located underground, saving space within the development.

Two options that meet the targets are

- Proprietary treatment devices, including approximately 10-14 filter cartridges and 5 pit filter baskets.
- A bioretention basin, approximately 120m<sup>2</sup>, incorporated into the landscaping at the low point on the site.

These options are based on preliminary calculations only and are presented spatially in Appendix A. Treatment sizing will change according to the proposed development final architectural scheme and Council’s resolution.

#### Carwashing Requirements

According to “Rockdale Technical Specification – Stormwater Management” (2011) Section 7.5.5, carwashing bays are required to reduce the impact of soapy water on receiving waters. For developments with more than 16 dwellings, a dedicated carwash bay is to be provided per each 60 dwellings. The car wash bay must either discharge to the sewer or be designed to treat and re-circulate the car wash water with a proprietary treatment system maintained by the owner or body corporate.

Dedicated car washing bays can be provided within the development, most likely in the basement and therefore discharging to the sewer network via a pump out system.

### **3.3 Stormwater Re-Use**

The proposed development will be a mixed use development, consisting of commercial and residential components. The water conservation requirements for the residential precinct will be covered in a BASIX assessment and it may include a provision of a minimum volume for a rainwater tank to reduce the demand for potable water. This should be considered as part of the stormwater design for the site.

According to “Rockdale Technical Specification – Stormwater Management” (2011) Section 7.2, the minimum mandatory rainwater tank for commercial developments is 1.5m<sup>3</sup> per 100 m<sup>2</sup> in addition to BASIX rainwater volume required.

It is feasible to incorporate this re-use volume within the proposed development arrangement.

### **3.4 Groundwater**

The proposed development is located in a groundwater protection zone, as presented in **Figure 4**. As two levels of basement are being proposed, approval by the NSW State Government agency administering the Water Act 1912 and the Water Management Act 2000 may be required in addition to development consent.

According to “Rockdale Technical Specification – Stormwater Management” (2011) Section 7.7.1, permanent or semi-permanent pumping of groundwater is not permitted, therefore alternatives such as tanked structures may be required depending on the groundwater level. The feasibility of this should be further investigated by a Geotechnical Engineer.



**Figure 4: Groundwater protection zone (Source: Rockdale Technical Specification - Stormwater Management, 2011)**



## 4. Flooding

The Bonnie Doon, Eve Street/ Cahill Park Pipe and Overland 2D Flood Study by WMAwater, 2017 was obtained from Council and used as a base for our investigation.

A critical storm duration of 60 minutes was determined in the WMA study, and all design events adopted a downstream tailwater level of 1.63m AHD which represents the peak 5%AEP flood level in the Cooks River.

Three scenarios were run as part of this assessment for both existing and developed cases including the:

- 5% AEP 60minute duration, tailwater level 1.63m AHD
- 1% AEP 60minute duration, tailwater level 1.63m AHD
- PMF 60minute duration, tailwater level 1.63m AHD

Some minor changes to the supplied model were made for the existing scenario to incorporate recent developments in the area, and these are described below.

### 4.1 Existing Case Model

The landuse in the vicinity of the subject site has significantly changed over the past few years, and the WMA model was therefore updated with the followings to reflect these recent re-developments.

- Additional four buildings were added to the north of the site. These are new developments that had not previously been included in the WMA model (see Figure 5).
- Two inflow boundaries were moved to the road reserves as these were overlapping with the buildings added above (see Figure 6).

The revised model was used as the existing scenario for this investigation.

### 4.2 Development Case Model

The developed case model was based on the revised existing case model and includes the building block-outs for the proposed development. In addition, the following amendments were made:

- The Manning's roughness value in the proposed public open space was changed from 0.022 to 0.040. This area was previously classified as commercial buildings in the WMA model and required to be updated to parks and grass areas to represent the public open space proposed (see Figure 7).
- The site elevation in the eastern boundary of the open public space were raised to a minimum of 3m AHD to provide low hazard evacuation route towards Mount Olympus Boulevard which is located above the PMF level.
- The levels in the western corner of the subject site were lowered to 2m AHD to divert flows entering from Mount Olympus Boulevard to Guess Avenue.

The proposed elevation changes were added as elevation shapes in the model and their extents are shown in **Figure 8**.

#### 4.3 Comparison of the Revised Model and Original WMA Model

A comparison between the 1%AEP flood depth for the revised existing case model and the original WMA model is shown in **Figure 9**. Generally, the results are consistent and considered suitable for use in the assessment.

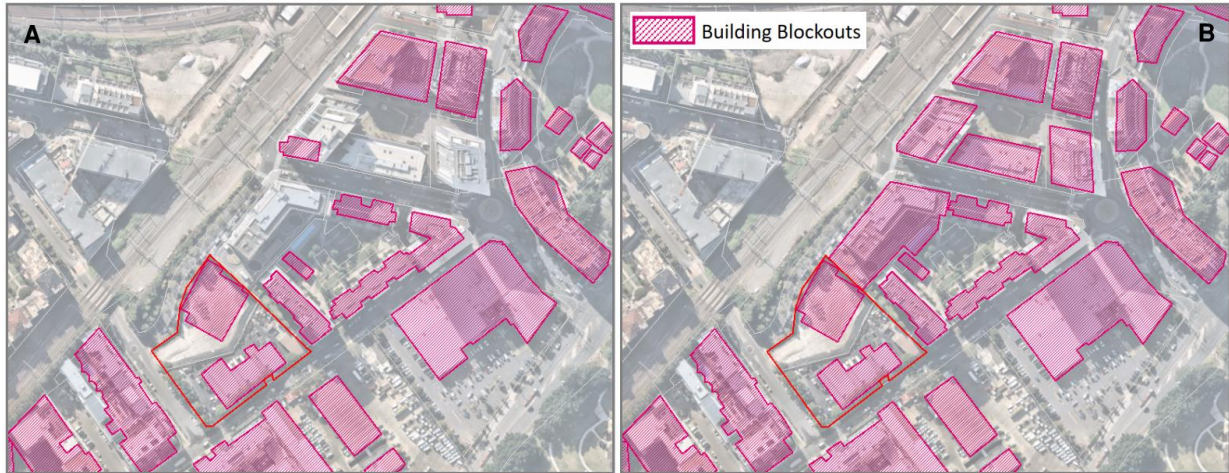


Figure 5 - Building blockouts used in (A) original WMA model and (B) revised existing case model

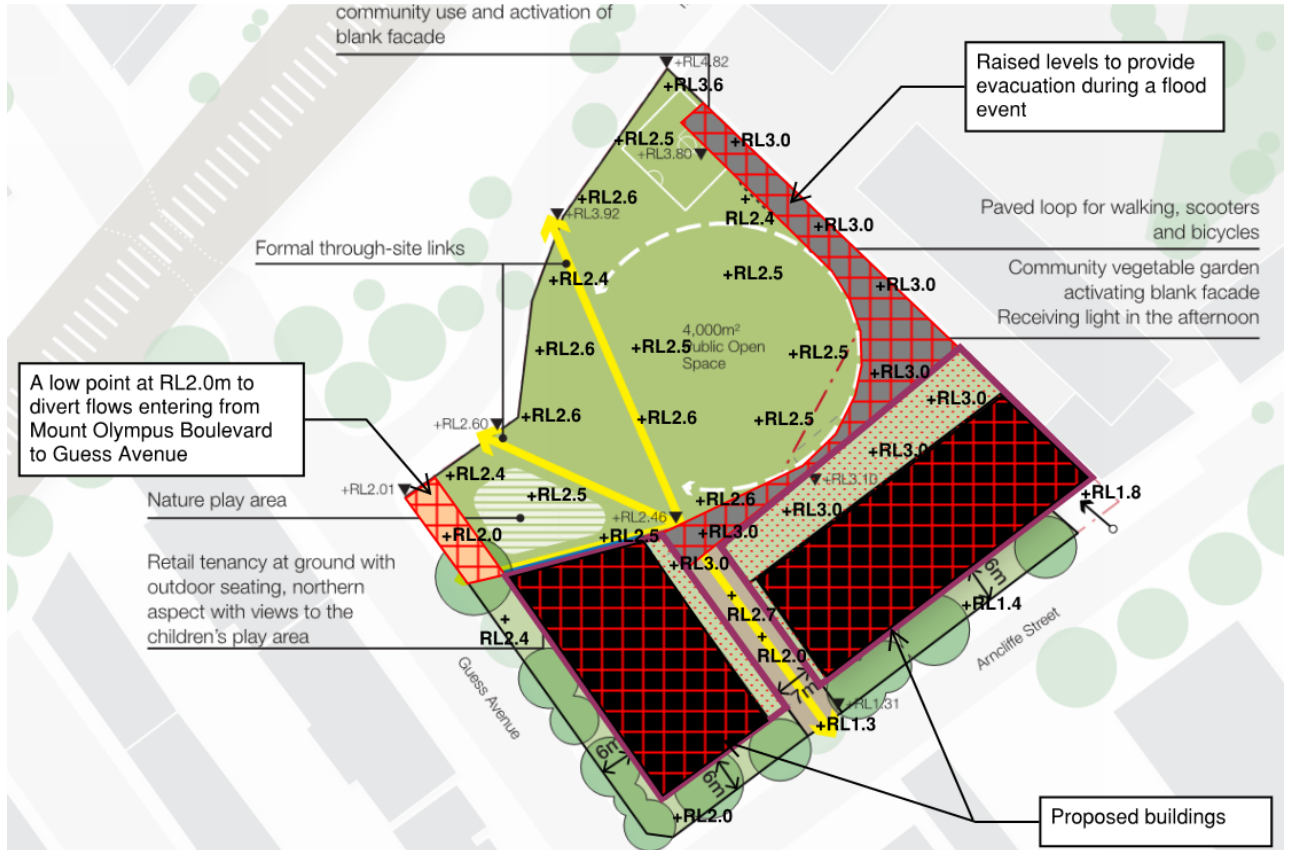


Figure 6 Inflow boundaries used in the models (A) Original WMA model and (B) Revised existing case model

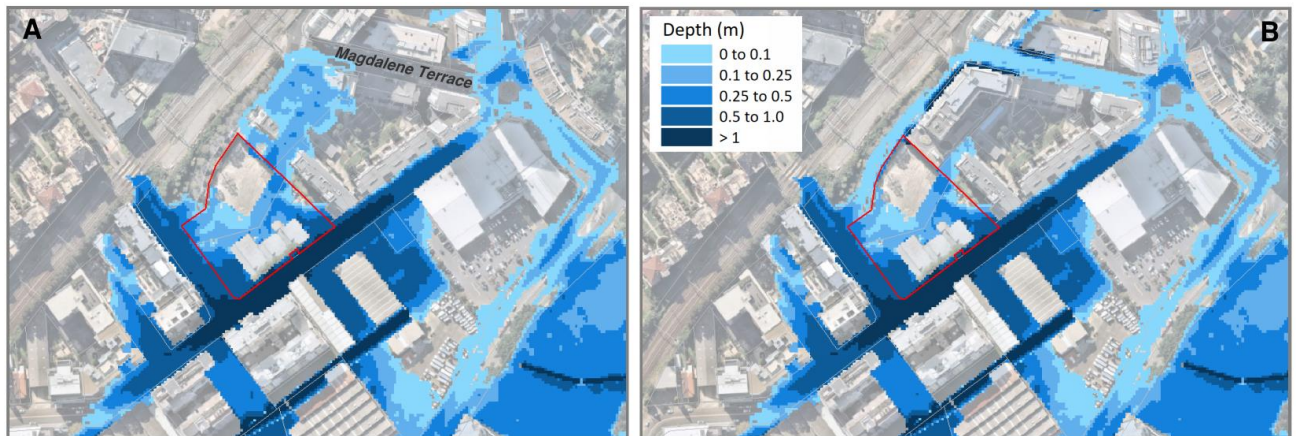


Figure 7 Manning's roughness values used in the models (A) Original WMA model and (B) Revised existing case model





### Figure 8 Proposed elevation changes



**Figure 9 1% AEP flood depth comparison (A) Original WMA model and (B) Revised existing case model**

The original WMA model in **Figure 9A** indicates that the property to the north of the site is likely to be inundated in the 1%AEP. The reason for this is because it had been included as a vacant lot in the original WMA model, with an inflow boundary also applied within the property.

However, this vacant land has recently been re-developed to a high-rise residential building and is no longer available for flood storage. Therefore, the new building was added in the revised model. The included new development and the changed inflow boundary reflect the increased flood levels on Magdalene Terrace shown in **Figure 9B**.

#### 4.4 Flood Levels

The modelling shows that flows generally enter the site from the Mount Olympus Boulevard, spill around the proposed public open space up to a depth of 0.4m during 1% AEP event and then discharge towards Guess Avenue. Tailwater from the Cooks River affects the Arncliffe Street frontage.

The 1% AEP, 5% AEP and PMF depths, elevations and ARR 2019 Hazard categories are presented in Appendix C – Figures A0 to A8. The site flood elevations are presented in **Table 2** below.

**Table 2 - Flood Elevations**

Event	Council Flood Advice (m AHD)	Model Result (m AHD)
5% AEP	-	2.56
1% AEP	2.64	2.64
PMF	3.65	3.39

The PMF level discrepancy is likely due to the rearrangement of buildings and inflow boundaries between the original and revised models.

#### 4.5 Flood Impact

A comparison of pre to post development 1% AEP levels is presented in Appendix C - Figure A4. With the development included in the model, there is an approximately 0.3m reduction in the flood levels along the western boundary of the park. This is due to the removal of the existing building in the western portion of the site as it allows more flows downstream through the proposed public open space.

During the 1% AEP event, the ARR 2019 hazard categories in the developed case shows that an H1 hazard is present over the majority of the site, with H3 hazard over the southern boundary next to Arncliffe Street. The extent of H3 hazard in this area is slightly lower than that of the existing case (shown in Figure A5 in Appendix C).

**From the assessment, it was determined there was no significant impacts to adjoining properties as a result of the development.**

#### 4.6 Council Controls

The flood related development controls are outlined in the DCP and Council Flood Advice. These include:

- The flood planning level (FPL) is equal to the 1%AEP plus 500mm freeboard from the WMA model. This is approximately equivalent to the previous study 0.5%AEP plus 500mm freeboard, which was required in this area.



- The basement entrance shall be located 1m above ground level or at the FPL whichever is higher.
- Any portion of the building below the FPL shall be constructed of flood proof material.
- All services associated with the development shall be flood proofed.
- Filling of the land may impact flood storage and behaviour and a study to assess the risks should be undertaken.
- The structure should withstand the forces of floodwater, debris and buoyancy in a 1%AEP event.
- A flood risk management plan is to be submitted at DA stage to detail evacuation procedures and flood preparedness measures.

The feasibility of implementing these controls is examined further in the discussion below.

#### **4.7 Discussion**

##### **Finished Floor Levels**

It is recommended that the all floor levels to be above 3.14m AHD which is the “minimum habitable level” stated in the DCP and the Council’s Flood Advice Letter.

**Minimum habitable floor levels can be achieved on the subject site.**

##### **Basement Crest Level**

The basement crest levels of the proposed development should facilitate protection up to the FPL. This may be through ramping up from the existing levels in Arncliffe Street, or incorporating a passive floating flood barrier to allow better level interface with the street.

**It is feasible to incorporate basement protection to the flood planning level on-site.**

##### **Materials, Servicing and Structural Integrity**

Due to the type of development proposed, it is considered the construction material are likely to be flood resistant (concrete, metal and blockwork). Furthermore, it is feasible to prepare a structural design to withstand flood and debris forces.

All critical utilities infrastructure (switchboards and communications rooms) are to be located above the flood planning level.

**It is considered feasible to construct the development with flood proof material below the FPL, provide a design that withstands flood forces in the 1%AEP and locate utilities infrastructure above the FPL.**

##### **Filling of Land and Flood Impact**

A flood impact assessment has been undertaken using the TUFLOW model provided by Council. There was no significant impact in the critical 1%AEP event.

**The proposed development concept has no significant impacts on flood behaviour in the 1%AEP.**

## **Emergency Response and Evacuation**

As part of the development, we have modelled a continuous access to Mount Olympus Boulevard at 3m AHD and above. This allows for low hazard access suitable for pedestrians (H1 and H2) in all events including the PMF. Having a low hazard access acts to minimise the risk to life in all events.

In addition to the provided evacuation route, there is ample space for residents in the proposed development to seek refuge on-site.

**Low hazard access can be incorporated in the proposed development. It is therefore considered feasible to formulate emergency response plans that promote flood awareness and minimise risk to life.**

## **Section 9.1(2) Directions**

The Section 9.1(2) Clause 4.3 Flood Prone Land directions for planning proposals made under the Environmental Planning and Assessment Act 1979 aim:

- to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone and Policy and the principles of the Floodplain Development Manual 2005.
- to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.

This proposal generally complies with part (6) of this clause in so far as the site:

- a) is not a floodway.
- b) does not result in significant impacts off-site.
- c) results in development consistent with the surrounding area.
- d) will include flood mitigation measures constructed by the developer of that land.
- e) only permit works with consent.

**The development proposal generally complies with the objectives of the directions.**

## **Alternative Solutions**

The solutions proposed in this assessment demonstrate the feasibility of complying with Council's floodplain development controls. This does not preclude different building arrangements or potential complying solutions from being investigated or approved on-site including:

- Flood storage tanks.
- Amended park topography.
- Vertical evacuation or refuge on-site in publicly accessible building areas.
- Suspended building elements to reduce displaced flood storage.

Investigation and assessment of these options could be explored during the development application stage.

## 5. Summary and Conclusion

In summary, the stormwater requirements for the proposed development are as follows;

- Water Quality measures would be required for the proposed zoning and development on this site. Water quality treatment could be achieved using propriety filter cartridge devices or through bioretention treatment located in the landscaped areas of the site.
- A rainwater tank is required and must comply with requirements from BASIX for residential apartments, and Council's requirement in addition if a Commercial component is proposed.
- On-site Detention and Retention is not required, and a Section 7.11 contribution is necessary to provide for drainage augmentation.
- There are several possible connection points in Arncliffe St. The legal point of discharge chosen should be coordinated with the future plans for drainage network upgrades in the area. Furthermore, the upgrades planned should ensure there is capacity to include the site drainage, now that a partly impervious development is proposed.

The flooding requirements for the site are as follows;

- Habitable floor levels and basement protection to the Flood Planning Level of the 1%AEP plus 500mm freeboard, or 3.14m AHD.
- Buildings to be designed to withstand flood forces, be constructed from flood proof materials and have services flood proofed to the Flood Planning Level.
- Low hazard evacuation to Mount Olympus Boulevard as a preference or refuge on-site to manage flood emergency response.
- Flood storage to facilitate negligible impacts on adjoining property.

It was determined that it is feasible to implement Council's stormwater management and floodplain related development controls on the site.

## Appendix A

### Concept Stormwater Management Layout



NOTES:

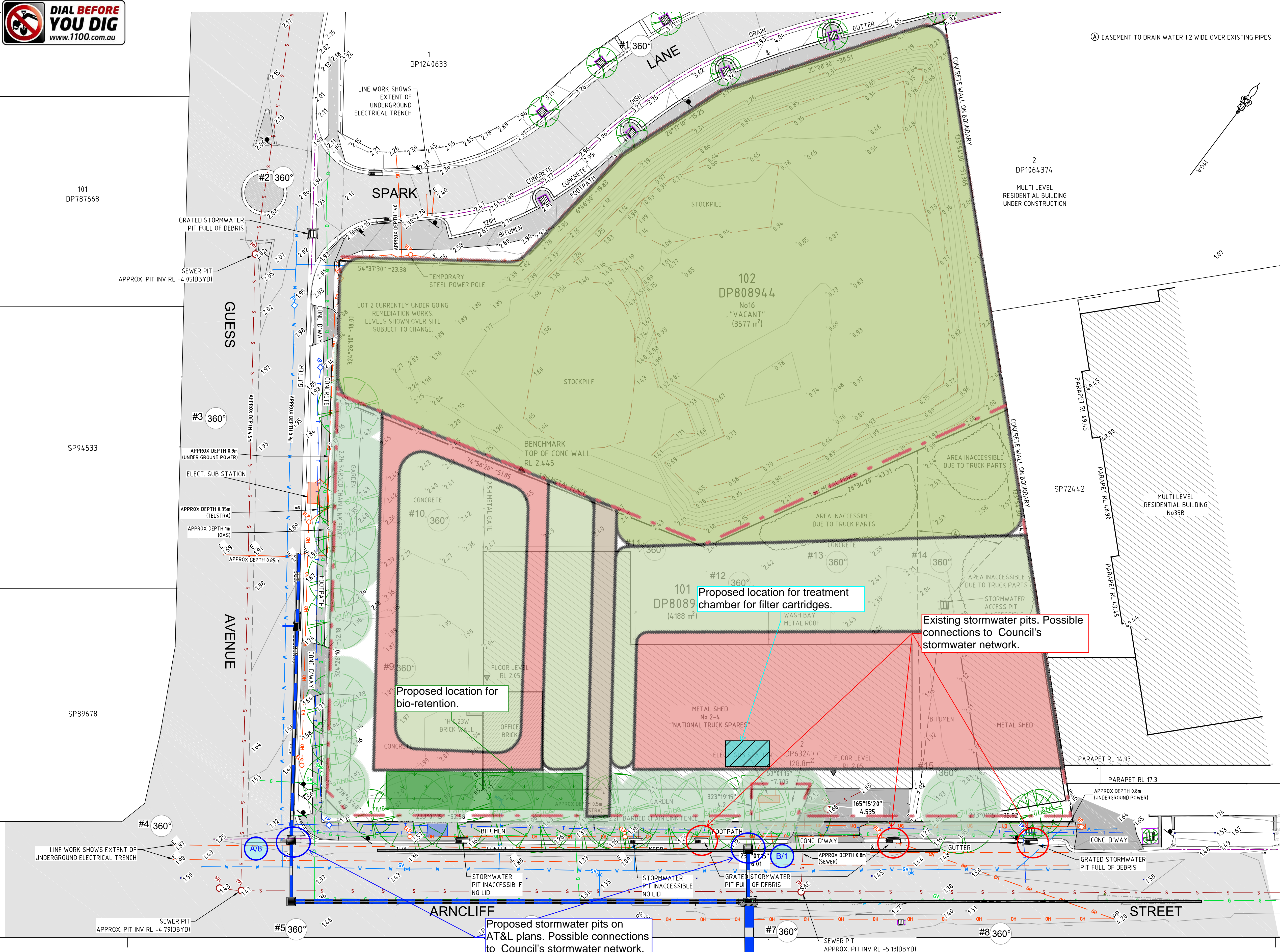
1. THIS PLAN IS PREPARED FROM A FIELD SURVEY FOR THE PURPOSE OF DESIGNING NEW CONSTRUCTIONS ON THE LAND AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

2. ALL UNDERGROUND SERVICES SHOWN ARE BASED ON A COMBINATION OF PREVIOUS COUNCIL RECORDS, VERBAL INSTRUCTIONS AND SURFACE INDICATORS LOCATED AT TIME OF SURVEY. SEE ATTACHED PHOTOS FOR APPROXIMATE DEPTHS WHERE MARKED BY SERVICE LOCATOR

3. CONTOUR INTERVAL 0.25m.

4. THESE NOTES ARE AN INTEGRAL PART OF THIS PLAN.

- LEGEND:
- ROAD CENTRELINE
  - FENCE
  - BOTTOM OF BANK
  - TOP OF BANK
  - OH OVERHEAD ELECTRICITY LINES
  - UG UNDERGROUND ELECTRICITY LINES
  - G GAS MAIN
  - T TELECOMMUNICATIONS
  - D STORMWATER DRAINAGE
  - S SEWER MAIN
  - W WATER MAIN
  - ELP ELECTRIC LIGHT POWER POLE
  - EP ELECTRICITY PIT/PILLAR
  - TP TELECOMMUNICATIONS PIT
  - MH SEWER MANHOLE
  - FH FIRE HYDRANT
  - SV STOP VALVE
  - WMR WATER METER
  - GMP GAS MARKER POST
  - GV GAS VALVE
  - TREE
  - VEGETATION
  - FLOOR LEVEL
  - BENCH MARK
  - #1 360° LOCATION OF 360° PHOTO AND NUMBER
  - PROPOSED PIPES AND PITS BY AT&L

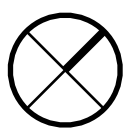


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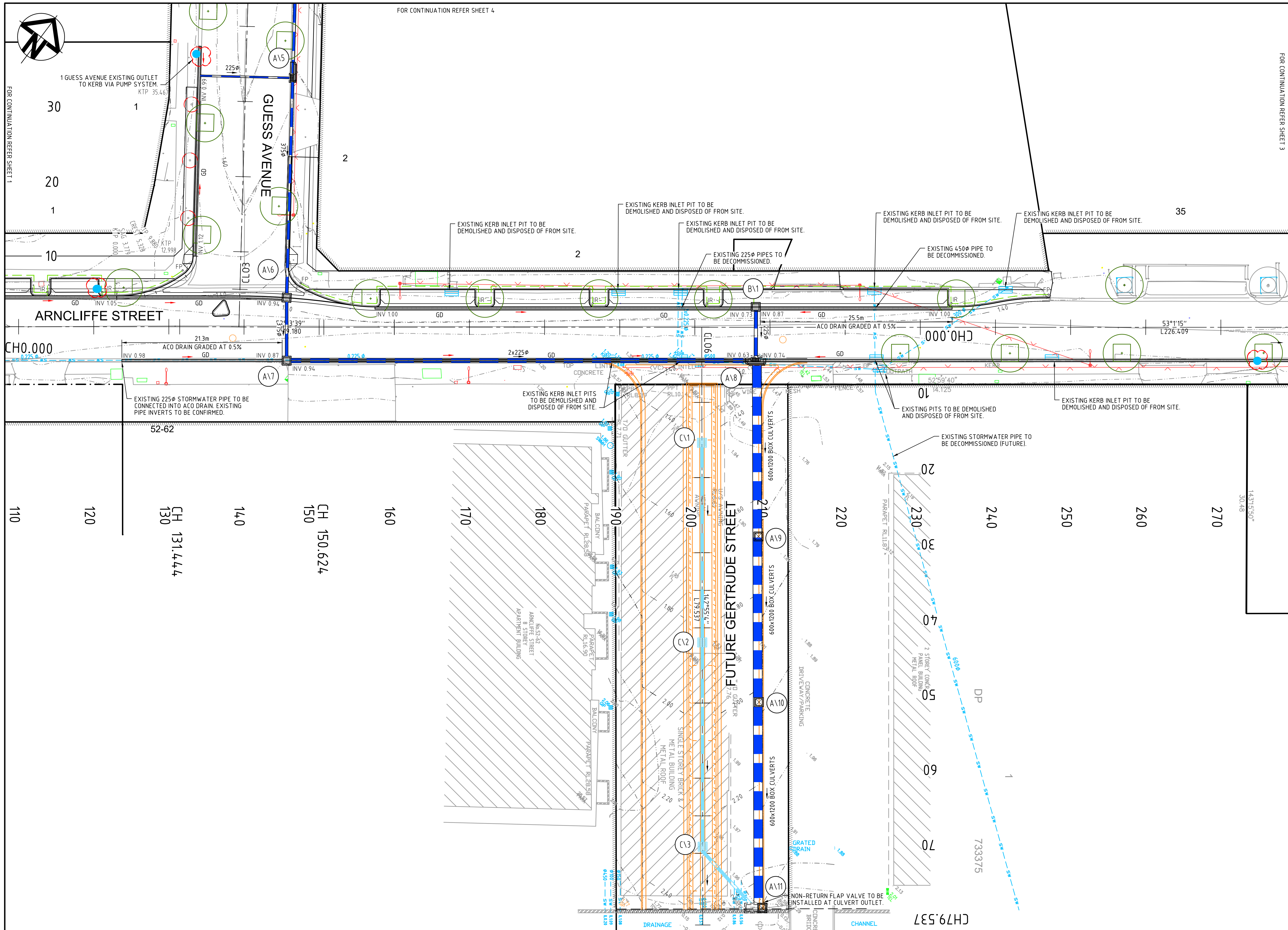
PROJECT	DRAWING TITLE
2-4 GUESS AVE WOLLI CREEK	CONCEPTUAL STORMWATER MANAGEMENT STRATEGY

JOB NUMBER	DRAWING NUMBER	REVISION
182980	SK-01	1
DRAWING SHEET SIZE = A1		



## Appendix B

### AT&L Stormwater Drainage Plan – Wolli Creek Road and Drainage Upgrades



- NOTES**
1. ALL PROPOSED STORMWATER PIPES TO BE CLASS '4' UNLESS NOTED OTHERWISE.
  2. ALL PROPOSED GRATES TO BE CLASS 'D' UNLESS NOTED OTHERWISE.
  3. ALL GRATED DRAINS TO BE ACO TRAFFIC DRAIN TD300 WITH CLASS 'D' GRATE.

**STORMWATER LEGEND**

**EXISTING (REFER SURVEY NOTES)**

- EXISTING BOUNDARY
- EXISTING CONTOUR
- EXISTING STORMWATER PIPE
- EXISTING KERB OUTLET

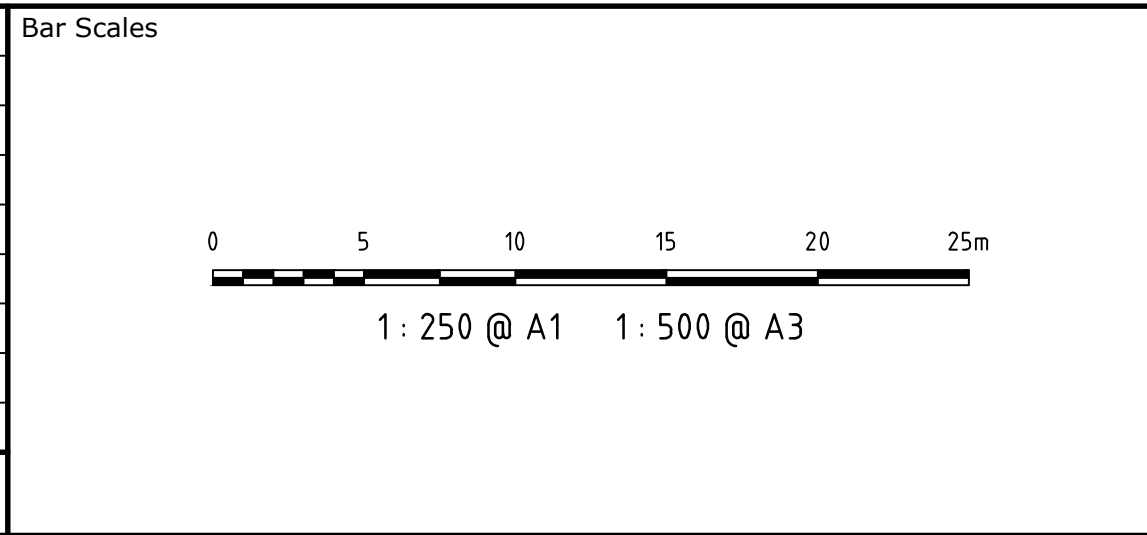
**PROPOSED**

- PROPOSED CONTOUR
- FINISHED SURFACE LEVEL
- EXISTING KERB OUTLET TO BE UNDERGROUNDED INTO GRATED DRAIN
- GRATED DRAIN WITH FLOW DIRECTION AND INVERT
- STORMWATER PIPE WITH FLOW DIRECTION AND PIPE SIZE
- STORMWATER JUNCTION PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER SURFACE INLET PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER KERB INLET PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER PIT NAME
- 100 $\phi$  SUBSOIL PIPE AT MIN. 1.0% GRADE. REFER DWG C085 FOR DETAILS.
- SUBSOIL FLUSHING POINT. REFER DWG C085 FOR DETAILS
- SUBSOIL INVERTED RISER. REFER DWG C085 FOR DETAILS
- PROPOSED TREE AND ASSOCIATED TREE PIT
- EXISTING TREE TO BE REMOVED

**FUTURE**

- STORMWATER PIPE WITH FLOW DIRECTION
- STORMWATER SURFACE INLET PIT

P3	ISSUED FOR REVIEW	20-06-18
P2	ISSUED FOR REVIEW	09-05-18
P1	ISSUED FOR REVIEW	16-03-18
Issue	Description	Date



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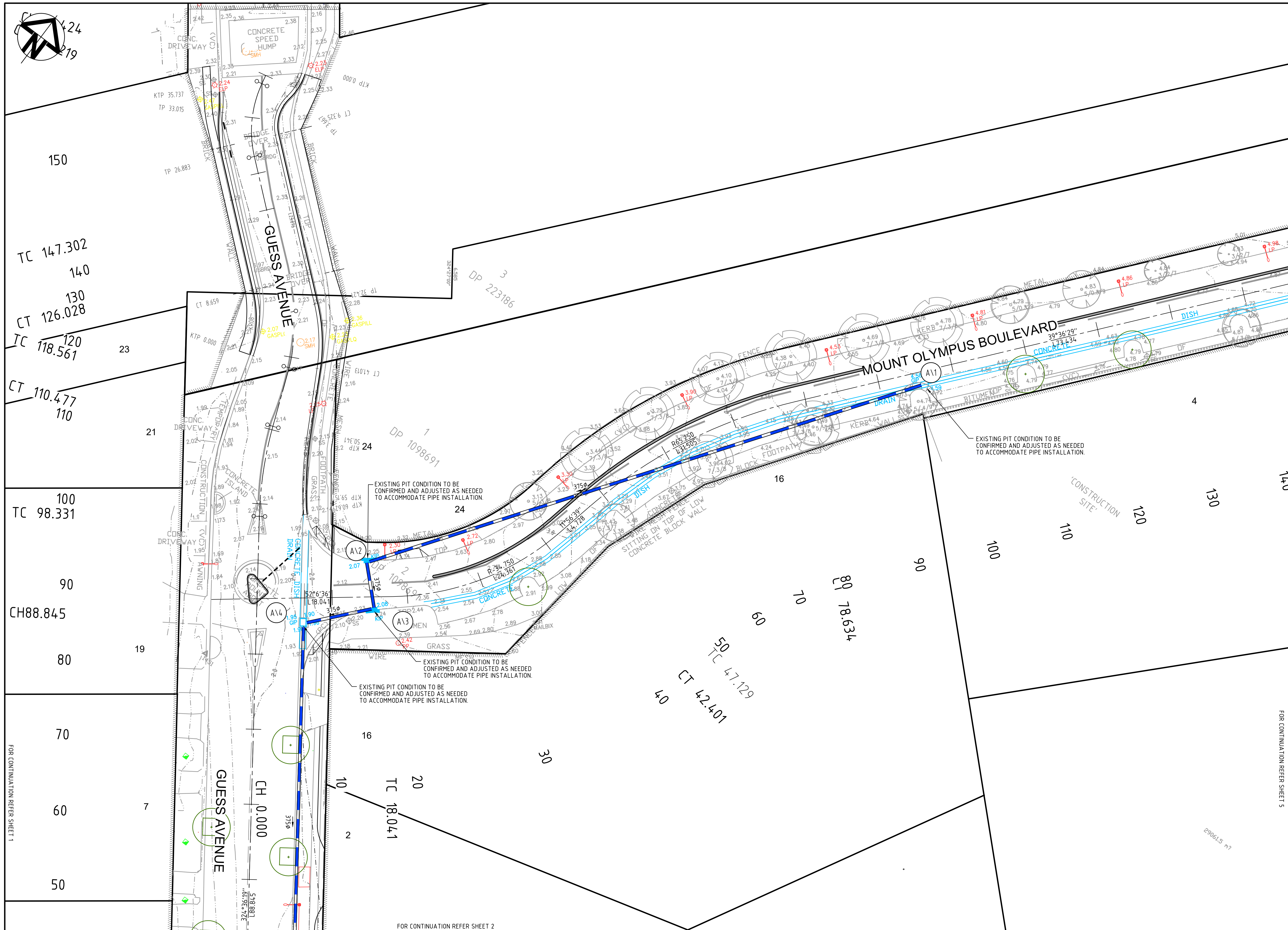


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Project	WOLLI CREEK ROAD AND DRAINAGE UPGRADES
Title	STORMWATER DRAINAGE PLAN SHEET 2

Civil Engineers and Project Managers		
<b>at&amp;l</b>		
Level 7, 153 Walker Street North Sydney NSW 2060 ABN 96 130 882 405 Tel: 02 9439 1777 Fax: 02 9923 1055 www.atl.net.au info@atl.net.au		
Status	FOR REVIEW	A1
NOT TO BE USED FOR CONSTRUCTION		
Drawing No.	Project No.	Issue
C071	18-525	P3





- NOTES**
1. ALL PROPOSED STORMWATER PIPES TO BE CLASS '4' UNLESS NOTED OTHERWISE.
  2. ALL PROPOSED GRATES TO BE CLASS 'D' UNLESS NOTED OTHERWISE.
  3. ALL GRATED DRAINS TO BE ACO TRAFFIC DRAIN TD300 WITH CLASS 'D' GRATE.

**STORMWATER LEGEND**

**EXISTING (REFER SURVEY NOTES)**

- EXISTING BOUNDARY
- EXISTING CONTOUR
- EXISTING STORMWATER PIPE
- EXISTING KERB OUTLET

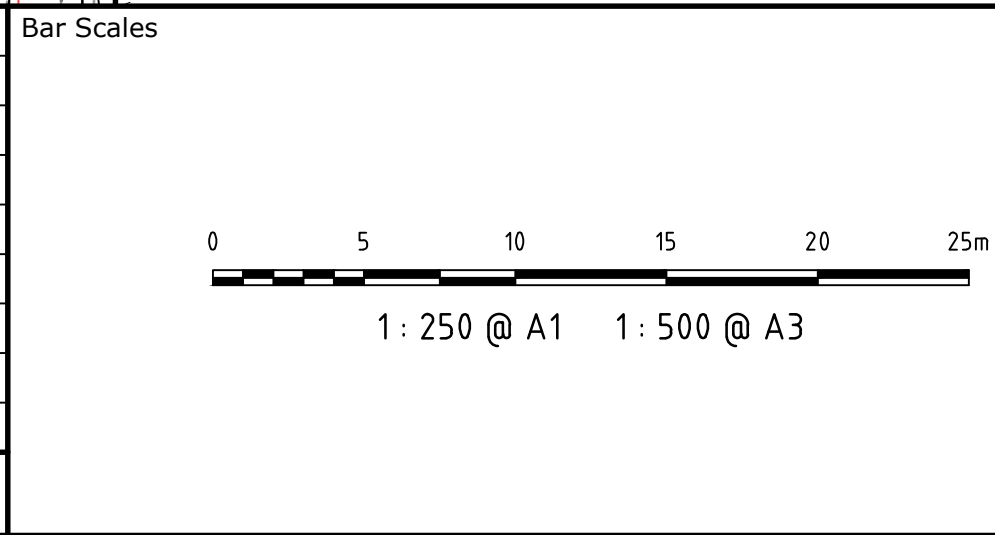
**PROPOSED**

- PROPOSED CONTOUR
- FINISHED SURFACE LEVEL
- EXISTING KERB OUTLET TO BE UNDERGROUNDED INTO GRATED DRAIN
- GRATED DRAIN WITH FLOW DIRECTION AND INVERT
- STORMWATER PIPE WITH FLOW DIRECTION AND PIPE SIZE
- STORMWATER JUNCTION PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER SURFACE INLET PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER KERB INLET PIT REFER DRAWING C085 FOR DETAIL
- STORMWATER PIT NAME
- 100Φ SUBSOIL PIPE AT MIN. 1.0% GRADE. REFER DWG C085 FOR DETAILS.
- SUBSOIL FLUSHING POINT. REFER DWG C085 FOR DETAILS
- SUBSOIL INVERTED RISER. REFER DWG C085 FOR DETAILS
- PROPOSED TREE AND ASSOCIATED TREE PIT
- EXISTING TREE TO BE REMOVED

**FUTURE**

- STORMWATER PIPE WITH FLOW DIRECTION
- STORMWATER SURFACE INLET PIT

Issue	Description	Date
P2	ISSUED FOR REVIEW	20-06-18
P1	ISSUED FOR REVIEW	16-03-18



THIS DRAWING CANNOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY OTHER PURPOSE OTHER THAN THAT ORIGINALLY INTENDED WITHOUT THE WRITTEN PERMISSION OF AT&L



Scales	1 : 250	Drawn	GB
		Designed	RT
Grid	MGA	Checked	AT
Height Datum	AHD	Approved	

**DRAFT**

Project	WOLLI CREEK ROAD AND DRAINAGE UPGRADES
Title	STORMWATER DRAINAGE PLAN SHEET 4

Civil Engineers and Project Managers		
<b>at&amp;l</b>		
Level 7, 153 Walker Street North Sydney NSW 2060 ABN 96 130 882 405 Tel: 02 9439 1777 Fax: 02 9923 1055 www.atl.net.au info@atl.net.au		
Status	FOR REVIEW	A1
Drawing No.	C073	Issue
Project No.	18-525	P2

# Appendix C

## Flood Figures



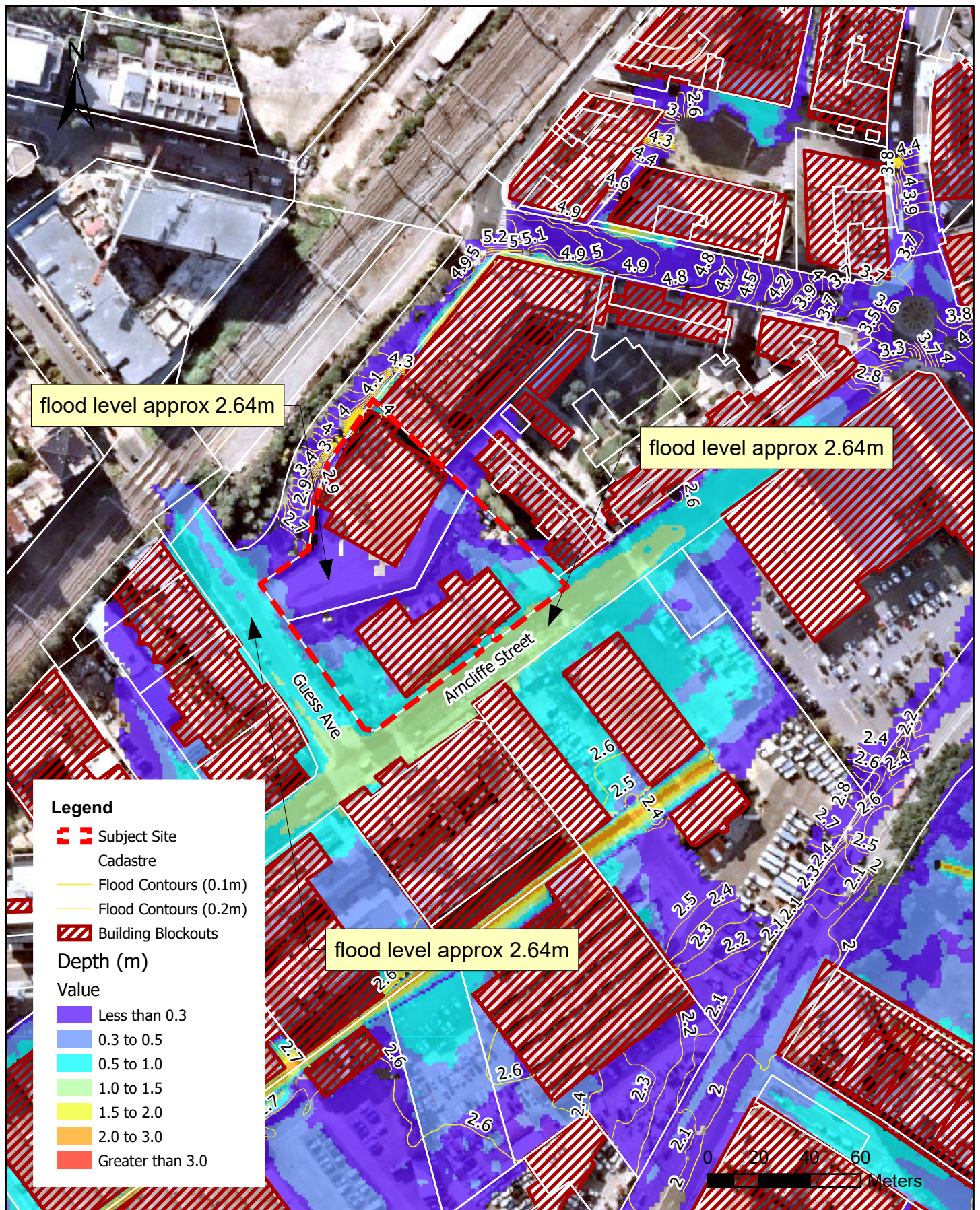


Figure A0  
Existing 1% AEP Depth and Elevation



Newcastle

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email newcastle@northrop.com.au ABN 81 094 433 100

2-4 Guess Avenue  
Wolli Creek, NSW 2205

Job Number: SY182980



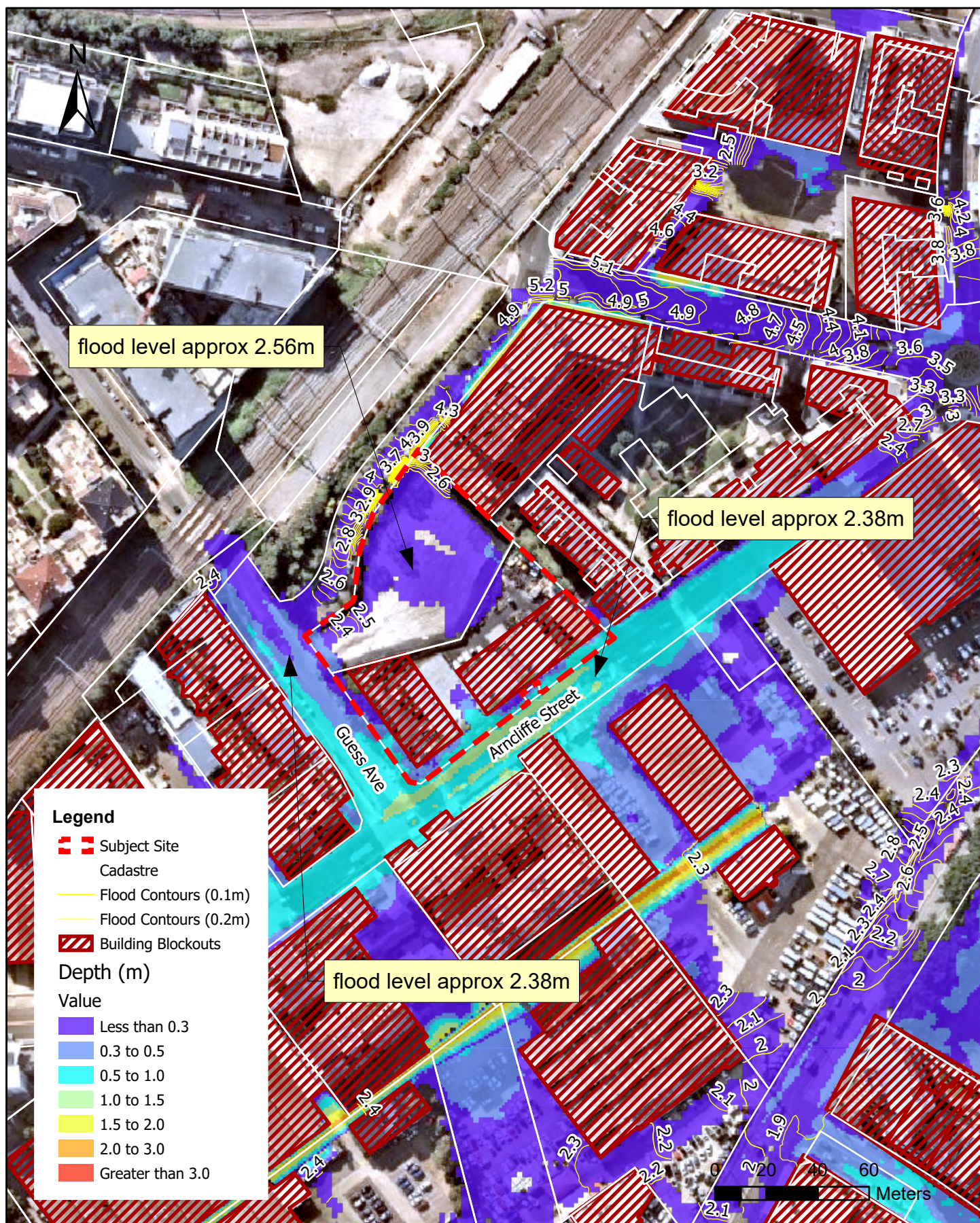


Figure A1

## Developed 5% AEP Depth and Elevation

**2-4 Guess Avenue  
Wolli Creek, NSW 2205**

**Job Number: SY182980**



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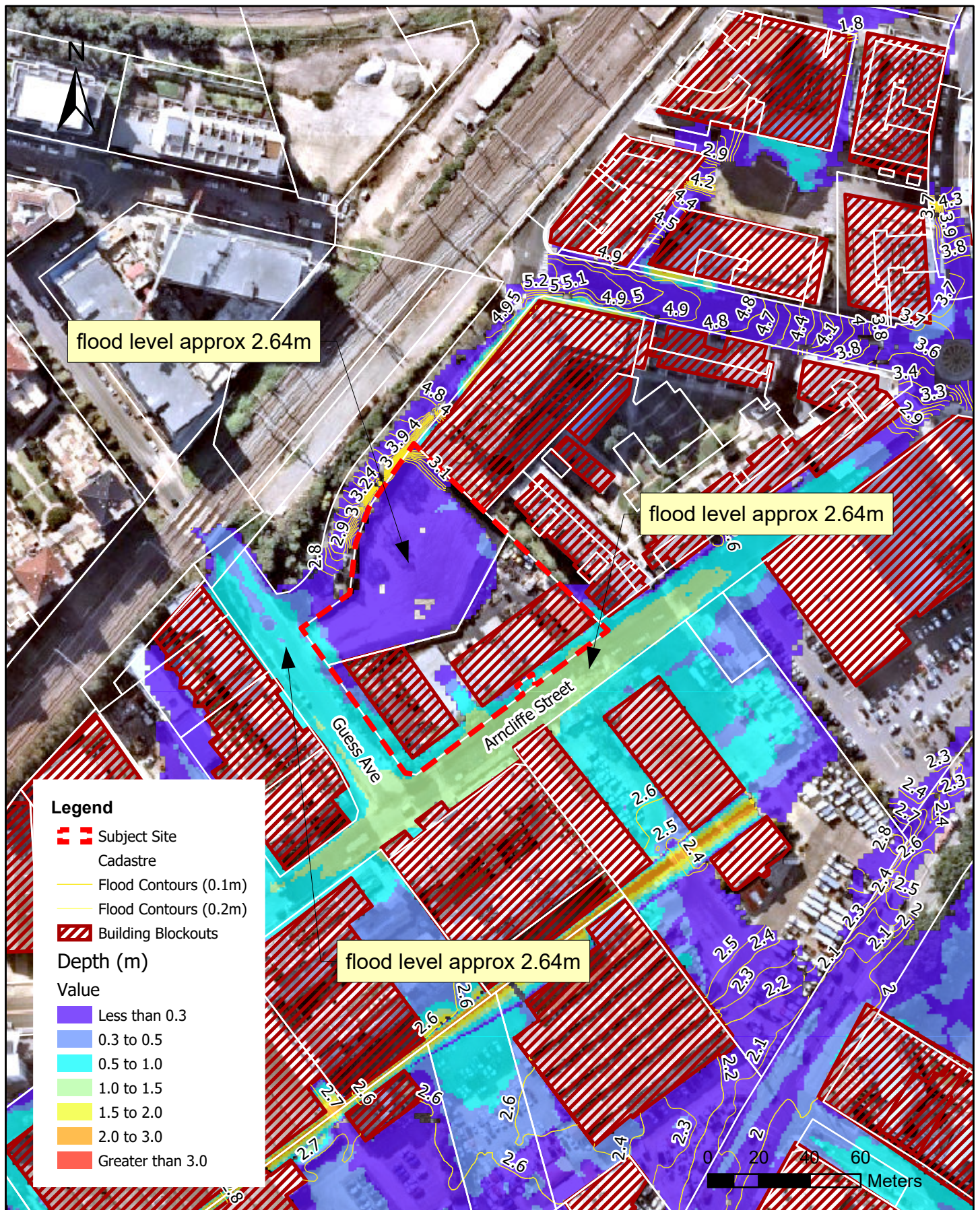


Figure A2

## Developed 1% AEP Depth and Elevation

2-4 Guess Avenue  
Wolli Creek, NSW 2205

Job Number: SY182980



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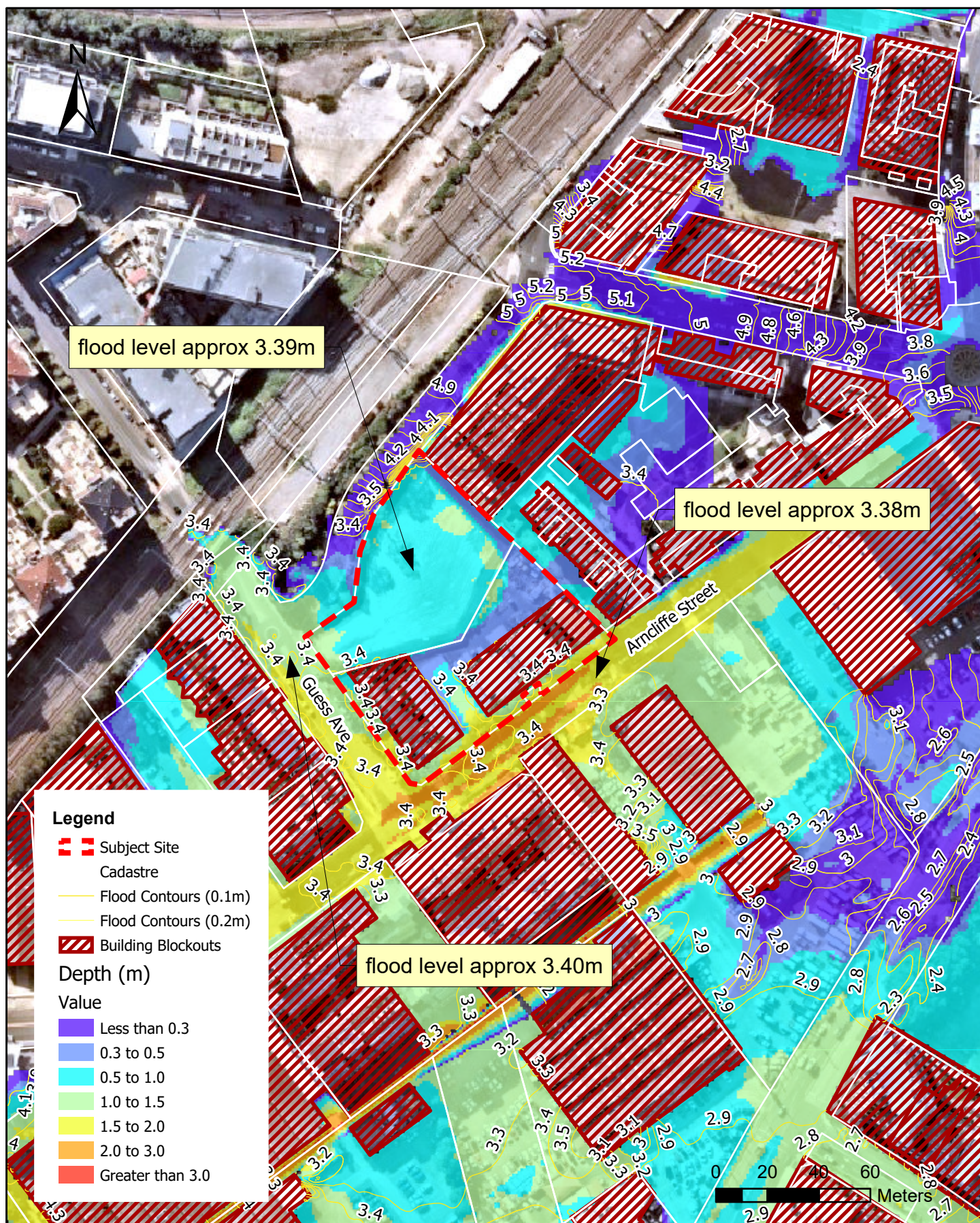


Figure A3

## Developed PMF Depth and Elevation

2-4 Guess Avenue  
Wolli Creek, NSW 2205

Job Number: SY182980



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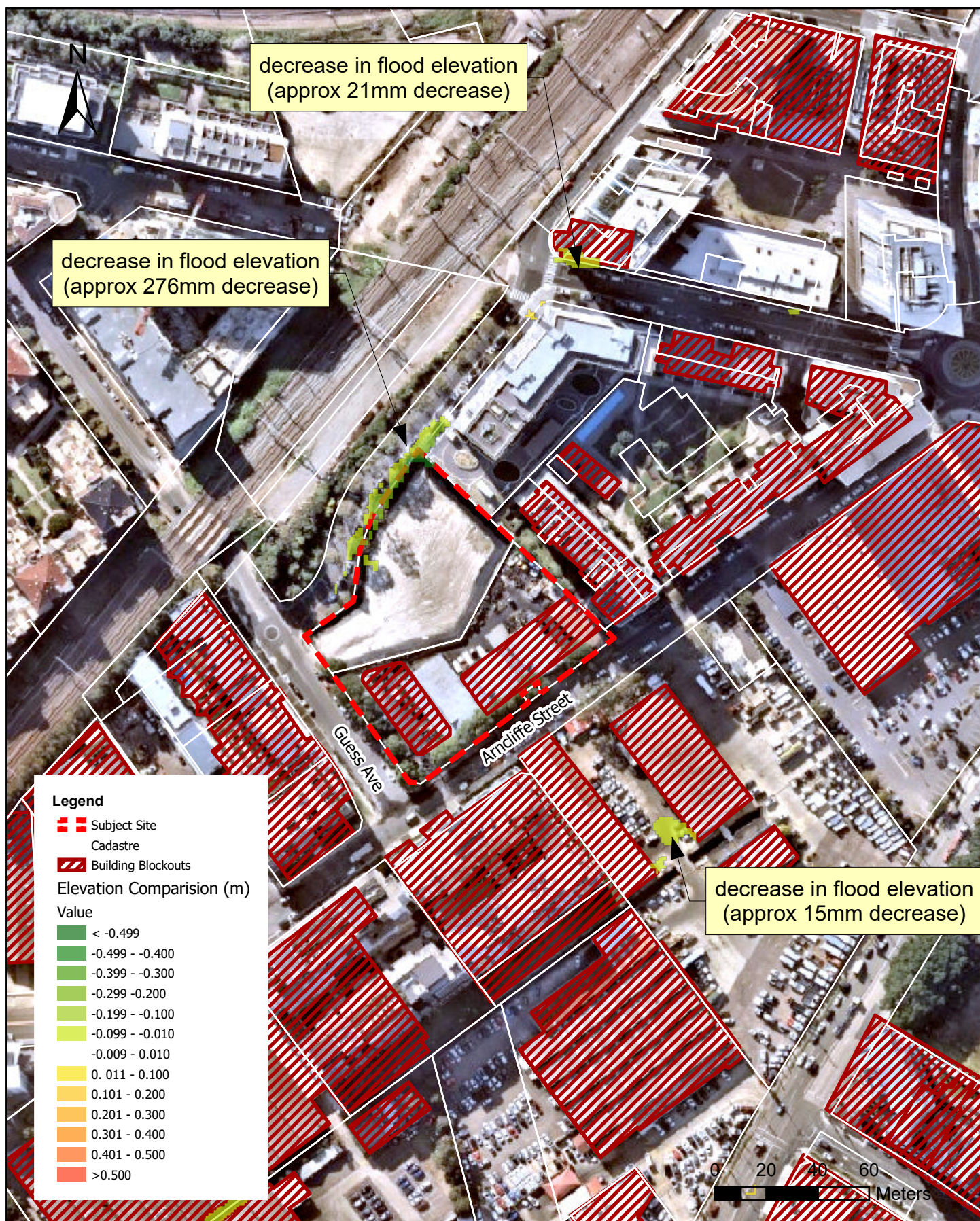


Figure A4

## 1% AEP Post-Pre Elevation Comparison

2-4 Guess Avenue  
Wolli Creek, NSW 2205

Job Number: SY182980



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email newcastle@northrop.com.au ABN 81 094 433 100



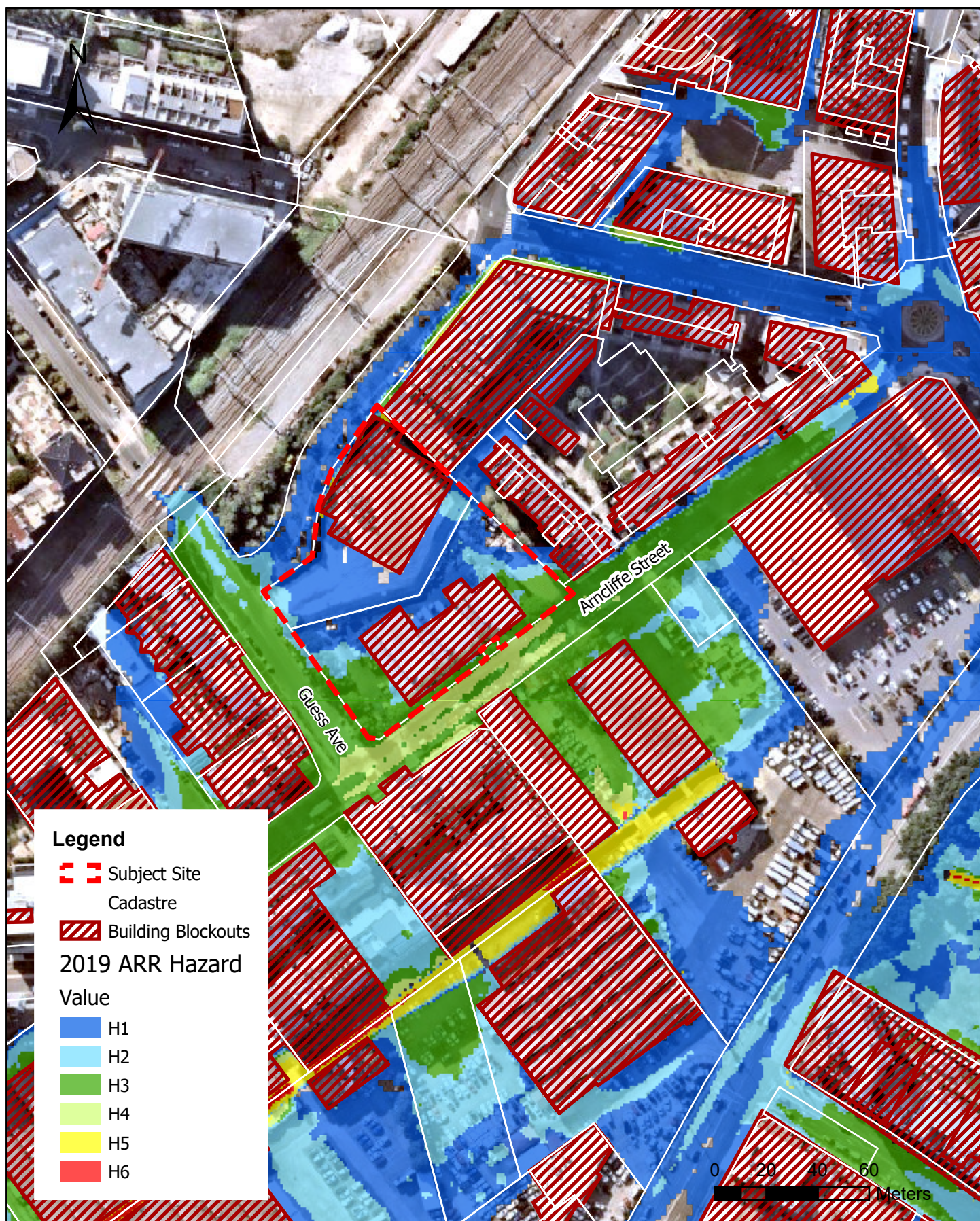


Figure A5

## Existing 1% AEP ARR 2019 Hazard

**2-4 Guess Avenue  
Wolli Creek, NSW 2205**

**Job Number: SY182980**



**Newcastle**

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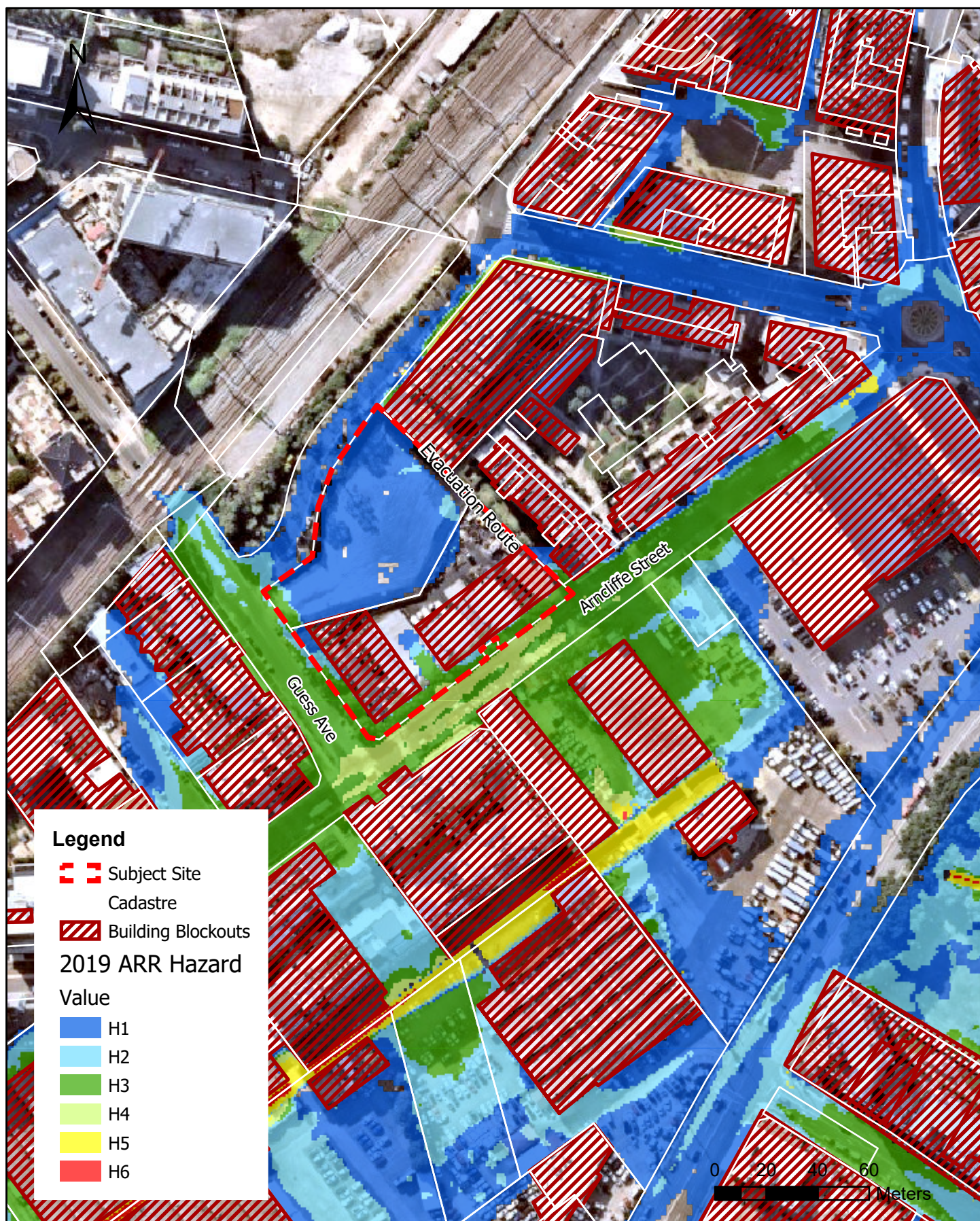


Figure A6

## Developed 1% AEP ARR 2019 Hazard

**2-4 Guess Avenue  
Wolli Creek, NSW 2205**

**Job Number: SY182980**



**Newcastle**

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email [newcastle@northrop.com.au](mailto:newcastle@northrop.com.au) ABN 81 094 433 100



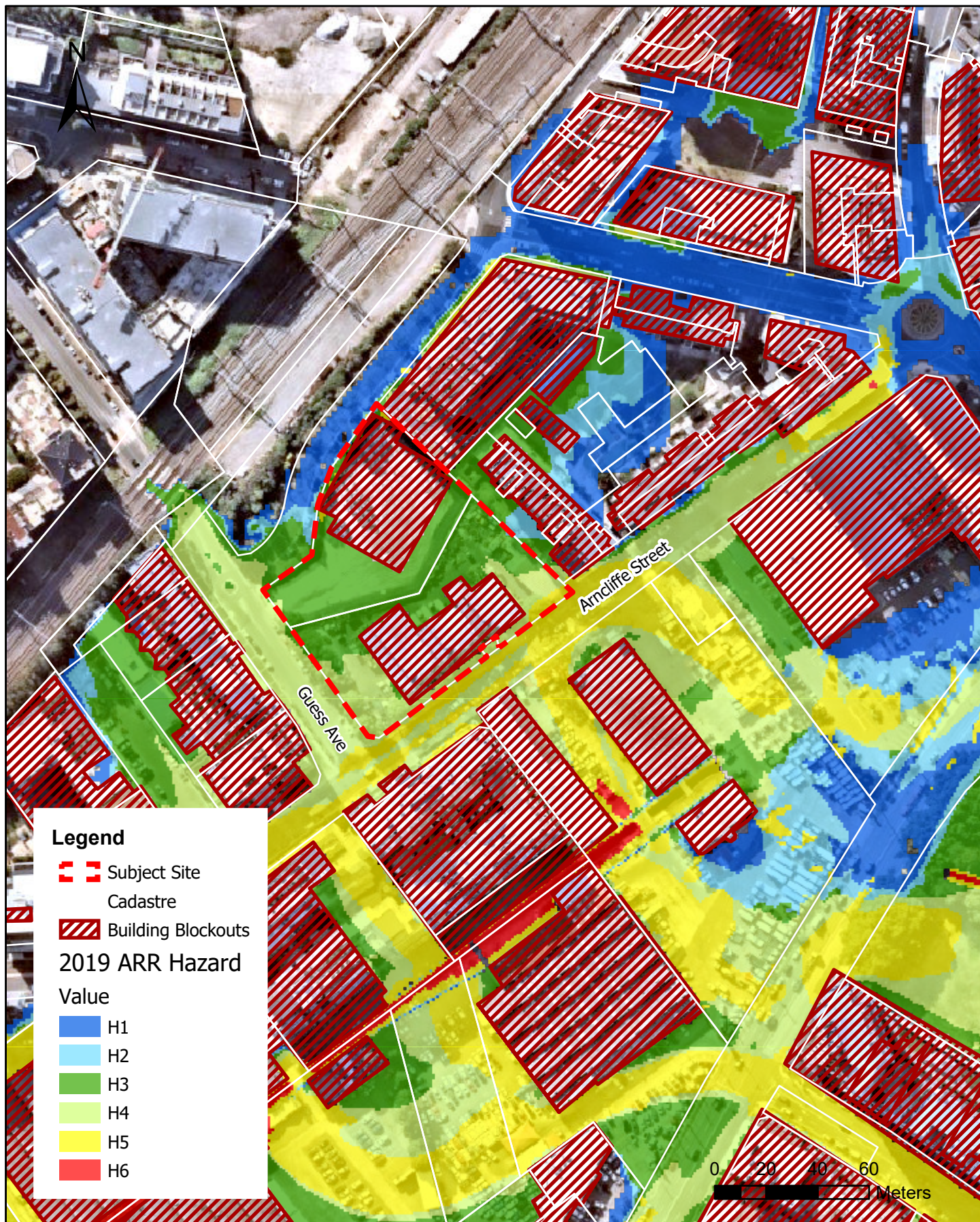


Figure A7

## Existing PMF ARR 2019 Hazard

**2-4 Guess Avenue  
Wolli Creek, NSW 2205**

**Job Number: SY182980**



**Newcastle**

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email [newcastle@northrop.com.au](mailto:newcastle@northrop.com.au) ABN 81 094 433 100



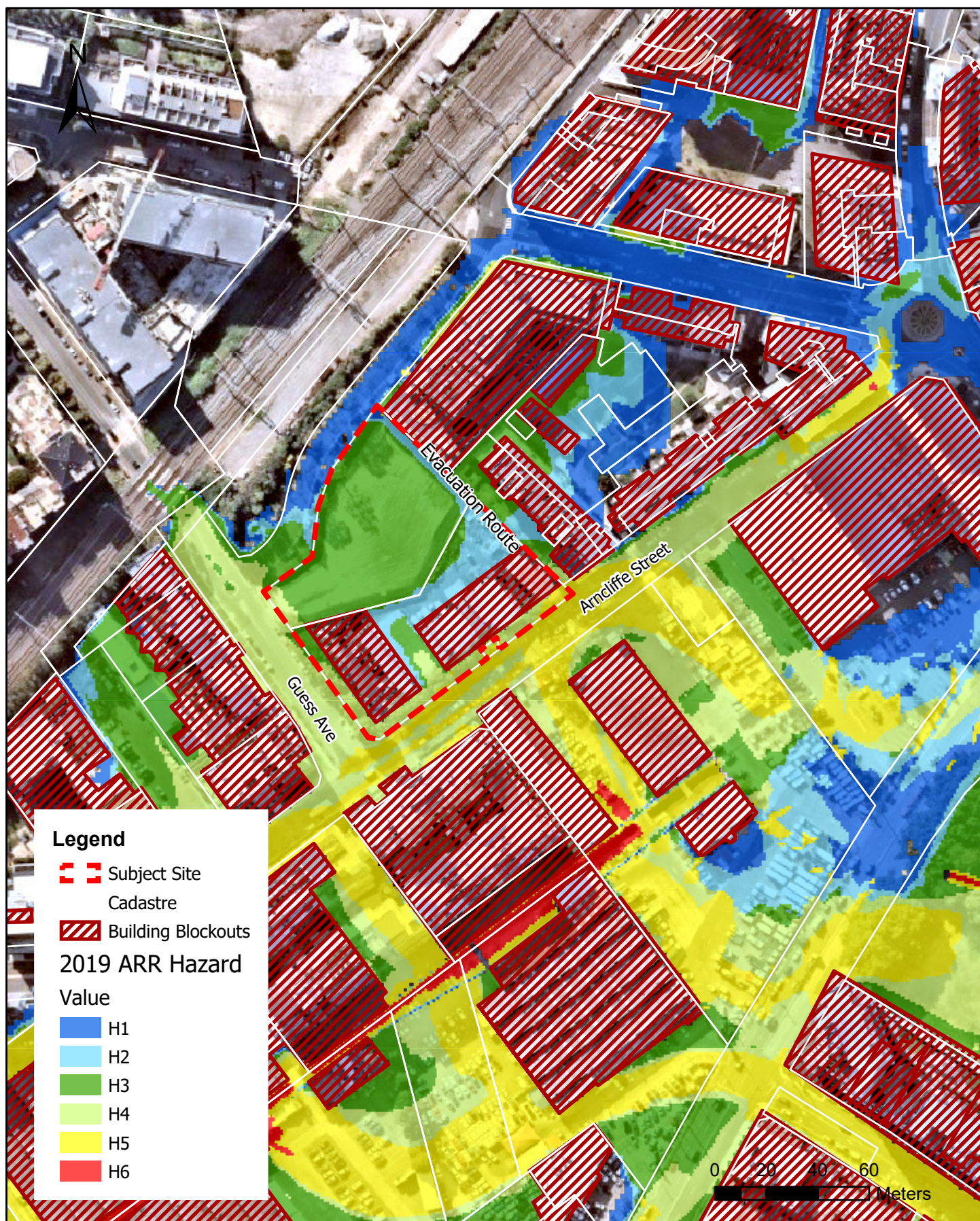


Figure A8

## Developed PMF ARR 2019 Hazard

**2-4 Guess Avenue  
Wolli Creek, NSW 2205**

**Job Number: SY182980**



**Newcastle**

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P.O. Box 180, Charlestown NSW 2290

email [newcastle@northrop.com.au](mailto:newcastle@northrop.com.au) ABN 81 094 433 100

## Appendix D

### Flood Advice



7 November 2018

Our Ref: F18/ 24  
Contact: Pulak Saha



**Bayside Council**

Serving Our Community

Mr Michael File  
FPD Pty Ltd  
PO Box H219 Australia Square  
NSW 1215

Dear Mr File

**Re: Flood Advice Letter for 2 & 4 Guess Avenue, Wolli Creek (Lot 101 DP 808944 and Lot 102 DP 808944)**

**When lodging a Development Application you must enclose a copy of this letter.**

**FLOOD NOTATION**

Council has notated this property as being affected by the 1% Annual Exceedance Probability (AEP) flood. The 1% AEP flood means there is a 1% (i.e. a 1 in 100) chance of a flood of this height, or higher occurring in any one year.

This property lies in the Wolli Creek Development Area and Council's existing DCP determined that the 0.5% AEP flood is to be the design standard in this area.

WMAwater completed a flood study review in this catchment in 2017 and revised the 1% AEP flood level.

The revised 1% AEP flood level is similar to the previous 0.5% AEP flood level. In accordance with the findings of the current flood study and best available information, the 1% AEP flood level with a 500mm freeboard is considered applicable for this site as it will provide protection up to the level of the 0.5% flood level which was set as flood planning level in part 7.1 of Rockdale DCP 2011.

**FLOOD STUDY**

The Council Flood Study applicable to the property is:

Bonnie Doon, Eve Street, Cahill Park Pipe and Overland 2D Flood Study by WMA Water, 2017

**FLOOD LEVELS**

**1% AEP Flood level:**  
2.64m AHD

**Probable Maximum Flood (PMF) Level:**  
3.65m AHD

**Eastgardens Customer Service Centre**

Westfield Eastgardens  
152 Bunnerong Road  
Eastgardens NSW 2036, Australia  
ABN 80 690 785 443 Branch 004

**Rockdale Customer Service Centre**

444-446 Princes Highway  
Rockdale NSW 2216, Australia  
ABN 80 690 785 443 Branch 003  
DX 25308 Rockdale

**Phone 1300 581 299**

**T (02) 9562 1666 F 9562 1777**

**E [council@bayside.nsw.gov.au](mailto:council@bayside.nsw.gov.au)**

**W [www.bayside.nsw.gov.au](http://www.bayside.nsw.gov.au)**

**Postal address:** PO Box 21, Rockdale NSW 2216



**Telephone Interpreter Services - 131 450**

Τηλεφωνικές Υπηρεσίες Διερμηνέων

بخدمة الترجمة الهاتفية

電話傳譯服務處

Служба за преведување по телефон

<b>FLOOD RISK EXPOSURE</b>	<p>The Flood Risk Exposure of these sites has been assessed as</p> <p><b>Overland Flooding: Flood Fringe and Flood Storage: Low Hazard</b></p>
<b>FLOOD COMMENTARY</b>	<ul style="list-style-type: none"> <li>• Refer to figure 1 for flood extent map.</li> <li>• No accurate information is recorded regarding the impact of tsunamis in the Bayside Local Government area.</li> </ul>
<b>FLOOD PLANNING LEVEL (FPL)</b>	<p>The Flood Planning Level (FPL) is a height used to set floor levels for property development in flood prone areas. It is generally defined as the 1% AEP flood level plus an appropriate freeboard.</p> <p>For the design of new developments on these lands the minimum habitable floor level is: 3.14m AHD</p> <p>The minimum level, for storage shed floor, patio, pool coping, deck, carport and/or garage floor is: 1% AEP Flood level (no freeboard is required)</p> <ul style="list-style-type: none"> <li>• Basements and below ground garages are to be physically protected to the minimum habitable floor level. All electrical connections, air conditioning units and external power points are to be set above the minimum habitable floor level.</li> </ul> <p>As noted these floor levels are minimums, floor levels higher than these are allowable subject to normal planning rules. In order to relate these levels to your property you will need to obtain a survey to determine the ground level to AHD at the site.</p>
<b>OVERLAND FLOW</b>	<p>Any new development is not to increase the water level or hazard on adjoining properties. Opportunities should be investigated to design a development that is clear of the overland floodway and acts to reduce the impacts of these flows, possibly by removing inappropriate travel paths and/or reducing the hazard.</p> <p>Where a new development may impact on flood behaviour a civil/hydraulic engineer is to be engaged to assess the impacts of the overland flows before and after development using a hydraulic model. A TUFLOW/DRAINS model has been created by WMAwater for Bayside Council reflecting catchment conditions in 2017. The model will be made available to a nominated Consulting Engineer subject to entering a Model and Data Licence Agreement and payment of the required fee as listed in Council's fees and charges — Flood studies/ GIS drainage.</p>
<b>FLOW THROUGH FENCING</b>	<p>Flow through open form fencing (louvres or pool fencing) is required for all new fencing up to 1% AEP flood level to allow flood water flow through.</p>
<b>DEPTH OF WATER ON</b>	<p>Average depth of water at the invert of road gutter along Arncliffe Street property frontage is 1.1m and average depth of water at the invert of road</p>

**ROAD  
FRONTAGE**

gutter along Guess Avenue property frontage is 0.5m.

Opportunities are being investigated to improve the road drainage system to reduce flooding in the vicinity, however this drainage network will only mitigate the more regular smaller floods.

To avoid the area subject to flooding it is recommended driveway access for a new development be via Guess Avenue towards Mt Olympus Drive or from Mt Olympus Drive.

**FLOOD  
RELATED  
DEVELOPMENT  
CONTROLS**

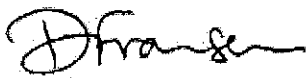
The following additional flood related development controls apply:

1. Any portion of the building or structure lower than the applicable flood planning level (FPL) shall be built from flood compatible materials to be specified by a Structural Engineer.
2. All services associated with the development shall be flood proofed to the habitable floor level.
3. Filling on this land may impact on flood storage and flood behaviour and may increase the hazard on adjoining properties. A qualified civil/hydraulic engineer is to be engaged to assess the impacts of these overland flows before and after development using Manning's Equation or a hydraulic model.
4. A suitably qualified engineer is to certify that the structure can withstand the forces of floodwater, debris and buoyancy in a 1% AEP flood event.
5. A Flood Risk Management Plan is required to be lodged with the DA which will detail whether evacuation procedures are required and if so how they will be initiated, warning signs and preservation of flood awareness as owners and/or occupants change through time. An example is attached.

Council considers that this is the best information currently available on flooding in the area, but Council cannot comment on the accuracy of the result.

Should you require any further information, please contact Council's Strategic Floodplain Engineer, Pulak Saha on 9562 1652.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Dfransen', with a stylized, cursive script.

Debbie Fransen  
**COORDINATOR ASSET STRATEGY**

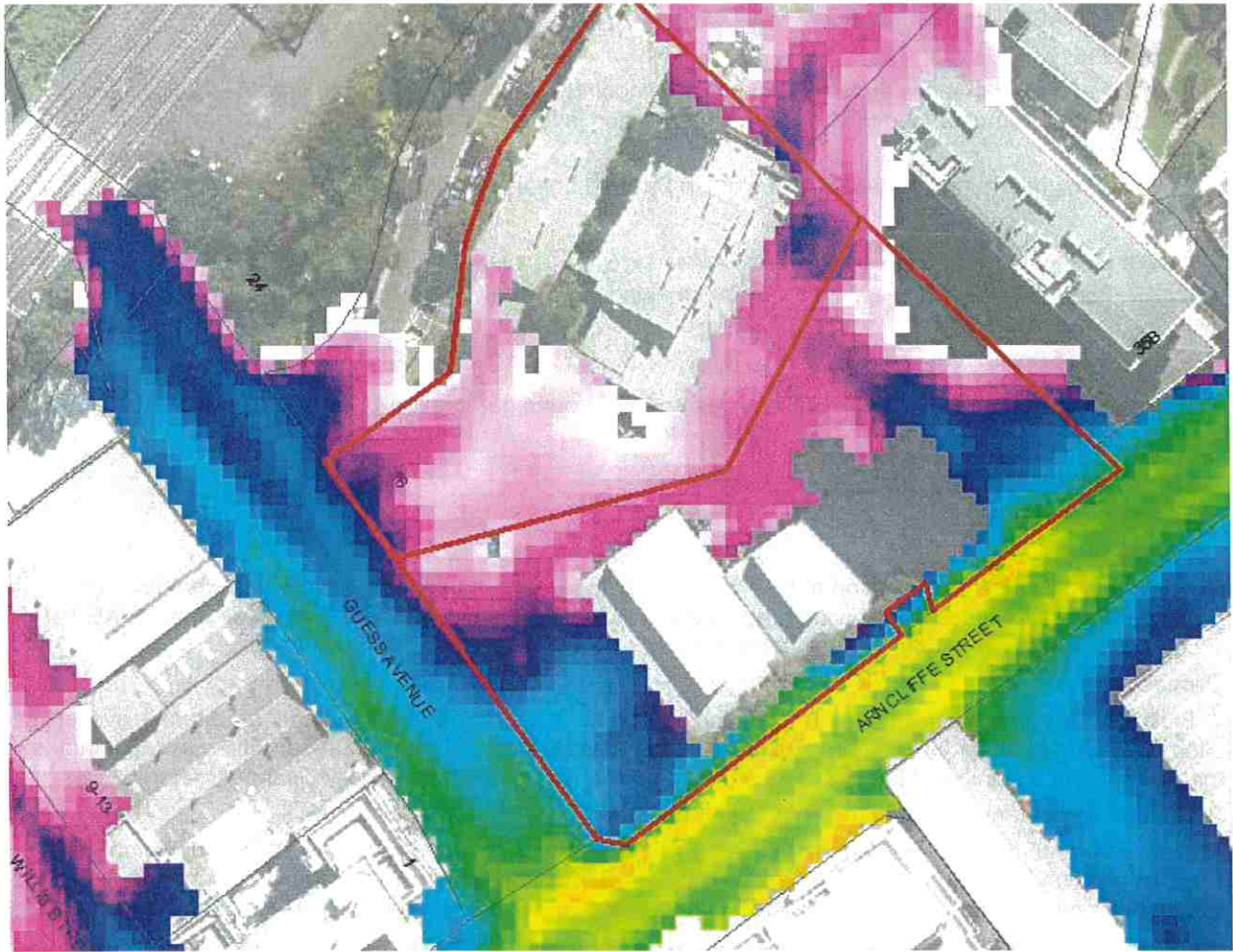


Figure 1: 1% AEP flood extent map (yellow indicates greater depth of flood water and pale pink indicates shallower depth)



## FLOOD MANAGEMENT PLAN FOR XXXXXXXXXXXXXXXX

### Background

Council has advised that this property is subject to flooding in a 1% AEP (1 in 100 year AEP) storm event. The Probable Maximum Flood (PMF) is the highest flood level that is ever likely to occur, however it is extremely rare.

Council has no information regarding Tsunami in Bayside Local Government.

Relevant levels are: *Complete as appropriate for your property*

1% AEP Flood Level =	m Australian Height Datum (AHD)
Probable Maximum Flood =	m AHD
Garage Floor Level =	m AHD
Driveway Crest Level =	m AHD (below ground garages only)
Habitable Floor Level =	m AHD
Second Floor Level =	m AHD
Front Boundary Level =	m AHD
Lowest Ground Level =	m AHD at .....

The above levels give an indication of how the various floods will impact this property and what level of protection is provided. Habitable living areas are designed to be a minimum of 0.5 m above the 1% AEP Flood Level and staying within the home will provide protection for a wide range of floods.

### Procedure

1. Floods in Bayside Local Government are considered as "flash floods" and no warning system is available. Storms leading to major flooding are typically 2 hours long, however shorter storms as little as a 30 minutes long can produce significant flooding. Once the storm passes floodwaters usually disappear rapidly.

2. During floods many local and major streets and roads will be cut by floodwaters.

Traveling through floodwaters on foot, or in a vehicle can be very dangerous as the water may be polluted, obstructions can be hidden under the floodwaters, or you could be swept away. Council recommends staying within the home as much as practical as this is the safest option. If you need to leave the home do so early in the flood event, before the flood level reaches ..... *(the trigger location for your property)* ....

3. Develop your own family flood plan and be prepared if flooding should occur while the kids are coming home from school or when you are returning from work. Talk to the Council to determine the safer travel routes that are less likely to be cut by floodwaters.

4. For below ground garages do not attempt to save the car if floodwaters start to enter the garage, it is too dangerous as water levels will rise rapidly and you could be trapped.

5. As the flood level approaches the garage floor level (but only if safe to do so) relocate any items that may be damaged by water, or poisons, or wastes to as high a level as possible.

6. As the flood level approaches the habitable floor level:

i) gather medicines, special requirements for babies or the elderly, mobile phones, first aid kit, special papers and any valuables into one location,

ii) put on strong shoes, raise any items within the home that may be damaged by water (e.g. photo albums) to as high a level as possible, with electrical items on top. Turn off and disconnect any large electrical items such as a TV that cannot be raised.

iii) place wet towels across the bottom and lower sides of external doors to slow down the entry of water through the door.

7. In the very rare event that floodwaters may enter the home collect items from 6.i) above and move to an upper level if possible, or if in a single level dwelling provide a chair in the kitchen to enable access to the kitchen bench preferably adjacent to the window. Ensure window is not locked or key readily available. Do not evacuate the home unless instructed to do so by the SES or the Police. Remember floodwaters are much deeper and flow much faster outside.

8. In the case of a medical emergency ring 000 as normal, but explain about the flooding.

9. A laminated copy of this flood plan should be permanently attached (glued) on an inside cupboard door in the kitchen and laundry and to the inside of the electrical meter box.

10. This flood management plan should be reviewed every 5 years, particularly with the potential effects of Climate Change with sea level rise and increased rainfall intensities.

