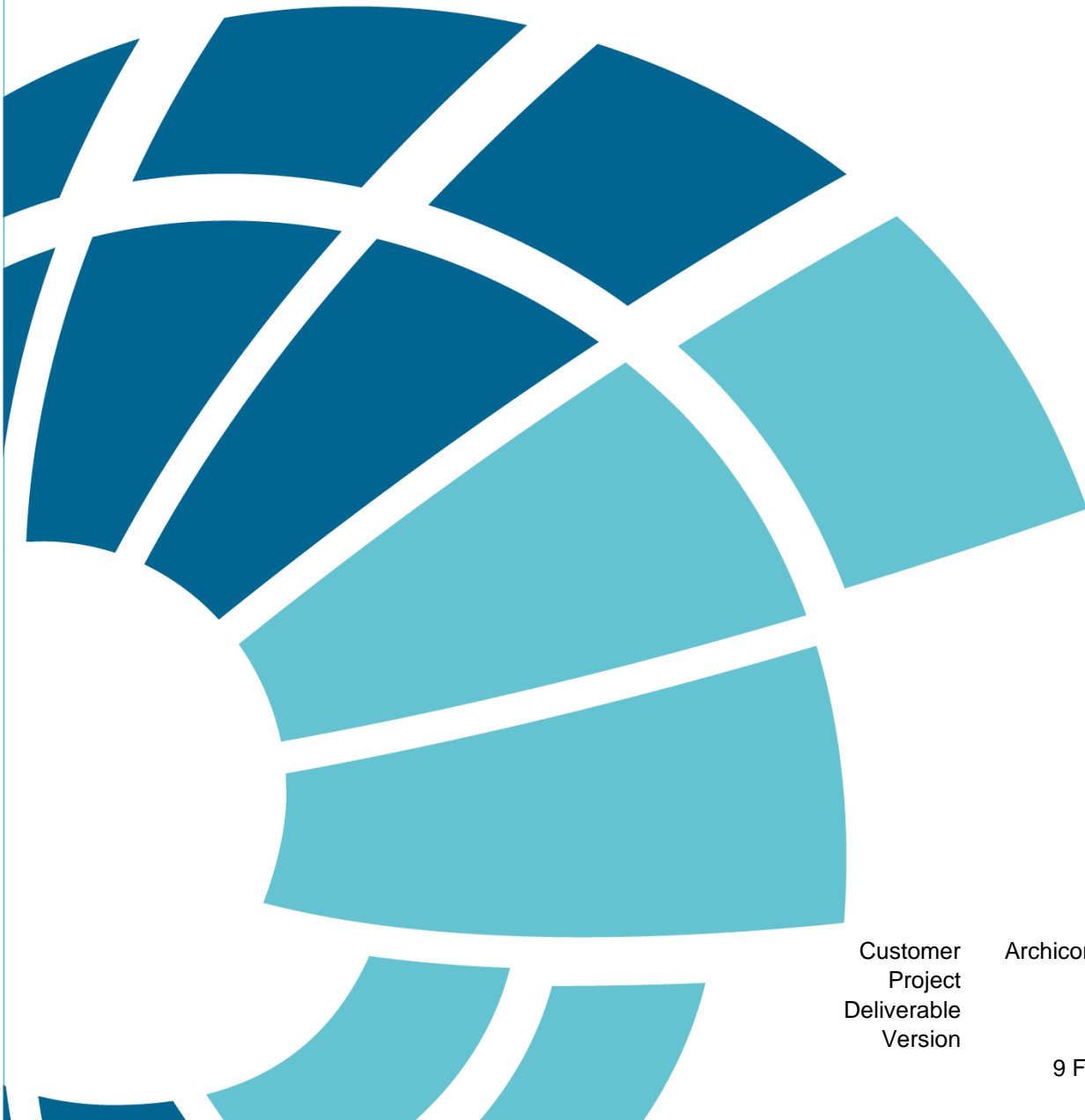


# 26 Tupia Street Flood and Risk Assessment



Customer  
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Deliverable  
Version

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# 1 Introduction

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## 1.1 Background

26 Tupia Street, Botany ("the Site") is an industrial development approximately 0.8 ha in size currently made up of 3 industrial warehouse buildings, large sections of paved surfaces and a thick coverage of vegetation along the site boundary. The Site is located within the Foreshore Beach drainage catchment along the north-east edge of Botany Bay. Site terrain varies between 4.2 m AHD at the north-east corner to 1.6 m AHD along the southern boundary (refer Figure 1.1). The Foreshore Beach catchment is characterised as being low in elevation with generally flat drainage gradients and as a result, during significant flood events flood waters pond on Site in a number of locations.

A Planning Proposal is proposed to facilitate the development of a multi-unit residential complex at the Site. The development will involve the construction of three residential flat buildings (RFB) that will be 3-4 storeys high and contain approximately 109 apartments. The Site is located within the Bayside Council Local Government Area and subject to the Bayside Local Environment Plan (BLEP) 2021. Under the current BLEP, the Site is designated as an R3 Medium Density Residential Zone. The Planning Proposal will seek amendments to the BLEP for the following within the existing R3 zoned site:

- Increase in the maximum permissible building height;
- Increase in the maximum permissible floor space ratio; and
- RFBs to be permitted.

In August 2021, a Planning Proposal for a previous development at the Site was not supported by the Bayside Local Planning Panel due to key matters including adequate addressal of flooding, height and density requirements. The development has been adjusted in line with this feedback, including:

- A reduction from 5-storeys under the previous planning proposal;
- A reduction in density; and
- Further consideration of flooding (undertaken as part of this assessment).

# LEGEND

 Lot Boundary

## Elevation (m AHD)

-  0
-  2
-  4
-  6
-  8



Title:

**Existing Elevations**

Drawing:


**1.1**

Rev:

**A**

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0 30 60 m






## 1.2 Proposed Development

The proposed future development sought through this Planning Proposal is a residential flat building development. The development works will involve demolishing of existing structures on Site, followed by construction of three residential flat buildings (RFB) that will be 3-4 storeys high and contain approximately 109 apartments and an underground carpark. The proposed development plan view and the modelled site layout are outlined in Figure 1.2 and Figure 1.3 respectively. Finished floor levels for residential finished floor levels have been preliminary set at 4.0 m AHD. Communal open spaces have been preliminary set at 3.85 m AHD. Access to and from the development will be via Tupia Street.

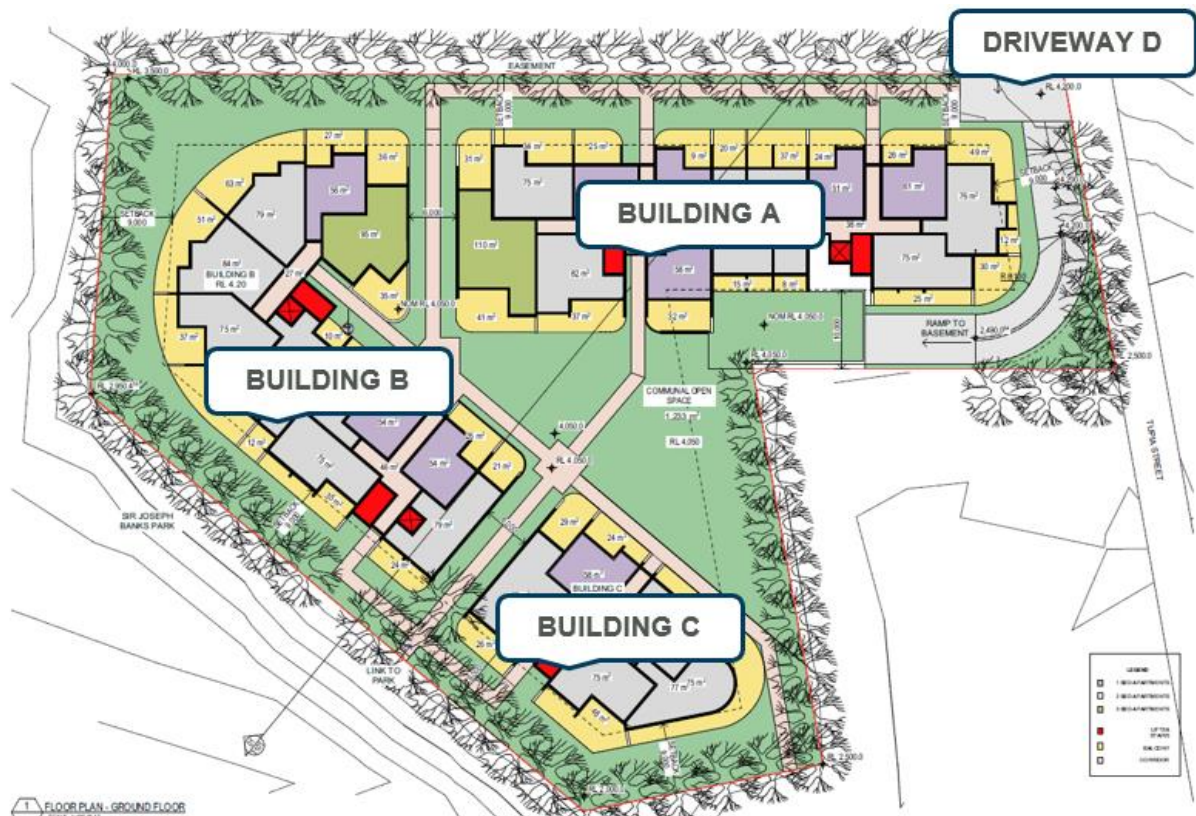





Figure 1.2 Proposed Development



## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD



Title:

## Post Development Conditions

Drawing:


1.3

Rev:

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### 1.3 Purpose of this Report

The Site lies within the Foreshore Beach catchment, located along the north-east edge of Botany Bay. Flood behaviour within the Foreshore Beach catchment is defined by the '*Botany Bay Foreshore Beach Catchment Floodplain Risk Management Study and Plan*' (Bayside Council, 2020) (herein referred to as the "2020 FRMS&P"). Under existing flood conditions, the Site is subject to overland flow flooding with inundation predicted in rare and extreme flood events.

Accordingly, BMT Commercial Australia Pty Ltd ("BMT") was commissioned to undertake a site-specific Flood Impact Assessment (FIA) for the proposed development to accompany the Planning Proposal. This report documents the methodology and findings of the assessment, including:

- definition of existing (baseline) design flood conditions;
- definition of post-development flood conditions;
- assessment of the potential impacts of the proposed development on existing flood behaviour; and
- preparation of a flood impact assessment report inclusive of a flood emergency response plan.

## 2 Comparison of Council Results to New Development

---

### 2.1 Available Flood Studies and Modelling

Mainstream flooding for the Foreshore Beach catchment draining to Botany Bay was originally assessed as part of the *Botany Bay Foreshore Beach Catchment Flood Study* (BMT, 2015) and more recently as part of the 2020 FRMS&P. The 2020 FRSM&P utilised a TUFLOW hydraulic model with a direct-rainfall (rainfall-on-grid) hydrologic modelling approach based on Australia Rainfall and Runoff 2019 inputs. The model assumed total blockage of buildings (i.e. it is assumed water cannot enter into buildings and no storage occurs) and a 50% blockage to the underground stormwater network. A 5 mm map cut-off depth was also applied to remove nuisance ponding from the final mapped results. For the purpose of this assessment, the 2020 FRMS&P TUFLOW model has been used as the basis of this flood impact assessment.

### 2.2 Model Updates

In order to assess the existing flood conditions at a more localised and detailed scale, modifications were made to the 2020 FRMS&P TUFLOW hydraulic model to better reflect existing on-site conditions in more detail. This includes the following updates for the Site and immediate surrounds.

- Ground surface elevations within and surrounding the Site were updated based on 2020 LiDAR data.

This updated version of the model is referred to as the "Existing Scenario TUFLOW model" and was initially used to simulate the 1% Annual Exceedance Probability (AEP) event. The results of the Existing Scenario TUFLOW model were verified through comparison with the predicted 1% AEP flood levels produced by the 2020 FRMS&P TUFLOW model. For this purpose, peak flood level difference mapping was prepared by subtracting peak existing flood levels predicted by the 2020 FRMS&P TUFLOW model from the peak flood levels predicted by the Existing Scenario TUFLOW model. This mapping is shown in Figure 2.1 and indicates the magnitude and location of changes associated with the model updates listed above.

From Figure 2.1, it can be seen that 1% AEP flood levels from the Existing Scenario TUFLOW model are similar to those predicted by the 2020 FRMS&P TUFLOW model, with only minor differences in the flood extent at the north, east and west of the Site and a minor increase in flood increase located along the southern boundary. Changes to the flood extent are reflective of the inclusion of the 2020 LiDAR data.


Overall, minor changes to predicted localised flood conditions result from the model updates undertaken for this assessment, however these differences are reflective of the use of more recent topographic. Therefore, the Existing Scenario TUFLOW model is considered fit for purpose for this assessment for use in defining on-Site existing flood conditions (defined in Section 3.1), post-development flood conditions and potential impacts of the proposed development on local flood behaviour (refer Section 4).

## LEGEND


 Lot Boundary


 Existing Buildings

### Peak Flood Level Change (m)

  $\leq -0.2$

  $-0.2 - -0.1$


  $-0.1 - -0.05$


  $-0.05 - -0.02$

  $-0.02 - 0.02$


  $0.02 - 0.05$

  $0.05 - 0.1$

  $0.1 - 0.2$

  $\geq 0.2$

### Change In Inundation

 Decrease In Inundation

 Increase In Inundation



Title:

**1% AEP Peak Flood Level Impact Updated Model vs 2020  
FRMS&P**

Drawing:


**2.1**

Rev:

**A**

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0 30 60 m






### 3 Existing Flood Behaviour

#### 3.1 Existing Flood Conditions

The Existing Scenario TUFLOW model was used to stimulate the 5% AEP, 1% AEP, 0.5% AEP, 0.2% AEP and Probable Maximum Flood (PMF), and define the on-site flood conditions discussed in this section. This defined the pre-development (baseline) flood conditions against which flood impacts of the proposed developments will be assessed.

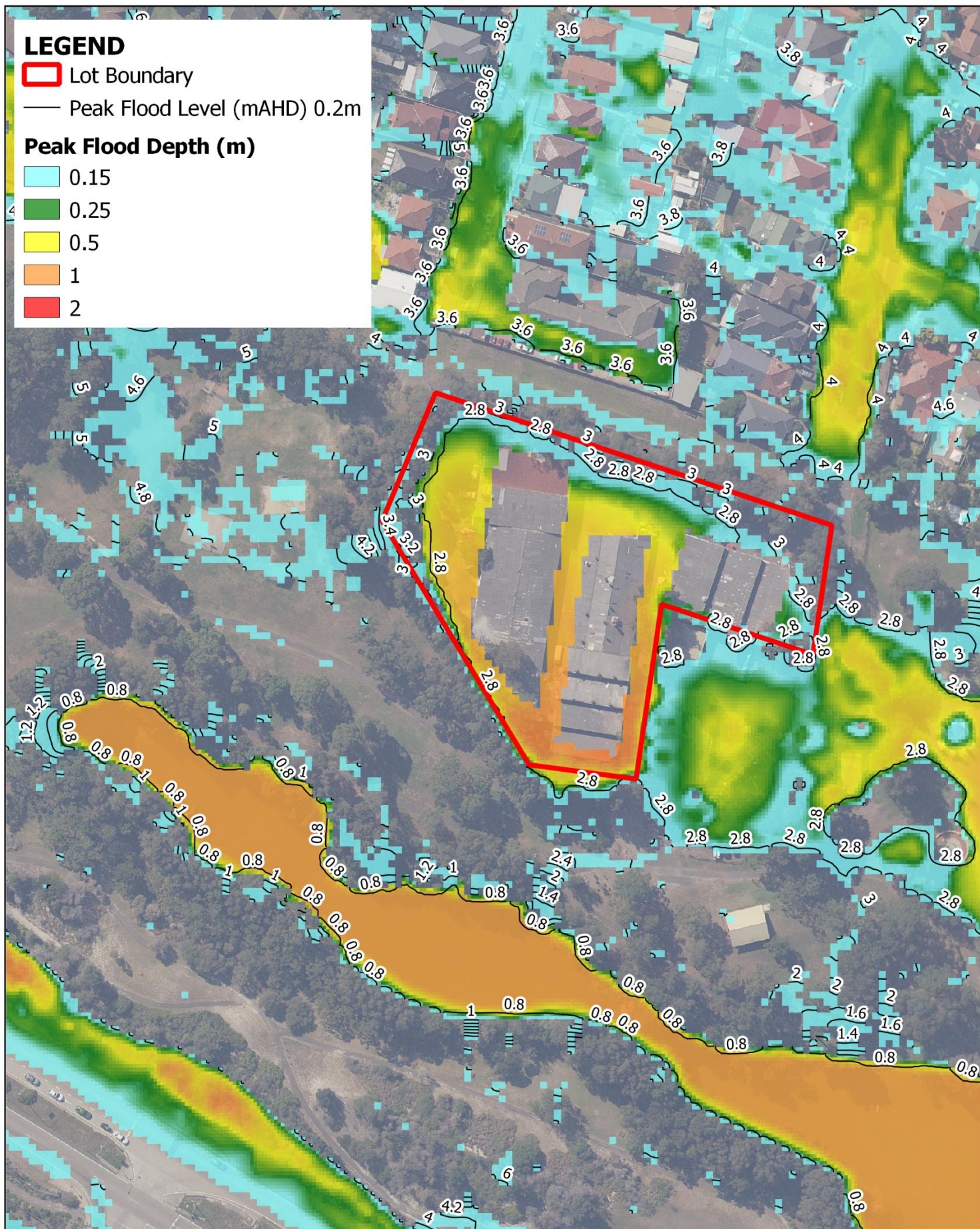
Existing peak 1% AEP and PMF depths and levels at the Site are shown in Figure 3.1 and Figure 3.2 respectively. Table 3.1 lists the predicted maximum peak existing flood levels at the location of the 3 proposed buildings.

Table 3.1 Existing Peak Flood Levels

Design Event	Peak Flood Level (m AHD)		
	Building A	Building B	Building C
5% AEP	2.86	2.79	2.79
1% AEP	2.87	2.74	2.74
0.5% AEP	2.87	2.80	2.80
0.2% AEP	2.88	2.79	2.79
PMF	3.52	3.52	4.15

There is a minor variation in peak 1% AEP flood level across the Site, with approximately 0.13m difference in peak existing flood levels at the location of the proposed Building A and Building C. Maximum flood depths of up to 1.10m in the 5% AEP, 1.14m in the 1% AEP, 1.15m in the 0.5% AEP, 1.16m in the 0.2% AEP and 1.87m in the PMF are experienced at the Site. Maximum peak velocities are relatively small, less than 0.05m/s for the 5% AEP, 1% AEP, 0.5% AEP and 0.2% AEP. The maximum peak flood velocity at the Site for the PMF is approximately 1.2m/s at the north-western corner boundary.





Title:  
**Existing 1% AEP Peak Flood Levels and Depths**

Drawing:

**3.1**

Rev:

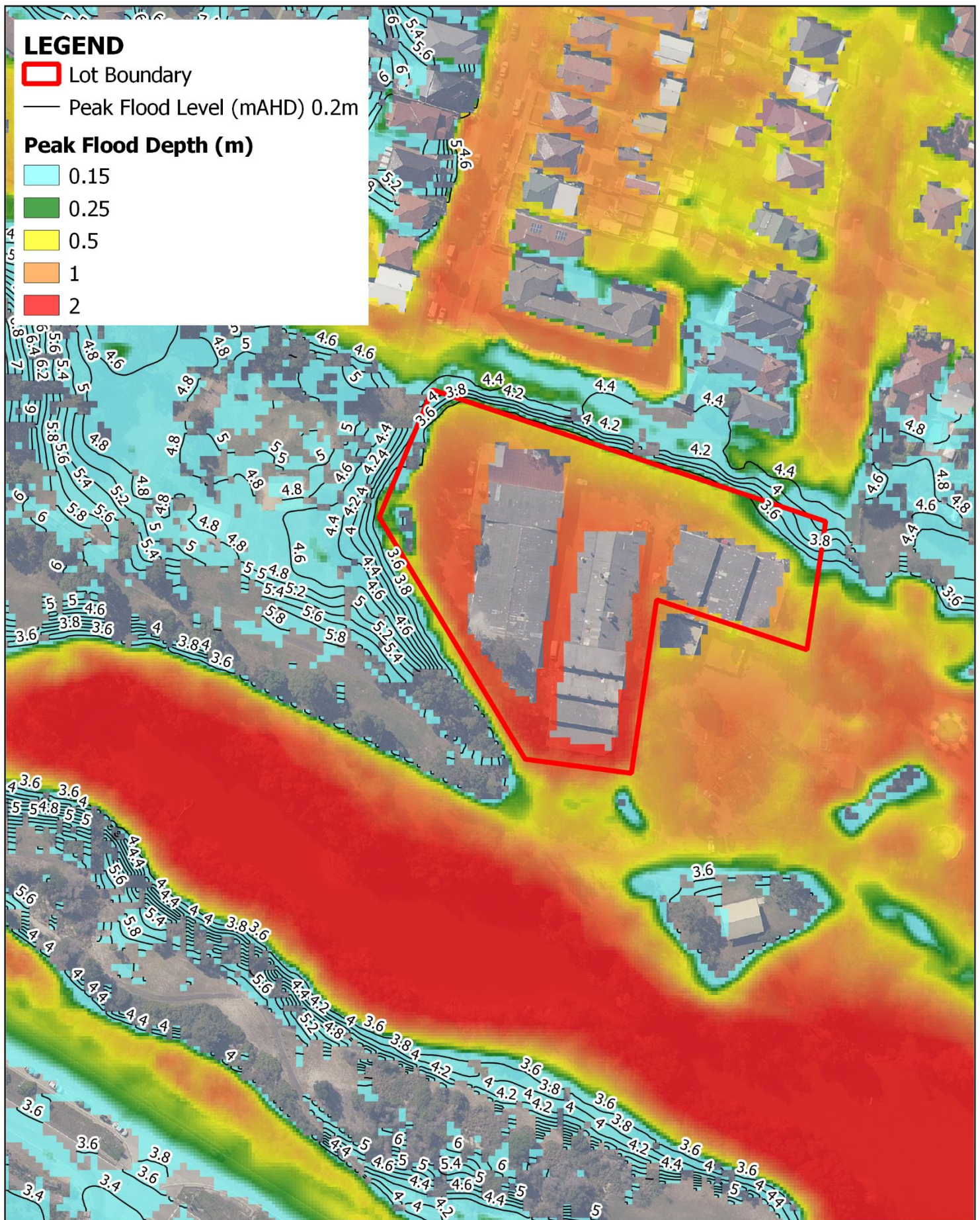
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Title:  
**Existing PMF Peak Flood Levels and Depths**

Drawing:

**3.2**

Rev:

**A**

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0 30 60 m





## 4 Post-Development Flood Behaviour

### 4.1 Model Updates

The proposed development shown in Figure 1.2 comprises the following works:

- Demolition of existing buildings;
- Construction of new 3 residential flat buildings (Building A, Building B and Building C); and
- Ground filling in communal areas to 3.85 m AHD.

These proposed works have been incorporated into the Existing Scenario TUFLOW model, and this modified version of the model is referred to as the Post Development Scenario TUFLOW model.

### 4.2 Potential Flood Impacts

The Post-Development Scenario TUFLOW model was used to simulate the 5% AEP, 1% AEP, 0.5% AEP, 0.2% AEP and PMF events. Modelling results were used to assess and map the relative flood impacts of the proposed development (i.e. post-development scenario result minus the existing scenario result). Peak 1% AEP event impact mapping is shown below, with impact mapping for the remaining events included as Appendix A.

#### Peak Flood Level Impacts

The peak 1% AEP flood level impact map shown in Figure 4.1 indicates that the proposed development will re-distribute floodwaters on Site. Peak flood level increases are located primarily along the northern boundary of the Site, where proposed ground level raising and new building construction act to prevent flows from traversing between buildings (as per current conditions) and instead encourage flows around the Site boundary. Localised peak flood level increases are shown along the western boundary as a result, although it is noted that these increases are localised, proximate to the boundary and occur only in areas where development is not present. The proposed works will also reduce peak flood levels within the water body to the south of the Site due to the reduction in flow conveyance through the Site as a result of the raising of ground levels in communal areas. It is noted that an overland flowpath exists between the waterbody and the Site, but that due to the very low depth of flooding present in the flowpath (see Section 2.1) it is not displayed on the mapping presented in this report.

#### Peak Flow Velocity Impacts

The flow velocity impact mapping shown in Figure 4.2 indicates that the proposed development will result in negligible changes to peak flows.

#### Peak Velocity-Depth Product




Velocity-depth product ( $V \times D$ ) mapping is included in Appendix A. Mapping indicates that for the 1% AEP event peak  $V \times D$  is below  $0.2 \text{ m}^2/\text{s}$  but that peak PMF  $V \times D$  is above  $0.4 \text{ m}^2/\text{s}$  in some locations. Fencing along the boundary of the Site should be open type to provide minimal restriction to passing floodwaters.

### 4.3 Sensitivity Testing










The sensitivity of the post-development Scenario TUFLOW model to a 100% blockage to the underground stormwater network (as outlined in Section 2.1 a 50% blockage has been applied as part of this assessment) has been assessed as part of this report. The results of the sensitivity test indicate that total blockage of the underground stormwater network has a negligible effect on local conditions. A map showing a comparison of peak 1% AEP flood levels for the Post-Development Scenario with 100% blockage and the Post-Development Scenario (with the assumed 50% blockage) is included in Appendix A.





## LEGEND

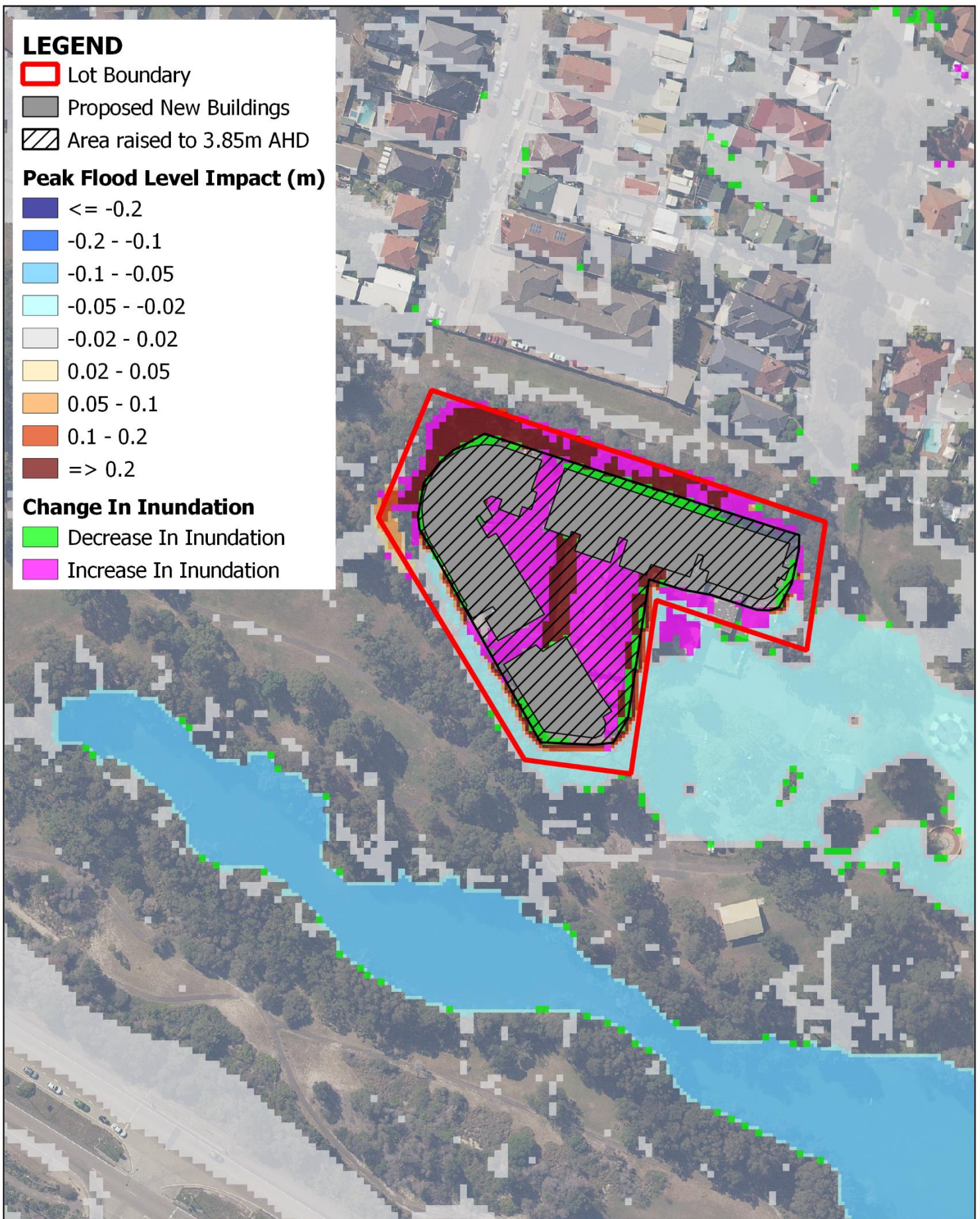
-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Flood Level Impact (m)

-   $\leq -0.2$
-   $-0.2 - -0.1$
-   $-0.1 - -0.05$
-   $-0.05 - -0.02$
-   $-0.02 - 0.02$
-   $0.02 - 0.05$
-   $0.05 - 0.1$
-   $0.1 - 0.2$
-   $\geq 0.2$

## Change In Inundation

-  Decrease In Inundation
-  Increase In Inundation



Title:

## 1% AEP Peak Flood Level Impact Design (Post-Development) vs Existing Conditions

Drawing:


4.1

Rev:

A




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0 30 60 m















## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Velocity Impact (m/s)

-   $\leq -1.0$
-  -1.0 to -0.50
-  -0.50 to -0.25
-  -0.25 to -0.10
-  -0.10 to 0.10
-  0.10 to 0.25
-  0.25 to 0.50
-  0.50 to 1.0
-   $\geq 1.0$



Title:

**1% AEP Peak Flood Velocity Impact Design (Post-Development) vs Existing Conditions**

Drawing:


**4.2**

Rev:

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0 30 60 m




#### 4.4 Flood Hazard

The Best Practice Flood Risk Management approach to flood hazard mapping (AIDR, 2017) classifies the floodplain into the six distinct hazard classification (H1 to H6) shown in Figure 4.3. These hazard classifications are based on adopted thresholds of flood depth, velocity and depth-velocity product that identify when flood conditions are likely to present a risk to people, vehicles and buildings. A description of each hazard threshold is provided in Table 4.1.

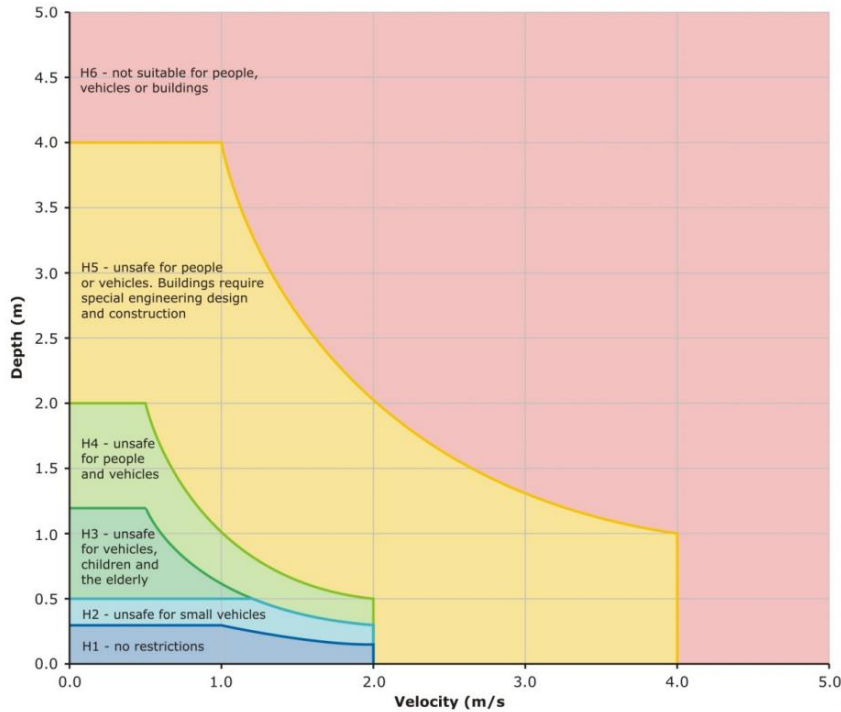


Figure 4.3 Flood Hazard Curves (2017)

Table 4.1 Flood Hazard Classification Thresholds (ADR, 2017)

Hazard Classification	Description
H1	Relatively benign flow conditions. No vulnerability constraints.
H2	Unsafe for small vehicles.
H3	Unsafe for all vehicles, children and the elderly.
H4	Unsafe for all people and vehicles.
H5	Unsafe for all people and vehicles. Buildings require engineering design and construction.
H6	Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.






As shown in Figure 4.4, the modelling results indicate a 1% AEP flood hazard classification of H1 to H4 on-Site under post development conditions, noting that floodwaters are considered unsafe for vehicles, all people and vehicles within areas of H4 hazard classification. During the PMF event (refer Figure 4.5), hazard classifications of H1 to H5 are predicted on-Site, with the H5 classification extending across larger areas when compared to the peak 1% AEP flood hazard classification. The H4 hazard classification within the Site for both events is primarily driven by higher flood depths within trapped low points.

Whilst Table 4.1 and Figure 4.3 may indicate that some hazard may be manageable, in practice flood hazard is highly variable and subject to a range of situational factors. Current best practice is to avoid entering floodwater wherever possible, and under no circumstances should floodwater be considered "safe".







It is noted that the proposed development is not predicted to increase the peak 1% AEP flood hazard classification across nearby floodplain areas. This is because the magnitude of the changes in peak 1% AEP flood level and/or peak 1% AEP flow velocity are not sufficient to result in an increased flood hazard categorisation.

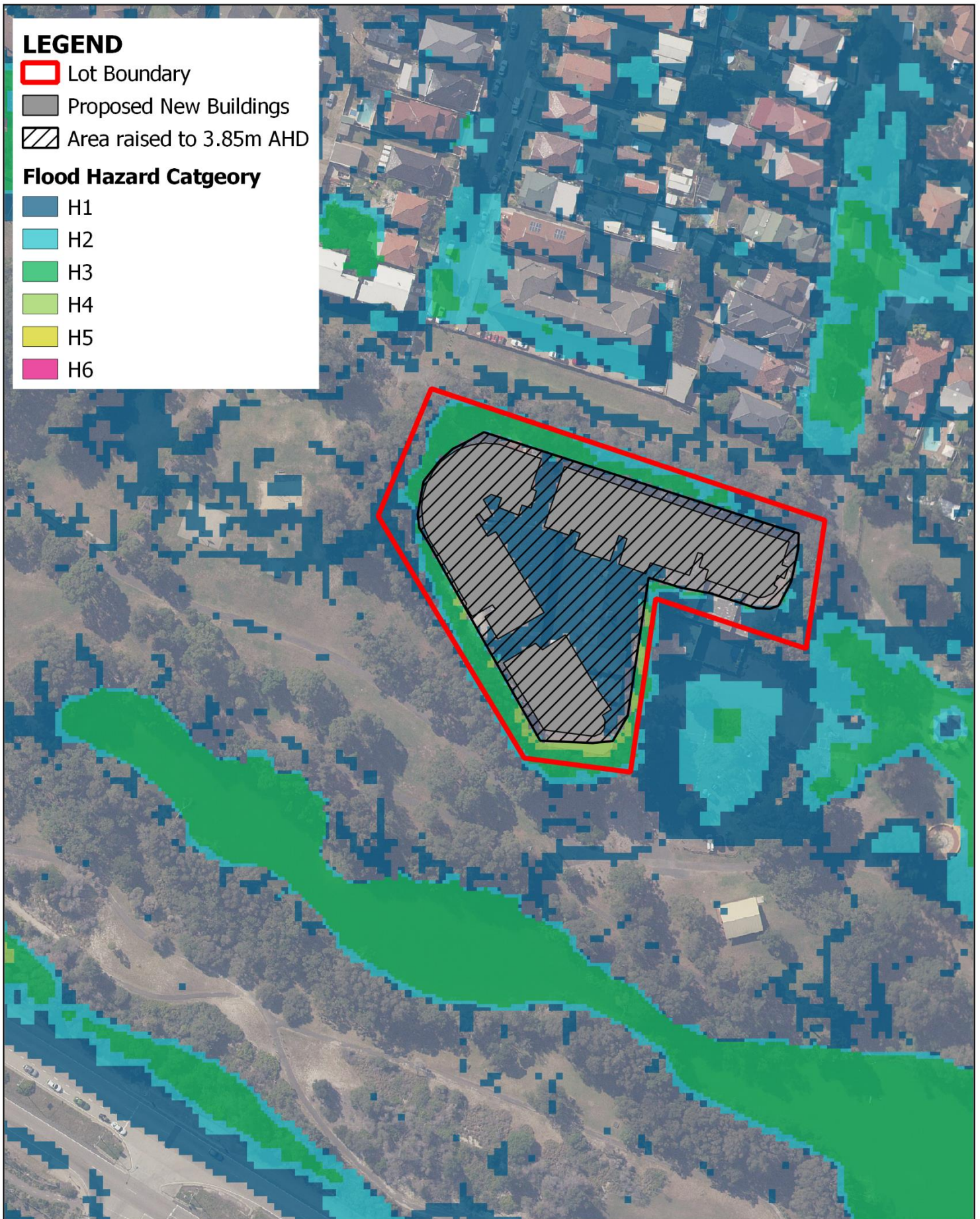


## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Flood Hazard Category

-  H1
-  H2
-  H3
-  H4
-  H5
-  H6



Title:

## 1% AEP Flood Hazard Category Design (Post-Development) Conditions

Drawing:

4.4

Rev:

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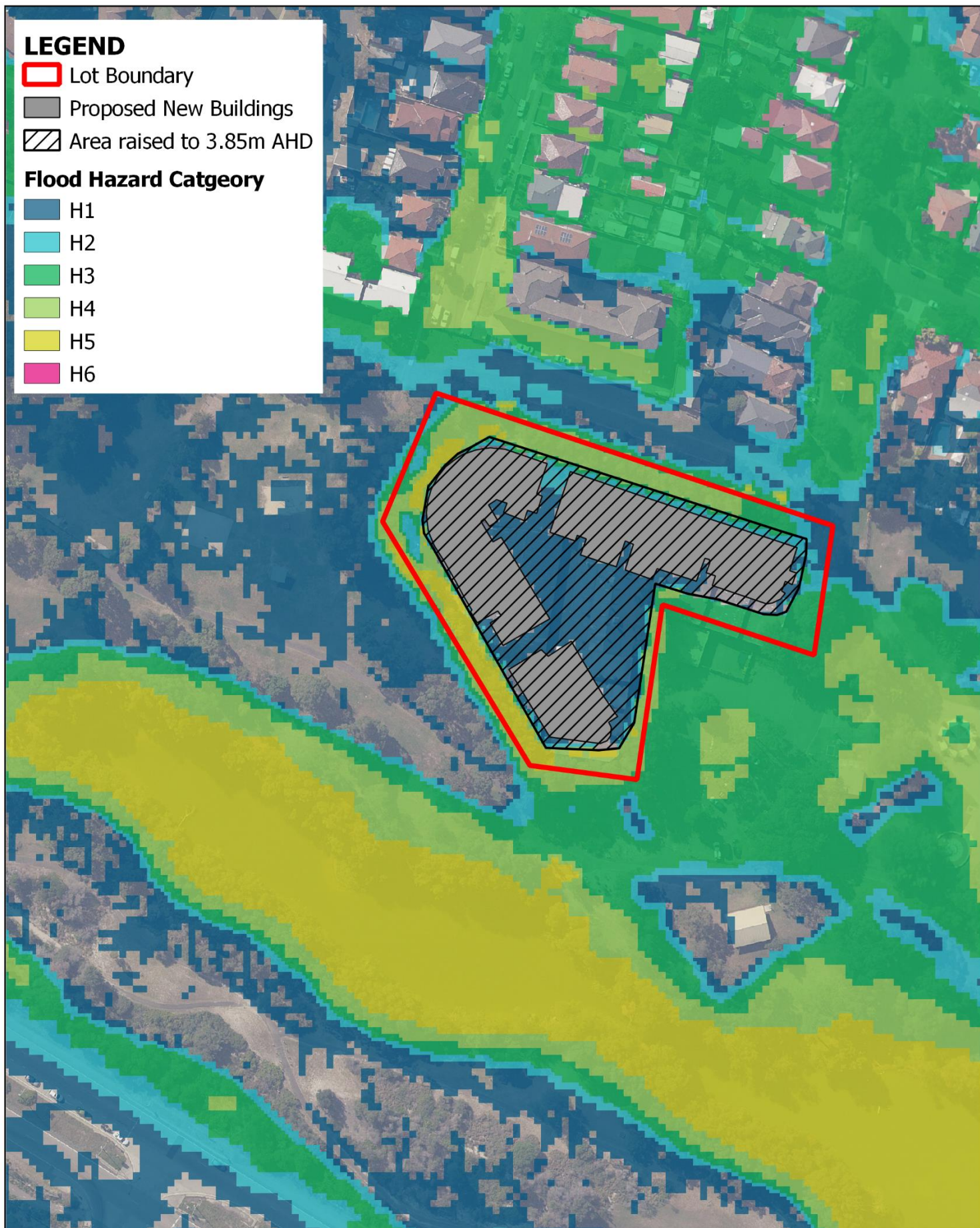


## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Flood Hazard Category

-  H1
-  H2
-  H3
-  H4
-  H5
-  H6



Title:

## PMF Flood Hazard Category Design (Post-Development) Conditions

Drawing:


4.5

Rev:

A

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## 5 Development Controls

### 5.1 General Flood Planning Requirements

Bayside Council utilises two overarching DCPs against which new development are assessed. As the Site is located within the bounds of the old City of Botany Bay LGA, the development is required to comply with the Botany Bay Development Control Plan 2013, including *Part 10 Stormwater Management Technical Guidelines Section 11 Flood Study or Overland Flowpath Assessment*. Specific requirements from this section have been extracted for this assessment and are shown in Table 1 below.

Table 5.1 Section 11.2 Flood Study Assessment Requirements

Submission Requirement	BMT Comment
<p><i>For site with upstream catchments greater than 5 Ha, a detailed flood study in accordance with the current version of Australian Rainfall and Runoff (AR&amp;R) and the NSW Floodplain Development Manual shall be submitted to Council.</i></p>	<p>Bayside Council have supplied the Botany Bay Foreshore Beach Catchment Risk Management Flood Model for use in this assessment.</p>
<p><i>The assessment shall be prepared by a qualified civil engineer experienced in preparation of flood modelling and shall address and comply with the following</i></p>	
<p><i>(i) The flood study which shall include:</i></p> <ul style="list-style-type: none"> <li><i>Flood model of the 1% Annual Exceedance Probability (AEP) design storm events and Probable Maximum Flood (PMF) with the predicated impacts of Climate Change;</i></li> <li><i>Two-dimensional (2D) flood modelling (such as TUFLOW) shall be used for the development site with upstream catchments greater than 20 Ha.</i></li> <li><i>Scaled maps, including 0.2 m contour lines that showing full upstream catchment area;</i></li> <li><i>Scaled maps showing the flood extent, flood contour, flood depth and velocity of pre-development and post-development 1% AEP and PMF flood; and</i></li> </ul> <p><i>Detailed scaled plan view showing the pre-development and post-development 1% AEP and PMF flood extent and levels on the subject property.</i></p>	<p>The 1% AEP and PMF design storm events have been assessed as part of this study. Rarer storm events (the 0.5% AEP and 0.2% AEP events) have been used as a proxy for climate change.</p> <p>Mapping fulfilling the outlined requirements is included in Section 3 and Annex A.</p>
<p><i>(ii) A 50% blockage factor shall always apply to the underground drainage system in flood modelling.</i></p>	<p>This requirement has been included in the modelling for all events.</p>
<p><i>(iii) A sensitivity analysis on flooding impact when the stormwater drainage system is 100% blocked shall be considered in the modelling.</i></p>	<p>This requirement was included in the modelling for sensitivity testing in Section 4.3. See map in Appendix A for 1% AEP post-construction with 100% blockage applied.</p>



Submission Requirement	BMT Comment
(iv) All levels shown on flood study shall be to the Australian Height Datum (AHD).	This requirement was included as part of this report.
(v) The flood study shall demonstrate that the proposed development will not impede the passage of floodwater to cause a rise (afflux) in the flood level upstream and/or increase the downstream velocities of flow of the flood standard.	Figure 4.1 and Figure 4.2 indicate that the proposed works will not cause a rise in flood level upstream or increase downstream velocities.
(vi) The proposed finished floor levels of habitable buildings/structures and non-habitable buildings/structures (including garage, ramps to the basement car parking area etc.) shall be minimum 300mm and 100mm above the 1% AEP floodwater level respectively.	Finished floor levels for the proposed development will need to be set at a flood planning level to ensure habitable areas are flood-free. This will be demonstrated at Development Application stage.
(vii) Flood storage within the site shall be maintained before and after the development.	It is noted that the proposal includes the raising of communal areas. As per Figure 4.1 this raising does not cause peak flood level increase to neighbouring properties. However, in line with this requirement during detailed design stage it will need to be ensured that flood storage within the Site is maintained before and after the development.
(viii) Structures/filling shall not be placed within the flood extent unless suitably and adequate mitigation measures have been proposed and implemented. These measures will require approval from Council.	Any proposed structures/filling required as part of the proposed emergency management plan (see Section 6.2.3) will require approval from Council.
(ix) The boundary fence over the estimated flood extent must be replaced with open type fencing to allow unimpeded passage of overland floodwater.	Any fences proposed as part of the development will need to be open type.
(x) Flood Evacuation Plan in PMF storm events shall be submitted for assessment.	A FERP has been included as part of this report.
(xi) If the velocity - depth product of the overland flow path exceeds $0.4\text{m}^2/\text{s}$ , suitable open type fencing or other appropriate measures shall be used to restrict access to such areas affected by hazardous overland flows.	Velocity-depth product exceeds $0.4\text{m}^2/\text{s}$ in some locations for the PMF event only.
(xii) The flood study must be signed by an engineer declaring that the study has been undertaken in accordance with Australian Rainfall and Runoff and the NSW Floodplain Development Manual.	<p>This flood study has been undertaken in accordance with Australian Rainfall and Runoff and the NSW Floodplain Development Manual</p>  <p>Kieran Smith Senior Engineer BMT</p>

## 5.2 Flood Planning Levels

Bayside Council sets flood related development controls in the Botany Bay Development Control Plan 2013, Part 10 Stormwater Management Technical Guidelines (as fully outlined Table 5.1 above). The DCP identifies that:

- Finished floor levels for habitable buildings/structures shall be a minimum of 300 mm above the 1% AEP floodwater level; and
- Finished floor levels for non-habitable buildings/structures and ramps to basement carparking areas shall be a minimum of 100 mm above the 1% AEP floodwater level.

Based on these requirements, finished floor levels for each of the buildings identified in Figure 1.2 are outlined in Table 5.2 below. It is noted that preliminary architectural designs for the 26 Tupia Street indicate that finished floor levels for Buildings A, B and C will be set at 4.2 m AHD.

**Table 5.2 FPL Requirements for Proposed Development Buildings**

Location	Flood Planning Requirement	1% AEP Level	PMF Level	Flood Planning Level (m AHD)	Preliminary Architectural Level (m AHD)	BMT Comment
Building A	1% AEP Flood Level + 300 mm freeboard	3.9	4.2	4.2	4.2	Complies with the FPL
Building B	1% AEP Flood Level + 300 mm freeboard	3.9	4.2	4.2	4.2	Complies with the FPL
Building C	1% AEP Flood Level + 300 mm freeboard	3.9	4.0	4.2*	4.2	Complies with the FPL
Driveway (D)	1% AEP Flood Level + 100 mm freeboard	3.9	4.2	4.0	TBC	Compliance with FPL to be demonstrated at DA Stage.

\* 1% AEP Flood Level plus 300 mm freeboard is above the PMF level. It is recommended that consideration be given to the setting of finished floor levels at the PMF level.

## 5.3 Compliance With Ministerial Direction

As the Site is affected by flooding, the planning proposal must comply with *Section 9.1(2)* of the *Environmental Planning and Assessment Act 1979* focus area *4.1 Flooding*. The requirements of the Ministerial Direction are addressed in the Flood Risk Management Plan prepared for the Site (see Ref R.A12264.02.00\_TupiaStreetFRMP.pdf).

## 5.4 Addressing of Previous Flood-Related Comments

A previous planning proposal for the Site was not supported by the Bayside Local Planning Panel for several reasons including a failure to adequately address the risks to the residents of living on flood prone land. The following findings were provided in Council's deliberation and have been briefly addressed here.

- 1. The proposal is considered as a significant increase in population density on land which is affected by 1% AEP and PMF flooding and has an access road which will be heavily affected by flood events. This will cause disruption for the SES and other emergency organisations.*
- 2. Access to the site is proposed via Tupia Street (only access to the site), which is significantly affected by flooding. Flood hazard in 1% AEP and PMF event in Tupia St is H3 which is unsafe for all vehicles, children and the elderly. Increasing population will increase the risk of more cars being trapped in the road and more road users requesting assistance from Council and the SES in a flood event. There will be significant pressure from the additional population to improve road drainage, hence more govt. expenditure. Therefore, this site is not suitable to increase density of population.'*

The development proposes a shelter-in-place emergency management strategy, with allowance for emergency off-site egress via alternate vehicular routes in the event of an emergency (see Section 6). The proposed finished floor levels for all residences will place occupants above the PMF and outside of potential interaction with hazardous floodwaters. The proposed off-site egress route (which is provided for emergency access only) will be along very low hazard routes.

Potential increases to stormwater affectation as a result of the development is assessed in the Stormwater Engineers report.

- 3. The Planning Proposal seeks provisions that will permit a significant increase in development within a flood planning area. Additional residential development in this location is likely to require additional stormwater infrastructure provision, which is inconsistent with the terms of the direction. The proponent has not submitted a floodplain risk management plan prepared in accordance with the principles and guidelines of the Flood Plain Development Manual 2005, or specifically addressed the NSW Flood Prone Land Policy to support the Planning Proposal. Therefore, the inconsistency with the terms of this direction have not been adequately justified.*

A floodplain risk management plan has been submitted as part of this application (see Ref R.A12264.02.00\_TupiaStreetFRMP.pdf)

## 6 Flood Emergency Response Plan (FERP)

### 6.1 Introduction

This Flood Emergency Response Plan (FERP) has been prepared for the proposed development at 26 Tupia Street. The Site is subject to overland flow flooding in minor flood events, with flood depths and extent of inundation increasing in magnitude up to the Probable Maximum Flood (PMF). Assessment of the flood risks up to the PMF has been undertaken to determine appropriate management measures if an extreme flood event were to occur.

This report outlines the proposed strategy for flood emergency management for the Site, considering the nature of flooding, proposed development and relevant local and state government policies and guidelines, including the NSW Floodplain Development Manual (NSW Government 2005). The report describes the requirements for the proposed buildings, such as required finished floor levels, as well as procedures for flood evacuation, warning system, signage and responsibilities of building wardens in case of flood emergency. It is to be read in conjunction with the Flood Impact Assessment and Flood Risk Management Plan for the development.

#### 6.1.1 Site Flood Behaviour

A preliminary Site layout is shown in Figure 1.2. Flood levels applicable to the Site were established as part of the Flood Impact Assessment for this development and are provided in Table 6.1.

Table 6.1 Design Flood Levels

Building	1%AEP Flood Level (m AHD)	Flood Planning Level (m AHD)	PMF Flood Level (m AHD)
A	3.9	4.2	4.2
B	3.9	4.2	4.2
C	3.9	4.2	4.0

\* 1% AEP Flood Level plus 300 mm freeboard is above the PMF level. It is recommended that consideration be given to the setting of finished floor levels at the PMF level.

PMF depths on Site in the proximity of the proposed building footprints are in the order of 0.1 m (along the shared communal space) to 2.0 m (along the entry pathways at the north of the Site). Flood modelling undertaken as part of this FIA indicates the following flood behaviour along Tupia Street adjacent to the proposed site driveway (Location D):

- Average rate of rise at Driveway (D)
  - 1% AEP: 0.3 m/hour
  - PMF: 0.8 m/hour

Flood warning time for local overland flows draining to the site may be on the order of minutes and would be classified as “flash flooding” according to the BoM definition. Modelling undertaken as part of the FIA indicates that floodwaters would be above an H1 hazard and prevent potential vehicular egress via Tupia Street would be lost for up to 7.5 hours in a PMF event.

#### 6.1.2 Site Road Access

Vehicular egress from the Site is via Tupia Street. During rare and extreme events, Tupia Street will be cut by floodwaters within 2 hours from the onset of rainfall in a 1% AEP event and 15 minutes from the

onset of rainfall in a PMF event, making it hazardous and inadvisable to travel for the period noted in above. Current best practice is to avoid entering floodwaters wherever possible, and under no circumstances should floodwaters be considered safe. Accordingly, vehicular evacuation from the Site via Tupia Street is not considered feasible during rare and extreme storm events.

### 6.1.3 Flood Protection

The ground floor levels of the proposed buildings will need to be set to the FPLs indicated in Table 6.1 above. Flood protection of these buildings will also need to be set to the FPLs as per the requirements outlined in Bayside Council DCP. Future design development should attempt to minimise opportunities for water ingress through suitable design including waterproofing and physical protection.

As per Table 6.1, the flood planning level for all buildings places them above the PMF flood level.

### 6.1.4 Evacuation Requirements

Physical protection of buildings to exclude floodwaters for all events up to the PMF is generally not practical, achievable and/or cost effective. For floods larger than the level of protection that is achieved by design, an emergency management plan may be used to assist in mitigation of the residual flood risk to people during extreme floods. A key objective of such a plan is to facilitate evacuation of building occupants to safe locations if there is a risk of floodwater inundation. Enclosed ground floor spaces are prone to higher risk as once the flood protection level is breached the space may fill rapidly, reducing the available evacuation time.

While it is preferable to evacuate off-site if possible, available warning and evacuation time as well as other factors may preclude this option. Due to the rate of rise associated with overland flow flooding, areas along the northern boundary on-site and along the vehicular egress route on Tupia Street will be inundated with high hazard floodwaters during extreme events with insufficient warning time to enable safe evacuation. As such, the most practical method of controlling the risk is to provide evacuation to refuge points on-site that are above the level of the PMF and which can be reached quickly and without reliance on automated measures.

The finished floor levels for all proposed development buildings are proposed to be set at the estimated PMF level; and therefore all internal floors will be elevated above the floodplain if ground levels are set at the flood planning levels nominated in Table 6.1. However, high depth and high hazard floodwaters will be present on-site and in surrounding areas during flood events. Therefore, a shelter-in-place arrangement is the most suitable evacuation strategy for the Site.

In the event of a flood emergency, where residents are located in their apartments, and these apartments are above the PMF flood level, it is recommended that they remain inside their apartment until floodwater recedes. People located in communal areas or the underground carpark shall swiftly make their way to their residences. The total shelter-in-place period would be up to 7.5 hours in a PMF event, although it is assumed egress from the Site will be possible on foot prior to the availability of vehicular egress: and thus the likely shelter-in-place period would be lower.

During future design it will be necessary to confirm the number of people expected to occupy the building to establish that there is adequate space available within the allocated flood refuge areas and identify if additional refuge areas need to be allocated. Consideration of the likely site occupants and their awareness of the potential flood risk will also need to be undertaken in the final flood emergency management plan.



## 6.2 Flood Emergency Management Plan

A Flood Emergency Management Plan (FEMP) is to be prepared by the building operators that will formalise flood evacuation planning and strategy with respect to flood intelligence, the flood behaviour presented in this report, and relevant procedures. The FEMP will be expected to build on the strategy and intent presented in this report.

The SES recommends that all flood prone properties prepare their own emergency management plans as SES resources are scarce during emergencies and it is often the case that they cannot service all affected parties in case of flood, particularly given mobilisation time. The FEMP shall be used as a guide for building wardens and other responsible parties nominated in the evacuation strategy. The aim of the FEMP is to inform the future operators of the building of the appropriate response measures required in the event of an extreme flood.

Key elements to be included in the FEMP are outlined in the following sections.

### 6.2.1 Flood Response Personnel

As outlined in the Flood Risk Management Plan prepared for the Site, it is recommended a Site Manager be appointed. The Site Strata manager is preliminarily recommended.

### 6.2.2 Emergency Warning System

Warning in case of a flood event is required to alert residents and other people on-site that an extreme flood event may be imminent. As extreme events are typically very infrequent, a warning system in the form of an audible alarm is considered appropriate to communicate the urgency of the situation. An emergency siren and building PA system that is installed for other emergencies or day-to-day facility use is likely suitable for communicating with building occupants during other building emergencies such as a flood emergency. These emergency warning systems are to be located above the PMF level.

Flood levels during a PMF can rise rapidly and it is necessary to ensure that sufficient warning time is available so that personnel may evacuate to safety. In order to maximise the available warning time, it is recommended that residents monitor BoM forecast for warnings of flash flooding or severe weather. A subscription to the BoM to send updates and warnings to residents on anticipated heavy rainfall events may also be appropriate.

### 6.2.3 Evacuation Routes

Evacuation of people in a safe manner during an extreme flood is dependent on warning time and availability of easily identifiable routes. As outlined above, limited flood warning time will be available during rare and extreme flood events before vehicular access is lost along Tupia Street. It will take up to 7.5 hours in a PMF event before hazardous floodwaters recede and vehicular access is again possible.

Given the proposed development at 26 Tupia Street is a residential flat building development with levels above the PMF, the potential vehicular isolation time is not considered wholly unreasonable given the likely possibilities that:

- Flooding may occur during working hours, in which case many occupants may be off-site and outside of the potential flood affected area; or
- Flooding may occur at night-time, in which case the temporary loss of vehicular evacuation may occur during nominal sleeping periods.

However, it is noted that isolation times are long enough to pose a significant risk to occupants in the event of a medical or other emergency. Therefore, as part of this FERP, two potential egress routes off-site have been nominated to facilitate emergency services access during rare and extreme flood events.

As per Figure 4.5, in the PMF flood event conditions within St Joseph Banks park to the immediate east and west of the northern boundary of the Site are considered to be an H1 hazard. As per Table 4.1, an H1 hazard is considered to represent *"Relatively benign flow conditions. No vulnerability constraints"*, especially during an extreme flood event such as the PMF. St Joseph Banks Park can also be accessed from low hazard roads including Hayden Place (to the west of the Site) and/or Waratah Road (to the east of the Site). Therefore, vehicular egress from the Site, via St Joseph Banks Park is possible in the event of an emergency. It is recommended that an ingress/egress point from the Site is established along the northern edge via a platform situated above the PMF level (4.2 mAHd).

A potential platform location and proposed egress path are shown in Figure 6.1 below, and is recommended for further discussion and design consideration. It is noted that preliminary modelling of the platforms shown below – assumed as solid obstructions at an elevation of 4.2 mAHd – indicates that the works have the potential to cause local off-site impacts to the north of the Site. A slight revision in proposed layout or the use of suspended, or semi-suspended platform would likely alleviate these impacts. Final platform design will need to be confirmed in the detailed design stage.

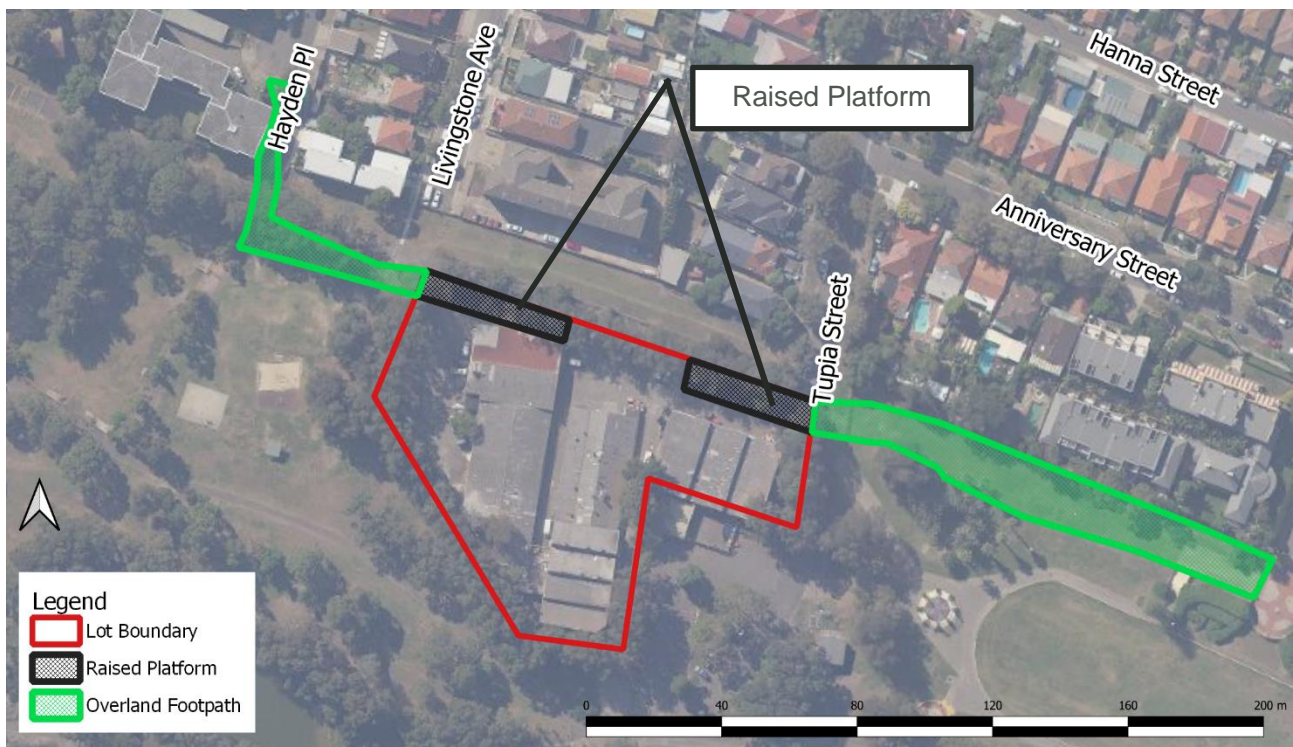


Figure 6.1 Location Of Proposed Emergency Access Walkways

It is noted that the recommended emergency management strategy is for all residents to shelter-in-place until floodwaters recede or directed to do so by the SES and that the proposed egress routes are to be utilised for emergencies only.

#### 6.2.4 Structural Soundness

As the proposed emergency management strategy is to shelter in place within residences located above the PMF, the structure must be capable of resisting flood forces including buoyancy in events up to the PMF. This will require confirmation by a suitably qualified structural engineer as part of the detailed design process.

#### 6.2.5 Signage

It is recommended that appropriate signage be adopted to promote the awareness of occupants and visitors of the potential for inundation along Tupia Street on approach to Site, along the Site boundary (particularly at the north) and in communal areas below the PMF. Signage of a form similar to the example provided below shall be located prominently near the Site entrance, the Site driveway and in common areas.

#### **FLOOD NOTICE**

Road access to this site can flood due to very intense rainfall over a short period.

If directed by the Site Manager or by Flood Warning by Council, SES or the BoM shelter inside residence until water recedes. Under no circumstances should you enter into floodwater.

Flood depth signage should be installed on the site, located at the access driveway (Location D) and in areas along the northern boundary susceptible to flooding. This signage would indicate to occupants the depth of water on the Site and include signage that advises no entry into floodwater.

To reinforce occupant awareness of the shelter in place procedure during flooding, it is recommended that signage be provided within each apartment and common areas that highlights the flood shelter zones at the site where occupants should gather when directed to shelter in place.

#### 6.2.6 Consultations

The FEMP should be prepared as part of future design development for the Health and Wellbeing Precinct site in consultation with the following stakeholders:

- SES; and
- Bayside Council

The outcome of these consultations is to develop a management plan which coordinates with the parties which may be involved during the event of a flood evacuation and implements the most suitable evacuation procedures.

### 6.3 Flood Emergency Response Procedure

This section describes some of the specific actions to be undertaken in anticipation of a flood event, as well as actions recommended during and after a flood.

#### 6.3.1 Before Flood

Outlined below are several flood safety actions to be followed by residents and staff in the buildings in case of a flooding event:

- Review and be familiar with the applicable *SES Emergency Business Continuity Plan*.

- Ensure that the plan is up to date.
- Check (or prepare) the contents of the Emergency Flood Kit and ensure that it is the correct location.
- Identify the needs of vulnerable persons likely to be on-site during the flood emergency (i.e. elderly, disabled, young children).
- Inspect the property for hazardous substances, furniture, equipment and sensitive belongings, and relocate to another flood free area if possible.
- Check communication devices such as internet connections, mobile phone, landline or radio. If a device has become inoperable, identify a suitable alternative (such as a back-up device or using the device of someone else in the building).
- Communicate to all residents the requirements of the applicable *SES Emergency Business Continuity Plan*, location of the Emergency Flood Kit, and discuss the risk of flooding to the Site, contact methods, and actions to take before, during and after a flood event.
- Ensure that any electrical equipment located below the PMF level is disconnected or isolated from the electricity and gas supplies.

### 6.3.2 During a Flood

Outlined below are key flood safety measures to be followed by the residents and visitors in the buildings during a flood or a severe weather event that may lead to flooding:

- Follow the procedures outlined in the applicable *SES Home Emergency Plan* or *SES Emergency Business Continuity Plan*.
- Locate the Emergency Flood Kit.
- Listen and respond to directions from emergency services or others with a special responsibility.
- Monitor the BoM website, radio broadcasts, local emergency services social media pages, and local news outlets for warnings.
- Follow all advice and instructions given by emergency services and the Site Manager.
- Ensure all occupants on-site are informed and in agreeance on the shelter in place approach.
- As floodwater approach building entryways, immediately commence shelter in-place procedures inside residence. This should commence prior to the warning from the Site Manager.
- Shelter in place until floodwaters have subsided to below the depth markers at the driveway or until advised safe to do so by the Site Manager or the SES.

### 6.3.3 After a Flood

Outlined below are a few key flood safety measures to be followed by all occupants after a flood event has occurred:

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- Check that electrical power and gas has been isolated to all flood affected areas of the buildings. If electrical systems or appliances have become inundated, these should be inspected by a qualified electrician. Gas appliances and gas bottles should also be inspected for safety before use.
- Check any flooded areas for safety hazards and structural stability. For example, items may have moved as a result of flood water.
- Review evacuation performance during the flood. Identify any areas for improvement and update flood emergency response plan if required.

Further information is provided in the [https://www.ses.nsw.gov.au/media/1196/after-flood\\_fact-sheet.pdf](https://www.ses.nsw.gov.au/media/1196/after-flood_fact-sheet.pdf)

## 7 Conclusions and Recommendations

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The Site 26 Tupia Street, Botany is affected by flooding. Flood models developed for Bayside Council as part of the *Botany Bay Foreshore Beach Catchment Flood Study* and updated part of the *Botany Bay Foreshore Beach Catchment Floodplain Risk Management Study* indicate that the existing Site has variable flood depths, with peak depths in excess of 1 m in the 1% AEP increasing with severity up to the PMF event.

A Planning Proposal is proposed to facilitate the development of residential flat buildings at the Site. This report has demonstrated that the development is compatible with the flooding controls in the *Botany Bay Development Control Plan 2013*. Post-development flood modelling indicates that the proposed works will reduce ponding flood depths on the Site. Modelling also indicates that the development causes only minor flood afflux, will not impact on neighbouring properties and is not heavily impacted by the potential effects of climate change.

Due to the presence of high hazard floodwaters in rare or extreme events, evacuation off-site is not recommended if it can be avoided. A Flood Emergency Response Plan prepared as part of this report has identified that shelter-in-place is an appropriate emergency management option for the Site. It is noted that adherence to the required flood planning levels will result in all habitable space being set at or above the Probable Maximum Flood Level. In addition, an egress route off-site has also been identified for emergency evacuation if necessary during a flood event.

As the Site is affected by flooding, the planning proposal being submitted for the proposed development must comply with Section 9.1(2) of the Environmental Planning and Assessment Act 1979 focus area 4.1 Flooding. These requirements are addressed as part of the Flood Risk Management Plan for the Site, which should be read in conjunction with this report.



## 8 References

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Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia  
<http://arr.ga.gov.au/>

BMT (2015). *Botany Bay Foreshore Beach Catchment Flood Study*, prepared for City of Botany Bay Council.

City of Botany Bay (2013). *Botany Bay Development Control Plan 2013*.  
<https://www.bayside.nsw.gov.au/services/development-construction/planning-ourcity/controls/development-control-plans/botany-bay>

Jacobs (2018). *Botany Bay Foreshore Beach Catchment Flood Risk Management Study*, prepared for Bayside Council

McLuckie et. al (2014). *Updating National Guidance on Best Practice Flood Risk Management*

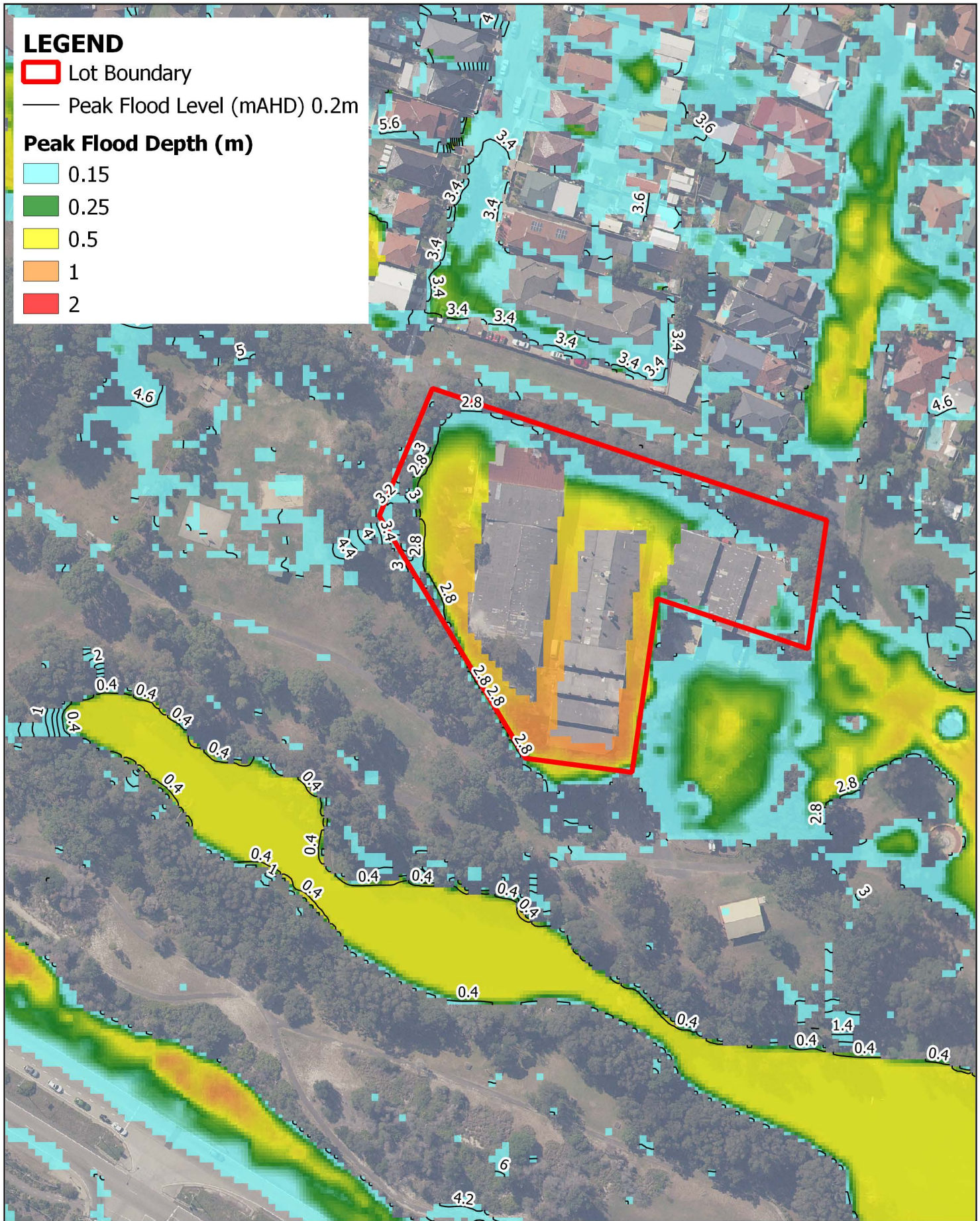
NSW SES (2018), *New South Wales State Flood Plan*.  
<https://www.emergency.nsw.gov.au/Documents/plans/sub-plans/SubPlan-Flood.pdf>

NSW SES (2017). *NSW SES Home Emergency Plan*. <http://www.seshomeemergencyplan.com.au/>

## APPENDIX A: Additional Flood Mapping

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# LEGEND

  Lot Boundary

— Peak Flood Level (mAHD) 0.2m

## Peak Flood Depth (m)

0.15

0.25

0.5

1

2

Title:  
**Existing 5% AEP Peak Flood Levels and Depths**

Drawing:

**A.1**

Rev:

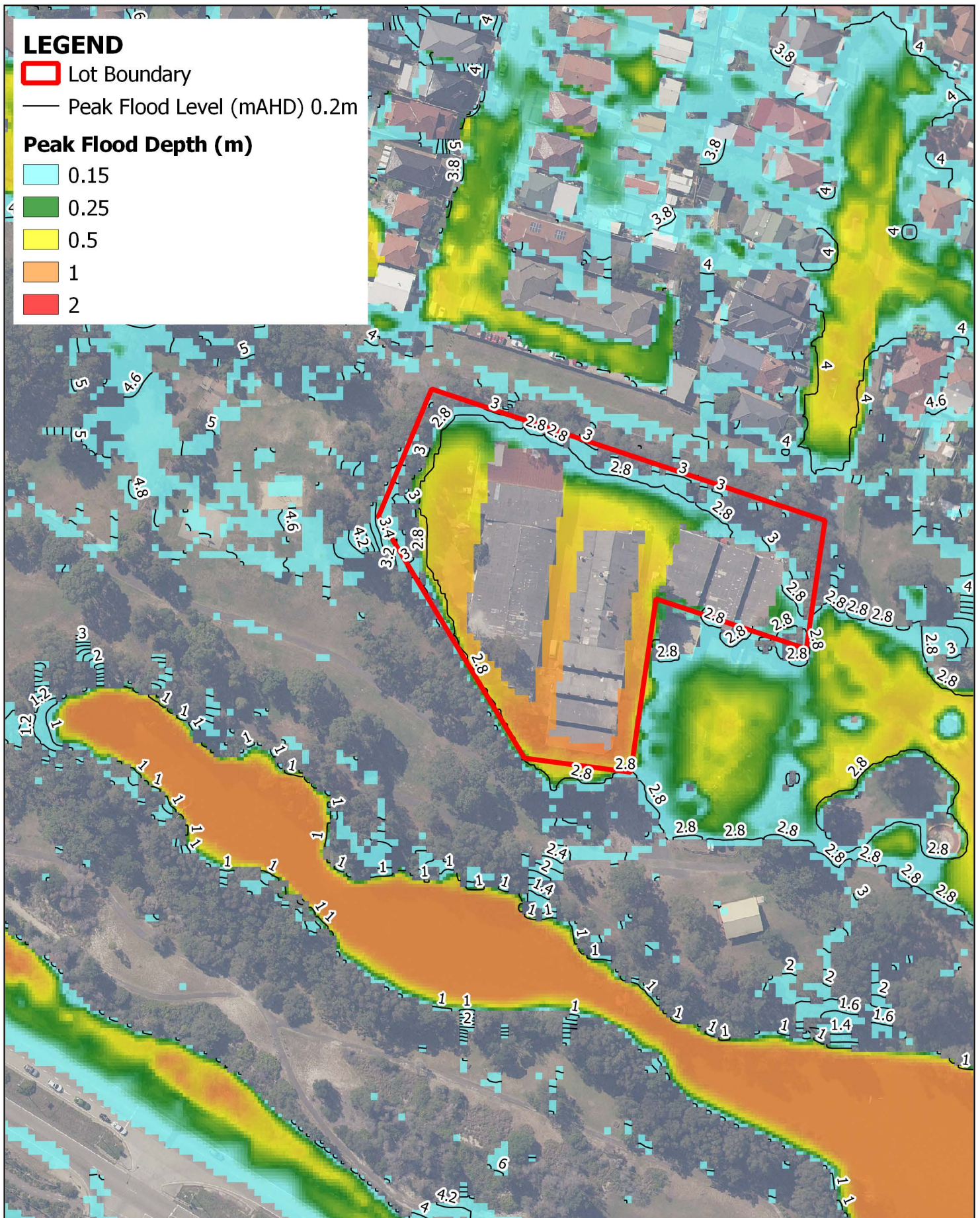
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**Existing 0.5% AEP Peak Flood Levels and Depths**

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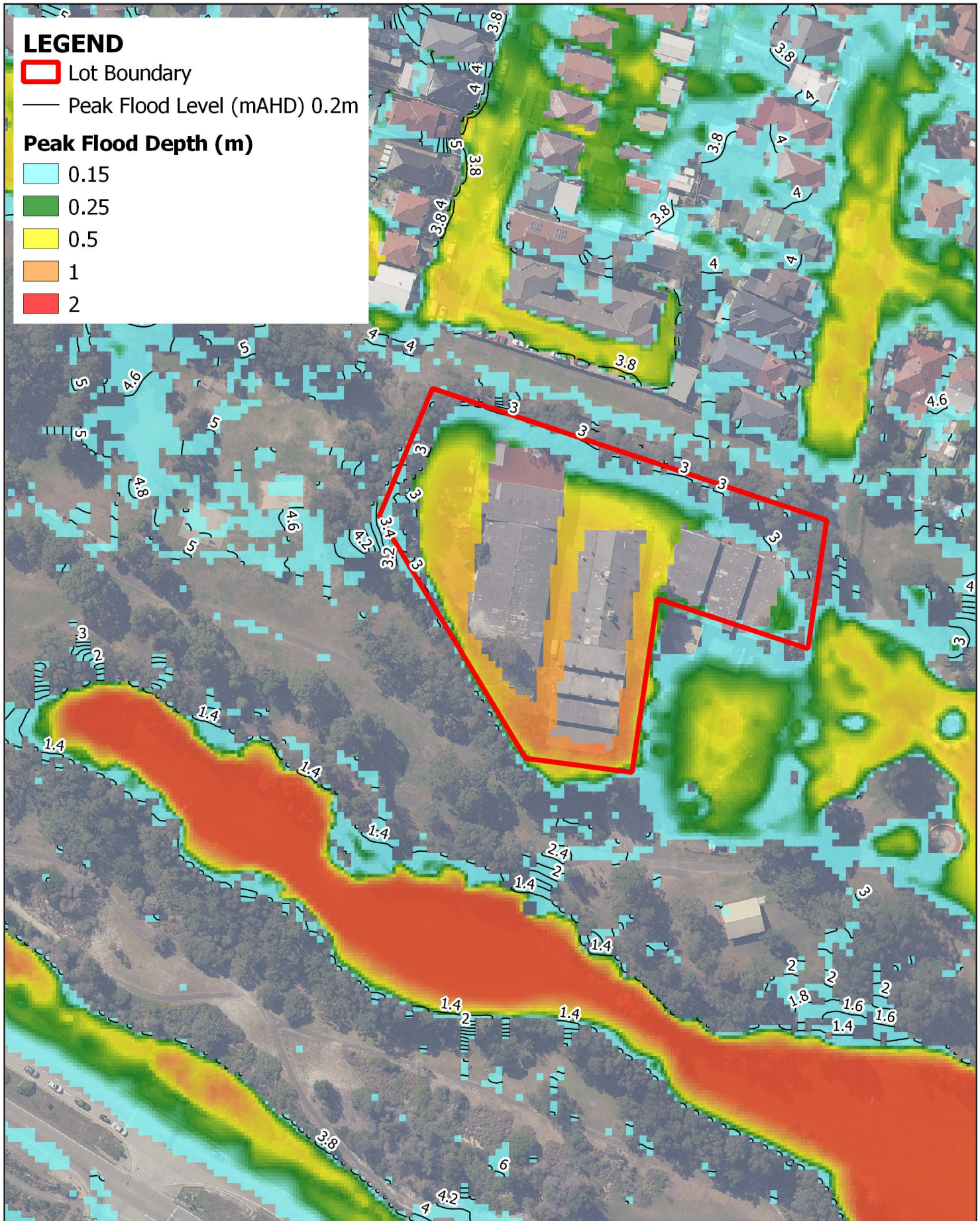
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**Existing 0.2% AEP Peak Flood Levels and Depths**

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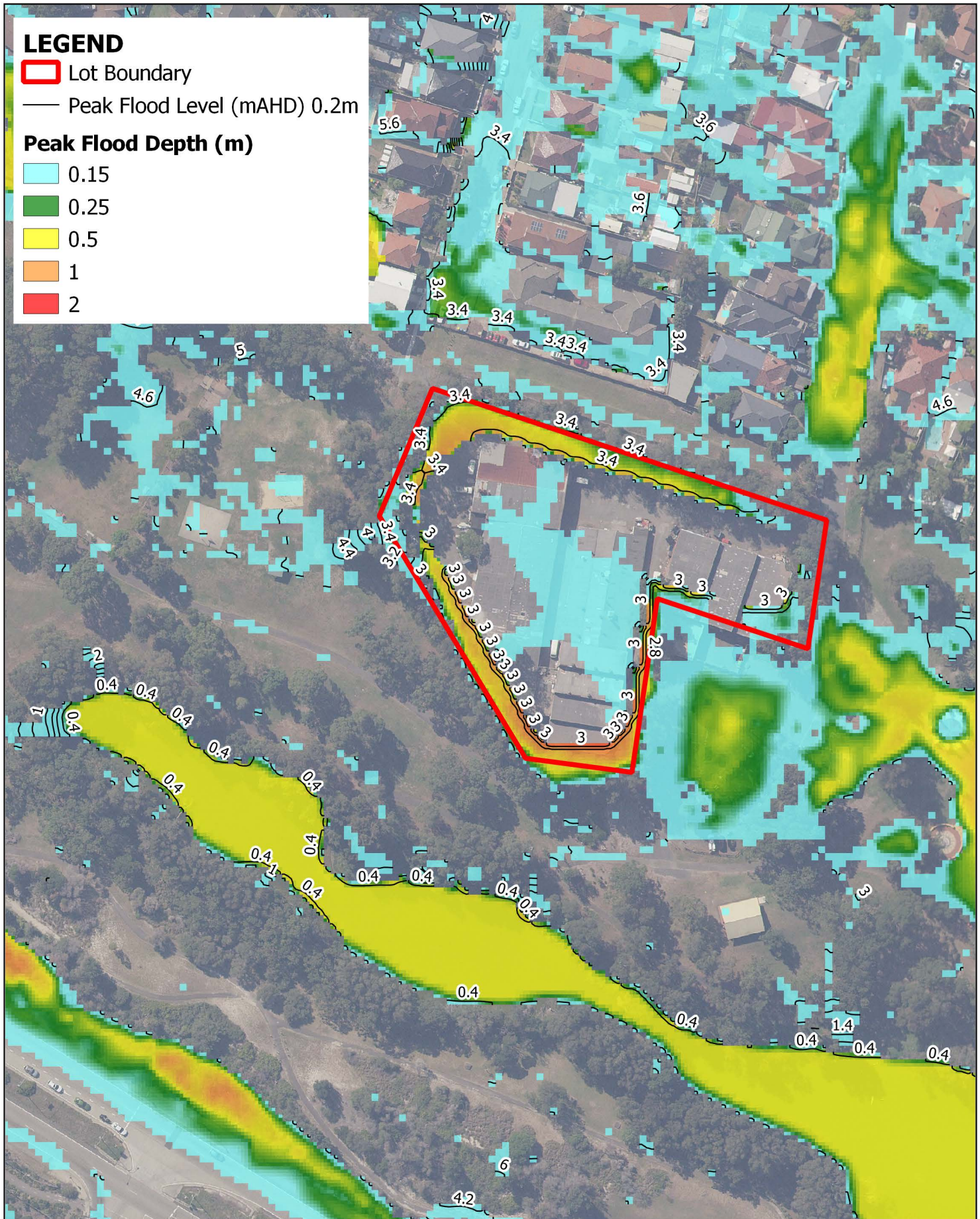
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**Post Construction 5% AEP Flood Levels and Depths**

Drawing:  
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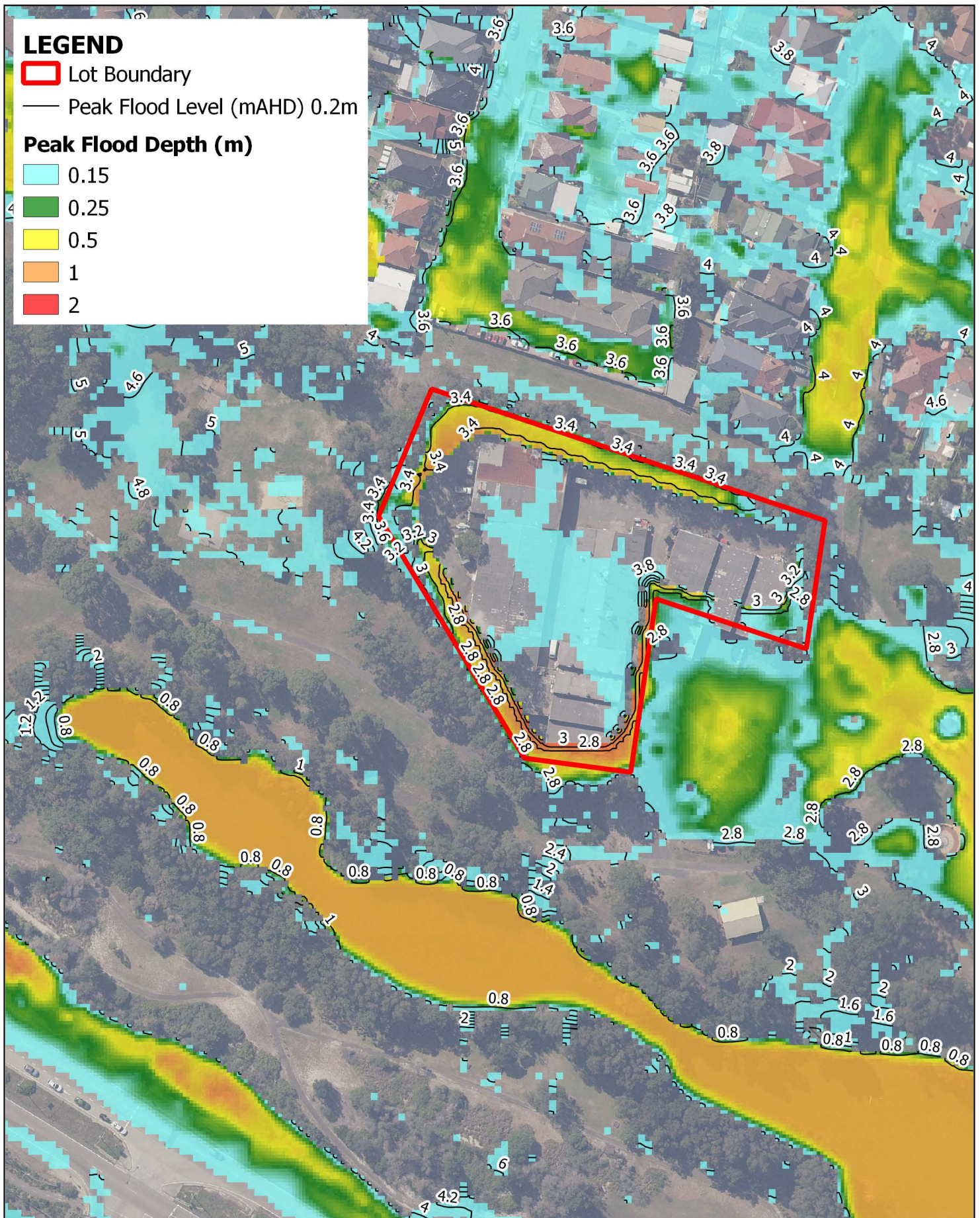
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**Post Construction 1% AEP Flood Levels and Depths**

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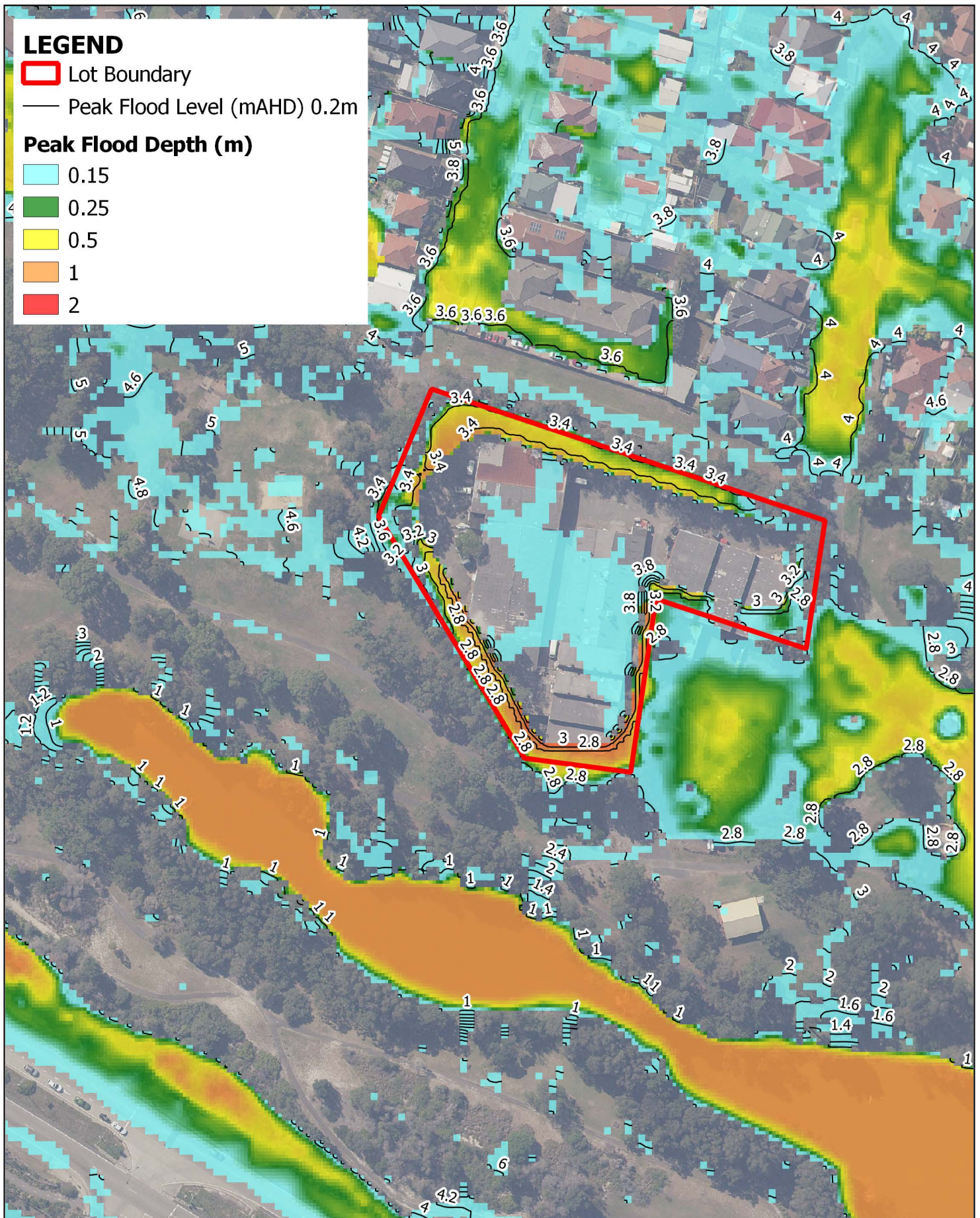
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**Post Construction 0.5% AEP Flood Levels and Depths**

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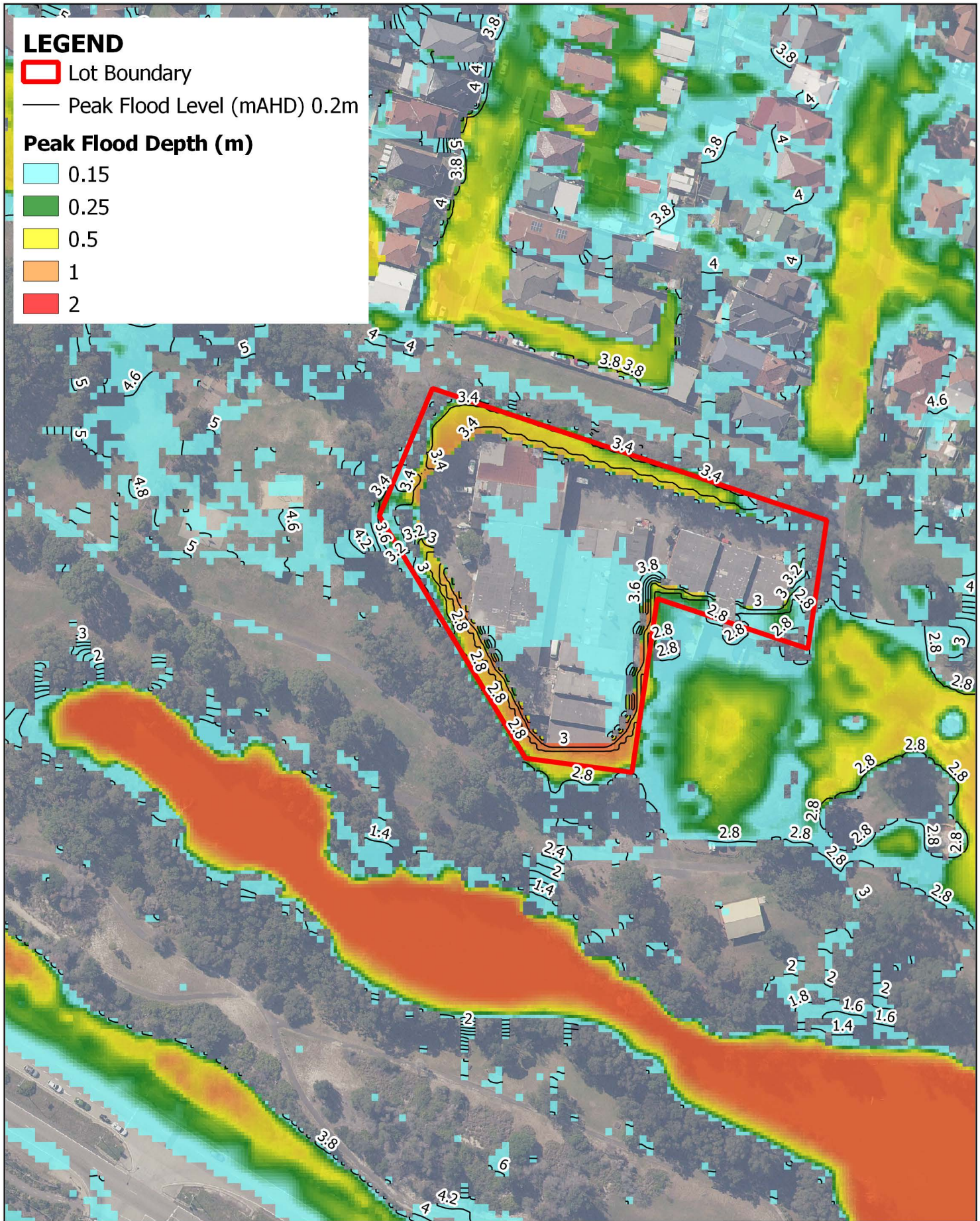
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**Post Construction 0.2% AEP Flood Levels and Depths**

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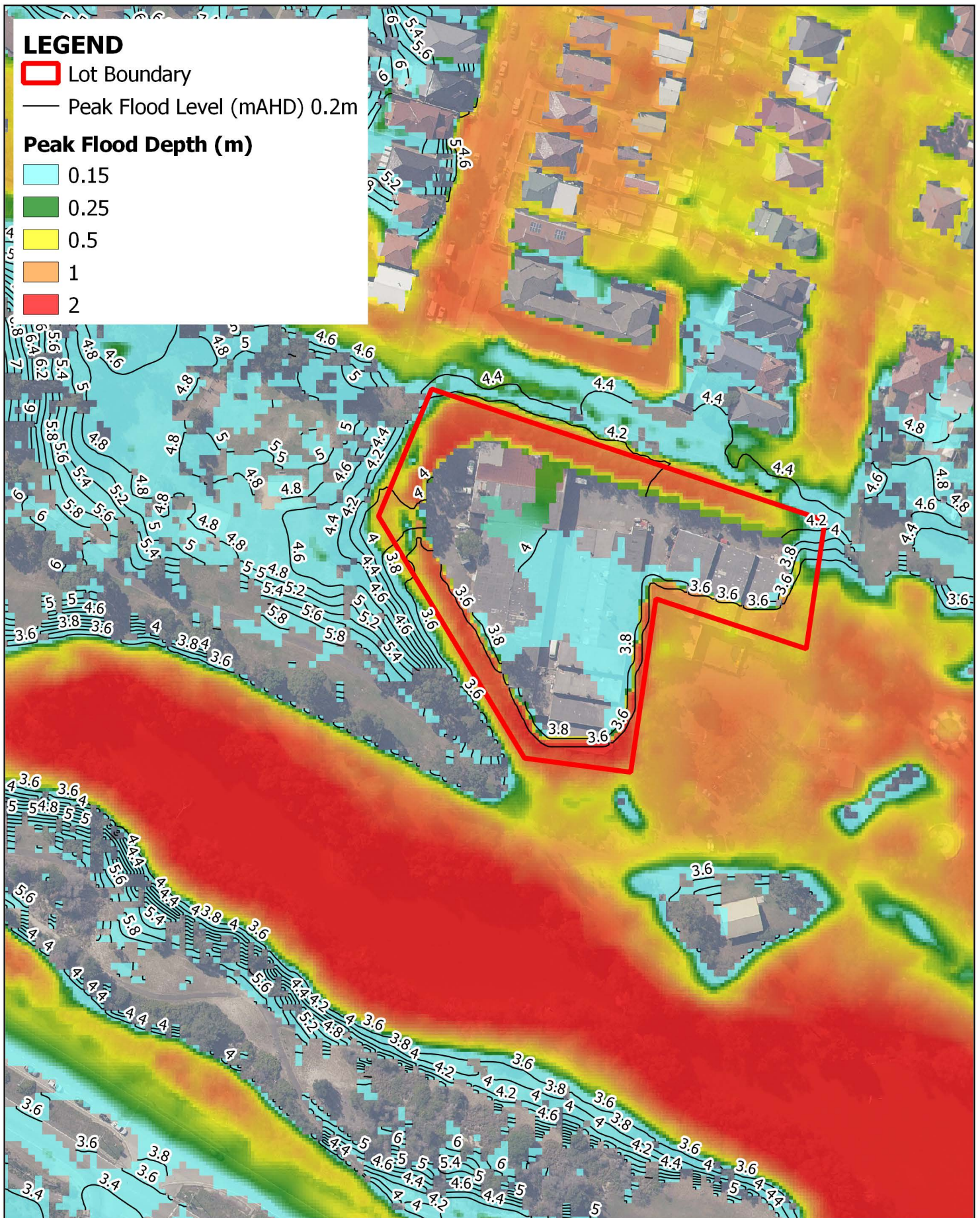
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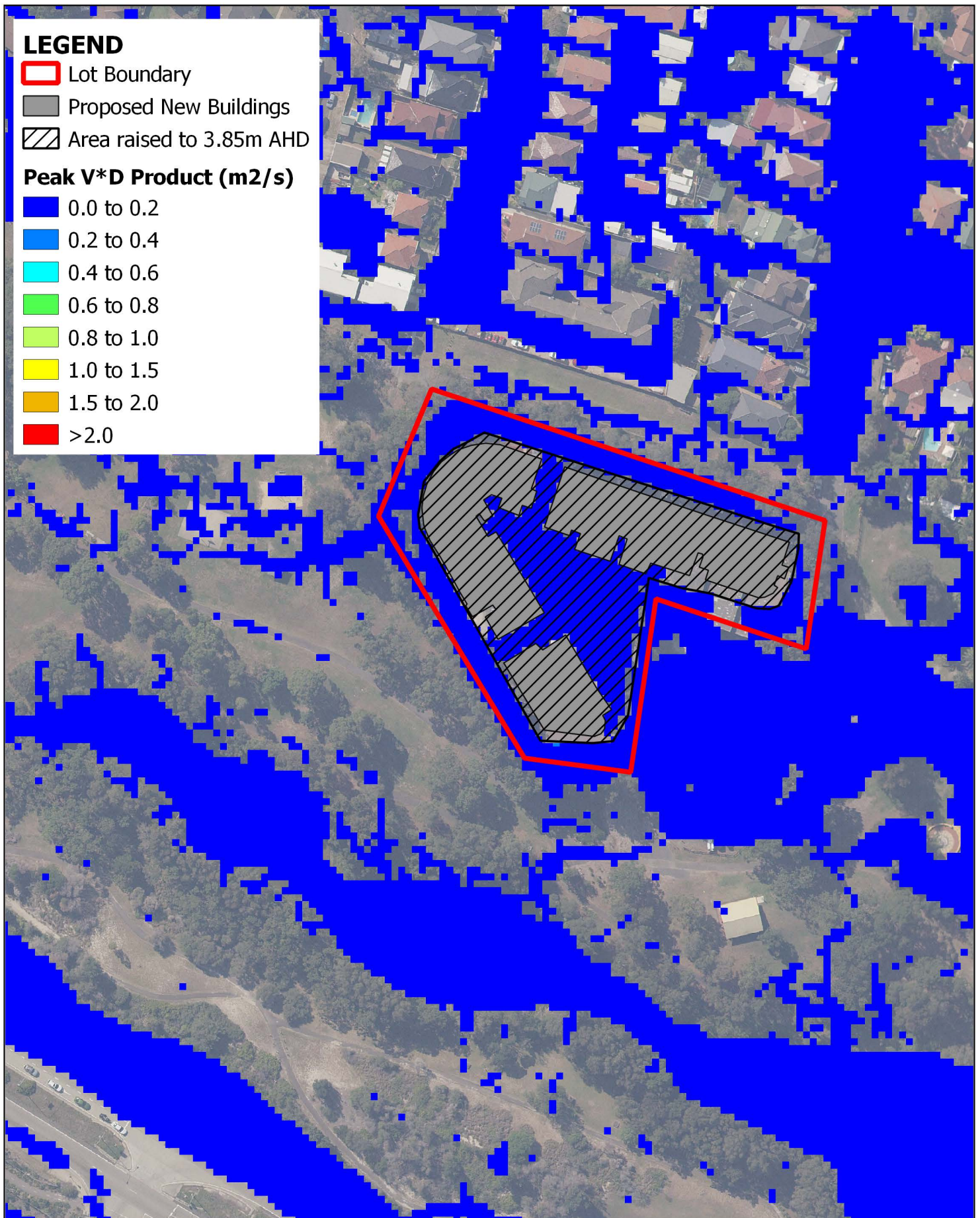






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Title:

**1% AEP Peak Flood Velocity-Depth Product Design (Post-Development) Conditions**

Drawing:

**A.9**

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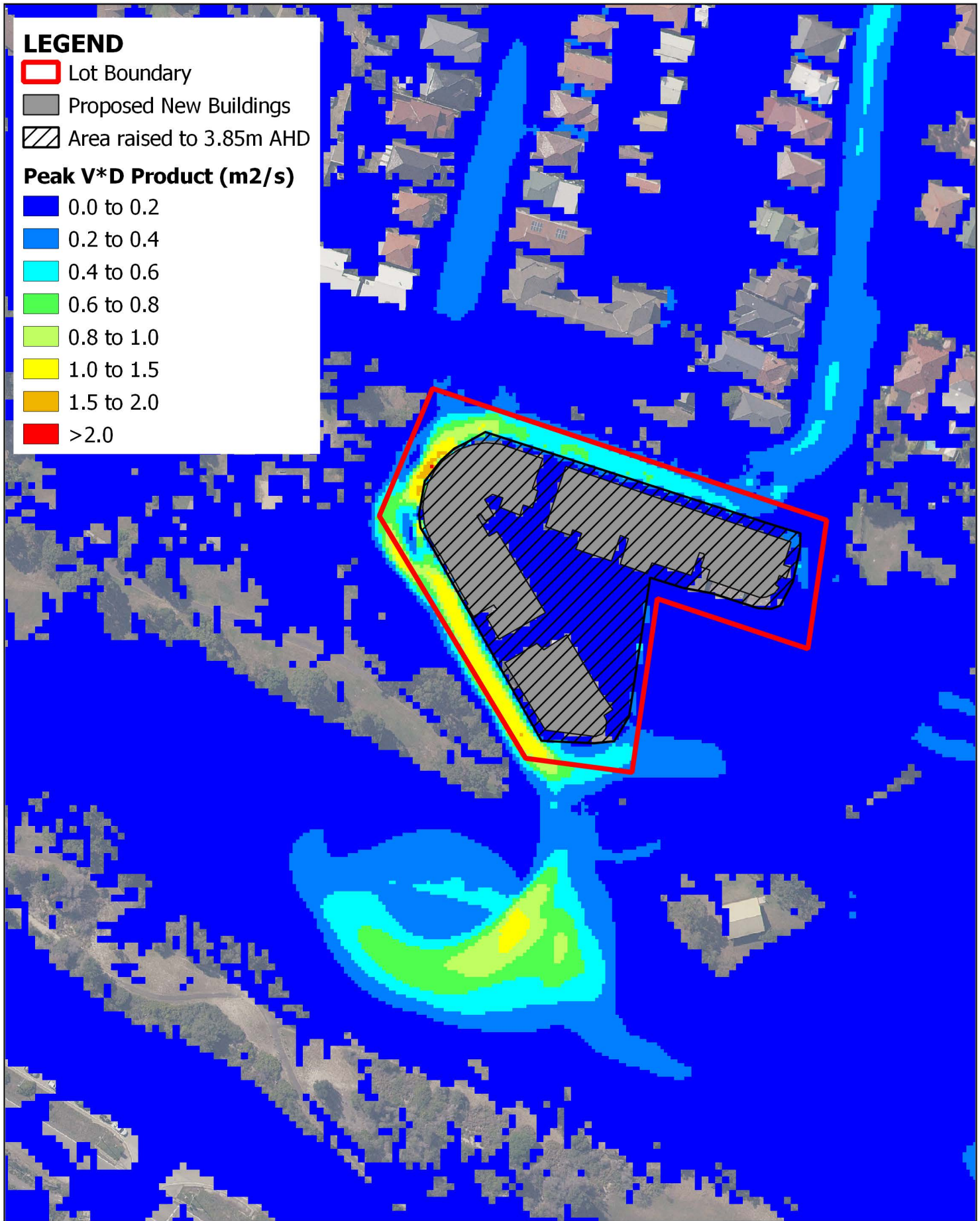
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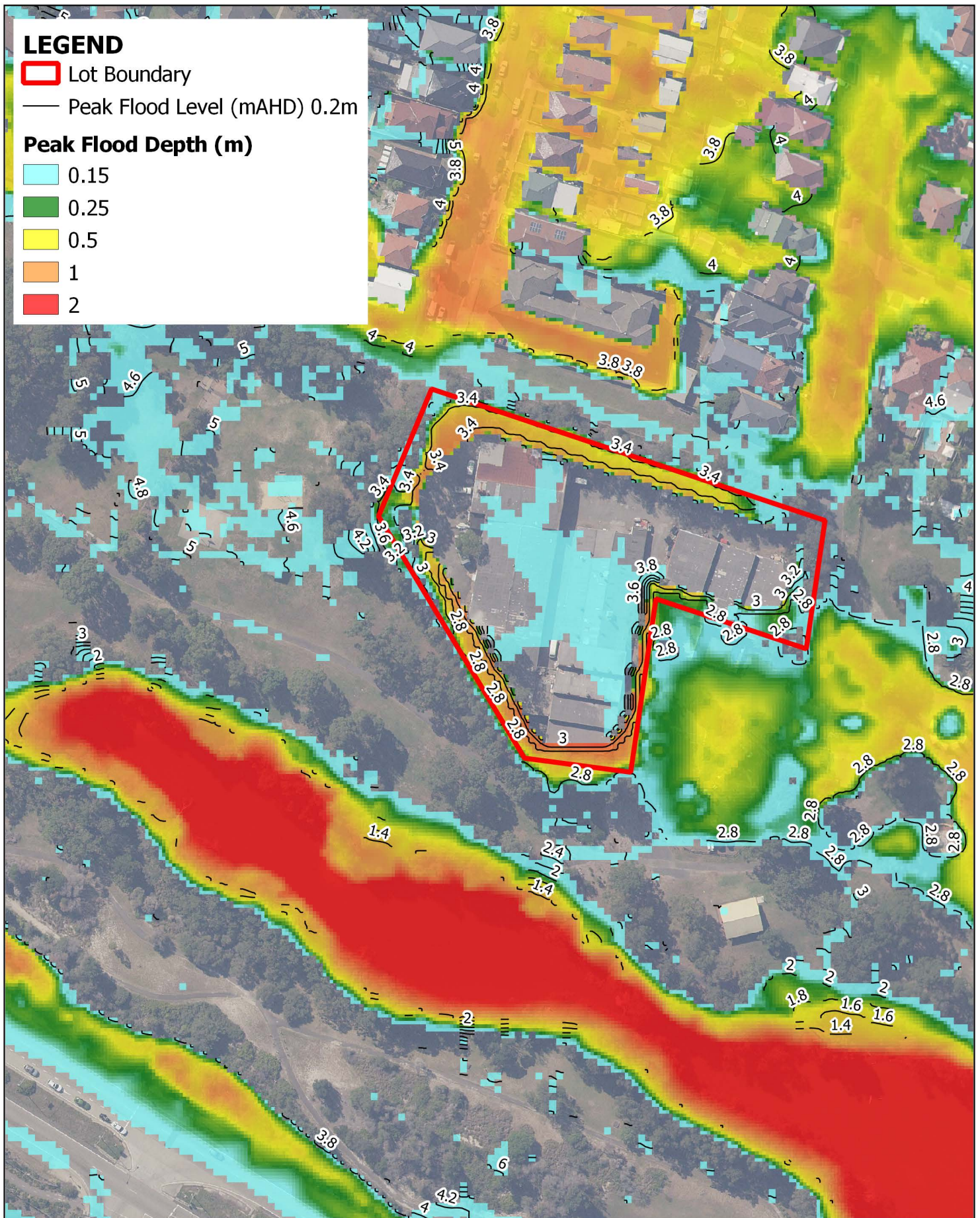




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<p>BMT endeavours to ensure that the information provided in this map is correct at the time of publication. BMT does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.</p>	<p>0 30 60 m</p> 	























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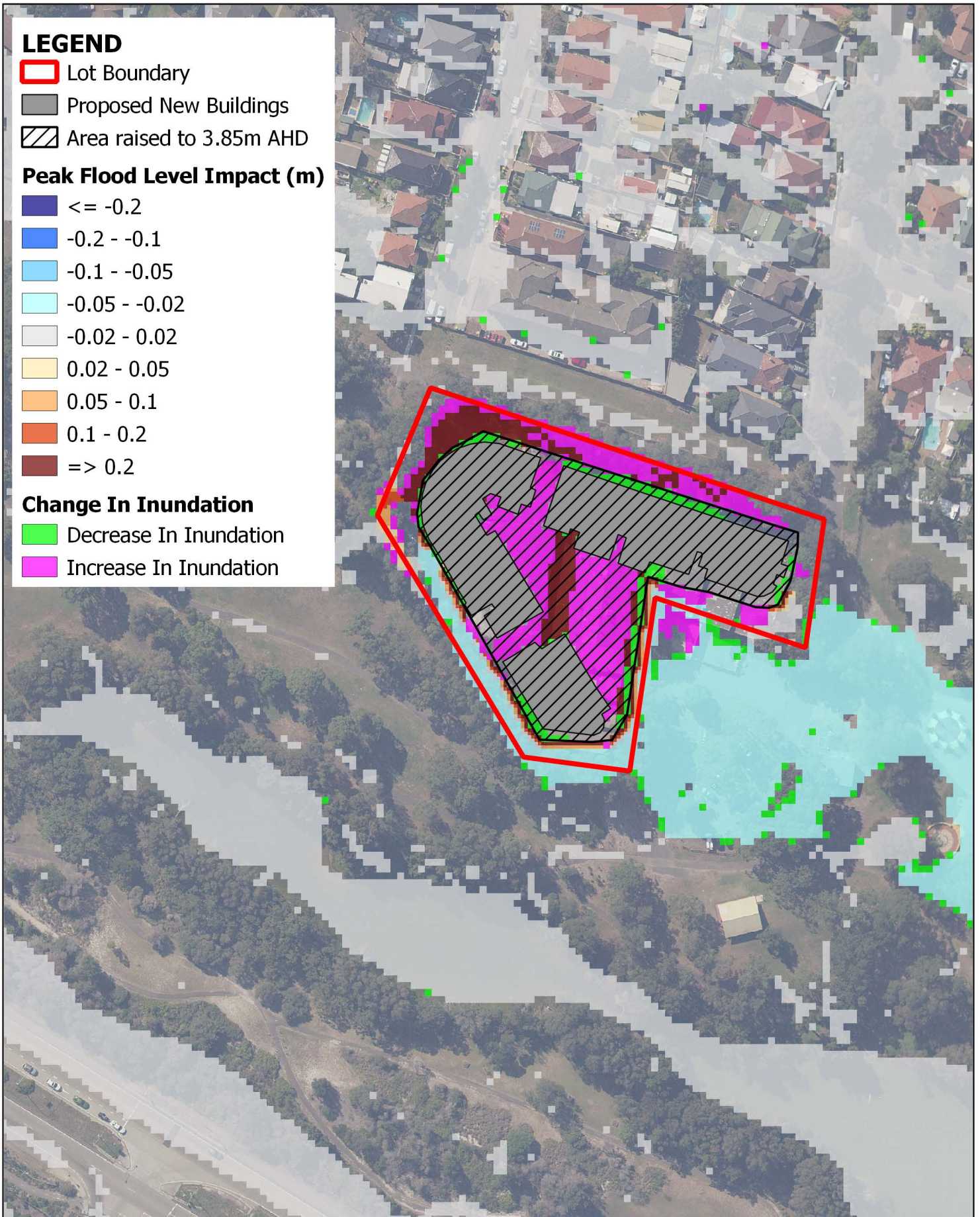
-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Flood Level Impact (m)

-   $\leq -0.2$
-   $-0.2 - -0.1$
-   $-0.1 - -0.05$
-   $-0.05 - -0.02$
-   $-0.02 - 0.02$
-   $0.02 - 0.05$
-   $0.05 - 0.1$
-   $0.1 - 0.2$
-   $\geq 0.2$

## Change In Inundation

-  Decrease In Inundation
-  Increase In Inundation



Title:

**5% AEP Peak Flood Level Impact Design (Post-Development)  
vs Existing Conditions**

Drawing:


**A.12**

Rev:

**A**




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









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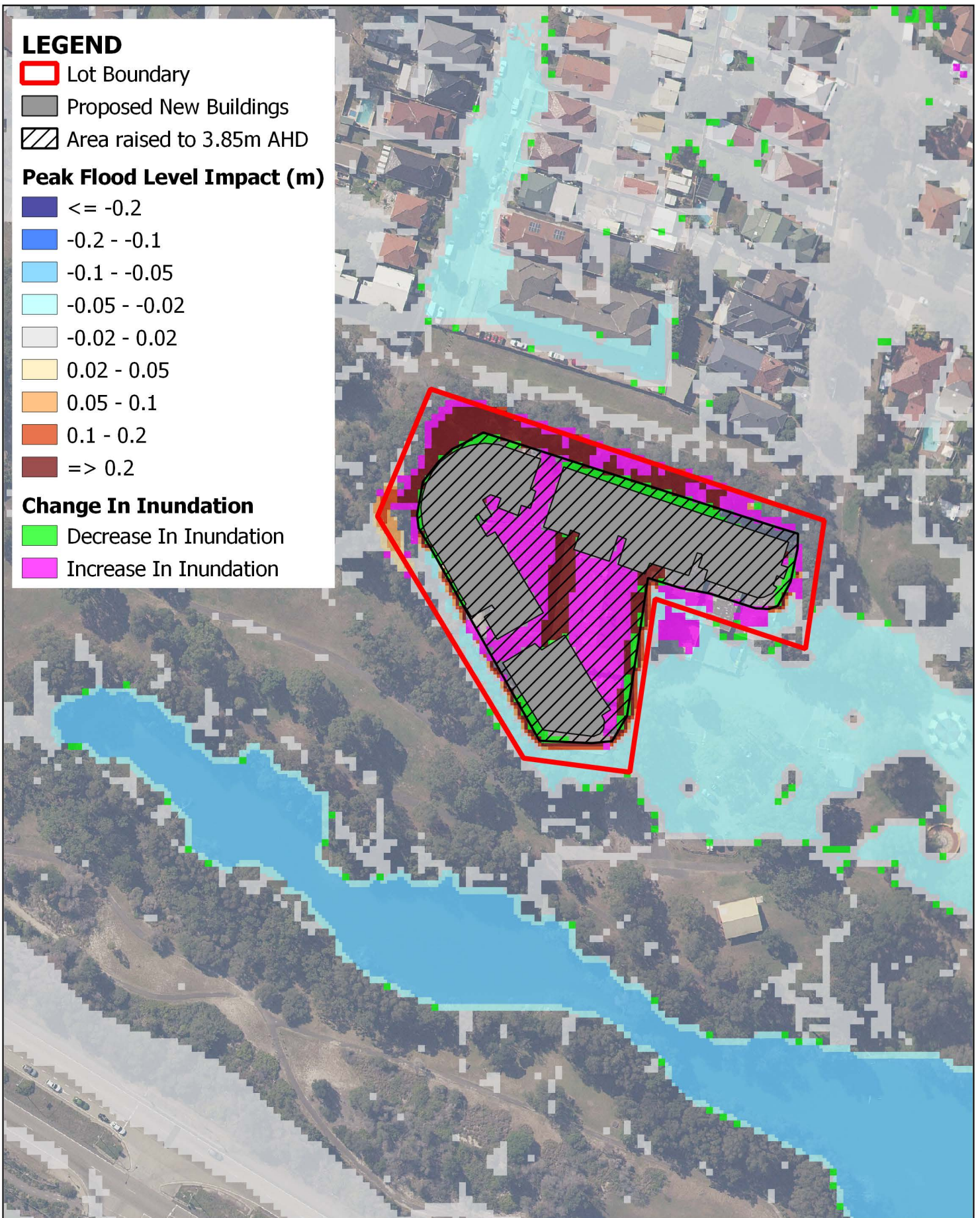
-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Flood Level Impact (m)

-   $\leq -0.2$
-   $-0.2 - -0.1$
-   $-0.1 - -0.05$
-   $-0.05 - -0.02$
-   $-0.02 - 0.02$
-   $0.02 - 0.05$
-   $0.05 - 0.1$
-   $0.1 - 0.2$
-   $\geq 0.2$

## Change In Inundation

-  Decrease In Inundation
-  Increase In Inundation



Title:

**0.5% AEP Peak Flood Level Impact Design (Post-Development)  
vs Existing Conditions**

Drawing:


**A.13**

Rev:

**A**




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









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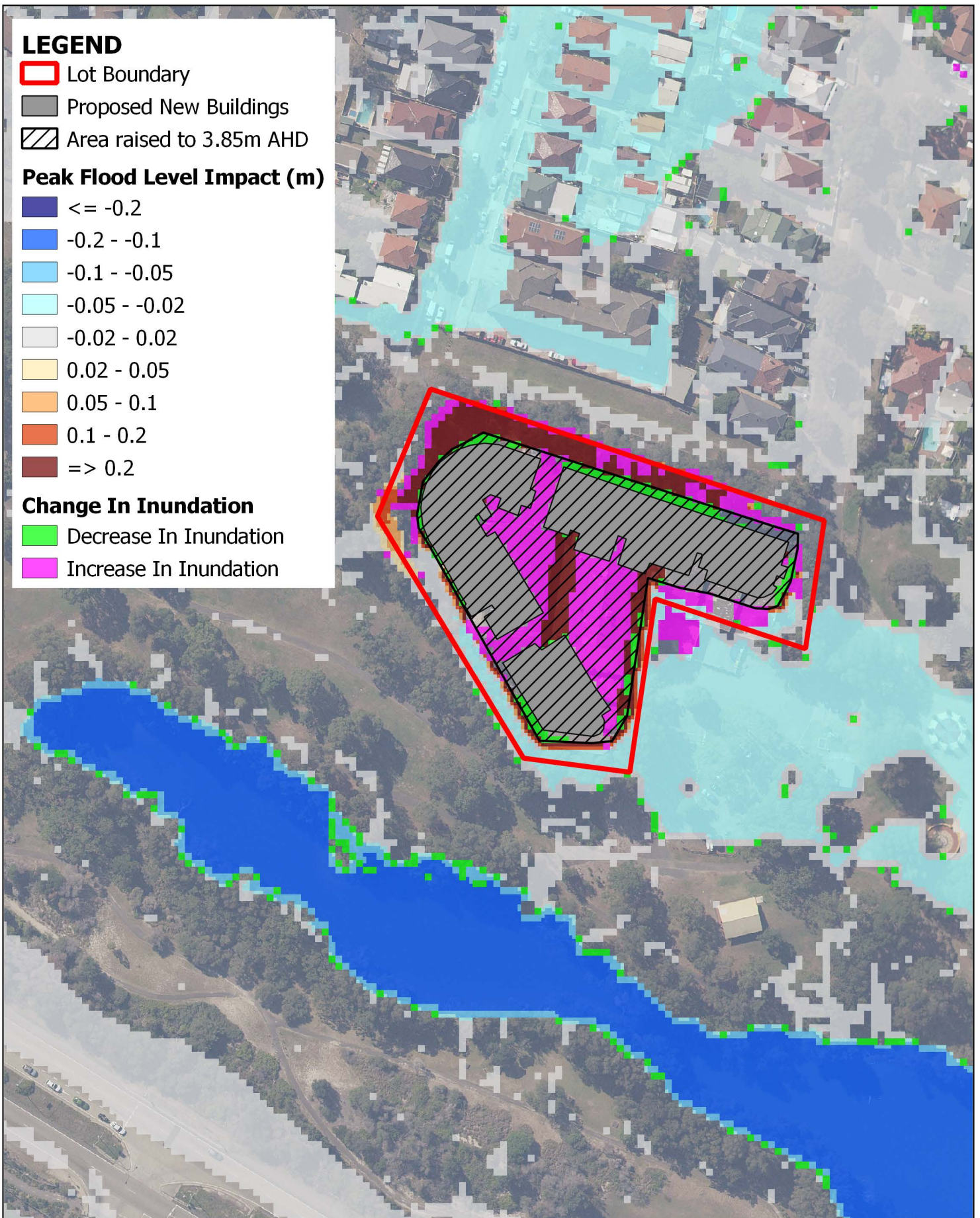
-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Flood Level Impact (m)

-   $\leq -0.2$
-   $-0.2 - -0.1$
-   $-0.1 - -0.05$
-   $-0.05 - -0.02$
-   $-0.02 - 0.02$
-   $0.02 - 0.05$
-   $0.05 - 0.1$
-   $0.1 - 0.2$
-   $\geq 0.2$

## Change In Inundation

-  Decrease In Inundation
-  Increase In Inundation



Title:

**0.2% AEP Peak Flood Level Impact Design (Post-Development)  
vs Existing Conditions**

Drawing:


**A.14**

Rev:

**A**




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







## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Velocity Impact (m/s)

-   $\leq -1.0$
-  -1.0 to -0.50
-  -0.50 to -0.25
-  -0.25 to -0.10
-  -0.10 to 0.10
-  0.10 to 0.25
-  0.25 to 0.50
-  0.50 to 1.0
-   $\geq 1.0$



Title:

**5% AEP Peak Flood Velocity Impact Design (Post-Development) vs Existing Conditions**

Drawing:


**A.15**

Rev:

**A**




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








## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Velocity Impact (m/s)

-   $\leq -1.0$
-  -1.0 to -0.50
-  -0.50 to -0.25
-  -0.25 to -0.10
-  -0.10 to 0.10
-  0.10 to 0.25
-  0.25 to 0.50
-  0.50 to 1.0
-   $\geq 1.0$



Title:

**0.5% AEP Peak Flood Velocity Impact Design (Post-Development) vs Existing Conditions**

Drawing:


**A.16**

Rev:

**A**




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







## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Peak Velocity Impact (m/s)

-   $\leq -1.0$
-  -1.0 to -0.50
-  -0.50 to -0.25
-  -0.25 to -0.10
-  -0.10 to 0.10
-  0.10 to 0.25
-  0.25 to 0.50
-  0.50 to 1.0
-   $\geq 1.0$



Title:

**0.2% AEP Peak Flood Velocity Impact Design (Post-Development) vs Existing Conditions**

Drawing:


**A.17**

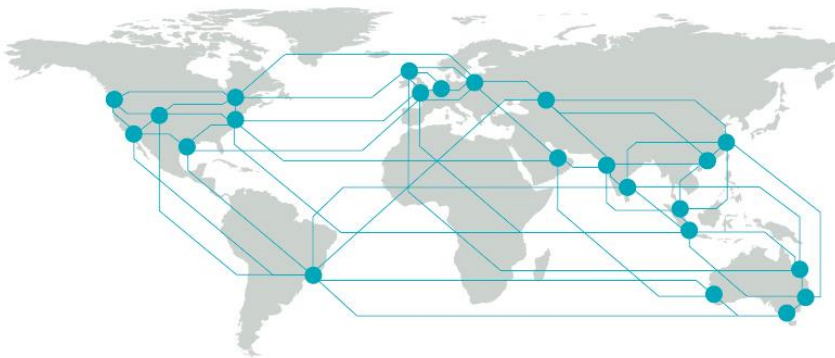
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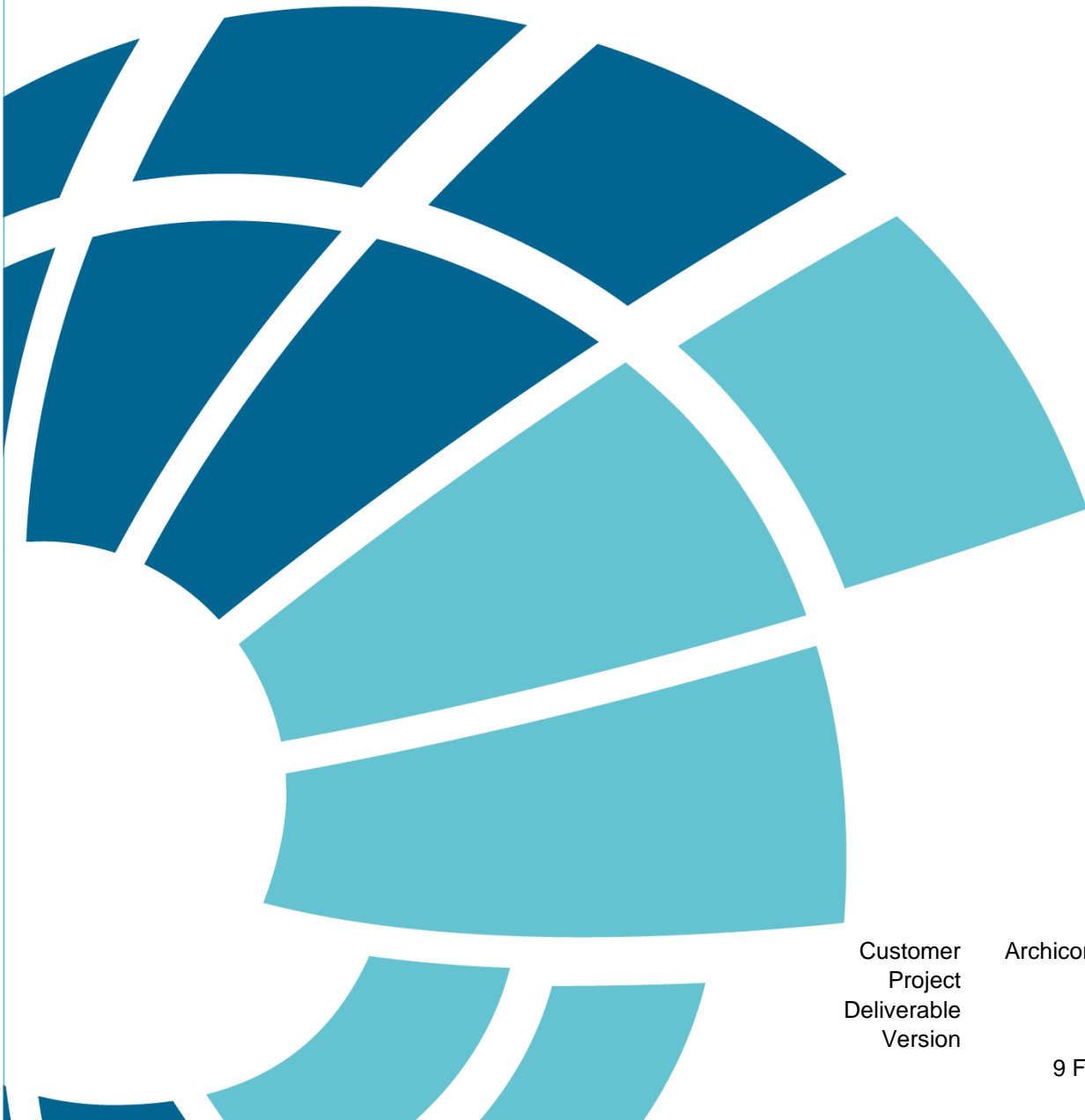


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# 26 Tupia Street Botany Flood Risk Management Plan



Customer  
Project  
Deliverable  
Version

Archicorpz Architects  
A12264  
002  
01  
9 February 2023

## Document Control

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Title	26 Tupia Street Botany Flood Risk Management Plan
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Version No	01
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Author	Kieran Smith
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Project Manager	Kieran Smith

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## 1 Introduction

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### 1.1 Intent

A Flood Risk Management Plan (FRMP) has been prepared for the proposed residential development at 26 Tupia Street, Botany (Lot X, DP 32914), herein referred to as the Site.

The information provided in this FRMP covers the following aspects:

- flood hazard;
- preparation for flooding and minimisation of risk due to flooding;
- who is responsible;
- provision of and maintenance of the on-site flood management systems and activities;
- warning signage/systems;
- awareness/education of occupants; and
- flood risk management plan procedures.

### 1.2 Development Background

The Site, shown in Figure 1.1, is located within the Bayside Council Local Government Area (LGA), specifically within the former Botany Bay City Council LGA (prior to the Council merger in 2016). The site is approximately 0.8 ha in size and is currently made up of 3 industrial warehouse buildings. Large sections of the site are covered by paved surfaces, although there is a thick coverage of vegetation at the Site boundary. The site is within the catchment for Foreshore Beach located along the north-east edge of Botany Bay. The site terrain varies between 4.2 m AHD at the north-east corner to 1.6 m AHD along the southern boundary. The Foreshore Beach catchment is characterised as being low in elevation and close to the water level in Botany Bay. Drainage gradients are generally flat; and as a result of this, during significant flood events flood waters pond on Site in a number of locations.





**Figure 1.1 Site Location (NSW SIX Maps)**

A Planning Proposal is proposed to facilitate the development of residential flat buildings at the Site. The development will involve the construction of three residential flat buildings (RFB) that will be 3-4 storeys high and contain approximately 109 apartments (see Figure 1.2).

The Site is located within the Bayside Council Local Government Area and subject to the Bayside Local Environment Plan (BLEP) 2021. Under the current BLEP, the Site is designated as an R3 Medium Density Residential Zone. BMT understands that as part of the proposed development at the Site, a Planning Proposal will be lodged to seek the amendments to the BLEP to allow for the proposed development within the existing R3 zoned Site. As the Site is affected by flooding, the planning proposal must comply with *Section 9.1(2) of the Environmental Planning and Assessment Act 1979* focus area *4.1 Flooding*. A copy of the focus area is included as Annex A. This FRMP seeks to satisfy Consistency Term (c) of the Focus Area which is included below:

*A planning proposal may be inconsistent with this direction only if the planning proposal authority can satisfy the Planning Secretary (or their nominee) that:*

*(c) the planning proposal is supported by a flood and risk impact assessment accepted by the relevant planning authority and is prepared in accordance with the principles of the Floodplain Development Manual 2005 and consistent with the relevant planning authorities' requirements,*

In August 2021, a Planning Proposal for a previous development design at the Site was not supported by the Bayside Local Planning Panel due to key matters including inadequate addressal of flooding, height and density requirements. The development has been adjusted in line with this feedback, including:

- A reduction from 5-storeys under the previous planning proposal;

- A reduction in density,
- Further consideration of flooding (undertaken as part of this assessment); and
- In line with the *Consistency* requirements outlined above, a FRMP has been prepared for the Site.

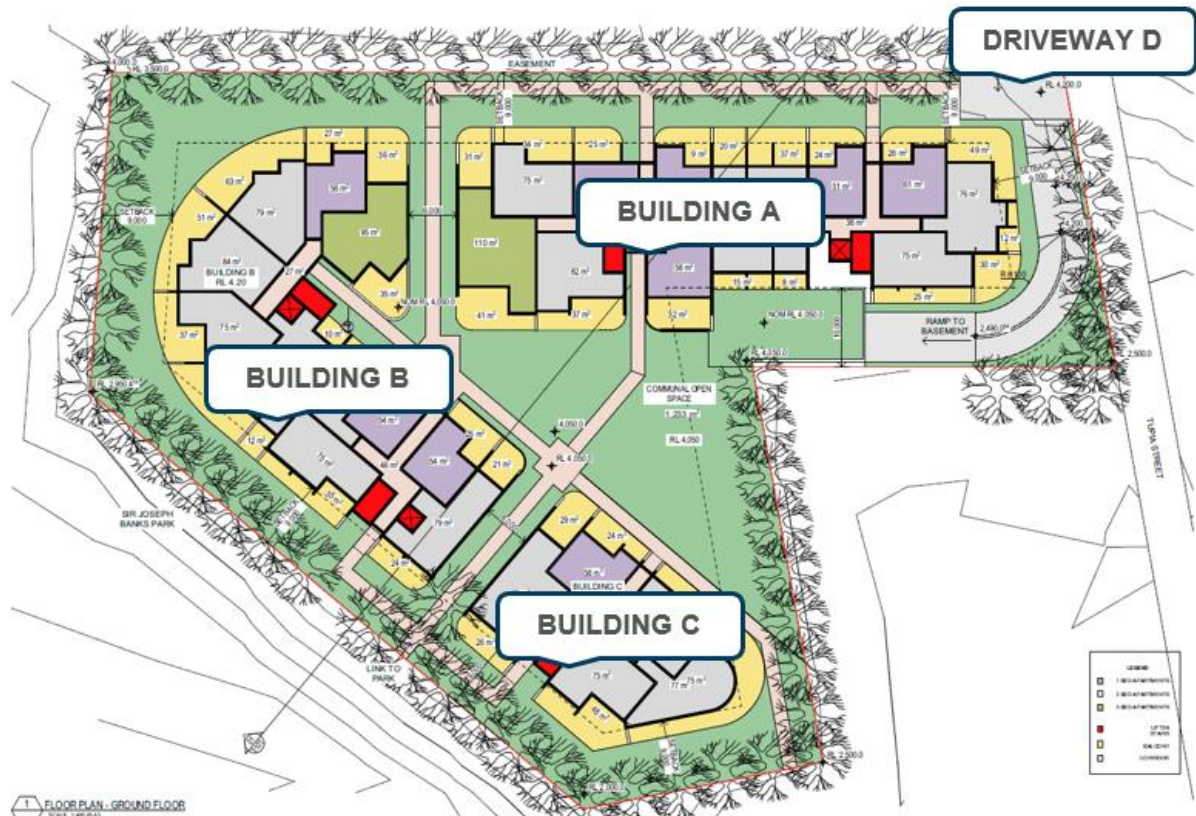


Figure 1.2 Proposed Development Layout (REF Project No. 6641, Drawing No. SK2003, Issue 01, TUPIA ST – RESIDENTIAL FLAT BUILDING OPTION FLOOR PLAN – GROUND FLOOR)

A Flood Impact Assessment (FIA) for the development has been prepared by BMT. The FIA establishes the development 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) design flood information and the proposed flood emergency response plan (FERP) to be adopted. The content of this FRMP is supported by the FIA and should be read and understood in conjunction with the findings of the FIA and the FERP. However, the flood risk management strategy documented herein provides in full the plan to manage the flood hazard at the Site.

Chapter 2 of this report describes the source of inundation and flood levels applicable to the site. Chapter 3 presents the risk management assessment for the development with respect to flooding. Chapter 4 presents the flood risk management measures to be applied for the development and Chapter 5 presents the flood risk management plan and procedures to be implemented.



## 2 Flood Hazard

Mainstream flooding for the Foreshore Beach catchment draining to Botany Bay was assessed as part of the *Botany Bay Foreshore Beach Catchment Flood Study* (BMT, 2015) and the *Botany Bay Foreshore Beach Catchment Floodplain Risk Management Study and Plan (FRMS&P)* (Jacobs, 2020). The TUFLOW hydraulic model developed for those studies was used as an input into the FIA undertaken for the proposed development.

The FIA indicates that the Site is located within the floodplain and is susceptible to overland flooding. Existing low-lying catchment topography results in floodwaters ponding within the Site, with high depths present along the southern boundary of the Site in particular. As per the FRMS&P, the Foreshore Beach catchment is subject to low velocity, deep floodwaters with durations of inundation at key drainage low points of up to 18-24 hours in the 1% AEP event and up to several days in the PMF event driven by poor drainage in the southern portion of the catchment. It is noted that the study calculates durations of flooding for depths above 0.1 m, which is considered to be a very low level of flood hazard, particularly for the PMF event.

The FIA determined that hazardous floodwaters may result at the Site and in the vicinity, with inundation from the north along Tupia Street and low-lying parkland areas from the east and west. The relevant flood levels with respect to the Site once developed, as established by the FIA are as per the table below.

**Table 2.1 Post-Development Design Flood Levels**

Location	1% AEP Flood Level (mAHD)	PMF Level (mAHD)
Building A	3.9	4.2
Building B	3.9	4.2
Building C	3.9	4.0
Driveway (D)	3.9	4.2

The FIA presents the flood management and mitigation design of the development, including proposed FFL requirements and the proposed FEMP shelter-in-place strategy. The recommended finished floor level of the development is tied to the post-development PMF level and varies between 4.0 mAHD (for the Building C) to 4.2 mAHD (for Buildings A and B).

Flood mapping included in the FIA identifies that during the 1% AEP event, the buildings will be free of flooding due to raising of existing ground levels and only minor ponding will be present in shared domain areas under post-development conditions. During the PMF event, the most extreme flooding reasonably possible, the site shared domain areas would be inundated to a depth of up to 0.3 m above finished ground levels (3.85 mAHD). Peak flood depths along proposed access paths at the front of the Site would be up to 1.3 m in a PMF event. Proposed finished ground floor levels for all 3 buildings on Site would place occupants above the PMF level.

As outlined in the Section 6 Flood Emergency Response Plan (FERP) of the FIA, given the potential for a relatively rapid onset and subsequent rate of rise of floodwater, it is considered appropriate and recommended that a 'shelter in place' response to flooding be adopted. It is noted in the FRMS&P that due to the large volumes of water and poor drainage conditions present in low-lying areas of the catchment during rare and extreme events, that "*Durations of flooding are expected to be up to 18 – 24 hours in events up to the 1% AEP ...[and] be prolonged (several days) in the PMF.*" While this figure may be true for some areas of the catchment the following is noted:

- As outlined above, flooding is defined within the FRMS&P as being any depth above 0.1 m. A 0.1 m flood depth can be considered to be a very low flood hazard particularly when paired with the slow velocities typical in the Foreshore Beach catchment.
- Modelling undertaken as part of the FIA indicates that the floodwaters would be above an H1 hazard and prevent potential vehicular egress via Tupia Street for up to 7.5 hours in a PMF event.

Given the above, the potential amount of time that vehicular access to the Site would be lost is considered to be significantly less than the several days outlined in the FRMS&P.

Although vehicular access to the Site will be lost for up to 7.5 hours in the PMF event, total isolation of the Site will not necessarily occur in such an event. Inclusion of a platform set above the PMF level is provided along either the north-east or north-west corner boundary of the Site, emergency access off Site is possible (and is recommended as part of the FERP).

Site access along Tupia Street is subject to flooding. The FIA identifies that during the 1% AEP event, Tupia Street would be inundated by depths of up to 1.6 m with a highest flood hazard classification of H5. During the PMF event, maximum peak depths are greater than 2.1 m, with a highest flood hazard classification of H5. Flood hazard classifications are outlined in Table 2.2 and Figure 2.2 below, with post-development 1% AEP and PMF hazards shown in Figure 2.2 and Figure 2.3 respectively. While a shelter-in-place strategy is recommended as part of the FERP, flood warning signs, education of Site occupants and the establishment of off-site pedestrian egress to potential alternate vehicular routes will be key considerations in the management of flood risk.

**Table 2.2 Flood Hazard Classification Thresholds (ADR, 2017)**

Hazard Classification	Description
H1	Relatively benign flow conditions. No vulnerability constraints.
H2	Unsafe for small vehicles.
H3	Unsafe for all vehicles, children and the elderly.
H4	Unsafe for all people and vehicles.
H5	Unsafe for all people and vehicles. Buildings require engineering design and construction.
H6	Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.



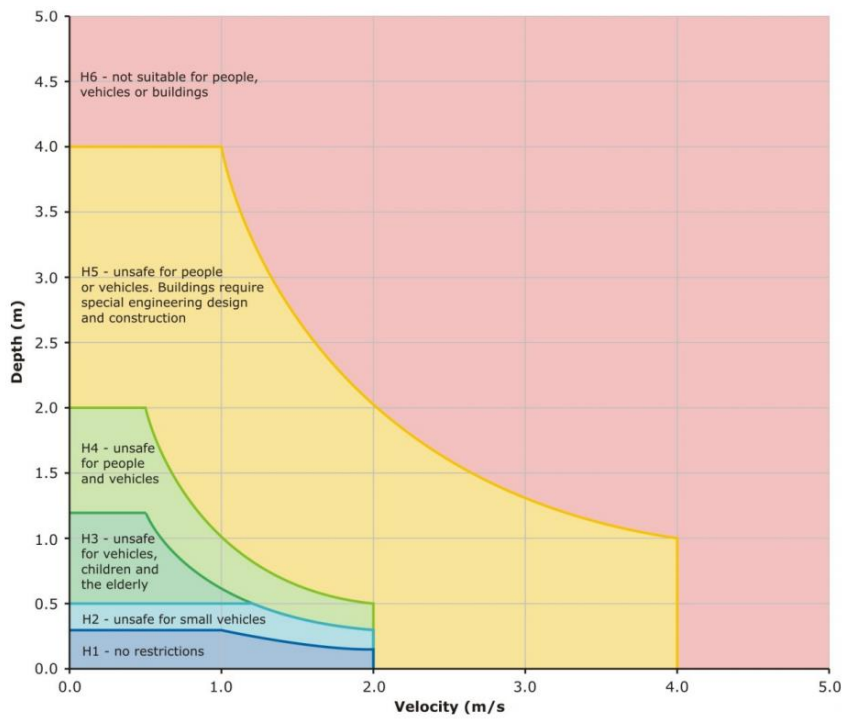











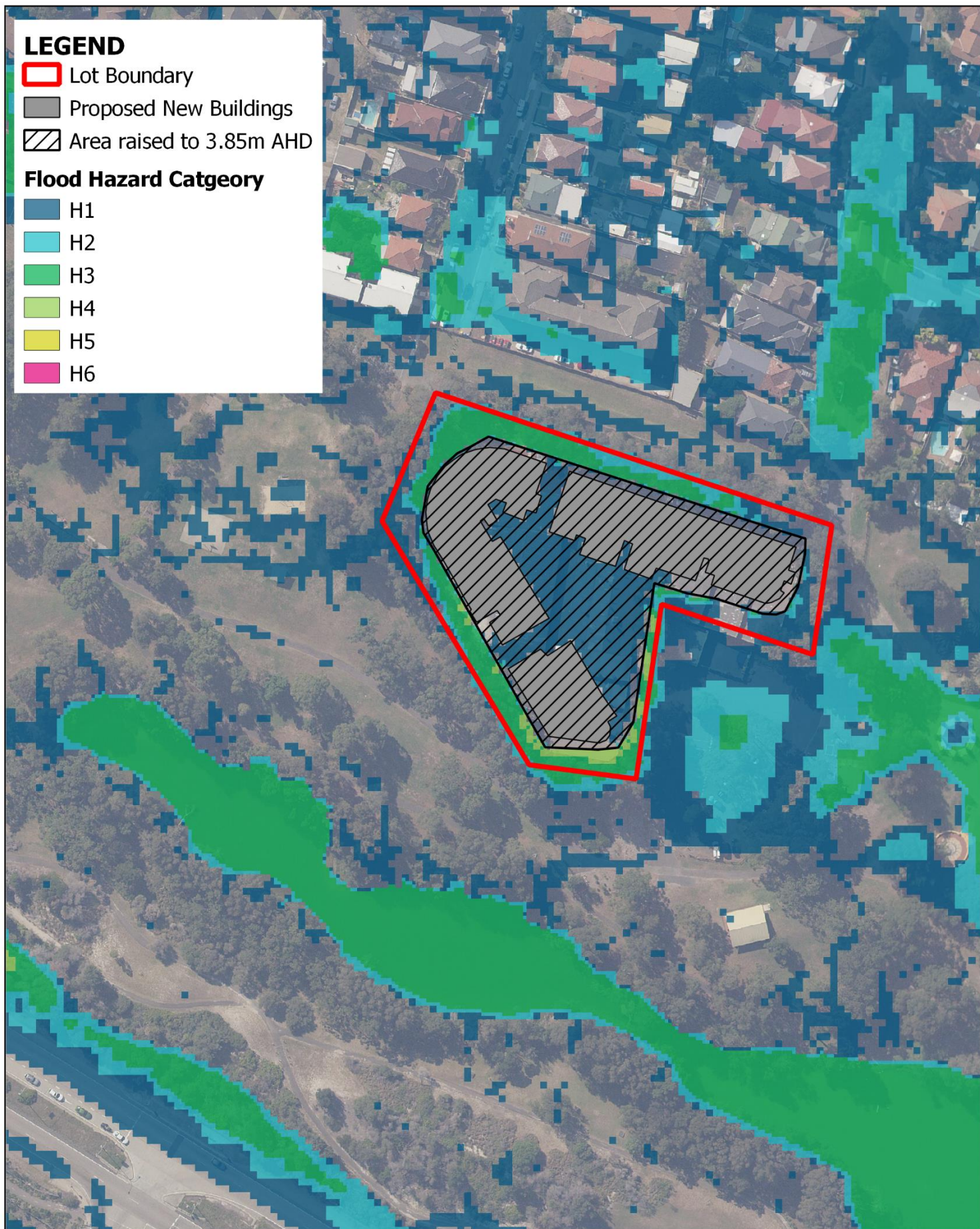
Figure 2.1 Flood Hazard Curves (2017)

## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Flood Hazard Category

-  H1
-  H2
-  H3
-  H4
-  H5
-  H6



Title:

## 1% AEP Flood Hazard Category Design (Post-Development) Conditions

Drawing:

2.2

Rev:

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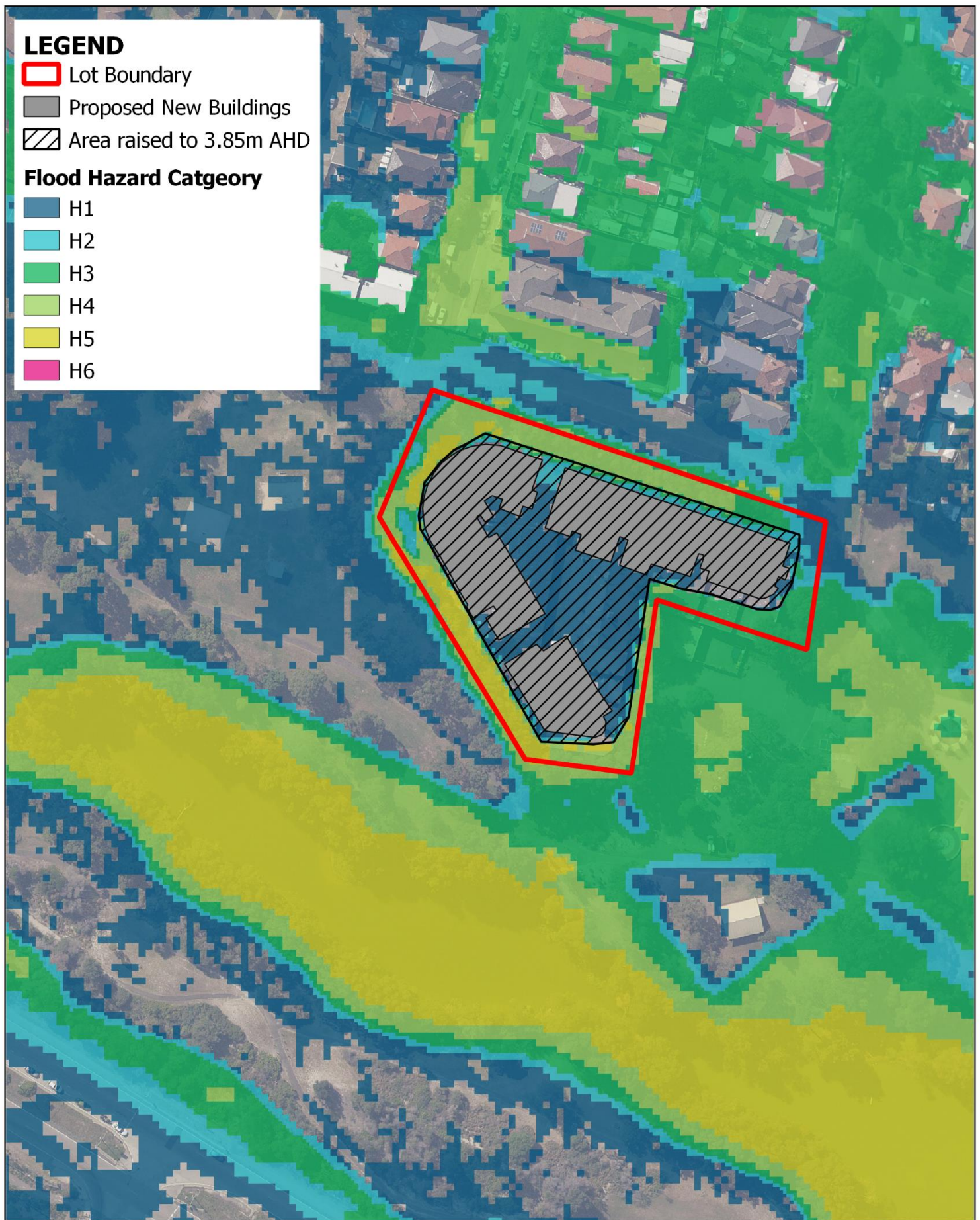


## LEGEND

-  Lot Boundary
-  Proposed New Buildings
-  Area raised to 3.85m AHD

## Flood Hazard Category

-  H1
-  H2
-  H3
-  H4
-  H5
-  H6



Title:

## PMF Flood Hazard Category Design (Post-Development) Conditions

Drawing:


2.3

Rev:

A

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## 3 Flood Risk Management Assessment

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### 3.1 Guidelines

This flood risk management assessment was prepared in accordance with recommendations and guidance contained in the *National Emergency Risk Assessment Guidelines* (Australian Institute for Disaster Resilience, 2020) and the CSIRO report *Floodplain Management in Australia: Best Practise Principles and Guidelines [SCARM report 73]* (CSIRO, 2000). Further reference is made to the following documents:

- Bayside Council Botany Bay Development Control Plan 2013.
- ISO 31000:2018 Risk Management.
- Flood Emergency Planning for Disaster Resilience (2020).
- Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia – Handbook 7, Australian Disaster Resilience Handbook Collection (2017).
- The Flood Risk Management Manual (2022).
- The Botany Bay Foreshore Floodplain Risk Management Study and Plan (2020).

These documents relate specifically to the steps required in determining risk, and in this instance, flood risk associated with a particular situation and/or development.

A risk assessment has been undertaken for the Site with respect to present day flood inundation risk to the Site from the upstream drainage catchment. In line with the National Emergency Risk Assessment Guidelines the following steps have been taken:

- Risk Identification (see Table 3.1)
- Risk Analysis (see Table 3.2)
- Risk Evaluation (see Table 3.3)
- Risk Treatment (see Table 3.4)

It is recommended that the qualitative risk analysis be reviewed no less than once every five-year period as part of the overall FRMP review to ensure the impacts of climate change do not alter the assessment outcomes. This requirement is underscored by the NERAG (2020) guidelines and by AS:31000, which states the following:

*5.7.2 Continually improving - The organization should continually improve the suitability, adequacy and effectiveness of the risk management framework and the way the risk management process is integrated. As relevant gaps or improvement opportunities are identified, the organization should develop plans and tasks and assign them to those accountable for implementation. Once implemented, these improvements should contribute to the enhancement of risk management.*



The risk assessment is based on the development of the site at the proposed design levels and consequently the ability to provide flood refuge on-site above the PMF flood level. **While procedures nominated in this FRMP are considered to reflect the most feasible options available to minimise flood risks, any directions provided by Council officers, Police, State Emergency Services or other authorised emergency personnel should take precedence over the FRMP.**

### 3.2 Risk Management Options

Based on the proposed residential use of the Site, the primary risks associated with the Site relate to occupants. The greatest risk to the occupants of the Site with regards to flooding is attempting to enter or exit the Site through hazardous floodwaters.

During flood conditions assessed as part of the FIA, there is a risk that the Site's sole road/vehicular access along Tupia Street becomes inundated such that it is untrafficable and unsafe for all persons for a time. Additionally, peak flood depths on and surrounding the Site may make pedestrian egress difficult or even unsafe. Although proposed finished ground floor levels for new buildings at the Site will place them above the PMF and outside of the floodplain, the potential for isolation during long periods of flooding in rare and extreme events may result in residents entering into floodwaters while attempting to leave the Site.

Risk management measures that have been included as part of the development at the Site include:

- Setting of finished ground floor levels above the PMF level;
- Provision of an off-site pedestrian egress route to Hayden Place and/or Waratah Road to facilitate emergency access to property during flood events;
- Strict triggers on the approach to the basement to ensure warning prior to any significant flooding occurring
- Flood warning signage at the entrance to the basement, in common areas in buildings and at low points on the Site where ponding may occur.
- Provision of services and supplies on the Site above the PMF level to support safe refuge of occupants until flooding recedes.

Table 3.1 Risk Identification

Vulnerable Element	Risk Description	Source of Risk	Consequence Category (Existing Flood Conditions)	Prevention and Preparedness Controls	Response and Recovery Controls
Site Occupants/Residents	Potential injury, illness or drowning for site occupants and residents entering into floodwaters.	Parts of the Site are subject to deep flooding, increasing with severity up to the PMF. Occupants may attempt to traverse the Site or enter/exit the access road and be subject to hazardous floodwaters. Flood hazards may include entrapment in vehicles, debris in floodwater and drowning.	Catastrophic – potential for drowning or severe illness or injury	Flood Emergency Response Plan recommends shelter-in-place strategy. Proposed building finished floor level is above the PMF placing all Site occupants outside of the floodplain within their homes. Ground levels in common spaces elevated to prevent deep ponding for all events up to and including the PMF.	Warning signs are to be installed on approach to Site and in areas of higher ponding to warn site occupants/residents about the potential danger of floodwaters.
Vehicles, Property and Goods	Damage to or loss of vehicles, property or goods.	Inundation of vehicles, property or goods as the flood level approaches the PMF level.	Catastrophic – potential for significant economic damage to property and goods	Driveway crest levels to be set as high as practical to prevent potential ingress into basement. Finished floor levels to be set above the PMF. Direct damage to goods from floodwaters minimised.	N/A



Vulnerable Element	Risk Description	Source of Risk	Consequence Category (Existing Flood Conditions)	Prevention and Preparedness Controls	Response and Recovery Controls
Site Access/Critical Evacuation	Potential inability to reach and evacuate Site occupants for a time when flood depths are greater than 500 mm, other than by emergency services evacuation by airlift (e.g. medical emergency). Potential for inaccessibility and isolation for up to 18 hours in a 1% AEP event and up to several days in the PMF event.	Access to/from the Site will generally be untrafficable once the floodwater level on Tupia Street rises to a depth of 300 mm for small cars to 500 mm for large 4WD (and/or roads are closed). Water depths on Site would be unsafe to traverse on foot.	Catastrophic – potential for death due to isolation of those with medical needs in an emergency.	Installation of platform above the PMF level to provide flood-free access to St Joseph Banks Park.	<p>Potential ingress to and egress from the Site via platform. Non-vehicular access to platform via low-hazard route in St Joseph Banks Park. Vehicular access to St Joseph Banks Park via low-hazard route along Hayden Place and/or Waratah Road.</p> <p>Potential egress and ingress via vehicle along low-hazard Hayden Place and/or Waratah Road via St Joseph Banks Park for site occupants/residents and emergency services personnel.</p>

Table 3.2 Risk Analysis

Vulnerable Element	Level of Prevention and Preparedness Control(s)	Level of Response and Recovery Control(s)	Revised Consequence Category (Post-Development Flood Conditions)	Likelihood Level	Risk Level	Confidence Level
Site Occupants/Residents	High	Low	Minor – ponding on Site reduced significantly with filling works. Floor level above PMF with recommended shelter in place strategy. Peak flood depths located at Site boundary away from walkways and common areas. Signage to inform occupants of potential danger	Unlikely	Low	Highest
Vehicles, Property and Goods	Medium	N/A	Moderate – placement of goods above PMF level where practical will remove them from flood affectation. Potential for inundation in extreme event if driveway crest is set below the PMF level.	Extremely Rare	Low	Highest



Vulnerable Element	Level of Prevention and Preparedness Control(s)	Level of Response and Recovery Control(s)	Revised Consequence Category (Post-Development Flood Conditions)	Likelihood Level	Risk Level	Confidence Level
Site Access/Critical Evacuation	Medium	Medium	<p>Moderate – inclusion of platform allows for potential ingress to and egress from the Site in the event of a flood emergency.</p> <p>Flood Emergency Response Plan identifies plausible evacuation route via vehicle from Site.</p> <p>Some residual risk due to the potential need to cross very low hazard floodwaters.</p>	Unlikely	Medium	High

Table 3.3 Risk Evaluation

Vulnerable Element	Risk Priority*	Risk Category*	Treatment Plan
Site Occupants/Residents	5	3	N/A
Vehicles, Property and Goods	5	3	Driveway crest level to be as high as reasonably practical
Site Access/Critical Evacuation	3	1	Flood Emergency Response Plan to be distributed to all residents and potential occupiers. Detailed survey of boundary required to confirm potential tie-in with proposed platform. Assessment of proposed evacuation route by SES if possible. Evacuation platform to be placed on yearly maintenance plan. Prominent placement of flood warning signs on Site to prevent egress through floodwaters.

See *National Emergency Risk Assessment Guidelines Chapter 7*

Table 3.4 Risk Treatment Plan

Vulnerable Element	Existing Controls	Additional Treatment Plan	Potential for Risk Reduction
Site Occupants/Residents	Proposed building FFL above PMF. Elevated ground levels in common spaces. Warning signs to be installed on approach to Site and in areas of potential ponding. Distribution of Flood Emergency Response Plan to all occupants/residents.	N/A	N/A
Vehicles, Property and Goods	Driveway crest levels to be set as high as practical to prevent potential ingress of water into basement. Finished floor levels set above the PMF.	Potential for driveway crest level to be situated above the PMF to be investigated during detailed design. Potential for pumps to be installed in basement carpark in the event of an extreme flood event to be investigated during detailed design.	Placement of driveway crest level above PMF would prevent floodwater ingress to basement. Installation of pumps in basement would minimise potential damage during an extreme flood event.
Site Access/Critical Evacuation	Platform installed above PMF level to provide flood-free access to St Joseph	Detailed survey of Site boundary during detailed design stage to confirm	Survey of Site boundary would optimise placement of raised platform



Vulnerable Element	Existing Controls	Additional Treatment Plan	Potential for Risk Reduction
	<p>Banks park, and in turn vehicular access from Hayden Place and/or Waratah Road.</p>	<p>neighbouring site ground levels and potential tie-in with proposed platform.</p> <p>Assessment of proposed evacuation route by SES (if possible).</p> <p>Evacuation platform to be placed on yearly maintenance plan for development.</p> <p>Potential for a dedicated evacuation path through St Joseph Banks park to Hayden Place and/or Waratah Road to be discussed with Council.</p>	<p>along high ground, minimising potential interaction with floodwaters.</p> <p>Assessment of proposed evacuation route by SES would confirm viability and identify potential areas for improvement.</p> <p>Maintenance of evacuation platform annually will ensure it is suitable for use in the event of a flood emergency.</p> <p>Development of a dedicated evacuation path would reduce potential issues of unstable ground along evacuation route.</p>

## 4 Flood Risk Management Measures

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### 4.1 Overview

The risk management assessment outlined in Section 3 has identified the need for appropriate management measures and procedures to minimise flood risk to site occupants. Inundation of the Site is expected in major flood events and will increase with severity up to the PMF event. Flooding of the Site access route along Tupia Street is expected in major flood events (from the 1% AEP event). Consequently, it is necessary to ensure that the risk to site occupants is managed and minimised to as great an extent as practicable.

Minimisation of risk can be achieved by appropriate design, followed by operation of the site in accordance with the Flood Risk Management Plan detailed in Section 5 of this report. Section 4 discusses the requirements for these management procedures.

### 4.2 Design and Construction

#### 4.2.1 Building Materials

To facilitate the minimisation of risk to property and ability to rapidly recover from inundation, building elements (i.e., walls and floors) below 4.0 m AHD (for Building C) and 4.2 m AHD (for Buildings A and B) should be constructed from materials resistant to floodwater damage wherever feasible (e.g., concrete, metal sheeting, tiles) and readily amenable to cleaning following a flood event.

#### 4.2.2 Unit Fit Out

The fit out of individual units and common spaces should consider minimising flood damage and recovery time. It is recommended that valuable property and property sensitive to water damage be located on elevated spaces above 4.0 m AHD (for Building C) and 4.2 m AHD (for Buildings A and B).

Proposed FFLs for all 3 buildings will place all residences above the PMF and outside of the floodplain. To accommodate occupants during any periods of temporary shelter in place, residences should be designed to accommodate the maximum number of ordinarily expected site occupants. This area should be provided on the basis of no less than 3.5 m<sup>2</sup> per person (in line with minimum UNHCR standards for emergency shelters).

#### 4.2.3 Electrical Infrastructure

To minimise the risk of electrocution, all power and lighting switches shall be located above the PMF level (4.0 m AHD for Building C, 4.2 m AHD for Buildings A and B).

#### 4.2.4 Signage

It is recommended that appropriate signage be adopted to promote the awareness of occupants and visitors of the potential for inundation along Tupia Street on approach to Site, along the Site boundary (particularly at the north) and in communal areas below the PMF. Signage of a form similar to the example provided below shall be located prominently near the Site entrance, the Site driveway and in common areas.



## FLOOD NOTICE

Road access to this site can flood due to very intense rainfall over a short period.

If directed by the Site Manager or by Flood Warning by Council, SES or the BoM shelter inside residence until water recedes. Under no circumstances should you enter into floodwater.

Flood depth signage should be installed on the site, located at the access driveway (Location D) and in areas along the northern boundary susceptible to flooding. This signage would indicate to occupants the depth of water on the Site and include signage that advises no entry into floodwater.

To reinforce occupant awareness of the shelter in place procedure during flooding, it is recommended that signage be provided within each apartment and common areas that highlights the flood shelter zones at the site where occupants should gather when directed to shelter in place.

### 4.2.5 Emergency Services Access

As outlined in Table 3.1, emergency services access is recommended to be provided:

- From Hayden Place via St Joseph Banks Park on the west of the Site; and/or
- From Waratah Road via St Joseph Banks Park on the east of the Site.

Provision of walkways at the locations and finished heights shown in Figure 4.1 below will provide flood-free access routes to the Site in the event of an emergency.

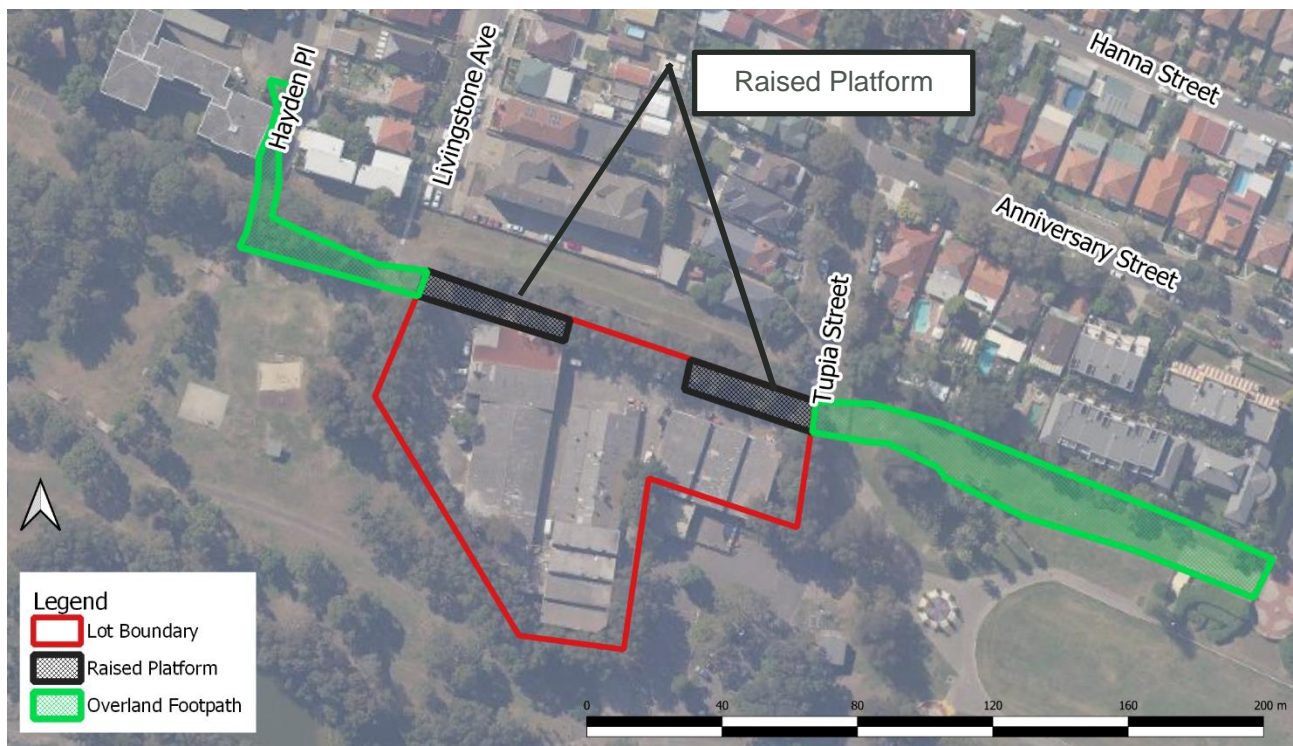


Figure 4.1 Location Of Proposed Emergency Access Walkways

### 4.2.6 Driveway Crest Level

To minimise the potential ingress of floodwaters into below ground areas it is recommended that the crest level of the driveway be set at, or as reasonably close to 4.2 mAHd as possible.

## 4.3 Operation

### 4.3.1 Site Management

It is necessary for a site manager to be designated responsible for the oversight, implementation and ongoing review of the FRMP. Although the plan envisages the strata manager being the responsible person, a suitable alternate person can be nominated.

It will also be necessary for an alternate person to be nominated in the event of the site manager being on leave or incapacitated. It is expected that this delegation will be a standard component of normal operation of the Site.

### 4.3.2 Resident Awareness

Future residents (both unit owners and potential tenants) of the Site should be provided with a copy of the Flood Emergency Response Plan and advised of (1) the rare risk of ponding floodwaters to the north of the Site and in communal areas, (2) the possible flooding and inaccessibility of the site access via Tupia Street and (3) ingress and egress routes along Livingstone Avenue and Waratah Road via parkland to the east and west of the Site. Residents should appreciate that finished floor levels will place residences above the PMF and potential inundation.

### 4.3.3 Occupant Induction and Training

The risk management plan outlined in this report will be implemented as part of the Strata management of the Site. The Site manager will be responsible for ensuring that residents are made aware of the nature of flood risk as described in this plan and requirements to shelter in place when flooding over the access road occurs or shallow flooding (albeit extremely rare) occurs on-site.

### 4.3.4 Communications

It is recommended that multiple communication platforms are maintained on the site (such as internet, mobile phone, landline phone or radio) so that if one communication platform fails there is a redundancy. These platforms can be used to monitor for severe weather warnings, refer to the section below, as well as to enable communication between the site manager and site occupants and to maintain effective communication with others during severe weather events.

### 4.3.5 Severe Weather Warning Service

Watch and warning alerts of severe weather including rainfall and flooding are provided by the BoM. Receipt of warnings will provide the site management with warning of possible flooding over the site's access via Tupia Street, leaving it temporarily inaccessible, and in very rare instances, of possible shallow inundation of the site.

At a minimum, the site manager (including delegated alternate) and residents should take measures to receive BoM severe weather warnings from any of the following:

- BoM website – flood warnings are available directly from the BoM, refer to <http://www.bom.gov.au/nsw/warnings/>. Broader information about the service is also available, refer to <http://www.bom.gov.au/weather-services/severe-weather-knowledge-centre/warnings.shtml>.
- Telephone recorded information services – flood Warnings are available on a BoM recorded message service, 1300 659 219 (charges apply for the service).
- BoM smartphone application – BoM Weather app provides direct access to the BoM weather warnings.
- Radio – local radio stations, broadcast warnings (and bulletins) soon after issue.



The alerts issued by the above sources shall be used as a guide to pay close attention to the site surroundings. The site manager should monitor weather warnings during such times.

#### 4.3.6 Triggers for Temporary Closure and Shelter in Place

##### **Severe Rainfall Warning**

On issue and receipt of severe weather warnings for severe rainfall/thunderstorm in the area (BoM southern Sydney region) and/or the potential for flash flooding, the site manager may adopt a precautionary approach and instruct residents to shelter-in-place in their residences prior to flooding occurring over Tupia Street and on-site.

To provide guidance regarding forecast rainfall warnings and monitoring of site conditions, it is proposed that the following rainfall amounts, being design rainfall depths obtained from the BoM, be used as an approximate guide to monitor the potential for flooding:

- 75 mm or more over three hours.
- 100 mm or more over six hours.
- 120 mm or more over nine hours.

If weather alerts have also been issued by the BoM for major flooding actively occurring in the vicinity of southern Sydney or water is present over Tupia Street, the Site driveway and/or the site access paths, the direction by the Site manager to shelter in place should be given to all residents.

##### **Flood Warning**

On issue and receipt of severe weather warnings for expected major flooding in the area (BoM southern Sydney region), the Site manager and/or authorised delegate is to monitor for any flooding to the site access and Tupia Street in the vicinity of the Site. Upon the occurrence of floodwater over the site access driveway or Tupia Street, direction by the site manager to shelter in place should be given to all residents.

#### 4.3.7 Triggers for Site Re-Opening

Access to/from the Site may be re-opened by the Site manager when floodwaters have completely receded from the site access driveway and Tupia Street and no further inundation is expected. The site manager shall be responsible for coordinating inspection by suitably qualified tradespersons of any flooded areas of the site or utilities connections (if flooded).

#### 4.3.8 Records Management

Records shall be retained regarding the following:

- Nominated site manager, alternate and delegates responsible for flood risk management of the site.
- Site flood signage maintenance.
- Evaluation of the performance of the site and FRMP during flood events including non-conformances and areas where the FRMP might be revised or improved.

## 5 Flood Risk Management Plan

All procedures of the FRMP are outlined in Table 5.1.

Table 5.1 Flood Risk Management Plan

Item	Plan Procedures
Person Responsible:	Site manager (including designated alternate).
Performance Objectives:	<ol style="list-style-type: none"> <li>1. To review the 26 Tupia Street Flood Impact Assessment (2022) and make themselves familiar with flood risk at the site and Tupia Street.</li> <li>2. To implement the content of this Flood Risk Management Plan, in the event of severe rainfall or flooding being expected or occurring.</li> <li>3. To inform residents and occupants of the flood characteristics of the site and vicinity and of the site closure and shelter in place procedures in case of a flood event occurring.</li> <li>4. To minimise and manage flood effects.</li> <li>5. To ensure that the flood risk to people and property on the site is appropriately managed and minimised.</li> </ol>
Implementation Strategy:	<p><b>Building Materials</b></p> <ol style="list-style-type: none"> <li>1. Building materials below 4.0-4.2 m AHD are resistant to floodwater damage wherever feasible.</li> <li>2. Essential electrical services (power points, lighting etc.) are located at a minimum level of 4.0-4.2 m AHD.</li> </ol> <p><b>Fit Out Design</b></p> <ol style="list-style-type: none"> <li>3. Any equipment of value and/or sensitive to water damage be located on elevated spaces/platforms above 4.0-4.2 m AHD.</li> <li>4. Sufficient on-site area is provided, within residences, elevated no lower than 4.0-4.2 m AHD to accommodate the maximum number of ordinarily expected site occupants. This area is calculated based on no less than 3.5 m<sup>2</sup> per person.</li> </ol> <p><b>Signage</b></p> <ol style="list-style-type: none"> <li>5. Signage that promotes awareness of the potential for floodwater inundation from Tupia Street and in communal areas be installed. Installation locations to be prominent and near to the entry driveway. Refer to Flood Risk Management Measures section 4.2 for example signage.</li> <li>6. Flood depth signage to be installed at the southern vehicle crossover susceptible to flooding. Flood depth signage is to indicate to occupants the depth of water over the shared paths into the Site and include accompanying signage that advises no entry into floodwater.</li> </ol> <p><b>Emergency Services Access</b></p> <ol style="list-style-type: none"> <li>7. Emergency Services Access platforms connecting the Site to Sir Joseph Banks Park and/or parklands to the east are to be installed above the PMF Level of 4.2 m AHD.</li> </ol> <p><b>Driveway Crest Level</b></p> <ol style="list-style-type: none"> <li>8. The Driveway Crest level for entry into the underground carpark should be set at, or as close as reasonably possible to, 4.2 m AHD.</li> </ol> <p><b>Site Operation</b></p> <ol style="list-style-type: none"> <li>9. Site manager to ensure that the Flood Risk Management Plan is incorporated into the site's operational procedures.</li> <li>10. Prospective residents/occupants to review the Flood Emergency Response Plan and accept adopted flood risk management measures, specifically including the requirements to: <ol style="list-style-type: none"> <li>a avoid entering floodwater at all times; and</li> <li>b shelter in place within residences when flooding occurs over Site entry paths/driveway, or when directed to do so by site manager or emergency services.</li> </ol> </li> <li>11. The site manager (including alternate) are to receive and monitor Bureau of Meteorology severe weather watch and warning alerts for the southern Sydney area (includes Floodvale Drain, Springvale Drain and Banksmeadow).</li> <li>12. It is recommended that multiple communication platforms are maintained on the Site (such as internet, mobile phone, landline phone or radio) to provide redundancy in communication methods.</li> <li>13. First aid and non-life-threatening medical supplies are to be maintained within communal areas where possible.</li> <li>14. Adopt a precautionary principle with respect to site evacuation, closure and shelter in place.</li> </ol>



Item	Plan Procedures
	<p>15. Update this plan as required based on experience to revise and improve its effectiveness to minimise flood risk to site occupants and property.</p> <p><b>Awareness and Education</b></p> <p>16. Prospective residents of the site to be provided with a copy of the Flood Emergency Response Plan and advised of risks of on-site inundation and periodic flooding and inaccessibility of the site.</p> <p>17. Through appropriate means of notification, all regular residents/occupants are to be made aware of the nature of flood risk as described in this plan and requirements to shelter in place when flooding over the access driveway or shallow flooding (albeit extremely rare) occurs on-site.</p>
Closure and Shelter Strategy:	<p><b>Severe Rainfall/Thunderstorm Warning</b></p> <p>18. Adopt a precautionary principle where safe and practical to do so:</p> <ul style="list-style-type: none"> <li>a On issue and receipt of Bureau of Meteorology severe weather warnings for severe rainfall/thunderstorms in the area (southern Sydney region) and/or the potential for flash flooding, the site manager may instruct residents to shelter-in-place in their residences prior to flooding at the northern boundary/Site access driveway.</li> </ul> <p>19. If, in addition to rainfall warning(s), a warning of major flooding actively occurring in the vicinity of southern Sydney has been issued, or water is present over Tupia Street and/or other site access point, the site manager is to direct all site occupants to shelter in place.</p> <p><b>Flood Warning</b></p> <p>20. On issue and receipt of severe weather warnings for expected major flooding in the area (BoM southern Sydney region), the site manager and/or authorised delegate is to monitor for any flooding to the site access and Coal Pier Road in the vicinity of the site.</p> <p>21. The site manager is to direct all site occupants to shelter in place upon the occurrence of floodwater over the site access crossovers or Coal Pier Road.</p>
Re-Opening strategy:	<p>22. The site manager may re-open access to/from the site once floodwaters have completely receded from the site access crossovers and Coal Pier Road and no further inundation is expected.</p> <p>23. The site manager shall be responsible for coordinating inspection by suitably qualified tradespersons of any flooded areas of the site or utilities connections (if flooded).</p>
Plan Records:	<p><b>Post-Event Reporting</b></p> <p>24. Records are to be retained for the following:</p> <ul style="list-style-type: none"> <li>a Nominated site manager, alternate and delegates responsible for flood risk management of the site.</li> <li>b Site flood signage maintenance.</li> <li>c Evaluation of the performance of the site during actual events, including non-conformances and areas where the plan might be revised or improved.</li> </ul>

## 6 Conclusion

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A Flood Risk Management Plan (FRMP) has been prepared for the proposed residential flat building development at 26 Tupia Street, Botany (Lot X, DP 32914).

The Site is potentially affected by flooding in rare and extreme flood events, with inundation of the Site's access from Tupia Street and potential ponded flood depths on Site increasing with severity up to the PMF.

It is proposed to adopt a risk-based approach for the site, incorporating design elements to minimise both risk to occupants and flood damage to property. These design elements include the setting of finished floor levels above the PMF level, the setting of driveway crest levels as close as possible to the PMF and the installation of a platform above the PMF to provide emergency services access to the Site. These measures are to be implemented in accordance with a Flood Risk Management Plan. It is considered that this approach will minimise flood risk to an acceptable degree.

A risk assessment was prepared to comprehensively assess flood-related risks, consequences and potential treatment options. A series of flood risk management measures appropriate to the site were identified, with a Flood Risk Management Plan prepared, suitable for incorporation at the detailed design stage and during future Site operation. The plan allows for ongoing periodic review and opportunities for revision and improvement where appropriate following flooding events.



## References

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Bayside Council (2013) *Botany Bay Development Control Plan 2013*.

BMT (2015). *Botany Bay Foreshore Beach Catchment Flood Study*, prepared for City of Botany Bay Council.

BMT (2022) *26 Tupia Street Flood Impact Assessment*, prepared for Archicorpz

Commonwealth of Australia (Australian Institute for Disaster Resilience) (2020) *National Emergency Risk Assessment Guidelines*.

Commonwealth of Australia (Australian Institute for Disaster Resilience) (2020) *Flood Emergency Planning for Disaster Resilience*.

Commonwealth of Australia (Australian Institute for Disaster Resilience) (2017) *Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia – Handbook 7*.

CSIRO (2000) *Floodplain Management in Australia: Best Practise Principles and Guidelines [SCARM report 73]*.

ISO 31000:2018 (2018) *Risk Management – Principles and Guidelines*.

Jacobs (2018). *Botany Bay Foreshore Beach Catchment Flood Risk Management Study*, prepared for Bayside Council

NSW Government (2022). *Environment Planning and Assessment Act 1979 No 203, Section 9.1 (2), Focus Area 4.1 Flooding*

## ***Annex A Section 9.1(2) of the Environmental Planning and Assessment Act 1979 Focus Area 4.1 Flooding***

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## Focus area 4: Resilience and Hazards

### 4.1 Flooding

#### Objectives

The objectives of this direction are to:

- (a) ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and
- (b) ensure that the provisions of an LEP that apply to flood prone land are commensurate with flood behaviour and includes consideration of the potential flood impacts both on and off the subject land.

#### Application

This direction applies to all relevant planning authorities that are responsible for flood prone land when preparing a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land.

#### Direction 4.1

- (1) A planning proposal must include provisions that give effect to and are consistent with:
  - (a) the NSW Flood Prone Land Policy,
  - (b) the principles of the Floodplain Development Manual 2005,
  - (c) the Considering flooding in land use planning guideline 2021, and
  - (d) any adopted flood study and/or floodplain risk management plan prepared in accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.
- (2) A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.
- (3) A planning proposal must not contain provisions that apply to the flood planning area which:
  - (a) permit development in floodway areas,
  - (b) permit development that will result in significant flood impacts to other properties,
  - (c) permit development for the purposes of residential accommodation in high hazard areas,
  - (d) permit a significant increase in the development and/or dwelling density of that land,
  - (e) permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,
  - (f) permit development to be carried out without development consent except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,
  - (g) are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or
  - (h) permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.

- (4) A planning proposal must not contain provisions that apply to areas between the flood planning area and probable maximum flood to which Special Flood Considerations apply which:
- (a) permit development in floodway areas,
  - (b) permit development that will result in significant flood impacts to other properties,
  - (c) permit a significant increase in the dwelling density of that land,
  - (d) permit the development of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate,
  - (e) are likely to affect the safe occupation of and efficient evacuation of the lot, or
  - (f) are likely to result in a significantly increased requirement for government spending on emergency management services, and flood mitigation and emergency response measures, which can include but not limited to road infrastructure, flood mitigation infrastructure and utilities.
- (5) For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.

## Consistency

A planning proposal may be inconsistent with this direction only if the planning proposal authority can satisfy the Planning Secretary (or their nominee) that:

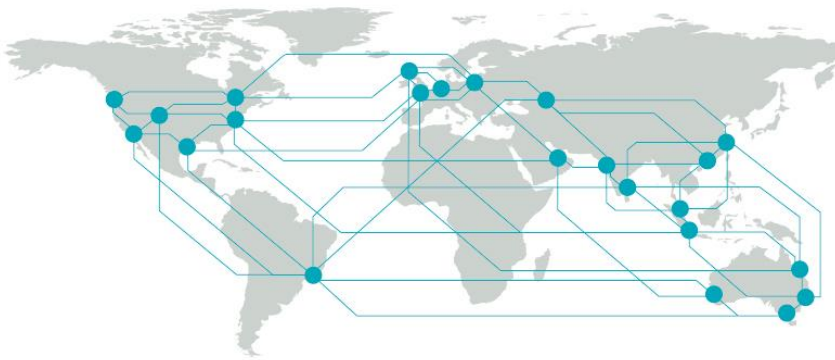
- (a) the planning proposal is in accordance with a floodplain risk management study or plan adopted by the relevant council in accordance with the principles and guidelines of the *Floodplain Development Manual 2005*, or
- (b) where there is no council adopted floodplain risk management study or plan, the planning proposal is consistent with the flood study adopted by the council prepared in accordance with the principles of the *Floodplain Development Manual 2005* or
- (c) the planning proposal is supported by a flood and risk impact assessment accepted by the relevant planning authority and is prepared in accordance with the principles of the *Floodplain Development Manual 2005* and consistent with the relevant planning authorities' requirements, or
- (d) the provisions of the planning proposal that are inconsistent are of minor significance as determined by the relevant planning authority.

**Note:** In this direction:

- (a) "flood prone land" "flood storage" "floodway" and "high hazard" have the same meaning as in the Floodplain Development Manual 2005.
- (b) "flood planning level" "flood behaviour" and "flood planning area" has the same meaning as in the Considering flooding in land use planning guideline 2021.
- (c) Special flood considerations are outlined in the Considering flooding in land use planning guideline 2021 and an optional clause in the *Standard Instrument (Local Environmental Plans) Order 2006*.
- (d) Under the floodplain risk management process outlined in the NSW Government's Floodplain Development Manual 2005, councils may produce a flood study followed by a floodplain risk management study and floodplain risk management plan.

**Issued to commence 1 March 2022 (replaces previous Direction 4.3)**





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