RF2221

Overland Flow Study Report

For Proposed Additions and Alterations to Existing Dwelling

Development Site at:

7 Rounce Avenue, Forestville

Lot 11, DP 200198

15 February 2022

Prepared by:

ACCON ENGINEERS

PO Box 307

Minto, NSW 2566

Phone: +61 2 8712 1487

Email: info@acconengineers.com.au

REPORT DESCTRIPTION

Overland Flow Study Report for

Proposed Additions and Alterations to Existing Dwelling

at

7 Rounce Avenue, Forestville

Prepared for: Jary Hyvarinen

Prepared By:

Anil Shrestha

Operations Manager

Civil/Flood and Drainage Engineer, MIEAust, NER

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1. INTRODUCTION

1.1 Background

ACCON Engineers was commissioned by Jari Hyvarinen to carry out site specific overland flow study report for the proposed additions and alterations to existing dwelling at 7 Rounce Avenue, Forestville.

As advised by Northern Beaches Council, the proposed development site is likely to be affected by overland flooding during major storm events. This report has been prepared to accompany a development application for the proposed development in accordance with Australian Rainfall and Runoff, NSW Floodplain Development Manual 2005 and Northern Beaches Council flooding requirements. This report describes the existing characteristics of the area, proposed development and quantifies the impact of flooding due to the proposed development.

1.2 Objectives

The main objective of this study is to undertake overland flow study and flood impact assessment due to the proposed additions and alterations to existing dwelling at 7 Rounce Avenue, Forestville. The scope of this study includes:

- Establish hydraulic model to determine flood levels;
- Prepare flood extent maps at the development site and surrounding area for the 1% AEP storm event for the existing and developed condition;
- Prepare flood difference map due to the proposed development for the 1% AEP storm event;
- Estimate provisional hydraulic hazard category at the development site and
- Setting up finished floor level of the proposed development.

2. SITE DESCRIPTION

2.1 Land Details

The site is located at the northern side of Rounce Avenue. The land is identified as 7 Rounce Avenue (Lot 11, DP 200198). A locality plan of the site is shown in Figure 2.1.

Figure 2.1 Location of site (Source: Sixmap)

2.2 Topography

The site is currently developed with single storey residential dwelling and detached garage. Based on topography of the locality, the overland flow path runs through the development site and is likely to be affected by overland flooding in the major storm events. The detail survey plan of the site is provided in Figure 2.2 and Appendix A.

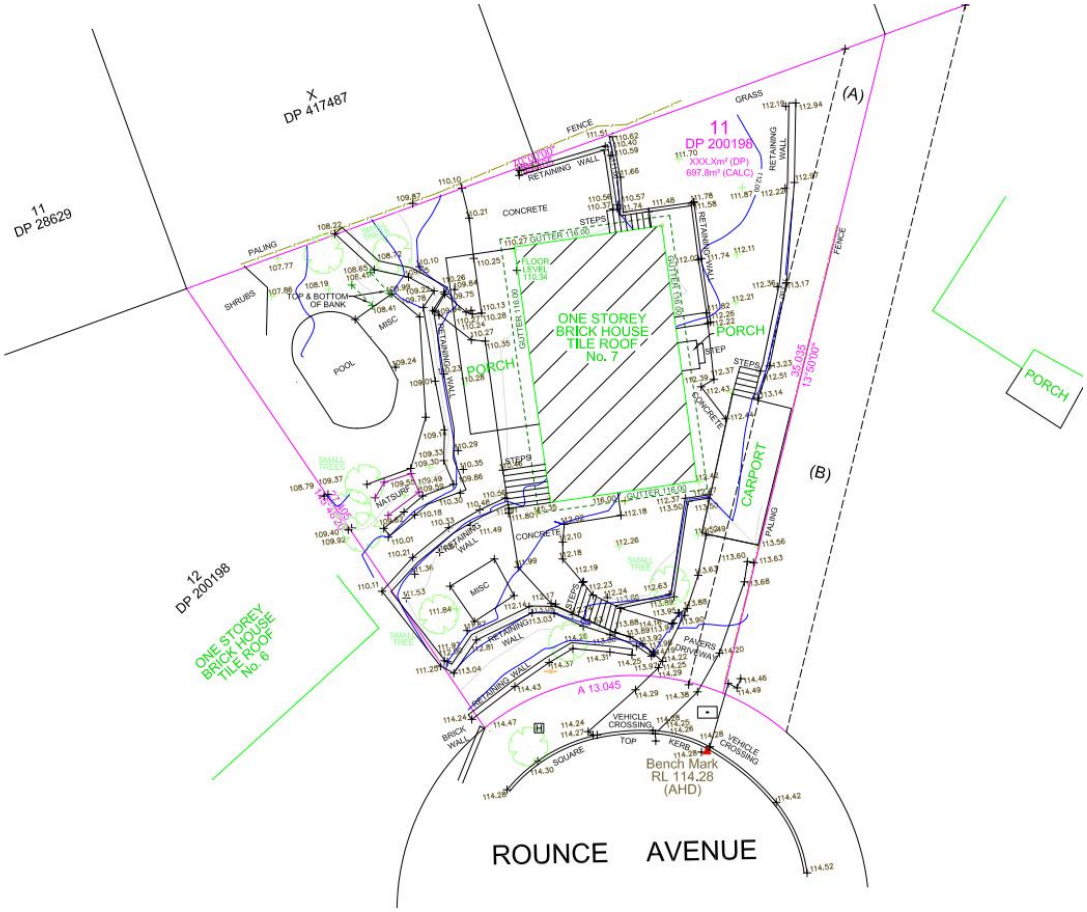


Figure 2.2 General topography of the development site

3. PROPOSED DEVELOPMENT

The proposed development involves additions and alterations to existing dwelling at 7 Rounce Avenue, Forestville. The site plan of the proposed development is shown in Figure 3.1. The detail site plan of the development site is provided in Appendix B.

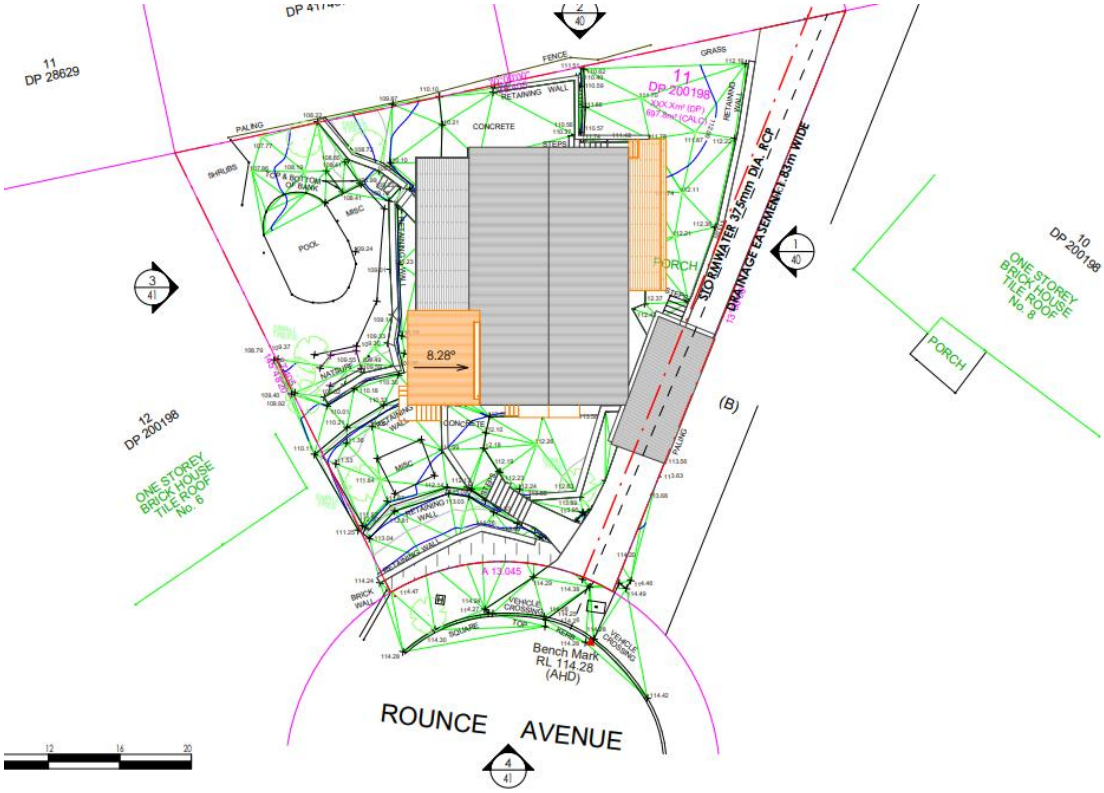


Figure 3.1 Site Plan of Proposed Development

4. HYDROLOGIC ANALYSIS

4.1 Intensity Frequency Duration (IFD) Design Rainfall Depth

Intensity duration frequency design rainfall depth (IFD) of Forestville, NSW obtained from Bureau of Meteorology has been used to determine design precipitation of the study area. Table 4.1 presents IFD of Forestville.

Table 4. 1: IFD Design Rainfall Depth

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	2.41	2.71	3.66	4.30	4.94	5.78	6.43
2 min	4.02	4.49	5.99	7.01	8.01	9.40	10.5
3 min	5.57	6.23	8.32	9.75	11.2	13.1	14.6
4 min	6.97	7.81	10.5	12.3	14.1	16.5	18.4
5 min	8.23	9.24	12.4	14.6	16.7	19.6	21.8
10 min	13.0	14.6	19.8	23.3	26.7	31.3	34.8
15 min	16.2	18.3	24.7	29.1	33.4	39.1	43.4
20 min	18.6	21.0	28.4	33.4	38.4	44.9	49.9
25 min	20.6	23.2	31.3	36.8	42.3	49.5	55.0
30 min	22.2	25.0	33.7	39.6	45.5	53.3	59.2
45 min	26.0	29.1	39.2	46.1	52.9	62.0	69.1
1 hour	28.8	32.3	43.4	51.0	58.5	68.7	76.7
1.5 hour	33.2	37.2	49.8	58.6	67.3	79.3	88.7
2 hour	36.7	41.1	55.0	64.8	74.6	88.0	98.6
3 hour	42.5	47.5	63.7	75.2	86.8	103	116
4.5 hour	49.6	55.4	74.5	88.2	102	122	137
6 hour	55.5	62.1	83.8	99.5	116	138	156
9 hour	65.5	73.5	99.9	119	139	167	188
12 hour	73.9	83.0	114	136	159	191	216
18 hour	87.6	98.8	136	164	193	232	263
24 hour	98.6	112	155	187	220	265	300
30 hour	108	122	170	206	243	292	331
36 hour	115	131	184	222	262	315	357
48 hour	128	146	205	248	292	351	397
72 hour	145	166	234	282	332	397	447
96 hour	157	179	252	303	355	423	474
120 hour	165	188	264	316	369	437	489
144 hour	171	195	272	325	377	445	496
168 hour	175	200	277	330	382	449	498

4.2 Rainfall Pattern

The ARR2019 method is used for the determination of flow hydrographs of the catchment contributing flows at the overland flow paths at 7 Rounce Avenue, Forestville. Rainfall pattern file at Forestville is downloaded from Australian Rainfall and Runoff data hub.

4.3 Catchment Area and Rainfall Depth

Based on the topography of the development site at 7 Rounce Hill, Forestville and surrounding area, the site is likely to be affected by overland flooding. To assess the impact of overland flooding, 2D hydraulic modelling is undertaken for this study. The possible maximum catchment area contributing overland flow at the proposed development site and surrounding area has been estimated from the topographic map of the development site and surrounding area prepared from the DEM obtained from Geoscience Australia. It is estimated that the catchment area contributing flow to the development site and surrounding area is approximately 1.66 Ha. The catchment of overland flow path running through the development site is shown in Figure 4.1.

The time of concentration has been estimated using the equation:

$$Tc = 0.76A^{0.38}$$

Where Tc = Time of concentration in hours

A = Area of catchment in km^2

The time of concentration of the catchment has been estimated to be approximately 10 minutes.

The flow hydrograph from the catchment has been derived using DRAINS-ILSAX model. An impervious area of 75% has been used in the model. Figure 4.2 presents median flow hydrograph generated from DRAINS model.

Figure 4. 1 Catchment Area of the Overland Flow Path at Development Site

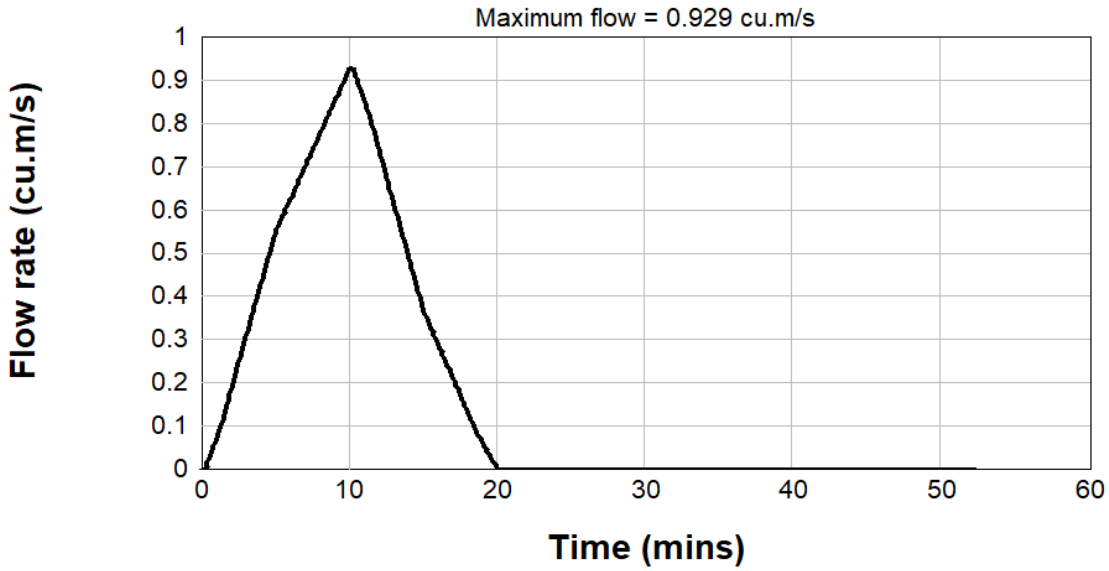


Figure 4. 2 Median Flow Hydrograph of Catchment of Overland Flow Path

5. HYDRAULIC MODELLING SETUP

5.1 Introduction

TUFLOW software was used to develop 2D hydraulic model of the overland flow path at 7 Rounce Avenue, Forestville. TUFLOW is a suite of advanced numerical engines and supporting tools for simulating free-surface water flow for urban waterways, rivers, floodplains, estuaries and coastlines. The TUFLOW engines are technically superior and are industry leaders in solving all the necessary physical processes using 1D, 2D and 3D solutions.

5.2 Model Set-up

One metre Digital Elevation Model (DEM) in Esri ASCII Grid obtained from Australian Government Geoscience Australia has been used to build terrain model of the study area. The terrain model developed from the ASCII Grid file at development location is checked with surveyed spot levels within the development site and found reasonably consistent with a discrepancies of up to ± 50 mm. Thus, the DEM obtained from Geoscience Australia have been used for this study. The terrain model of the modelled area is presented in Figure 5.1.

The possible maximum flood affected area at the vicinity of the development site is modelled in 2D-TUFLOW hydraulic software. The grid size of 0.5 m has been used in the model to accurately assess the extent of flooding, flood behaviour at the development site and surrounding area and impact of flooding to adjoining properties. The estimated flow hydrograph of the overland flow path at the 7 Rounce Avenue, Forestville derived from DRAINS model has been assigned at the overland flow path at approximately 80 m east of the development site near Loxton Place as inflow QT boundary. The downstream boundary of the modelled area is assigned at the overland flow path at approximately 95 m west of the development site near Wakey Place as HQ boundary. Schematic of model layout is presented is Figure 5.2. The footprints of the existing dwellings at the vicinity of the development site have been raised in DEM. The

footprint of the proposed dwelling has been raised in the developed condition DEM to reflect the proposed development.

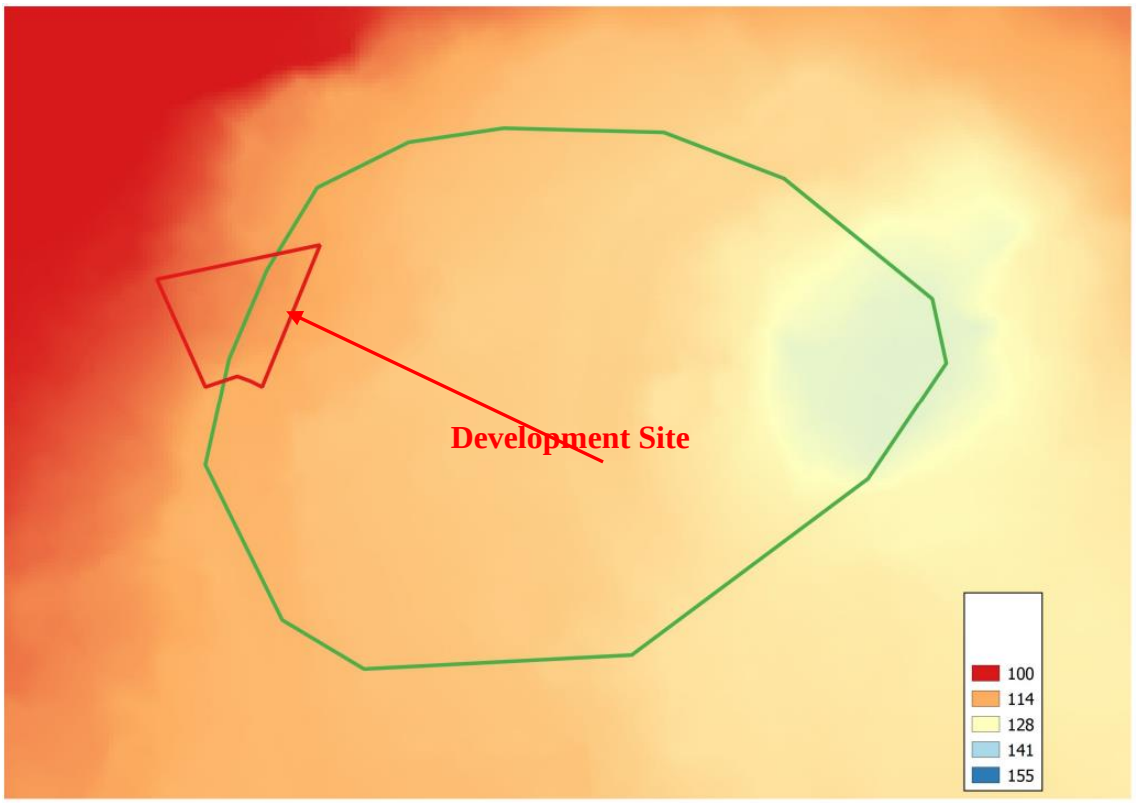


Figure 5. 1 Terrain model of study area

Figure 5. 2 Schematic of Model Layout

5.3 Model Results

The developed TUFLOW model was used to determine the flood level and extent at the vicinity of the proposed development site at 7 Rounce Avenue, Forestville.

5.3.1 Existing Condition

Appendix C presents 1% AEP flood extent with flood level, flood depth and velocity depth product (v*d) maps for the existing condition. Based on modelling result, the subject property is affected by overland flood. The 1% AEP flood level at the site ranges between RL 114.4 m AHD to RL 105.4 m AHD. The flood depth along the overland flow path is up to 500 mm in very negligible area. The flood depth near the

proposed development area is up to 290 mm. The velocity depth product maps indicates that the velocity depth product along the overland flow path is up to 0.69 m^2/s in very negligible area. The velocity depth product maps indicates that the velocity depth product near the development area is up to 0.22 m^2/s.

5.3.2 Developed Condition

The 1% AEP flood extent with flood level, flood depth and velocity depth product maps for the developed condition are presented in Appendix D. Based on modelling result, the proposed development is affected by overland flood. The flood extent and depth maps are consistent with existing condition. The velocity depth product maps indicates that the velocity depth product along the overland flow path is up to 0.67 m^2/s. The velocity depth product maps indicates that the velocity depth product near the development area is up to 0.22 m^2/s.

Appendix E presents flood level difference map for the 1% AEP storm events. This map indicates localised change in flood level by up to 220 mm adjacent to the proposed deck at the eastern side and no change in flood level elsewhere in the adjoining neighbouring properties. This increase in flood level is in very negligible area. The most of the area inside the property has negligible flood level change. The hydraulic modelling results for the existing and developed condition proved that the proposed development has negligible impact to the development site and no impact to the surrounding area. The proposed development will not have any adverse impact of flooding to adjoining properties.

5.4 Provisional Flood Hazard Category

Hazard classification plays an important role in informing floodplain risk management in an area. Previously, hazard classifications were binary – either Low or High Hazard as described in the Floodplain Development Manual (2005), Figure 5.3. However, in recent years there have been a number of developments in the classification of hazard. Managing the floodplain: a guide to best practice in flood risk management in Australia (Figure 5.4 – Smith et al 2014) provides revised hazard classifications which add clarity

to the hazard categories and what they mean in practice. The classification is divided into 6 categories, listed in Table 5.1, which indicate the restrictions on people, building and vehicles.

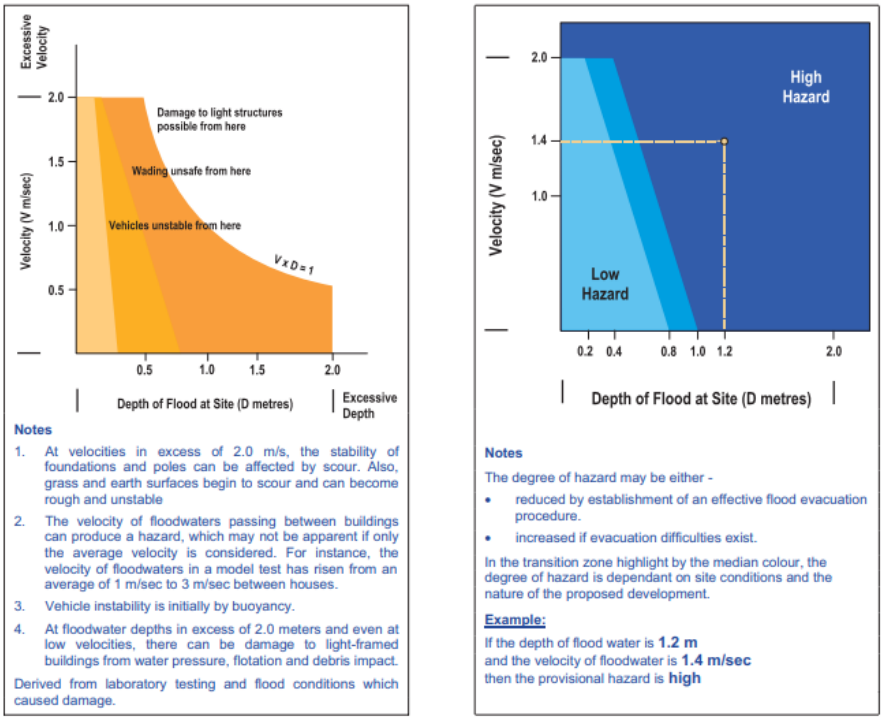


Figure 5. 3 Provisional Flood Hazard Category (Floodplain Development Manual 2005)

Table 5. 1: Hazard Categories

Category	Constraint to people/vehicles	Building Constraints
H1	Generally safe	*No constraints*
H2	Unsafe for small vehicles	*No constraints*
H3	Unsafe for all vehicles, children and the elderly	*No constraints*
H4	Unsafe for all people and all vehicles	*No constraints*
H5	Unsafe for all people and all vehicles	Buildings require special engineering design and construction
H6	Unsafe for people and vehicles	All building types considered vulnerable to failure

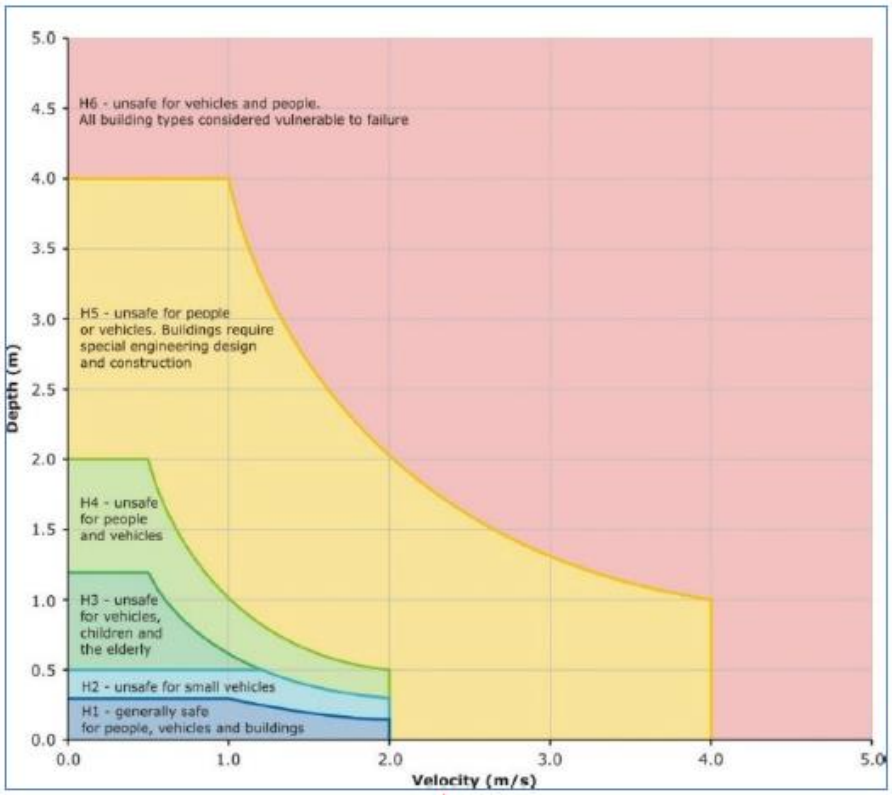


Figure 5. 4 Flood Hazard Classification (Smith et al 2014)

Based on modelling result the maximum flood depth at the overland flow path within the development site is 0.5 m and the maximum velocity at the location of maximum flood depth is 1.57 m/s. Based on these values, Figure 5.4 indicates that the flood hazard category at the development site is LOW to TRANSITION (Dependent on-site condition). Similarly Figure 5.5 indicates that the flood hazard classification ranges between is H1 - generally safe for people, vehicle and buildings to H3 – Unsafe for vehicle and the elderly at small area of the site. Most of the area inside the property lies in H1.

6. SITE FLOOD EMERGENCY RESPONSE PLAN

As 7 Rounce Avenue, Forestville is likely to be affected by local overland flooding in the 1% AEP and large storm event, the occupant of the premises should be aware of Site Flood Emergency Response Plan. The following table provides an outline of the site emergency response plan for the dwelling at 7 Rounce Avenue, Forestville, NSW.

Table 6. 1: Site Emergency Response Plan

Be Aware	• Add mobile phone number to the SES contact list for the issue of SMS alerts for severe weather warnings. • During prolonged or intense rainfall in Sydney region, 7 Rounce Avenue, Forestville is prone to local overland flooding. • You should maintain an Emergency Kit containing battery powered radio, spare batteries, torch, first aid kit and emergency contact details for use in the event of a flood.

Prior to an Imminent Flood	• When heavy storms or significant rainfall are forecast:
	  ○ Keep an eye on Bureau of Meteorology flood warnings for this area.
	  ○ Turn your radio to the local ABC station for emergency broadcasts.
	• Relocate motor vehicles to a higher area with substantially less risk of flooding.
	• If directed to evacuate, follow SES evacuation and move to the higher flood free area.
	• Locate emergency kit and have it ready.

During Flood	• The existing habitable floor level might be below the 1% AEP flood level. In the event that emergency authorities such as SES issue an evacuation order, evacuation from the site should be done towards flood free area as directed by emergency authorities during major flood events. The evacuation should be done once the evacuation order is issued from emergency authorities before major flood events. • Relocate valuables at ground floor level to as high as possible. • If need to leave the premises do so early in the flood event, before the flood depth reaches to 0.2 m at the surrounding streets. • Never drive, ride or walk through floodwater. • For emergency help in floods and storms call SES on 132 500. • Keep listening to emergency radio broadcasts. • Follow advice of emergency services.

After a Flood	• Never drive, ride or walk through floodwater.
	• Wait for flood water to reduce before leaving building.
	• Keep listening to emergency radio broadcasts.
	• Follow advice of emergency services
	• After floodwater have receded:
	  ○ Take photographs of flood marks and damaged areas, and prepare insurance claim for damaged areas (subject to insurance terms)
	  ○ Arrange for utilities to be inspected and repaired by qualified trades people.
	  ○ Arrange for cleaning and repair of flood affected areas.
	• Restock and replace your emergency kit.

7. DEVELOPMENT CONTROL

As the subject site and proposed development area of 7 Rounce Avenue, Forestville is affected by local overland flooding at 1% AEP flood event, flood related development controls apply for this development.

7.1 Floor Level

The proposed bedroom and ensuite at first floor level is proposed at 112.67 m which is 670 mm higher than 1% AEP flood level at that location.

7.2 Building Components and Materials

All structures of proposed bed room and ensuite should have flood compatible building components below proposed habitable floor level. All structural components below habitable floor level should be constructed with flood compatible materials. All electrical equipment and wiring should be situated above the proposed habitable floor level. The proposed deck at the eastern side should be built with flood compatible building materials.

7.3 Structural Soundness

Engineers report required certifying that the structure can withstand the forces of floodwater debris and buoyancy up to and including proposed habitable floor level.

7.4 Flood Affection

Based on modelling results, the site is partially affected by overland flooding with LOW to TRANSITION flood hazard category with a flood risk category of H1 - generally safe for people, vehicle and buildings to H3 – Unsafe for vehicle and the elderly at small area of the site. Most of the area inside the property lies in H1.

The hydraulic modelling results for the existing and developed condition proved that the proposed development has negligible impact to the development site and no impact to

the surrounding area. The proposed development will not have any adverse impact of flooding to adjoining properties.

7.5 Car Parking and Driveway Access

No car park and driveway are proposed in this application.

7.6 Evacuation

The existing habitable floor level might be below the 1% AEP flood level. In the event that emergency authorities such as SES issue an evacuation order, evacuation from the site should be done towards flood free area as directed by emergency authorities during major flood events. The evacuation should be done once the evacuation order is issued from emergency authorities before major flood events.

7.7 Fence

Any new fencing within the 1% AEP flood extent of the development site is to be of permeable (open) type to allow free flow of floodwaters and not to cause damage to surrounding land in the event of a flood. Fence materials below 1% AEP flood level should be constructed with flood compatible materials.

8. CONCLUSIONS & RECOMMENDATIONS

This study considered the impacts of flooding due to the proposed additions and alterations to existing dwelling at 7 Rounce Avenue, Forestville.

Two dimensional TUFLOW model has been developed to assess the impact of flooding at the development site and surrounding area due to the proposed development. One metre Digital Elevation Model in Esri ASCII Grid obtained from Australian Government Geoscience Australia has been used in the model. The terrain model developed from the ASCII Grid file at the development location is checked with surveyed spot levels within the development site and found reasonably consistent.

Based on existing modelling result, the subject property is affected by overland flood. The 1% AEP flood level at the site ranges between RL 114.4 m AHD to RL 105.4 m AHD. The flood depth along the overland flow path is up to 500 mm in very negligible area. The flood depth near the proposed development area is up to 290 mm in very negligible area. The velocity depth product maps indicates that the velocity depth product along the overland flow path is up to 0.69 m^2/s. The velocity depth product maps indicates that the velocity depth product near the development area is up to 0.22 m^2/s.

Modelling results for the developed condition indicate that the flood extent and depth are consistent with the existing condition with some localised change in flood level by up to 220 mm adjacent to the proposed deck at the eastern side and no change in flood level elsewhere in the adjoining neighbouring properties. This increase in flood level is in very negligible area. The most of the area inside the property has negligible flood level change. The hydraulic modelling results for the existing and developed condition proved that the proposed development has negligible impact to the development site and no impact to the surrounding area. The proposed development will not have any adverse impact of flooding to adjoining properties. The velocity depth product maps indicates that the velocity depth product along the overland flow path is up to 0.67 m^2/s. The

velocity depth product maps indicates that the velocity depth product near the development area is up to 0.22 m^2/s.

The proposed bedroom and ensuite at first floor level is proposed at 112.67 m which is 670 mm higher than 1% AEP flood level at that location.

All structures of proposed bed room and ensuite should have flood compatible building components below proposed habitable floor level. All structural components below habitable floor level should be constructed with flood compatible materials. All electrical equipment and wiring should be situated above the proposed habitable floor level. The proposed deck at the eastern side should be built with flood compatible building materials.

Engineers report required certifying that the structure can withstand the forces of floodwater debris and buoyancy up to and including proposed habitable floor level.

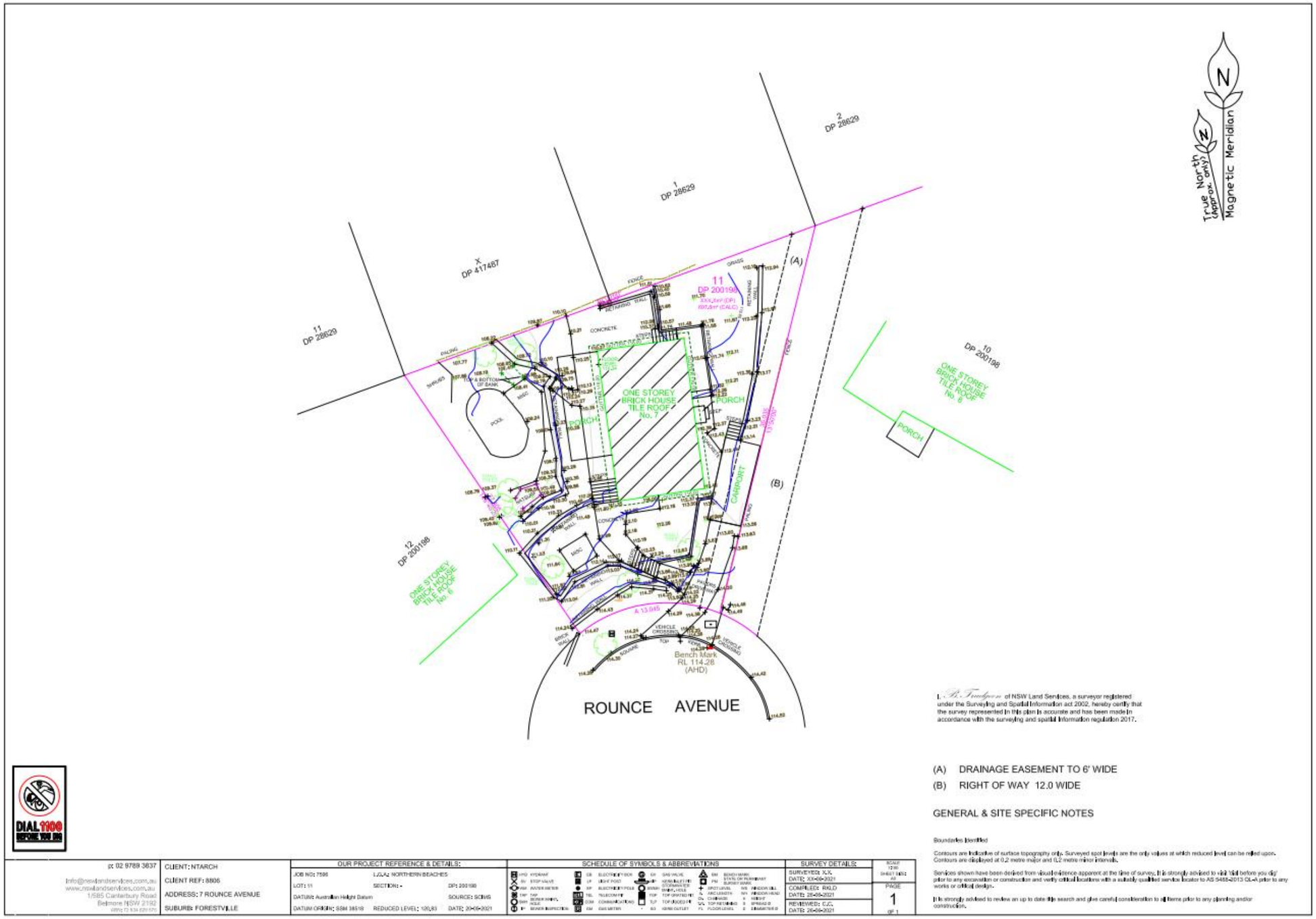
Based on modelling results, the site is affected by overland flooding with LOW to TRANSITION flood hazard category with a flood risk category of H1 - generally safe for people, vehicle and buildings to H3 – Unsafe for vehicle and the elderly at small area of the site. Most of the area inside the property lies in H1.

It is also recommended that any new fencing within the 1% AEP flood extent of the development site is to be of permeable (open) type to allow free flow of floodwaters and not to cause damage to surrounding land in the event of a flood. Fence materials below 1% AEP flood level should be constructed with flood compatible materials.

The existing habitable floor level might be below the 1% AEP flood level. In the event that emergency authorities such as SES issue an evacuation order, evacuation from the site should be done towards flood free area as directed by emergency authorities during major flood events. The evacuation should be done once the evacuation order is issued from emergency authorities before major flood events.

Any new fencing within the 1% AEP flood extent of the development site is to be of permeable (open) type to allow free flow of floodwaters and not to cause damage to surrounding land in the event of a flood. Fence materials below 1% AEP flood level should be constructed with flood compatible materials.

APPENDIX A – SURVEY PLAN OF PROPOSED DEVELOPMENT SITE



APPENDIX B – ARCHITECTURAL PLAN OF PROPOSED DEVELOPMENT

LEGEND	
COLOUR LEGEND	
EXISTING	
DEMOLITION	
NEW	
SYMBOLS	
RL (REDUCED LEVEL TO AHD)	
REVISION TAG NUMBER	
SMOKE ALARM	

GENERAL / SMOKE ALARM NOTE

-HARD WIRED PHOTO-ELECTRIC SMOKE ALARMS TO BE INSTALLED IN ACCORDANCE WITH NCC PART 3.7.2 & AS 3786.
- INTERNAL WALLS TO BE FINISHED WITH AS SELECTED BY CLIENT
- EXTERNAL WALLS TO BE FINISHED AS PER ELEVATIONS AND FINISHES SCHEDULE
- CONTRACTOR TO ENSURE WALLS ARE SET BACK FOR PROVISION OF CLADDING THICKNESS. ALL MEASUREMENTS OF CLADDING THICKNESS TO BE CONFIRMED PRIOR TO SET OUT OF WALLS
- CLADDING THICKNESS HAS NOT BEEN SHOWN ON THIS DRAWING FOR THE PURPOSES OF CLARITY. ALL EXTERIOR WALLS TO BE SET BACK AS PER THESE PLANS. ANY CLADDING TO BE IN LINE WITH SETBACK SHOWN IN DRAWINGS AND TO BE PROVISIONED DURING WALL SET OUT.

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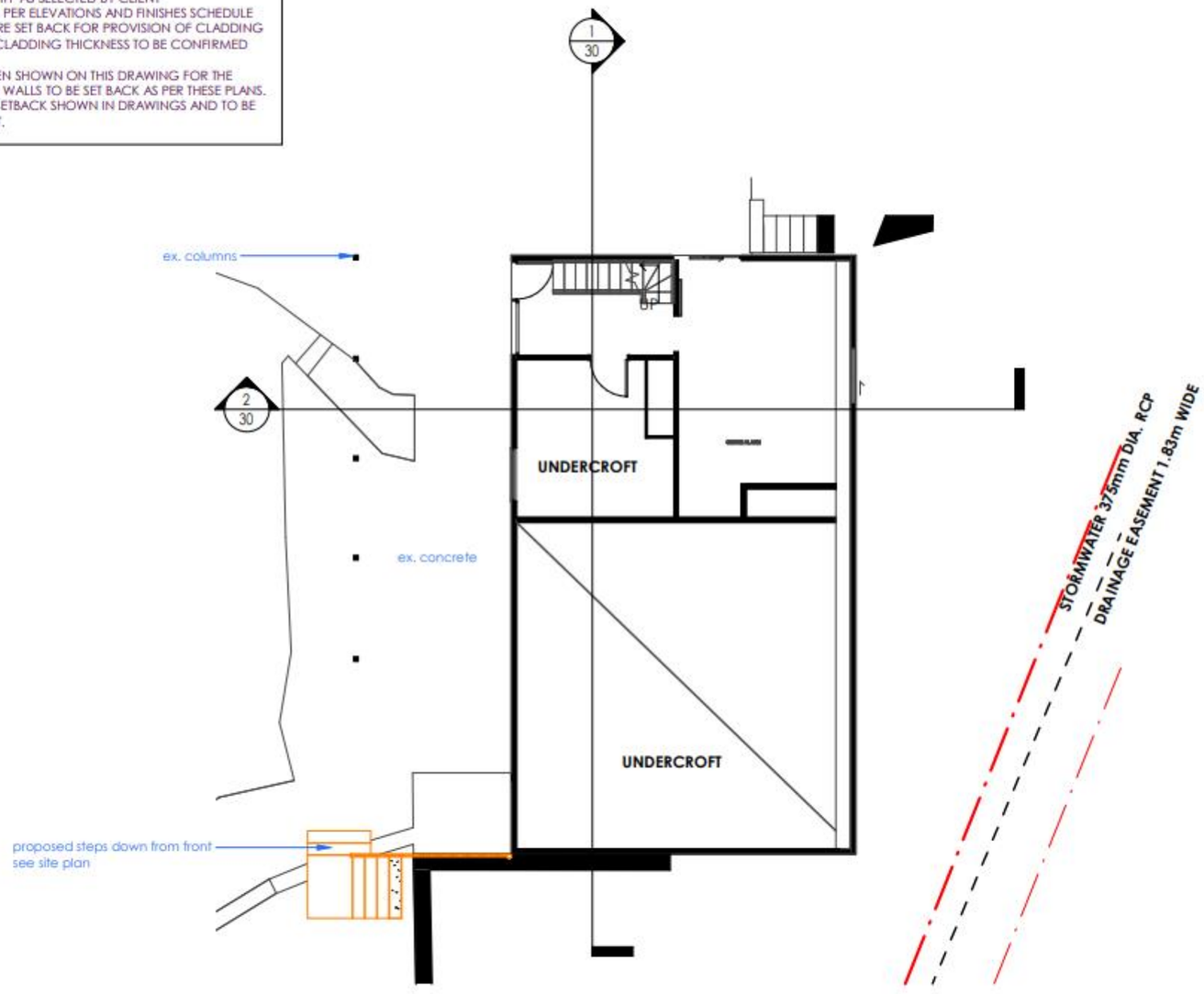


0 1 2 3 4 5 10

GRAPHIC SCALE: 1:100

renovate plans BUILDING DESIGNERS
(02) 8719 0569
PO BOX 107, BELMORE NSW 2192
WWW.RENOVATEPLANS.COM.AU

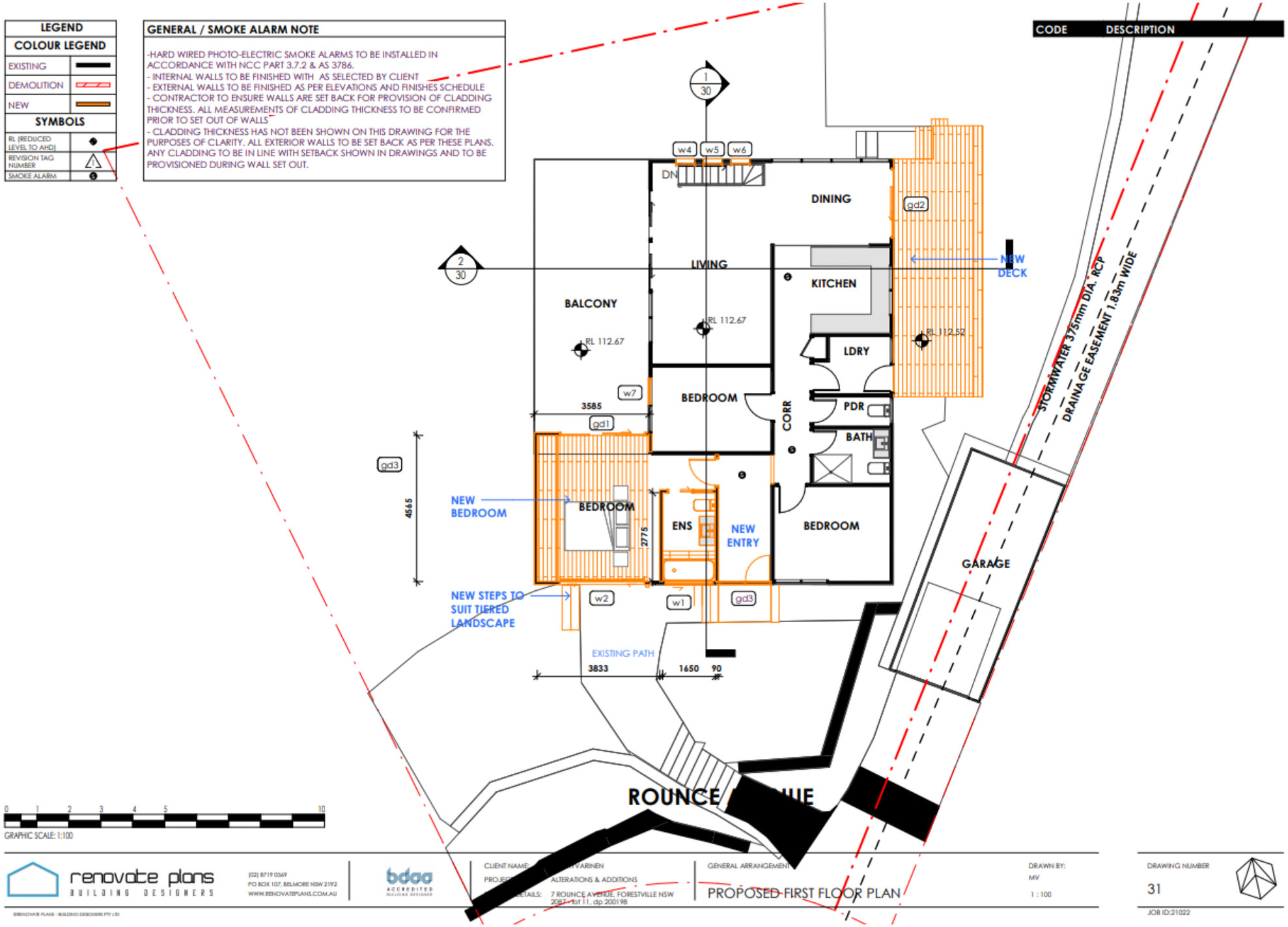
bdaa ACCREDITED BUILDING DESIGNER

CLIENT NAME: JARI HYVARINEN
PROJECT TYPE: ALTERATIONS & ADDITIONS
PROJECT DETAILS: 7 ROUNCE AVENUE, FORESTVILLE NSW 2087 - lot 11, dp 200198

GENERAL ARRANGEMENT
PROPOSED GROUND FLOOR PLAN

DRAWN BY: MV
1 : 100

DRAWING NUMBER 30
JOB ID:21022


LEGEND
COLOUR LEGEND
EXISTING
DEMOLITION
NEW
SYMBOLS
RL (REDUCED LEVEL TO AHD)
REVISION TAG NUMBER
SMOKE ALARM
GENERAL / SMOKE ALARM NOTE
-HARD WIRED PHOTO-ELECTRIC SMOKE ALARMS TO BE INSTALLED IN ACCORDANCE WITH NCC PART 3.7.2 & AS 3786.
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CODE
DESCRIPTION
1
30
2
30
w4
w5
w6
DN
DINING
gd2
LIVING
NEW DECK
KITCHEN
BALCONY
RL 112.67
RL 112.67
RL 112.52
LDRY
w7
3585
gd1
BEDROOM
CORR
PDR
BATH
gd3
4565
NEW BEDROOM
BEDROOM
ENS
NEW ENTRY
BEDROOM
2775
GARAGE
STORMWATER 375mm DIA. RCP
DRAINAGE EASEMENT 1.83m WIDE
NEW STEPS TO SUIT TIERED LANDSCAPE
w2
w1
gd3
EXISTING PATH
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1650
90
ROUNCE AVENUE
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GRAPHIC SCALE: 1:100
renovate plans
BUILDING DESIGNERS
(02) 8719 0569
PO BOX 107, BELMORE NSW 2192
WWW.RENOVATEPLANS.COM.AU
bdaa
ACCREDITED BUILDING DESIGNER
CLIENT NAME:
ALTERATIONS & ADDITIONS
DETAILS: 7 ROUNCE AVENUE, FORESTVILLE NSW 2087 - lot 11, dp 200198
GENERAL ARRANGEMENT
PROPOSED FIRST FLOOR PLAN
DRAWN BY:
MV
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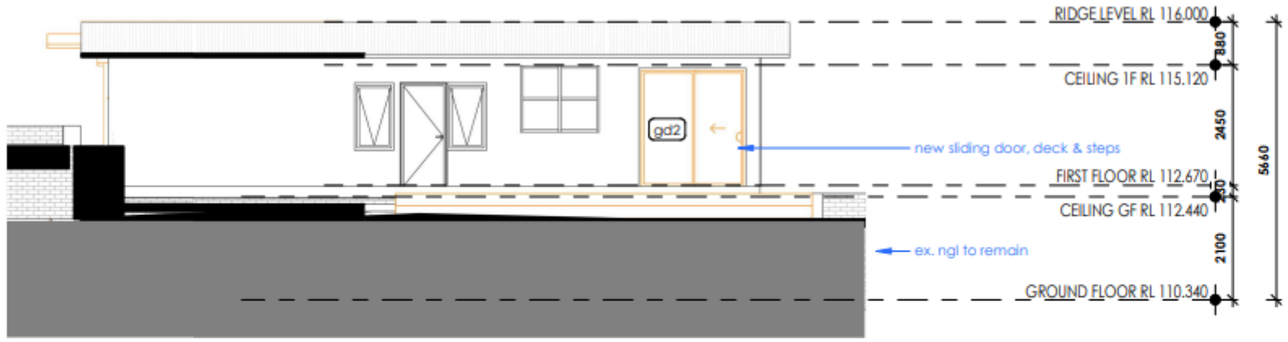

1 | ELEVATION 1

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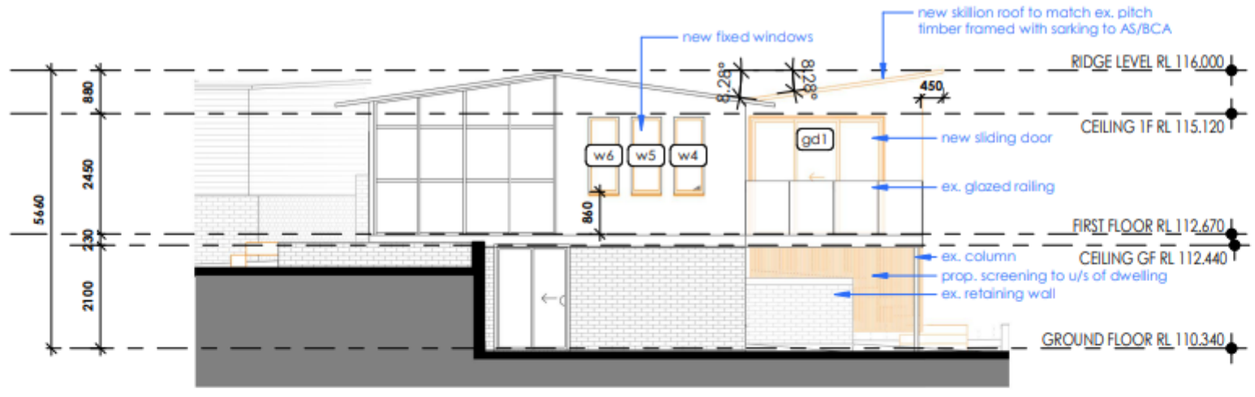

2 | ELEVATION 2

SCALE: 1 : 100

0 1 2 3 4 5 10

GRAPHIC SCALE: 1:100

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(02) 8719 0569
PO BOX 107, BELMORE NSW 2192
WWW.RENOVATEPLANS.COM.AU

bdaa ACCREDITED BUILDING DESIGNER

CLIENT NAME: JARI HYVARINEN
PROJECT TYPE: ALTERATIONS & ADDITIONS
PROJECT DETAILS: 7 ROUNCE AVENUE, FORESTVILLE NSW 2087 - lot 11, dp 200198

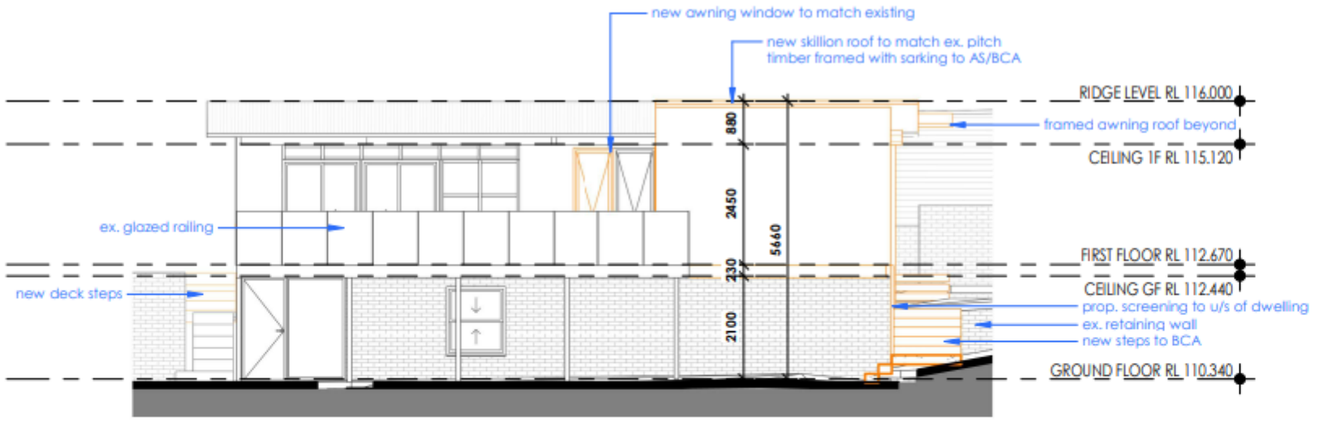
GENERAL ARRANGEMENT

ELEVATIONS

DRAWN BY: MV
1 : 100

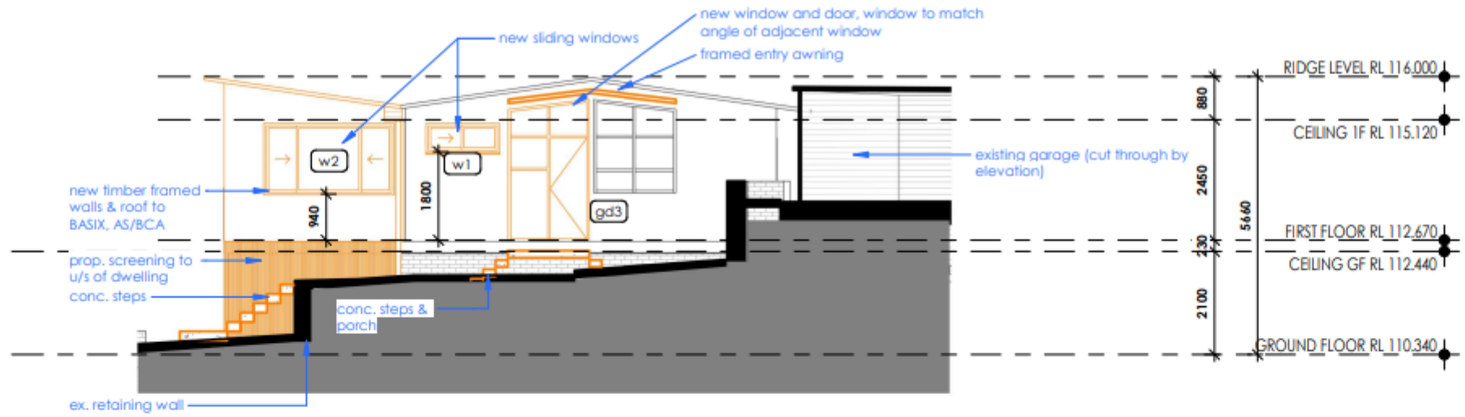
DRAWING NUMBER
40
JOB ID:21022

CODE	DESCRIPTION



3 | ELEVATION 3

SCALE: 1 : 100



4 | ELEVATION 4

SCALE: 1 : 100

0 1 2 3 4 5 10

GRAPHIC SCALE: 1:100

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GENERAL ARRANGEMENT
ELEVATIONS

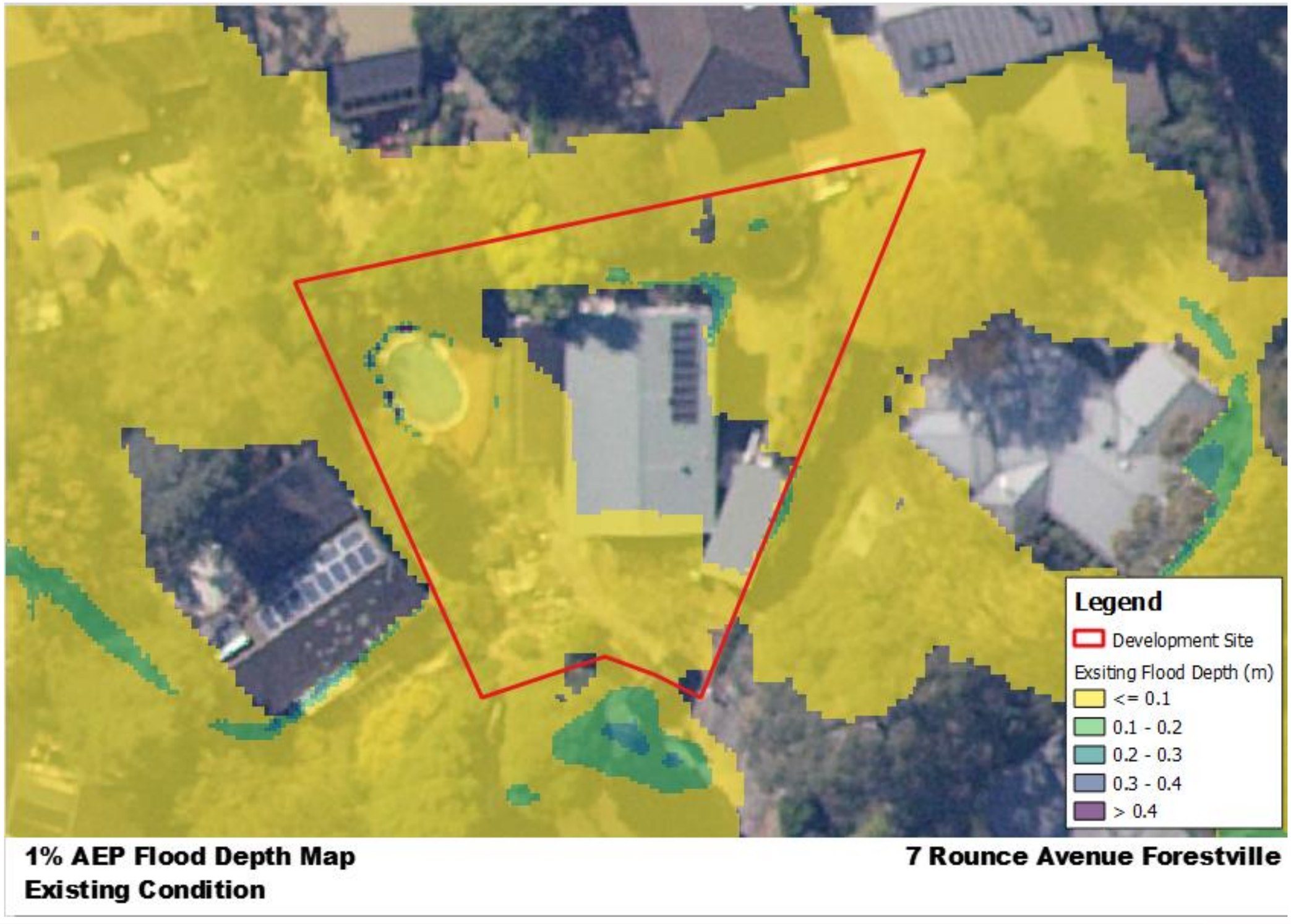
DRAWN BY: MV
1 : 100

DRAWING NUMBER 41
JOB ID:21022

APPENDIX C – EXISTING CONDITION FLOOD MAPS

1% AEP Flood Exten with Flood Level Contour
Existing Condition

7 Rounce Avenue Forestville



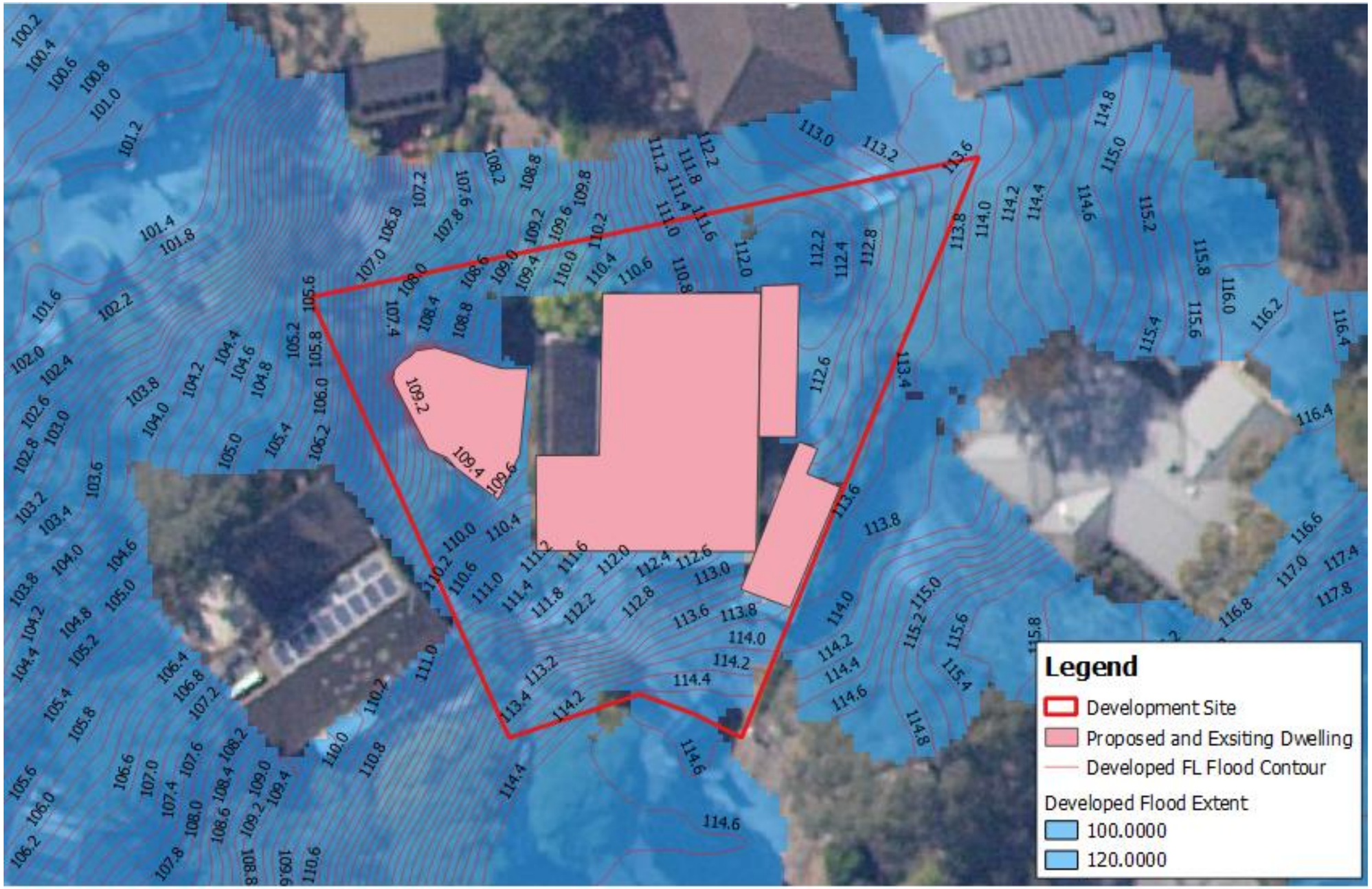
1% AEP Flood Depth Map
Existing Condition

7 Rounce Avenue Forestville

1% AEP Flood Hazard (Velocity Depth Product) Map
Existing Condition

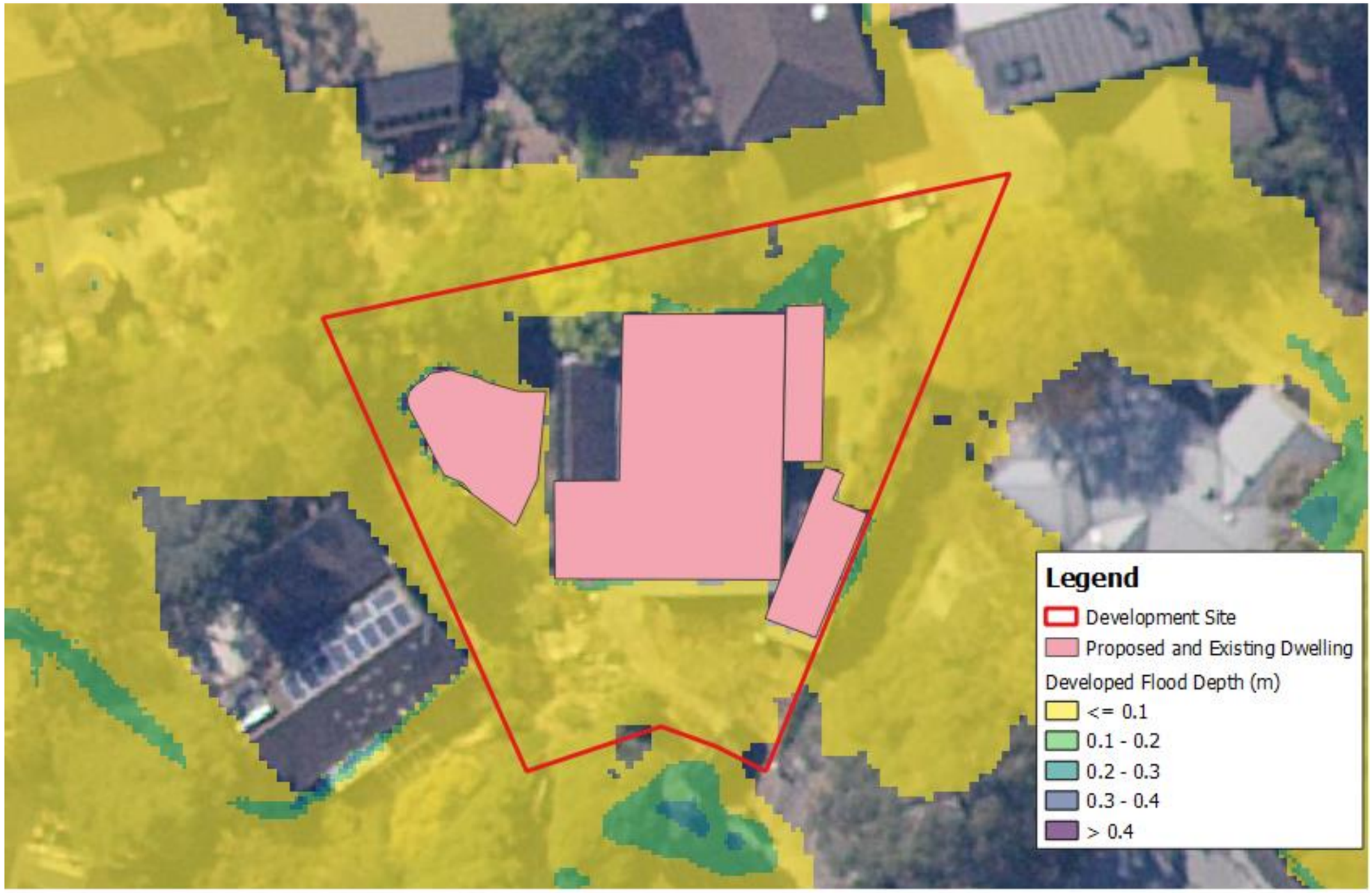
7 Rounce Avenue Forestville

APPENDIX D – DEVELOPED CONDITION FLOOD MAPS



1% AEP Flood Extent with Flood Level Contour
Developed Condition

7 Rounce Avenue Forestville



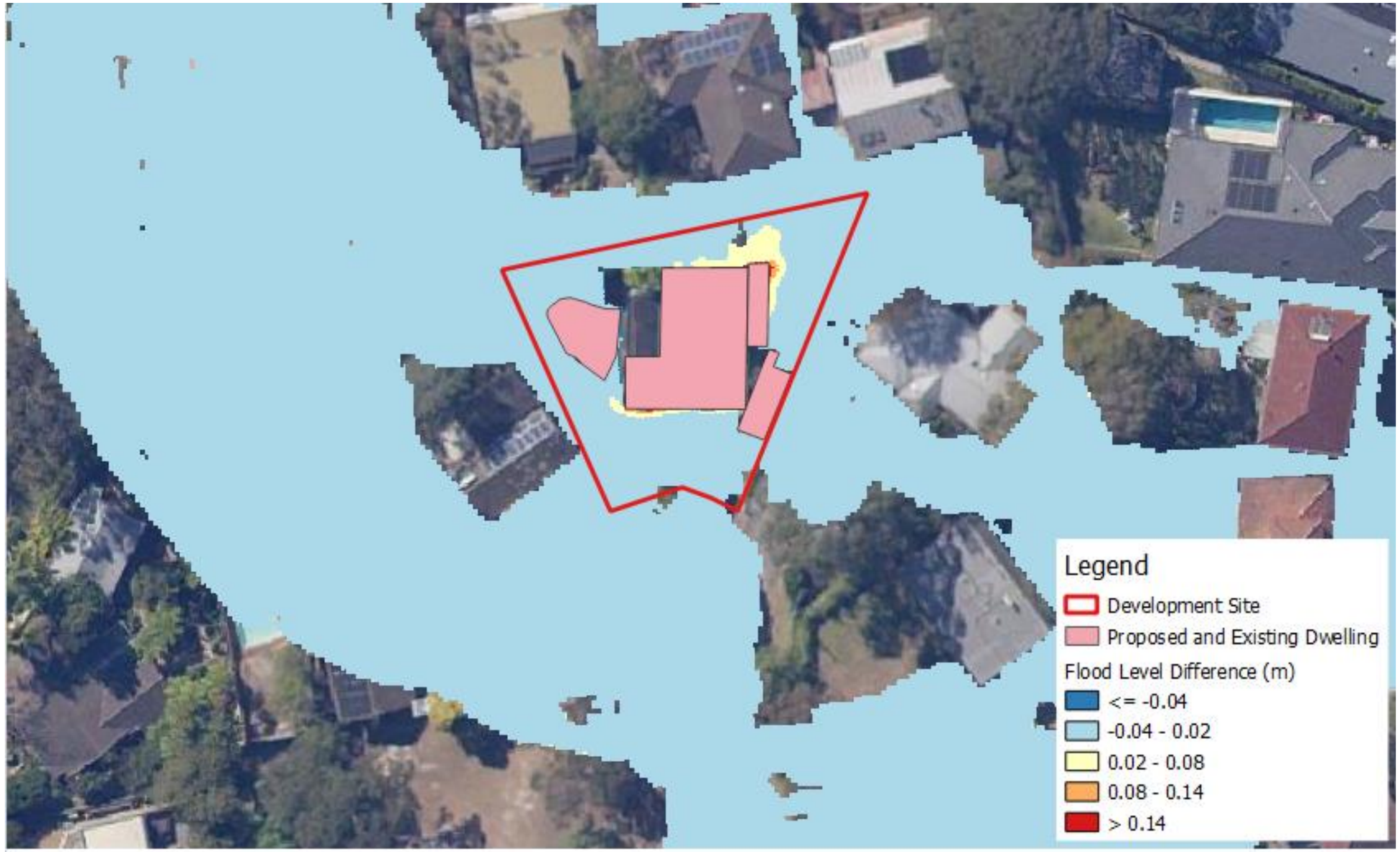
1% AEP Flood Depth Map
Developed Condition

7 Rounce Avenue Forestville

1% AEP Flood Hazard (Velocity Depth Product) Map
Developed Condition

7 Rounce Avenue Forestville

APPENDIX E – FLOOD LEVEL DIFFERENCE MAP



1% AEP Flood Level Difference Map **7 Rounce Avenue Forestville**