Flood Planning Assessment

10 and 12 Boondah Rd, 6 Jacksons Rd and Reserve Field 2, 3, 4, 6 and 7, Warriewood

PREPARED FOR HENROTH GROUP

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1 Introduction

This Preliminary Flood Assessment has been prepared to support the planning proposal for a proposed multi-building residential development at 10 and 12 Boondah Road. This also include playing field development at 6 Jacksons Road, Warriewood and the adjoining council playing fields (Boondah Reserve Field No. 2, 3, 4, 6, and 7). This report has been prepared for Daniel Maurici on behalf of Henroth Group.

This report outlines:

- The proposed development.
- Existing 100yr and PMF flooding based on council's maps.
- The analysis undertaken in 12D to determine the earthworks required to ensure the proposed development does not deprive the flood storage in the 100yr event.
- Flooding planning on the proposed development.

2 Description of Proposed Development

The site is bounded by Boondah Road to the east and the Warriewood Wetlands to the west as shown in Figure 2-1. The current site includes isolated residential buildings and agricultural plantations.

Figure 2-1 Site Locality

The proposed site includes a development of residential flat buildings, 4 stories high with basement car parking. These are located at 10 and 12 Boondah Road. The new playing fields are located on the Boondah field reserve and on 6 Jacksons Road. A draft plan of the development is shown in Figure 2-2 and Figure 2-3.

Figure 2-2 Proposed Site (Henroth Group)

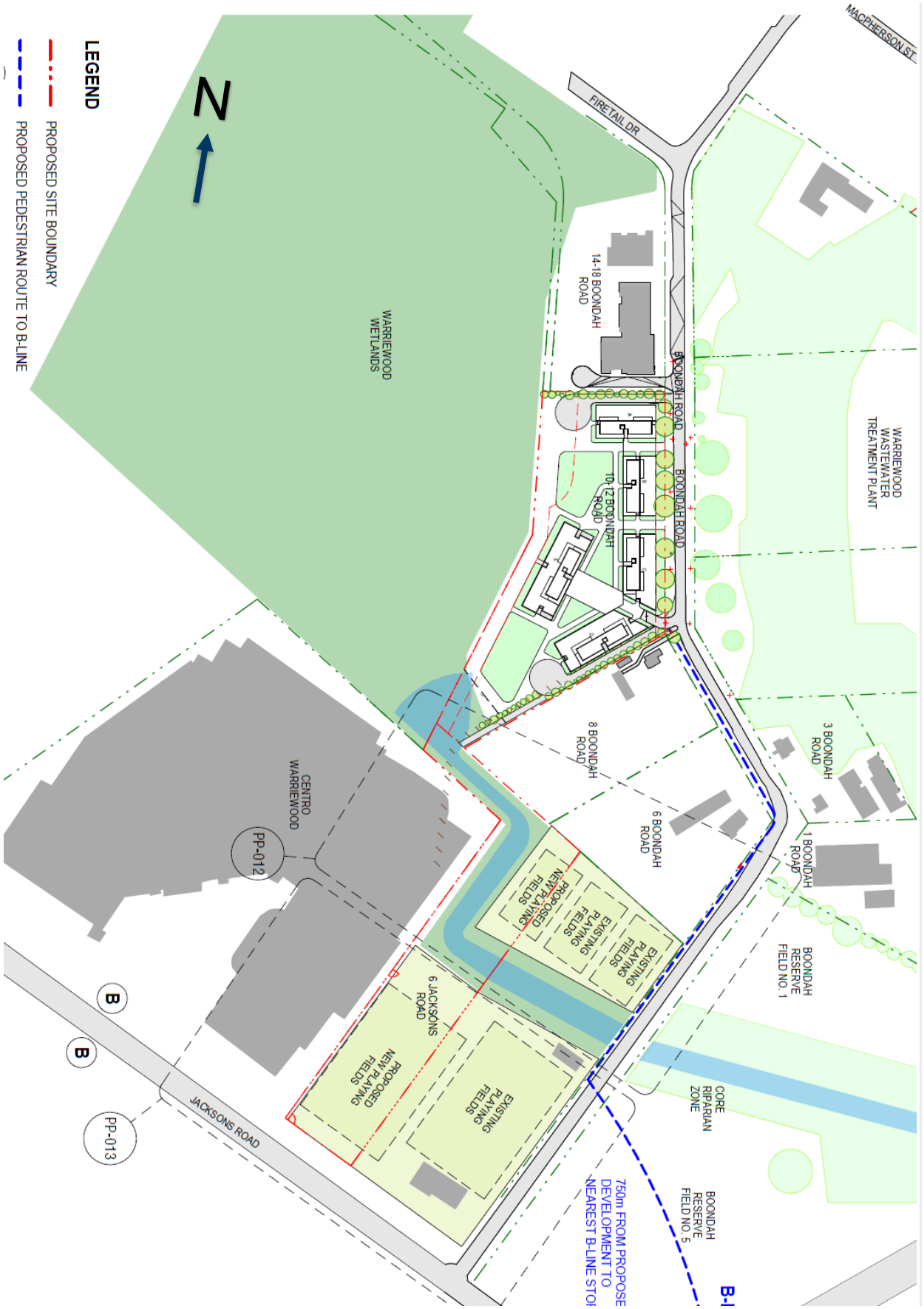
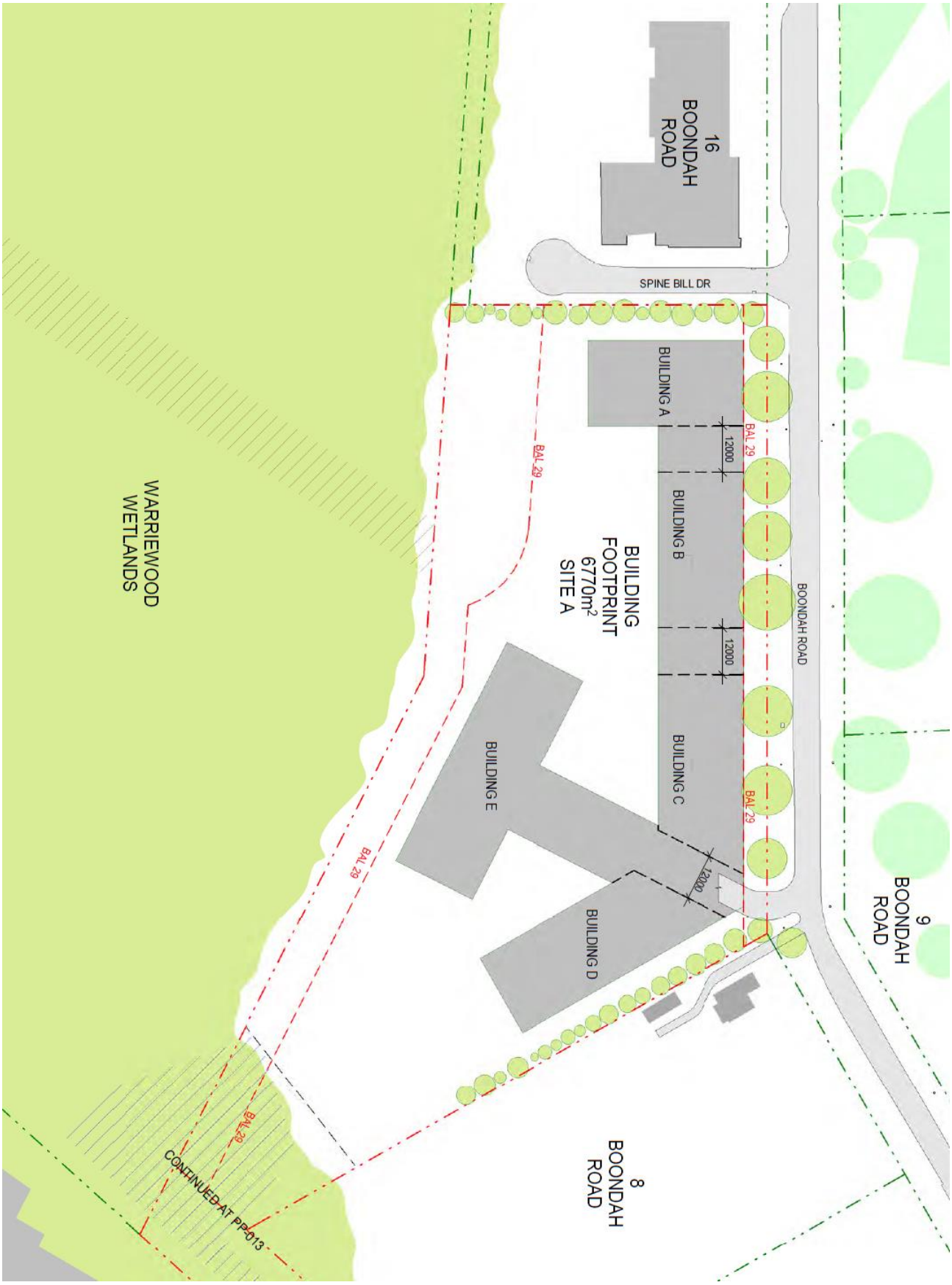


Figure 2-3 Proposed Site Footprint (Henroth Group)



3 Existing Flooding Issues

The *Ingleside, Elanora and Warriewood overland flow flood study* [Draft] (Smith & Jones, 2018) identifies flood issues in the Northern Beaches catchment area. Preliminary flood information derived from the Study (2018) indicates that the site is flood affected in both the 100yr and PMF event. Using the flood studies provided, it is estimated that the water levels at the site boundaries are 3.2m AHD and 4m AHD for the 100yr and PMF event respectively.

The existing flood extent is identified as shown in Figure 3-1 and Figure 3-2. In the existing conditions, within the boundaries of 10-12 Boondah Rd, the water will flow towards the existing road on the eastern boundary, and the wetlands on the south-western boundary. The overland flow is presented below in Figure 3-3, and is derived from 12D calculations.

Figure 3-1 Flood Depth 1% Map (Northern Beaches Council 2018)

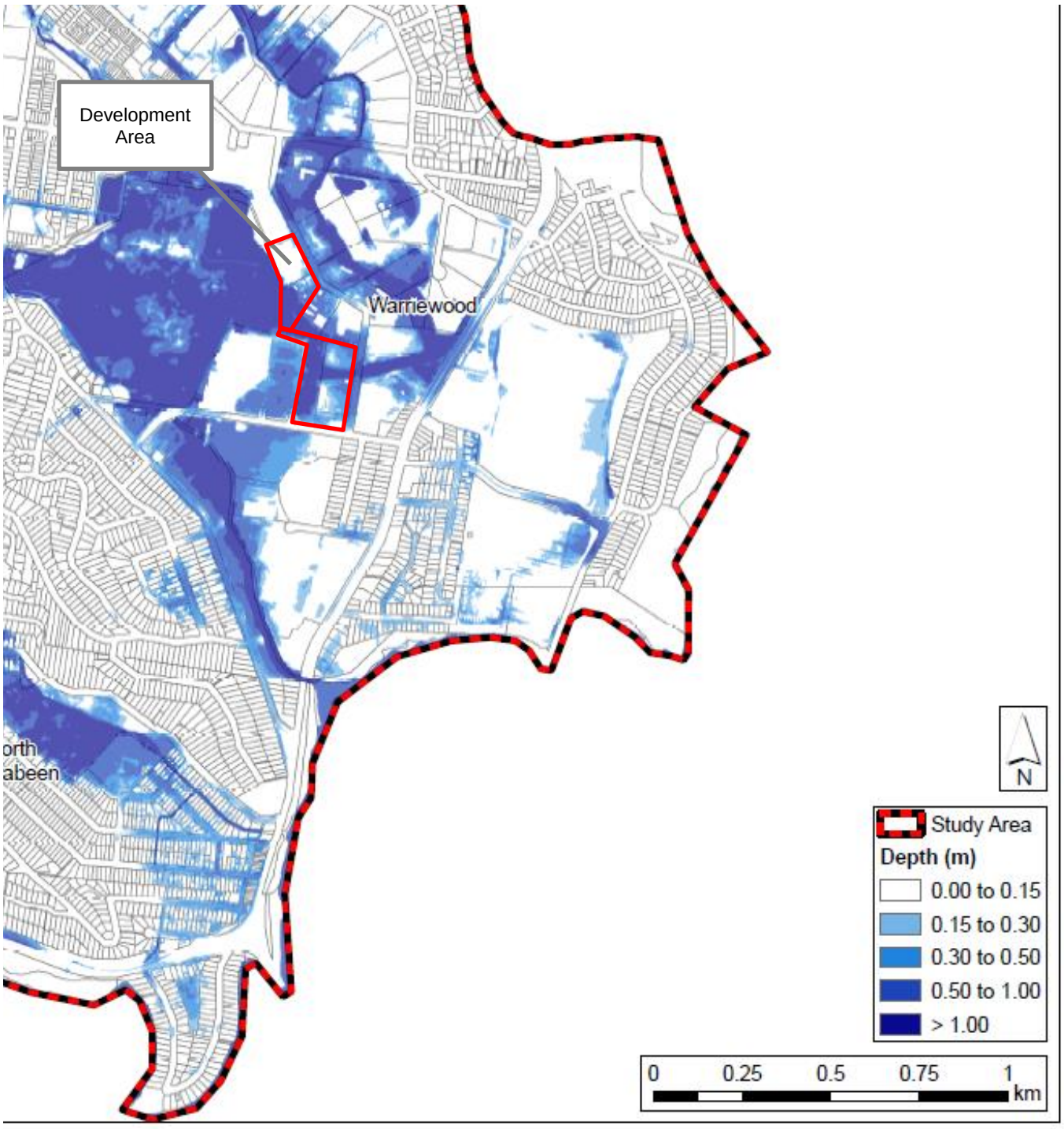


Figure 3-2 Flood Depth PMF Map (Northern Beaches Council 2018)

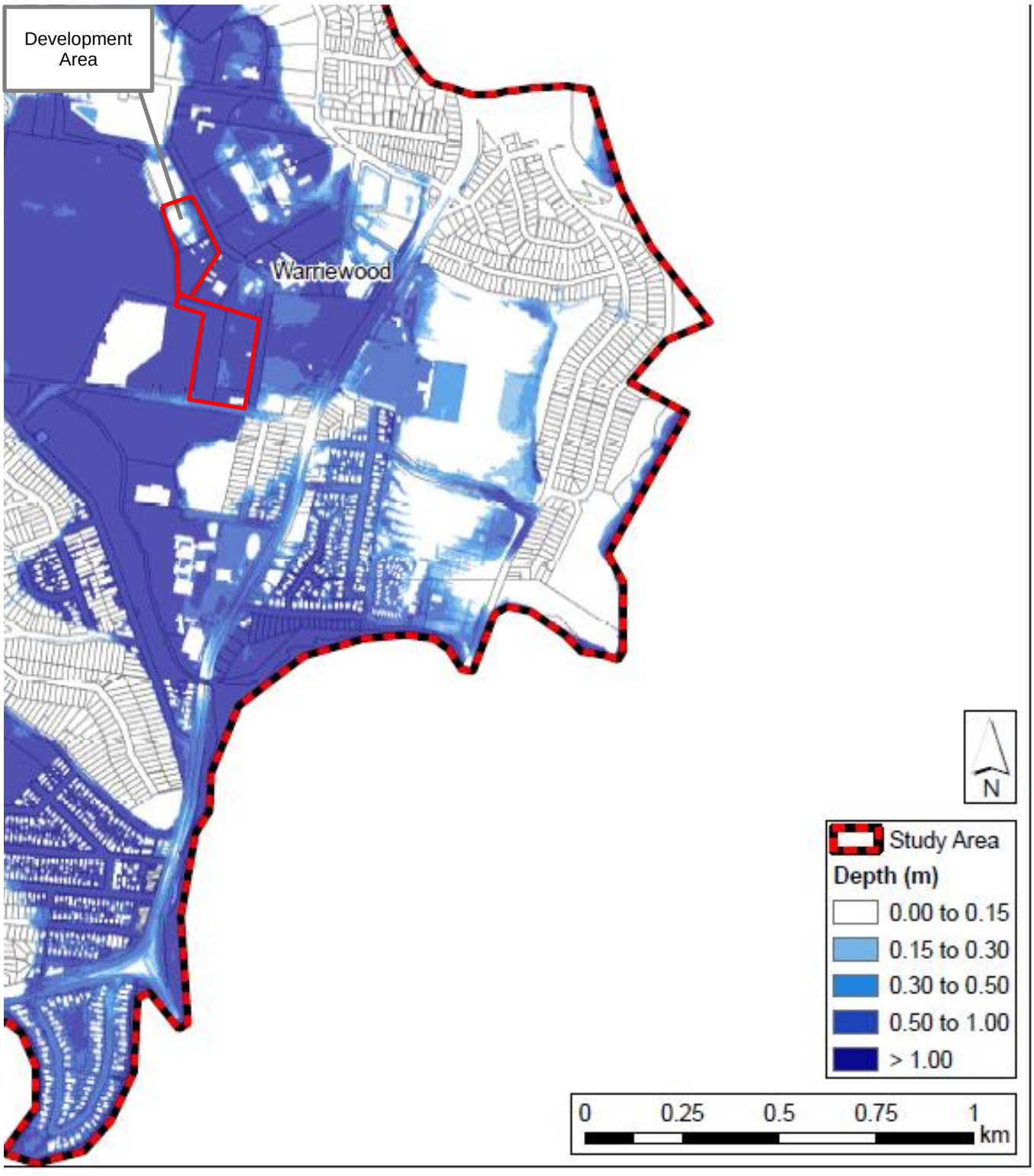
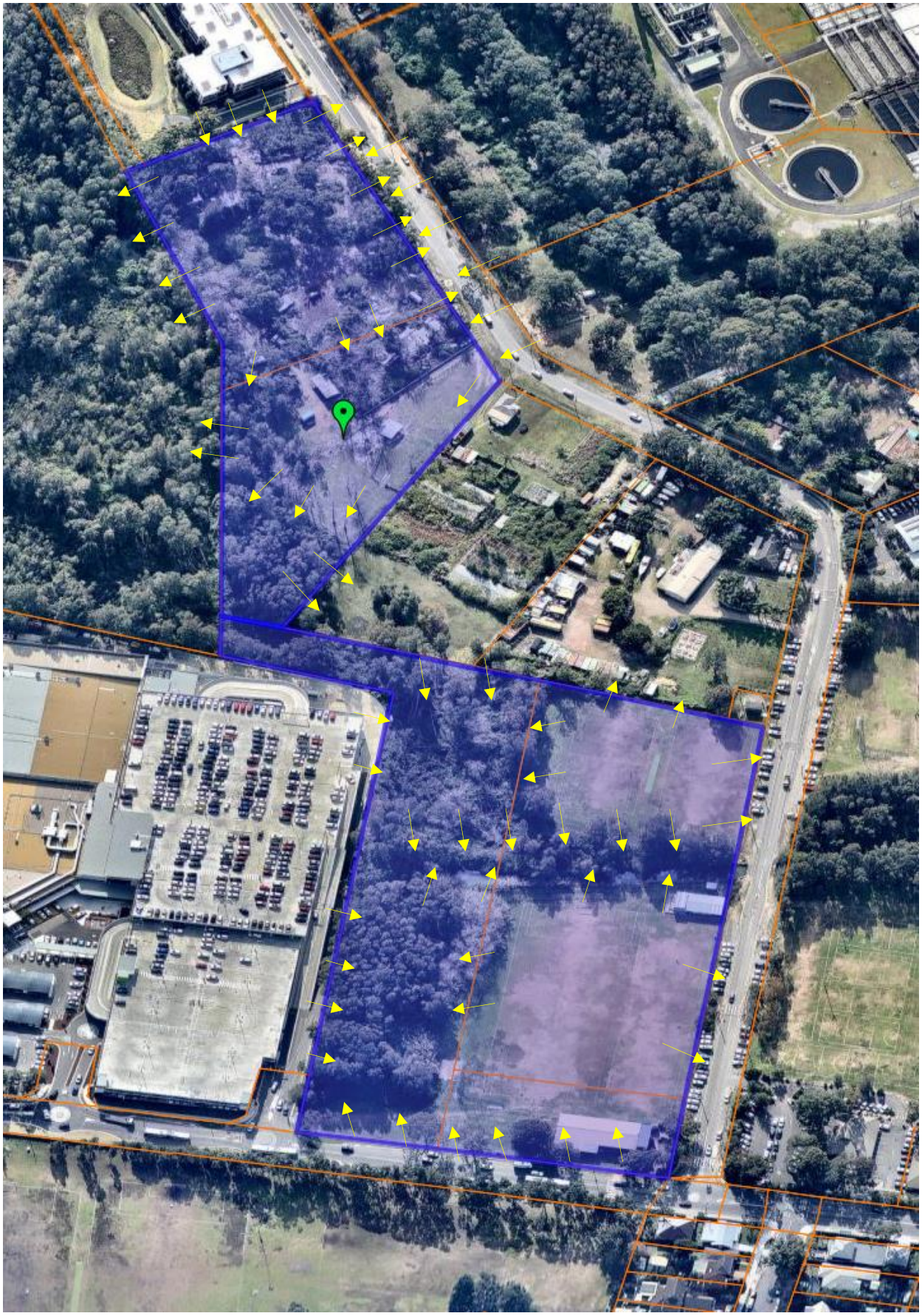


Figure 3-3 Existing Flow Pattern



3.1 Council Flood Study Breakdown

It must be noted that the ground levels used for the draft flood study are based on ALS data from 2011. As such, the inferred levels do not reflect the existing road levels. This is confirmed by a survey dated 2019, which shows the road upstream of the development sitting above the 100yr flood level. This is also confirmed for the Macpherson Road bridge crossing from east to west as shown in Figure 3-1 and Figure 3-2; the water should not be crossing the road at that location, as a bridge has been designed to provide passageway up to the PMF flooding.

Comparing a survey from 2003 to the survey in 2019, it can be seen that the road levels along Boondah Rd have been raised. Refer to Figure 3-4 and Figure 3-5 below for a snapshot of the intersection between Boondah Road and Firetail Drive. The depth of water in that region is at least 1m, according to Figure 3-1 and Figure 3-2. It can be seen from Figure 3-5 that the road level at this location sits above the road levels of the previous survey + 1m.

Therefore, Boondah Road north of the property boundary of 12 Boondah Road will not act as a floodway for at least the 100yr event. Therefore, only the road in front of the proposed development at 10-12 Boondah Road will require raising to match the 100yr water level. This is feasible and this has been included in the 100yr flood storage analysis (refer to Section 5).

Figure 3-4 Road Levels from survey dated 2003

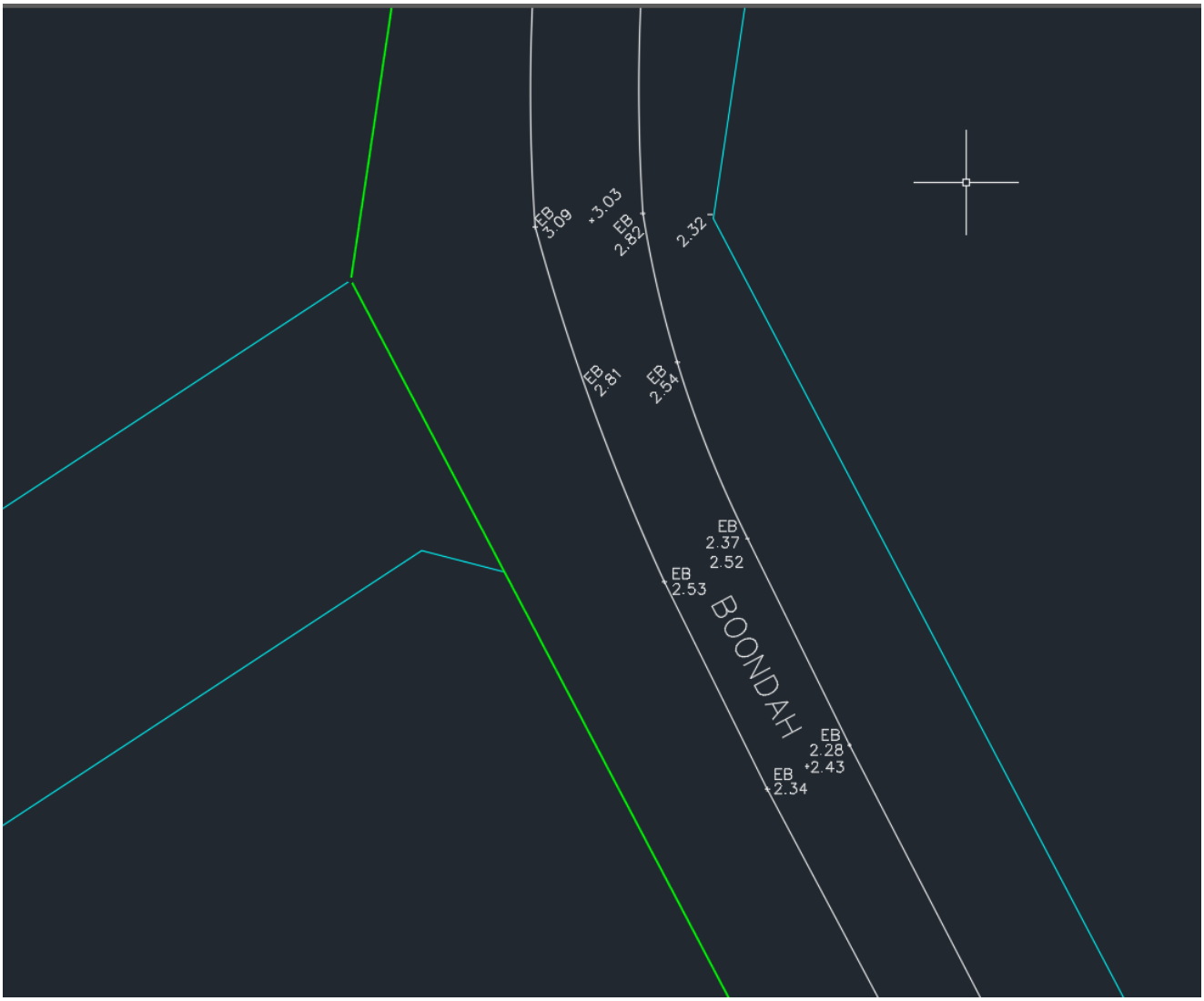


Figure 3-5 Road Levels from survey dated 2019

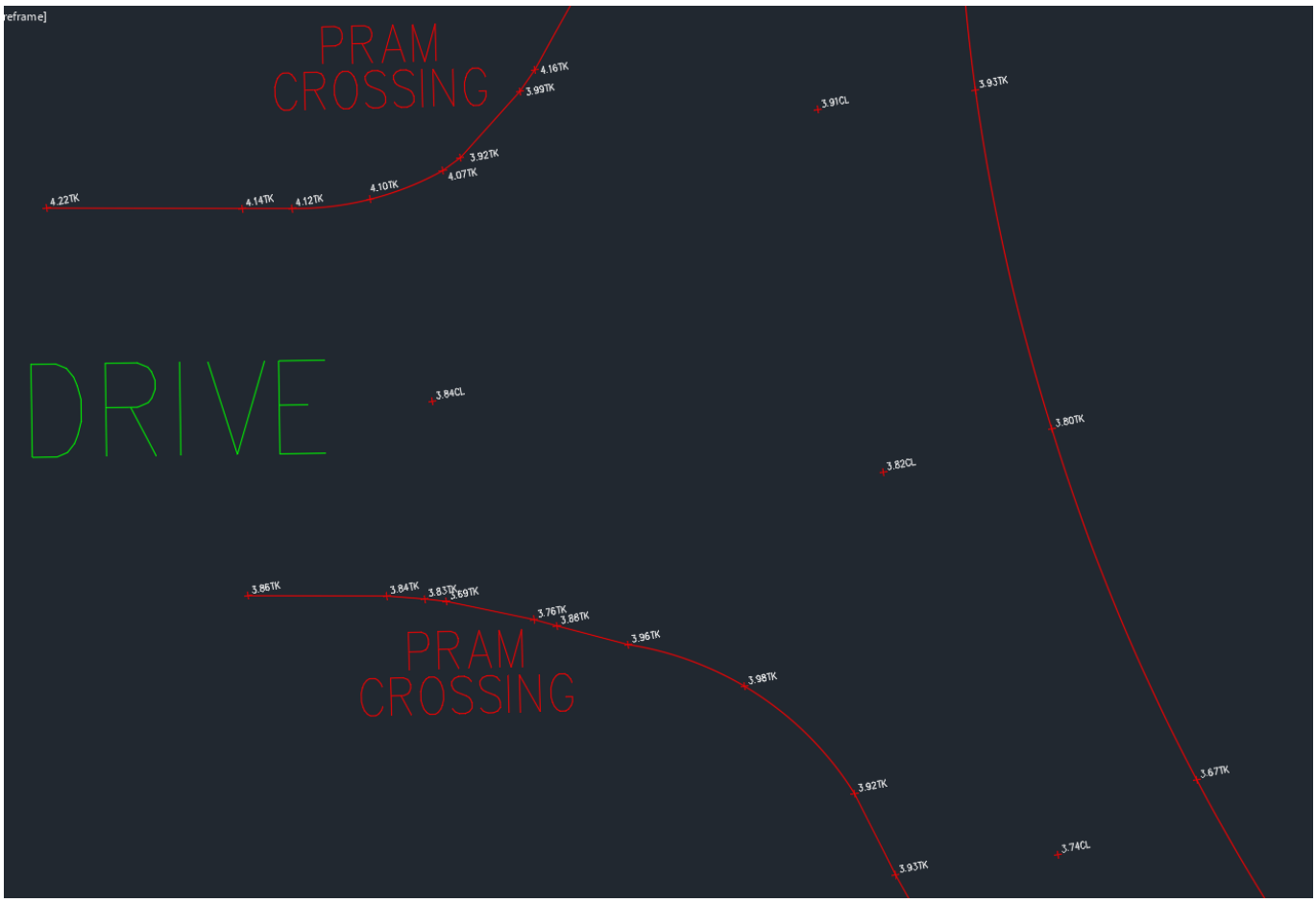


Figure 3-6 and Figure 3-7 detail the hydraulic categorisation of the site during the 100yr and PMF flood events. As per the points raised above, the categorisation for Boondah Road north of No.12 does not reflect the current conditions, nor does Macpherson street. The flood studies do accurately detail the behaviour of the properties themselves. It is shown in the 100yr event that No.10 Boondah Road and 6 Jacksons Road operate as flood storage areas. In the PMF event, 10 Boondah Road and 6 Jacksons Road become floodways. 12 Boondah Road is partially impacted as a floodway at its boundaries.

Figure 3-6 Existing Overland Flow Path for 100yr

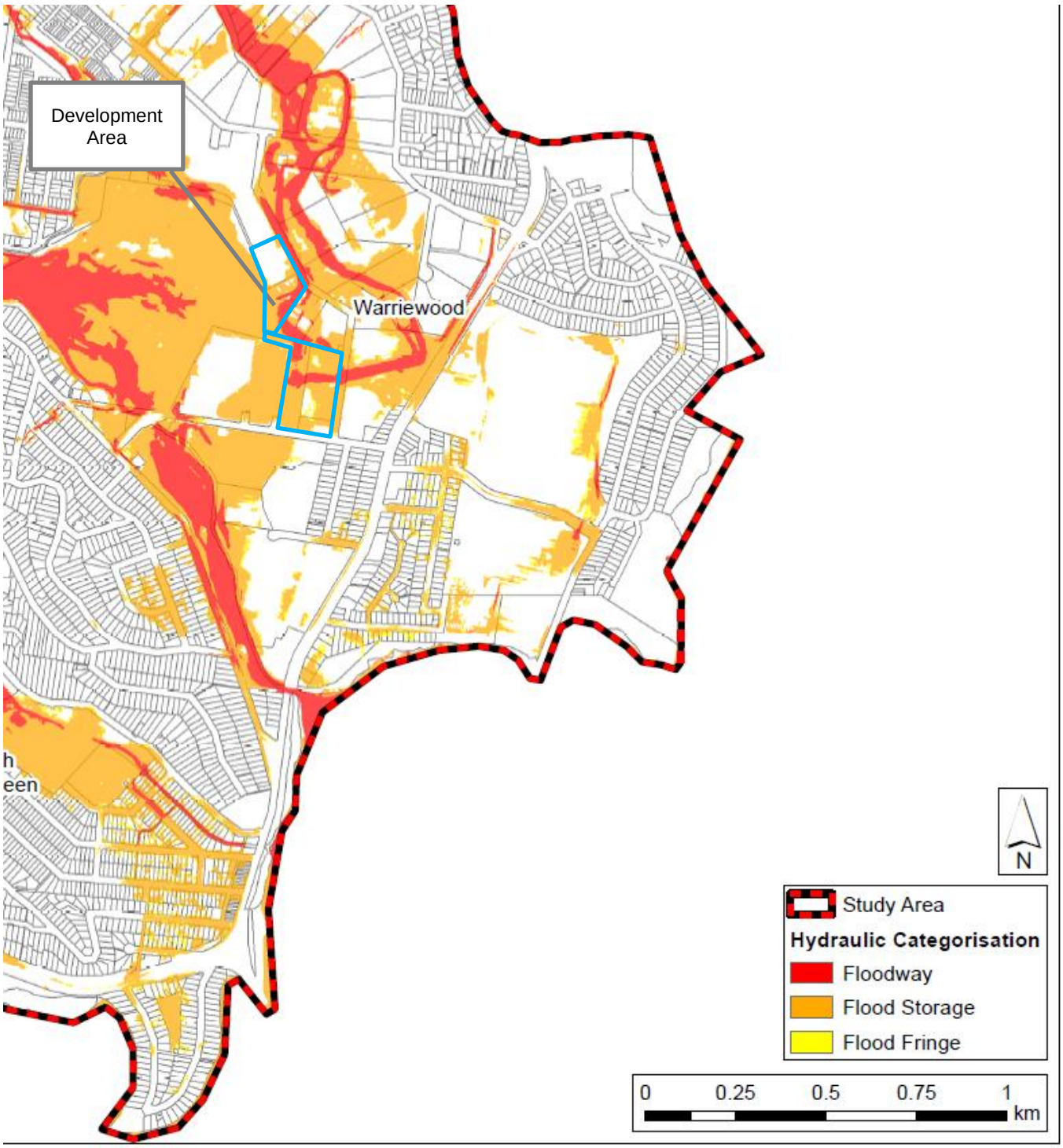
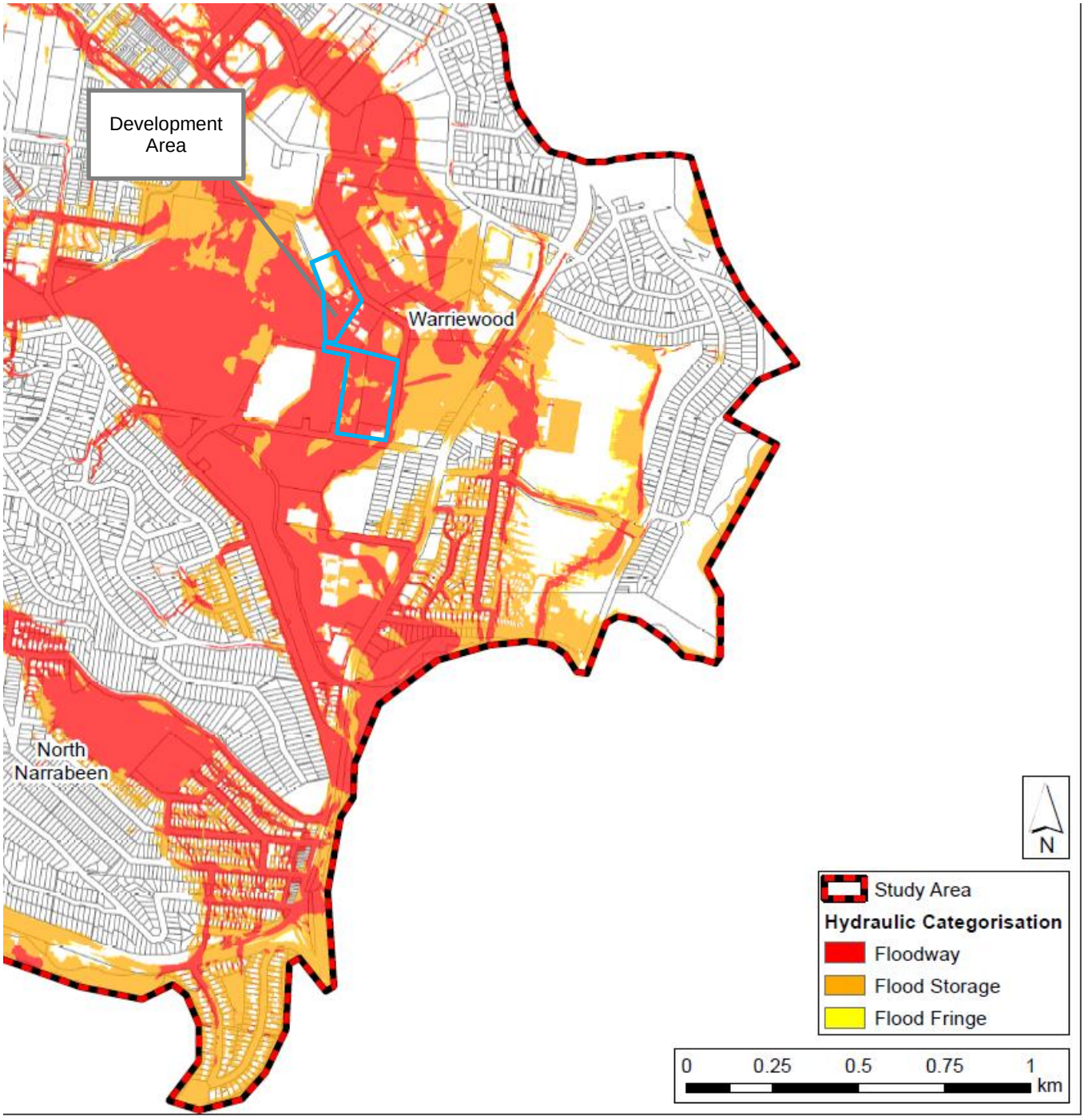


Figure 3-7 Existing Overland Flow Path for PMF



4 Flood Level for Planning

Based on Warringah's Development Control Plan 2011 and Local Environmental Plan 2011, the ground floor of the residential development must be set to the flood planning level of 1:100ARI + 0.5m freeboard, although we have set the ground floor at the PMF level (4m AHD). The road at the front of the development will be amended to 3.2m AHD to allow evacuation north from the development in the event of the 100yr flood, as required. Refer to Section 7 for details on the flood evacuation strategy.

5 12D Analysis

Setting the development level at 4m AHD and the road at 3.2m AHD will require applying a cut and fill earthworks balance procedure. Altering the levels of the site will alter the flood capacity of the site – if the flood volume is reduced here it will increase flood levels elsewhere and potentially compromise the evacuation strategies of other areas.

12D has therefore been used to determine the amount of cut that must be applied to the site to balance the fill required for the development, in order that the flood volume may remain consistent, or even improved. Refer to Figure 5-1 for the layout of the development in 12d with earthworks applied. Refer to Table 5-1, Table 5-2 and Table 5-3 for results.

Figure 5-1 12d Cut/Fill Development Plan

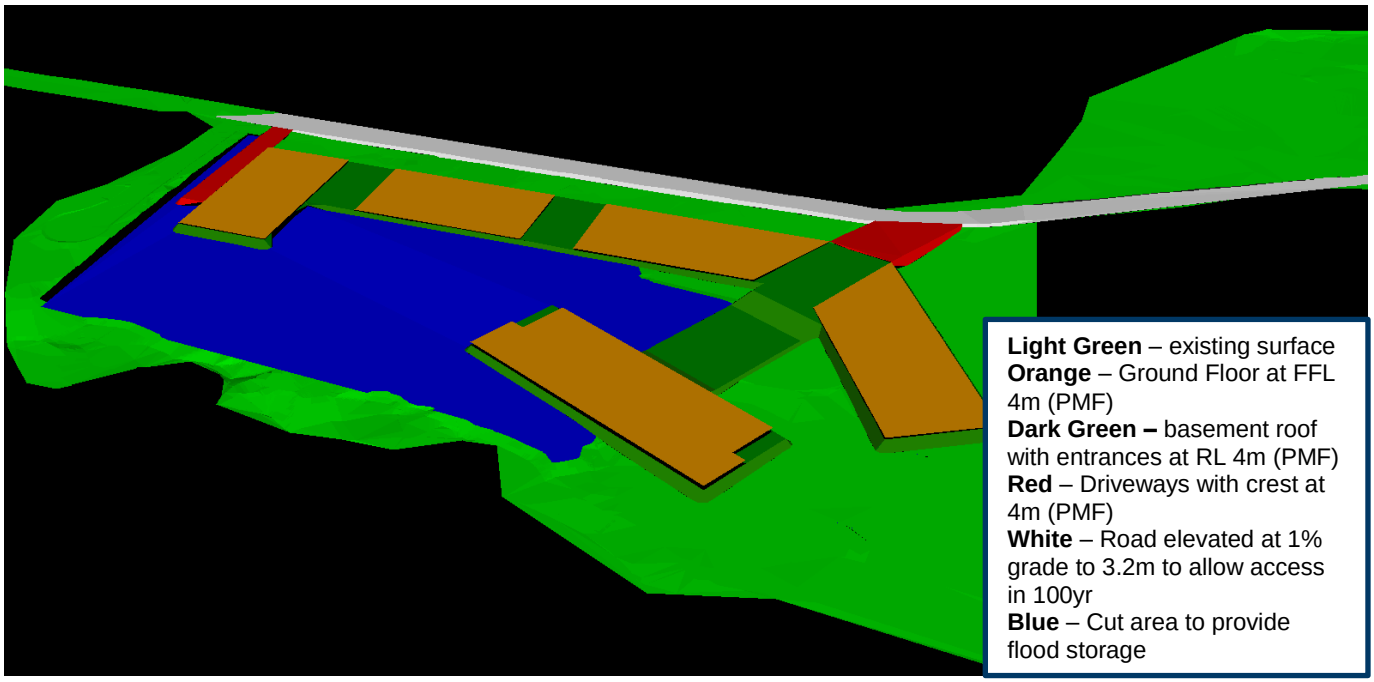


Table 5-1 Earthworks Strategy

Structure	Level
Buildings	Ground Floor at PMF – FFL 4 (completely flat)
Basement	Basement entrances at an RL of 4. Basement Roofs at an RL of 3.7m. Connecting basement roof to Building E will be at RL 2.9 to allow existing flow patterns to remain consistent.
Driveways	Crest of driveway at basement entrances set to RL 4. The driveways connection to Boondah Rd set at RL 3.2.
Road	100YR – 3.2 (road blends into the surrounding road, flat in the front of the development, and slopes at 1% to meet the existing road downstream of the development)

Cut Area	The upper half of the development is lowered to 2.9mAHD along the face of the basement, and 2.1mAHD along the western boundary. The tin shows that the amended site will drain as it does under existing conditions.

Table 5-2 Flood Volume for development (100yr)

	Flood Volume		
Flood Event	**Existing surface (m^3)**	**PMF Development and 100yr Road (m^3)**	**Difference (m^3)**
100yr (3.2m AHD)	12,754	12,913	159

As can be seen from Table 5-2, the existing 100yr flood storage from the site is improved by the development. This complies with council's DCP requirements.

Table 5-3 Earthworks Balance for development (100yr and PMF)

	Earthworks Balance		
Event	**Cut (m^3)**	**Fill (m^3)**	**Balance (m^3)**
Development incl. Road	-8068	8196	129

As can be seen from Table 5-3, the development will result with about 129m^3 of leftover fill to use for other purposes. The groundwater levels at this site vary from RL 1.2-1.3; the earthworks can be carried out without concern of being impacted in this manner.

6 Flood Hazard

The existing flood risk mapping shows that the flow path through most of the site was low to high hazard, though most of 12 Boondah Road has no hazard. The southern half of the site is considered high hazard, and the northern end of the site is considered low. The PMF increases the extent of the hydraulic hazard from the 100yr event. This is shown in Figure 6-1 and Figure 6-2.

In the proposed development case however, the cut/fill earthworks will result in a hazard free development platform for the residential flat buildings.

Please note that the hazard attributed to Boondah Road north of 12 Boondah Road and Macpherson Street is based on 2011 ground level data, and is not indicative of the existing road levels at the 1% level. Please refer to Section 3.1 for the breakdown on these findings.

Figure 6-1 Hydraulic Hazard for 1% AEP

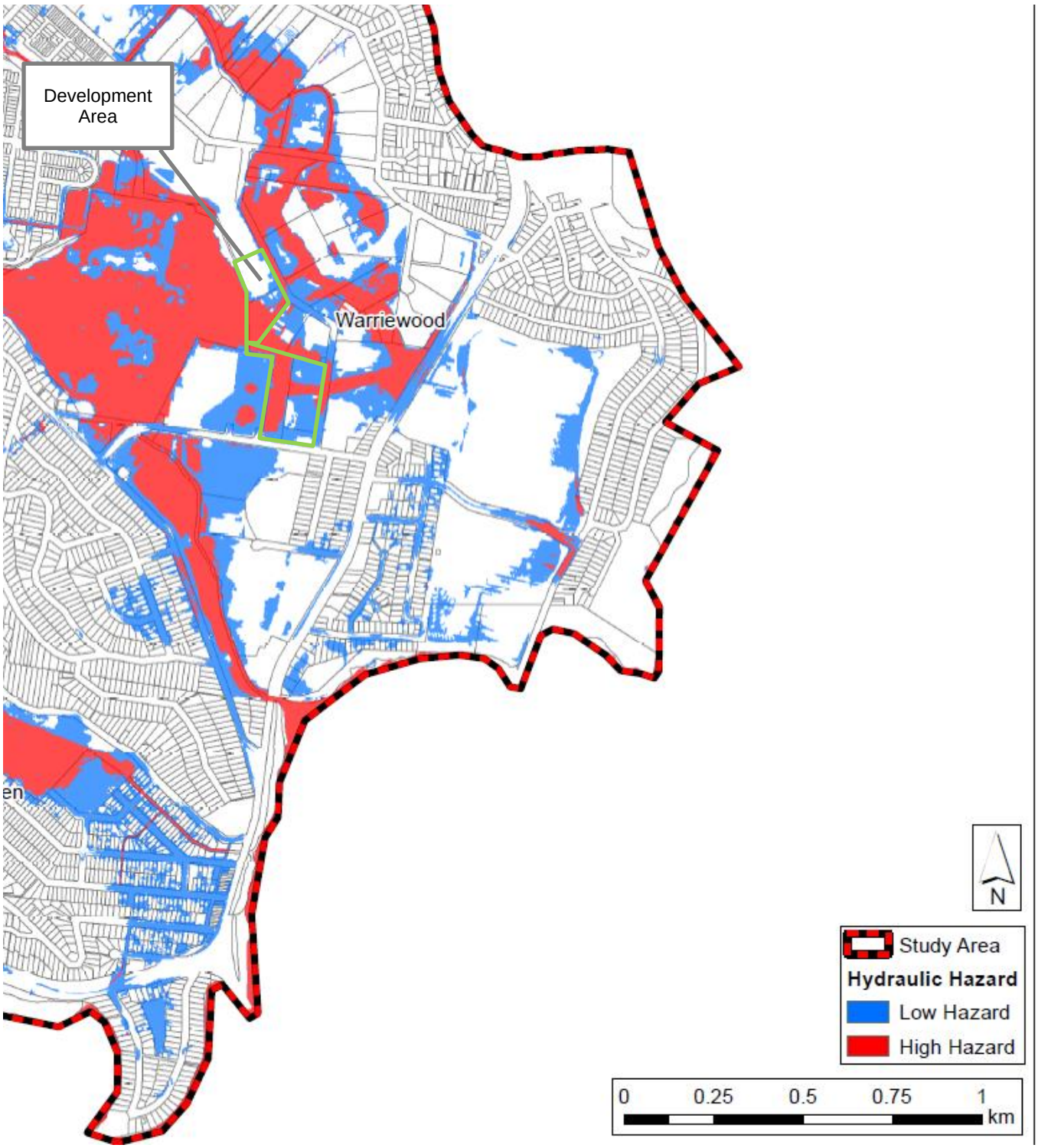
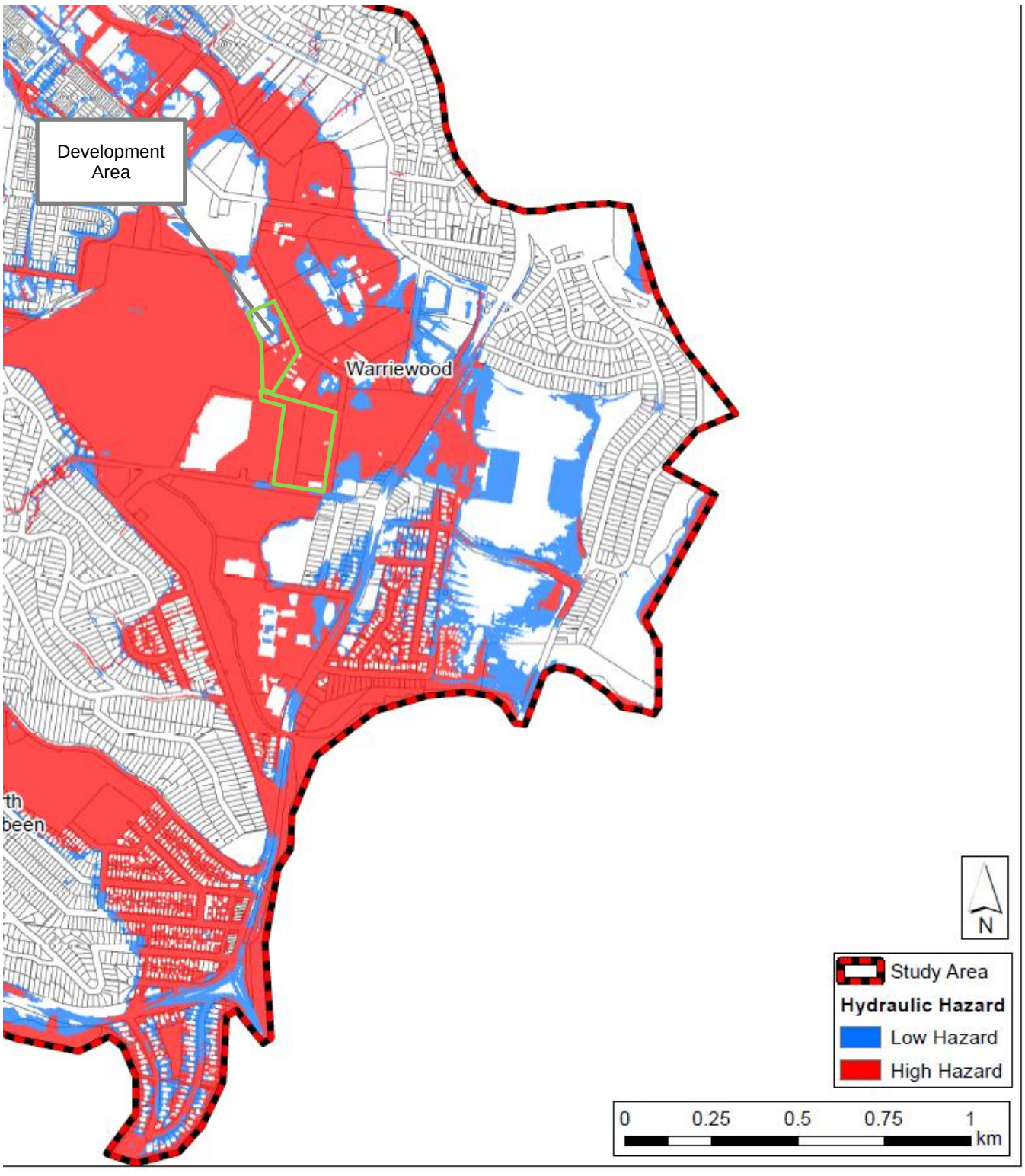


Figure 6-2 Hydraulic Hazard for PMF AEP

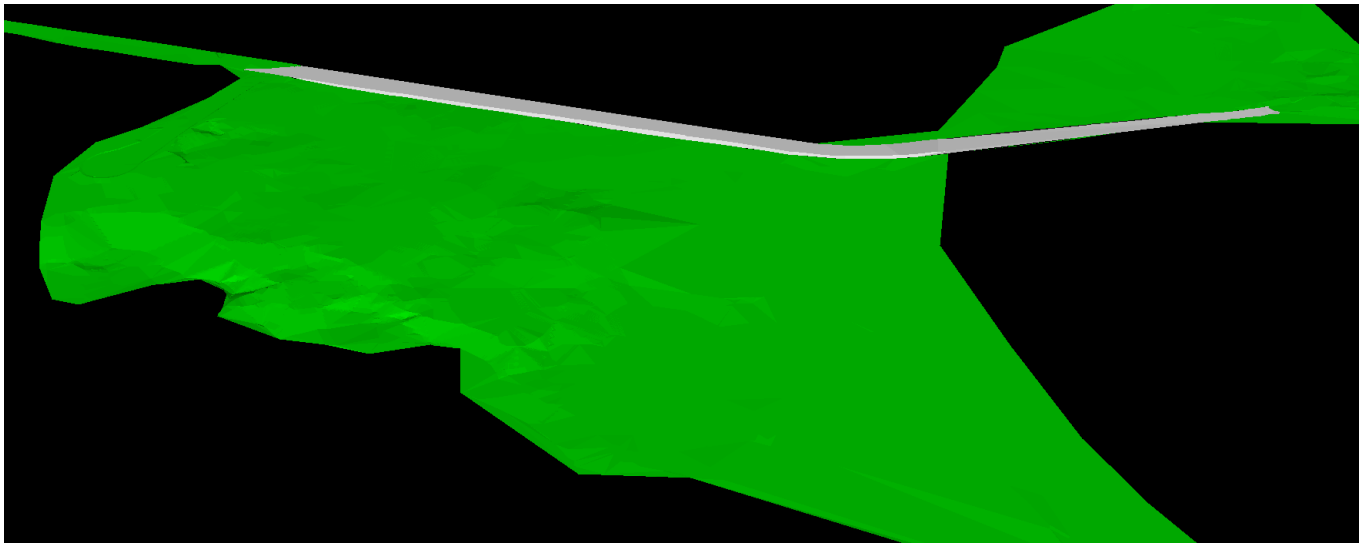


7 Flood Evacuation

As shown on the flood maps provided above, there will be flooding on the development site. However, there is a significant delay (> 4.5hr) in flood water arriving at the site for the 100yr AEP, and approximately a 9 hour delay in water arriving at the property for the PMF. Furthermore, the earthworks strategy will provide a flood free development at 4.0m AHD above the FPL – in this case, the FPL is 3.7m AHD (100yr 3.2m AHD + 0.5m freeboard, according to council's DCP).

An early warning evacuation procedure will be put in place for the 100yr event, as the road in front of the development will be raised as required and regraded to allow emergency access in this flood event (refer to Figure 7-1). Where the intensity of the storm is greater than the 100yr, vertical evacuation within the property is available. Note that the duration of the PMF event is relatively short, peaking for about half an hour, according to the council study.

Figure 7-1 12d Image of proposed road at 100yr level at 1%



A detailed flood management strategy will be developed identifying the evacuation procedures for each of the ground floor occupants prior to occupation. The plan will identify personnel responsible, flood warning, evacuation routes, exits and assembly points (including maps/plans). The plans will form part of the emergency procedure training for staff.

A flood evacuation booklet will be prepared for residents identifying procedure and flood refuge areas.

The preliminary details of the evacuation strategy are listed below. The evacuation strategy will be detailed as part of future work.

7.1 Flood Response Personnel

The body corporate will prepare a flood management plan. The flood plan will nominate the flood response personnel; this will include the First Aid Officer and emergency contact. The nominated person will be the contact point for any flood warnings.

7.2 Flood Warnings

The site is situated at the lower reaches of Narrabeen Creek, the regional flood models have shown flooding of residential, commercial and industrial land upstream of the site during extreme (PMF) flood events.

The Bureau of Meteorology (BoM) and SES will issue flood warnings, evacuation warnings and orders for the catchment. The nominated personnel can choose to register to receive text and email notifications regarding flood data.

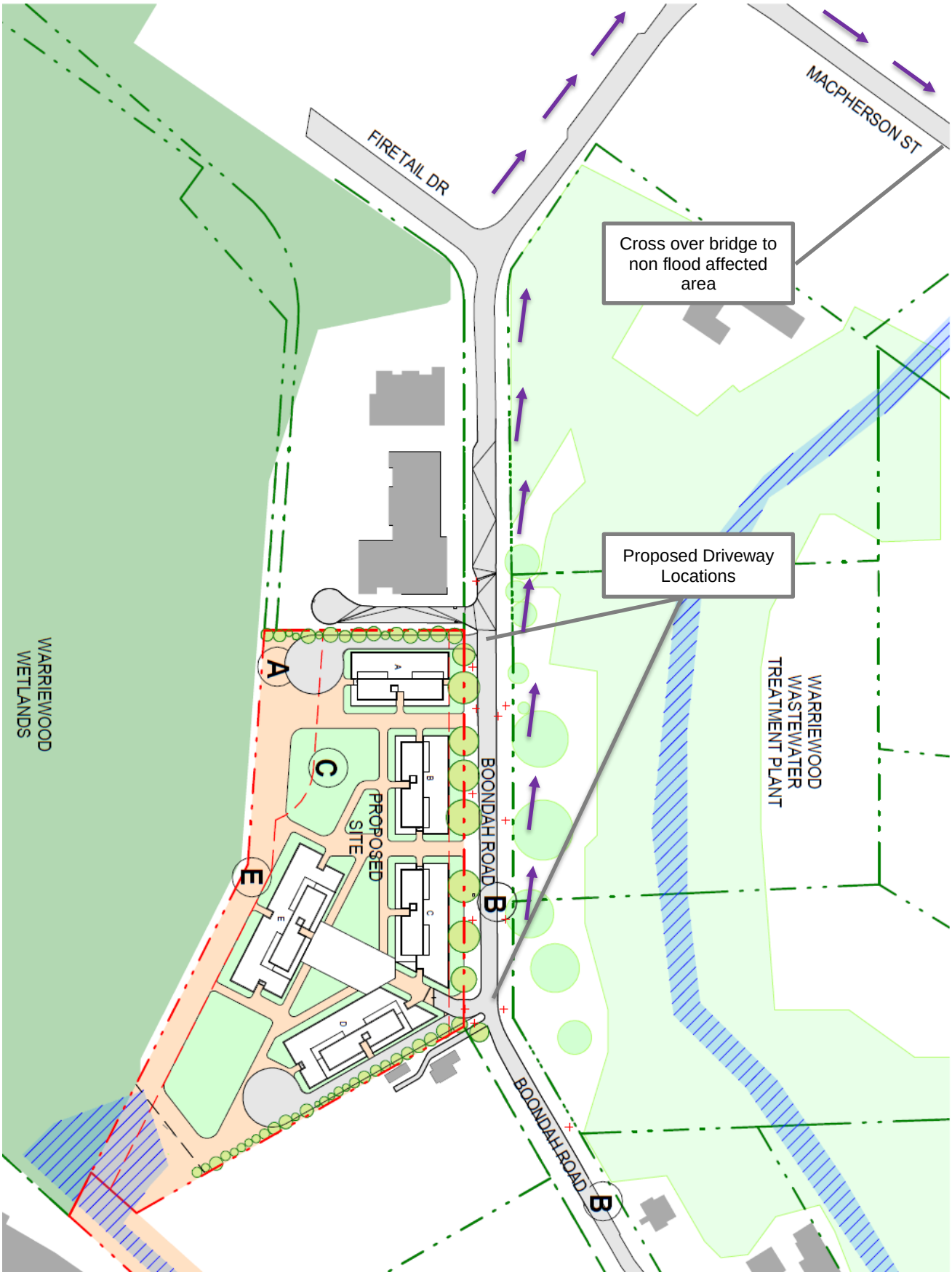
The warnings can include early warning of severe thunderstorms and flood alerts when flood producing rain is expected. When additional information is available more detailed flood warnings are issued. Additional to BoM and SES, public and commercial radio and TV stations issue regular flood warnings.

The SES may issues evacuation warnings when expected rainfall is likely to cause flooding upstream. If the SES determine evacuation is required, an Evacuation order will be issued. The order will be broadcast on radio/TV, door knock and telephone. It is recommended when an evacuation order is issued for the upstream sites of University Creek, then the 112 Talavera road site commence evacuation.

7.3 Evacuation Route

The proposal provides floor levels at the PMF flood level. A flood evacuation route is shown on Figure 7-2, as indicated by the arrows. All vehicles will make their way north to the intersection of Macpherson Street and Boondah Road. The route remains flood free for all storm events up to and including the 100 year ARI. Any events greater than the 100yr will require shelter within the buildings where the ground floor is set at the PMF level.

Figure 7-2 Flood Evacuation Route

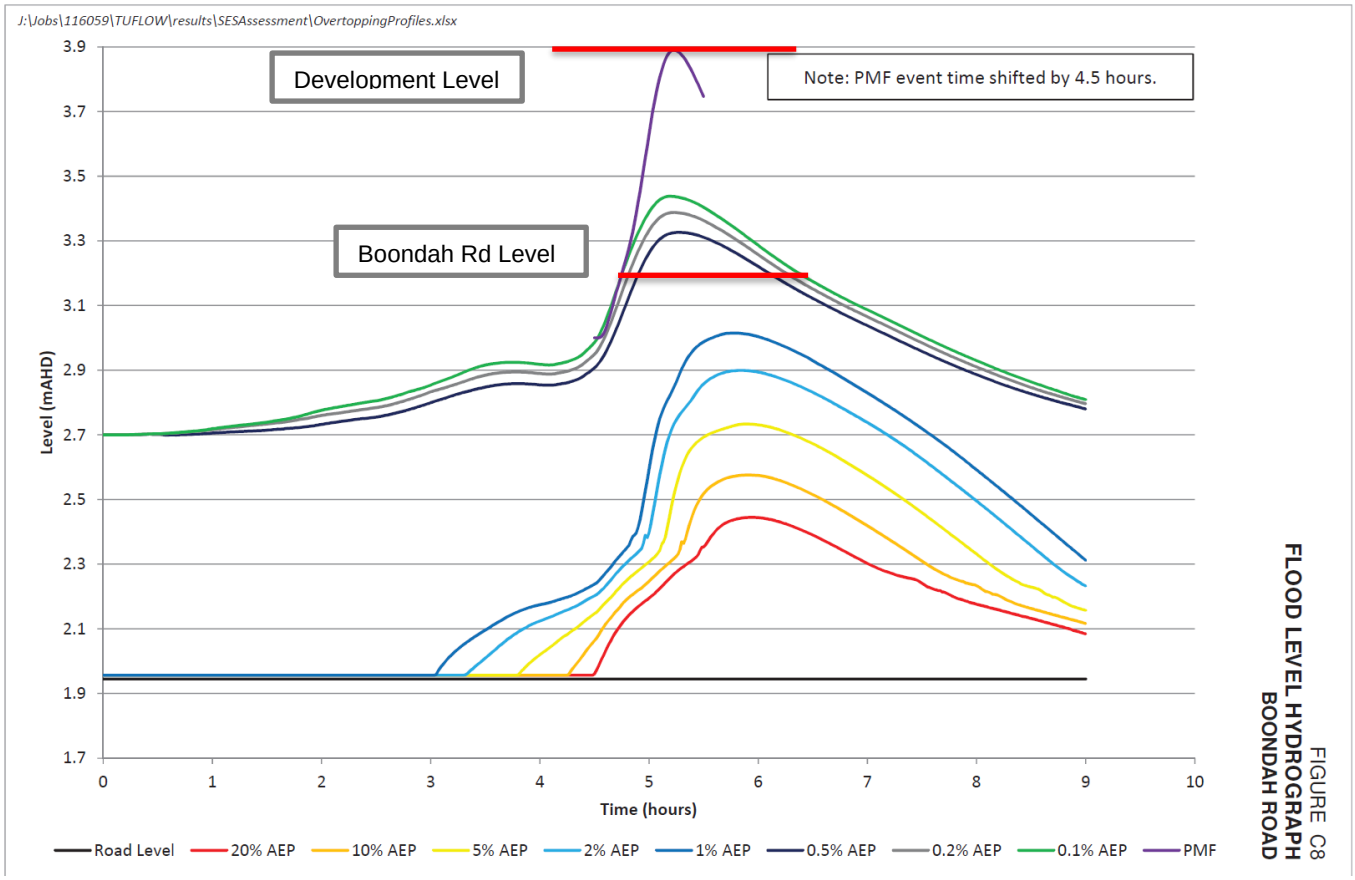


7.4 Shelter in Place

The flood free access via Boondah Rd to Macpherson street, confirmed by the survey, provides a safe flood evacuation refuge for storms up to the 100 year ARI. However, it is recognised that during an extreme rainfall event, the intensity of rainfall as well as other factors (wind, debris etc.) would make driving either difficult or potentially more dangerous than shelter in place. For instances where evacuation is not possible the option of shelter in place is available. Once flood waters rise to the flood markers (RL 3.2) residents will seek refuge within the building (vertical evacuation). The ground floor and above remain at and above the PMF flood levels; all residents will vacate to those areas. For residents utilising the ground floor level, they will be required to move to the first floor. The ground level will be set at the estimated PMF level, but vacating to the first floor will ensure residents remain safe.

Analysis of the hydrograph provided for the PMF event at a structure close to the site, suggests that the site is only subjected to PMF flooding for approximately 30mins (refer to Figure 7-3), after a delay of approximately 9 hours. This short duration means shelter in place will suffice.

Figure 7-3 Hydrograph for structure closest to development site



8 Playing Fields Assessment

In addition to the works described above, it is being considered that Boondah reserve fields No. 2-7 and 6 Jacksons Rd be developed. The extent of development for this area is as shown in Figure 8-1 and Figure 8-2, and regrading into a functional soccer field. It is assumed that the fields will be level with one another, for ease of access and playability. As a result, the entire land within the perimeter fence will need to be levelled to maintain the 100yr flood storage.

Figure 8-1 South Playing Fields Proposed Development

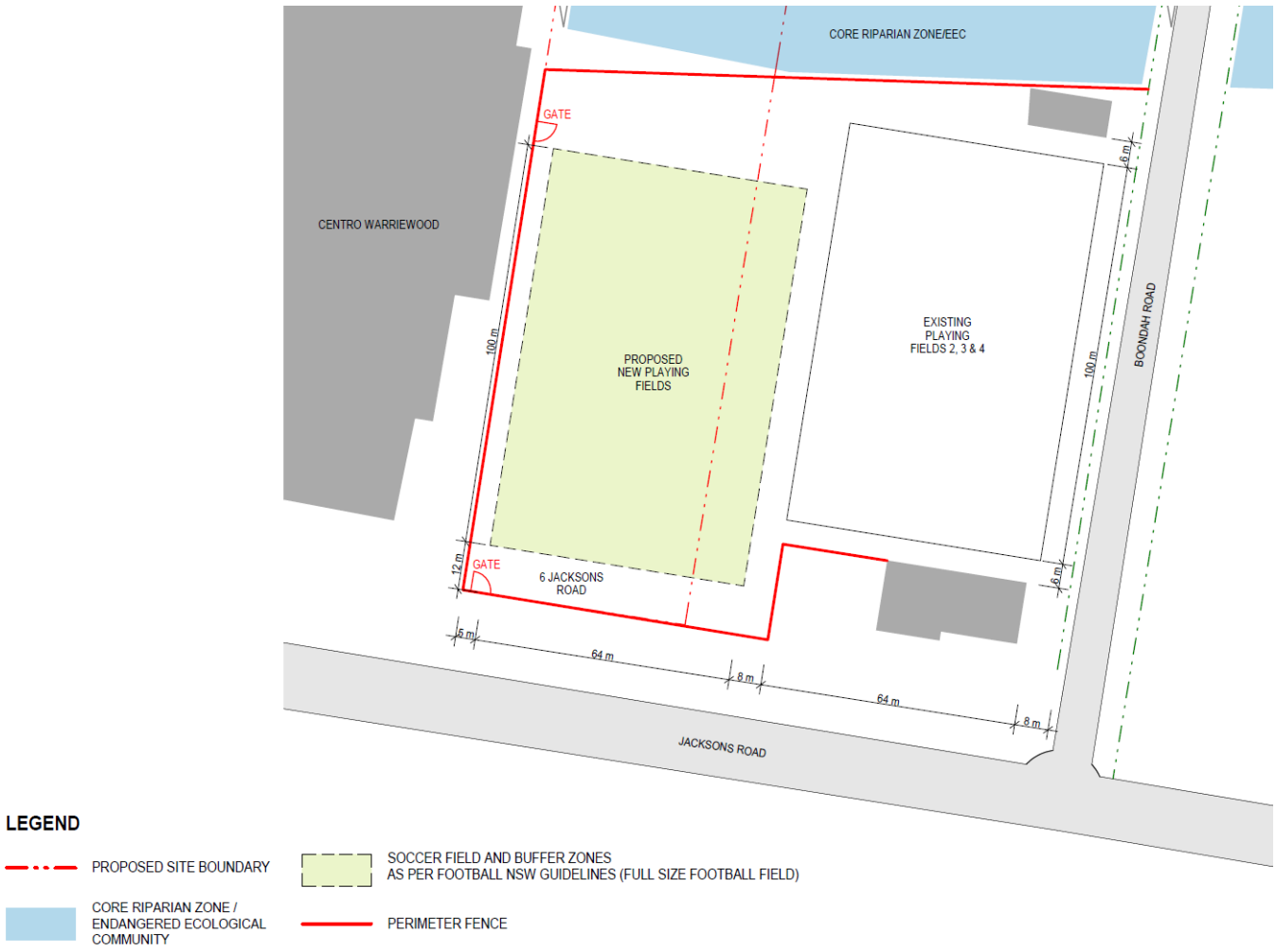
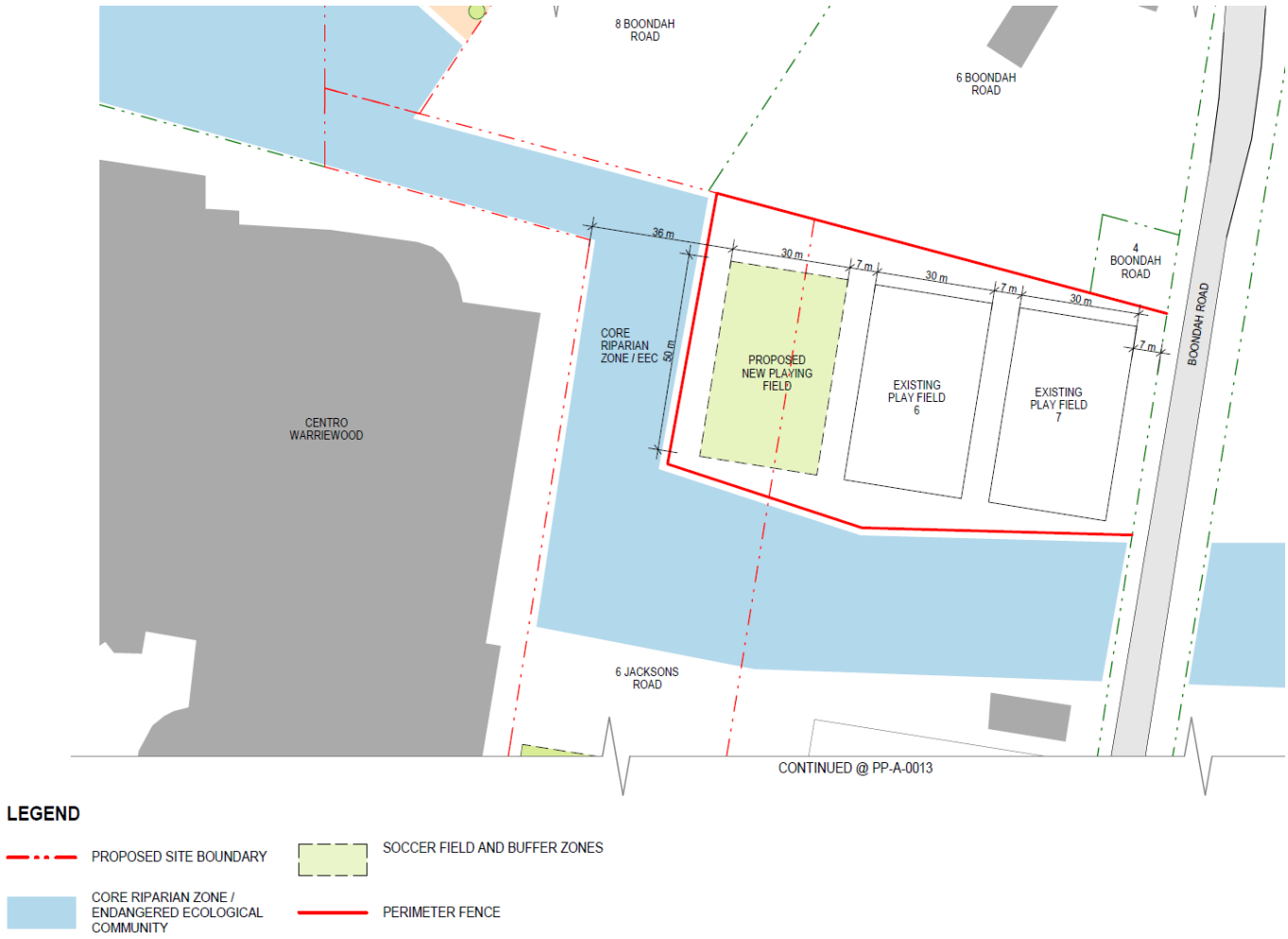


Figure 8-2 North Playing Fields Proposed Development



12D earthworks analysis has been carried out for the southern fields thus far to determine the existing flood volume, and the extent of levelling required. In this case, the entirety of the land within the perimeter field has been flattened to one level to promote use and ensure that the 100yr flood storage remains consistent. A 3D image of the proposed earthworks is shown in Figure 8-3.

Table 8-1 Flood Volume for South Playing Fields

	Flood Volume		
Flood Event	**Existing surface (m^3)**	**South Field levelled at 2.37 (m^3)**	**Difference (m^3)**
100yr (3.01)	11,790	11,820	30

Table 8-2 Flood Volume for North Playing Fields

	Flood Volume		
Flood Event	**Existing surface (m^3)**	**North Field levelled at 2.4 (m^3)**	**Difference (m^3)**
100yr (3.01)	5,315	5,350	35

Figure 8-3 12d image of Fields development

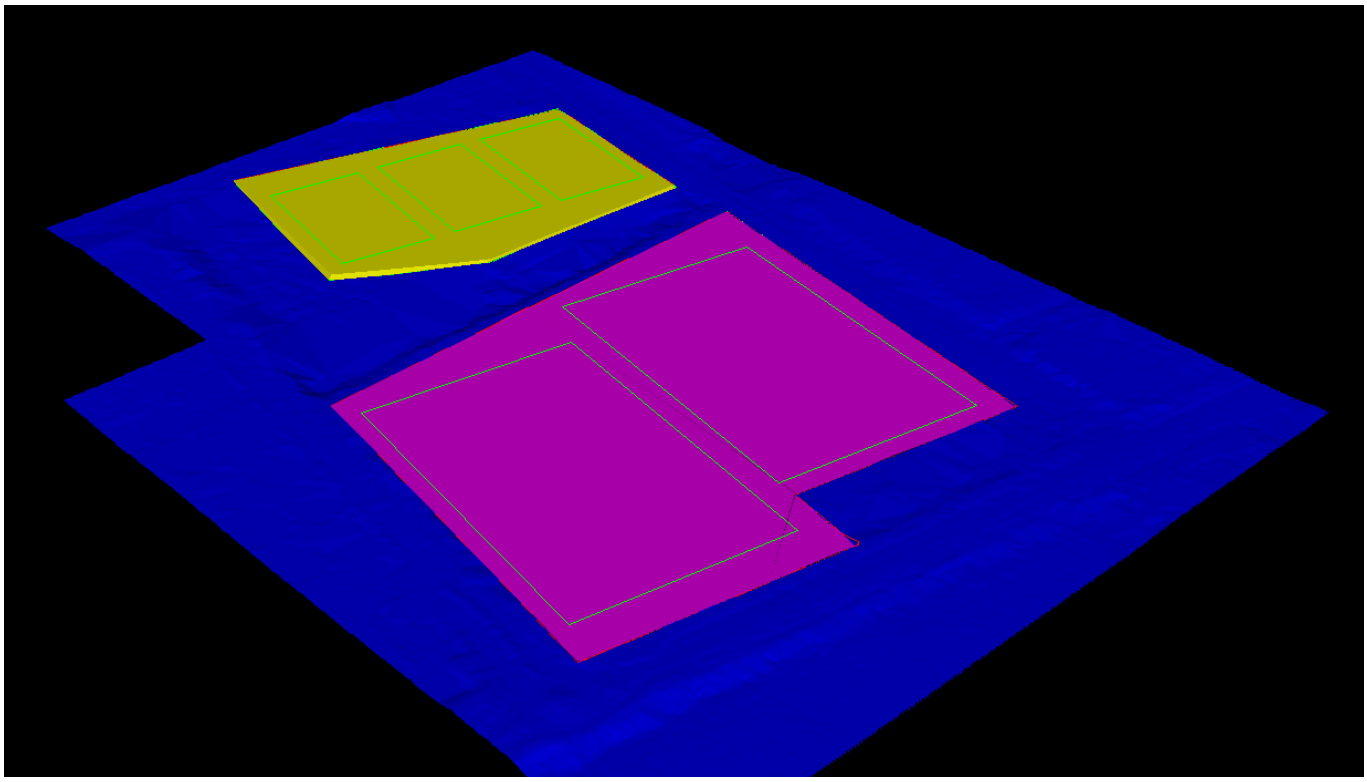


Table 8-3 Earthworks Balance for Playing Fields

Earthworks		
Type	**Existing Surface to South Field (2.37m) (m^3)**	**Existing surface to north field (2.4m) (m^3)**
Cut (amount of excavation required to reach Level)	-3883	-1225
Fill (amount of fill required to reach Level)	3817	1235
Balance	-66 (excess fill remaining)	10 (fill required)

The results show that levelling the south field to 2.37m and the northern field to 2.4m will increase the available 100yr flood storage of the site. Table 8-3 shows that the South Field will leave 66m^3 of fill leftover to balance out the North Field, and be used for any other projects onsite.

The groundwater level at this location is approximately RL 0.8; the earthworks can be carried out without concern of being impacted by groundwater.

9 Water Quality

Water quality from surface runoff will need to be managed during the DA stage of works. This can be accomplished via silt fences erected around the disturbed areas to exclude silt, and swales to direct flows to temporary sediment basins. This will be carried out in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) which is also commonly known as the Landcom 'Blue Book'. Sedimentation control during construction is critical to protect the downstream environment of the creek system.

It is proposed that the swales and sediment controls will manage sediments and pollutants off the site during the whole construction process, or until sufficient upstream sediment controls are installed. Access to the site will be restricted throughout construction.

When all upstream building activities have been substantially completed (approximately 80%), a bioretention basin to achieve pollutant reduction to required targets is to be commissioned. This is a future matter and will be detailed in the DA phase.

10 Conclusions

The proposed building provides elevation of the ground floor equal to the PMF, and a proposed road adjustment to provide a flood free (100yr) evacuation route to Macpherson Street. Earthworks balance has been carried out to ensure the 100yr flood storage for the site remains consistent. Detailed flood management plans identifying flood evacuation will be put in place prior to occupancy.

10 AND 12 BOONDAH RD, 6 JACKSONS RD AND RESERVE FIELD 2, 3, 4, 6 AND 7, WARRIEWOOD

Appendix A Council Flood Information

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