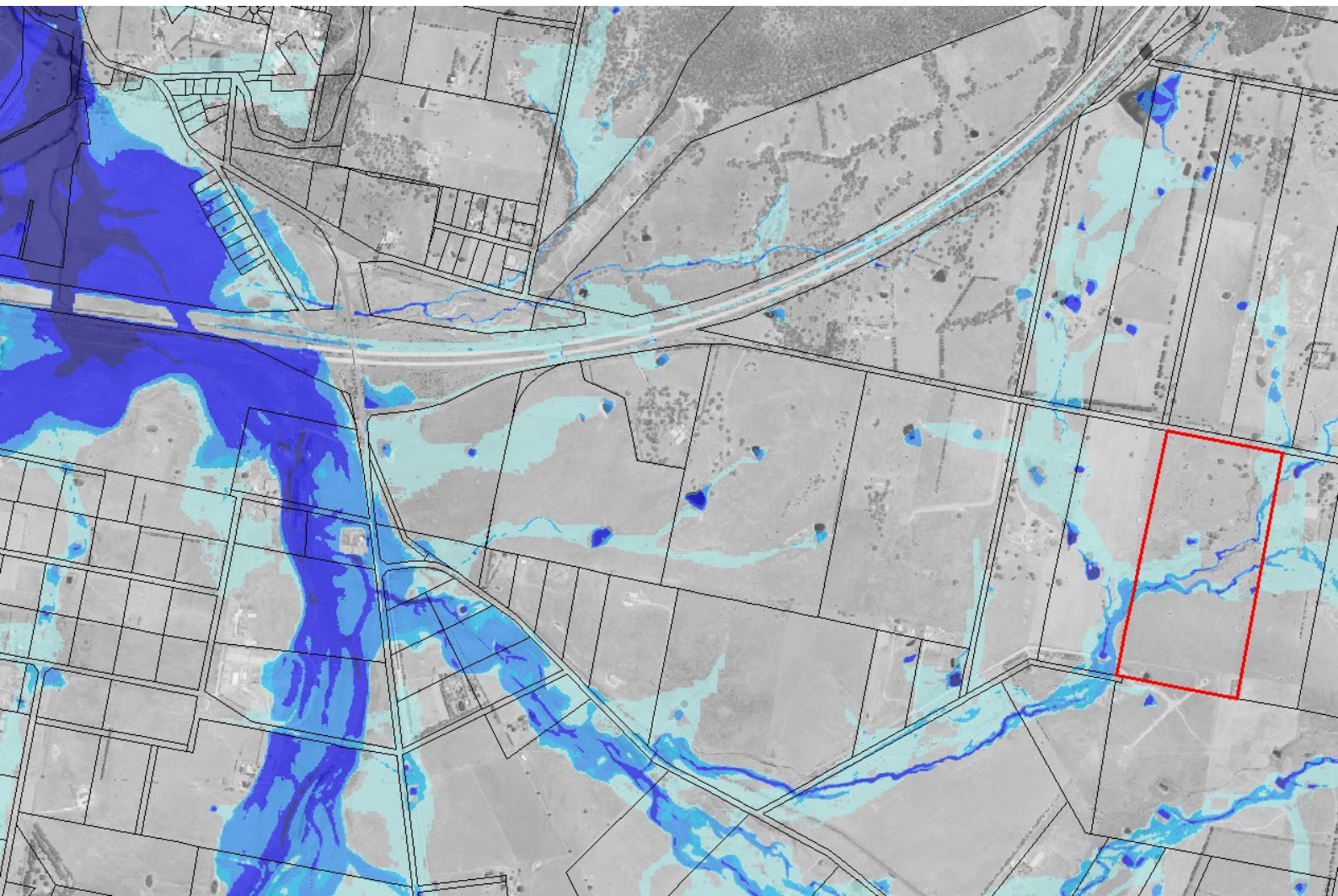


292 ROSEMONT ROAD, BOXERS CREEK PLANNING PROPOSAL - FLOOD ASSESSMENT

Rev B



December 2023





292 ROSEMONT ROAD, BOXERS CREEK PLANNING PROPOSAL - FLOOD ASSESSMENT

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EXECUTIVE SUMMARY

This Flood Assessment report has been prepared by GRC Hydro Pty Ltd on behalf of MMJ Real Estate Wollongong for 292 Rosemont Road, Boxers Creek (the site). A planning proposal is being prepared to amend the Goulburn Mulwaree Local Environmental Plan (LEP, 2009) to change the land use zoning at the site from RU6 Rural Transition to part R5 Large Lot Residential, C2 Environmental Conservation and the remaining land to retain the RU6 Rural Transition zone. A minimum lot size of 2 ha is proposed for the R5 zoned land, 20 ha to be retained on the RU6 zone and 100 ha for the C2 zone.

Flood modelling has been undertaken using Council's flood models, with the modelling of a range for flood events from the 10% AEP to the Probable Maximum Flood (PMF) assessed.

A zoning and lot layout strategy has been developed by KMJ Surveying Pty Limited with input from GRC Hydro to manage flood risk. The flood risk management strategy requires:

- Land within the Flood Planning Area (FPA) to be zoned as C2 Environmental Conservation (to comply with the Local Planning Direction);
- That future lots (post subdivision as a result of this planning proposal) provision for a building envelope that is situated outside of the PMF extent to ensure future dwellings are flood free during the PMF;
- That the internal access road layout is designed to provide site access to all lots for events up to the PMF; and
- No civil/roads works be allowed within the PMF extent as part of future design of the site.

It is the intent of Council to apply to an additional Local Provisions Clause in the LEP to restrict the siting of dwellings on flood prone land within the Brisbane Grove and Mountain Ash Precincts.

With implementation of the flood risk management strategy, flood risk is limited to risks associated with isolation as flooding of future dwellings cannot occur. Isolation of the site can occur due to flooding of access roads during events rarer than 0.2% AEP, with isolation noted for ~24 hours during the PMF event. The risks associated with isolation are:

- Secondary risks - Fire and medical emergencies which can occur during times of flood may be exacerbated by reduced potential for emergency services to access the site and
- Human behaviour - Residents who attempt to access Goulburn via flooded access roads could be subject to significant flood risk. Factors influencing this behaviour include inadequate provision of services, the occurrence of secondary risks, people attempting to access work / school or family etc.

Flood risk management measures to manage isolation risk are proposed and have been developed in consultation with Council, NSW Ambulance and the Rural Fire Service. These measures include:

- For Secondary Risks
 - Fire Emergency- The provision and maintenance of a Home Fire Safety Kit which includes as a minimum 1kg dry chemical powder fire extinguisher and wall bracket, fire extinguisher location sticker and fire blanket will be required for future dwellings

and will be implemented through requirements in the development control plan and Section 88b provisions.

- Medical Emergency – The provision and maintenance of an Automated External Defibrillator and First Aid Kit to reduce the risk of medical emergencies is required. This will be implemented through requirements in the development control plan and Section 88b provisions.
- For Human Behaviour:
 - Provision of adequate services - Provisions to access of adequate ablutions, water, power and basic first aid equipment will be required for future dwellings for the duration of flooding. Future proposed 2 ha lots will be largely self-contained with on-site sewerage treatment and portable water storage. Provision in the Section 88B certificate will also require domestic electricity generation and storage, as well as Automated External Defibrillator and First Aid Kit to reduce the risk/consequence of medical emergencies (which will also assist in managing Secondary Risks).
 - Notification of flood isolation risk - the site will be nominated as an area of Special Flood Considerations due to isolation risks. This will be defined in Council's DCP, and on Section 10.7 (2) and 88b certificates. These measures will notify property owners of the flood risk, and in particular the risk of isolation which will serve to increase community/property owner awareness which may assist in reducing the number of sensitive / at-risk populations living in the area through informed decision making and personal responsibility.

Residual secondary risks can be managed through existing risk management strategies which have been discussed with Ambulance NSW and the Rural Fire Service.

A compliance assessment of the planning proposal to the Local Planning Direction, Section 9.1 Direction 4.1 Flooding has been undertaken and the proposed rezoning of the site is considered compliant with these requirements.

1. INTRODUCTION

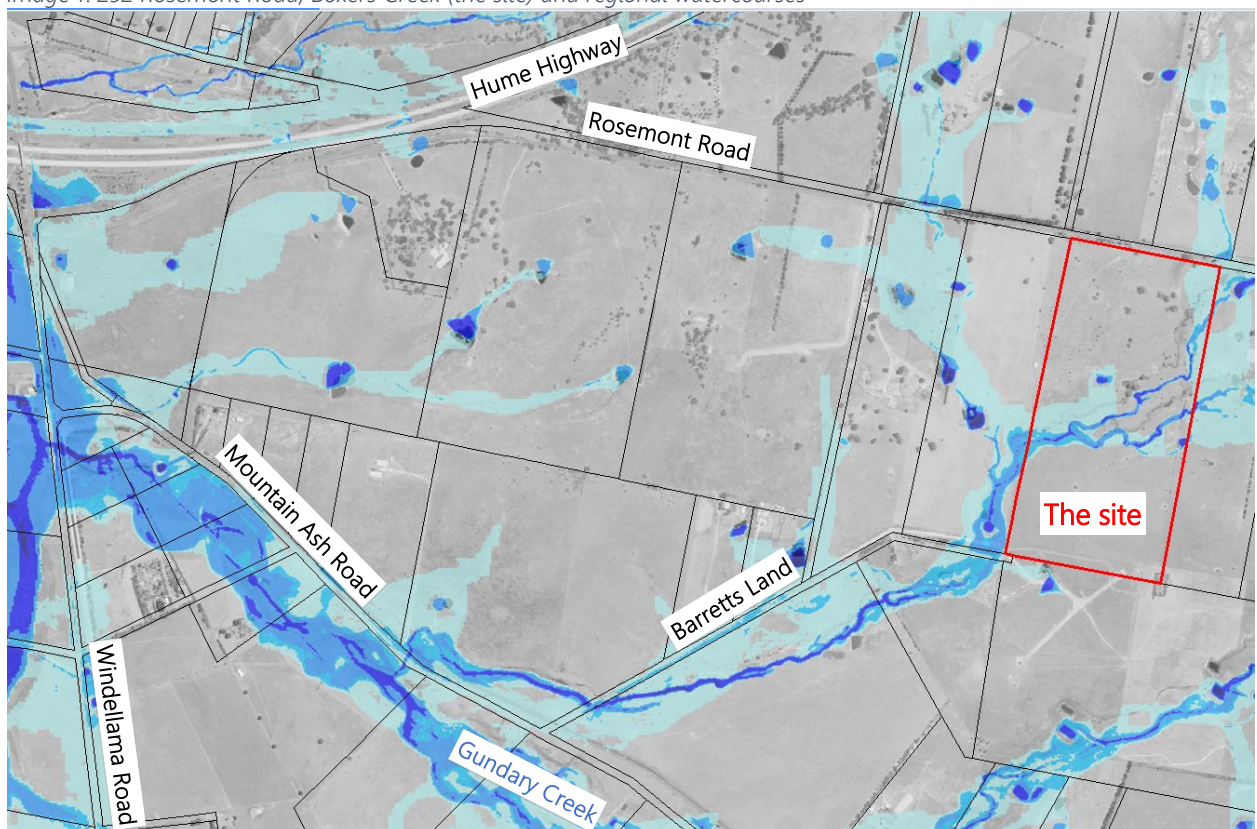
1.1 Background

This Flood Assessment report has been prepared by GRC Hydro Pty Ltd on behalf of MMJ Real Estate Wollongong for 292 Rosemont Road, Boxers Creek (the site). A planning proposal is being prepared to amend the Goulburn Mulwaree Local Environmental Plan (LEP, 2009) to change the land use zoning at the site from RU6 Rural Transition to part R5 Large Lot Residential, C2 Environmental Conservation and the remaining land to retain the RU6 Rural Transition zone. A minimum lot size of 2 ha is proposed for the R5 zoned land, 20 ha to be retained on the RU6 zone and 100 ha for the C2 zone.

1.2 Study Area

An unnamed ephemeral watercourse flows through the site in a westerly direction towards Gundry Creek and the Mulwaree River (see Image 1). The catchment area to the site is 3.9 km² with elevations ranging from ~740 to 650 mAHD. The region is predominantly rural in nature with few roads and houses and the Hume Highway to the north of the site. The Gundry Creek and Mulwaree River catchment areas are in the order of ~576 and 156 km² respectively, however, neither watercourse affects flooding at the site.

Image 1: 292 Rosemont Road, Boxers Creek (the site) and regional watercourses



1.3 Study Scope

This report has been prepared to respond to the Local Planning Directions, Section 9.1 (2), Clause 4.1 – Flooding and the policies and reference documents outlined in Section 1.4 of this report.

1.4 Policies and Reference Documents

The following policies and reference documents have been considered in preparation of this report:

Flood Prone Land Package

- Local Planning Directions, Section 9.1 (2), Clause 4.1 – Flooding
- Considering flooding in land use planning (2021)
- Planning Circular PS 21-006

Floodplain Risk Management Toolkit

- Flood Impact and Risk Assessment (LU01);
- Support for Emergency Management Planning (EM01)

Goulburn Mulwaree Local Environmental Plan (LEP) 2009

- Clause 5.21 - Flooding
- Clause 5.22 – Special flood considerations

Council Flood and Management Studies

- Wollondilly and Mulwaree Rivers Flood Study (WMAwater, 2016)
- Goulburn Floodplain Risk Management Study and Plan (GRC Hydro, 2021)
- Goulburn Overland Flow Modelling (GRC Hydro, 2021)
- Mountain Ash Road Precinct Flood Modelling (GRC Hydro, 2022)
- Marulan Flood Study (GRC Hydro, 2023)
- Marulan Floodplain Risk Management Study and Plan (GRC Hydro, ongoing)

1.5 Consultation

A summary of consultation undertaken in preparation of this report is outlined in Table 1.

Table 1: Summary of stakeholder consultation

Stakeholder Consulted	Date	Evidence of consultation
Ambulance NSW	24/8/23	Attachment A
Rural Fire Service (RFS)	24/8/23	Attachment A
NSW State Emergency Service (SES)	2/11/23	Attachment B
DPE Biodiversity and Conservation (BCD)	2/11/23	Attachment B

2. FLOOD RISK MANAGEMENT STRATEGY

A proposed flood risk managed strategy is presented herein, supporting mapping is included in Attachment C as outlined below:

- Proposed Land Zone maps that show the extent of rezoned land;
- A proposed site plan and lot configuration developed by KMJ Surveying Pty Ltd with input from GRC Hydro to manage flood risk.

The strategy implements the following flood risk management measures:

- Land within the Flood Planning Area (FPA) is zoned as C2 Environmental Conservation (to comply with the Local Planning Direction);
- Each proposed future lot allow for a building envelope that is situated outside of the PMF extent to ensure future dwellings are flood free during the PMF;
- The proposed internal access road layout is designed to be above the PMF flood level to provide site access for all lots;
- Access to the site is proposed via Rosemont Road, with no access to future dwellings proposed from Barretts Lane; and
- No civil/roads works are proposed within the PMF extent as part of future design of the site to ensure there are no adverse flood impacts to surrounding properties.

With implementation of the flood risk management strategy, flood risk is limited to risks associated with isolation as flooding of future dwellings cannot occur. The management of isolation risks are examined in Section 4.

The lot configuration results in a total of 4 future lots with a minimum lot size of 2 ha. The lots will not be connected to Council water and sewage mains and will be largely self-contained.

3. FLOOD IMPACT AND RISK ASSESSMENT

A Flood Impact and Risk Assessment prepared in line with requirements presented in the Flood Risk Management Guide LU01 (DPE, 2023) is detailed herein.

3.1 Overview of flood modelling analysis

3.1.1 Existing Conditions

The flood models associated with the Council studies described in Section 1.4 have been used as the basis of analysis. To define appropriate Existing Conditions modelling:

- The Goulburn Floodplain Risk Management Study and Plan (GRC Hydro, 2021) TUFLOW model was extended ~2 km upstream of the council flood model boundary on Gunday Creek to allow for flood results for the flood access route from the site to town.
- Mountain Ash Road Precinct Flood Model (GRC Hydro, 2022) was developed by extending the Goulburn Overland Flow Model (GRC Hydro, 2021) and was utilised without modification.

- The flood model result from the above studies were enveloped to show combined riverine and overland flow flood model results.

3.1.2 Proposed Conditions

As discussed in Section 2, no civil earthworks or road works are proposed within the PMF extent and therefore changes in flood behaviour due to loss of conveyance or storage will not occur. The effects of changes in imperviousness associated with potential future development are considered negligible in the context of the 730 km² catchment area for downstream watercourses and were not assessed in the flood model. As such the Proposed Conditions model was retained as per Existing Conditions and no modification of the flood model was deemed necessary to assess potential future development conditions at the site. This assumption would be confirmed during future subdivision of the site.

3.1.3 Climate Change

The impact of climate change on flood producing rainfall and resultant flooding has been considered. The assessment used the IPCC (Intergovernmental Panel on Climate Change) greenhouse gas concentration scenarios to estimate the effect of climate change on rare rainfall events. There are four IPCC greenhouse gas concentration projections named Representative Concentration Pathways (RCPs) 2.6, 4.5, 6.0 and 8.5, with the RCP 2.6 being the most optimistic and 8.5 the least optimistic. The ARR2019 methodology recommends the use of RCP 4.5 and 8.5 scenarios, and their projected increase in precipitation intensity was obtained from the ARR Data Hub and shown in Table 2 for the 2090 planning horizon.

Table 2: Climate Change Factors – Percentage Increase in Rainfall Intensity in 2090

Year	RCP 4.5	RCP 8.5
2090	+9.5%	+19.7%

Total rainfall depth for the 1%, 0.5% and 0.2% AEP events for the 1, 6 and 24 hour events were examined. It was noted that the 0.5% AEP rainfall event was ~13% greater than the 1% AEP event, and the 0.2% AEP event is 28% greater. Accordingly, these two events have been used as proxies for the assessment of potential changes in flood behaviour associated with climate change.

3.2 Analysis of Flood Model Results

3.2.1 Flood hazard

Flood hazard mapping has been developed through application of ARR2019 and Australian Emergency Management Institute (AEMI) flood hazard guidelines. The guidelines consider the threat to people, vehicles and buildings based on flood depth and velocity at a specific location. The AEMI flood hazard mapping can be used to assess the flood hazard for site occupants and proposed site usage, as well as for the community surrounding the site.

Image 2 and Table 3 present the relationship between the velocity and depth of floodwaters and the corresponding classification.

Image 2: Flood Hazard Curves (Australian Emergency Management Handbook 7)

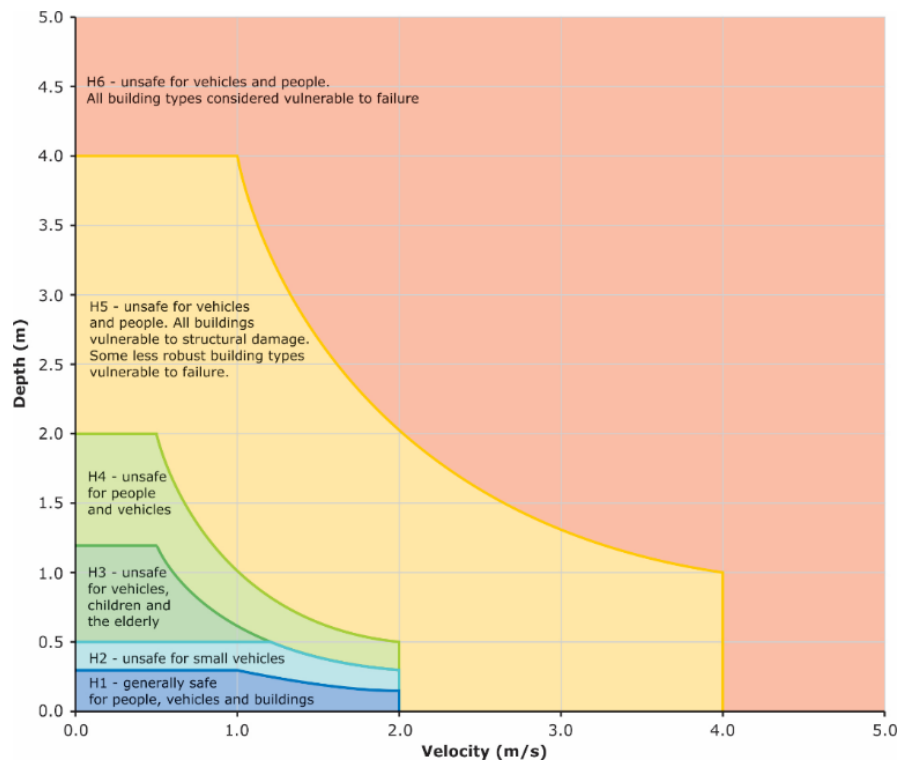


Table 3: Flood Hazard – Vulnerability Thresholds

Hazard Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles, children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

3.2.2 Hydraulic Categories

Hydraulic Categories (also known as Flood Function) refers to the classification of floodwaters into three categories; floodway, flood storage and flood fringe. These categories help to describe the nature of flooding across the floodplain and aid planning when assessing developable areas. According to the Australian Emergency Management Handbook 7, these three categories can be defined as:

- **Floodway** – the areas where a significant proportion of the floodwaters flow and typically align with defined channels. If these areas are blocked or developed, there will be significant redistribution of flow and increased flood levels across the floodplain. Generally, the flow conveyance are areas of deep and/or fast-moving floodwaters;
- **Flood Storage** – areas where, during a flood, a significant proportion of floodwaters extend into, water is stored and then recedes after a flood. Filling or development in these areas may increase flood levels nearby.

- Flood Fringe – areas that make up the remainder of the flood extent. Development in these areas are unlikely to alter flood behaviour in the surrounding area.

For overland flow flooding at the site the criteria proposed by Howells et. al. (2003) as reproduced in Image 3 was applied to the flood model results.

Image 3: Howells et. al. (2003) flood function criteria

Floodway:	Velocity x Depth > 0.25 m²/s AND Velocity > 0.25m/s OR Velocity > 1m/s AND Depth > 0.15m
Flood	Land outside the floodway where Depth > 0.5m
Storage:	
Flood Fringe	Land outside the floodway where Depth < 0.5m

3.2.3 Flood Planning Area

The Flood Planning Area (FPA) has been defined using the following methods:

- Mainstream flooding – The mainstream FPA on the main channel has been set as the extent of land below the Flood Planning Level which has been defined as the 1% AEP event plus 0.5 m freeboard.
- Overland flows – For overland flow paths the FPA has been determined using the methodology proposed for the Marulan FRMSP (GRC Hydro, ongoing) which defined the FPA as the extent of areas which act as a floodway, as well as areas where depths of inundation exceed 0.1 m in a 1% AEP event. This approach is consistent with that adopted in the nearby Yass FRSMP (Lyall, 2022).

3.3 Existing Conditions Results

Flood mapping for the site is presented in:

- *Figure A 1: 292 Rosemont Road, Boxers Creek - 10% AEP flood depths, levels & hazard*
- *Figure A 2: 292 Rosemont Road, Boxers Creek - 5% AEP flood depths, levels & hazard*
- *Figure A 3: 292 Rosemont Road, Boxers Creek - 1% AEP flood depths, levels & hazard*
- *Figure A 4: 292 Rosemont Road, Boxers Creek - 0.5% AEP flood depths, levels & hazard*
- *Figure A 5: 292 Rosemont Road, Boxers Creek - 0.2% AEP flood depths, levels & hazard*
- *Figure A 6: 292 Rosemont Road, Boxers Creek - 0.05% AEP flood depths, levels & hazard*
- *Figure A 7: 292 Rosemont Road, Boxers Creek - PMF flood depths, levels & hazard*
- *Figure B 1: 292 Rosemont Road, Boxers Creek – flood function*
- *Figure C 1: 292 Rosemont Road, Boxers Creek – Flood Planning Area*

The mapping shows that the 292 Rosemont Road has a mainstream flow path that passes through the site from the north-east corner from Rosemont Road to centre-western edge of the lot. An overland flow path from a farm dam discharges into the mainstream watercourse from the north.

During events from the 10% to 0.2% AEP floods, flow is largely confined to the mainstream channel, with shallow (<0.3) low hazard (H1) flood characteristics affecting the surrounding floodplain. During

the 0.05% AEP and PMF events flows breakout of the main channels and inundate the floodplain with depths of typically less than 1 m and hazard category of up to H5.

Areas of floodway are confined to the mainstream channel, outside of the concept lot boundaries. Floodplain flows are generally classified as flood fringe, with the exception of the farm dam near the centre of the site.

Potential future lots are noted to be situated outside of the flood planning area extent.

3.4 Developed Conditions Results & Flood Impact Assessment

As described in Section 3.1.2, changes to site conditions that impact on flood behaviour are not expected for the site, and accordingly the Existing Conditions results shown in Section 3.3 are considered representative of Developed Conditions. This would be confirmed during future subdivision of the site.

3.5 Flood Access

3.5.1 Internal site access

Internal site access from each lot to roads external to the site has been assessed. Review of the flood model results described in Sections 3.3 and 3.4 indicates that:

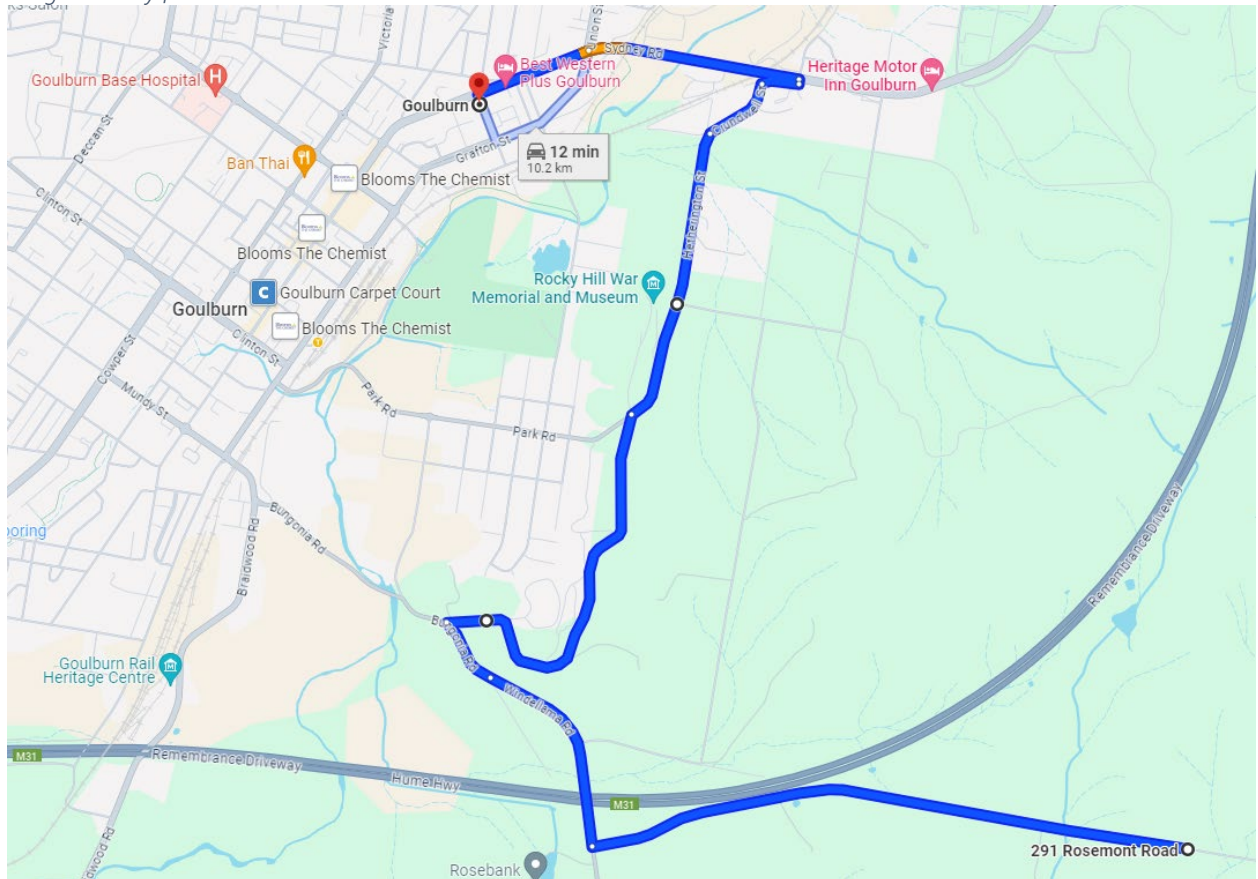
- Internal roads are flood free for events up to and including the PMF event; and
- The site access road connects to Rosemont Road in an area that is flood free during the PMF.

The above internal site access outcomes result in negligible flood risk to vehicles within the site, and importantly, allows for the development to benefit from road/bridge upgrades or community facilities that may be constructed in the future.

3.5.2 External site access

Important amenities and facilities are situated in Goulburn, with potential flooding of various access roads noted. The route to town that likely to be subject to the lowest flood liability is presented in Image 4.

Image 4: Likely flood access route to the site



* Source: Google Maps

The frequency and duration of road flooding along this route has been examined at the locations presented in Figure D 1, with the results presented in Table 4. Location 'A' is noted to be critical with a maximum inundation depth of 0.1 m noted for events up to and including the 0.2% AEP event and access to the site from Goulburn would be first lost in events rarer than this event. The road is expected to be inundated for a period of 24 hours during the PMF.

It should be noted that as described in Section 2, access to the site is proposed via Rosemont Road, with no access to future dwellings proposed from Barretts Lane.

Table 4: Frequency, depth and duration of inundation of the site access road

Location*	Events	Max Depth (m)	Duration of inundation (hours)	Duration with depth > 0.3 m
A	10%	-	-	-
	5%	-	-	-
	1%	0.05	0.9	-
	0.5%	0.07	1.1	-
	0.2%	0.10	2.2	-
	PMF	0.42	3.0	-
B	10%	-	-	-
	5%	-	-	-
	1%	-	-	-
	0.5%	0.00	0.1	-
	0.2%	0.01	0.7	-
	PMF	0.24	1.3	-
C	10%	-	-	-
	5%	-	-	-
	1%	-	-	-
	0.5%	-	-	-
	0.2%	-	-	-
	PMF	5.10	24.3	22.6
D	10%	-	-	-
	5%	-	-	-
	1%	-	-	-
	0.5%	-	-	-
	0.2%	-	-	-
	PMF	0.7	8.9	4.5
E	10%	-	-	-
	5%	-	-	-
	1%	-	-	-
	0.5%	-	-	-
	0.2%	-	-	-
	PMF	1.87	14.1	13.1

* for point locations see Figure D 1.

3.5.3 Joint probability of lost site access and secondary risks

A high-level joint probability analysis which examines the joint probability of isolation and the occurrence of secondary risks (see Section 4.1) is presented. Joint probability refers to the understanding of the probability of coincidence of two or more stochastic variables. For this assessment these variables are:

- The frequency and duration that site access to Goulburn is lost due to flooding of access roads; and
- The occurrence of a Secondary Risk such as a medical or fire emergency.

The degree of correlation of these variables is key to understanding the joint probability, with variables having the potential to be anywhere from:

- Perfectly correlated - in this case, this would mean that every time the access road floods, a fire or medical emergency would occur; to
- Independent - the chance of a fire or medical emergency happening when access roads are flooded is no more or less than when the road is not flooded.

To determine the correlation of these variables, a request was made to the NSW SES and DPE BCD teams (see Section 1.5) to provide studies/literature presenting correlation parameters so that a joint probability analysis could be undertaken. The documents were examined and were noted to provide anecdotal information or fires occurring during floods and evidence of delayed emergency response. However, none of the documents demonstrated correlation of the occurrence of secondary risks during a flood that would be suitable for identification of correlation parameters.

Anecdotally, and as notified by the NSW SES (correspondence dated 15 November 2023):

- Fire emergencies – show that, *'The probability of a fire occurring on a site whilst it was isolated and surrounded by floodwaters would be greater due to power surges, electrical faults and the use of ad hoc heating and lighting measures such as candles';* and
- Medical emergencies – may experience, *'Ambulance response times are critical to ensuring the survival of a patient, for example a person who suffers a heart attack has double the chance of surviving if they get to a hospital within an hour of feeling the symptoms. During flood events, the normal average response time of 15 minutes (day) to 30 minutes (night) is likely to increase.'*

These risks are acknowledged; however, they do not demonstrate correlation and are noted not to be directly applicable to the site due to the proposed flood risk management strategy (Section 2) and the flood risk management measures presented in Section 4. In particular, for fire emergencies:

- no properties will be surrounded by flood water as they are outside of the PMF extent (Section 2) which will reduce the risk of power surges and electrical faults; and
- proposed requirements to provide domestic electricity generation and storage, independent of mains power to ensure adequate electricity supplies during periods of isolation are required (Section 4.3.1.2) so the likelihood of 'ad hoc' heating and lighting are reduced.

The joint probability of flooding and secondary risks is clearly an area which requires further studies to understand correlation risks. However, based on the available information and the lack of inundation of future dwellings at the site (all dwellings will be hundreds of meters away from the flood extent for most events), it is considered reasonable to assume that the correlation of secondary risks and flooding of access roads are not, or very weakly, correlated.

Based on the above, a high-level joint probability assessment was undertaken assuming independence of the variables. The analysis is presented in Table 5 and shows that the probability that one (or more) of the future site dwellings or occupants will experience either a fire or medical emergency whilst access roads are inundated is estimated to be $4.4 \times 10^{-4}\%$ AEP. This estimate assumes independence of variables and likely does not assess all potential risk. However, the estimated probability is indicative, and it is likely that the true probability is extremely rare due to the frequency at which the site becomes isolated and the small number of proposed future dwellings/occupants (see Section 2).

Table 5: High-level joint probability assessment

Variable	AEP*	DEP**	Comment
Isolation Occurring	<0.2% AEP	$5.5 \times 10^{-4}\%$	Probability of isolation due to flooding of access roads.
Average chance of medical emergency	7.8%	0.022%	Average daily number of emergency department presentation at Goulburn Hospital = 7 (https://www.aihw.gov.au/reports-data/myhospitals/hospital/h0142) Population of Goulburn = 32,294 (census)
Average chance of fire emergency	0.13%	0.0004%	Average annual number of NSW house fires = 4,500 (https://www.fire.nsw.gov.au/page.php?id=9216) Number of NSW dwellings is ~3,364,770 (census)
Combined Probability (assuming independence of the variables)			
Road flooding & medical emergency	-	$1.2 \times 10^{-7}\%$	Occurrence of a medical emergency whilst access roads to the site are flooded.
Road flooding & fire emergency	-	$2.2 \times 10^{-9}\%$	Occurrence of a fire emergency whilst access roads to the site are flooded.
Site Characteristics			
Number of occupants	10		Assumed 2.5 people per dwelling as per Goulburn average (census)
Number of dwellings	4		See site lot layout in Section 2.
Binomial Distribution Calculations			
Chance of medical emergency at the site whilst isolated	$4.4 \times 10^{-4}\%$	$1.2 \times 10^{-6}\%$	The estimated probability of a medical emergency occurring for one or more future occupants whilst access roads are flooded and the site is isolated.
Chance of fire emergency at the site whilst isolated	$3.2 \times 10^{-6}\%$	$8.8 \times 10^{-9}\%$	The estimated probability of a fire emergency occurring for one or more future dwellings whilst access roads are flooded and the site is isolated.
Total Probability	$4.4 \times 10^{-4}\%$		1 in 200,000 AEP

*AEP = Annual Exceedance Probability,

**DEP = Daily Exceedance Probability (use of the DEP for this analysis is conservative as the modelling has shown road flooding for most events is in the order of hours, not days)

Whilst the probability of a secondary risks occurring whilst the site is isolated is expected to be very low, it must be acknowledged that the potential consequence of such an event could be significant due to risk to life potential. Accordingly, flood risk management measures are proposed to reduce risk and are presented in Section 4.

3.6 Flood Emergency Response Classifications

The Flood Emergency Response Classification (FERC) for the site has been determined based on 'Figure 18' of 'Support for Emergency Management Planning (EM01)' which is reproduced in Image 5. The site has 'No flood impacts' for events up to the 0.2% AEP flood (see in blue below). For extreme events, when access roads are flooded (see Section 3.5.2), the classification becomes 'High trapped perimeter' as flooding of the site will not occur but there is a flooded access route (see in red below).

Image 5: Flow chart for determining detailed flood emergency response classifications (from Figure 18 or EM01)

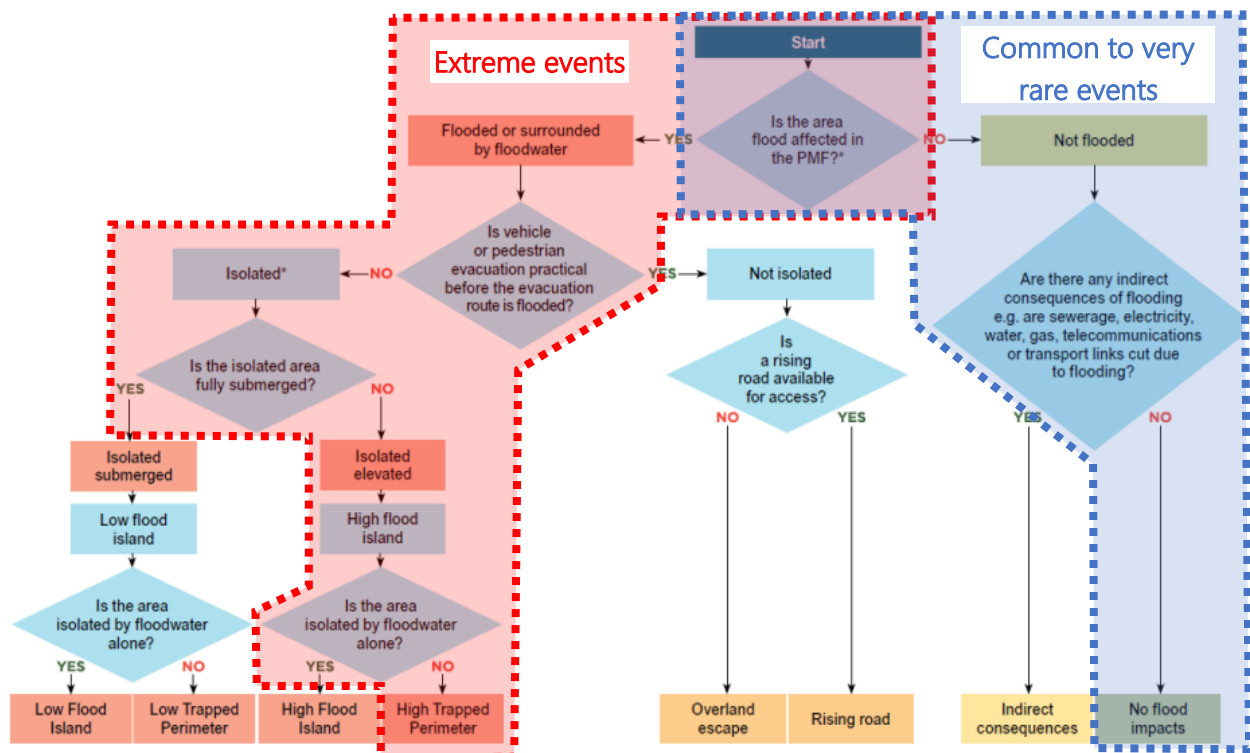


Figure 18 Flow chart for determining detailed flood emergency response classifications

3.7 Flood Warning

Catchment response times on Gundry Creek and its tributaries that pass through the site are short and classified as flash flood catchments. Flash flooding can be defined as flooding occurring ‘... within 6 hours of the precipitating weather event, and often involves rapid water level changes and flood water velocity. This definition excludes flooding caused by dam failure, storm surge or tsunami although similar emergency management principles may apply to these events’ (AFAC 2018). Due to the flash flood nature of these watercourses, little warning of an impending flood is available.

As mentioned in Section 3.5.2, flooding of key access roads due to Mulwaree River flooding may occur during the PMF. Section 8.7 of the Goulburn FRSMP describes available flood warning for Goulburn. It notes that the Local Flood Plan (2012) states that ‘flooding of both rivers in the Goulburn area, that warning times are generally short – in the order of hours following heavy rainfall in the catchments’. The LFP notes that the time from the onset of heavy rainfall to flooding in the town is about 13 hours for the Mulwaree River. The FRSMP extracted the time between the end of a rainfall burst and the flood peak from the flood model for the 5%, 1% AEP and PMF events, with the results reproduced in Table 6.

Table 6: Approximate time from end of a rainfall burst to flood peak at Goulburn (reproduced from Table 28 of the FRSMP)

Catchment	5% AEP Travel Time	1% AEP Travel Time	PMF Travel Time
Mulwaree	8.7 h	5.5 h	2.5 h

Due to the rapid response time of the Mulwaree River PMF, there is little warning of flooding of access roads to the site available during extreme flood events.

4. FLOOD RISK MANAGEMENT MEASURES

Flood risk management measures that respond to the flood impact and risk assessment presented in Section 3 are detailed in the following sections.

4.1 Risk Management Measures Summary

As discussed in Section 2, the flood risk management strategy is likely to result in ~4 future lots with a minimum lot size of 2 ha. The lots will not be connected to Council water and sewage mains and will be largely self-contained.

A summary of potential flood risks associated with future development of the site is outlined in Table 7 with an associated risk rating estimate. For each risk, a risk management measure is presented, along with a revised risk rating estimate and reference to ensuing sections where further details of the risk management measures are presented.

The managed flood risk ratings are noted to be predominately classified as 'none' or 'very low'. A 'low' risk rating is associated with potential isolations due to flooded access roads which results in potential risks associated with human behaviours and secondary risks.

Various risk management measures are proposed as part of this analysis which will reduce this risk. Residual risk would be managed by existing risk management measures that were identified by stakeholder consultation (see Section 1.5) for isolated rural communities.

Table 7: Flood risk assessment summary

#	Risk	Description	Risk Rating	Management measure	Managed Risk Rating*	Section Reference
1	Flood risk to future dwellings	Significant flood depths with high hazard flood conditions (H6) occur on the site during the PMF. Potential risk to future dwellings if development is proposed in areas subject to high hazard conditions during extreme flood events.	Very High	Land within the Flood Planning Area will be rezoned to C2 Environmental Conservation which will reduce development potential for events up to approximately 0.2% AEP. Additionally, special provisions in Council's flood planning policy are proposed to ensure that the flood risk management strategy proposed by the site plan and lot layout/building envelopes (see Section 2) will be implemented for future sub-division of the site. This will ensure future dwellings are outside of the PMF extent.	None	4.2
2	Flood risk to vehicles within the site	Significant flood depths with high hazard flood conditions (H6) occur on the site during the PMF. Potential risk of flooding of internal access roads causing isolation during extreme flood events.	High	The strategies proposed by the indicative site plan and flood risk management strategy (Section 2) ensure that internal access roads are outside of the PMF extent. The strategy ensures that that future lots would not be isolated within the site which allows for the developments to benefit from road works/risk management measures that may be undertaken by Council in the future. This outcome is proposed to be enforced for future sub-division of the site through special provisions in Council's planning policy.	None	4.2
3	Flood impacts affecting adjoining properties	Civil works within the flood extent can result in loss of flood storage or conveyance. Significant changes in land use can result in reduced infiltration and increase runoff flows and volumes.	Moderate	No civil works proposed within the PMF extent. Change in land use is negligible relative to catchment size. Impact assessment shows limited offsite flood impacts. The above-mentioned special provisions in Council's planning policies will ensure that future works will occur outside of the PMF extent and can therefore not impact on flood behaviour.	Very low	4.2
4	Potential for isolation due to flooded access roads	Flooding of access roads may result in isolation of the site during events rarer than 0.2% AEP. Lost site access is expected for ~24 hours in the PMF.	Low	Proposed management measures to address isolation are considered in Section 4.3 and include: <ul style="list-style-type: none"> • Secondary flood risk management measures developed in consultation with the Rural Fire Service and Ambulance NSW; • Provision of adequate services as required by EM01, including 'access to ablutions, water, power and basic first aid equipment and availability of onsite systems to provide for power, water and sewage services'. • Provision of flood warning signage and depth markers at key flooded access roads to reduce the risk of vehicles entering flood waters; • Notification of isolation risk in Council's flood planning policies and Section 88b certificates to increase preparedness and reduce the number of sensitive / at-risk populations living in the area. <p>It should be noted that there are also existing risk management measures already in place for isolated communities. These measures would be used to manage residual flood risk where proposed measures fail.</p>	Very Low	4.3
5	Climate change sensitivity	Climate change is expected to increase rainfall intensity. This may result in larger flood events relative to present day climate conditions.	Moderate	See management measures described in #1 and #2.	Very low	4.2
6	Change in flood function of the land	Civil works within the flood extent can result in loss of flood storage or conveyance. This can result in flood impacts affecting surrounding properties.	Moderate	Land within the FPA will be zoned as C2 Environmental Conservation which will limit development within the 1% AEP extent. Further, no civil works are proposed within the PMF extent and therefore no change in flood function is proposed.	None	4.2
7	Potential for cumulative impacts	Cumulative flood impacts affecting existing properties can occur if multiple similar developments are proposed.	Moderate	No civil works proposed within the PMF extent. Change in percentage imperviousness is negligible due to proposed large lot residential zoning type and limited development extent controlled by the concept building envelopes.	Very low	4.2

* Risk profile assuming management measures are fully implemented.

4.2 Management of Risk by Special Provisions in Council Planning Policy

Flood risk at the site is significantly reduced by the indicative site plan and flood risk management strategy proposed in Section 2. The strategy will result in:

- No risk to future dwelling as they are required to be situated outside of the PMF extent;
- No risk to vehicles within the site as all access roads are required to be outside of the PMF extent;
- Very low risk of the development being impacted by climate change as future dwellings are situated outside of the PMF extent;
- Very low risk of adverse flood impacts (including cumulative impacts) to surrounding areas as all development will be outside of the PMF extent;
- No risk that future development will be incompatible with the flood function of the land as all development will be outside of the PMF extent.

To ensure that the strategy is implemented at the Development Application (DA) stage for future subdivision of the land, two strategies outlined in Table 8 are currently under investigation by Council. It is the intent of Council to apply to an additional Local Provisions Clause in the LEP to restrict the siting of dwellings on flood prone land within the Brisbane Grove and Mountain Ash Precincts.

Table 8: Strategies to ensure that the flood management strategy is enforced for future site development

LEP Local Provisions Clause	DCP Clauses linked to LEP Clause 5.22
<p>Advice is being sought from Council's DPE liaison and Parliamentary Counsel to determine the feasibility of including new Local Provisions Clauses in Part 7 of the LEP (2009). Example clauses are shown below:</p> <p><i>'Clause 7.7 Restrictions on dwellings on flood prone land in the Brisbane Grove and Mountain Ash Precincts</i></p> <p><i>1. The objective of this clause is to enable the safe occupation of dwelling houses on land within the Brisbane Grove and Mountain Ash Precincts during the full range of possible flood events.</i></p> <p><i>2. Development consent must not be granted for dwelling houses within flood prone land (including the Probable Maximum Flood extent) on land within the Brisbane Grove and Mountain Ash Precincts as identified on the Precinct Area Map.'</i></p>	<p>An alternative strategy is being considered which would:</p> <ul style="list-style-type: none"> • Identify the site in the DCP as requiring special flood considerations related to the evacuation of people; • Reference the land as requiring compliance with LEP (2009) Clause 5.22 Special Flood Considerations; • Future DAs would need to show that building envelopes are above the PMF and would be enforced via an 88B restriction on the title of future lots.

4.3 Management of Isolation Risks

As described in Section 3.6, the site has 'No flood impacts' for events up to the 0.2% AEP flood but for extreme events, when access roads are flooded (see Section 3.5.2), the classification becomes 'High trapped perimeter. 'Support for Emergency Management Planning (EM01)' states that the 'primary strategy for the NSW SES is evacuation of people to an area outside of the effects of flooding

that has adequate facilities to maintain the safety of the community'. The effects of flooding are noted not only to be experienced by areas subject to inundation, but also areas which isolated due to flooded access roads. Isolation is noted to cause issues for evacuation, the provision of adequate services and the potential for secondary risks. Measures to manage these risks are considered in the following sections. Synergies between the various risk management measures are also discussed.

4.3.1 Proposed Risk Management Measures

4.3.1.1 Secondary flood risk management measures

EM01 states, '*To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding*'. Consultation with the Rural Fire Service and NSW Ambulance was undertaken (see Section 1.5) with proposed secondary risk management measures discussed as outlined below:

- Fire Emergency- The provision and maintenance of a Home Fire Safety Kit which includes as a minimum 1kg dry chemical powder fire extinguisher and wall bracket, fire extinguisher location sticker and fire blanket is required.
- Medical Emergency – The provision and maintenance of an Automated External Defibrillator and First Aid Kit to reduce the risk of medical emergencies is required.

These risk management measures will be implemented for future development in the Brisbane Grove and Mountain Ash Precinct through requirements in the development control plan and Section 88b provisions.

Synergies

- The Section 88b requirement to provision for fire and medial emergencies will notify property owners of the isolation risk (see Section 4.3.1.3).
- Provision for fire and medical emergencies will reduce the impact on existing risk management measures and emergency services (see Section 4.3.2).

4.3.1.2 Provision of adequate services

EM01 states that '*Access to ablutions, water, power and basic first aid equipment and availability of onsite systems to provide for power, water and sewage services for the likely flood duration (plus a further period of back-up to allow for restoration of external services), needs to be considered for the community. The need for access during a flood or ability to quickly recover these services afterwards must be considered depending on the strategy*'. To achieve this outcome, the following management measures are proposed:

- Ablutions - The site is not proposed to be connected to Council's wastewater treatment system. On-site sewage treatment will be situated on site outside of the FPA with very low risk of flooding. The proposed zoning of the site in line with the Local Planning Directions will ensure this outcome.
- Water - The site is not proposed to be connected to Council's water mains and future dwellings will be required to have rainwater tanks to provide portable water.

- Power - Council have agreed that future development in the Brisbane Grove and Mountain Ash Precinct will have a requirement through development control plan and S88b provisions to provide domestic electricity generation and storage, independent of mains power to ensure adequate electricity supplies are provided during periods of isolation.
- Basic first aid - Council have agreed that future development in the Brisbane Grove and Mountain Ash Precinct will have a requirement through development control plan and S88b provisions to provide and maintain an Automated External Defibrillator and First Aid Kit to reduce the risk/consequence of medical emergencies.

Synergies

- Provision of adequate power will reduce the risk of people using unsafe heating appliances, which will reduce carbon monoxide poisoning and house fire risks and thus impact on emergency services (see Section 4.3.2).

4.3.1.3 Notification of flood isolation risk

As described in Section 4.2, the site will be nominated as an area of Special Flood Considerations due to isolation risks. This will be defined in Council's DCP, and on Section 10.7 (2) and 88b certificates.

These measures will notify property owners of the flood risk, and in particular the risk of isolation. Community/property owner awareness may assist in reducing the number of sensitive / at-risk populations living in the area through informed decision making and personal responsibilities.

4.3.2 Existing Risk Management Measures

Consultation with emergency services (see Section 1.5) identified that there are various existing risk management measures in place that manage residual risks to isolated communities. These measures include:

Medical Emergency

- Aerial evacuation to a medical facility;
- Boat access provided with assistance by the NSW SES;
- Assistance by RFS using trucks to access flood waters that are not trafficable by an ambulance.

Fire Emergency

- There is an alternate brigade south of the planning proposal is Gundry Brigade located at Braidwood Road, Turraville.

The proposed risk mitigation measures for the site will minimise impacts to increases in emergency service requirements. However, a residual risk will remain which can be managed through these existing measures.

5. LOCAL PLANNING DIRECTIONS - FLOODING

A compliance assessment to the Local Planning Direction, Section 9.1 Direction 4.1 Flooding requirements is presented in Table 9. The proposed rezoning of the site is considered to be consistent with the requirements.

Table 9: Local Planning Direction, Section 9.1 Direction 4.1 Flooding requirements

Cl.	Requirement	Compliant	Comment
(1)	A planning proposal must include provisions that give effect to and are consistent with:		
(a)	the NSW Flood Prone Land Policy	Yes	Consideration of a range of flood events up to the PMF, including flood hazard and flood function classification, has been undertaken. Further, site access and the potential for isolation and emergency vehicle access issues are considered. The analysis and findings are consistent with the objectives of the NSW Flood Prone Land Policy.
(b)	the principles of the Floodplain Development Manual 2005	Yes	The FDM (2005) is superseded by the Flood Risk Management Manual (2023). The Manual (2023) and its relevant subsidiary documents listed in Section 1.4 have been considered in preparation of this document.
(c)	the Considering flooding in land use planning guideline 2021	Yes	The key focus of this guideline is the consideration of flood risk for events up to the PMF when undertaking strategic land use planning. As described in Section 4.2, special provisions in Council's flood policy are proposed to manage flood risk for future dwellings for events up the PMF.
(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	Yes	The council flood and floodplain risk management studies detailed in Section 1.4 have been used in preparation of this document.
(2)	A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Employment, Mixed Use, W4 Working Waterfront or Special Purpose Zones.	Yes	Land in the flood planning area is proposed to be rezoned to C2 Environmental Conservation.
(3)	A planning proposal must not contain provisions that apply to the flood planning area which:		
(a)	permit development in floodway areas	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit

			development potential within the FPA such that development will not be situated in floodway areas.
(b)	permit development that will result in significant flood impacts to other properties	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA such that development will not impact on other properties.
(c)	permit development for the purposes of residential accommodation in high hazard areas	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA which will ensure that residential accommodation will occur in high hazard areas.
(d)	permit a significant increase in the development and/or dwelling density of that land	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA.
(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,	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA which will ensure that sensitive and critical uses will not be permitted.
(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,	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA and will ensure that consent will be required for future development.
(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	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA and will ensure that there will not be a need to significantly increase government spending to manage flood risk.
(h)	permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.	Yes	Land within the FPA will be rezoned to C2 Environmental Conservation. This will limit development potential within the FPA and ensure that hazard industries, storage and materials will not be permitted in this area.
(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:		Areas of the site that are situated between the FPA and the PMF have been nominated as requiring Special Flood Considerations. As described in Section 5.2, special provisions in Council's flood policy are proposed to ensure that future development does not occur within the PMF extent. The risk of isolation has been

			considered with management measures presented. As such:
(a)	permit development in floodway areas,	Yes	Development will not occur in floodway areas.
(b)	permit development that will result in significant flood impacts to other properties,	Yes	No development will occur within the PMF extent and impacts to other properties are not expected.
(c)	permit a significant increase in the dwelling density of that land,	Yes	No development will occur within the PMF extent. The proposed R5 zoning will allow for a minimum 2 ha lot size which is low density.
(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,	Yes	No development will occur within the PMF extent and these uses are not proposed for the site.
(e)	are likely to affect the safe occupation of and efficient evacuation of the lot, or	Yes	No development will occur within the PMF extent and evacuation due to direct flood risk is not required. Flood management measures to manage isolation risk are presented. Future development of the site is will allow for safe occupation and efficient evacuation.
(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.	Yes	Proposed risk management measures outlined in Section 4.3.1 do not require significant spending to implement. For this reason, future development of the site will not significantly increase government spending requirements.
(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.	Yes	The methods for determining the Flood Planning Area (FPA) are outlined in Section 3.2.3 and are consistent with Council's FRMMP and the FDM (2005).

Table 9 shows that the proposed rezoning of the site is considered to be consistent with the Local Planning Direction, Section 9.1 Direction 4.1 Flooding requirements.

6. CONCLUSIONS

This Flood Assessment report has been prepared by GRC Hydro Pty Ltd on behalf of MMJ Real Estate Wollongong for 292 Rosemont Road, Boxers Creek (the site). A planning proposal is being prepared to amend the Goulburn Mulwaree Local Environmental Plan (LEP, 2009) to change the land use zoning at the site from RU6 Rural Transition to part R5 Large Lot Residential, C2 Environmental Conservation and the remaining land to retain the RU6 Rural Transition zone. A minimum lot size of 2 ha is proposed for the R5 zoned land, 20 ha to be retained on the RU6 zone and 100 ha for the C2 zone.

Flood modelling has been undertaken using Council's flood models, with the modelling of a range for flood events from the 10% AEP to the Probable Maximum Flood (PMF) assessed.

A zoning and lot layout strategy has been developed by KMJ Surveying Pty Limited with input from GRC Hydro to manage flood risk. The flood risk management strategy requires:

- Land within the Flood Planning Area (FPA) to be zoned as C2 Environmental Conservation (to comply with the Local Planning Direction);
- That future lots (post subdivision as a result of this planning proposal) provision for a building envelope that is situated outside of the PMF extent to ensure future dwellings are flood free during the PMF;
- That the internal access road layout is designed to provide site access to all lots for events up to the PMF; and
- No civil/roads works be allowed within the PMF extent as part of future design of the site.

With implementation of the flood risk management strategy, flood risk is limited to risks associated with isolation as flooding of future dwellings cannot occur. Isolation of the site can occur due to flooding of access roads for events rarer than 0.2% AEP, with isolation noted for ~24 hours during the PMF event.

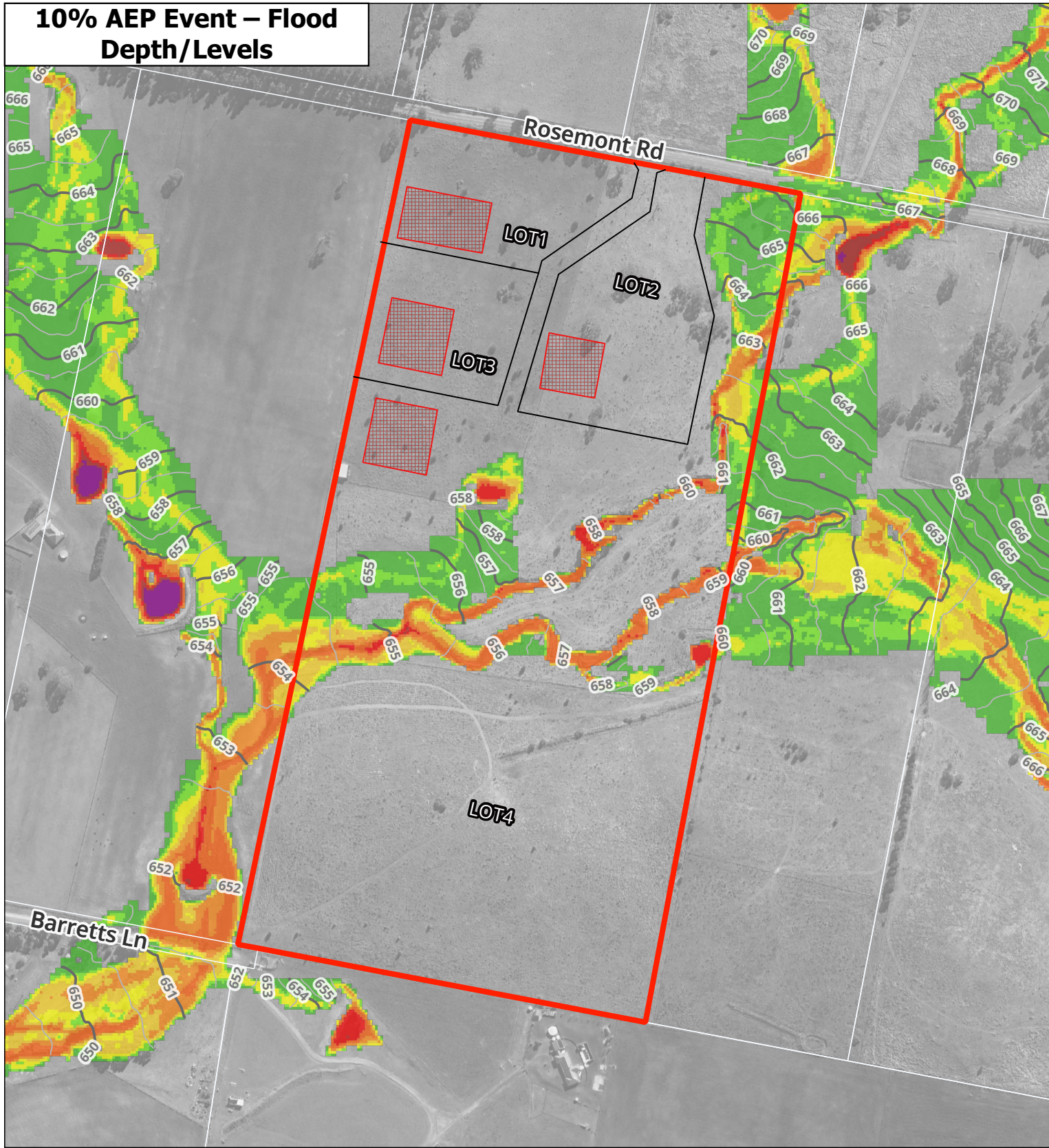
Flood risk management measures to manage isolation risk are proposed and have been developed in consultation with Council, NSW Ambulance and the Rural Fire Service.

Residual secondary risks can be managed through existing risk management strategies which have been discussed with Ambulance NSW and the Rural Fire Service.

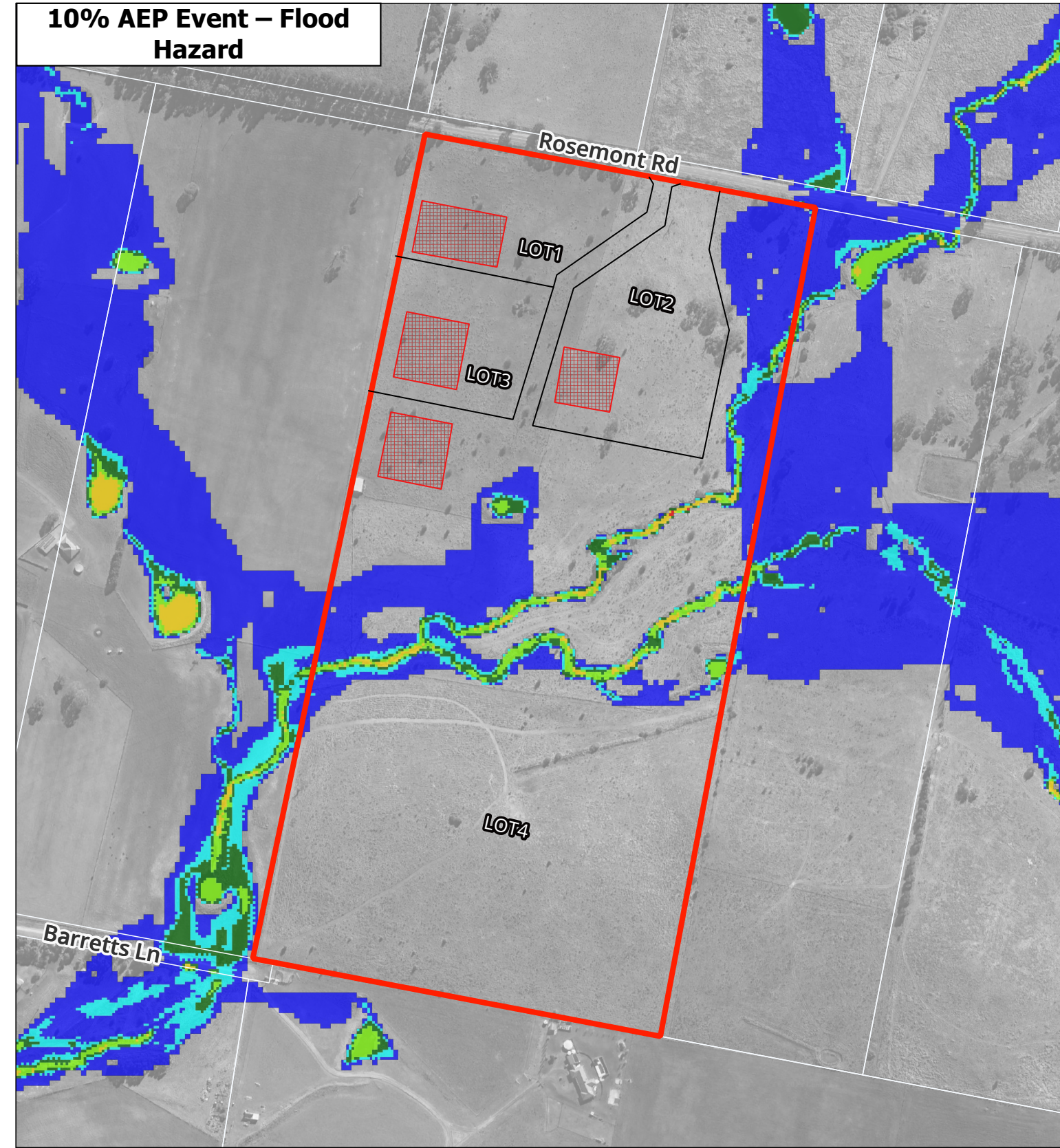
A compliance assessment of the planning proposal to the Local Planning Direction, Section 9.1 Direction 4.1 Flooding has been undertaken and the proposed rezoning of the site is considered consistent with these requirements.

Figures

10% AEP Event – Flood Depth/Levels



10% AEP Event – Flood Hazard

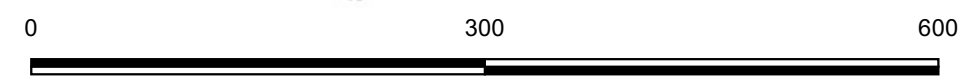


- Subject Site
- Cadastral Boundaries
- Concept Lot Layout
- Concept Building Envelopes

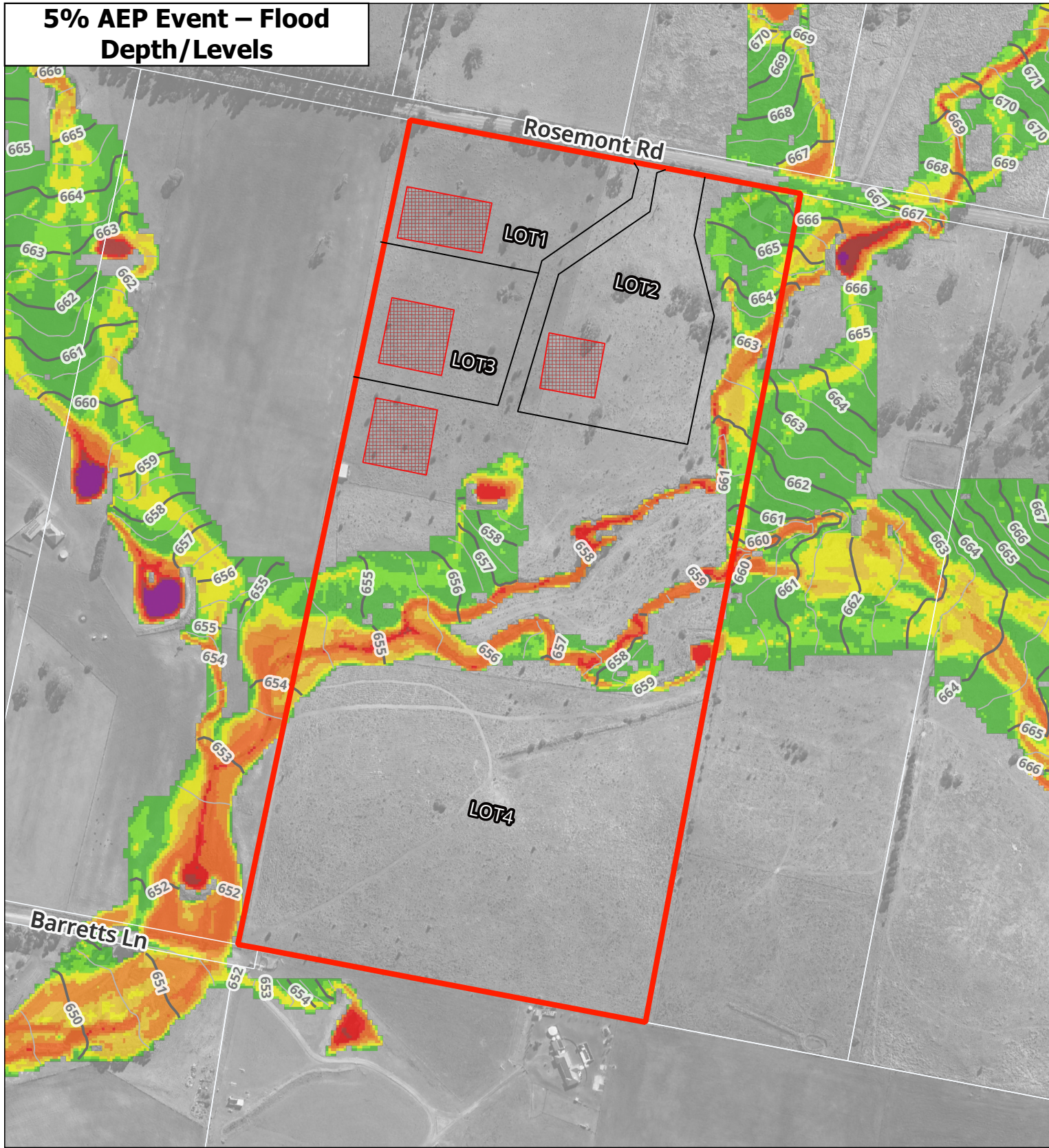
- Flood Depths (m)**
- 0 - 0.05
 - 0.05 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.3
 - 0.3 - 0.5
 - 0.5 - 1.0
 - 1.0 - 1.5
 - 1.5 - 2.0
 - > 2.0

- Minor Flood Level Contours (Spacing = 0.5 m)
- Major Flood Level Contours (Spacing = 1 m)

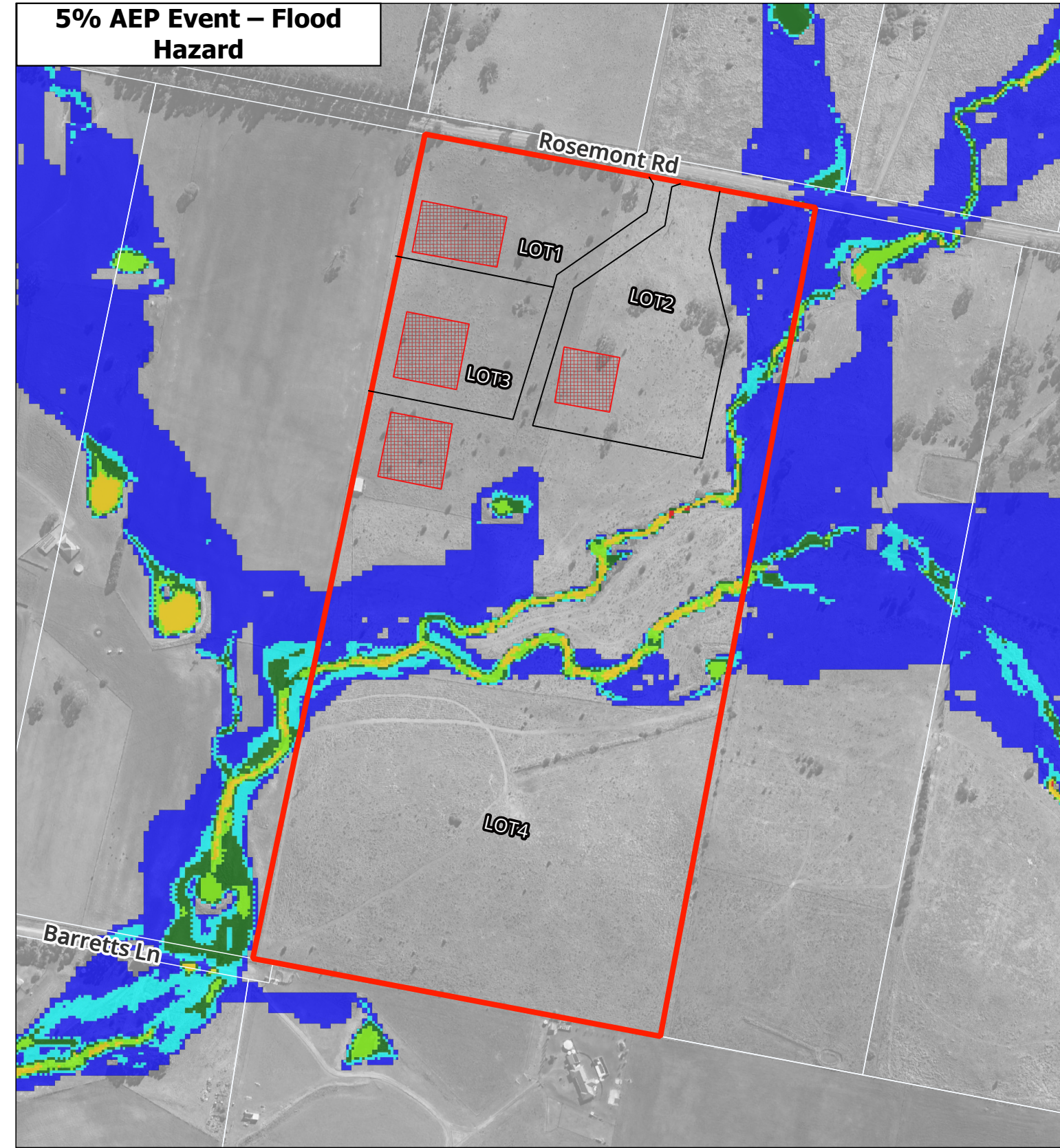
- Flood Hazard Category**
- H1
 - H2
 - H3
 - H4
 - H5
 - H6



5% AEP Event – Flood Depth/Levels



5% AEP Event – Flood Hazard



- Subject Site
- Cadastral Boundaries
- Concept Lot Layout
- Concept Building Envelopes

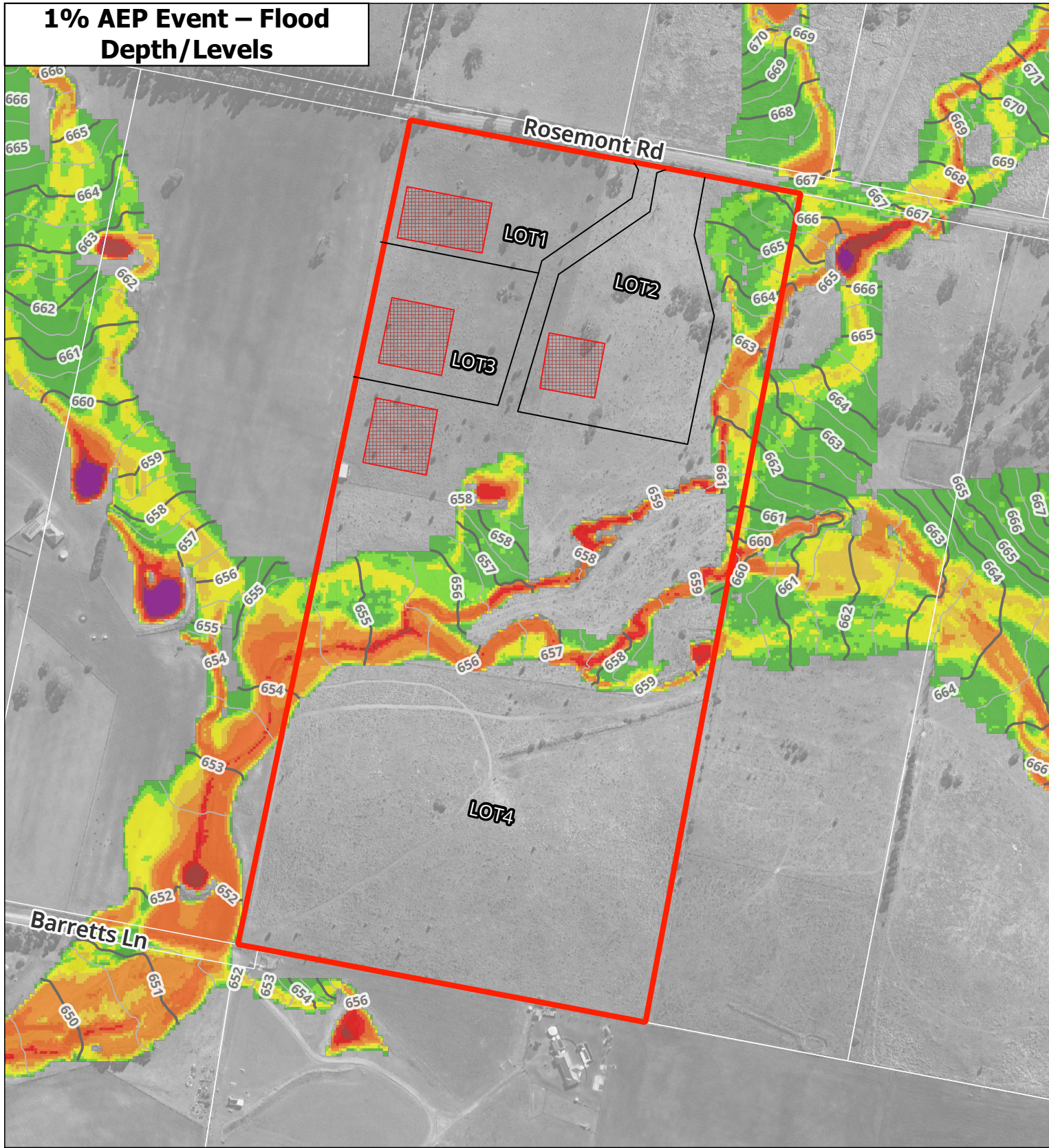
- Flood Depths (m)**
- 0 - 0.05
 - 0.05 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.3
 - 0.3 - 0.5
 - 0.5 - 1.0
 - 1.0 - 1.5
 - 1.5 - 2.0
 - > 2.0

- Minor Flood Level Contours (Spacing = 0.5 m)
- Major Flood Level Contours (Spacing = 1 m)

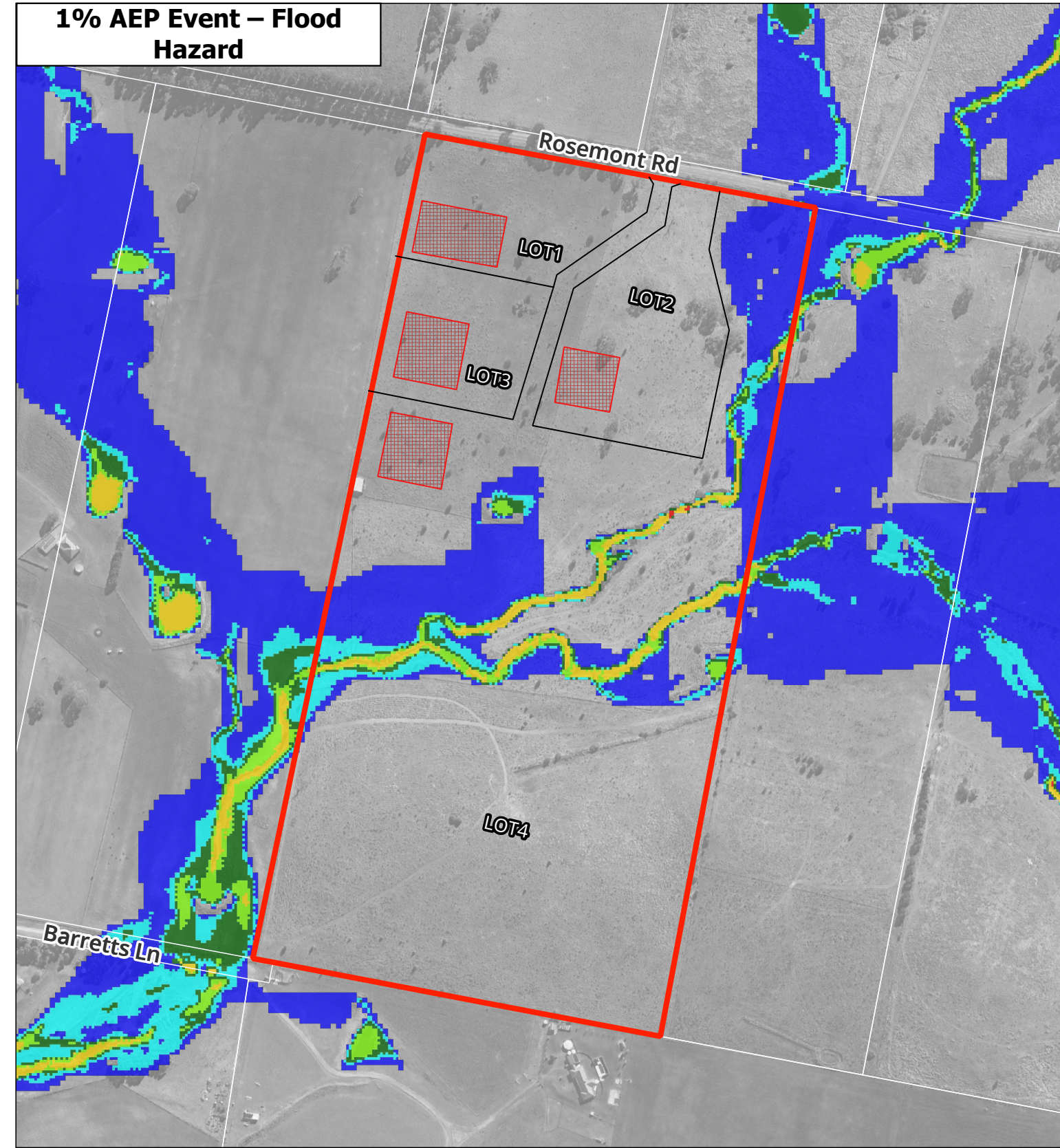
- Flood Hazard Category**
- H1
 - H2
 - H3
 - H4
 - H5
 - H6



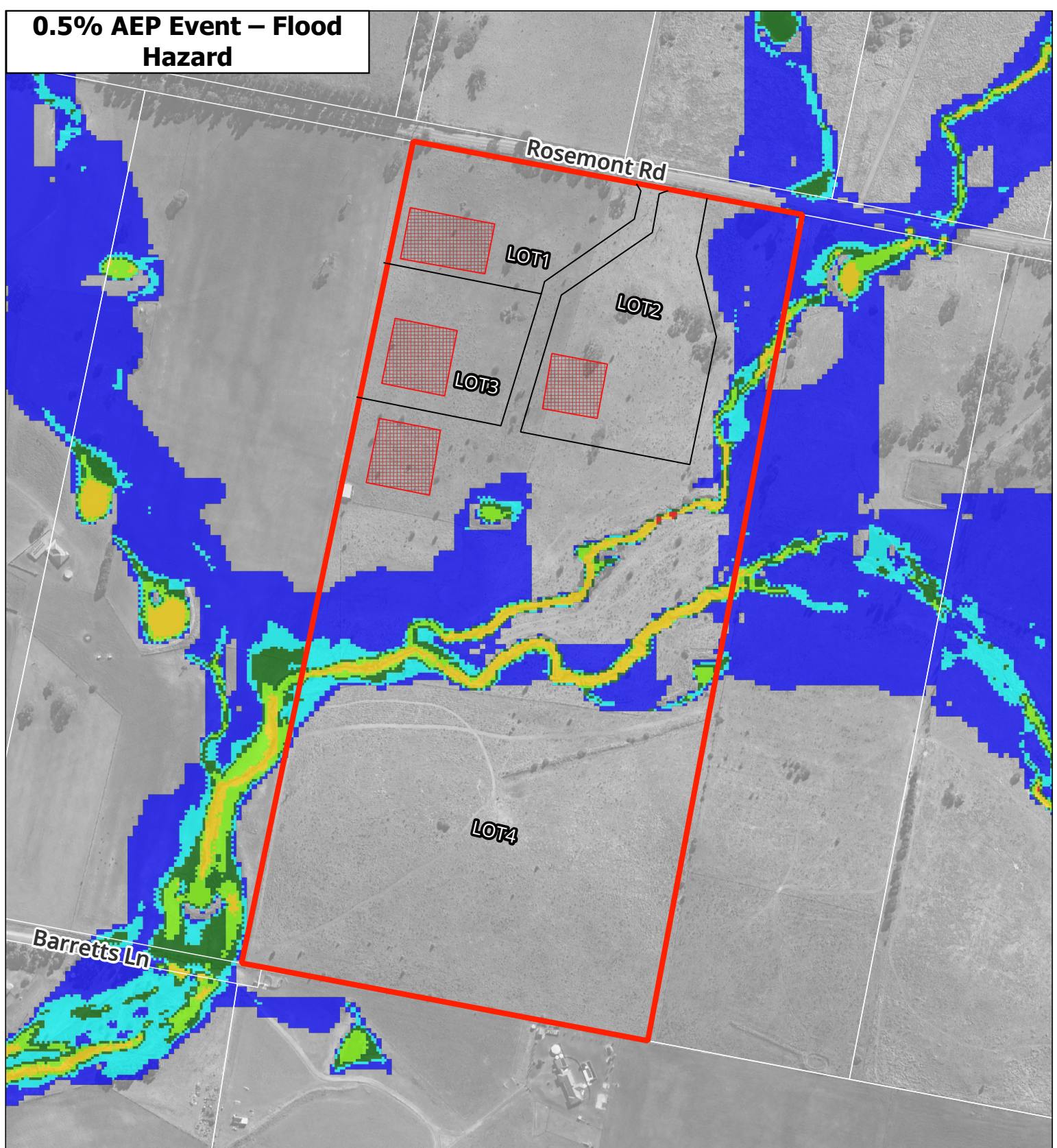
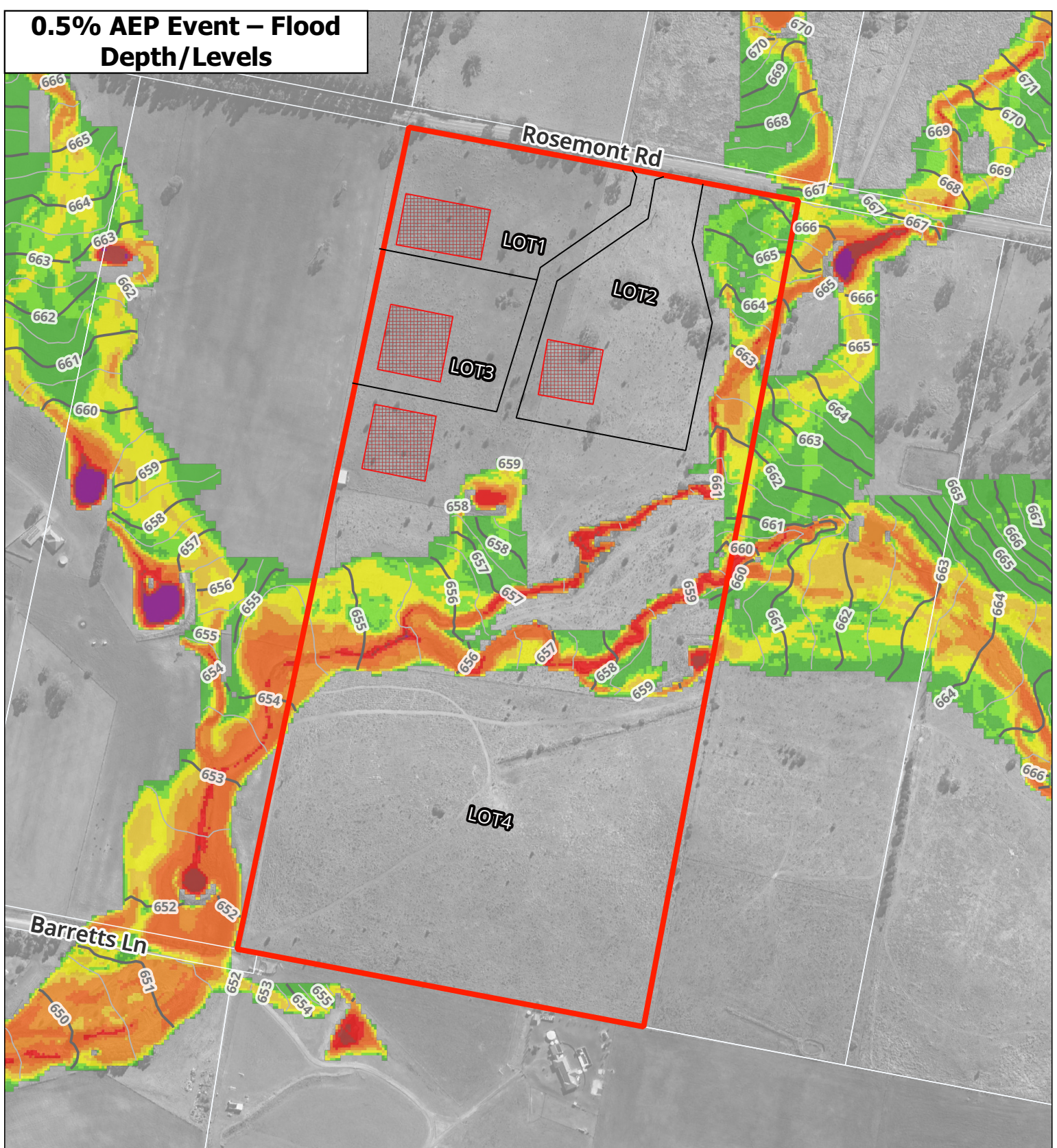
1% AEP Event – Flood Depth/Levels



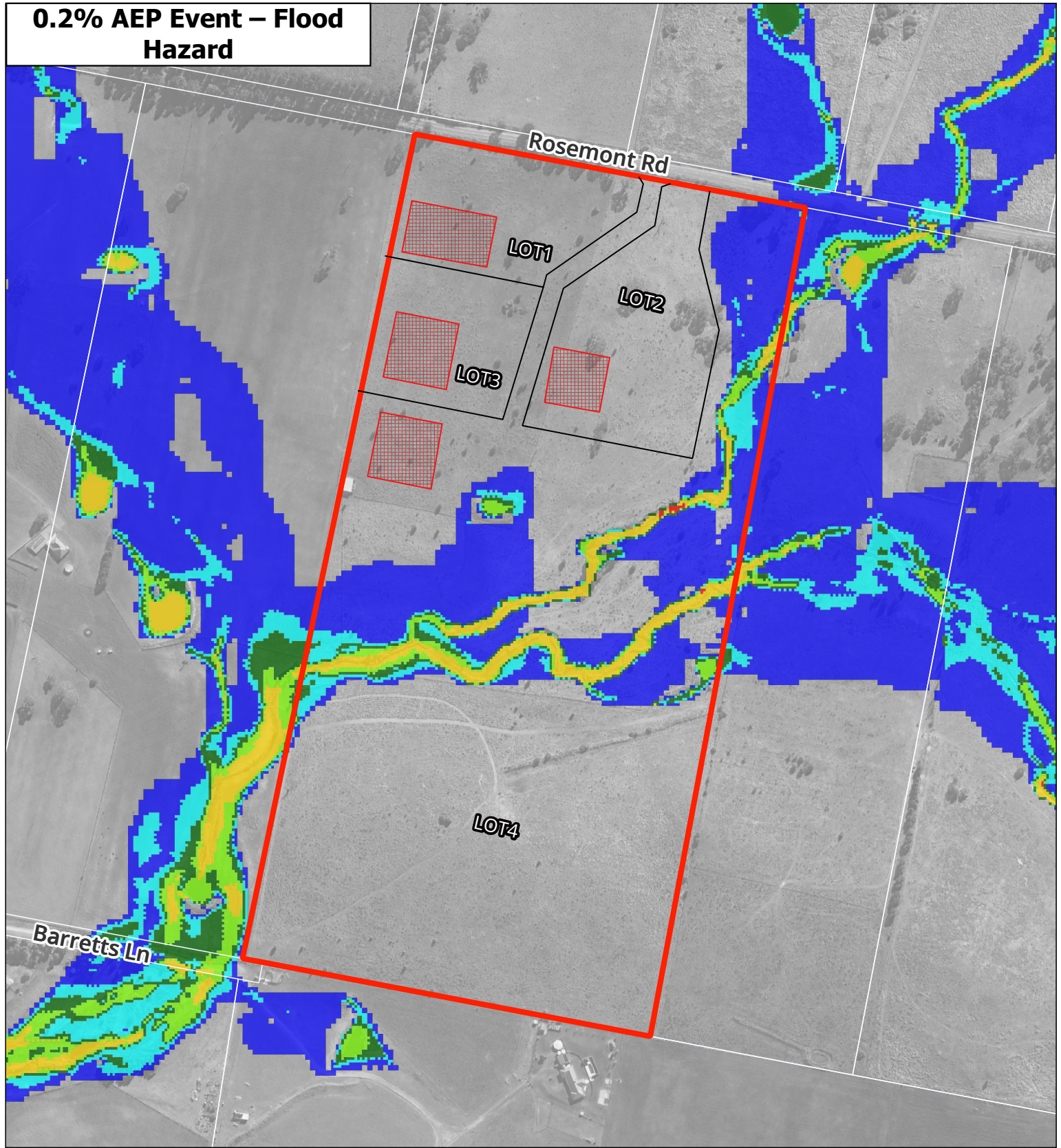
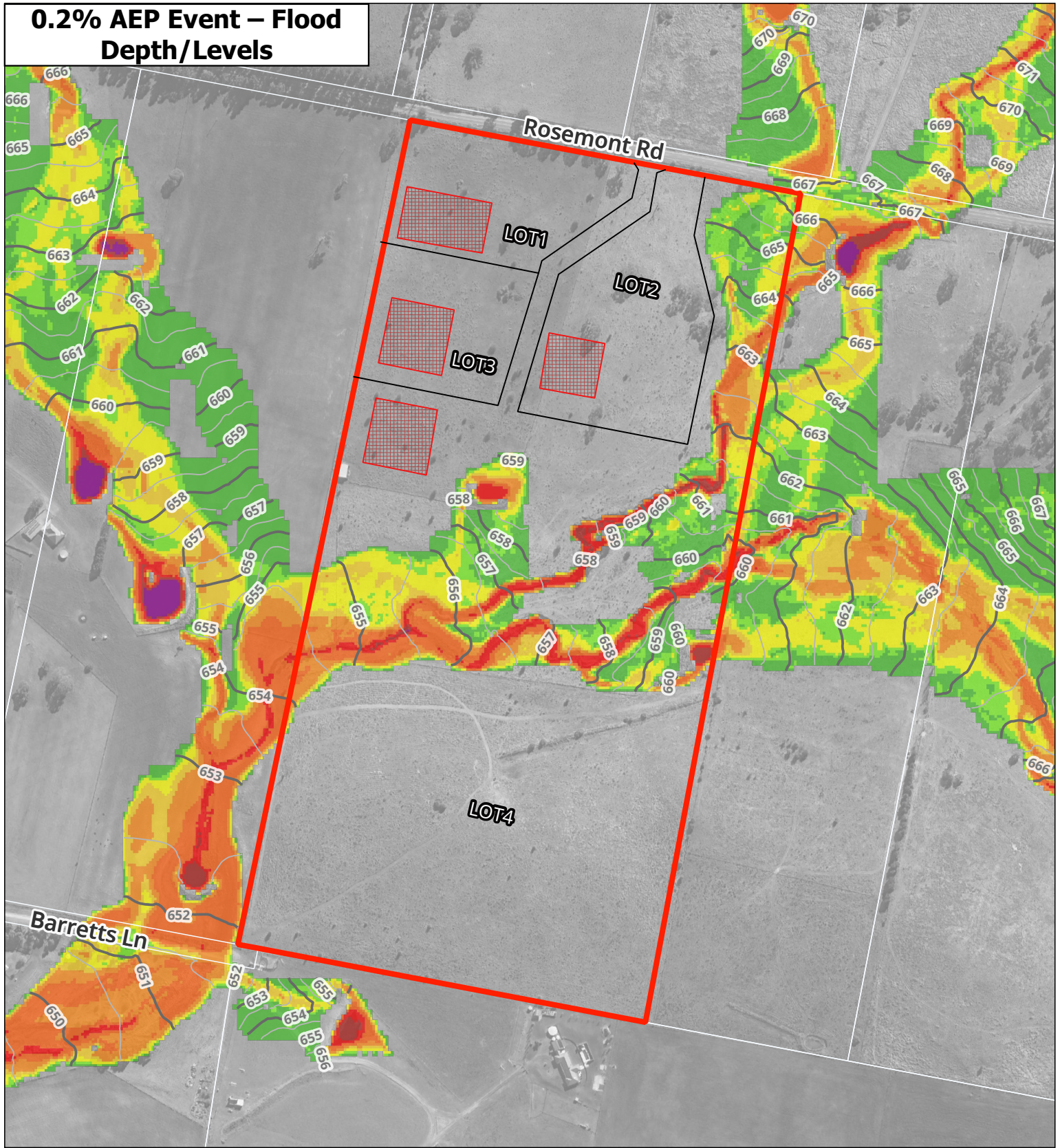
1% AEP Event – Flood Hazard



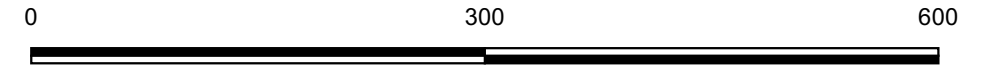
Subject Site	Flood Depths (m) 0 - 0.05	0.5 - 1.0	Minor Flood Level Contours (Spacing = 0.5 m)	Flood Hazard Category H1
Cadastral Boundaries	0.05 - 0.1	1.0 - 1.5	Major Flood Level Contours (Spacing = 1 m)	H2
Concept Lot Layout	0.1 - 0.2	1.5 - 2.0		H3
Concept Building Envelopes	0.2 - 0.3	> 2.0		H4
	0.3 - 0.5			H5
				H6

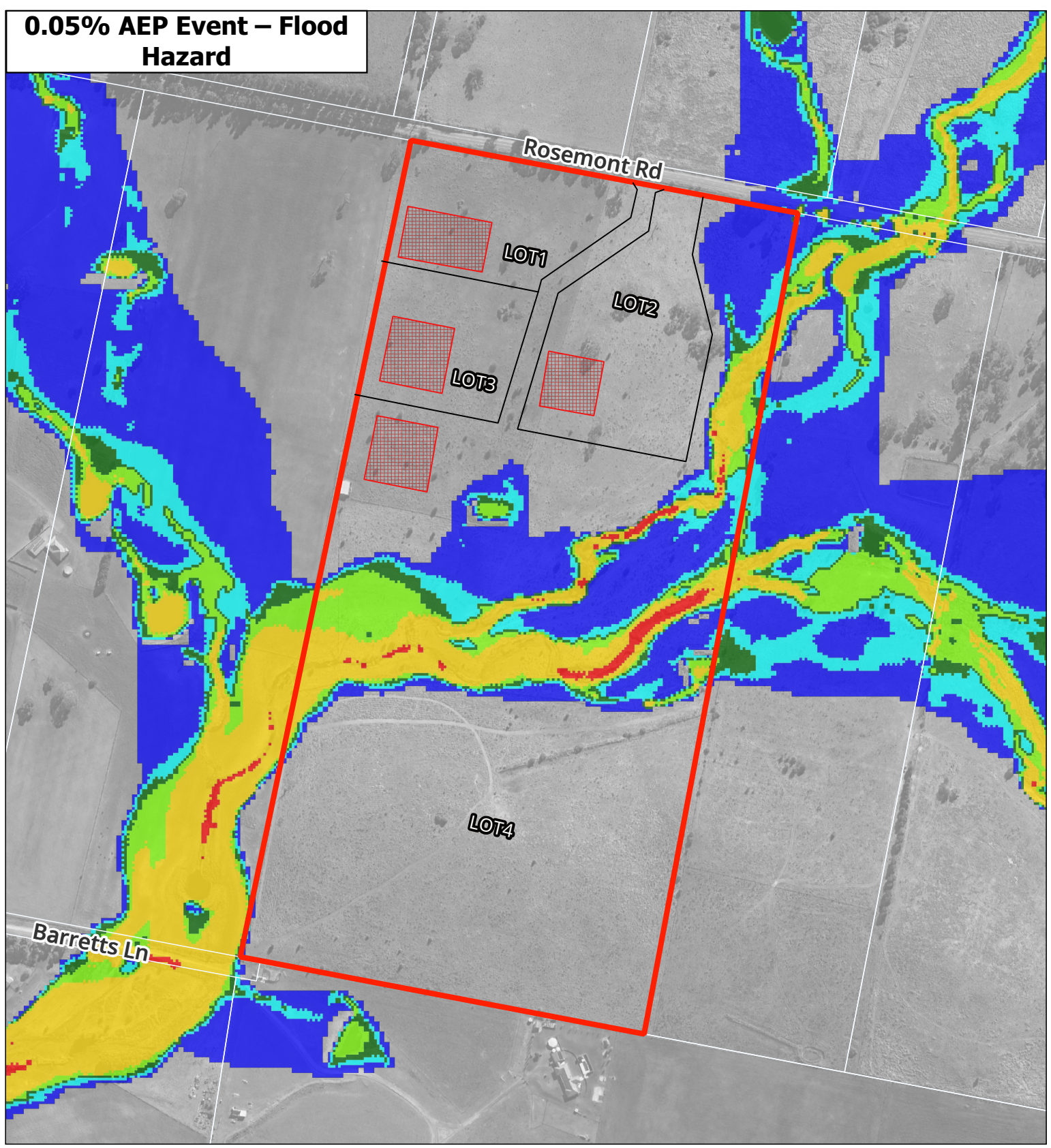
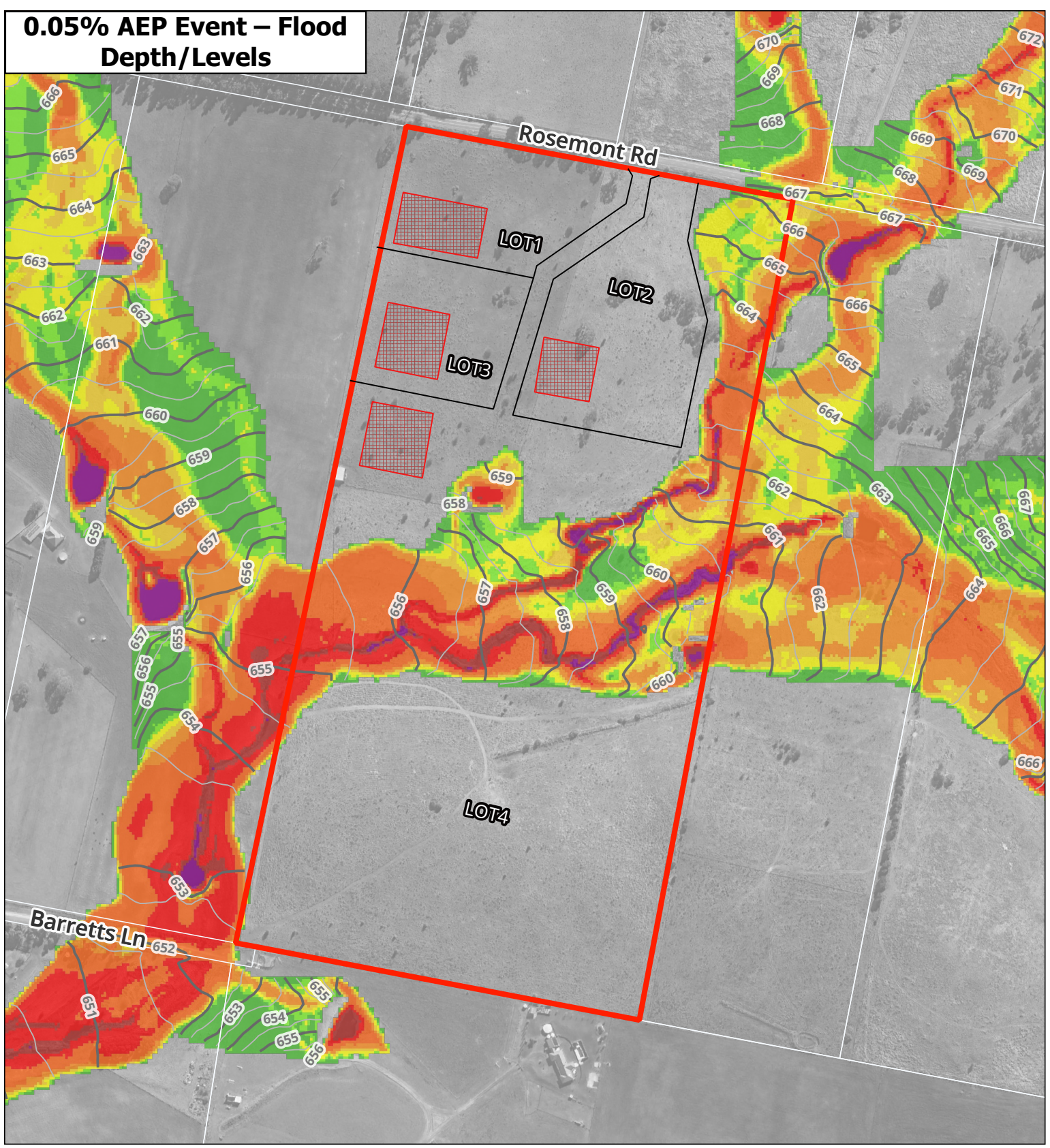


Subject Site	Flood Depths (m) 0 - 0.05	0.5 - 1.0	Minor Flood Level Contours (Spacing = 0.5 m)	Flood Hazard Category H1
Cadastral Boundaries	0.05 - 0.1	1.0 - 1.5	Major Flood Level Contours (Spacing = 1 m)	H2
Concept Lot Layout	0.1 - 0.2	1.5 - 2.0		H3
Concept Building Envelopes	0.2 - 0.3	> 2.0		H4
	0.3 - 0.5			H5
				H6

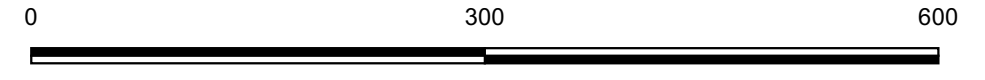


Subject Site	Flood Depths (m) 0 - 0.05	0.5 - 1.0	Minor Flood Level Contours (Spacing = 0.5 m)	Flood Hazard Category H1
Cadastral Boundaries	0.05 - 0.1	1.0 - 1.5	Major Flood Level Contours (Spacing = 1 m)	H2
Concept Lot Layout	0.1 - 0.2	1.5 - 2.0		H3
Concept Building Envelopes	0.2 - 0.3	> 2.0		H4
	0.3 - 0.5			H5
				H6

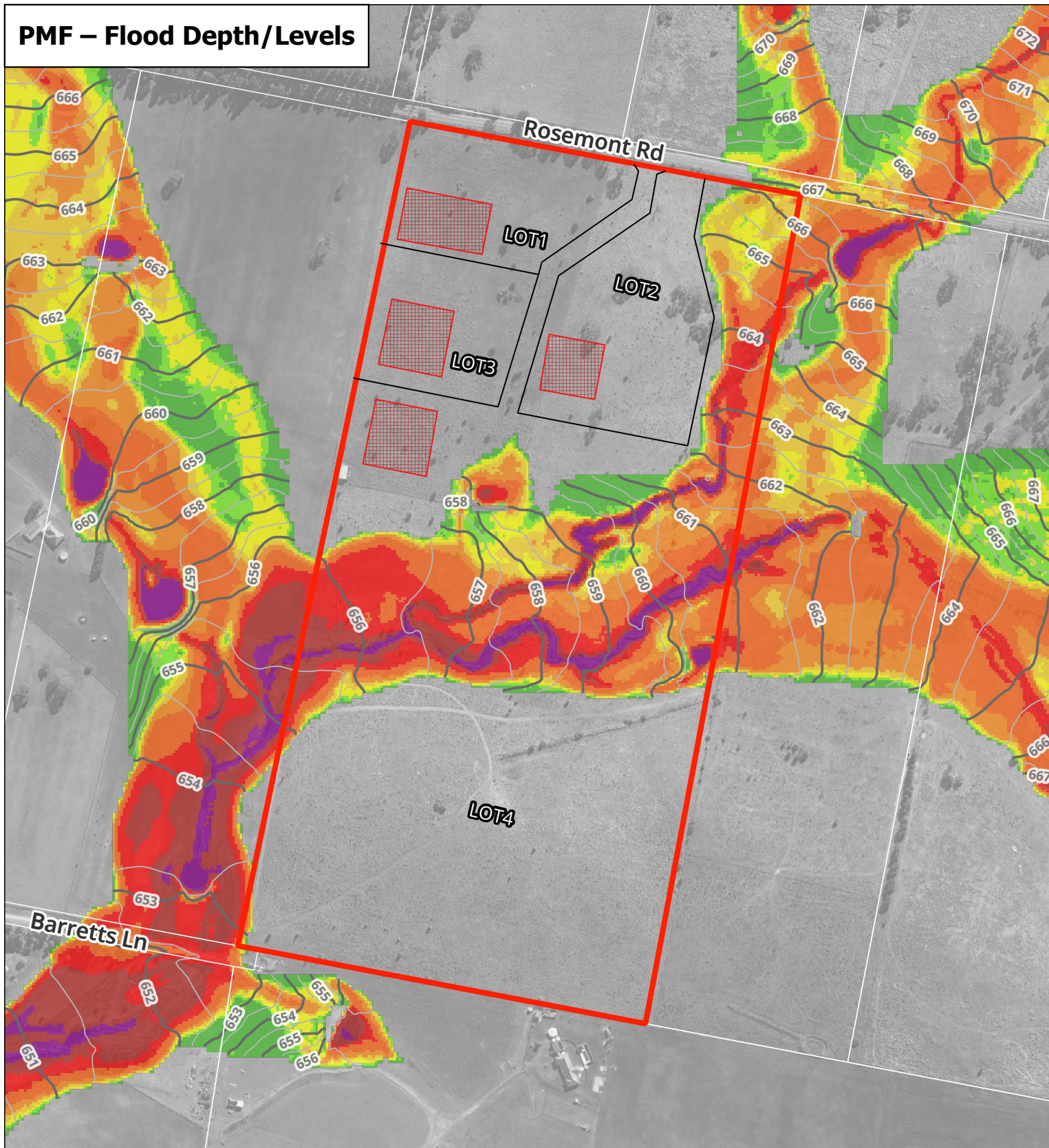




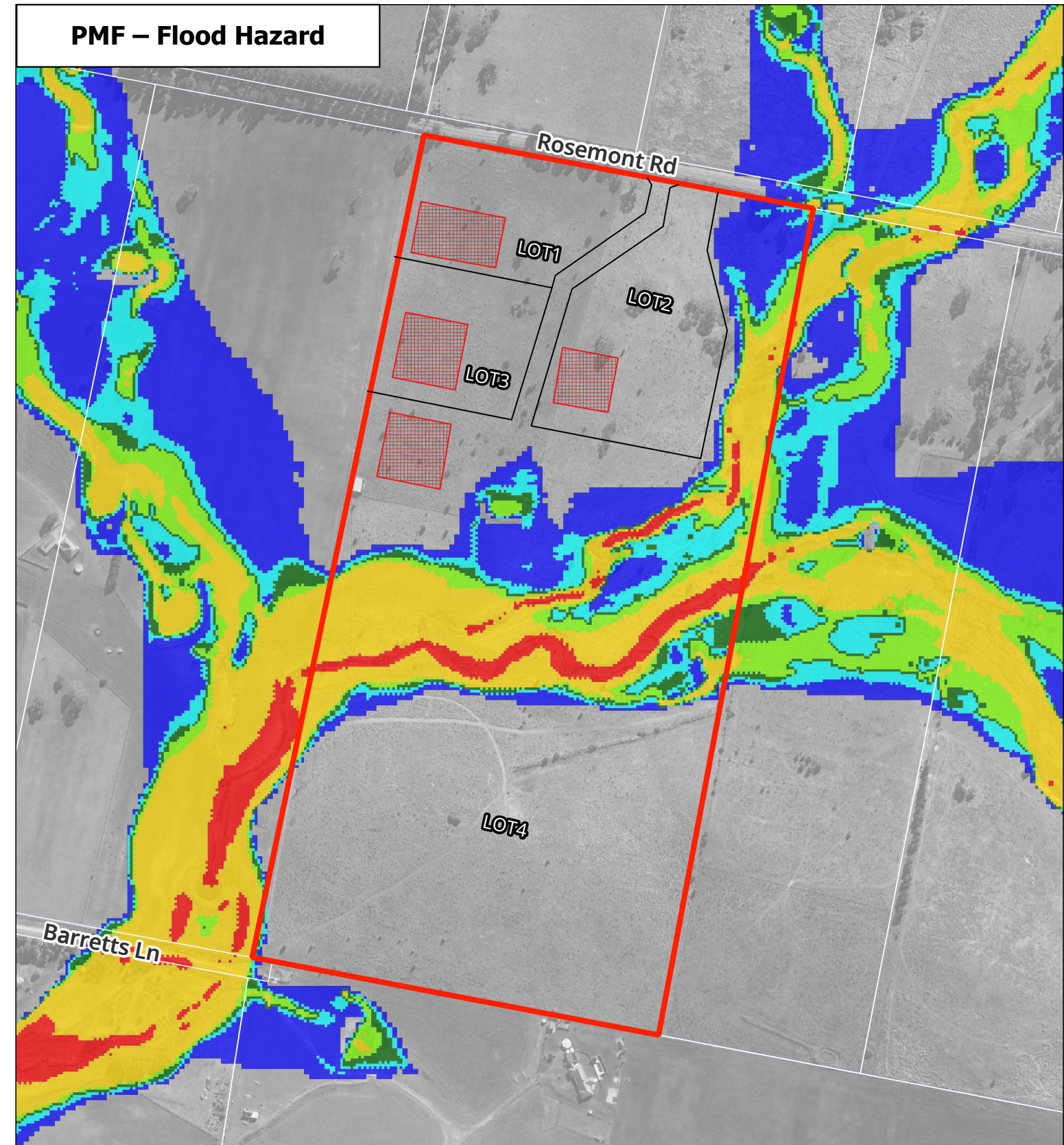
Subject Site	Flood Depths (m) 0 - 0.05	0.5 - 1.0	Minor Flood Level Contours (Spacing = 0.5 m)	Flood Hazard Category H1
Cadastral Boundaries	0.05 - 0.1	1.0 - 1.5	Major Flood Level Contours (Spacing = 1 m)	H2
Concept Lot Layout	0.1 - 0.2	1.5 - 2.0		H3
Concept Building Envelopes	0.2 - 0.3	> 2.0		H4
	0.3 - 0.5			H5
				H6



PMF – Flood Depth/Levels



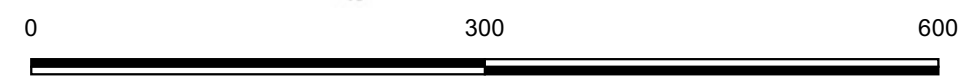
PMF – Flood Hazard

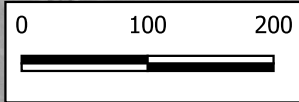
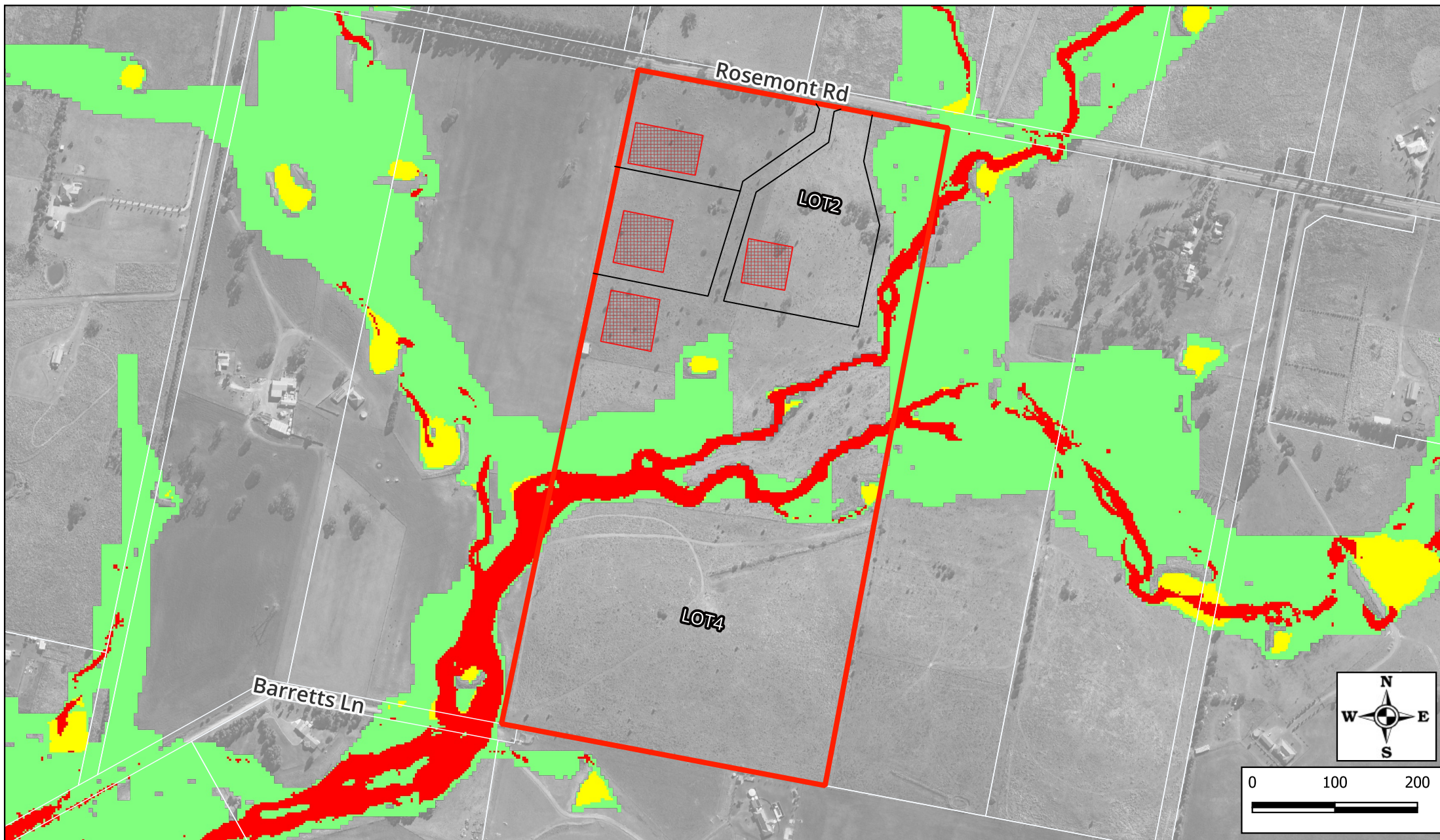


- Subject Site
 - Cadastral Boundaries
 - Concept Lot Layout
 - Concept Building Envelopes
- | | |
|--|---|
| <p>Flood Depths (m)</p> <ul style="list-style-type: none"> 0 - 0.05 0.05 - 0.1 0.1 - 0.2 0.2 - 0.3 0.3 - 0.5 | <ul style="list-style-type: none"> 0.5 - 1.0 1.0 - 1.5 1.5 - 2.0 > 2.0 |
|--|---|

- Minor Flood Level Contours (Spacing = 0.5 m)
- Major Flood Level Contours (Spacing = 1 m)

- Flood Hazard Category
- H1
 - H2
 - H3
 - H4
 - H5
 - H6





Hydraulic Category

- Flow Conveyance
- Flood Storage
- Flood Fringe

- Subject Site
- Cadastral Boundaries
- Concept Lot Layout
- Concept Building Envelopes

TITLE: Existing Conditions - 1% AEP Event – Flood Function

PROJECT: 292 Rosemont Rd, Goulburn

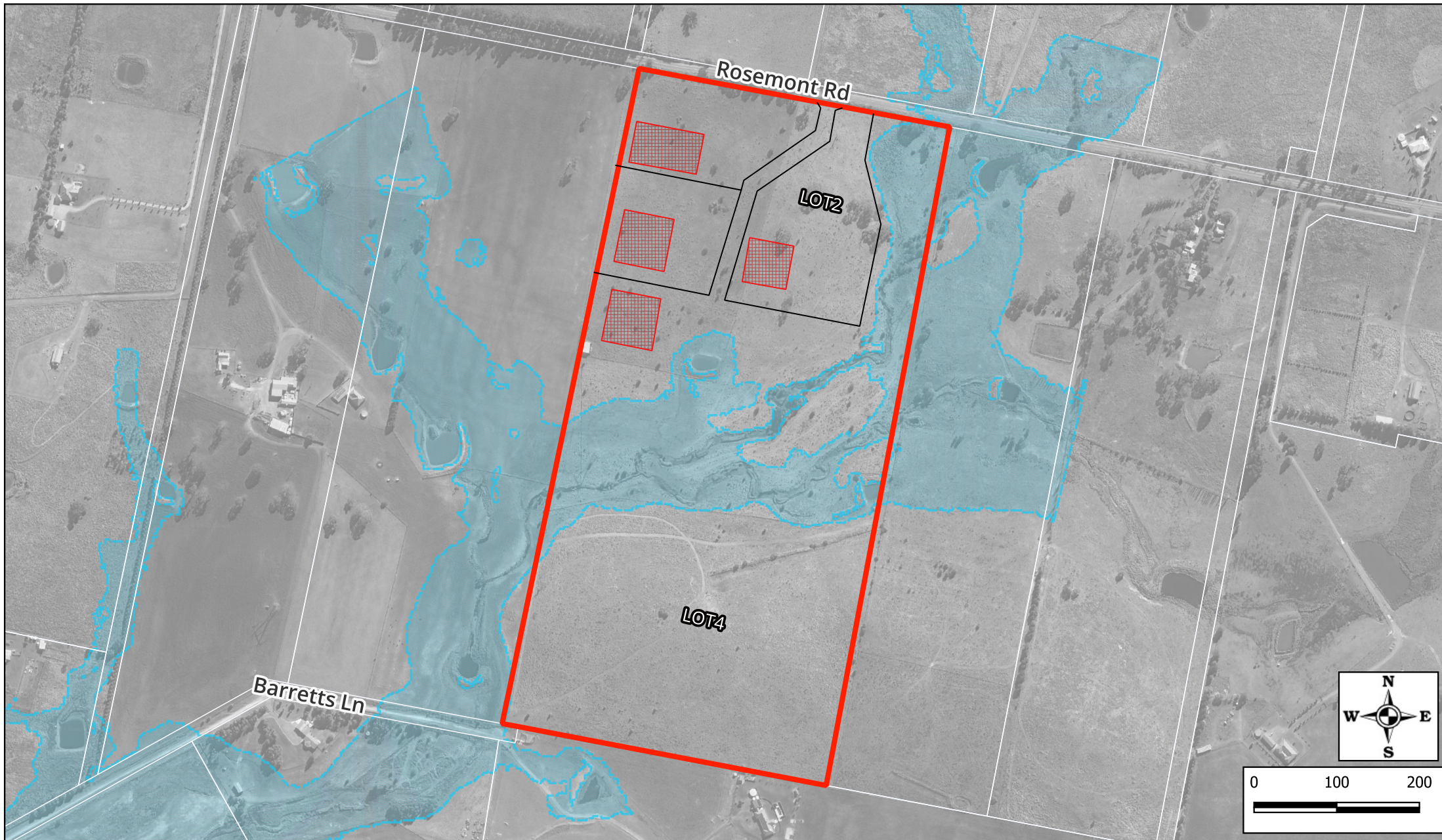
PROJECT No. 230049

DATE: 11-2023

SCALE: 1:6,000

FIGURE No. B1

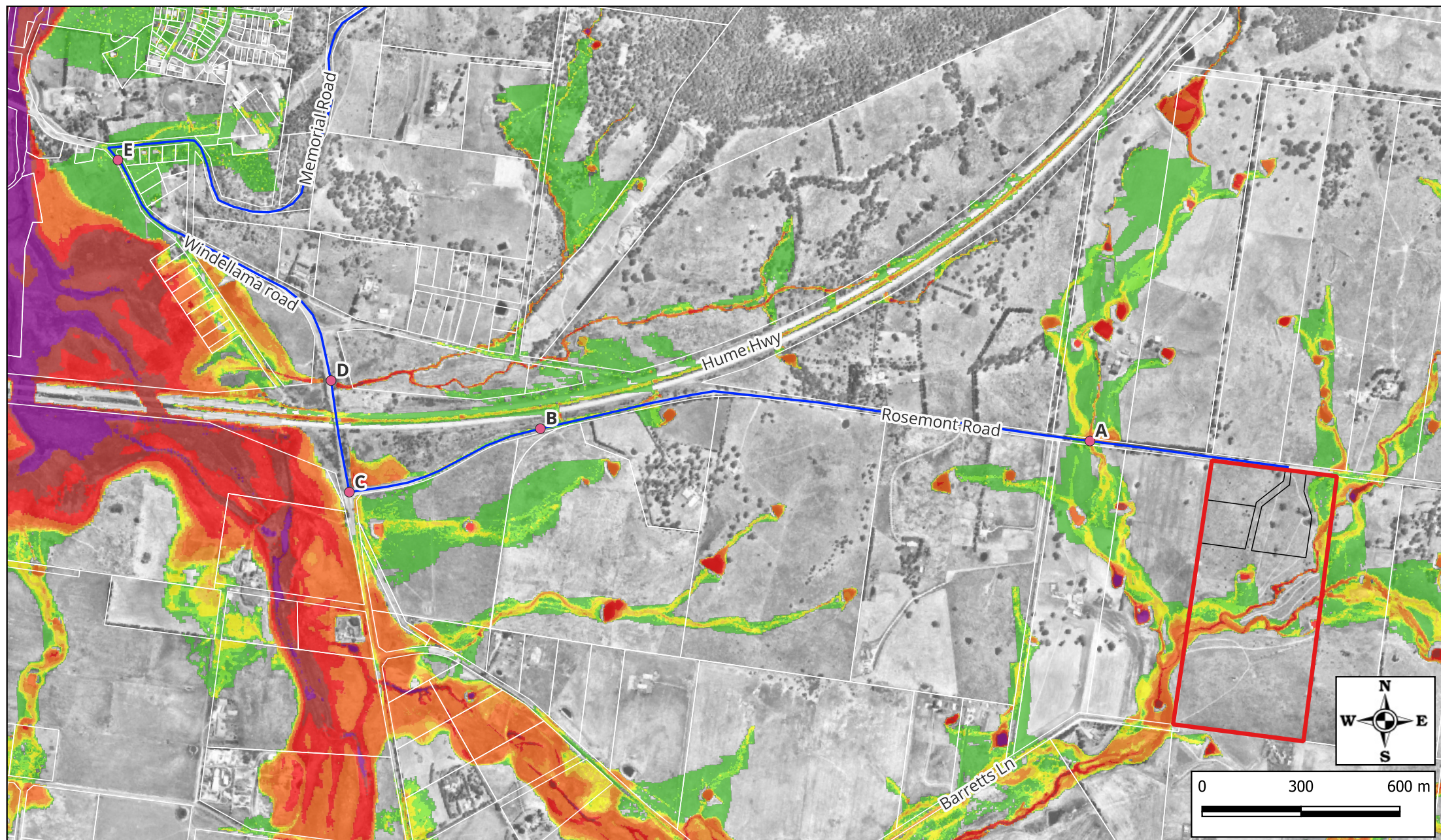




- Subject Site
- Flood Planning Area
- Cadastral Boundaries
- Concept Lot Layout
- Concept Building Envelopes

TITLE: Flood Planning Area Map		
PROJECT: 292 Rosemont Rd, Goulburn		
PROJECT No. 230049		
DATE: 11-2023	SCALE: 1:6,000	FIGURE No. C1





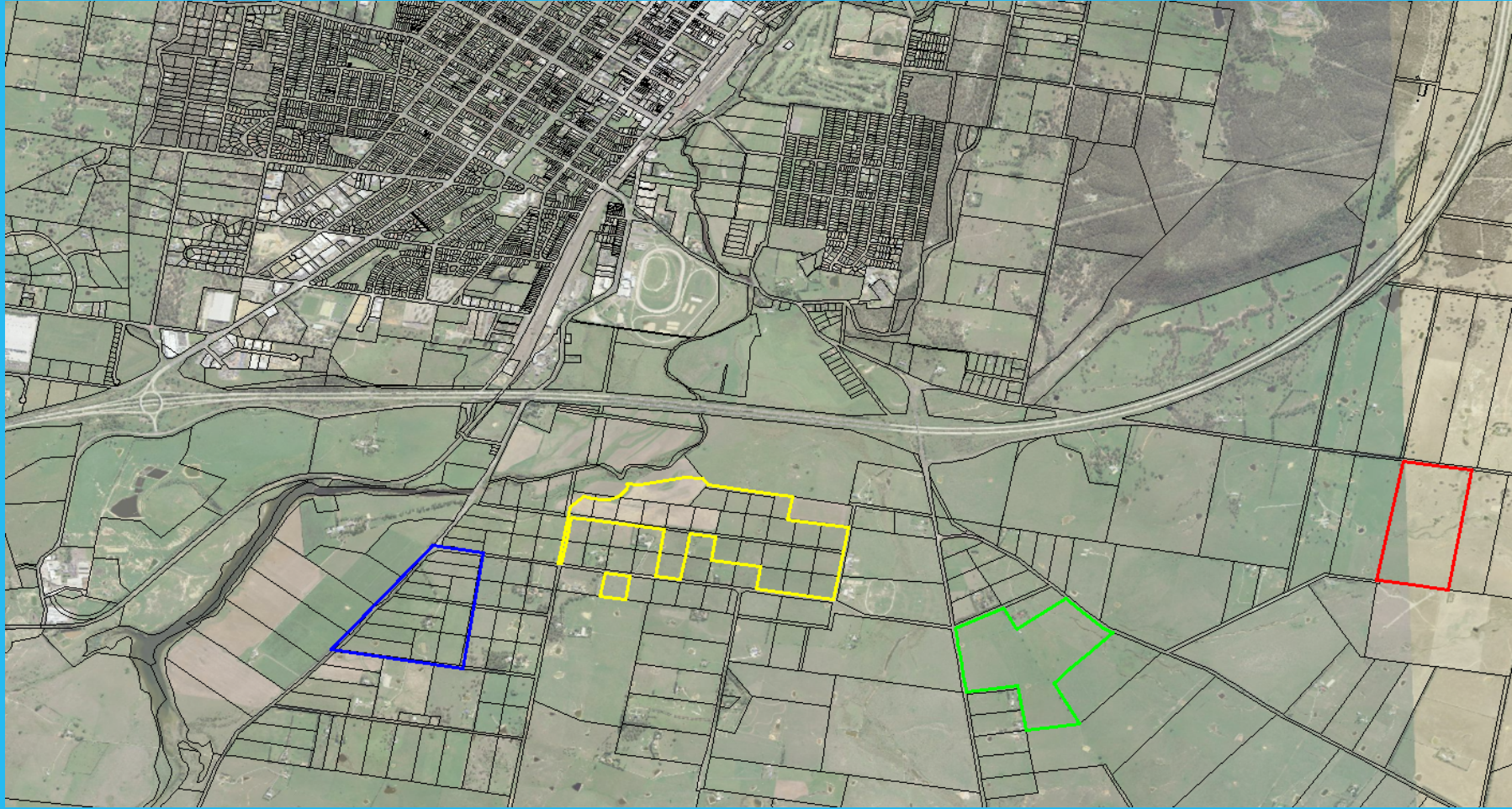
Flood Depths (m)	0.3 - 0.5	Subject Site
0 - 0.05	0.5 - 1.0	Concept Lot Layout
0.05 - 0.1	1.0 - 1.5	Local Cadastres
0.1 - 0.2	1.5 - 2.0	Road Crossing Locations
0.2 - 0.3	> 2.0	Site Access Routes

TITLE: Site Access Route		
PROJECT: 292 Rosemont Rd, Boxers Creek		
PROJECT No.	230049	
DATE: 12-2023	SCALE: 1:15,000	FIGURE No. D1



Attachment A

Goulburn Planning Proposal for Rezoning

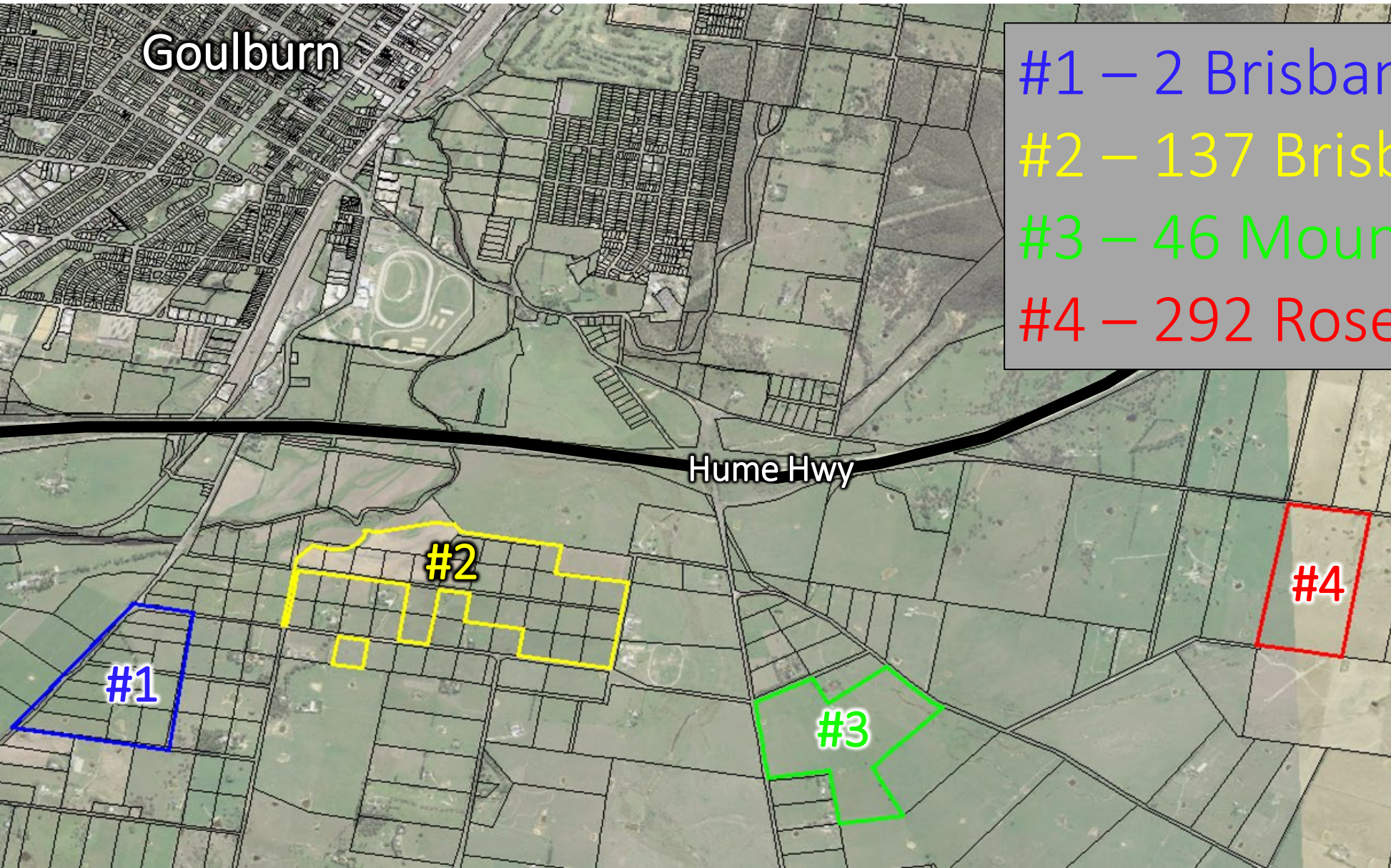


Support for Emergency Management Planning

Talking Points

- *Introduction*
- *Flood risk assessment*
- *EM01 - Support for Emergency Management Planning*
- *Conclusions & discussion*

Introduction



- #1 – 2 Brisbane Grove Rd
- #2 – 137 Brisbane Grove Rd
- #3 – 46 Mountain Ash Rd
- #4 – 292 Rosemount Rd

Introduction

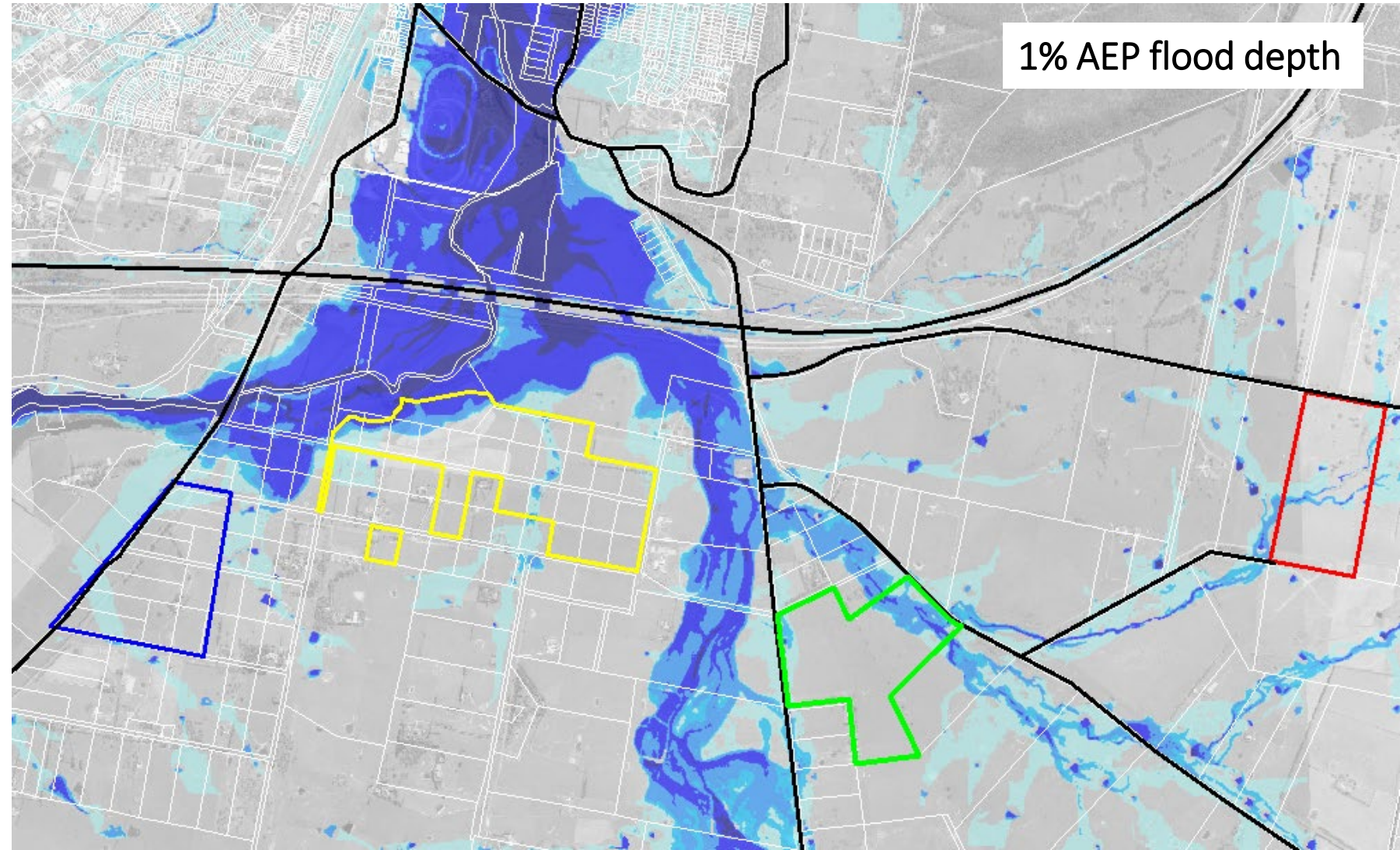
- *Current zoning is RU1 Primary Production – limited development potential*
- *Proposed rezoning to R5 Large Lot Residential – minimum lot size of ~2ha*
- *Rezoning would allow for an additional ~60 large lot residential dwellings*
- *Areas of flood prone land are present within and surrounding the land proposed for rezoning*

Introduction

- *Rezoning of land requires consideration of Section 9.1, Clause 4.1 'Flooding' - Local Planning Direction*
- *A planning proposal must be consistent with the requirements of Flood Risk Management Manual (2023)*
- *The Manual (2023) provides advice on support for emergency management services in Flood risk management guidelines EM01, Support for emergency management planning*
- *Consultation with emergency services required by EM01*
- *Consideration of secondary risk of fire and medical emergencies during flood*

Flood Risk Assessment

- *All future development outside of the floodplain – no risk of flooding up to the PMF*
- *Road flooding can reduce access*
- *Future developments are in 'indirectly affected areas'*



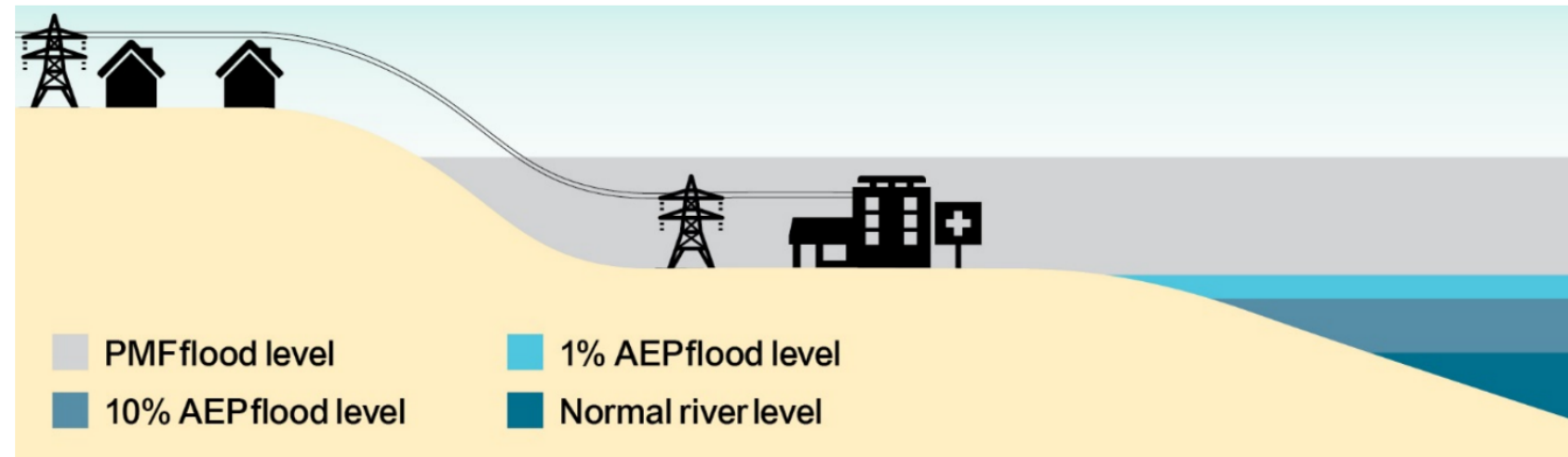
Flood Risk Assessment

- *Flood risk is correlated with road inundation:*

- Frequency
- Duration

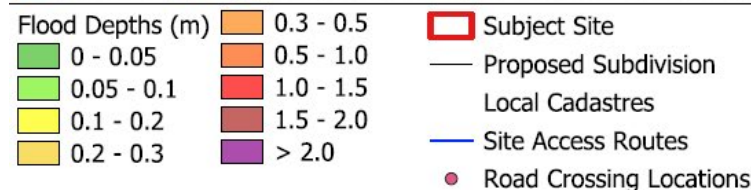
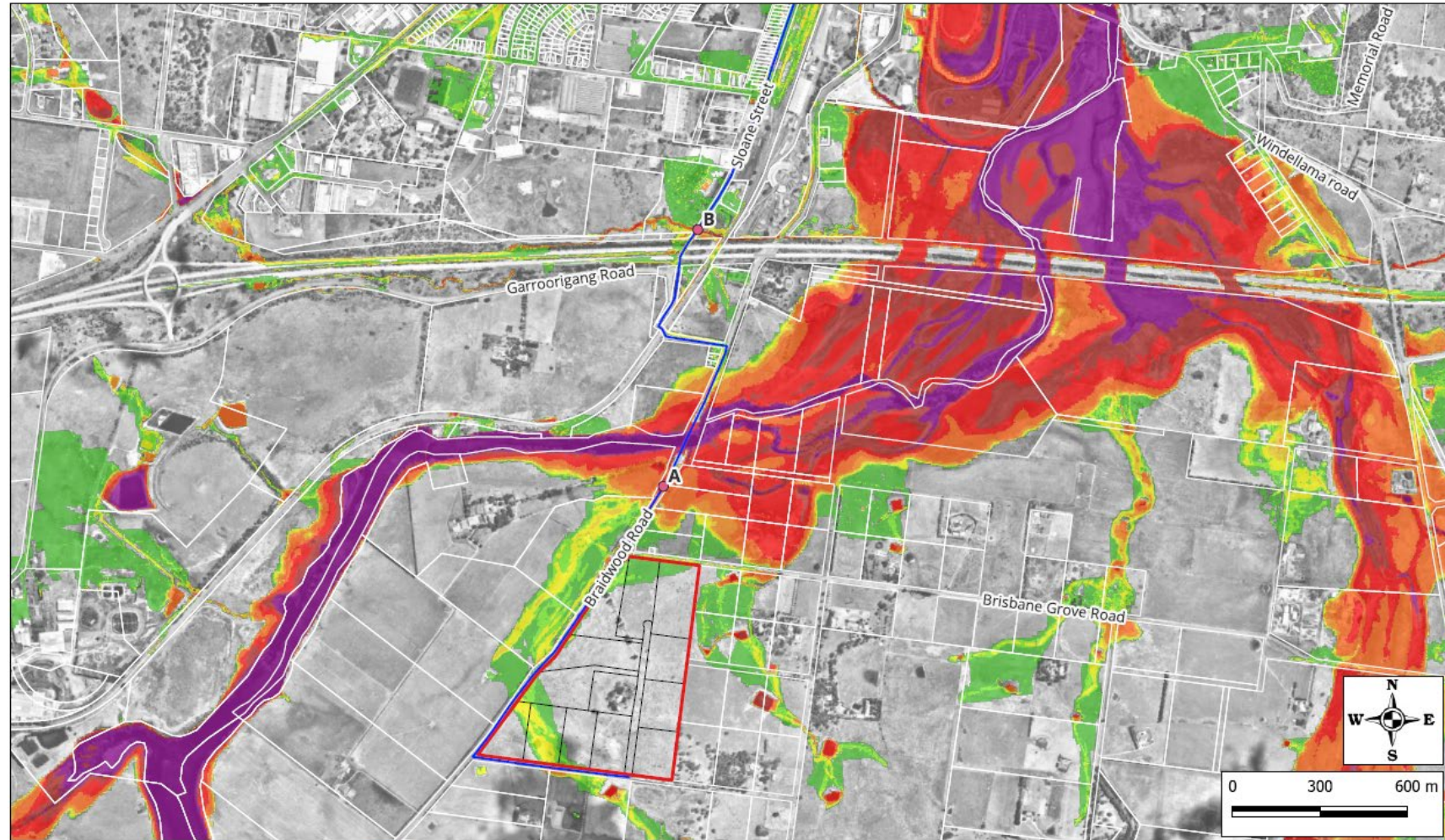
C2.3 Indirectly affected areas

These are areas that are outside the limit of flooding and therefore will not be inundated nor will they lose road access, however, they may be indirectly affected as a result of flood damaged infrastructure or due to the loss of transport links, electricity supply, water supply, sewage or telecommunications services (Figure 15). These areas may therefore require resupply or, in the worst case, evacuation.



Flood Risk Assessment

- Point A critical
- First flooded in rarer than 5% AEP
- Flooded for 23 hours during 1% AEP
- Depth > 0.3 m for 16 hours in 1% AEP
- Road flooded for 38 hours in the PMF

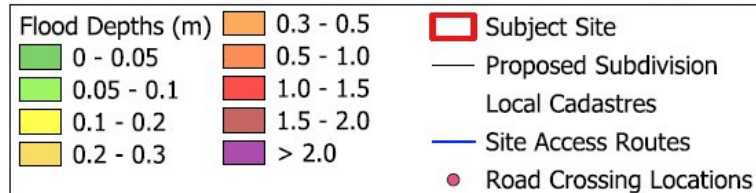
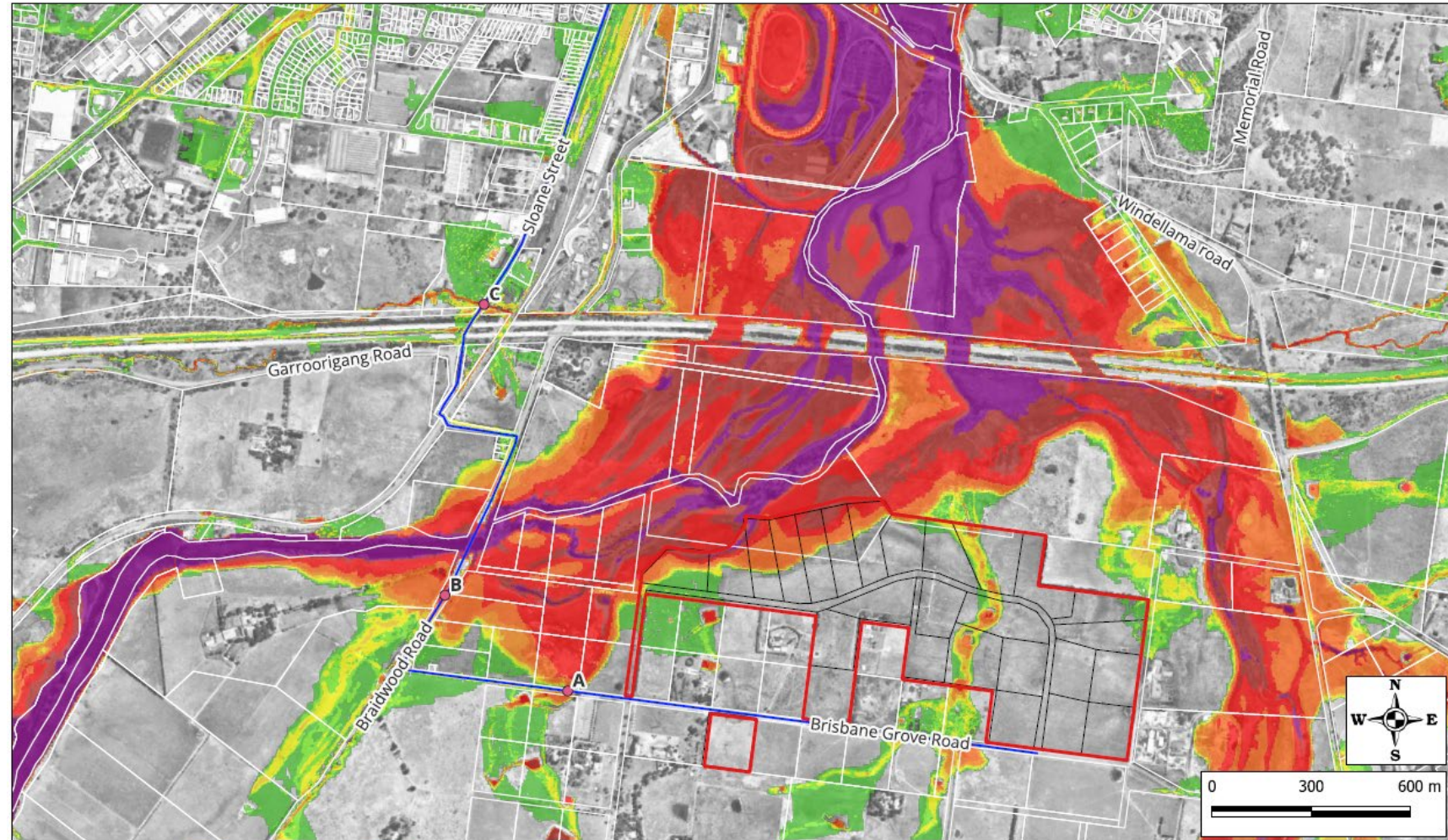


TITLE: Site Access Route		
PROJECT: 2 Brisbane Grove Road, Brisbane Grove		
PROJECT No. 230048		
DATE: 08-2023	SCALE: 1:17,000	FIGURE No. F1



Flood Risk Assessment

- Point B critical
- First flooded in rarer than 5% AEP
- Flooded for 23 hours during 1% AEP
- Depth > 0.3 m for 16 hours in 1% AEP
- Road flooded for 38 hours in the PMF

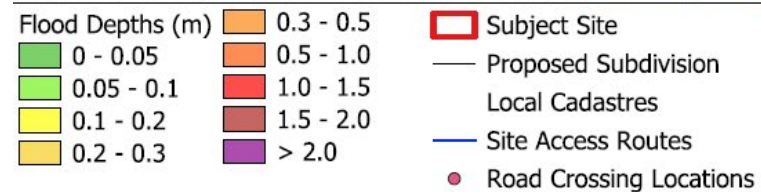
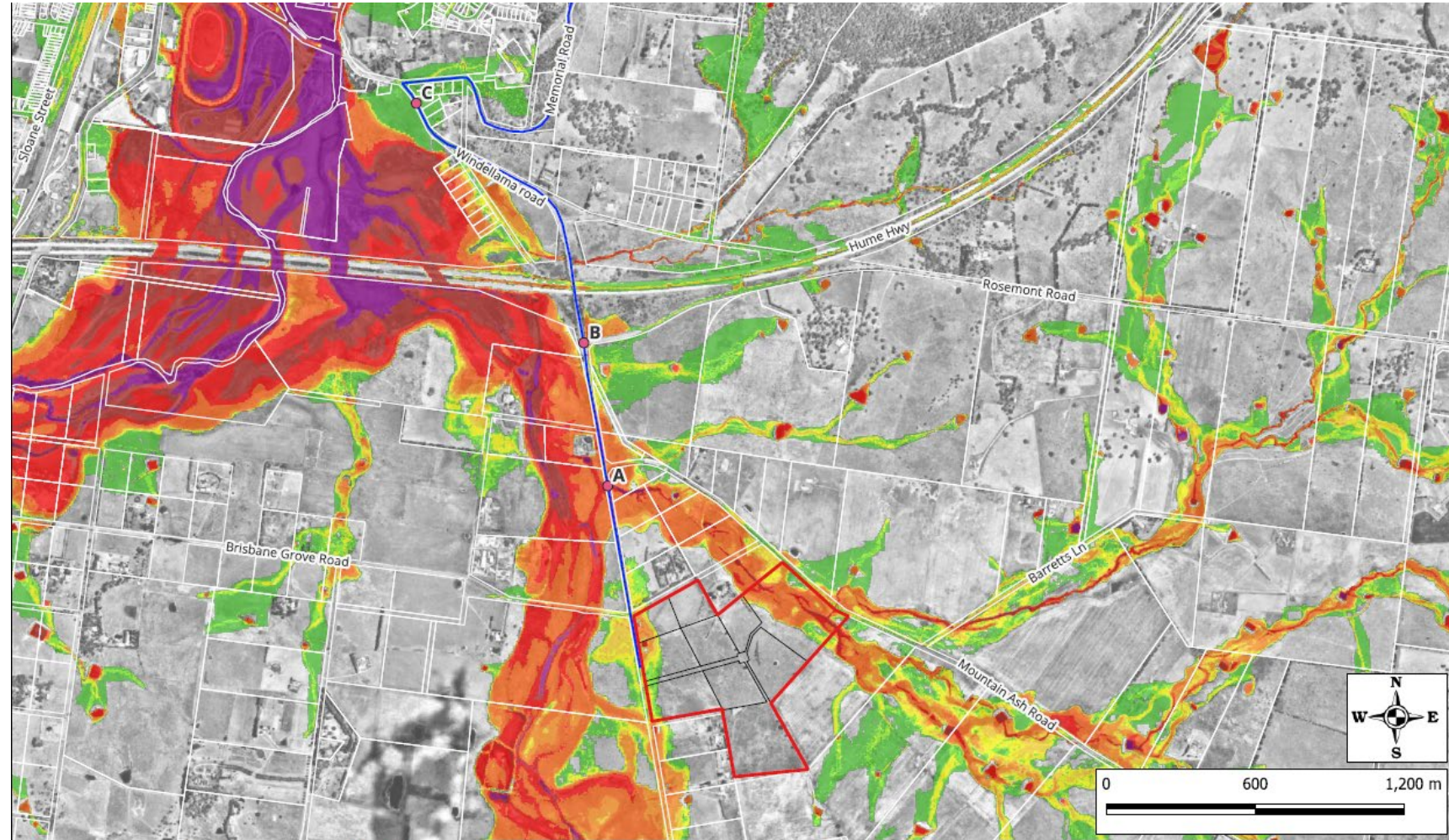


TITLE: Site Access Route		
PROJECT: 137 Brisbane Grove Road, Brisbane Grove		
PROJECT No. 230048		
DATE: 08-2023	SCALE: 1:15,000	FIGURE No. D1



Flood Risk Assessment

- Point A critical
- First flooded in ~10% AEP (depth = 0.1 m)
- Flooded for 30 hours during 1% AEP (depth < 0.4 m)
- Depth > 0.3 m for 13 hours in 1% AEP
- Road flooded for 42 hours in the PMF

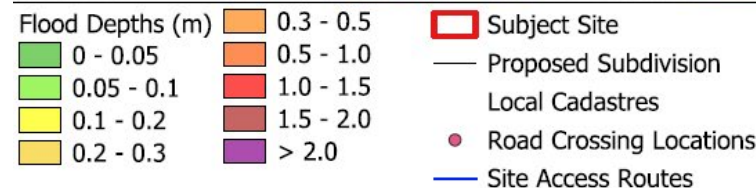
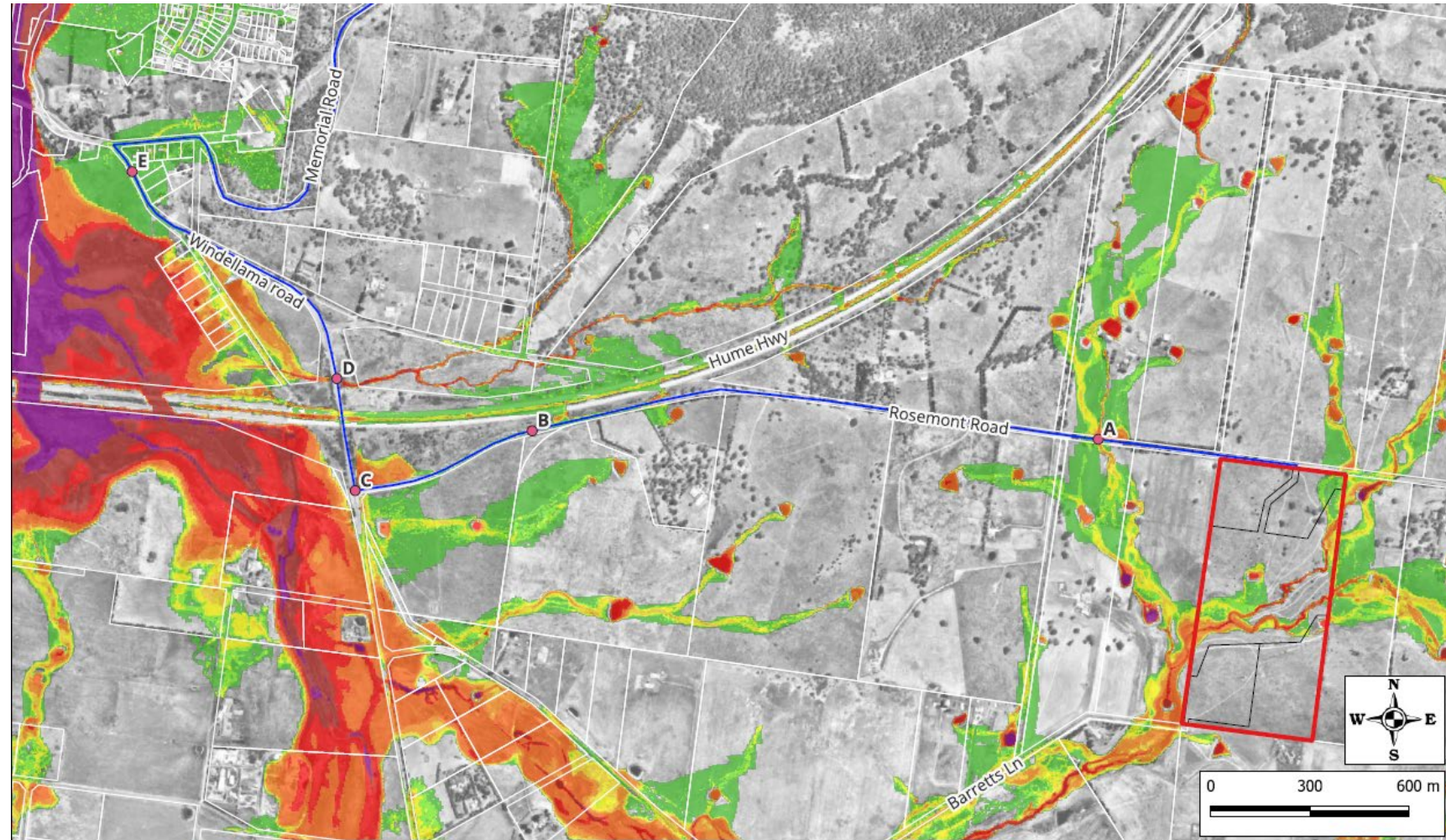


TITLE: Site Access Route		
PROJECT: 46 Mountain Ash Road, Brisbane Grove		
PROJECT No. 230049		
DATE: 08-2023	SCALE: 1:20,000	FIGURE No. D1



Flood Risk Assessment

- Point A & C critical
- First flooded in ~1% AEP (depth 0.05 m)
- Flooded for 1 hour during 1% AEP
- Road flooded at 'C' for 24 hours in the PMF



TITLE: Site Access Route		
PROJECT: 292 Rosemont Rd, Boxers Creek		
PROJECT No. 230049		
DATE: 08-2023	SCALE: 1:15,000	FIGURE No. D1

Flood Risk Assessment

- *Future development situated outside of the PMF – no flood risk to future dwellings*
- *Residual risk due to flooding of access roads*
- *Isolation of sites is 'rare', typically rarer than 5% AEP which equates to 0.01% chance on any given day*
- *Duration of isolation typically less than 24 hours but may be up to ~42 hours during extreme floods*

EM01 - Support for Emergency Management Planning

Emergency Services
Input

Council Planning

Key consideration	EM response strategy	
	Evacuation	Shelter in place
Additional risk management considerations		
Addressing secondary risks of fire and medical emergencies during floods	NA	To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding. Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services.
Limiting exposure of people to floodwaters	Needs to be considered as part of the evacuation strategy.	This can be aided by providing sufficient readily accessible habitable areas above the PMF to cater for potential occupants, clients, visitors and residents.
Provision of publicly accessible space for the itinerant population	Needs to be considered as part of the evacuation strategy.	Provision of publicly accessible space or access to space above the PMF (with adequate infrastructure to enable the physically impaired to access such space) that is easily accessible 24 hours a day, 7 days a week and is clearly identified for this purpose with associated directional signage.
Providing adequate services so people are less likely to enter floodwaters	NA	This includes access to ablutions, water, power and basic first aid equipment. Consideration must be given to the availability of onsite systems to provide for power, water and sewage services for the likely flood duration (up to 12 hours) plus a further period of up to 48 hours to allow for restoration of external services.

EM01 - Support for Emergency Management Planning

Council Planning

Limiting exposure of people to floodwaters	Needs to be considered as part of the evacuation strategy.	This can be aided by providing sufficient readily accessible habitable areas above the PMF to cater for potential occupants, clients, visitors and residents.
Provision of publicly accessible space for the itinerant population	Needs to be considered as part of the evacuation strategy.	Provision of publicly accessible space or access to space above the PMF (with adequate infrastructure to enable the physically impaired to access such space) that is easily accessible 24 hours a day, 7 days a week and is clearly identified for this purpose with associated directional signage.
Providing adequate services so people are less likely to enter floodwaters	NA	This includes access to ablutions, water, power and basic first aid equipment. Consideration must be given to the availability of onsite systems to provide for power, water and sewage services for the likely flood duration (up to 12 hours) plus a further period of up to 48 hours to allow for restoration of external services.

Risk Management Considerations	Management Options
Limiting exposure of people to flood waters	<ul style="list-style-type: none"> - All dwellings above the PMF. No need for evacuation. - Council / NSW SES – installing flood depth markers and flood warning signs at flooded crossings (FRSMP recommendation). - Notify of the risk of entering floodwaters as part of a community flood education program (FRSMP recommendation).
Provision of publicly accessible space for itinerant population	<ul style="list-style-type: none"> - Considered low risk due to likely small itinerant population, particularly during times of flood. - Sufficient space above the PMF level on various access roads.
Providing adequate services so people are less likely to enter floodwaters.	<p>Potential Management measures:</p> <ul style="list-style-type: none"> - Sewerage - Self-contained, treatment onsite – additional management measure not required. - Water – Self-contained, tanks onsite – additional management measure not required. - Power – Provision for solar and batteries may reduce risk. Can potentially be implemented through Section 88B provisions. - Basic first aid – advise rural residents to maintain and first aid kit as part of the ‘community flood education program’ recommended in the FRSMP. For discussion with Council/SES.

EM01 - Support for Emergency Management Planning

Emergency Services
Input

Key consideration	EM response strategy	
	Evacuation	Shelter in place
Additional risk management considerations		
Addressing secondary risks of fire and medical emergencies during floods	NA	<p>To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding.</p> <p>Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services.</p>

Risk Management Considerations	Management Options
Addressing secondary risk for fire and medical emergencies during floods	<p>Consult with Ambulance NSW and NSW RFS to assess the level of risk and to determine risk management measures if/where appropriate.</p> <p>Potential management of secondary risks during flooding:</p> <ul style="list-style-type: none"> - Advise rural residents to maintain and first aid kit as part of the 'community flood education program' recommended in the FRSMP – potential risk reduction for Ambulance NSW? - Potential <u>LEP</u> clauses to provision for additional fire protection in homes where access is <u>lost</u> due to flood – potential risk reduction for NSW RFS?

- Input from emergency services requested with identification of risk management measures

Conclusions / Discussion

- *No flood risk to future dwellings – outside of the PMF extent*
- *Sites are considered ‘indirectly affected areas’ due to flooded access roads*
- *Isolation of sites is ‘rare’, typically rarer than 5% AEP which equates to 0.01% chance on any given day*
- *Duration of isolation typically less than 24 hours but may be up to ~48 hours during extreme floods*
- *Consideration of secondary risk of fire and medical emergencies during flood*
- *Input from emergency services requested with identification of risk management measures*



Job Number: 230048 / 230049
Date: 29 August 2023

GRC Hydro
Level 9, 233 Castlereagh Street
Sydney NSW 2000

Tel: +61 409 833 039
www.grchydro.com.au

Minutes from Goulburn planning proposals - Emergency services meeting

Project: South Goulburn planning proposals
Date & Time: 24/08/2023 3.00 pm
Subject: Secondary flood risk due to loss of emergency services access
Location: MS Teams
Attendance: Goulburn Council RFS GRC Hydro
Kate Wooll Lyn Liston Zac Richards
David Kiernan Martin Webster William Tang

NSW Ambulance
Steven Owen

Apologies: Nil

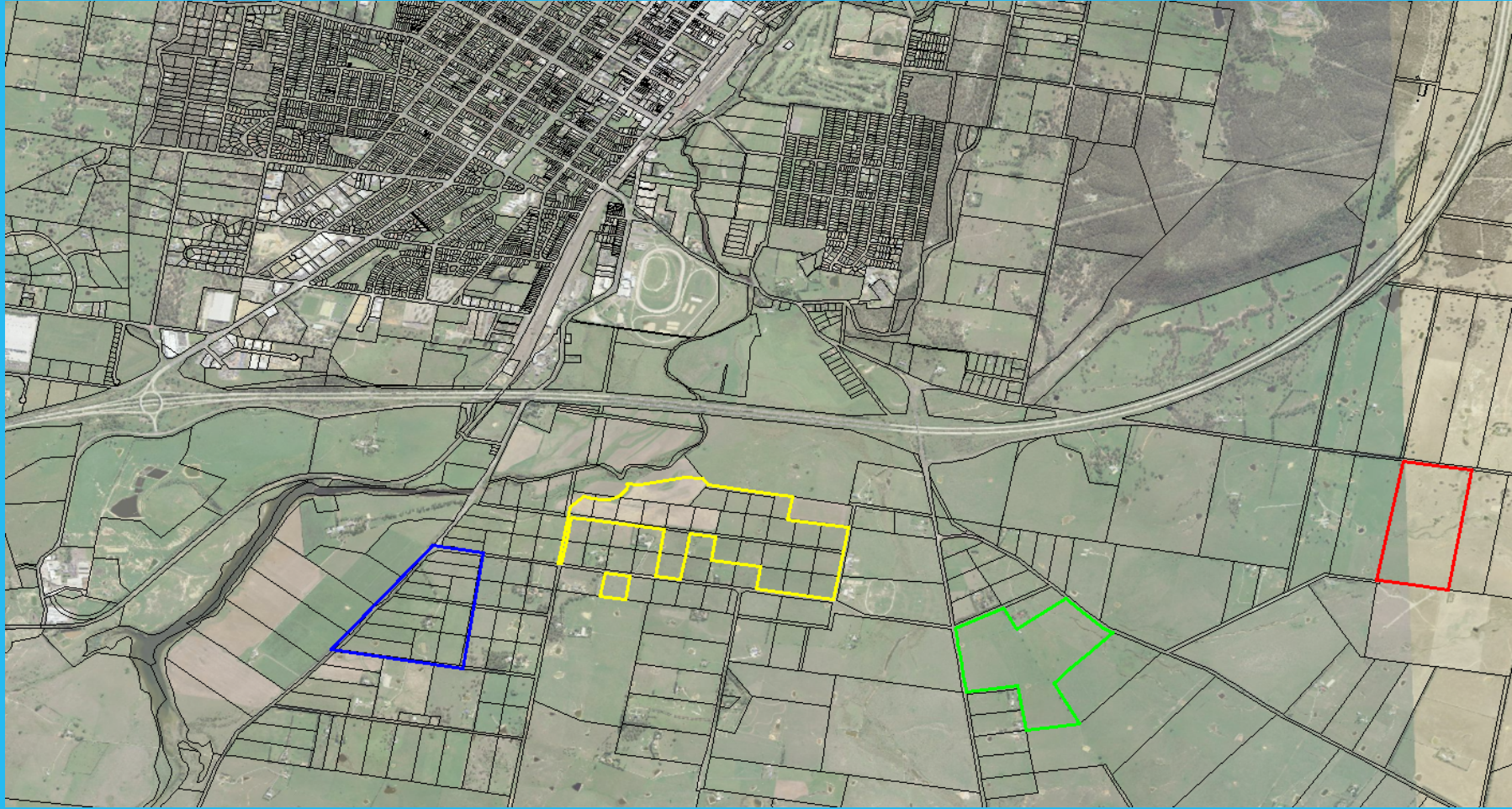
Meeting name	Goulburn planning proposals - Secondary flood risk due to loss of emergency services access
Meeting purpose	Meeting to discuss planning proposals to rezone land within Goulburn Mulwaree LGA and potential secondary flood risks which could result from flooding of access roads and reduce access for emergency services.
Agenda	<ol style="list-style-type: none">1. Introduction2. Flood Risk Assessment3. EM01 – Support for Emergency Management Planning4. Conclusions and Discussion

#	Item	Action (if any)
1	GRC Hydro: <ul style="list-style-type: none"> GRC Hydro go through presentation (attached) - P230823_Goulburn_PP_Stakeholder_Consultation_GRCHydro.pdf 	-
2	RFS attendees: <ul style="list-style-type: none"> RFS request a copy of the presentation for review. GRC Hydro agree to provide. 	GRC Hydro
3	RFS note: <ul style="list-style-type: none"> Bush fires and flooding events are noted to not be correlated. House fires are noted to have some correlation with flood events. Electrical fires are noted to be typically associated with older buildings with reduced risk associated with newer developments. 	- - -
4	Council query: <ul style="list-style-type: none"> Would ensuring future development have access to fire extinguishers reduce the risk of house fires? RFS respond 'yes'. Council note that requirement for fire extinguishers can likely be applied to future development to manage risk. GRC Hydro / Council to discuss mechanism. 	Council / GRC Hydro
	RFS note: <ul style="list-style-type: none"> Station access to the future development areas will be examined to see if there is potential for alternate stations to service these areas. It was noted that the subject sites are located within Rural Fire District and that the area is not serviced by reticulated water. RFS to provide the maximum flood depth at which the RFS trucks can safely traverse through. 	RFS - - RFS
4	NSW Ambulance note that: <ul style="list-style-type: none"> Standard ambulance vehicles (Mercedes type) are not recommended for traversing flood depths greater than 20 cm in flowing water, due to risk of engine becoming flooded, or potential for vehicle to start floating. Use of 4WD vehicle type may improve flood access depth up to ~30 cm. GRC Hydro request serviceability depth is confirmed. There are currently no 4WD type ambulances for the Goulburn region. NSW Ambulance note that it would be desirable to have access to a 4WD for the region. Currently, to service areas where access roads are flooded, NSW Ambulance would: <ul style="list-style-type: none"> Use a helicopter to access if weather permits; Request boat access with assistance from the NSW SES; Request access using NSW RFS trucks. NSW Ambulance advise that significant improvements in cardiac patient outcomes is achieved if AED (Automated external defibrillators) are readily available. 	- NSW Ambulance

	<p>Council:</p> <ul style="list-style-type: none"> Consider the potential for a requirement for future dwellings to own and maintain AEDs as a risk management measure. GRC Hydro / Council to discuss mechanism. 	Council / GRC Hydro
	<p>RFS note that:</p> <ul style="list-style-type: none"> RFS appliances are equipped with AEDs and first aid trained personnel. 	
	<p>NSW Ambulance suggest:</p> <ul style="list-style-type: none"> LEMC warnings be used to evacuate at risk populations prior to a flood event. GRC Hydro note that catchment response times are short and that a flood warning system is currently underdevelopment which may improve warning times and allow for early evacuation. 	
	<p>GRC Hydro request:</p> <ul style="list-style-type: none"> Suggestions from NSW Ambulance and RFS for additional potential risk management measures. Feedback is requested in 2-3 weeks' time. 	All

Attachment B

Goulburn Planning Proposal for Rezoning

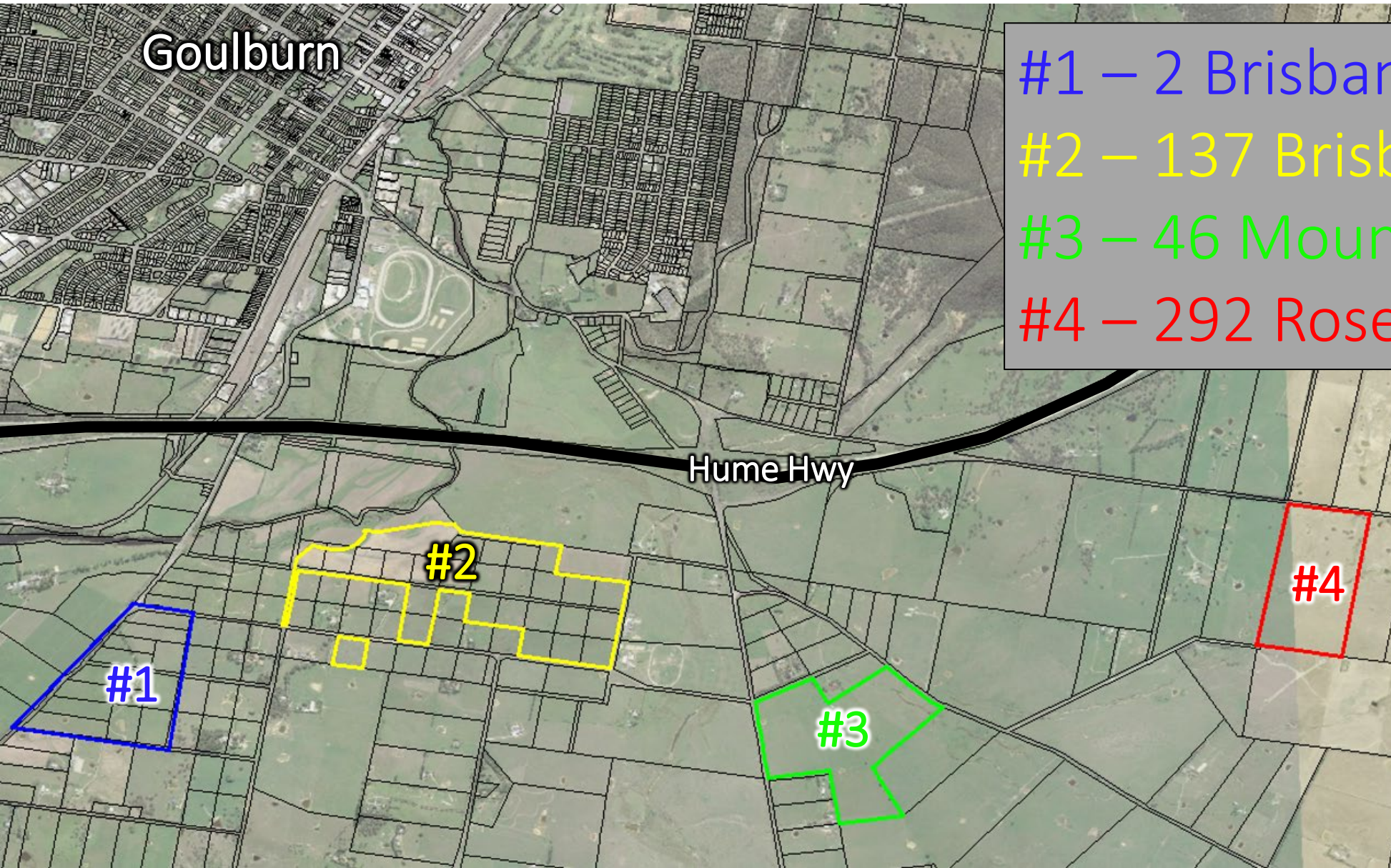


Support for Emergency Management Planning

Talking Points

- *Introduction*
- *Flood risk assessment*
- *EM01 - Support for Emergency Management Planning*
- *Discussion*

Introduction



- #1 – 2 Brisbane Grove Rd
- #2 – 137 Brisbane Grove Rd
- #3 – 46 Mountain Ash Rd
- #4 – 292 Rosemount Rd

Introduction

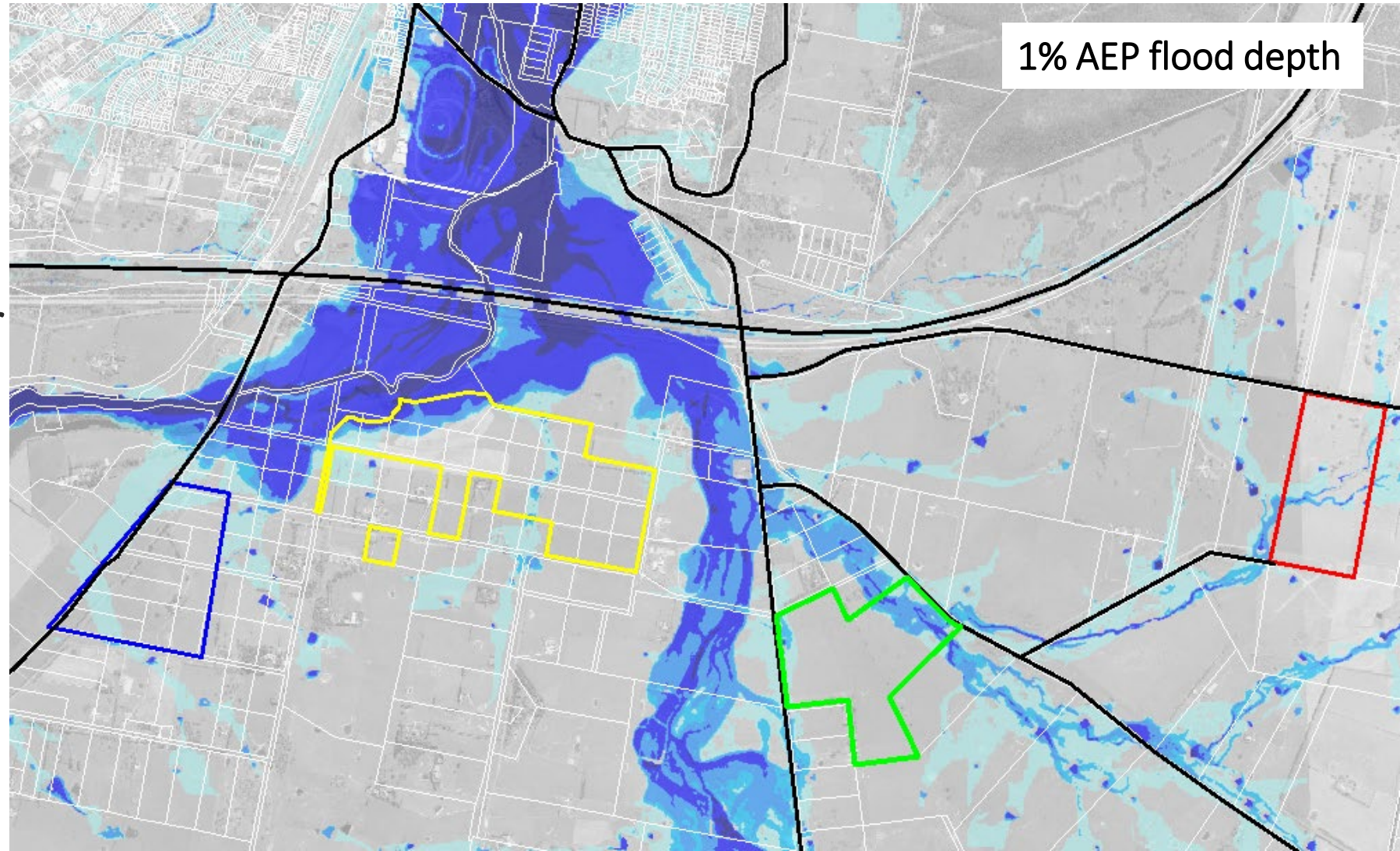
- *Current zoning is RU1 Primary Production – limited development potential*
- *Proposed rezoning to R5 Large Lot Residential – minimum lot size of ~2ha*
- *Rezoning would allow for an additional 39 large lot residential dwellings*
- *Areas of flood prone land are present within and surrounding the land proposed for rezoning*

Introduction

- *Rezoning of land requires consideration of Section 9.1, Clause 4.1 'Flooding' - Local Planning Direction*
- *A planning proposal must be consistent with the requirements of Flood Risk Management Manual (2023)*
- *The Manual (2023) provides advice on support for emergency management services in Flood risk management guidelines EM01, Support for emergency management planning*
- *Consultation with emergency services required by EM01*
- *Fire and medical emergency services have been consulted*

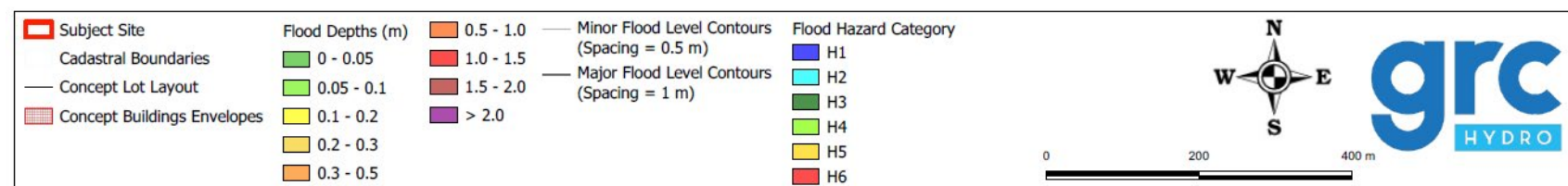
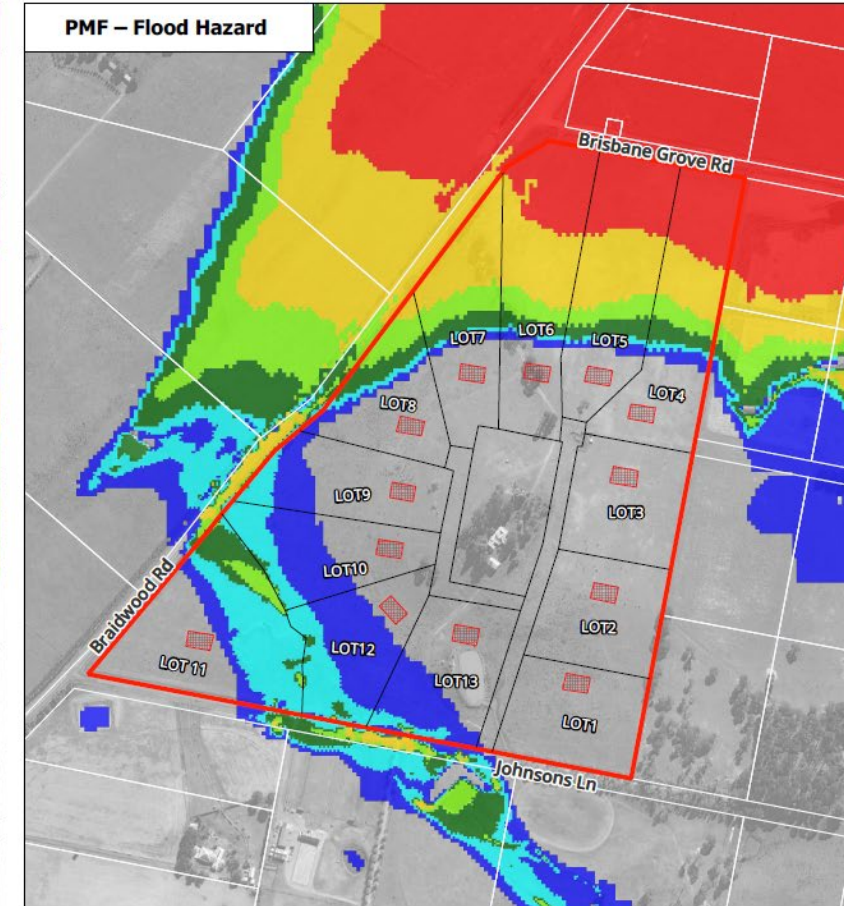
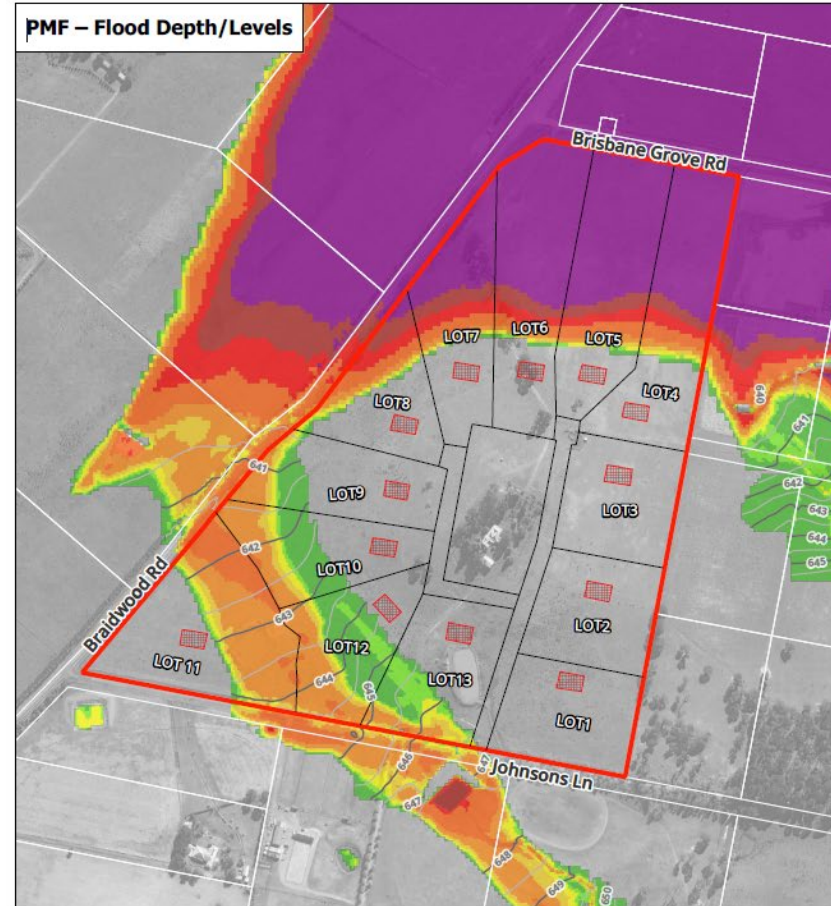
Flood Risk Assessment

- *Land within FPA zoned to C2 – limited development potential*
- *Future development required to be outside of the floodplain – no risk of flooding up to the PMF*
- *Road flooding can reduce access*
- *Future developments are in ‘indirectly affected areas’*



Flood Risk Assessment

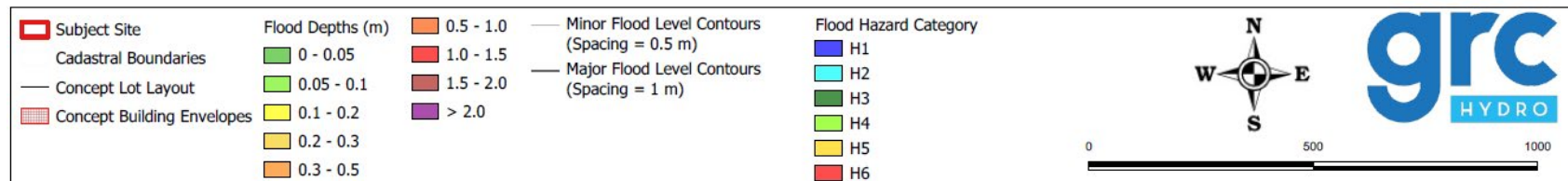
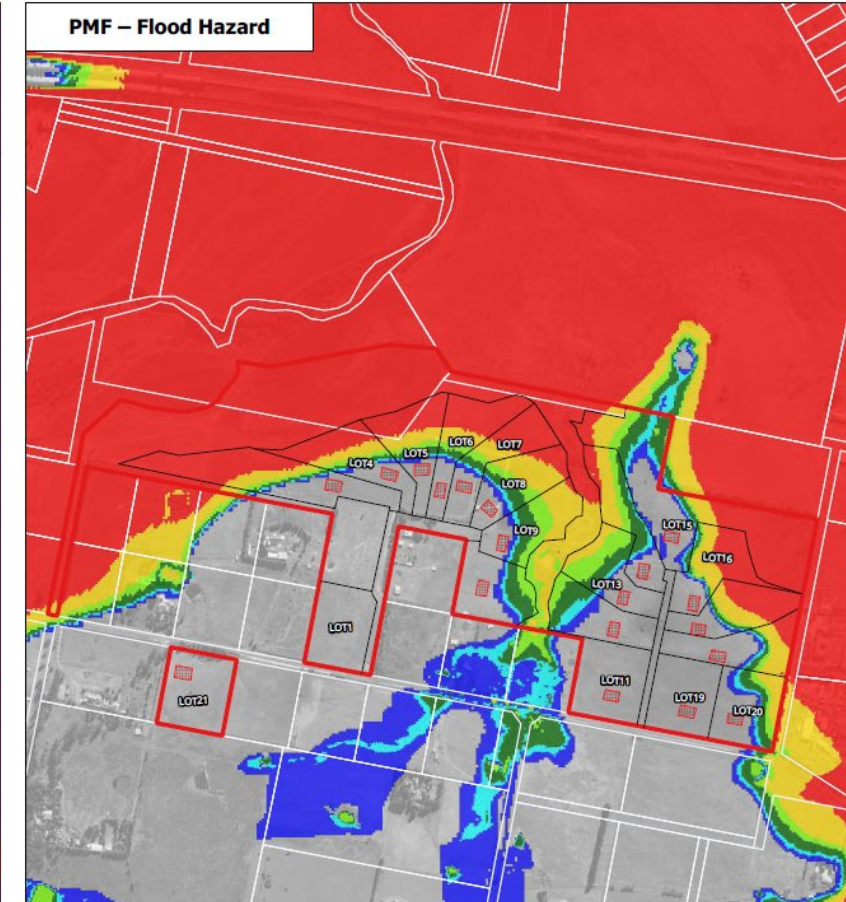
- *Land within FPA zoned to C2 – limited development potential*
- *Building envelopes flood free in PMF*
- *Flood free site access*



TITLE: Developed Conditions – PMF – Flood Depth/Levels and Hazard	PROJECT: 2 Brisbane Grove Road, Goulburn	PROJECT No. 230048	DATE: 11-2023	SCALE: 1:5000	FIGURE No. D2
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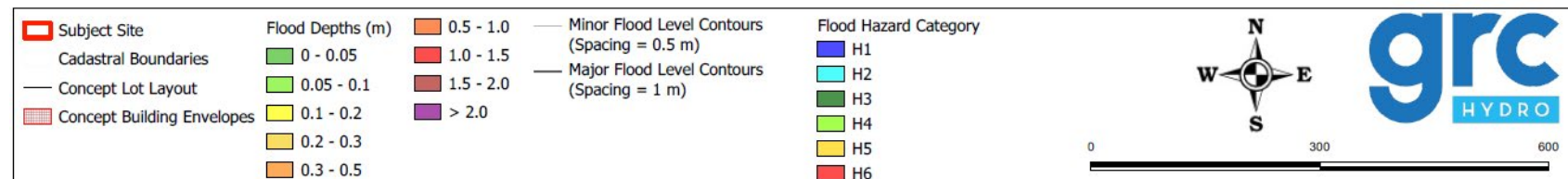
Flood Risk Assessment

- *Land within FPA zoned to C2 – limited development potential*
- *Building envelopes flood free in PMF*
- *Flood free site access*



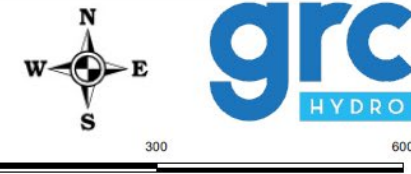
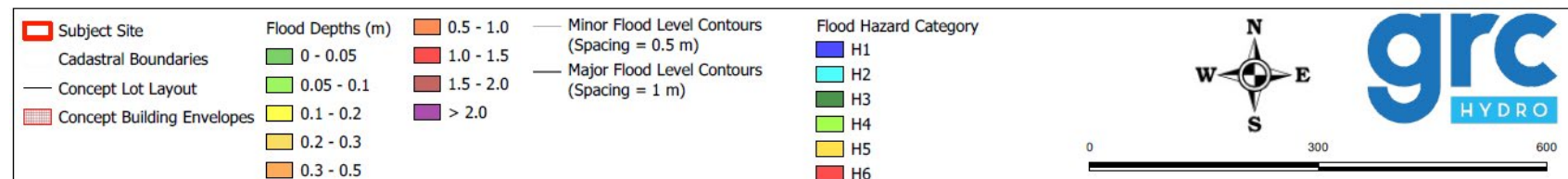
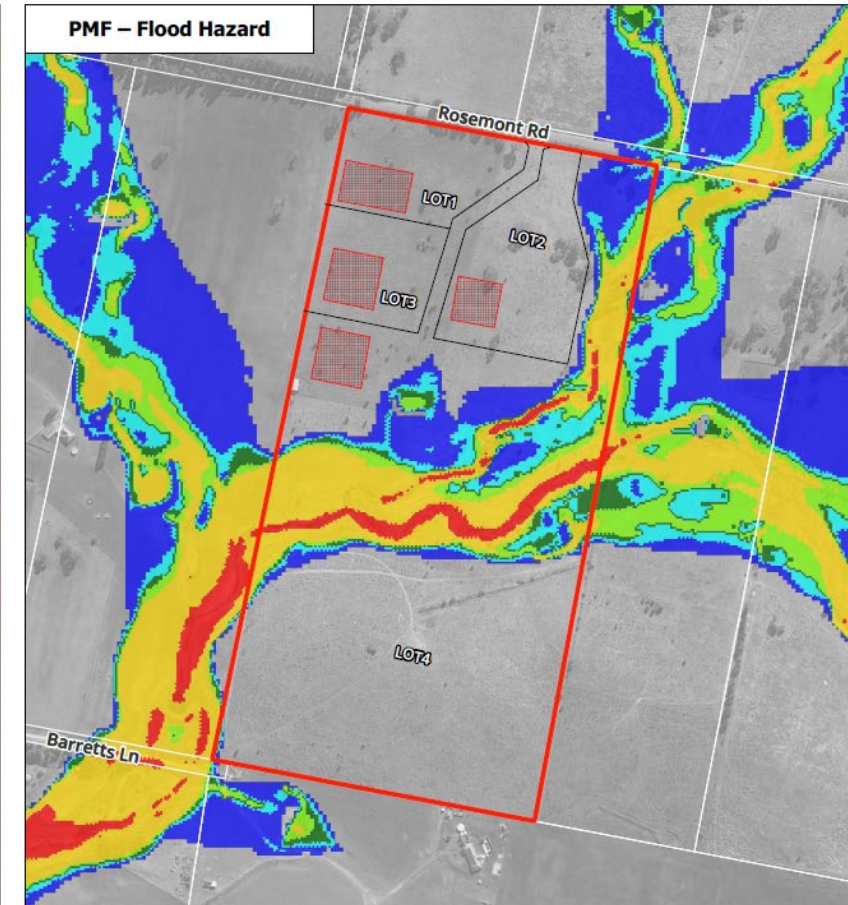
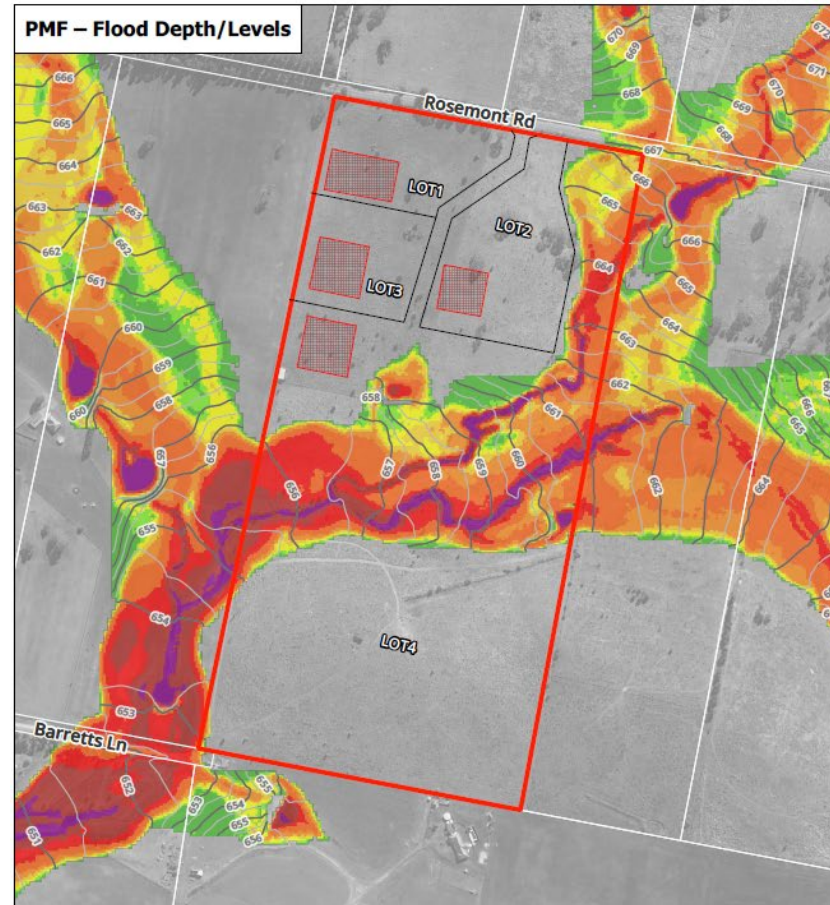
Flood Risk Assessment

- *Land within FPA zoned to C2 – limited development potential*
- *Building envelopes flood free in PMF*



Flood Risk Assessment

- *Land within FPA zoned to C2 – limited development potential*
- *Building envelopes flood free in PMF*
- *Flood free site access*



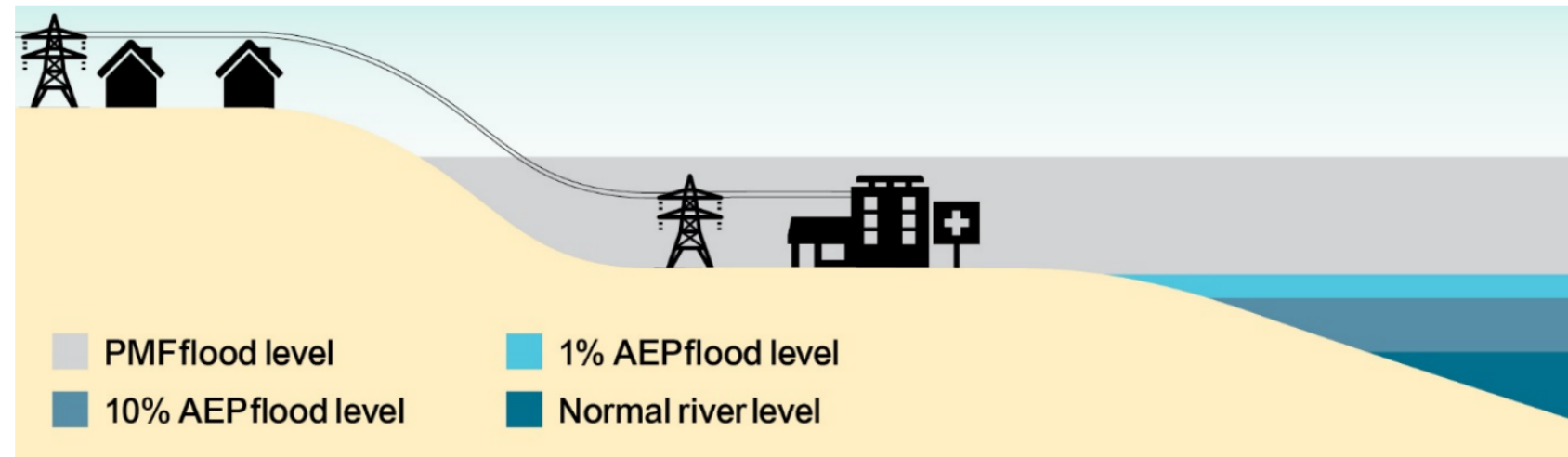
Flood Risk Assessment

- *For IAA flood risk is correlated with inundation:*

- Frequency
- Duration

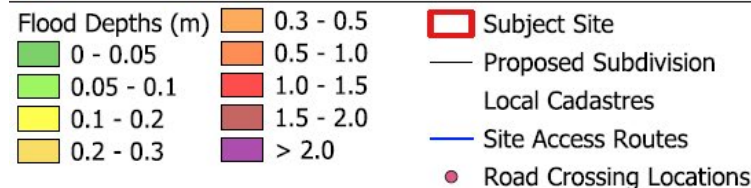
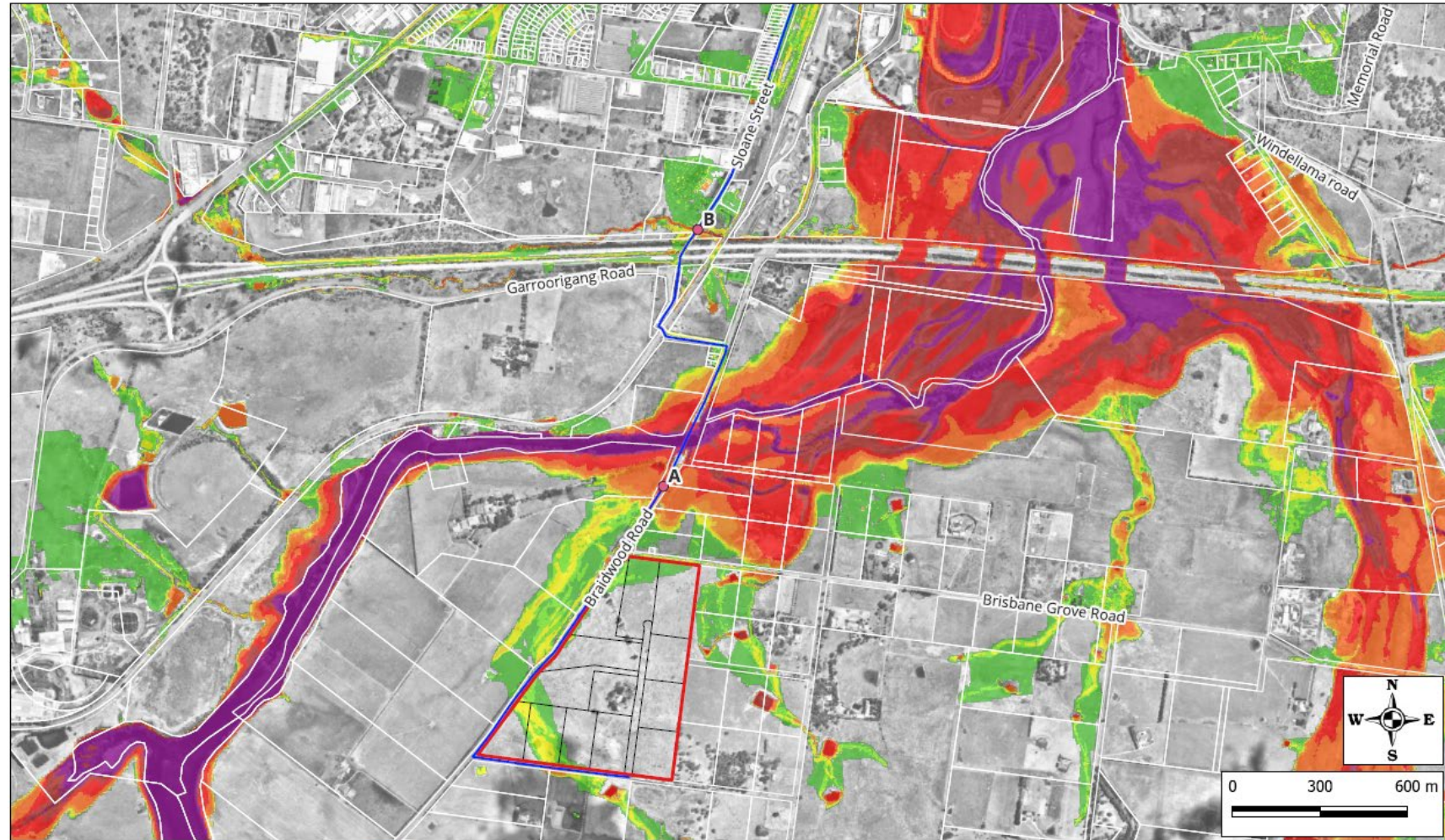
C2.3 Indirectly affected areas

These are areas that are outside the limit of flooding and therefore will not be inundated nor will they lose road access, however, they may be indirectly affected as a result of flood damaged infrastructure or due to the loss of transport links, electricity supply, water supply, sewage or telecommunications services (Figure 15). These areas may therefore require resupply or, in the worst case, evacuation.



Flood Risk Assessment

- Point A critical
- First flooded in rarer than 5% AEP
- Flooded for 23 hours during 1% AEP
- Depth > 0.3 m for 16 hours in 1% AEP
- Road flooded for 38 hours in the PMF

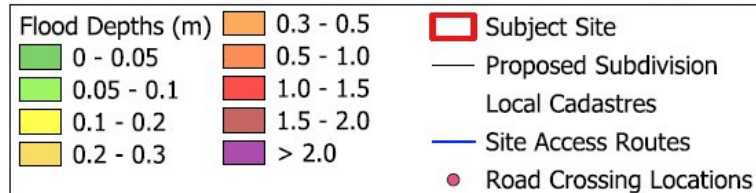
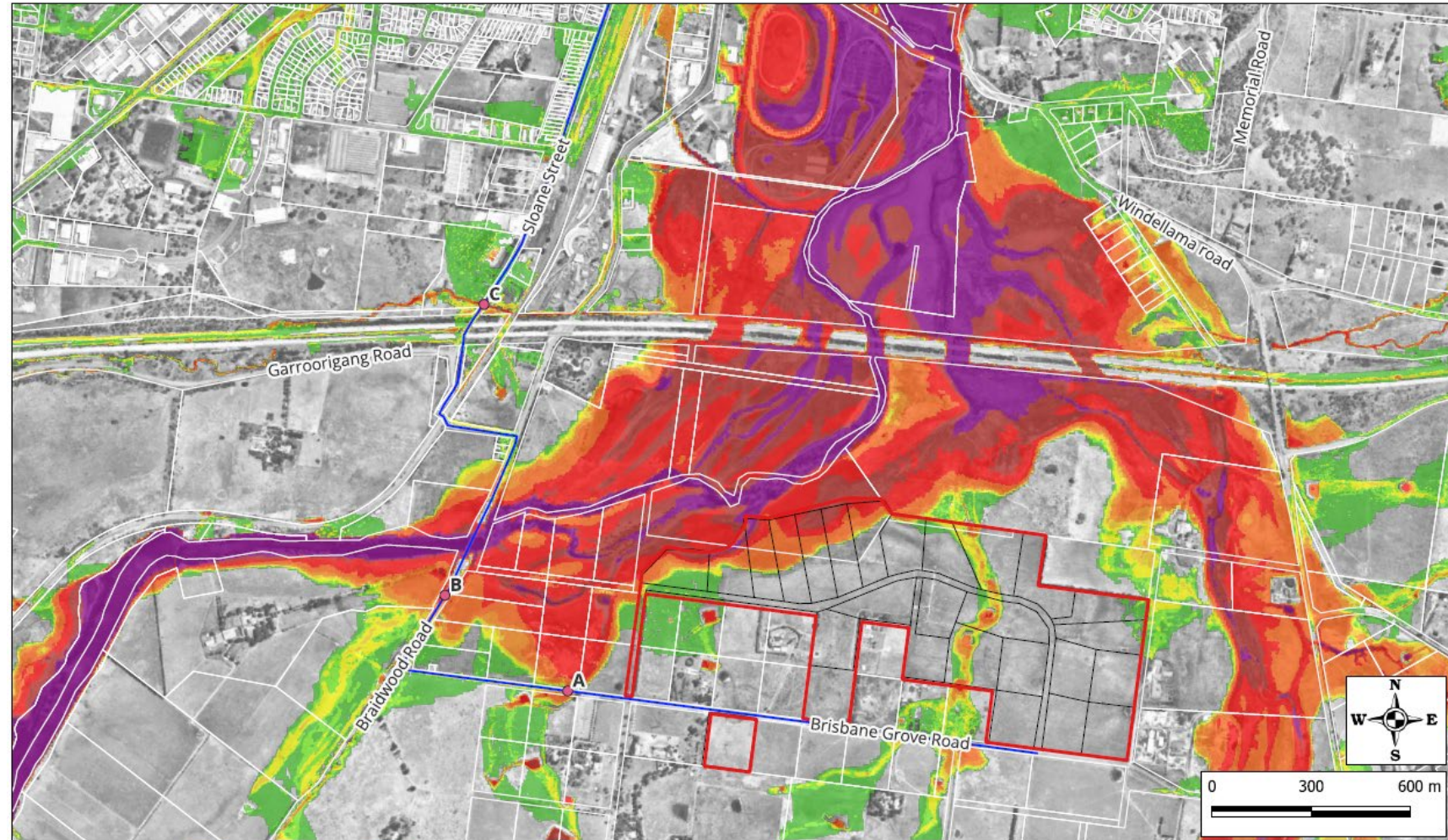


TITLE: Site Access Route		
PROJECT: 2 Brisbane Grove Road, Brisbane Grove		
PROJECT No. 230048		
DATE: 08-2023	SCALE: 1:17,000	FIGURE No. F1



Flood Risk Assessment

- Point B critical
- First flooded in rarer than 5% AEP
- Flooded for 23 hours during 1% AEP
- Depth > 0.3 m for 16 hours in 1% AEP
- Road flooded for 38 hours in the PMF

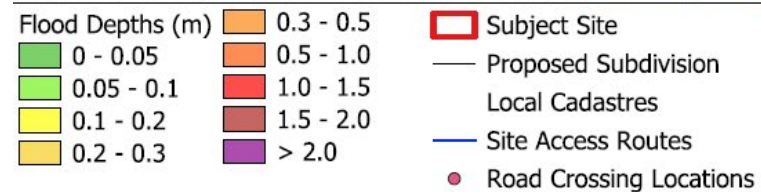
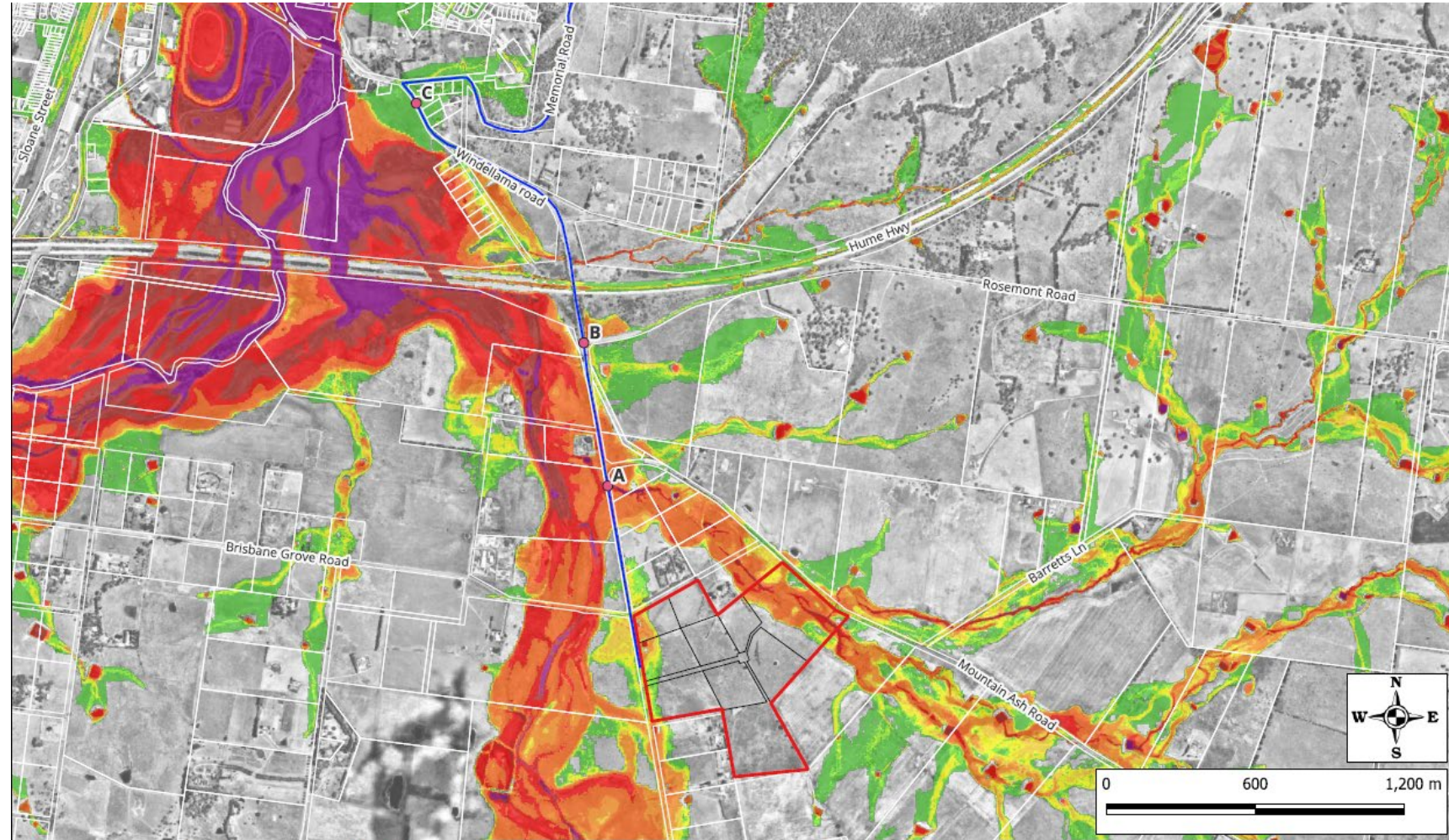


TITLE: Site Access Route		
PROJECT: 137 Brisbane Grove Road, Brisbane Grove		
PROJECT No. 230048		
DATE: 08-2023	SCALE: 1:15,000	FIGURE No. D1



Flood Risk Assessment

- Point A critical
- First flooded in ~10% AEP (depth = 0.1 m)
- Flooded for 30 hours during 1% AEP (depth < 0.4 m)
- Depth > 0.3 m for 13 hours in 1% AEP
- Road flooded for 42 hours in the PMF

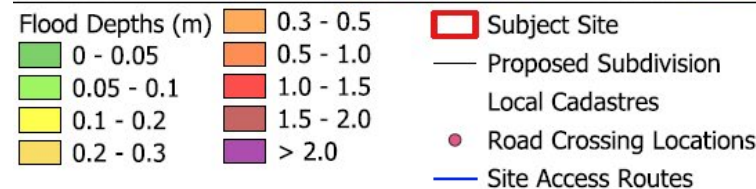
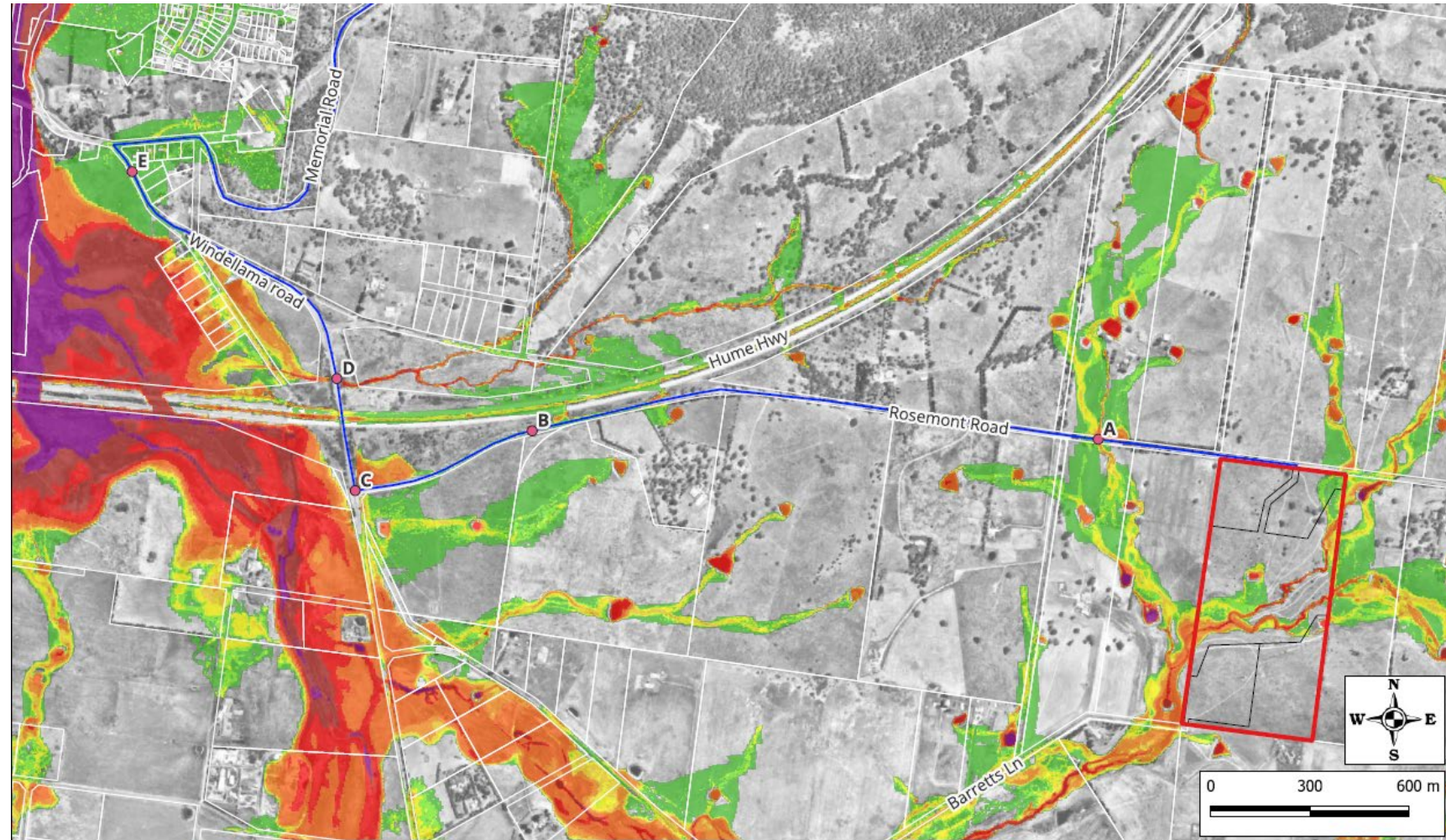


TITLE: Site Access Route		
PROJECT: 46 Mountain Ash Road, Brisbane Grove		
PROJECT No. 230049		
DATE: 08-2023	SCALE: 1:20,000	FIGURE No. D1



Flood Risk Assessment

- Point A & C critical
- First flooded in ~1% AEP (depth 0.05 m)
- Flooded for 1 hour during 1% AEP
- Road flooded at 'C' for 24 hours in the PMF



TITLE: Site Access Route		
PROJECT: 292 Rosemont Rd, Boxers Creek		
PROJECT No.	230049	
DATE: 08-2023	SCALE: 1:15,000	FIGURE No. D1



Flood Risk Assessment

- *Future development situated outside of the PMF – no flood risk to future dwellings*
- *Residual risk due to flooding of access roads*
- *Reduced access creates potential ‘Secondary Risks’*

EM01 - Support for Emergency Management Planning

Emergency Services
Input

Council Planning

Key consideration	EM response strategy	
	Evacuation	Shelter in place
Additional risk management considerations		
Addressing secondary risks of fire and medical emergencies during floods	NA	To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding. Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services.
Limiting exposure of people to floodwaters	Needs to be considered as part of the evacuation strategy.	This can be aided by providing sufficient readily accessible habitable areas above the PMF to cater for potential occupants, clients, visitors and residents.
Provision of publicly accessible space for the itinerant population	Needs to be considered as part of the evacuation strategy.	Provision of publicly accessible space or access to space above the PMF (with adequate infrastructure to enable the physically impaired to access such space) that is easily accessible 24 hours a day, 7 days a week and is clearly identified for this purpose with associated directional signage.
Providing adequate services so people are less likely to enter floodwaters	NA	This includes access to ablutions, water, power and basic first aid equipment. Consideration must be given to the availability of onsite systems to provide for power, water and sewage services for the likely flood duration (up to 12 hours) plus a further period of up to 48 hours to allow for restoration of external services.

EM01 - Support for Emergency Management Planning

Council Planning

Limiting exposure of people to floodwaters	Needs to be considered as part of the evacuation strategy.	This can be aided by providing sufficient readily accessible habitable areas above the PMF to cater for potential occupants, clients, visitors and residents.
Provision of publicly accessible space for the itinerant population	Needs to be considered as part of the evacuation strategy.	Provision of publicly accessible space or access to space above the PMF (with adequate infrastructure to enable the physically impaired to access such space) that is easily accessible 24 hours a day, 7 days a week and is clearly identified for this purpose with associated directional signage.
Providing adequate services so people are less likely to enter floodwaters	NA	This includes access to ablutions, water, power and basic first aid equipment. Consideration must be given to the availability of onsite systems to provide for power, water and sewage services for the likely flood duration (up to 12 hours) plus a further period of up to 48 hours to allow for restoration of external services.

Risk Management Considerations	Management Options
Limiting exposure of people to flood waters	<ul style="list-style-type: none"> - All dwellings above the PMF. No need for evacuation. - Council / NSW SES – installing flood depth markers and flood warning signs at flooded crossings (FRSMP recommendation). - Notify of the risk of entering floodwaters as part of a community flood education program (FRSMP recommendation).
Provision of publicly accessible space for itinerant population	<ul style="list-style-type: none"> - Considered low risk due to likely small itinerant population, particularly during times of flood. - Sufficient space above the PMF level on various access roads.
Providing adequate services so people are less likely to enter floodwaters.	<p>Management measures:</p> <ul style="list-style-type: none"> - Sewerage - Self-contained, treatment onsite – additional management measure not required. - Water – Self-contained, tanks onsite – additional management measure not required. - Power – Provision for solar and batteries may reduce risk. Can potentially be implemented through Section 88B provisions. - Basic first aid – advise rural residents to maintain and first aid kit as part of the ‘community flood education program’ recommended in the FRSMP. For discussion with Council/SES.

EM01 - Support for Emergency Management Planning

Key consideration	EM response strategy	
	Evacuation	Shelter in place
Additional risk management considerations		
Addressing secondary risks of fire and medical emergencies during floods	NA	<p>To minimise the increased risk of fire and to reduce both the potential for adverse outcomes in the case of a medical emergency and the risks to those who may aid the person/patient, the NSW SES, Ambulance NSW, the relevant Health functional area, and the fire agency servicing the area should be consulted by council to determine appropriate risk management measures to minimise risks during flooding.</p> <p>Where there is no CBD-wide strategy to address secondary risks during flooding, consideration needs to be given to how secondary risks will be managed for the duration of flooding and a further period of up to 48 hours to provide restoration of external services.</p>

Emergency Services
Input

- No objection made by Ambulance NSW or RFS
- RFS note:
 - negative correlation for bush fire risk during flood. House fires have some correlation that is reduced for newer developments. – Correlation for proposed future dwellings not expected as development is outside of PMF extent.
 - Council to require fire extinguishers to be available for future development to manage risk
- Ambulance NSW note:
 - to service areas where access roads are flooded, Ambulance NSW use helicopter, boat access (via NSW SES), request access from NSW RFS truck.
 - NSW Ambulance advise that significant improvements in cardiac patient outcomes is achieved if AED (Automated External Defibrillators). Council to require AED for future development to manage risk

Joint Probability Assessment

- *Probability of a 'secondary risk' occurring during flood*
- *Isolation of sites is 'rare', typically rarer than 5% AEP which equates to 0.01% chance on any given day*
- *Average daily number of emergency department presentations at Goulburn Hospital = 7*
(<https://www.aihw.gov.au/reports-data/myhospitals/hospital/h0142>)
- *Population of Goulburn = 32,294 (census)*
- *0.02% chance of any one person presenting at Goulburn hospital on a given day*
- *Probability that any one person living at the site will need to present at emergency during a 5% AEP or rarer flood = 0.000003% DEP (assuming no correlation)*
- *39 future dwellings with 2.5 people per dwelling (census) = ~98 people*
- *Binomial theorem finds that the probability of one of the 98 inhabitants needing medical assistance whilst access is not available is 1 in 1,000 AEP if no correlation. Very weak correlation is expected as dwellings are outside of the floodplain away from flood waters*
- *House fire probability is 1 in 2,000 AEP (4500 NSW house fires - 3,364,777 dwellings)*
- *Combined probability of secondary risk is ~1 in 667 AEP*

Conclusions / Discussion

- *No flood risk to future dwellings – outside of the PMF extent*
- *Sites are considered ‘indirectly affected areas’ due to flooded access roads*
- *Probability of a secondary risk occurring while access is not available is low*
- *Risk management measures have been considered*
- *Input from NSW SES requested*



Job Number: 230048 / 230049
Date: 15 November 2023

GRC Hydro
Level 9, 233 Castlereagh Street
Sydney NSW 2000

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www.grchydro.com.au

Minutes from Southern Goulburn planning proposal – NSW SES / BCD meeting

Project: Southern Goulburn planning proposals
Date & Time: 02/11/2023 3.30 pm
Subject: Secondary flood risk due to loss of emergency services access
Location: MS Teams
Attendance: Goulburn Council NSW SES GRC Hydro
Kate Wooll Elspeth O’Shannessy Zac Richards
David Kiernan Gilian Webber William Tang
Dialina Day Rodney Whalan Kate Wen

DPE
Shaza Raini

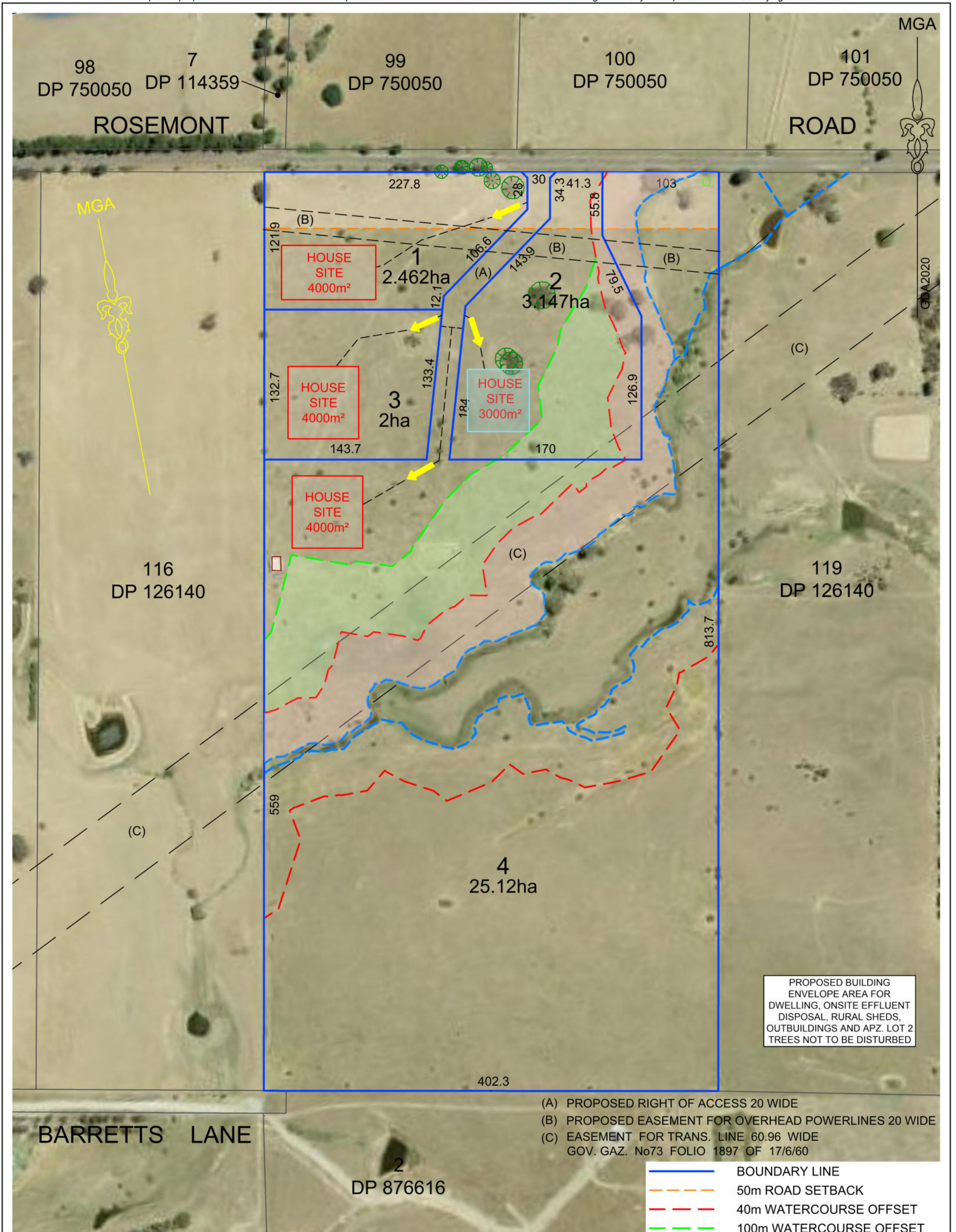
Apologies: Nil

Meeting name	Goulburn planning proposals for Rezoning - Support for Emergency Management Planning
Meeting purpose	Meeting to discuss planning proposals to rezone land within Goulburn Mulwaree LGA and potential secondary flood risks which could result from flooding of access roads and reduce access for emergency services.
Agenda	<ol style="list-style-type: none">1. Introduction2. Flood Risk Assessment3. EM01 – Support for Emergency Management Planning4. Discussion

#	Item	Action (if any)
1	GRC Hydro: <ul style="list-style-type: none"> GRC Hydro go through presentation (attached) - P021123_Goulburn_PP_NSWSES_Consultation_GRCHydro.pdf 	-
2	SES: <ul style="list-style-type: none"> Notes that studies are available which discusses the correlation of medical/fire emergencies during flooding. GRC Hydro requested the SES for more details (names, papers if available etc.) of the available studies. GRC Hydro to review the provided studies and investigate incorporating correlation data into joint probability analysis. 	- NSW SES GRC Hydro
3	Goulburn Council: <ul style="list-style-type: none"> Queried about potential to raise bridge approaches at Braidwood Road to reduce flood risks. GRC Hydro provided details of raise requirements (~0.2 m raise over 200m length for northern approach, and up to ~0.8m over ~100m length for southern approach). GRC Hydro notes that bridge raising should be considered as a long term plan. 	- - -
4	NSW SES: <ul style="list-style-type: none"> Queries GRC Hydro designation of the sites at an 'Indirectly affected area' FERC classifications. GRC Hydro provided further details of the terminology, and agree to re-examine FERC classifications. 	- GRC Hydro
	NSW SES: <ul style="list-style-type: none"> NSW SES advise that the key risks to consider are access, rescue of animals and people, capacity to evacuate people requiring medical assistance, resupply, increased fire risks, and maintenance of equipment such as AEDs and fire extinguishers. GRC Hydro to consider the above when preparing FIRA report. 	- GRC Hydro
4	DPE: <ul style="list-style-type: none"> Acknowledges that current design is a step forward relative to earlier submissions with provision of building envelopes outside the PMF extent, new access road to the south and all land within the FPA zoned so as to not enable residential use. The availability of facilities and a community space was discussed and broader planning of cumulative impacts of any potential future development in the area. SES cautioned that the community hub must be located outside of floodplain area, i.e. the airport is potentially not a good place for the setup as it is likely to be located on a floodplain. GRC Hydro note that all proposed future dwellings would be outside of the PMF extent with adequate amenities. GRC Hydro note that For this reason, evacuation to a community hub for these properties would be unlikely. Reiterates that the key issue to be addressed are secondary risks. 	- - - - -

	<ul style="list-style-type: none">• GRC Hydro notes that the concept lot/road configurations do not preclude benefits from future risk management works such as road upgrades/community hubs etc.• Goulburn Council to investigate the potential of a “contribution plan” to provide any flood related infrastructure to reduce isolation hazards including road upgrades, signage and community awareness information.	-
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Attachment C



NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY. C:\Users\JustinKell\KMJ surveying\KMJ Surveying - Documents\Surveyors\Jobs\214480 Taylor\4. Planning\DWG\Rosemont Road-Barretts Lane\214480 B-DA01- O Subdivision (Rosemont Road) 4 LOTS.dwg

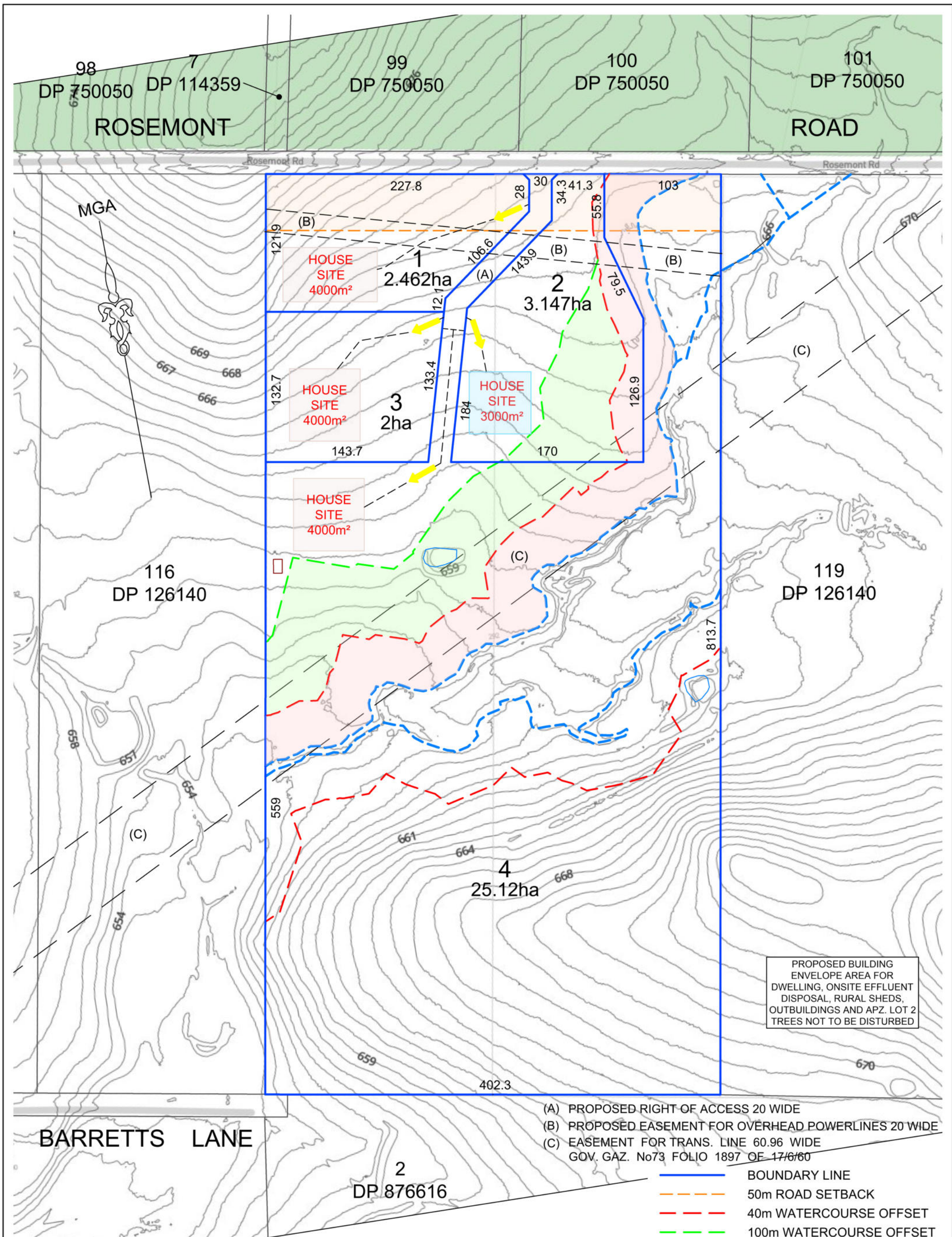
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K	BOUNDARY ADJUSTMENT	SH	07/08/2023
L	LAND ZONING ADJUSTMENT	SH	01/09/2023
M	BOUNDARY ADJUSTMENT	SH	20/09/2022
N	BOUNDARY ADJUSTMENT	SH	09/10/2023
O	NEW TEMPLATE	SH	17/10/2022



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 36 Montague Street
 GOULBURN NSW 2580
 p: (02) 4821 1033
 e: admin@kmjsurveying.com.au
 w: www.kmjsurveying.com.au

M. TAYLOR
 PLAN OF PROPOSED SUBDIVISION
AERIAL UNDERLAY
 LOTS 117 & 118 DP 126140,
 292 ROSEMONT ROAD, BOXERS CREEK.
 LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-01
ISSUE	O



PROPOSED BUILDING ENVELOPE AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ. LOT 2 TREES NOT TO BE DISTURBED

- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
 - (B) PROPOSED EASEMENT FOR OVERHEAD POWERLINES 20 WIDE
 - (C) EASEMENT FOR TRANS. LINE 60.96 WIDE
GOV. GAZ. No73 FOLIO 1897 OF 17/6/60
- BOUNDARY LINE
 - - - - 50m ROAD SETBACK
 - - - - 40m WATERCOURSE OFFSET
 - - - - 100m WATERCOURSE OFFSET

NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY

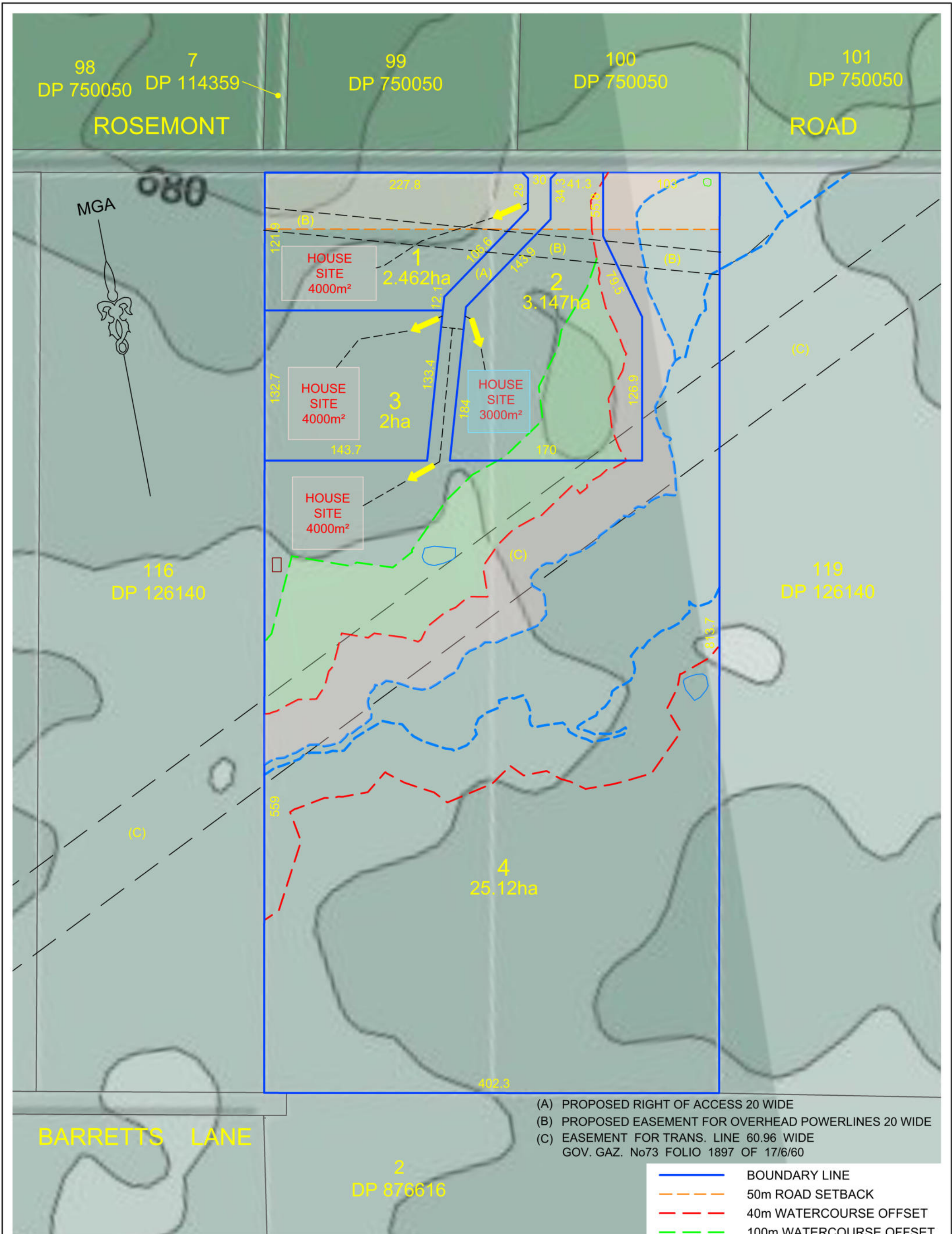
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N	BOUNDARY ADJUSTMENT	SH	09/10/2023
O	NEW TEMPLATE	SH	17/10/2022



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M. TAYLOR
 PLAN OF PROPOSED SUBDIVISION
1m CONTOURS UNDERLAY
 LOTS 117 & 118 DP 126140,
 292 ROSEMONT ROAD, BOXERS CREEK.
 LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-02
ISSUE	O



- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
- (B) PROPOSED EASEMENT FOR OVERHEAD POWERLINES 20 WIDE
- (C) EASEMENT FOR TRANS. LINE 60.96 WIDE
GOV. GAZ. No73 FOLIO 1897 OF 17/6/60

- BOUNDARY LINE
- - - - - 50m ROAD SETBACK
- - - - - 40m WATERCOURSE OFFSET
- - - - - 100m WATERCOURSE OFFSET

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ISSUE	AMENDMENT	DRAWN	DATE
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L	LAND ZONING ADJUSTMENT	SH	01/09/2023
M	BOUNDARY ADJUSTMENT	SH	20/09/2022
N	BOUNDARY ADJUSTMENT	SH	09/10/2023
O	NEW TEMPLATE	SH	17/10/2022



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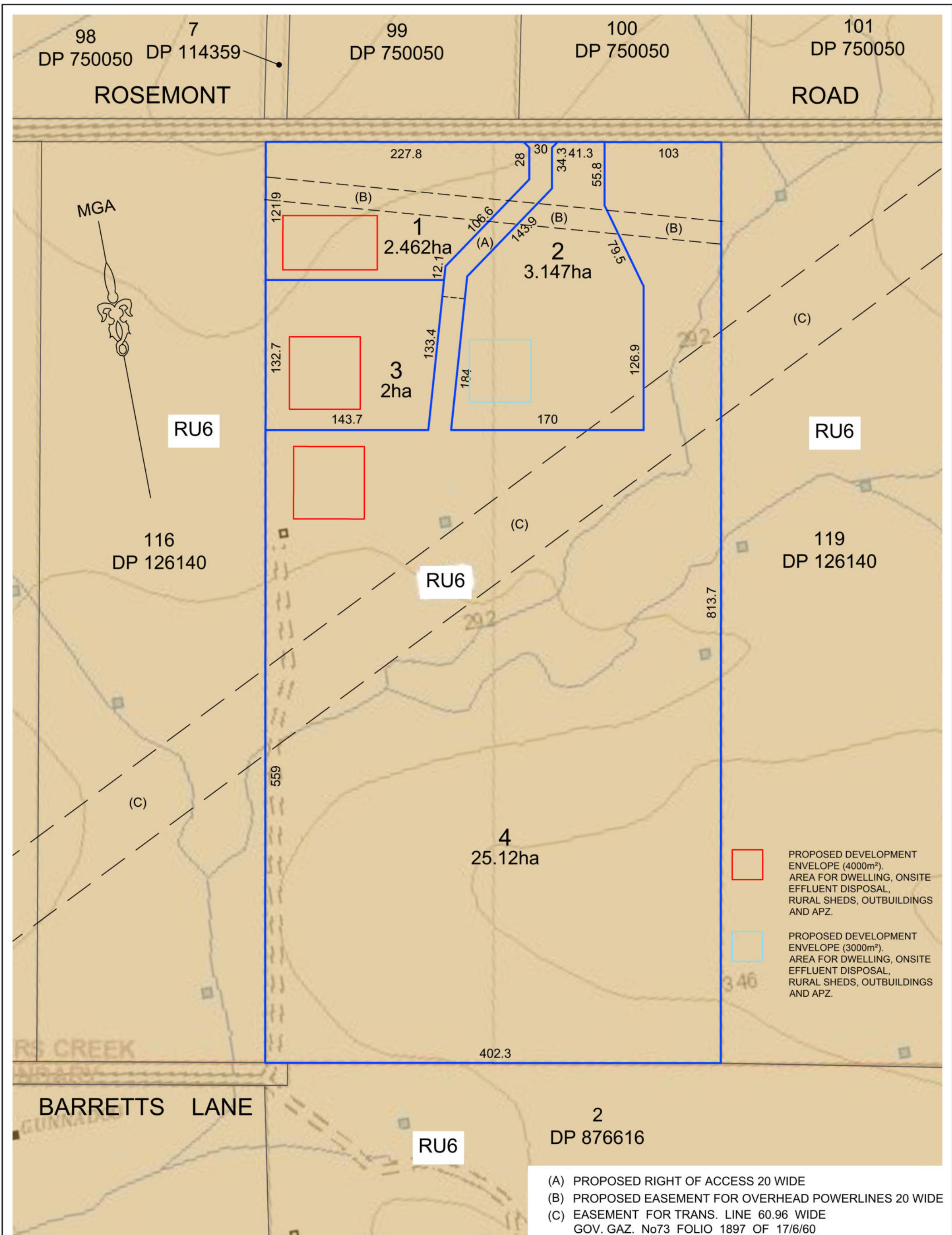
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w: www.kmjsurveying.com.au

M. TAYLOR

PLAN OF PROPOSED SUBDIVISION
10m CONTOURS UNDERLAY
LOTS 117 & 118 DP 126140,
292 ROSEMONT ROAD, BOXERS CREEK.

LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-03
ISSUE	O



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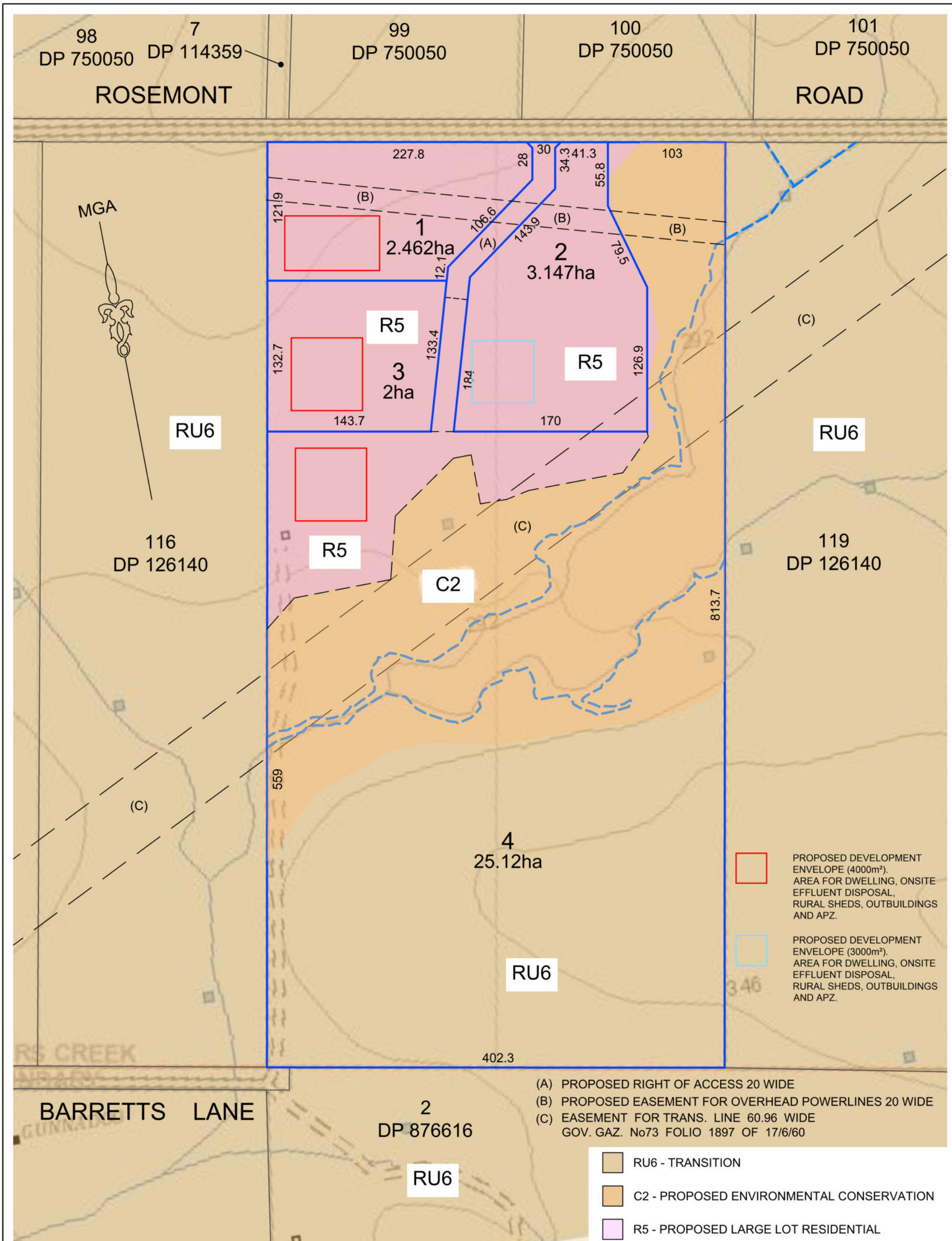
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M. TAYLOR

PLAN OF PROPOSED SUBDIVISION
CURRENT LAND ZONING PLAN
LOTS 117 & 118 DP 126140,
292 ROSEMONT ROAD, BOXERS CREEK.

LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-04
ISSUE	O



- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
- (B) PROPOSED EASEMENT FOR OVERHEAD POWERLINES 20 WIDE
- (C) EASEMENT FOR TRANS. LINE 60.96 WIDE
GOV. GAZ. No73 FOLIO 1897 OF 17/6/60

- RU6 - TRANSITION
- C2 - PROPOSED ENVIRONMENTAL CONSERVATION
- R5 - PROPOSED LARGE LOT RESIDENTIAL

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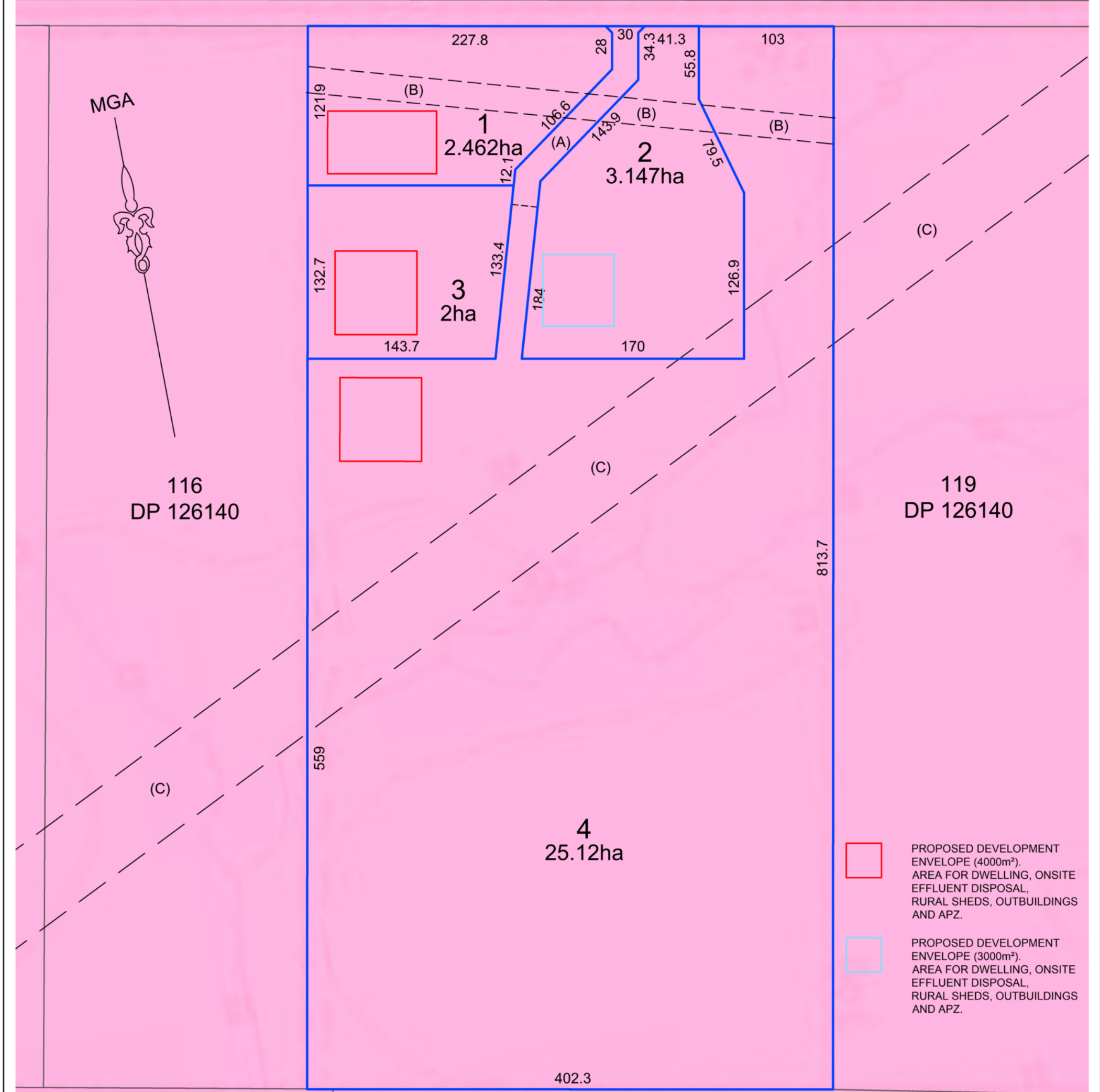


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M. TAYLOR
 PLAN OF PROPOSED SUBDIVISION
PROPOSED LAND ZONING PLAN
 LOTS 117 & 118 DP 126140,
 292 ROSEMONT ROAD, BOXERS CREEK.
 LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-05
ISSUE	O

98 DP 750050 ROSEMONT	7 DP 114359	99 DP 750050	100 DP 750050	101 DP 750050 ROAD
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- PROPOSED DEVELOPMENT ENVELOPE (4000m²). AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ.
- PROPOSED DEVELOPMENT ENVELOPE (3000m²). AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ.

116 DP 126140

119 DP 126140

BARRETTS LANE

2 DP 876616

- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
- (B) PROPOSED EASEMENT FOR OVERHEAD POWERLINES 20 WIDE
- (C) EASEMENT FOR TRANS. LINE 60.96 WIDE GOV. GAZ. No73 FOLIO 1897 OF 17/6/60

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ISSUE	AMENDMENT	DRAWN	DATE	M. TAYLOR	
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				ISSUE O	

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DP 750050
ROSEMONT

7
DP 114359

99
DP 750050

100
DP 750050

101
DP 750050
ROAD

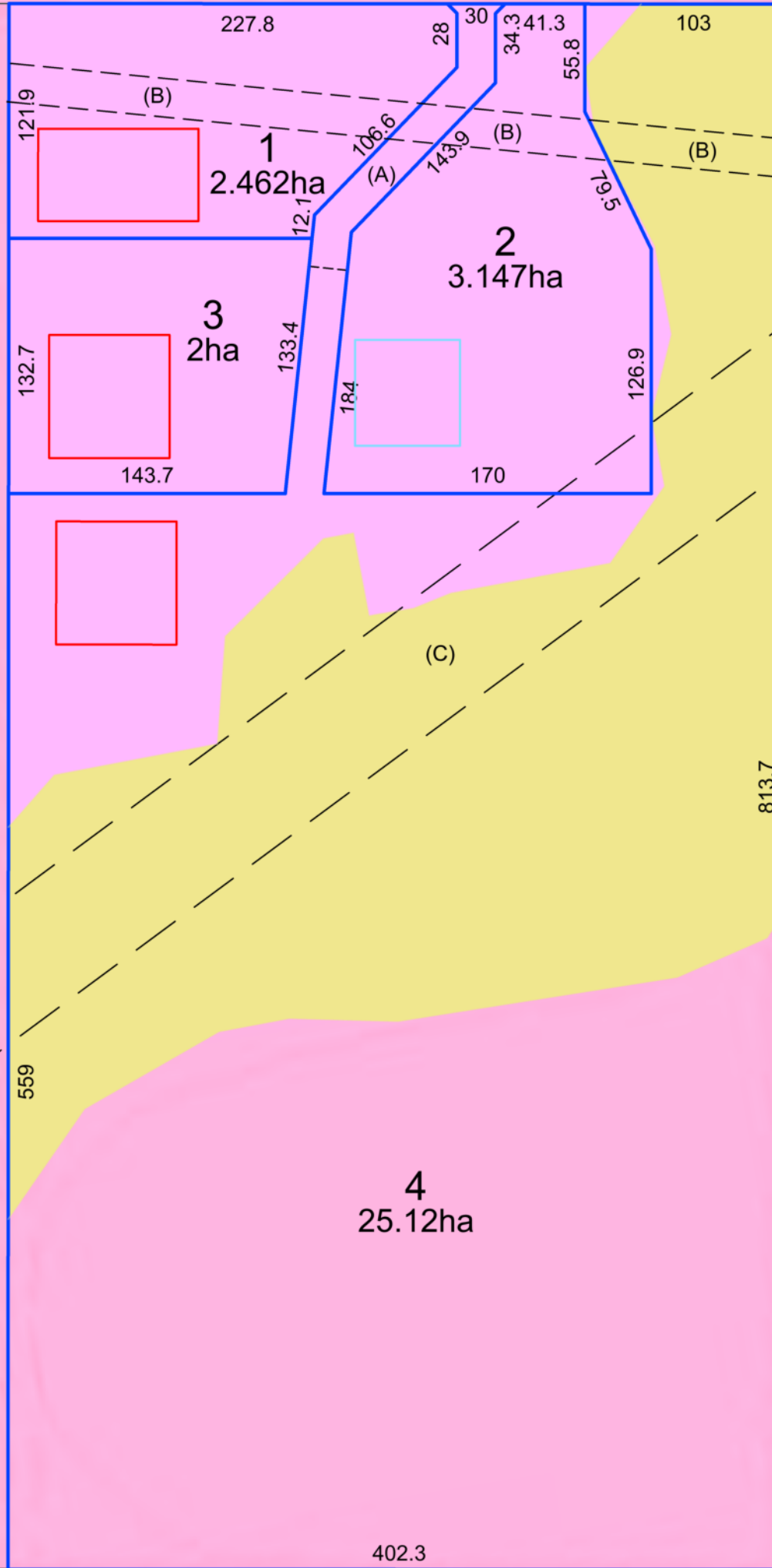
MGA

116
DP 126140

119
DP 126140

BARRETTS LANE

2
DP 876616



- PROPOSED DEVELOPMENT ENVELOPE (4000m²). AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ.
- PROPOSED DEVELOPMENT ENVELOPE (3000m²). AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ.

100ha 20ha Min 2ha

- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
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GOV. GAZ. No73 FOLIO 1897 OF 17/6/60

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ABN: 21 664 063 370

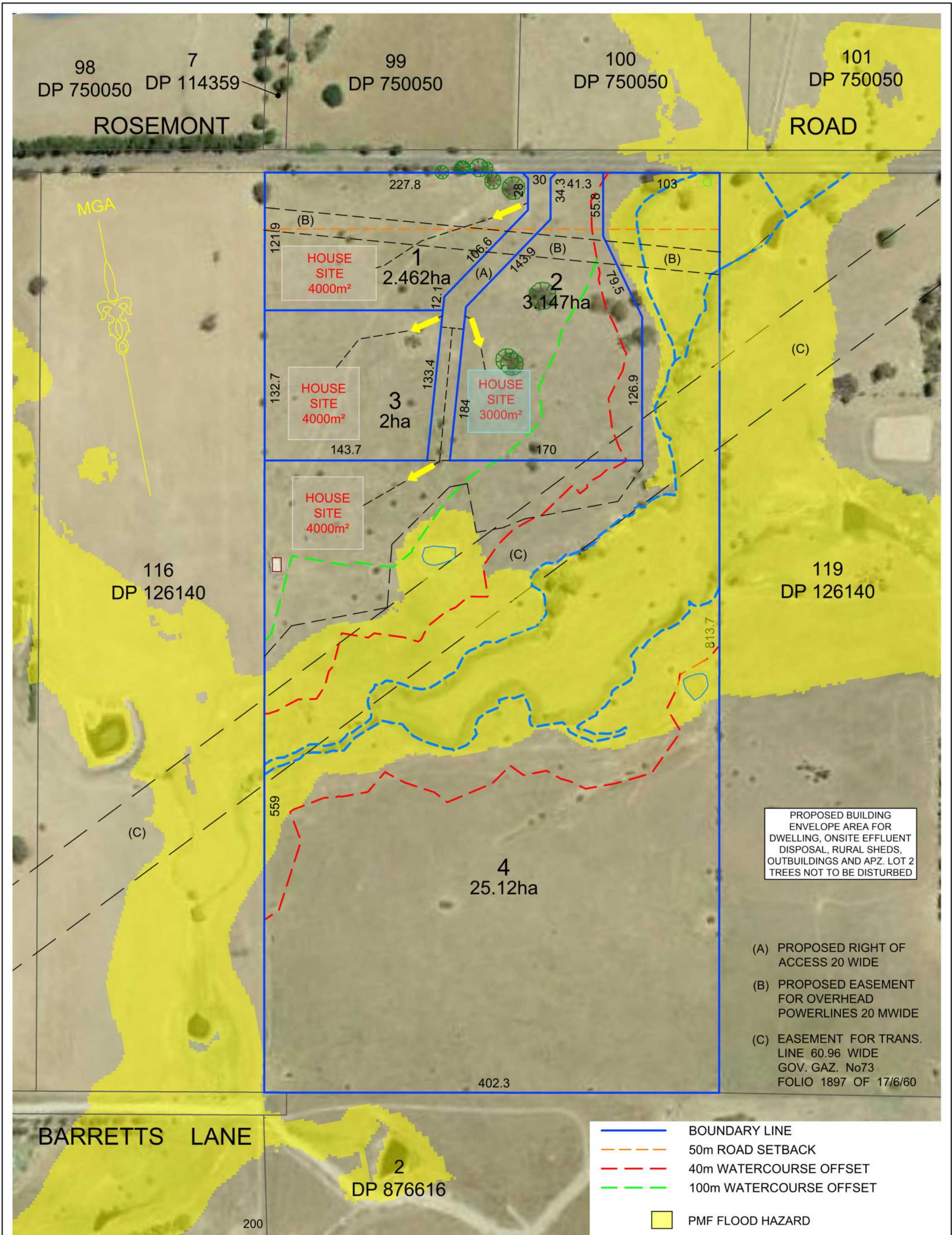
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M. TAYLOR

PLAN OF PROPOSED SUBDIVISION
PROPOSED LOT SIZES PLAN
LOTS 117 & 118 DP 126140,
292 ROSEMONT ROAD, BOXERS CREEK.

LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-07
ISSUE	O



PROPOSED BUILDING ENVELOPE AREA FOR DWELLING, ONSITE EFFLUENT DISPOSAL, RURAL SHEDS, OUTBUILDINGS AND APZ. LOT 2 TREES NOT TO BE DISTURBED

- (A) PROPOSED RIGHT OF ACCESS 20 WIDE
- (B) PROPOSED EASEMENT FOR OVERHEAD POWERLINES 20 MWIDE
- (C) EASEMENT FOR TRANS. LINE 60.96 WIDE GOV. GAZ. No73 FOLIO 1897 OF 17/6/60

- BOUNDARY LINE
- - - 50m ROAD SETBACK
- - - 40m WATERCOURSE OFFSET
- - - 100m WATERCOURSE OFFSET
- PMF FLOOD HAZARD

NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY. C:\Users\JustinKell\KMJ surveying\KMJ Surveying - Documents\Surveyors\Jobs\214480 Taylor\4. Planning\DWG\Rosemont Road-Barretts Lane\214480 B-DA01- O Subdivision (Rosemont Road) 4 LOTS.dwg

ISSUE	AMENDMENT	DRAWN	DATE
J	EXTRA SHEET ADDED	SH	17/03/2022
K	BOUNDARY ADJUSTMENT	SH	07/08/2023
L	LAND ZONING ADJUSTMENT	SH	01/09/2023
M	BOUNDARY ADJUSTMENT	SH	20/09/2022
N	BOUNDARY ADJUSTMENT	SH	09/10/2023
O	NEW TEMPLATE	SH	17/10/2022



KMJ Surveying Pty Limited
ABN: 21 664 063 370

36 Montague Street
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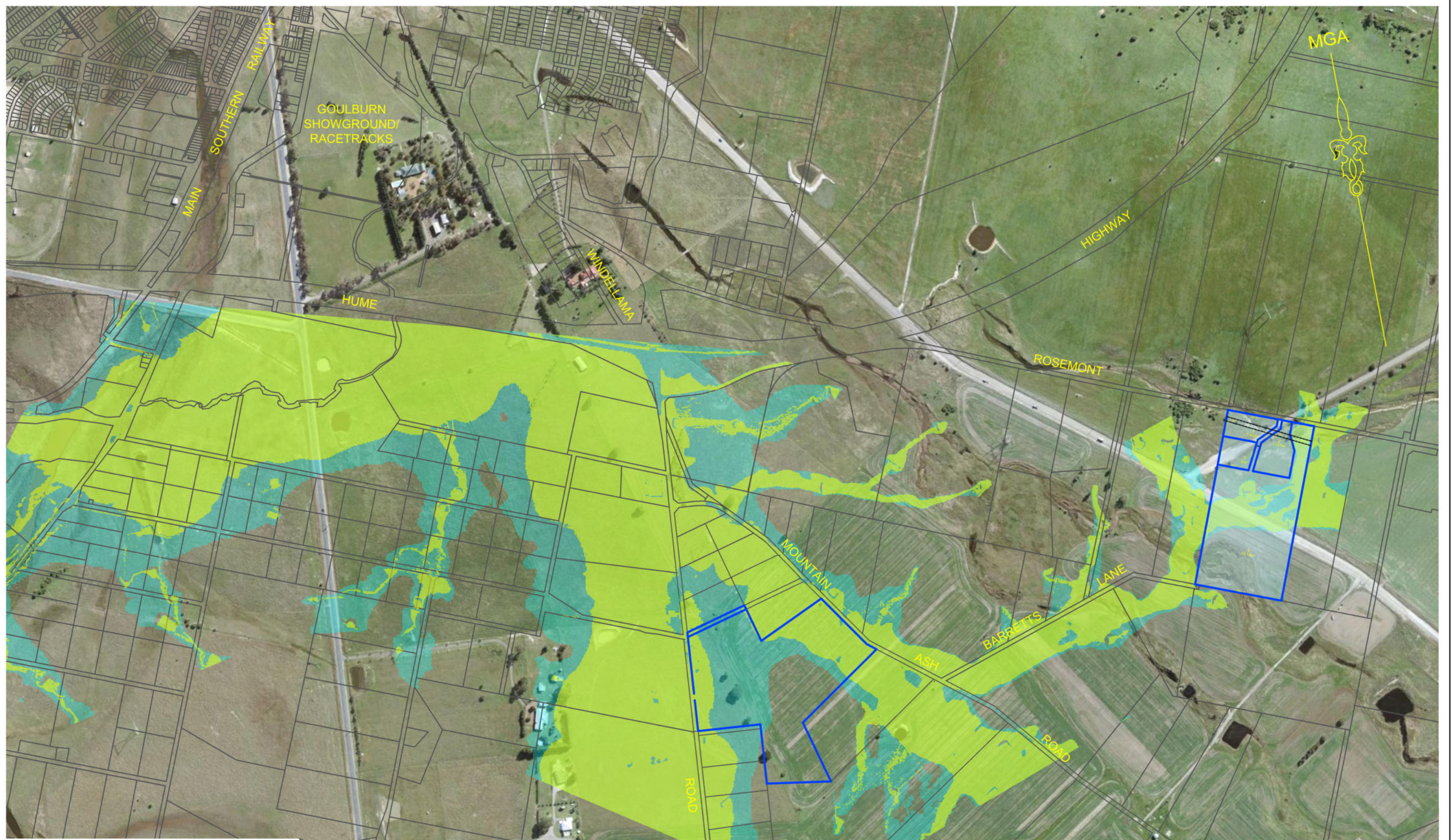
M. TAYLOR

PLAN OF PROPOSED SUBDIVISION
FLOOD ZONES
LOTS 117 & 118 DP 126140,
292 ROSEMONT ROAD, BOXERS CREEK.

LGA: GOULBURN MULWAREE

SURVEYED:	N/A
DRAWN:	SH
CHECKED:	JK
SURVEY DATE:	02/03/2021
DRAWING DATE:	17/10/2023
SCALE:	1:3000 (A3 SHEET)
DRAWING No:	214480 B-DA-08
ISSUE	O

Note: This plan is prepared in colour and should not be reproduced in black and white. Do not scale from this drawing. Refer any discrepancies to KMJ Surveying for clarification.



NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY

File Name: C:\Users\JustinKell\KMJ surveying\KMJ Surveying - Documents\Surveyors\Jobs\214480 Taylor\4. Planning\DWG\Rosemont Road-Barretts Lane\214480 B-DA01- O Subdivision (Rosemont Road) 4 LOTS.dwg

ISSUE	AMENDMENT	DRAWN	DATE
J	EXTRA SHEET ADDED	SH	17/03/2022
K	BOUNDARY ADJUSTMENT	SH	07/08/2023
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M. TAYLOR

PLAN OF PROPOSED SUBDIVISION
LOCATION PLAN
LOTS 117 & 118 DP 126140,
292 ROSEMONT ROAD, BOXERS CREEK.

LGA: GOULBURN MULWAREE

HORIZONTAL DATUM:	MGA2020	SURVEYED:	N/A
ORIGIN OF COORDINATES:	N/A	DRAWN:	SH
VERTICAL DATUM:	N/A	CHECKED:	JK
ORIGIN OF LEVELS:	N/A	SURVEY DATE:	02/03/2021
REDUCED LEVEL (RL):	N/A	DRAWING DATE:	17/10/2023
CONTOUR INTERVAL:	N/A	SCALE:	1:1,000 (A3 SHEET)

DRAWING No:	ISSUE
214480 B-DA- 09	O