BRISBANE GROVE ROAD PLANNING PROPOSAL - FLOOD ASSESSMENT

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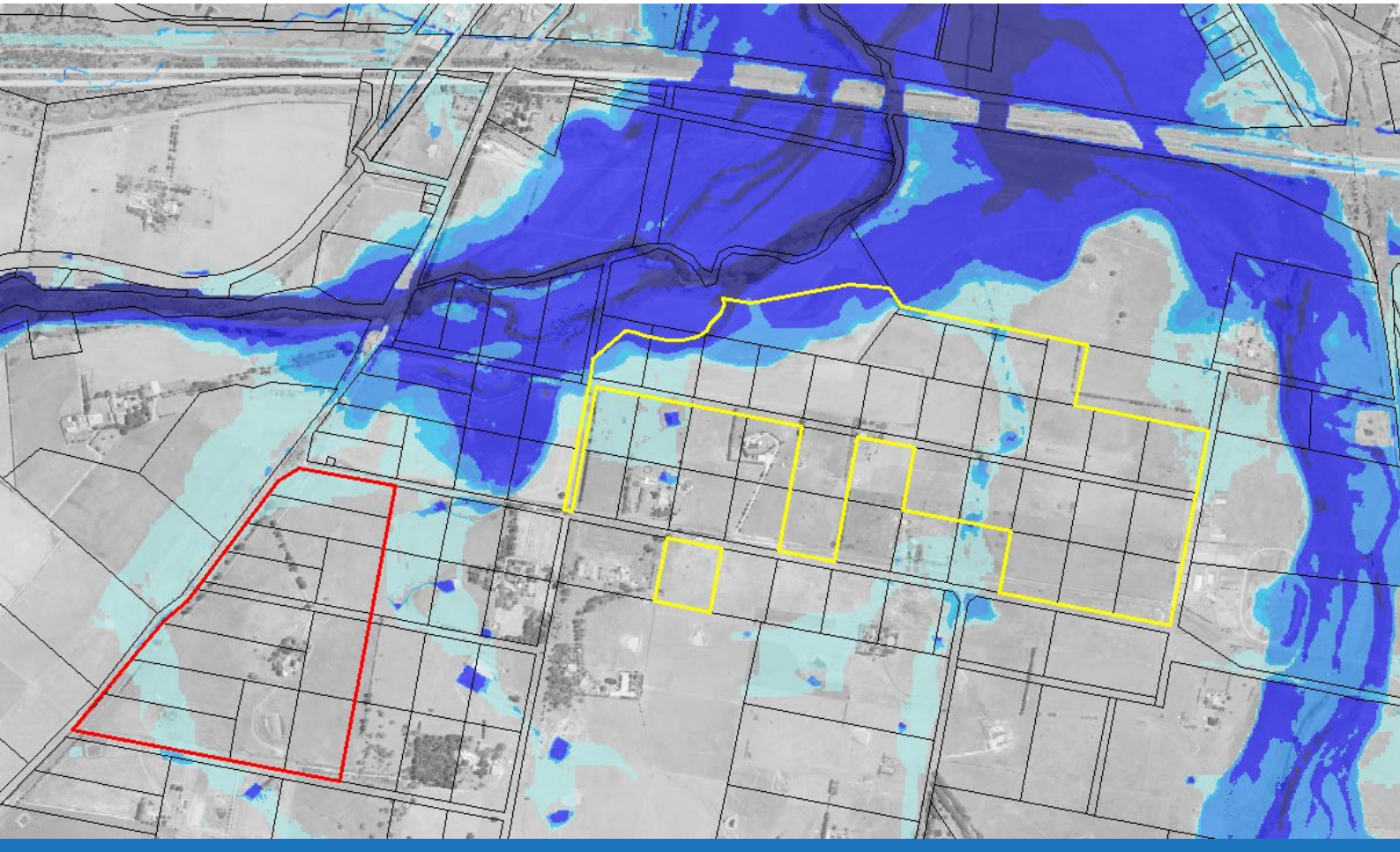

December 2023

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2 & 137 BRISBANE GROVE ROAD, PLANNING PROPOSAL - FLOOD ASSESSMENT

Project Number: 230048

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Date: 20 December 2023

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Date	Version	Description
7 December 2023	A	Flood Assessment - Draft
20 December 2023	B	Flood Assessment for submission

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EXECUTIVE SUMMARY

This Flood Assessment report has been prepared by GRC Hydro Pty Ltd on behalf of Sowdes Pty Limited for 2 and 137 Brisbane Grove, Brisbane Grove (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 'RU1 Primary Production' to 'R5 Large Lot Residential'.

Flood modelling has been undertaken using Council's flood models, with the modelling of a range for flood events from the 5% AEP to the Probable Maximum Flood (PMF) assessed.

A zoning and lot layout strategy has been developed by Sowdes 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 Braidwood Road during events rarer than 5% AEP, with the road flooded noted for ~24 hours during the 1% AEP 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).
    - Flood warning signage - Flood depth markers and warning signs are proposed for the Braidwood Road crossing of Mulwaree River to reduce the risk of vehicles entering floodwaters.
    - 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.

In addition to these proposed measures, a Total Flood Warning System has been recommended as part of the Goulburn Floodplain Risk Management Study and Plan (GRC Hydro, 2021). This is likely to allow for advanced warning of impending Mulwaree River flood events which will allow for early evacuation for sensitive and at-risk communities and better flood preparedness for the general community. There is also the potential to reduce risk of vehicles entering floodwaters on Braidwood Road through automated warning signage. Implementation of a Total Flood Warning System is likely to be finalised prior to occupation of any future dwellings as a result of this planning proposal. It should be noted that implementation of this measures is not required to achieve consistency with the Local Planning Directions, however, its implementation is likely to future reduce flood risk at the site.

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

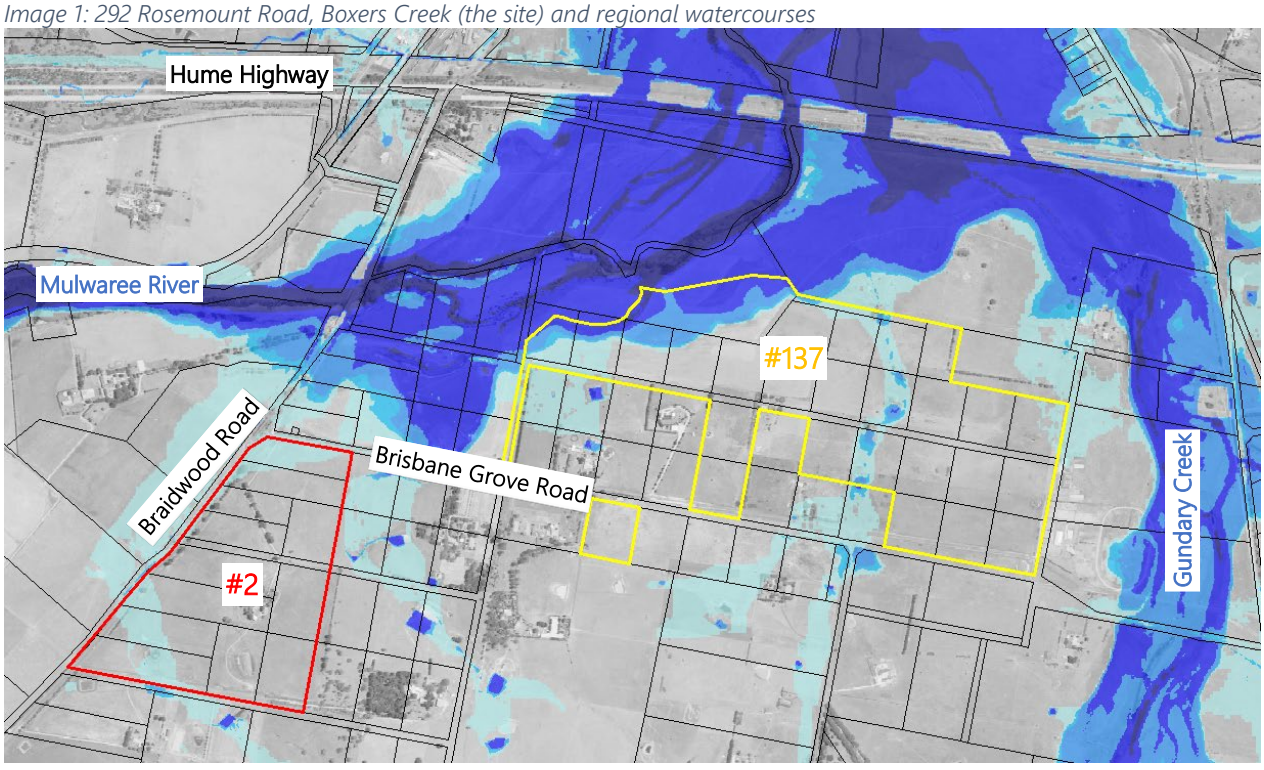
This Flood Assessment report has been prepared by GRC Hydro Pty Ltd on behalf of Sowdes Pty Limited for 2 and 137 Brisbane Grove, Brisbane Grove (the site). A planning proposal is being prepared to amend the Goulburn Mulwaree Local Environmental Plan (LEP, 2009) to change the land use zoning at the site from 'RU1 Primary Production' to 'R5 Large Lot Residential'.

1.2 Study Area

The site is situated approximately 3.5 km south of Goulburn town centre. Northern areas of the site are situated on the Mulwaree River floodplain, and eastern areas on the Gundary Creek floodplain. A number of overland flow paths pass through the site in a generally northerly direction towards the Mulwaree River (see Image 1).

The Mulwaree River and Gundary Creek catchment areas are 576 km^2 and 156 km^2 respectively. Local catchments are small at less than ~1 km^2. The region is predominantly rural in nature with few houses, and roads of significance comprising Braidwood Road, Brisbane Grove Road and the Hume Highway.

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



1.3 Study Scope

This report considers the policies and guidance documents described in Section 1.4 and addresses the Department of Planning and Environment (DPE) - Biodiversity and Conservation Division (BCD) post gateway feedback (see Attachment *A*) outlined in:

- 'PP-2021-7930 to amend Goulburn Mulwaree Local Environmental Plan 2009' (PP-2021-7390, dated 7/2/23);
- 'PP-2021-6932 to amend Goulburn Mulwaree Local Environmental Plan 2009' (PP-2021-6932, dated 7/2/23); and
- Water Floodplains and Coast (WFC), Floodplain Risk Management, Brisbane Grove Subdivision Planning Proposal Update (dated 18 April 2023).

A summary of key issues raised, and the sections of this report which respond to these issues is presented in Table 1.

Table 1: Summary of DPE post gateway flood concerns

Issues Raised	Report Section
The proposal needs to be '*considered in accordance with Local Planning Direction 4.1 Flooding*'	Section 5.2
A '*Flood Impact and Risk Assessment (FIRA) accompanying the proposal*' is required, which assesses: • *The impact of flooding on the proposed development* • *The impact of the proposed development on flood behaviour* • *The impact of flooding on the safety of people for the full range of floods including issues linked with evacuation* • *The implications of climate change on flooding* • *The implications of the full range of possible floods up to the Probable Maximum Flood*	Section 3
'*The study should address the potential for flood impacts to be caused by the development, including likely landform modifications*'	Section 3.3 & 3.4
The study '*should ensure that the FIRA supporting this planning proposal appropriately compares with best available information including Council's adopted flood studies and Floodplain Risk Management Studies and Plans (FRMS&P)*'	Section 3.1
'*evidence or information regarding emergency management or evacuation planning of the floodplain or consultation with the NSW State Emergency Service (SES)*' is required to be provided	Section 1.6
A '*flood risk assessment of the safety of occupants and emergency management across the full range of flood events, specifically in the rarer events (i.e. larger than the 1% AEP)*' is required.	Section 3 & 4
Consideration of '*Lots 2, 3 and 4 DP62157, which are proposed to be rezoned as R5 are completely inundated in the PMF*'.	Section 2
Consideration that '*the primary strategy for emergency management requires residents to be able to evacuate to an area above the PMF that has adequate facilities*'	Section 4
The report must '*demonstrate how emergency management services will provided including access to all proposed residential lots including those planned to be located above the PMF*'	Section 4
It is noted that '*flood isolation presents a significant risk to life that could be managed through better subdivision design including any road and bridge design requirements and upgrades that are required for flood access*'	Section 2 & 4

The report would *'benefit from further assessment of flood evacuation that considers events the full range of floods up to the PMF including the 0.5% and 0.2% AEP'*	Section 3.3 & 3.4
'The assessment should examine the period of isolation across the range of flood events up to and including the PMF and assess areas within or closer to the proposal site that is outside the PMF as a potential refuge area'	Section 3.6.2 & Section 2

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)
- Marulan Flood Study (GRC Hydro, 2023)
- Marulan Floodplain Risk Management Study and Plan (GRC Hydro, ongoing)

1.5 Previous Studies

In addition to the Council Flood and Management Studies listed in Section 1.4, the following site-specific studies have been undertaken:

- Water Cycle Management Study (Sowdes, 23 November 2021);
- Planning Proposal to rezone and amend Minimum Lot Size on Lots along Brisbane Grove Road, Goulburn (March 2023).

1.6 Consultation

A summary of consultation undertaken in preparation of this report is outlined in Table 2. Previous consultation by Council was also undertaken with the various stakeholders prior to GRC Hydro's involvement in the project.

Table 2: Summary of stakeholder consultation

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

2. FLOOD RISK MANAGEMENT STRATEGY

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

- Proposed Land Zone maps that show the extent of rezoned land;
- A proposed site plan and lot configuration developed by Sowdes 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; 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 35 future lots (21 lots for 137 Brisbane Grove Road, and 14 lots for 2 Brisbase Grove Road) 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:

- No modification of the Goulburn Overland Flow Modelling (GRC Hydro, 2021) model was required;
- 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 Gundary Creek to allow for flood results along the site's eastern boundary.
- 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 km^2 upstream catchment area and were not assessed in the flood model. As such:

- The Proposed Conditions model was retained as per Existing Conditions for 137 Brisbane Grove Road; and
- A similar approach was utilised for 2 Brisbane Grover Road, however, a farm dam embankment was removed from the overland flow path passing from Johnsons Land to Braidwood Road (see Image 2).

Image 2: Dam embankment removed for Proposed Conditions

No further modification of the flood models was deemed necessary to assess potential future development conditions at 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 3 for the 2090 planning horizon.

Table 3: 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 3 and Table 4 present the relationship between the velocity and depth of floodwaters and the corresponding classification.

Image 3: Flood Hazard Curves (Australian Emergency Management Handbook 7)

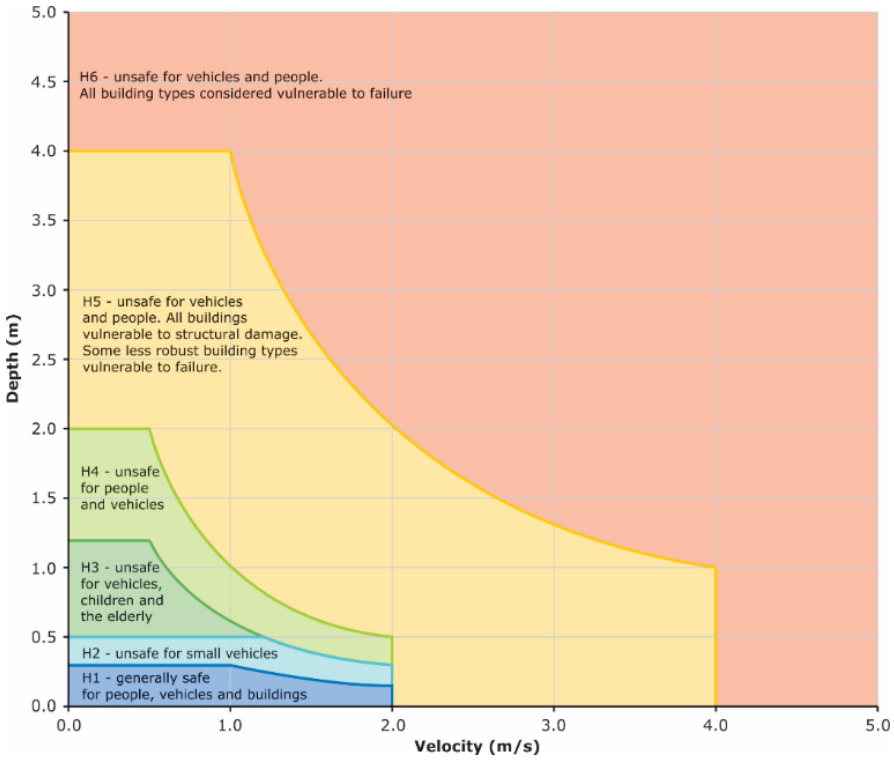


Table 4: Flood Hazard – Vulnerability Thresholds

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 mainstream flooding, the Goulburn FRMSP (GRC Hydro, 2021) derived flood function extents have been used. For overland flow flooding the criteria proposed by Howells et. al. (2003) as reproduced in Image 4 was applied to the flood model results.

Image 4: Howells et. al. (2003) flood function criteria

Floodway:		**Velocity x Depth > 0.25 m^2/s AND Velocity > 0.25m/s**
	OR	**Velocity > 1m/s AND Depth > 0.15m**
Flood Storage:		Land outside the floodway where Depth > 0.5m
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 has been set as the extent of land below the Flood Planning Level which has been defined as the 1% AEP event plus 0.8 m freeboard by the Goulburn FRSMP (GRC Hydro, 2021).
- Overland flows – The overland flow 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

Existing Conditions model results are described in the following sections.

3.3.1 137 Brisbane Grove Road Results

Flood mapping for 137 Brisbane Grove Road is presented in:

- *Figure A 1: 137 Brisbane Grove Road - Existing Conditions - 10% AEP flood depths, levels & hazard*
- *Figure A 2: 137 Brisbane Grove Road - Existing Conditions - 5% AEP flood depths, levels & hazard*
- *Figure A 3: 137 Brisbane Grove Road - Existing Conditions - 1% AEP flood depths, levels & hazard*
- *Figure A 4: 137 Brisbane Grove Road - Existing Conditions – 0.5% AEP flood depths, levels & hazard*
- *Figure A 5: 137 Brisbane Grove Road - Existing Conditions – 0.2% AEP flood depths, levels & hazard*
- *Figure A 6: 137 Brisbane Grove Road - Existing Conditions – 0.05% AEP flood depths, levels & hazard*
- *Figure A 7: 137 Brisbane Grove Road - Existing Conditions - PMF flood depths, levels & hazard*

- *Figure A 8: 137 Brisbane Grove Road – Flood Function*
- *Figure A 9: 137 Brisbane Grove Road – Flood Planning Area*

The mapping shows that the 137 Brisbane Grove Road site is free from mainstream flooding for events up to and including the 0.05% AEP event. An overland flow path due to local catchment flows originating near Corrinyah Road is conveyed through the site in an area proposed to be zoned C2 Environmental Conservation. Localised areas of floodway are confined to this watercourse, outside of the concept lot boundaries. Shallow sheet flows affect the far western end of the site. During the PMF, areas of significant flood depths (>2 m) and hazard (up to H6) affect many of the indicative lots, however, all concept building envelopes are situated outside of the PMF extent. Implementation of this strategy would ensure that future dwellings would be flood free for events up to and including the PMF.

3.3.2 2 Brisbane Grove Road Results

Flood mapping for 2 Brisbane Grove Road is presented in:

- *Figure B 1: 2 Brisbane Grove Road - Existing Conditions - 10% AEP flood depths, levels & hazard*
- *Figure B 2: 2 Brisbane Grove Road - Existing Conditions - 5% AEP flood depths, levels & hazard*
- *Figure B 3: 2 Brisbane Grove Road - Existing Conditions - 1% AEP flood depths, levels & hazard*
- *Figure B 4: 2 Brisbane Grove Road - Existing Conditions – 0.5% AEP flood depths, levels & hazard*
- *Figure B 5: 2 Brisbane Grove Road - Existing Conditions – 0.2% AEP flood depths, levels & hazard*
- *Figure B 6: 2 Brisbane Grove Road - Existing Conditions – 0.05% AEP flood depths, levels & hazard*
- *Figure B 7: 2 Brisbane Grove Road - Existing Conditions - PMF flood depths, levels & hazard*
- *Figure B 8: 2 Brisbane Grove Road – Flood Function*
- *Figure B 9: 2 Brisbane Grove Road – Flood Planning Area*

The mapping shows that the 2 Brisbane Grove Road site is free from mainstream flooding for events up to and including the 0.05% AEP event. An overland flow path due to local catchment flows enters the site Johnsons Land and is conveyed through the site in an area proposed to be zoned C2 Environmental Conservation. Shallow sheet flows affect the north-western corner of the site. All areas of the site are classified as flood fringe during the 1% AEP event. During the PMF, areas of significant flood depths (>2 m) and hazard (up to H6) affect the five northern concept lots, however, all concept building envelopes are situated outside of the PMF extent. Implementation of this strategy would ensure that future dwellings would be flood free for events up to and including the PMF.

3.4 Developed Conditions Results

As described in Section 3.1.2, changes to site conditions that impact on flood behaviour are not expected for 137 Brisbane Grove Road, and accordingly the Existing Conditions results shown in Section 3.3 are considered representative of Developed Conditions.

Flood mapping for 2 Brisbane Grove Road Developed Conditions is presented in the following maps:

- Figure C 1: 2 Brisbane Grove Road - Developed Conditions - 1% AEP flood depths, levels & hazard
- Figure C 2: 2 Brisbane Grove Road - Developed Conditions - PMF flood depths, levels & hazard
- Figure C 3: 2 Brisbane Grove Road – Flood Function
- Figure C 4: 2 Brisbane Grove Road – Flood Planning Area

The mapping shows that the expected flood depths and hazard conditions are comparable with Existing Conditions. The extent and depth of flooding on the overland flow path from Johnsons Lane is noted to be slightly reduced.

3.5 Flood Impact Analysis

As described in Section 3.1.2, no bulk earthworks or road works are proposed within the PMF extent and therefore changes in flood behaviour associated with these works are not expected. The impact of removing the dam at 2 Brisbane Grove Road is presented in:

- Figure D 1: 2 Brisbane Grove Road - 1% AEP flood level impact
- Figure D 2: 2 Brisbane Grove Road - PMF flood level impact

The analysis shows that flood impacts are generally limited to the site in the 1% AEP event and are not expected to affect Braidwood Road. Minor/localised impacts are expected in the PMF.

3.6 Flood Access

3.6.1 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.
- At 137 Brisbane Grove Road site access roads connect to surrounding roads which are above the PMF.
- A 2 Brisbane Grove Road, the site access to Johnsons Lane is on the fringe of the PMF flood extent into an area of H1/H2 hazard.

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.

3.6.2 External site access

Flooding of surrounding access roads that can result in reduced site access due to flooding has been considered. Important amenities and facilities are situated in Goulburn, with flooding of the Braidwood Road crossing of the Mulwaree River (see Image 5) noted to be critical for the frequency and duration of lost site access.

Image 5: Braidwood Road crossing of the Mulwaree River

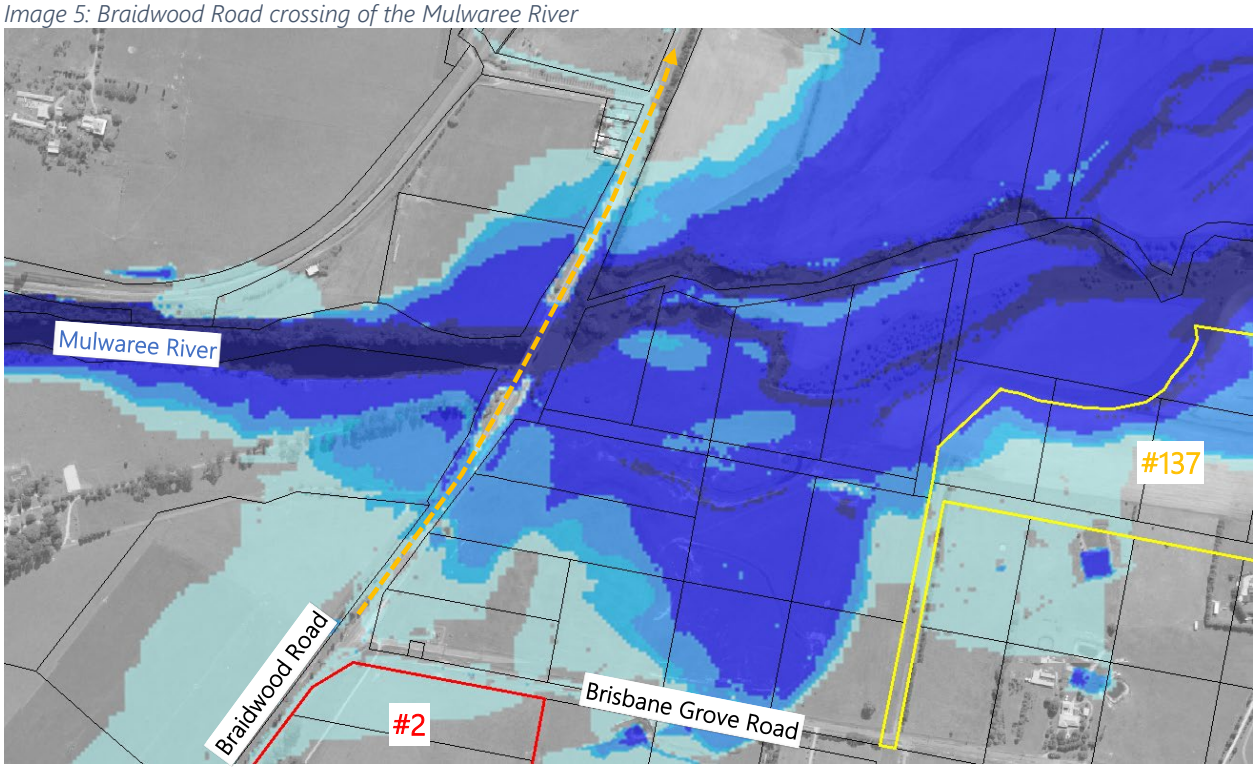


Table 5 presents the frequency, depth and duration of inundation of Braidwood Road. Access to the site from Goulburn would be first lost in events rarer than 5% AEP. The road is expected to be inundated for a period of 22.5 hours during a 1% AEP event and 38 hours during the PMF.

Table 5: Frequency, depth and duration of inundation of Braidwood Road

Events	Max Depth (m)	Duration of inundation	Duration with depth > 0.5 m
10%	-	-	-
5%	0.03	3.7	-
1%	0.57	22.5	8.5
0.5%	0.74	26.2	14.5
0.2%	0.98	30.2	20.5
PMF	8.62	38.4	35.7

3.6.3 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 Braidwood Road; 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 Braidwood Road floods, a fire or medical emergency would occur; to
- Independent - the chance of a fire or medical emergency happening when Braidwood Road is 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 1.6) 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 Braidwood Road 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 6 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 Braidwood Road is inundated is 0.1% 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 quite rare due to the frequency at which the site becomes isolated and the small number of proposed future dwellings/occupants (see Section 2).

Table 6: High-level joint probability assessment

Variable	AEP*	DEP*	Comment
Isolation Occurring	5% AEP	0.014%	Probability of isolation due to flooding of Braidwood Road.
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	-	3.0 x 10^{-6}%	Occurrence of a medical emergency whilst Braidwood Road is flooded.
Road flooding & fire emergency	-	5.1 x 10^{-8}%	Occurrence of a fire emergency whilst Braidwood Road is flooded.
Site Characteristics			
Number of occupants	88		See site lot layout in Section 2.
Number of dwellings	35		Assumed 2.5 people per dwelling as per Goulburn average (census)
Binomial Distribution Calculations			
Chance of medical emergency at the site whilst isolated	0.1%	2.6 x 10^{-4}%	The estimated probability of a medical emergency occurring for one or more future occupants whilst Braidwood Road is flooded and the site is isolated.
Chance of fire emergency at the site whilst isolated	7 x 10^{-4}%	1.8 x 10^{-6}%	The estimated probability of a fire emergency occurring for one or more future dwellings whilst Braidwood Road is flooded and the site is isolated.
Total Probability	**0.1%**		**1 in 1,000 AEP**

*AEP = Annual Exceedance Probability, DEP = Daily Exceedance Probability

Whilst the probability of a secondary risks occurring whilst the site is isolated is expected to be 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.

3.7 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 6. The site has 'No flood impacts' for events up to the 5% AEP flood (see in blue below). For rarer events, when Braidwood Road is flooded (see Section 3.6.2), 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 6: Flow chart for determining detailed flood emergency response classifications (from Figure 18 or EM01)

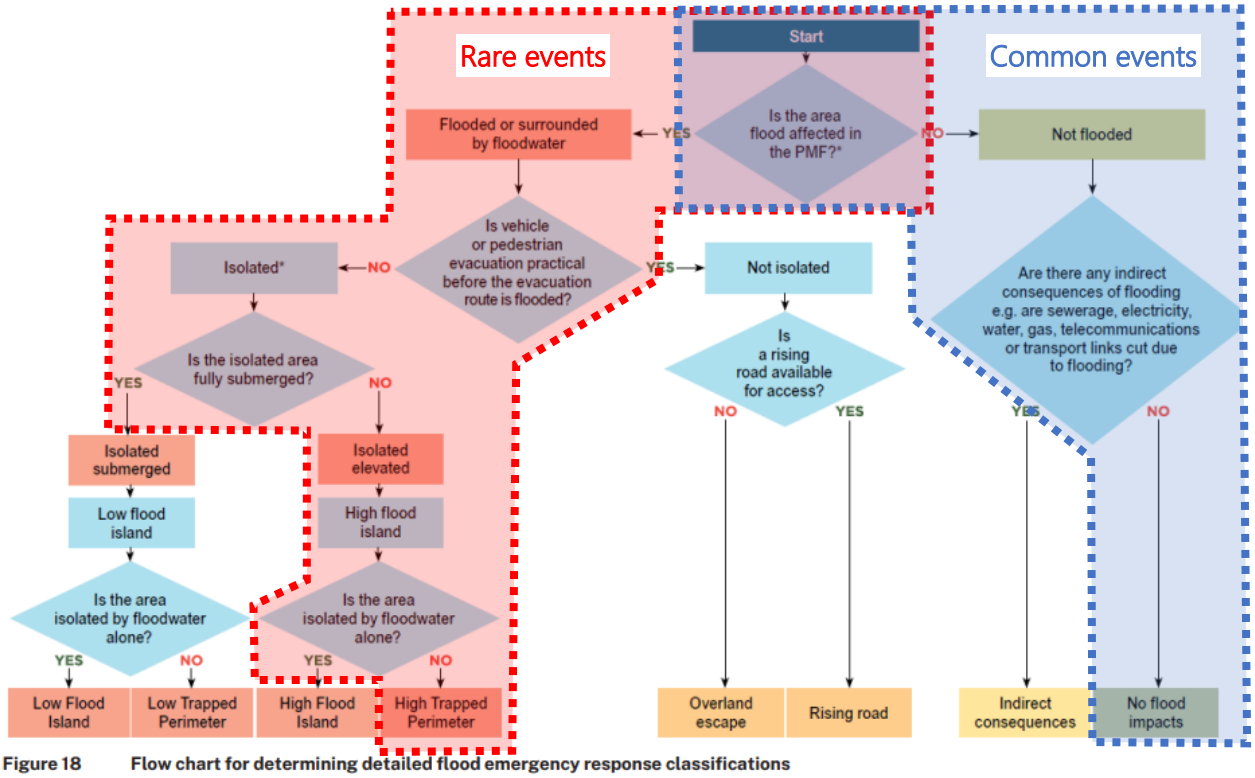


Figure 18 **Flow chart for determining detailed flood emergency response classifications**

3.8 Flood Warning

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 7.

Table 7: 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

The FRSMP recommended development of a Total Flood Warning System to increase flood warning availability and enhance emergency response. This is discussed further in Section 4.3.2.1.

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 ~35 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 8 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 flooding of Braidwood Road which results in potential risks associated with human behaviours and secondary risks.

Image 7 presents the flood risk management flowchart for the site. In this flowchart, two populations (general & at-risk groups) are examined, with risks presented. Management of risk are examined via proposed, potential future and existing management measures. The flowchart shows how there are synergies between the various management measures, where implementation of one measure improving risk management provided by another.

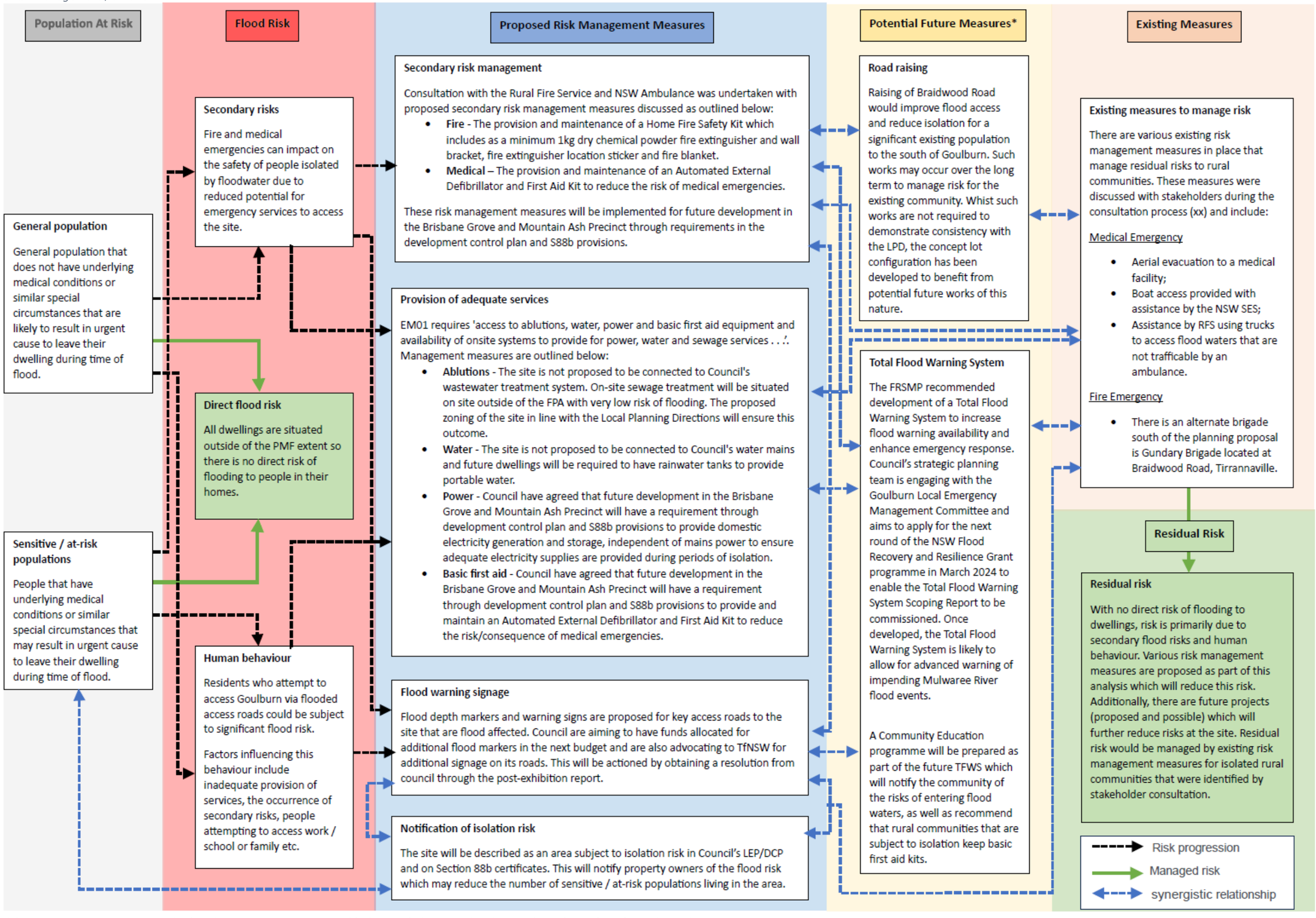
Various risk management measures are proposed as part of this analysis which will reduce this risk. Additionally, there are future projects (proposed and possible) which may further reduce risks at the site. It must be noted that these future projects are not required to demonstrate consistency with the Local Planning Directions and are shown for information only. Residual risk would be managed by existing risk management measures that were identified by stakeholder consultation (see Section 1.6) for isolated rural communities.

Table 8: 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. 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 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 in the future. 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	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 polices 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 Braidwood Road will result in isolation of the site during events rarer than 5% AEP. Lost site access is expected for ~24 hours in the 1% AEP event and 38 hours during the PMF.	High	Proposed management measures to address isolation are considered in Section 4.3 and include: • 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. In addition to the proposed management measures listed above, the following possible future works may also reduce flood risk for the site (noting that these are not required to be consistent with the Local Planning Directions): • A Total Flood Warning System is a recommendation in the FRSMP proposed for implementation. The system will increase flood warning availability and enhance emergency response. Significant reduction in risk are likely for sensitive / at-risk populations with minimisation of human behaviour risks. • Raising of Braidwood Road could improve flood access and reduce isolation. Existing populations would also benefit from these works and they should be considered as part of Council's medium to long term capital works program. 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/future measures fail.	Low 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 proposed management measures are fully implemented. ** Risk profile if future proposed or potential works are implemented (not required to demonstrate consistency with the Local Planning Directions)

Image 7: Risk management framework



* Potential Future Measures are not required to demonstrate consistency with the Local Planning Directions and are shown for information only

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 9 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 9: 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
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: *'Clause 7.7 Restrictions on dwellings on flood prone land in the Brisbane Grove and Mountain Ash Precincts* *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.* *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.'*	An alternative strategy is being considered which would: • 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 3.7, the site has 'No flood impacts' for events up to the 5% AEP flood but for rarer events, when Braidwood Road is flooded (see Section 3.6.2), 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

These measures are proposed to manage flood risk for future development at the site to achieve consistency with the Local Planning Directions.

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 1.6) 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 4.3.1.4).
- Provision for fire and medical emergencies will reduce the impact on existing risk management measures and emergency services (see Section 4.3.3).

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

- The provision of adequate services will reduce the risk of people entering floodwaters to access Goulburn (see Section 4.3.1.3);
- 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 4.3.3).

4.3.1.3 Flood warning signage

Flood depth markers and warning signs are proposed for the Braidwood Road crossing of Mulwaree River. These signs would be required for both the northern and southern approaches. The signs at the approximate locations detailed in Table 10 are recommended.

Table 10: Recommended warning signs for flooded access roads

#	Road	Type*	Approximate Coordinates	Direction
1	Braidwood Road South of Mulwaree River	Warning sign	747500, 6147540	South facing
2	Braidwood Road South of Mulwaree River	Depth markers	50 m spacing north of #1	South and north
3	Braidwood Road North of Mulwaree River	Warning sign	747820, 6148070	North facing
4	Braidwood Road North of Mulwaree River	Depth markers	50 m spacing south of #3	South and north

* see Image 8 for sign types.

Image 8: Flood warning sign and depth markers (Transport for NSW)

Warning sign | Depth marker

Council Works Business Unit has a budget for signage and does replace flood markers where already present from time to time. Council are aiming to have funds allocated for additional flood markers

in the next budget and have been advocating to TfNSW for additional signage on its roads. For implementation of warning signs as part of rezoning of the site, it is proposed that a resolution from council be obtained through the post-exhibition report.

Synergies

- If implemented, the future Total Flood Warning System could allow for automatic powered signs which flash a "Road Flooded" warning for motorists which would be activated by rising waters which would future reduce the risk of motorists entering floodwaters.
- Flood warning signage could reduce the impact on emergency services responding to vehicles entering floodwaters (Section 4.3.3).

4.3.1.4 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 Future Risk Management Measures

These measures are not proposed as part of this flood assessment to manage flood risk for future development at the site. Implementation of these measures is not required to achieve consistency with the Local Planning Directions, however, their implementation is possible and would reduce flood risk.

4.3.2.1 Proposed Total Flood Warning System

The FRSMP recommended development of a Total Flood Warning System (TFWS) to increase flood warning availability and enhance emergency response. Council's strategic planning team is engaging with the Goulburn Local Emergency Management Committee and aims to apply for the next round of the NSW Flood Recovery and Resilience Grant programme in March 2024 to enable the Total Flood Warning System Scoping Report to be commissioned.

Once developed, the Total Flood Warning System is likely to allow for advanced warning of impending Mulwaree River flood events. This will allow for:

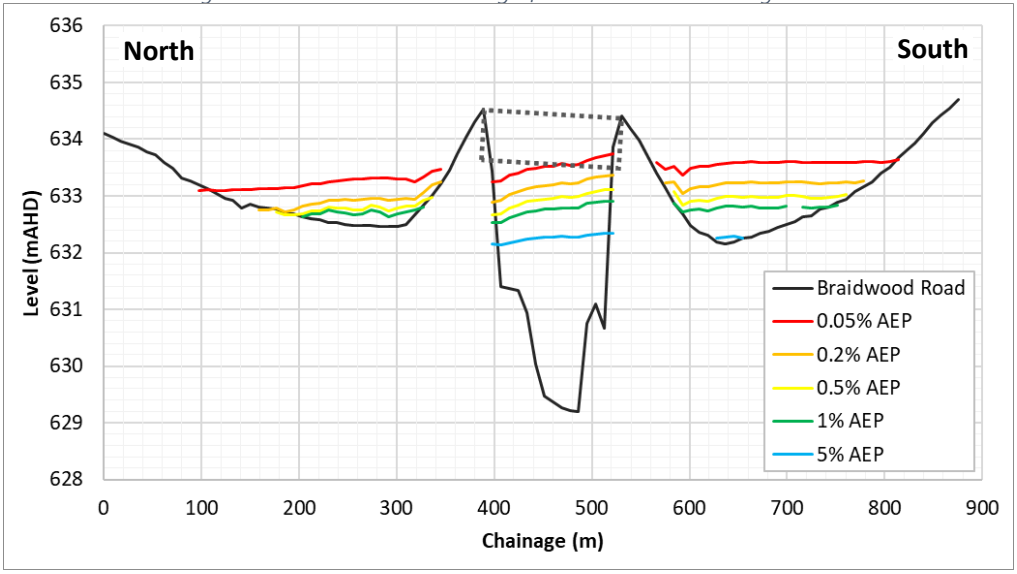
- Sensitive / at-risk communities to be prepared and evacuate into Goulburn (if required) if flooding of Braidwood Road is expected;
- Reduced risk of people entering flood waters as it will allow for better preparedness. E.g. people may elect to stay at home for work/school etc. if adequate warning of road flooding is provided. This will reduce risks associated with human behaviour of people attempting to cross flooded access roads;
- Implementation of automatic powered signs which flash a "Road Flooded" warning for motorists which would be activated by rising waters and triggered by the TFWS. This has been shown in other areas to significantly reduce the risk of vehicles entering floodwaters.

Whilst it is acknowledged that the Total Flood Warning System has not yet been implemented, it is likely to be finalised prior to occupation of any future dwellings given that the planning proposal, subdivision DA, land sale, dwelling design and construction phases of the project are likely to take minimum five to ten years to complete.

4.3.2.2 Braidwood Road raising

A long section of Braidwood Road at the bridge crossing of Mulwaree River is presented in Image 9. The long section shows that the bridge deck level is above the 0.05% AEP event, however, the road approaches are flood liable from the 5% AEP event.

Image 9: Braidwood Road crossing of Mulwaree River – Long Section



There is the potential for future road upgrades to increase the immunity of Braidwood Road, without the need for upgrading the bridge. To raise the road above the 1% AEP flood level the:

- Northern approach would need to be raised by an average of 0.2 m over a length of 120 m; and
- The southern approach would need to be raised by an average of 0.4 m over a length of 140 m.

Whilst there are no current proposals to raise Braidwood Road, road raising works could improve flood access and reduce isolation for a significant existing population who access Goulburn from the south. The internal road configuration outlined in Section 3.6.1 would allow for future development within the site to benefit from such works, if they are implemented in the long term. However, these works are not considered to be required to demonstrate consistency with the Local Planning Directions.

4.3.3 Existing Risk Management Measures

Consultation with emergency services (see Section 1.6) 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 Gundary Brigade located at Braidwood Road, Tirrannaville.

The proposed and future risk mitigation measures proposed 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. COMPLIANCE ASSESSMENT

5.1 Biodiversity and Conservation Division (BCD) post gateway feedback

The Department of Planning and Environment (DPE) - Biodiversity and Conservation Division (BCD) post gateway feedback (see Attachment *A*) is summarised below, with a response provided in Table 11.

Table 11: Summary of DPE post gateway flood concerns and response

Issues Raised	Report Section
The proposal needs to be '*considered in accordance with Local Planning Direction 4.1 Flooding*'	Consideration of the Local Planning Direction is presented in Section 5.2.
A '*Flood Impact and Risk Assessment (FIRA) accompanying the proposal*' is required, which assesses: • *The impact of flooding on the proposed development* • *The impact of the proposed development on flood behaviour* • *The impact of flooding on the safety of people for the full range of floods including issues linked with evacuation* • *The implications of climate change on flooding* • *The implications of the full range of possible floods up to the Probable Maximum Flood*	A FIRA has been undertaken which has presented the flood characteristics at the site for a range of flood events up to the PMF (Section 3.3), potential impacts on flood behaviour as a results of the development (Section 3.5), evacuation considerations (Section 4.3), and climate change (Section 3.1.3).
'*The study should address the potential for flood impacts to be caused by the development, including likely landform modifications*'	Landform modifications are not proposed. Potential impacts on flood behaviour as a results of the development are considered in Section 3.5.

The study '*should ensure that the FIRA supporting this planning proposal appropriately compares with best available information including Council's adopted flood studies and Floodplain Risk Management Studies and Plans (FRMS&P)*'	Council's flood and floodplain risk management studies have been used in preparation of this analysis (Section 3.1).
'evidence or information regarding emergency management or evacuation planning of the floodplain or consultation with the NSW State Emergency Service (SES)' is required to be provided	Emergency services have been consulted. Details are presented in Section 1.6.
A '*flood risk assessment of the safety of occupants and emergency management across the full range of flood events, specifically in the rarer events (i.e. larger than the 1% AEP)*' is required.	A flood risk assessment of the development is detailed in Section 3.
Consideration of '*Lots 2, 3 and 4 DP62157, which are proposed to be rezoned as R5 are completely inundated in the PMF*'.	The proposed flood management strategy will ensure future development occurs outside of the PMF extent (Section 2).
Consideration that '*the primary strategy for emergency management requires residents to be able to evacuate to an area above the PMF that has adequate facilities'*	All future dwellings will be situated outside of the PMF extent (Section 2) so evacuation due to direct flood risk is not required. Management of evacuation due to secondary risks is considered in Section 4.
The report must '*demonstrate how emergency management services will provided including access to all proposed residential lots including those planned to be located above the PMF'*	Emergency services can access the site using standard methods for events up to the 5% AEP event. Consultation with emergency services was undertaken to discuss risk management measures to manage isolation risks during rarer flood events (see Section 4.3). Where these management measures fail, emergency services would implement exiting risk management measures used for isolated rural communities (Section 4.3.3).
It is noted that '*flood isolation presents a significant risk to life that could be managed through better subdivision design including any road and bridge design requirements and upgrades that are required for flood access'*.	Measures to manage isolation risks are outlined in Section 4.3. A refined lot layout that responds to the flood risk has been prepared (Section 2) which allows for access to all future lots to areas outside of the site. This also allows for the development to benefit from any potential future road upgrades (Section 4.3.2.2), noting that they are not required to demonstrate consistency with the Local Planning Direction.
The report would *'benefit from further assessment of flood evacuation that considers events the full range of floods up to the PMF including the 0.5% and 0.2% AEP'*	Flood modelling for events ranging from 5% AEP to the PMF has been undertaken (Section 3.3).

'The assessment should examine the period of isolation across the range of flood events up to and including the PMF and assess areas within or closer to the proposal site that is outside the PMF as a potential refuge area'	The duration of inundation of Braidwood Road that results in isolation of the site is presented in Section 3.6.2. All future dwellings will be situated outside of the PMF extent and residents will remain in their homes (Section 2).

5.2 Local Planning Directions - Flooding

A compliance assessment to the Local Planning Direction, Section 9.1 Direction 4.1 Flooding requirements is presented in Table 12. The proposed rezoning of the site is considered to be compliant with the requirements.

Table 12: 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**	Yes	Land in the flood planning area is proposed to be rezoned to C2 Environmental Conservation.

	or Conservation Zones to a Residential, Employment, Mixed Use, W4 Working Waterfront or Special Purpose Zones.		
(3)	A planning proposal must not contain provisions that apply to the flood planning area which:		
(a)	permit development in floodway areas	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/works 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 and 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. The Total Flood Warning System was a recommendation of the FRSMP and negligible increased costs are expected due to future development of the site. Raising of Braidwood Road is not required to demonstrate consistency with the Local Planning Directions, however, future raising of this road for other purposes will benefit the site. For these reasons, it is not likely that future development of the site will 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**	Yes	The methods for determining the Flood Planning Area (FPA) are outlined in Section 3.2.3 and are consistent with Council's FRSMP and the FDM (2005).

	Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.		

Table 12 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 Sowdes Pty Limited for 2 and 137 Brisbane Grove, Brisbane Grove (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 'RU1 Primary Production' to 'R5 Large Lot Residential'.

Flood modelling has been undertaken using Council's flood models, with the modelling of a range for flood events from the 5% AEP to the Probable Maximum Flood (PMF) assessed.

A zoning and lot layout strategy has been developed by Sowdes 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 Braidwood Road during events rarer than 5% AEP, with road flooded noted for ~24 hours during the 1% AEP event. 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.

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.

In addition to these proposed measures, a Total Flood Warning System has been recommended as part of the Goulburn Floodplain Risk Management Study and Plan (GRC Hydro, 2021). This is likely to allow for advanced warning of impending Mulwaree River flood events which will allow for early evacuation for sensitive and at-risk communities and better flood preparedness for the general community. There is also the potential to reduce risk of vehicles entering floodwaters on Braidwood Road through automated warning signage. Implementation of a Total Flood Warning System is likely

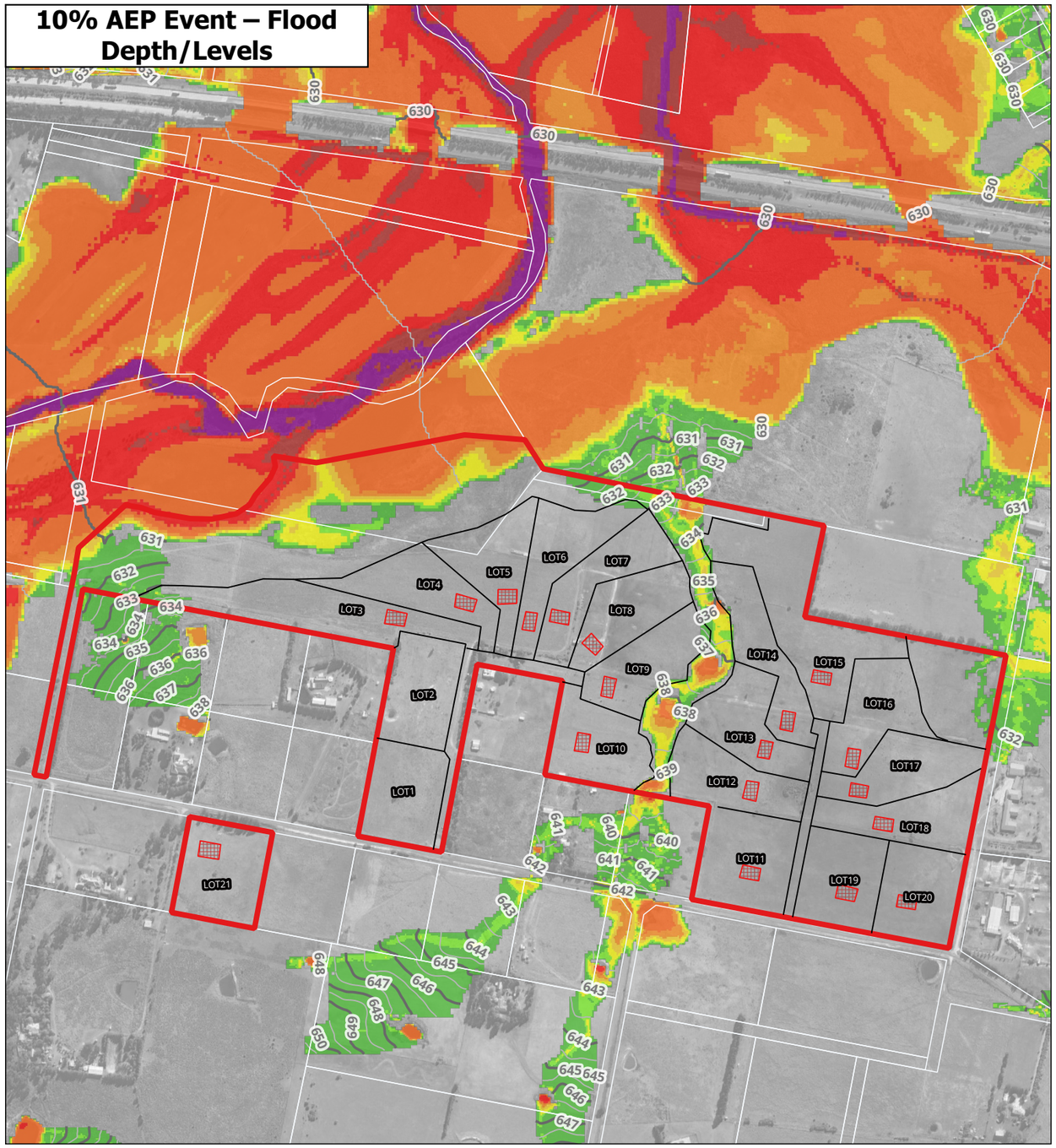
to be finalised prior to occupation of any future dwellings as a result of this planning proposal. It should be noted that implementation of this measures is not required to achieve consistency with the Local Planning Directions, however, its implementation is likely to future reduce flood risk at the site.

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

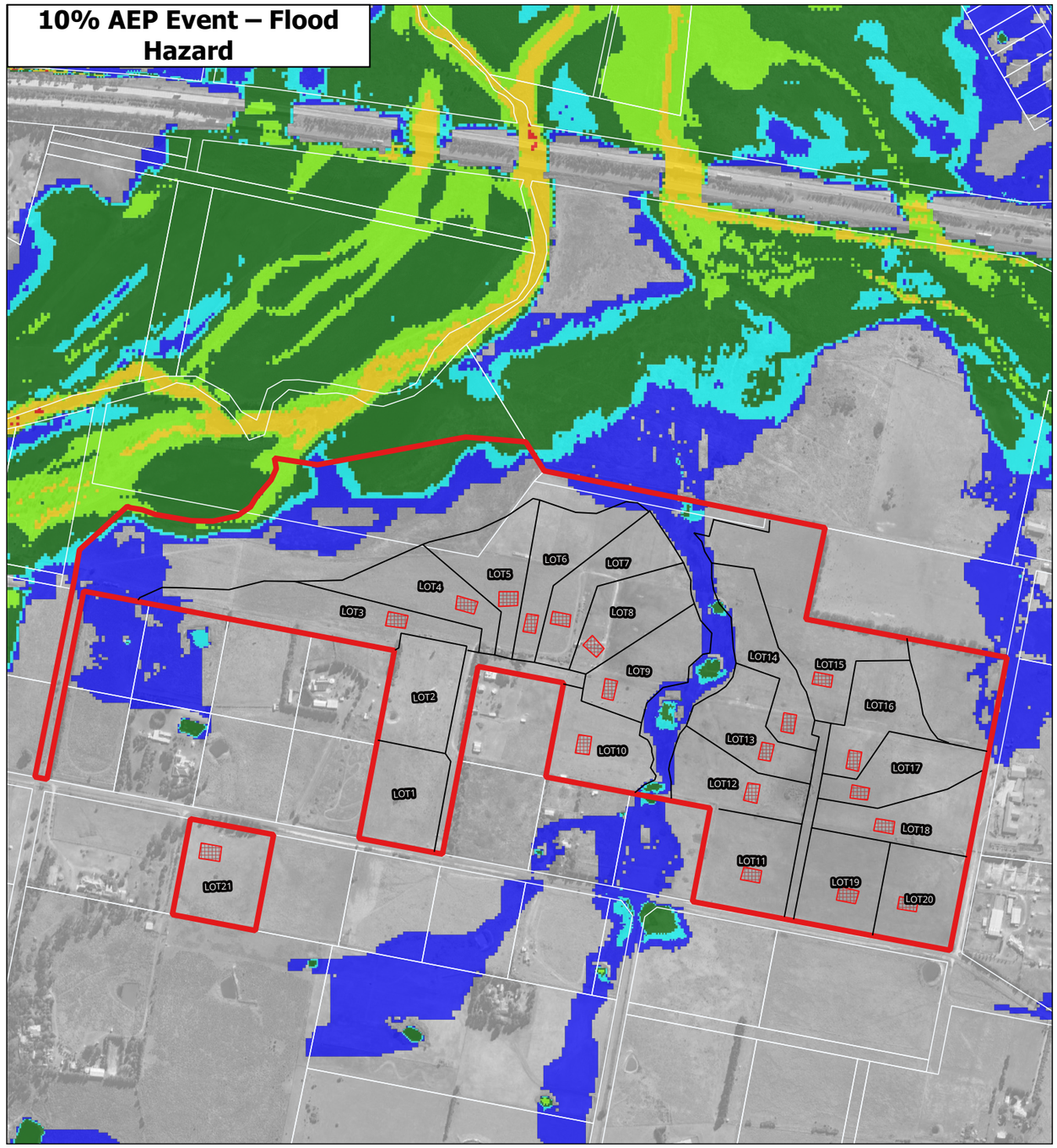
A compliance assessment of the planning proposal to the Local Planning Direction, Section 9.1 Direction 4.1 Flooding has been undertaken and the proposed rezoning of the site is considered consistent with these requirements.

Appendix A

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

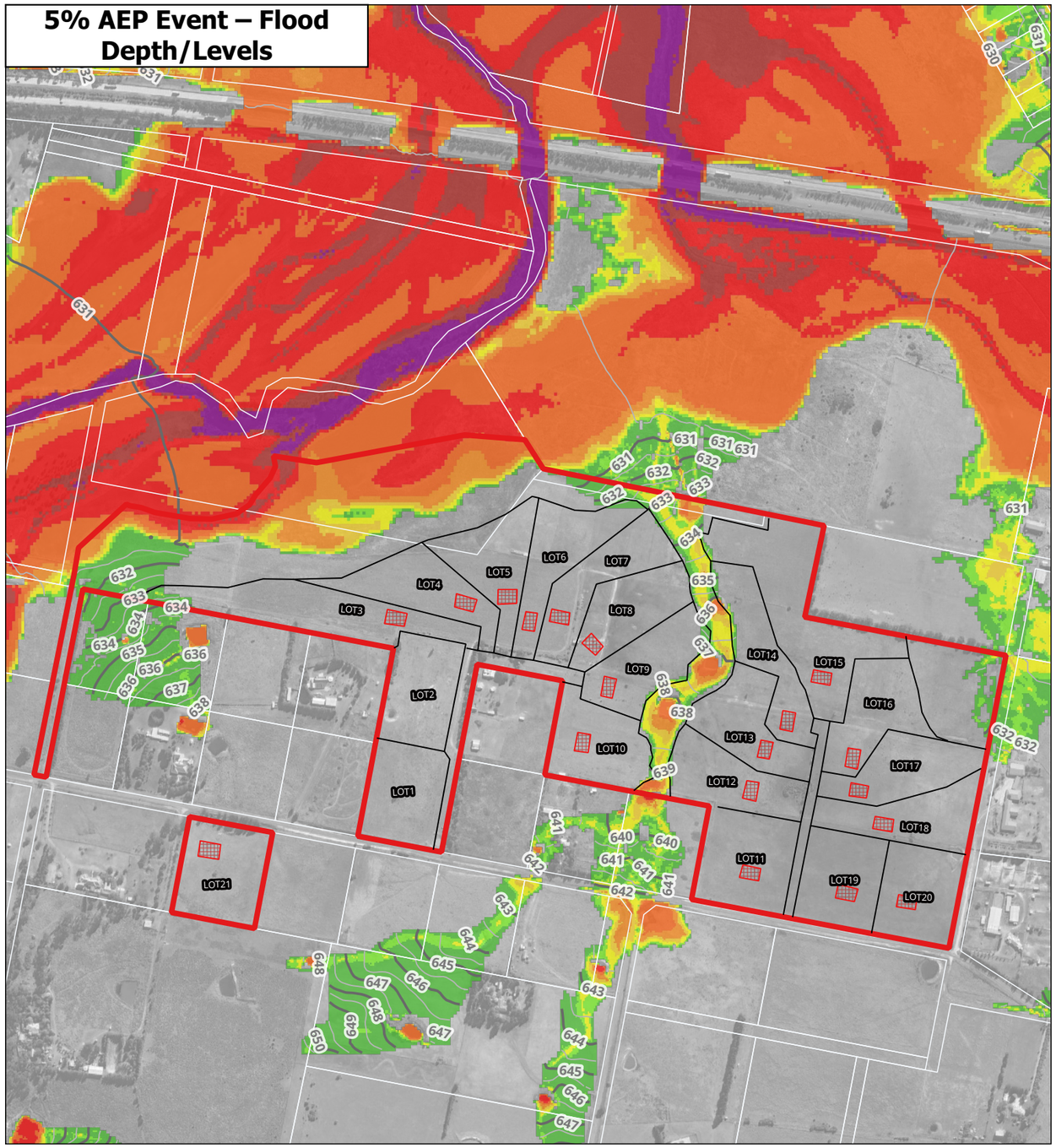
N
W
E
S

0 500 1000

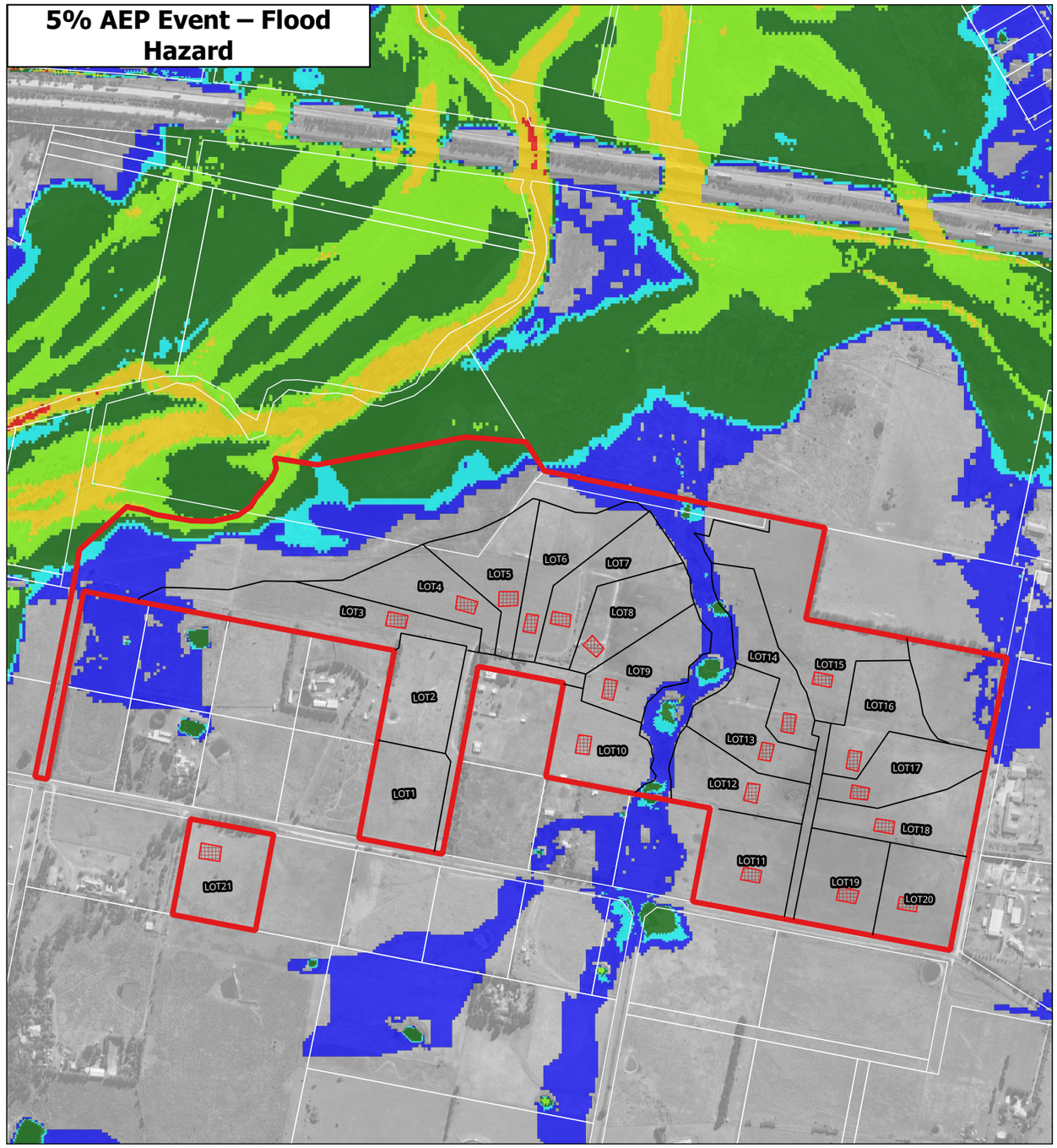
grc HYDRO

TITLE: **Existing Conditions - 10% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:8500**	FIGURE No. **A1**

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

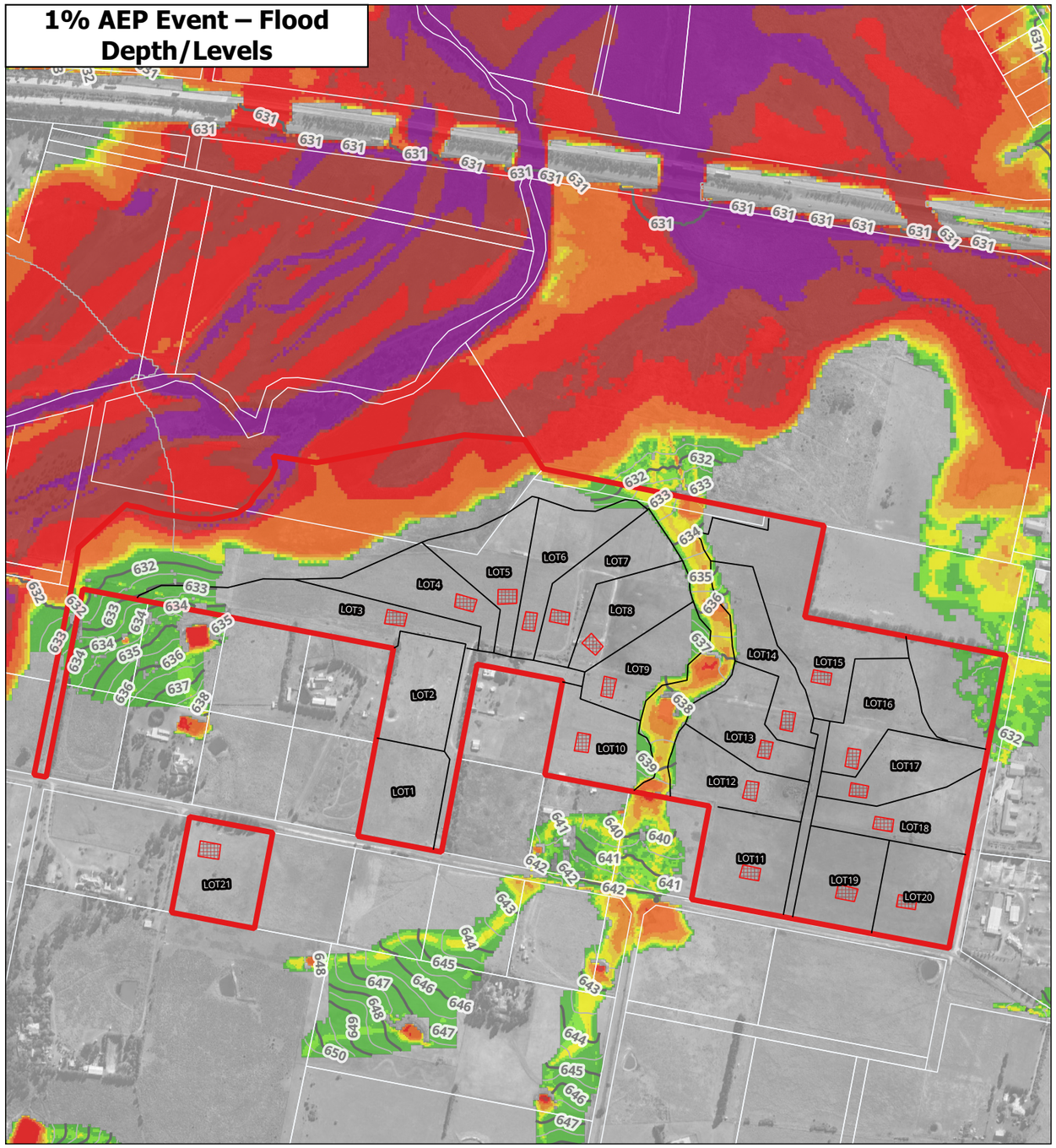
N
W
E
S

0 500 1000

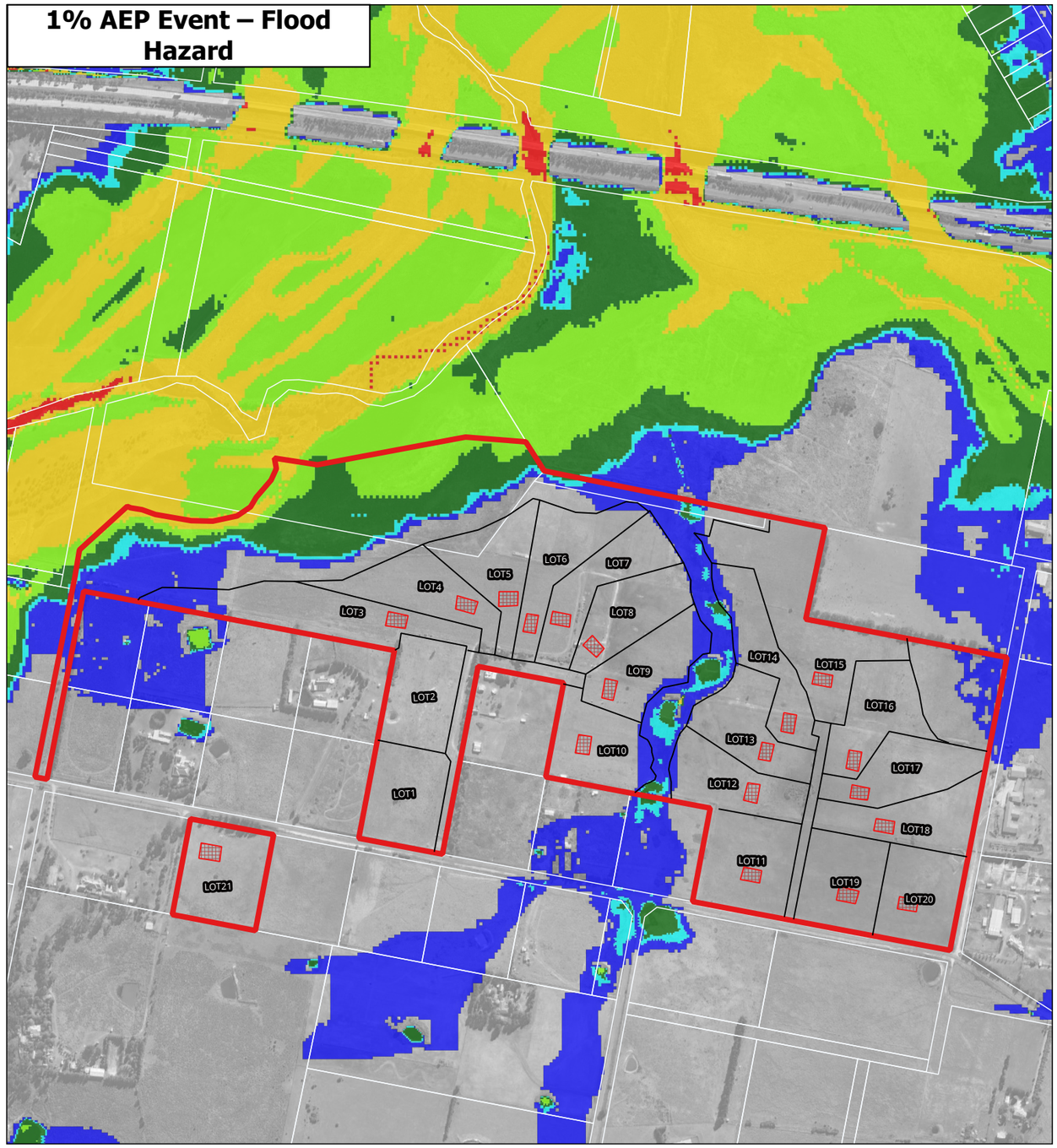
grc HYDRO

TITLE: **Existing Conditions - 5% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A2**

1% AEP Event – Flood Depth/Levels



1% 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

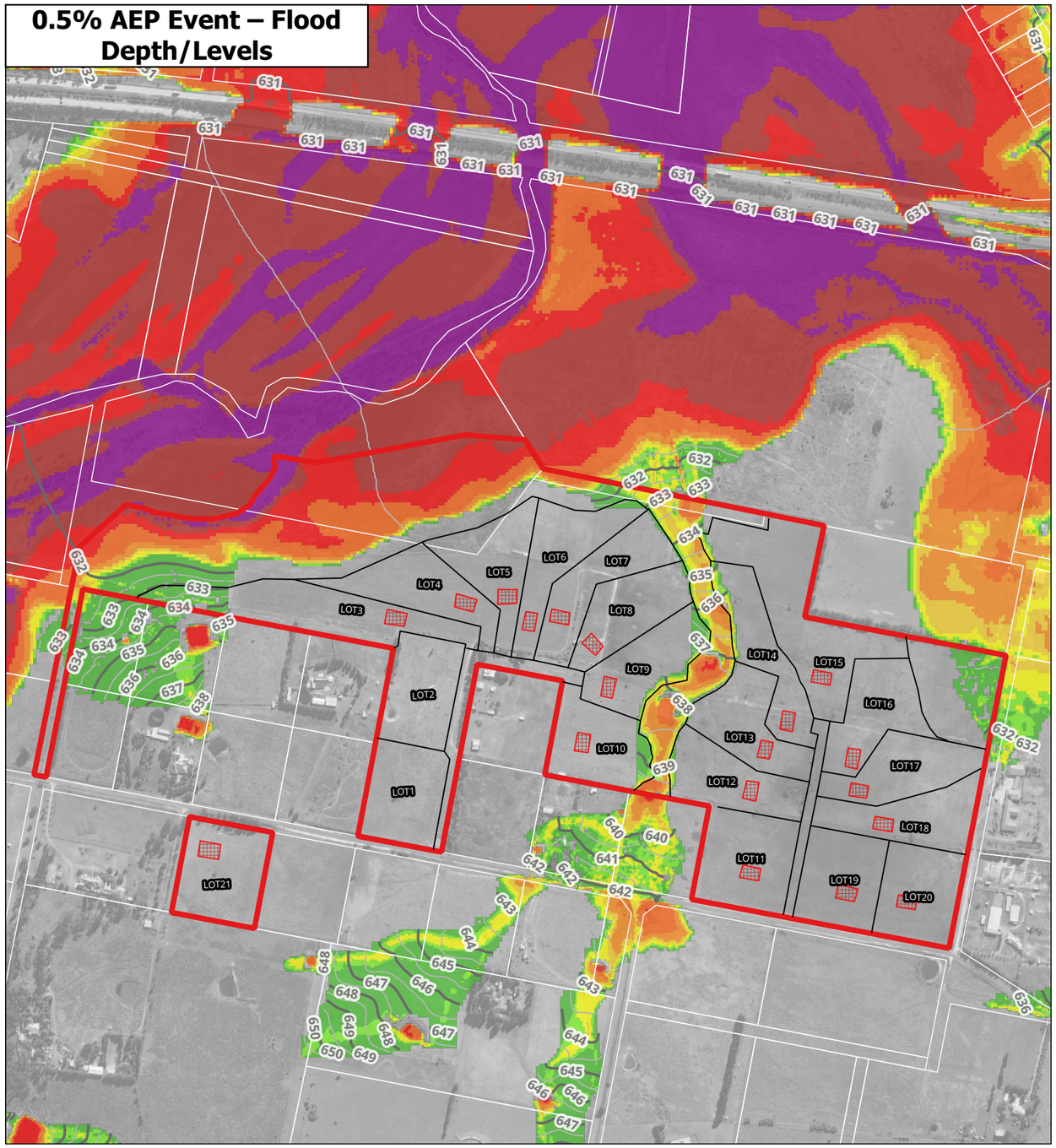
N W E S

0 500 1000

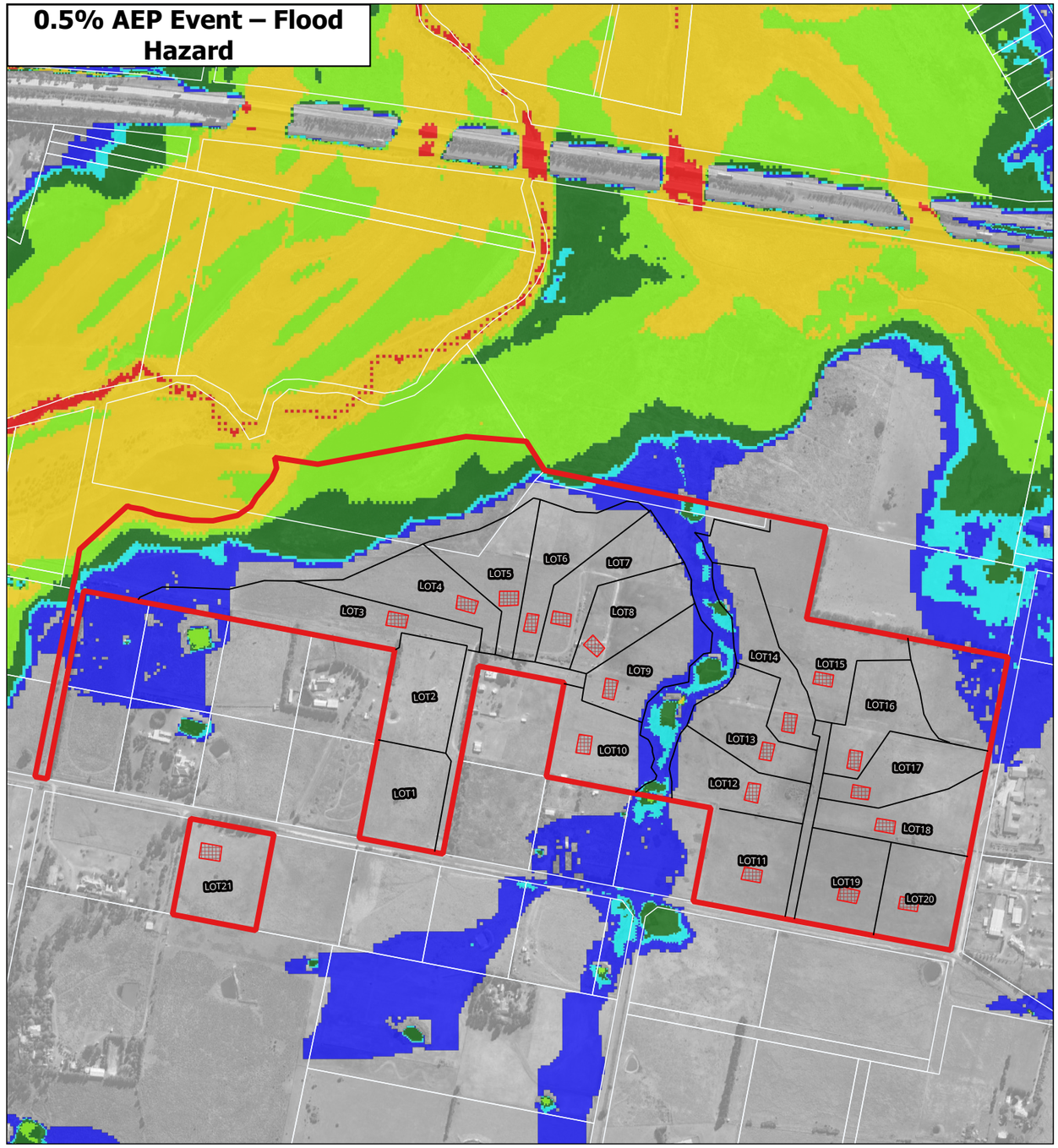
grc HYDRO

TITLE: **Existing Conditions - 1% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A3**

0.5% AEP Event – Flood Depth/Levels



0.5% 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

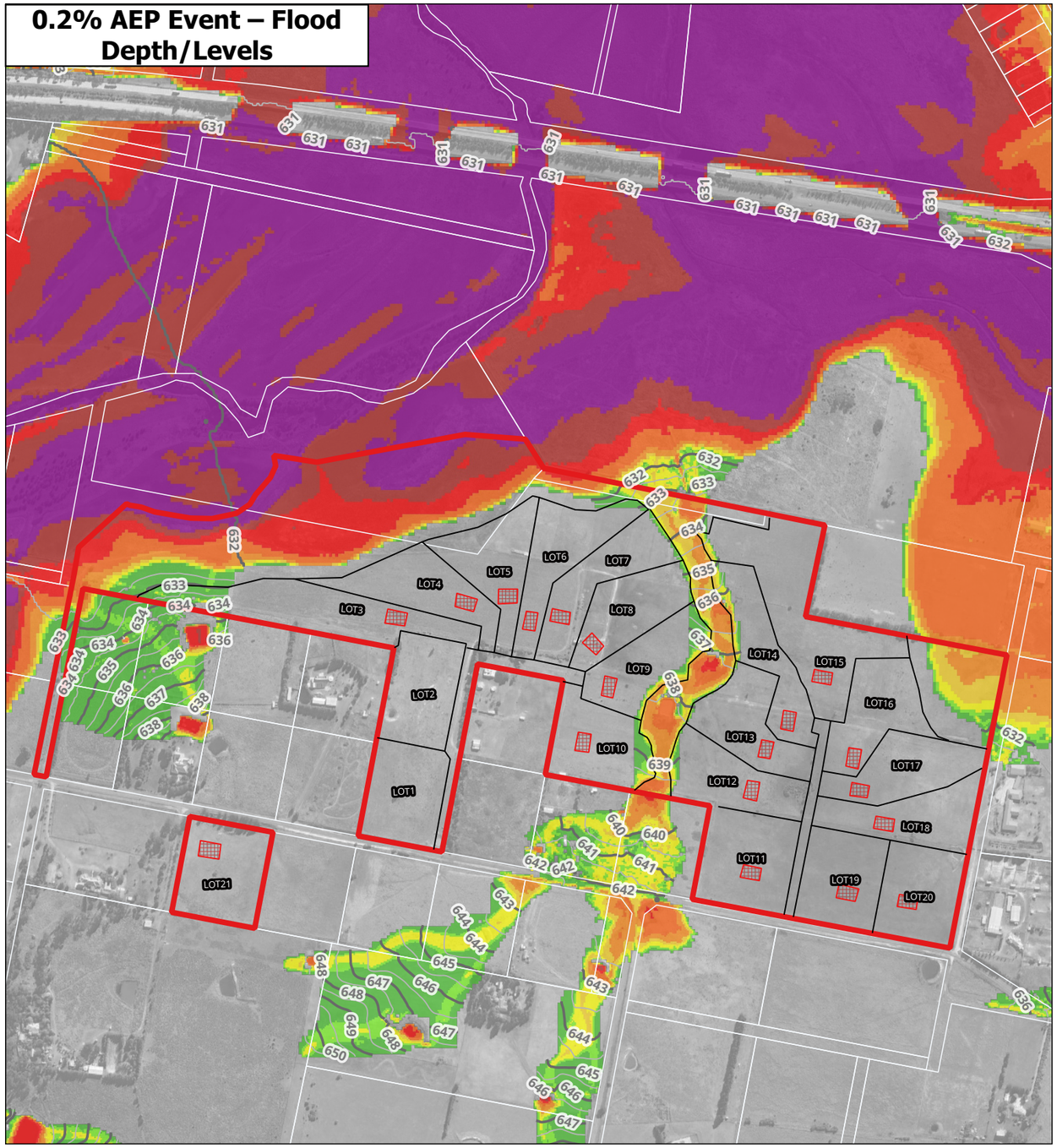
N
W
E
S

0 500 1000

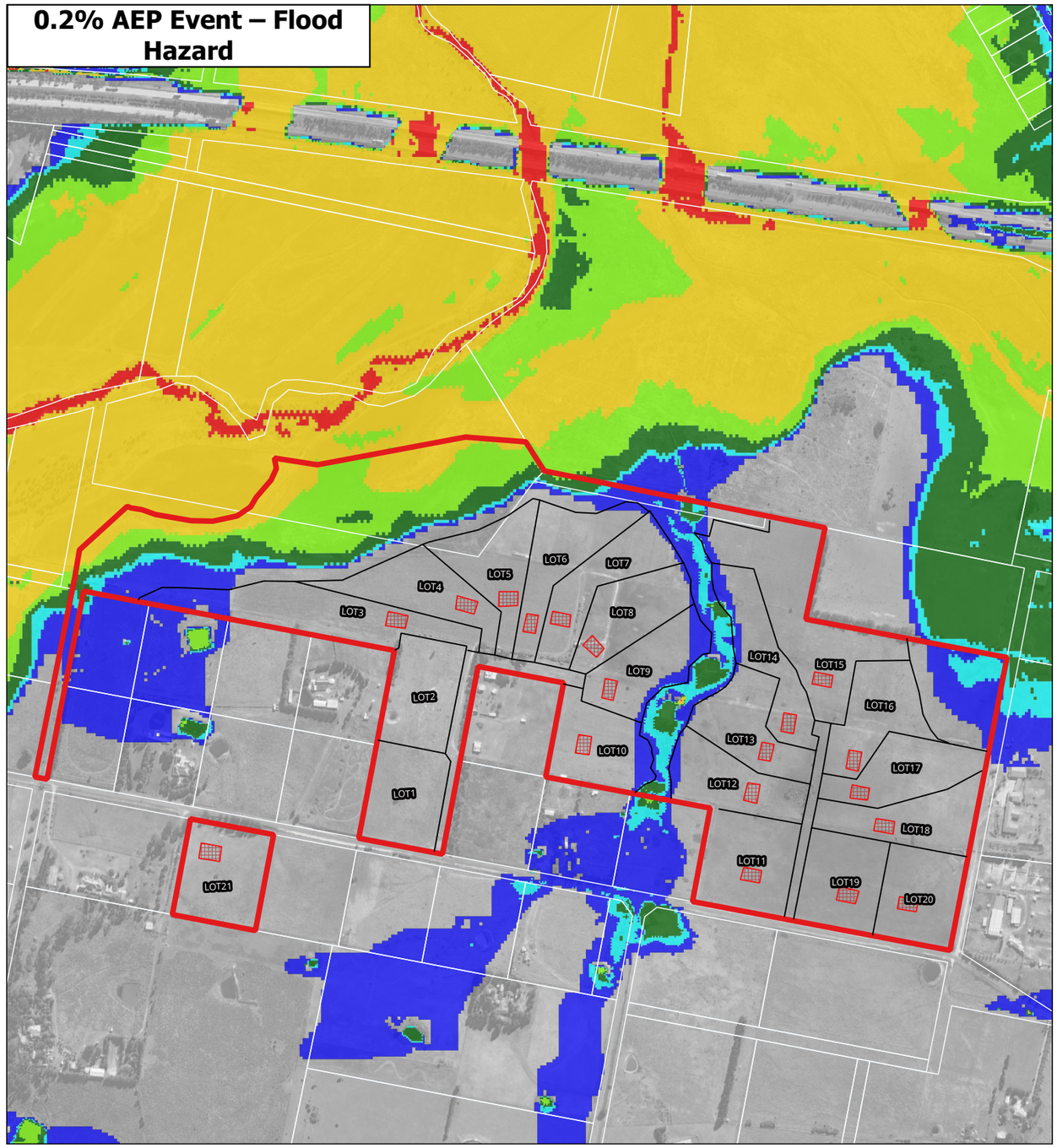
grc HYDRO

TITLE: **Existing Conditions – 0.5% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A4**

0.2% AEP Event – Flood Depth/Levels



0.2% 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

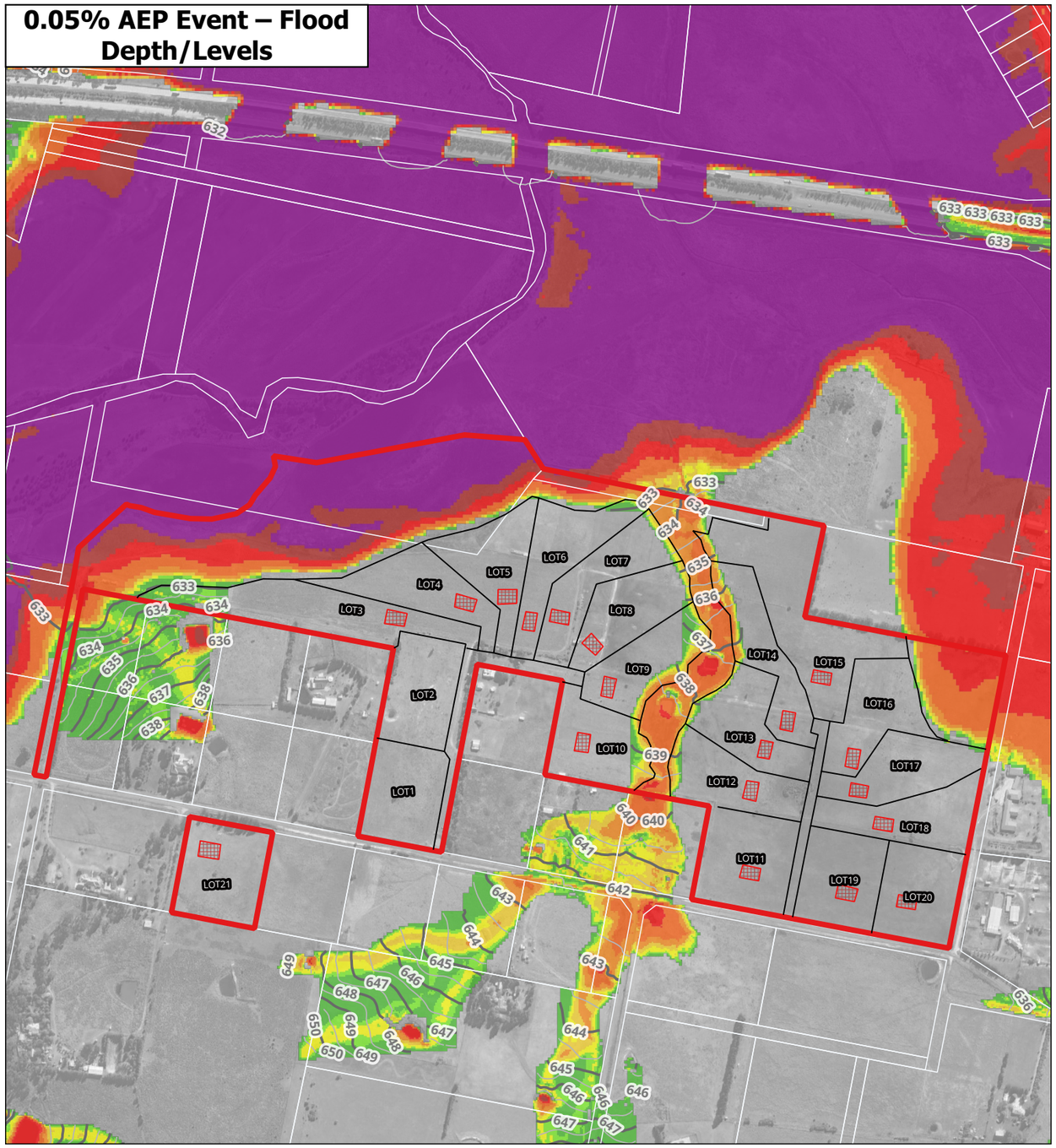
N
W
E
S

0 500 1000

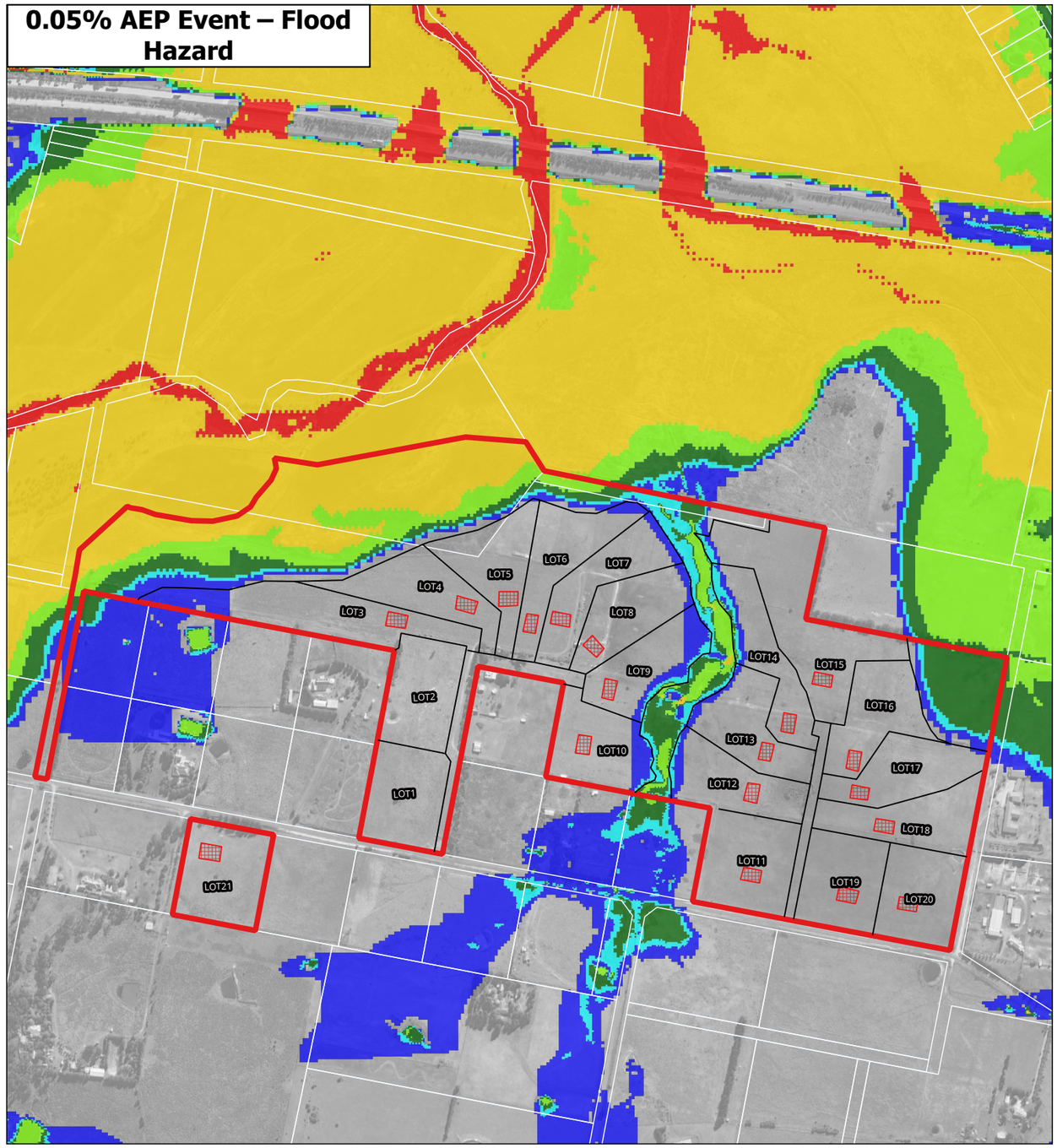
grc HYDRO

TITLE: **Existing Conditions – 0.2% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A5**

0.05% AEP Event – Flood Depth/Levels



0.05% 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

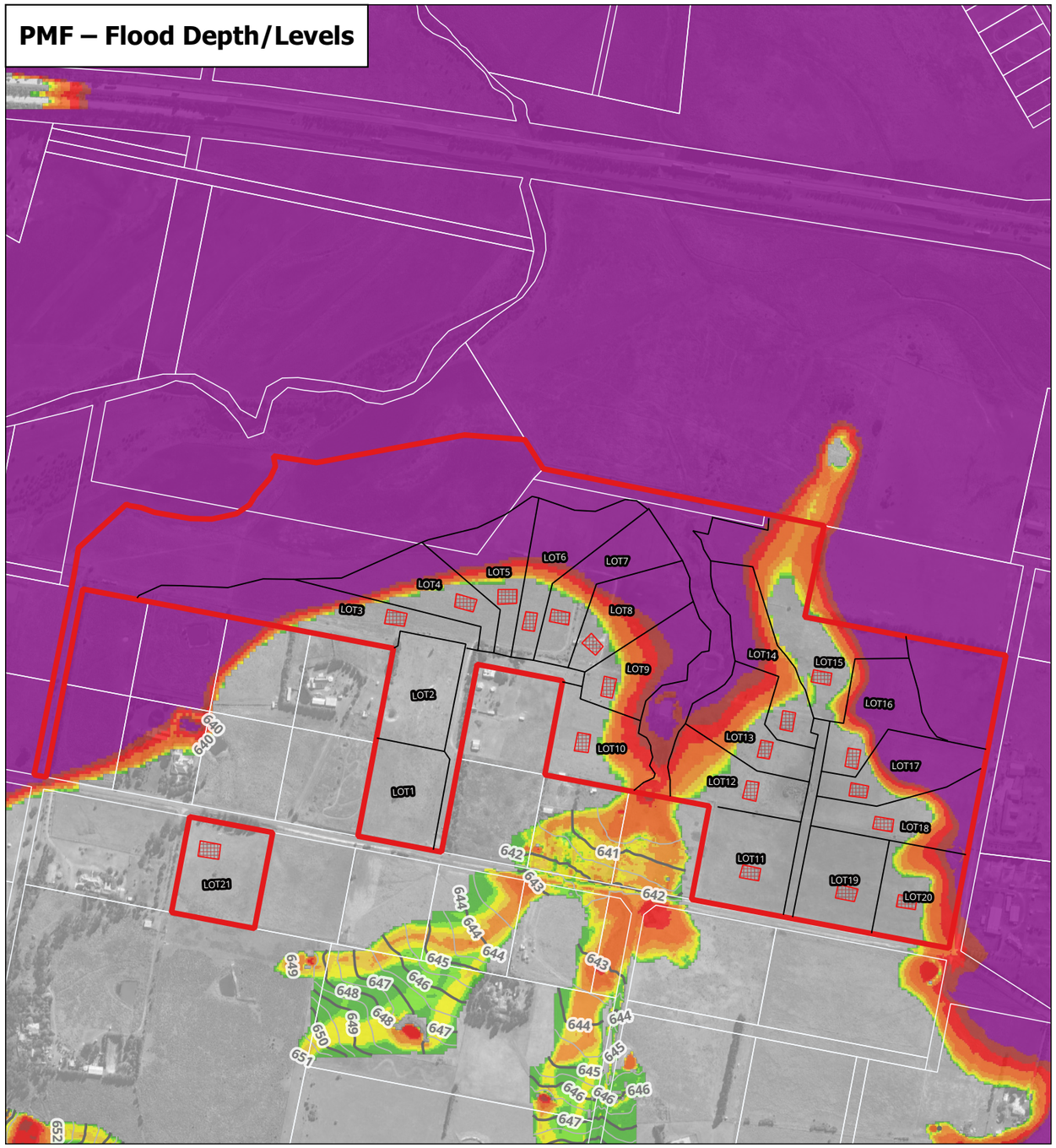
N
W
E
S

0 500 1000

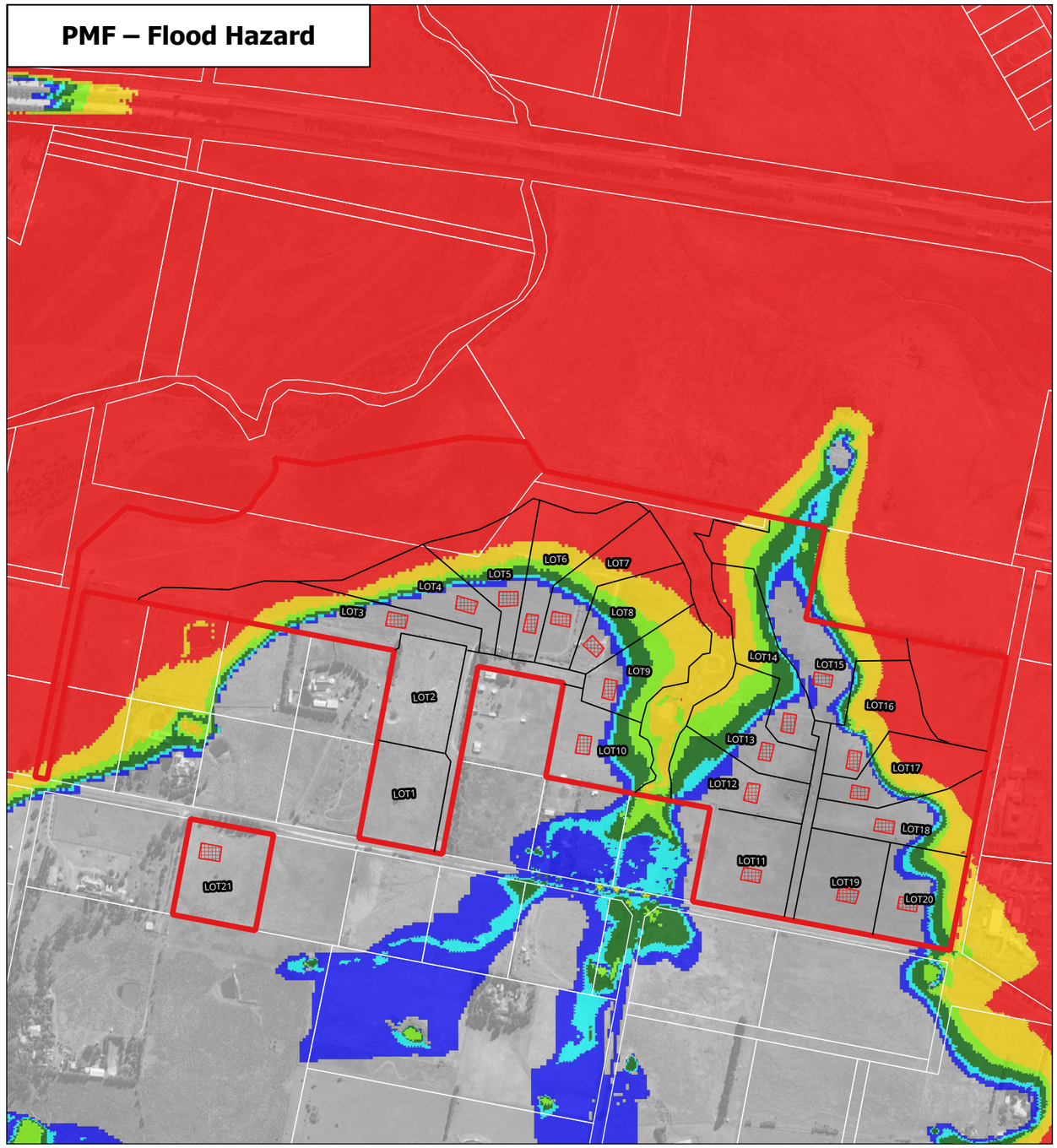
grc HYDRO

TITLE: **Existing Conditions – 0.05% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A6**

PMF – Flood Depth/Levels



PMF – 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)

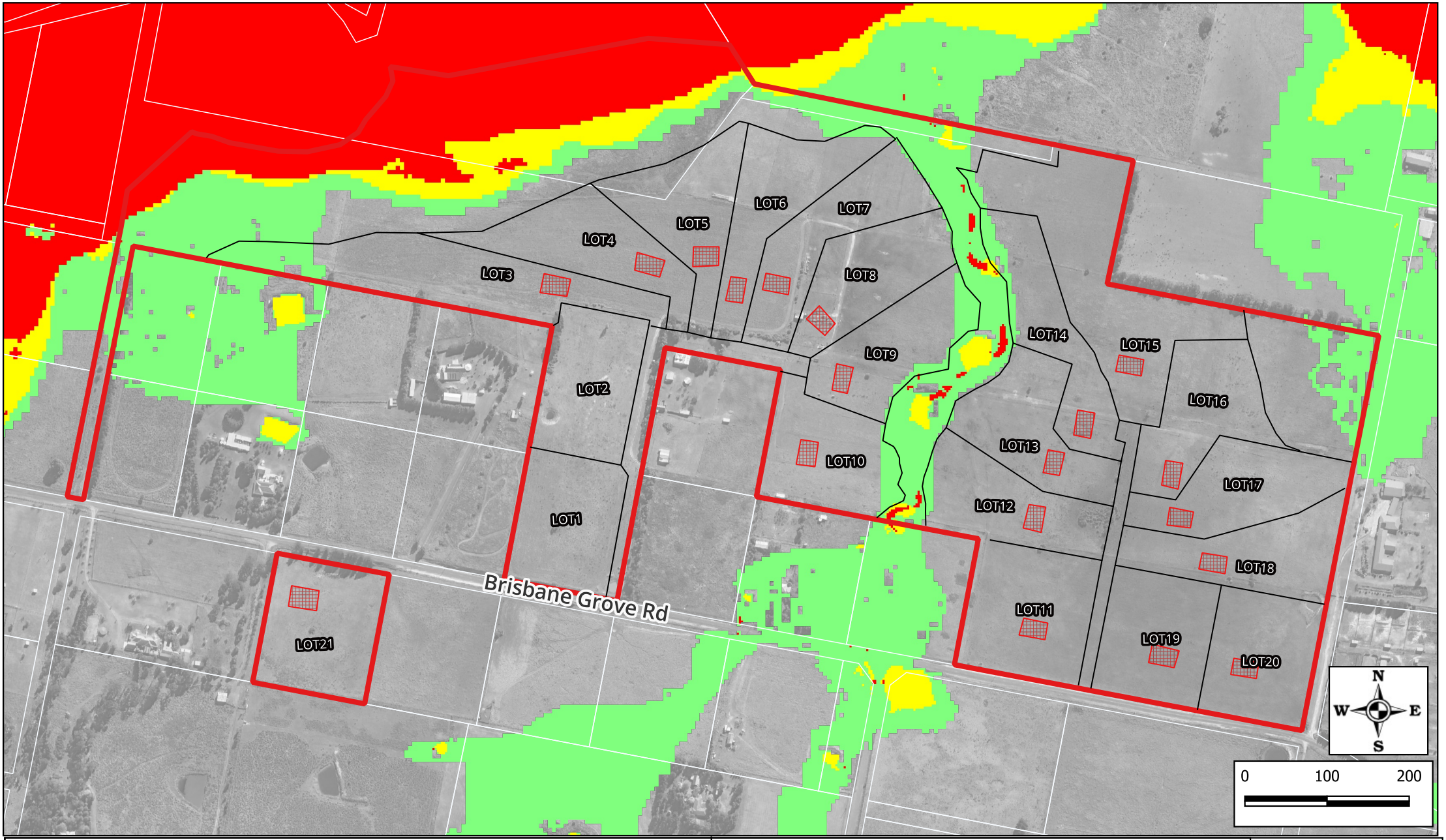
Flood Hazard Category
- H1
- H2
- H3
- H4
- H5
- H6

N W E S

0 500 1000

grc HYDRO

TITLE: **Existing Conditions – PMF – Flood Depth/Levels and Hazard**	PROJECT: **137 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **11-2023**	SCALE: **1:8500**	FIGURE No. **A7**

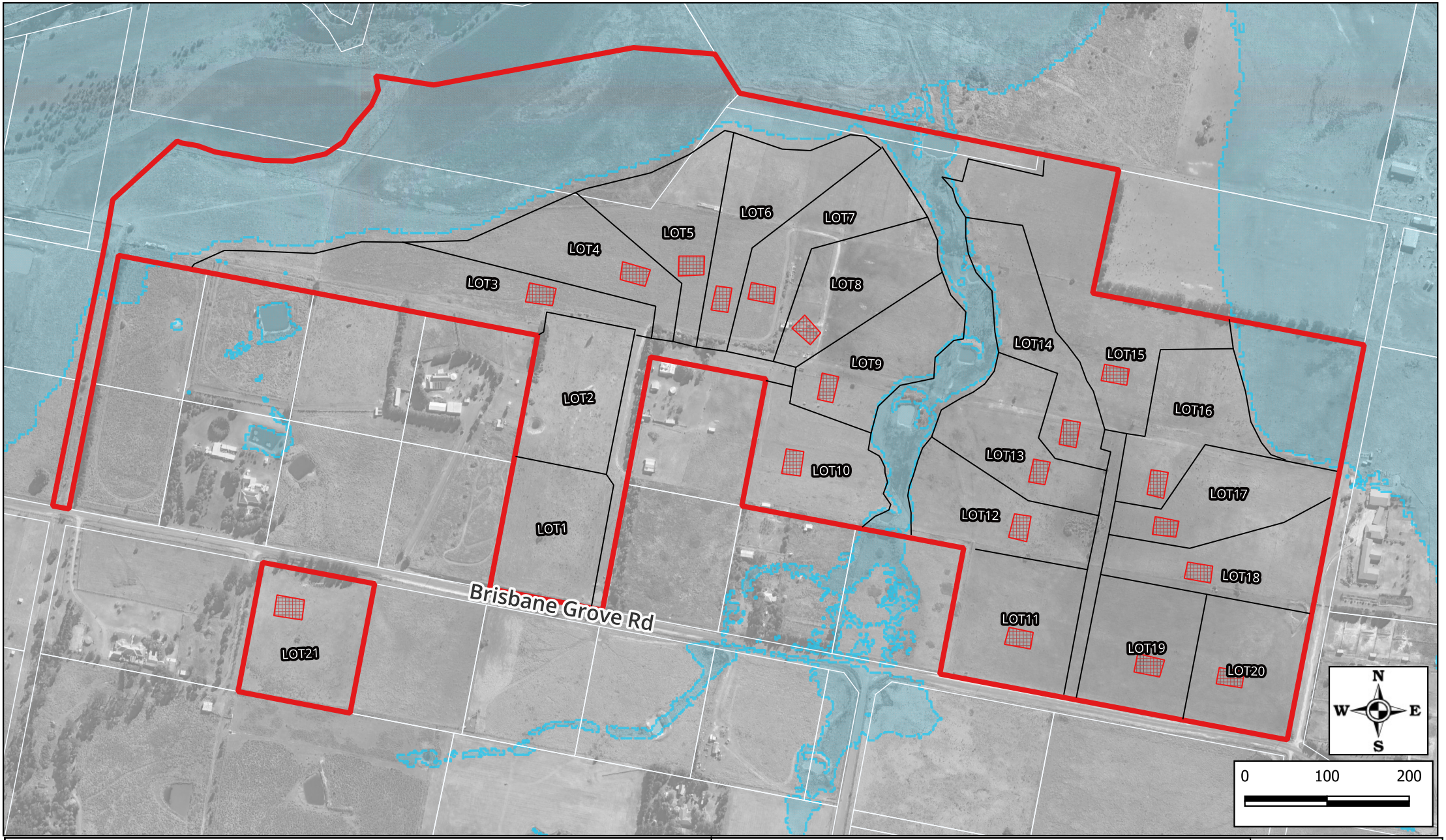


Hydraulic Category
- Flow Conveyance
- Flood Storage
- Flood Fringe

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

TITLE: **Existing Conditions - Flood Function**		
PROJECT: **137 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **A8**

grc HYDRO



Subject Site

Cadastral Boundaries

Concept Lot Layout

Concept Building Envelopes

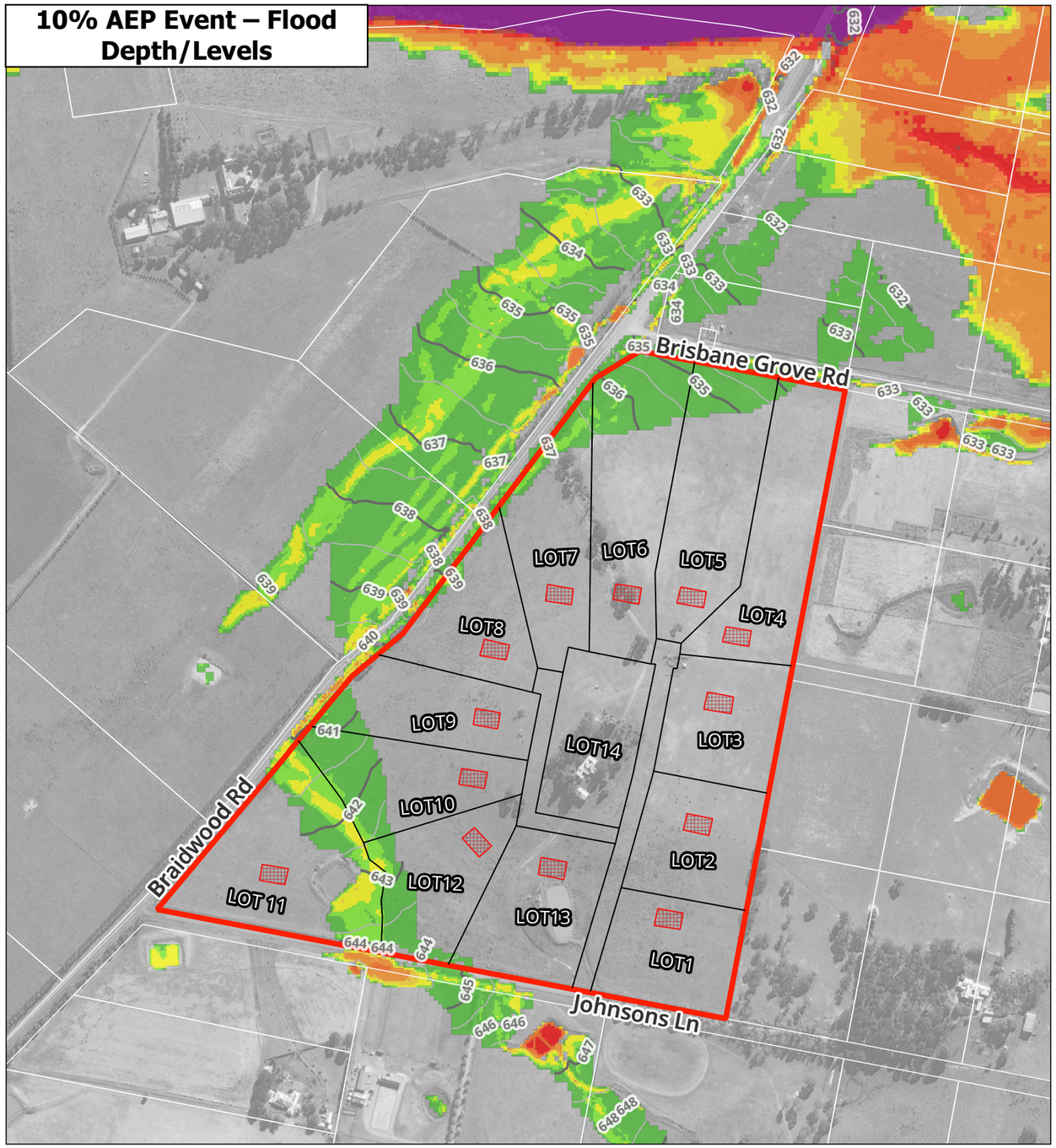
Flood Planning Area

TITLE: **Flood Planning Area**		
PROJECT: **137 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **A9**

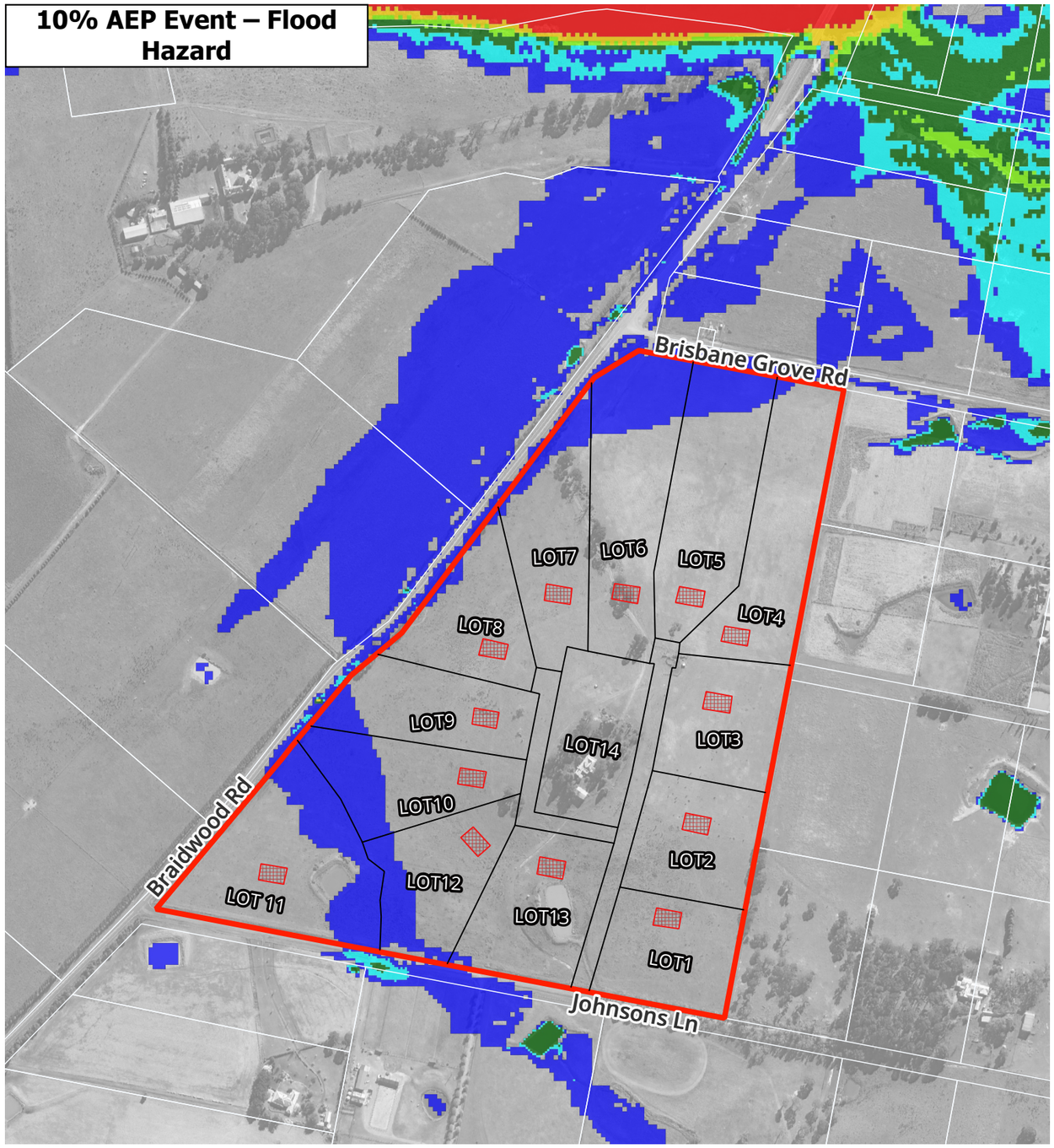
grc HYDRO

Appendix B

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

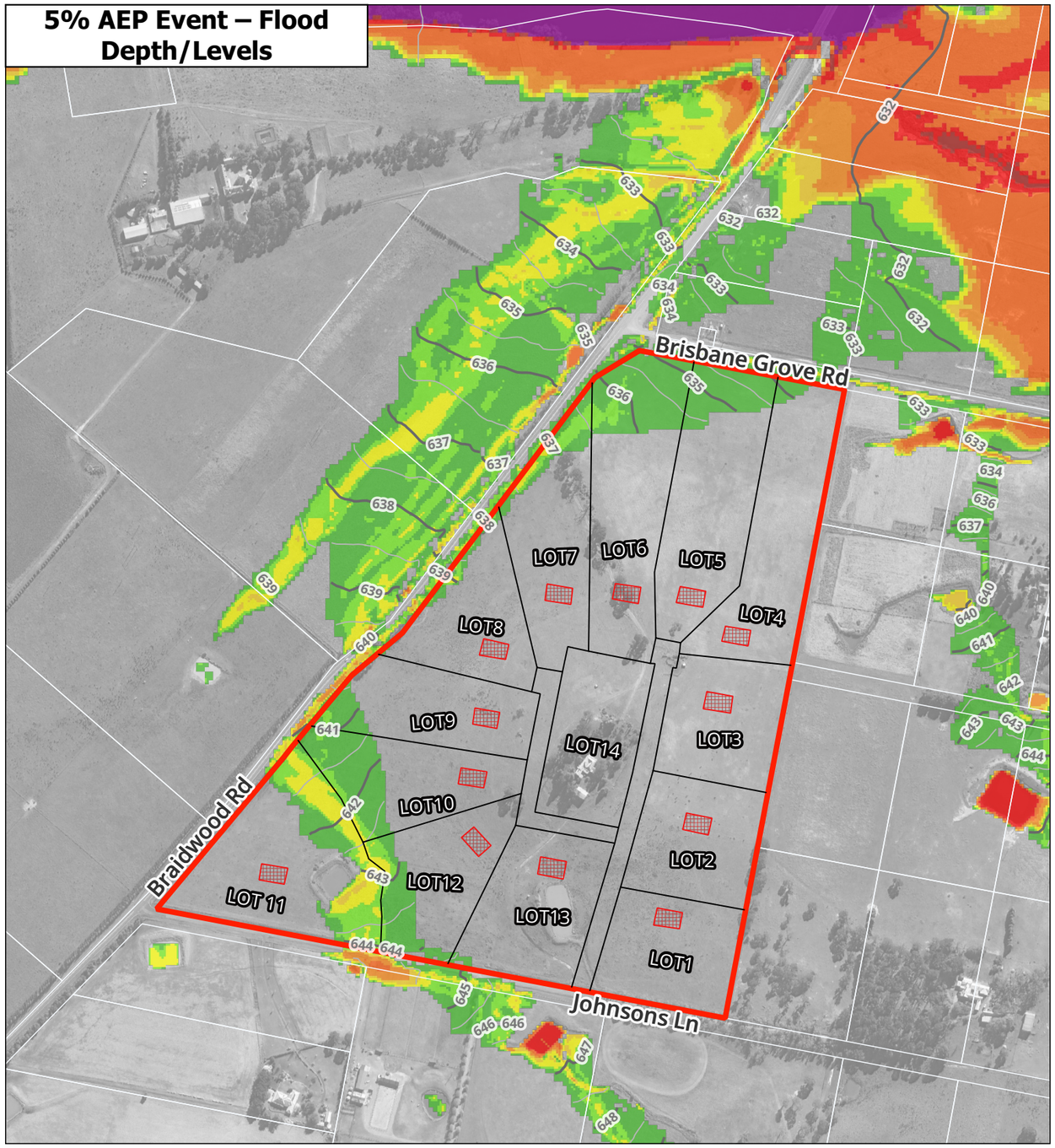
N W E S

0 300 600

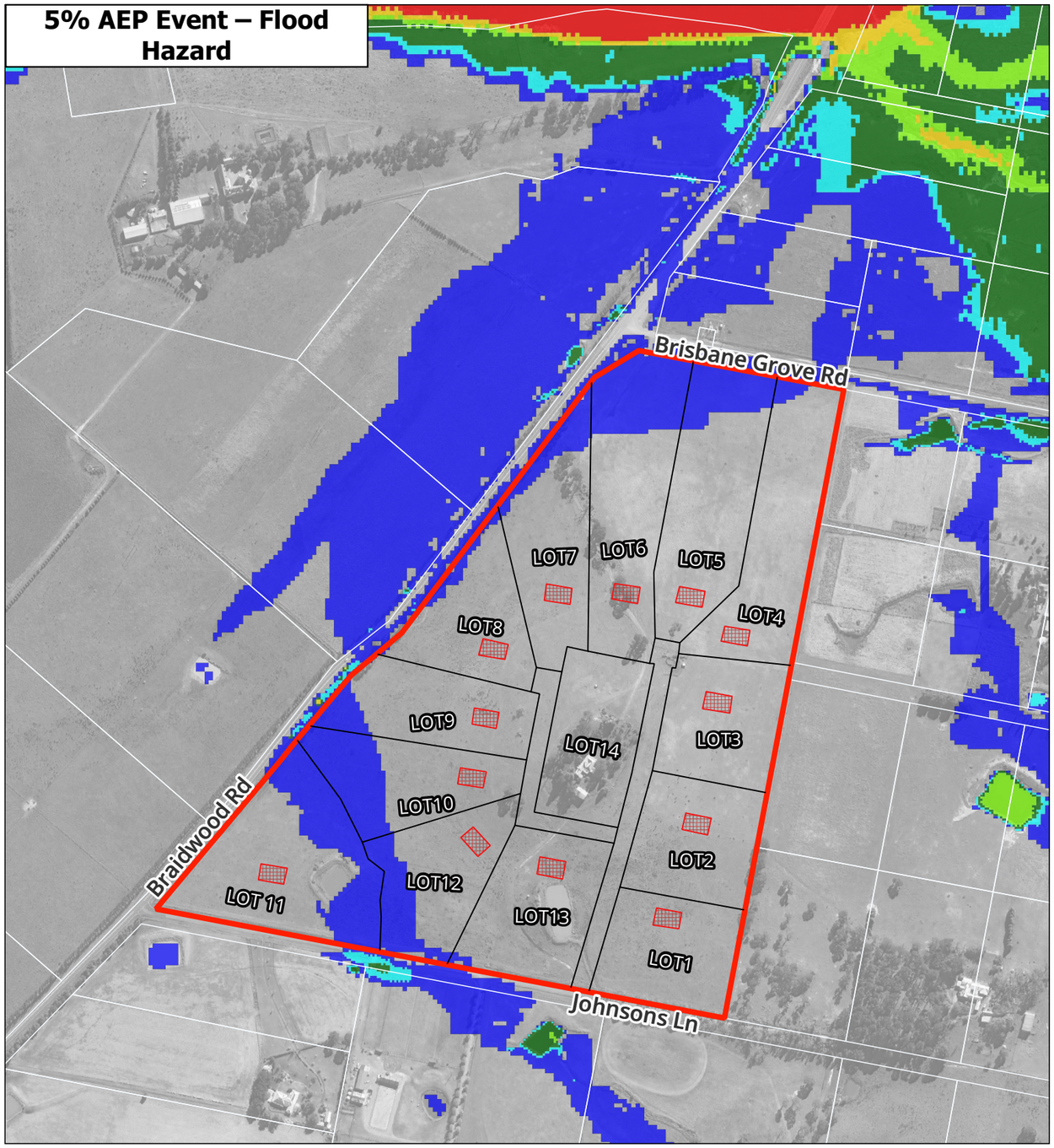
grc HYDRO

TITLE: **Existing Conditions - 10% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B1**

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

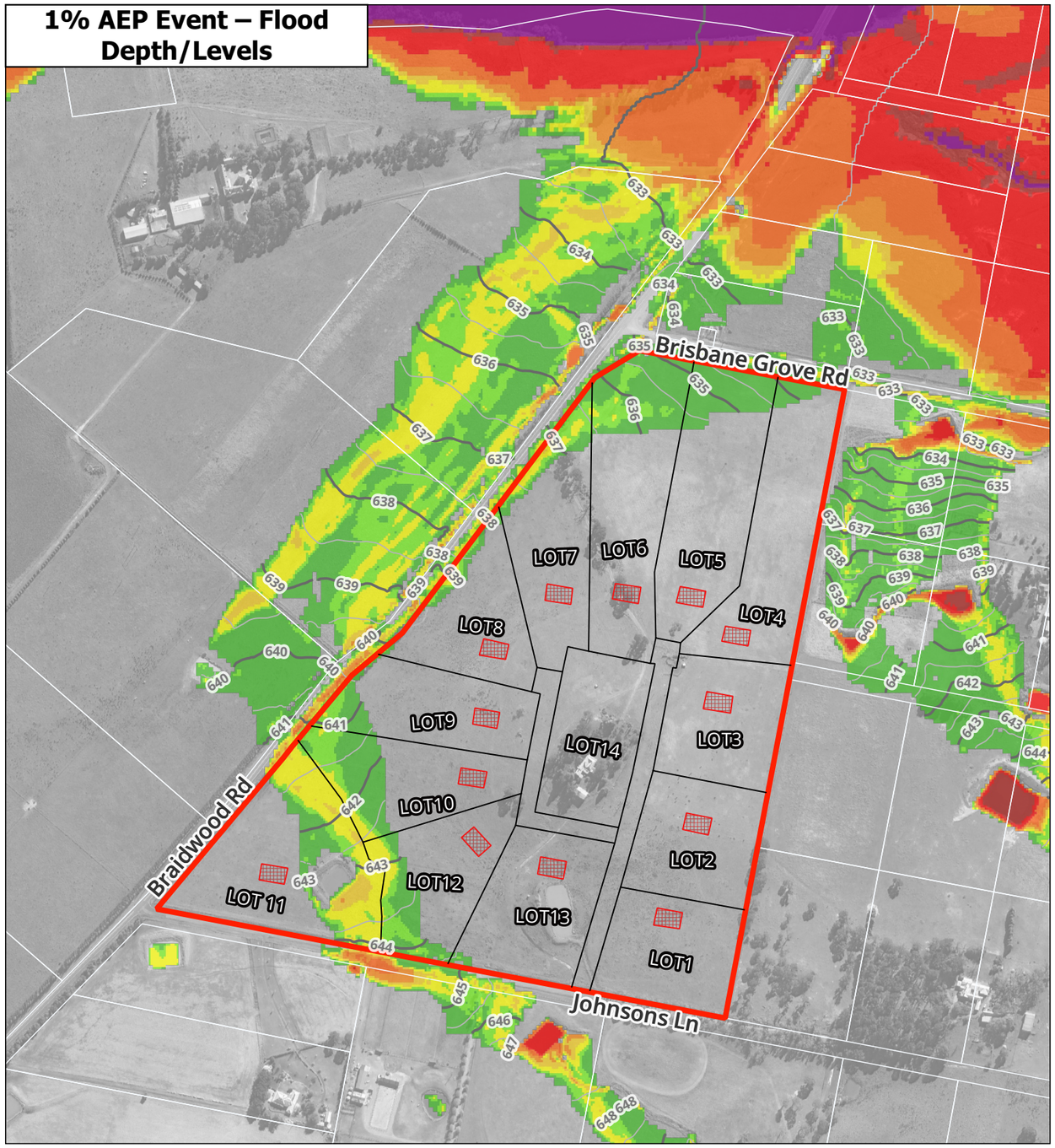
N
W
E
S

0 300 600

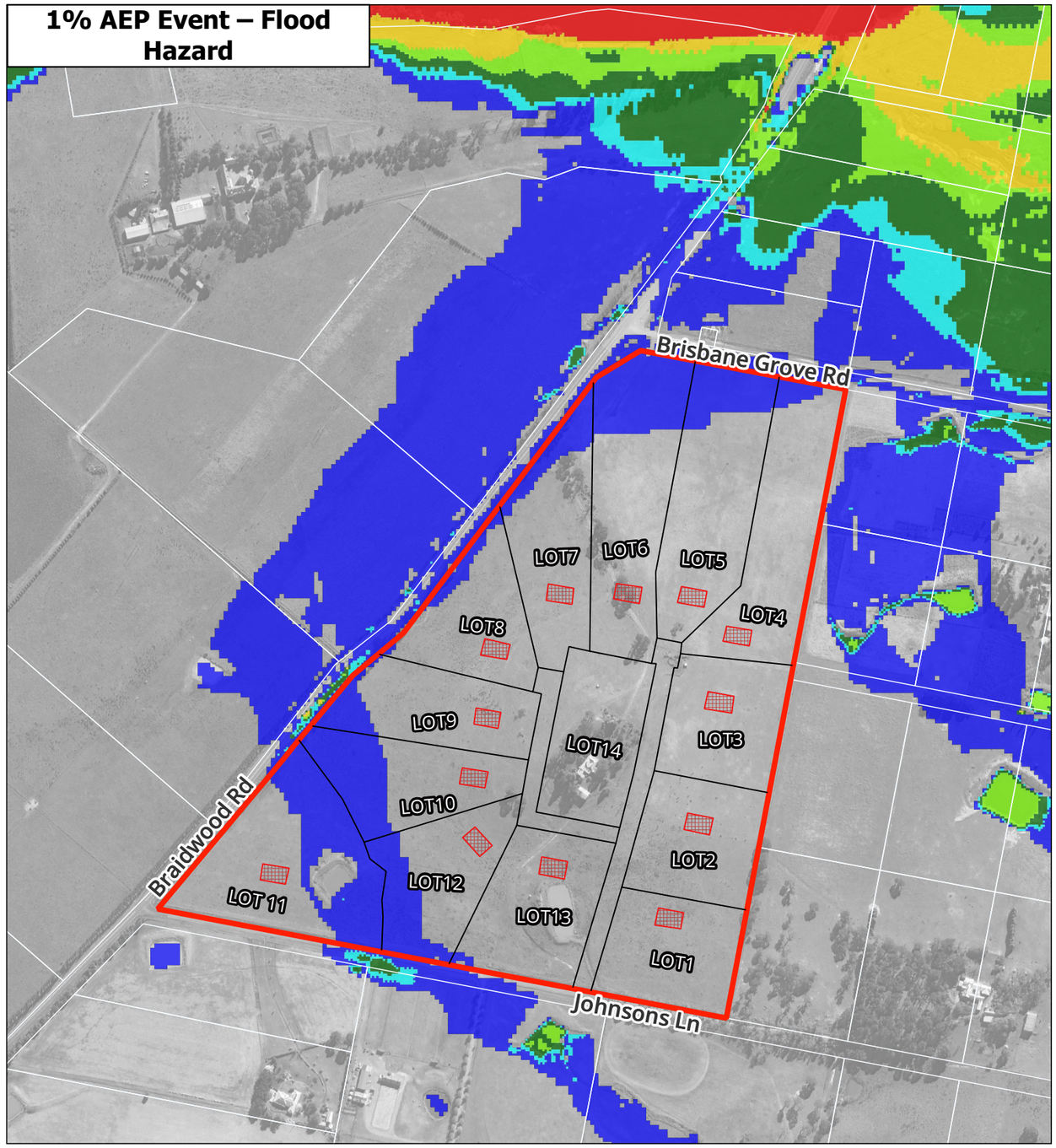
grc HYDRO

TITLE: **Existing Conditions - 5% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B2**

1% AEP Event – Flood Depth/Levels



1% 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

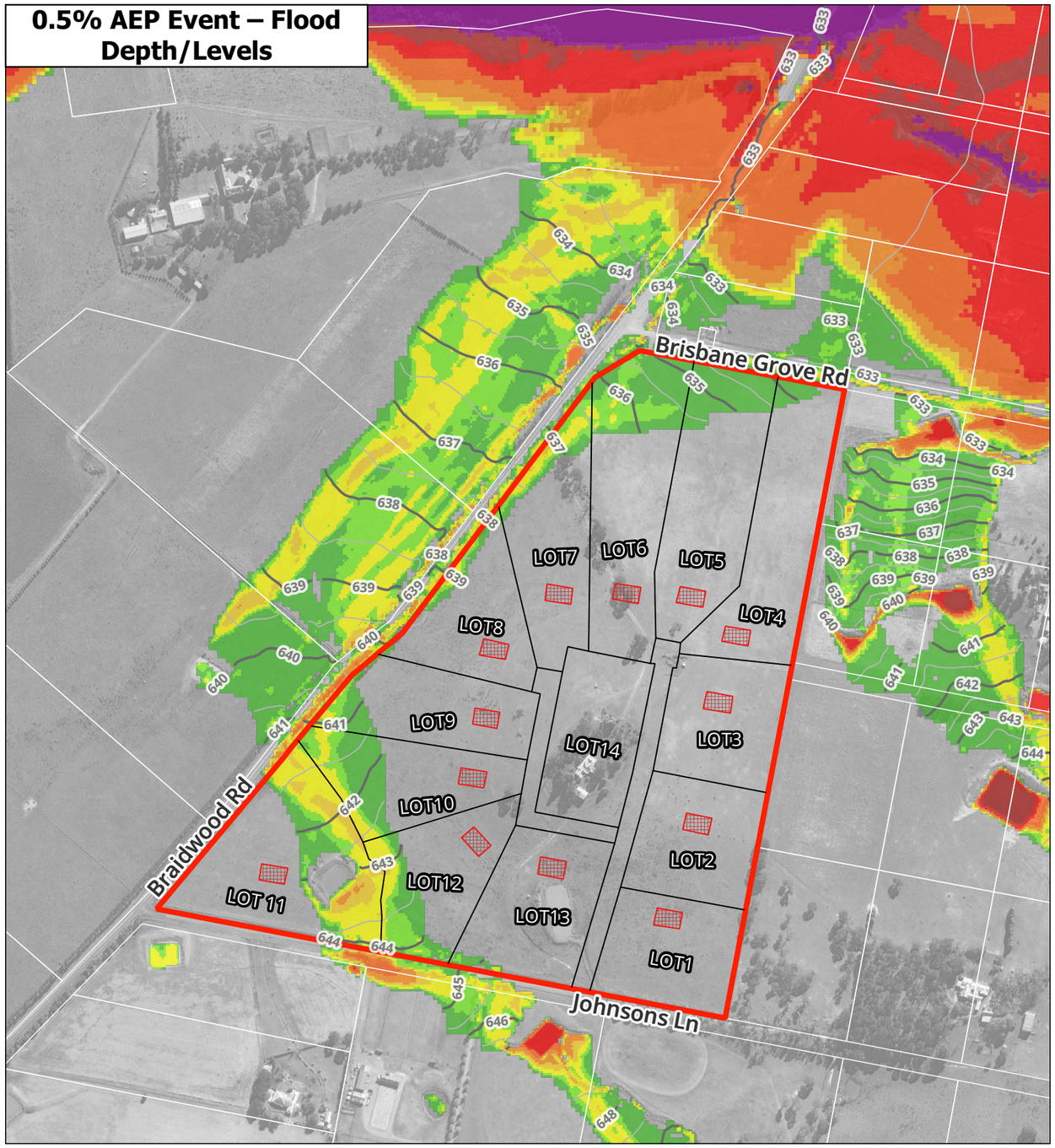
N W E S

0 300 600

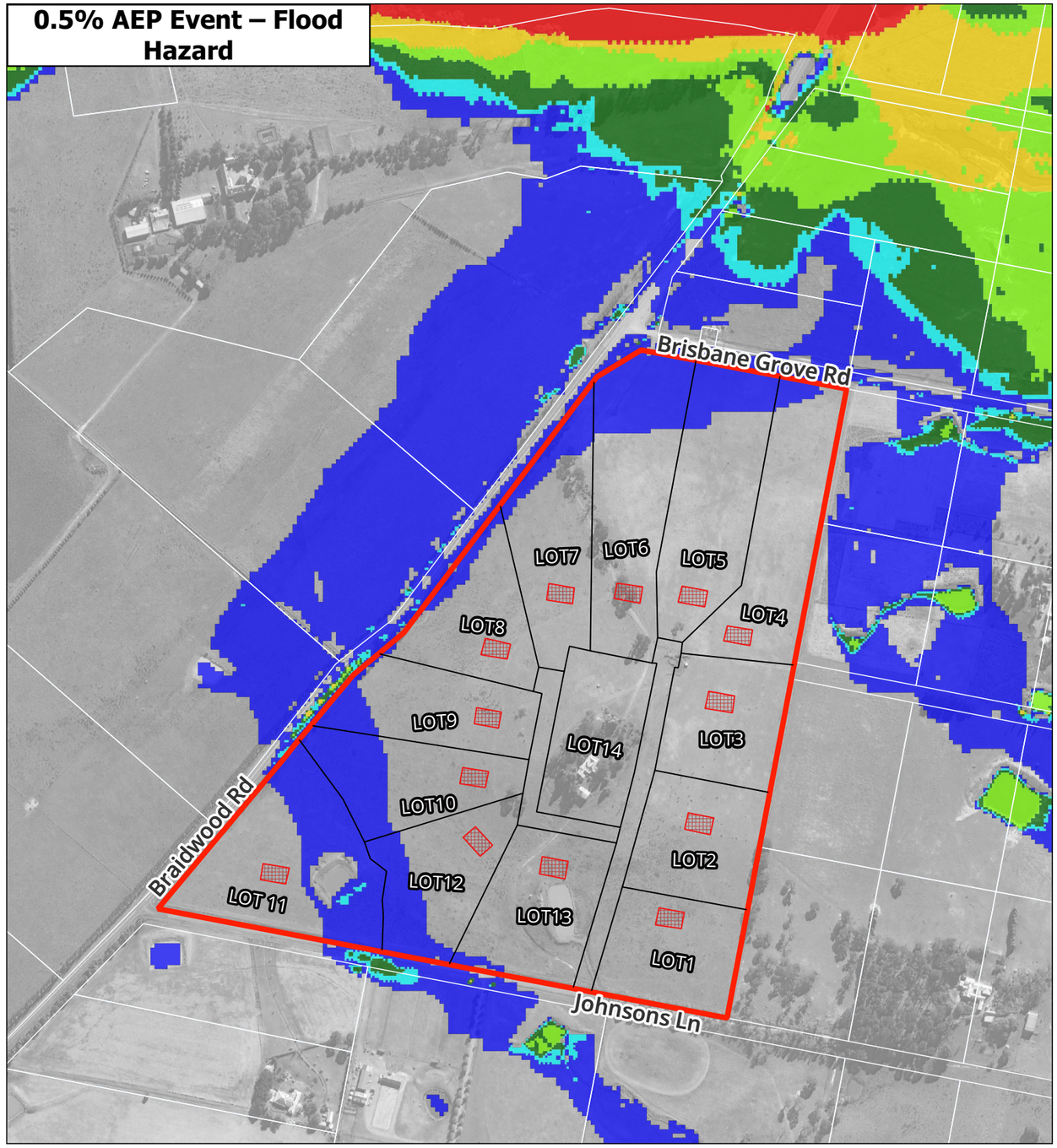
grc HYDRO

TITLE: **Existing Conditions - 1% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B3**

0.5% AEP Event – Flood Depth/Levels



0.5% 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

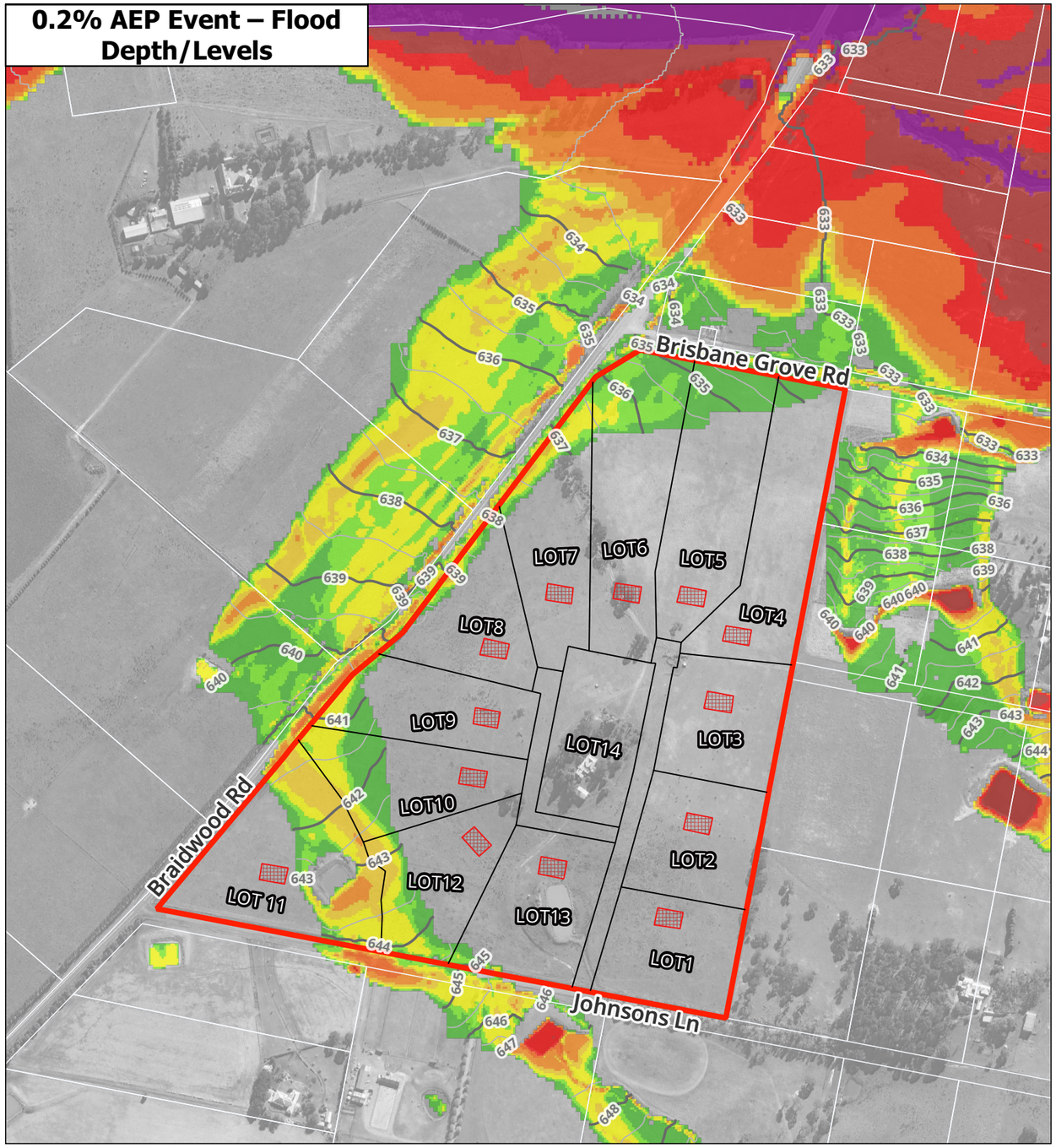
N W E S

0 300 600

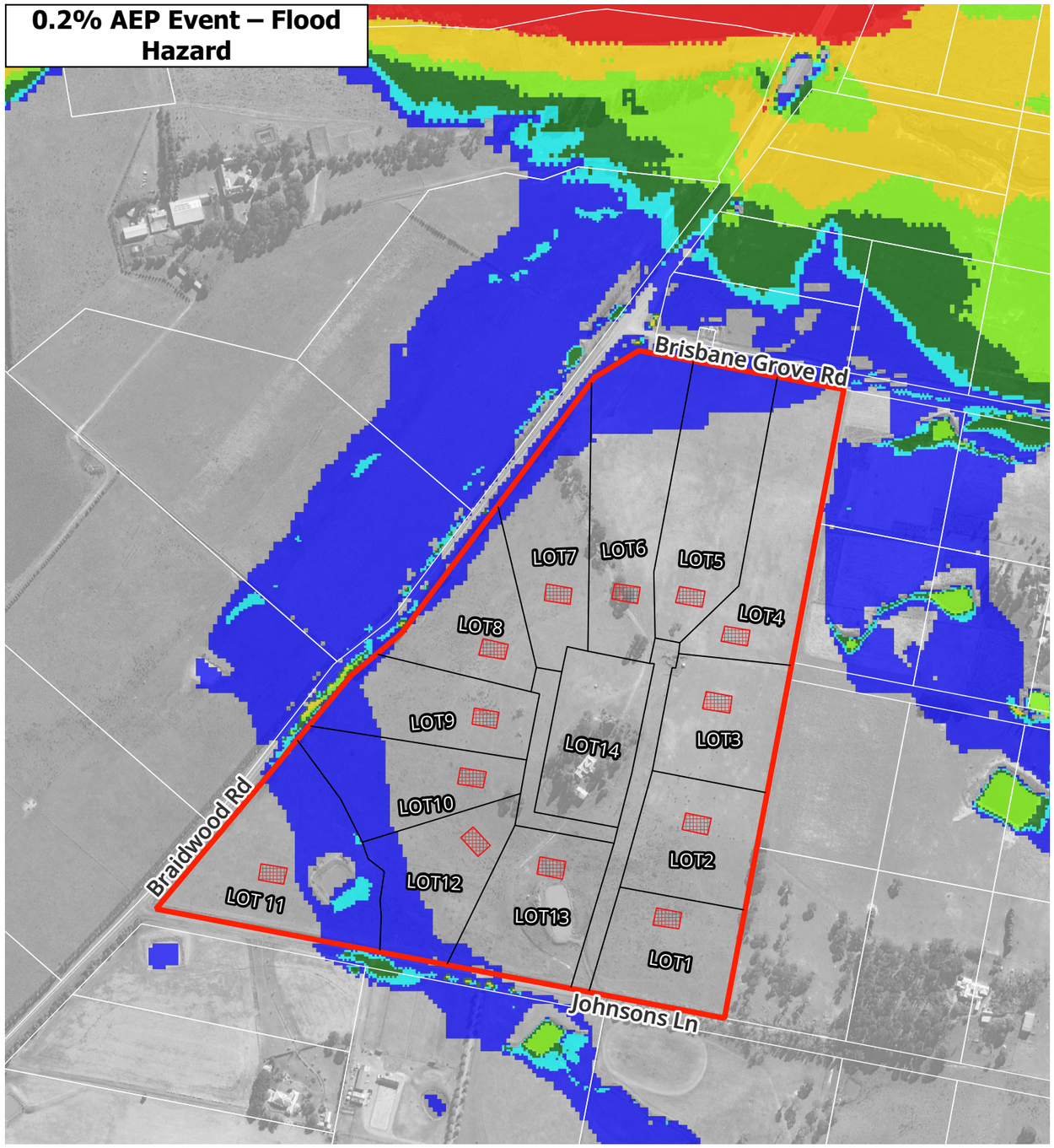
grc HYDRO

TITLE: **Existing Conditions – 0.5% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B4**

0.2% AEP Event – Flood Depth/Levels



0.2% 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

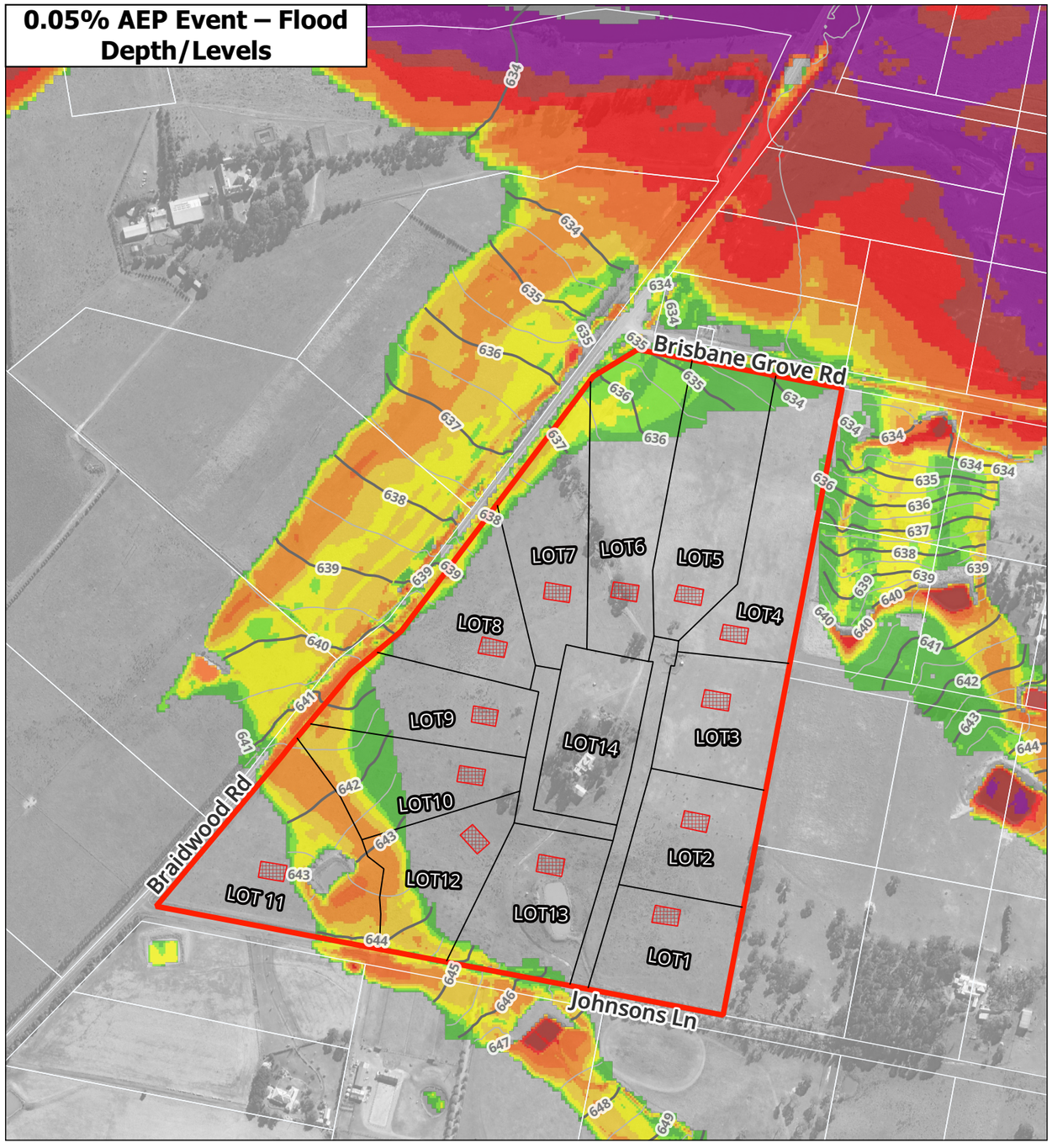
N W E S

0 300 600

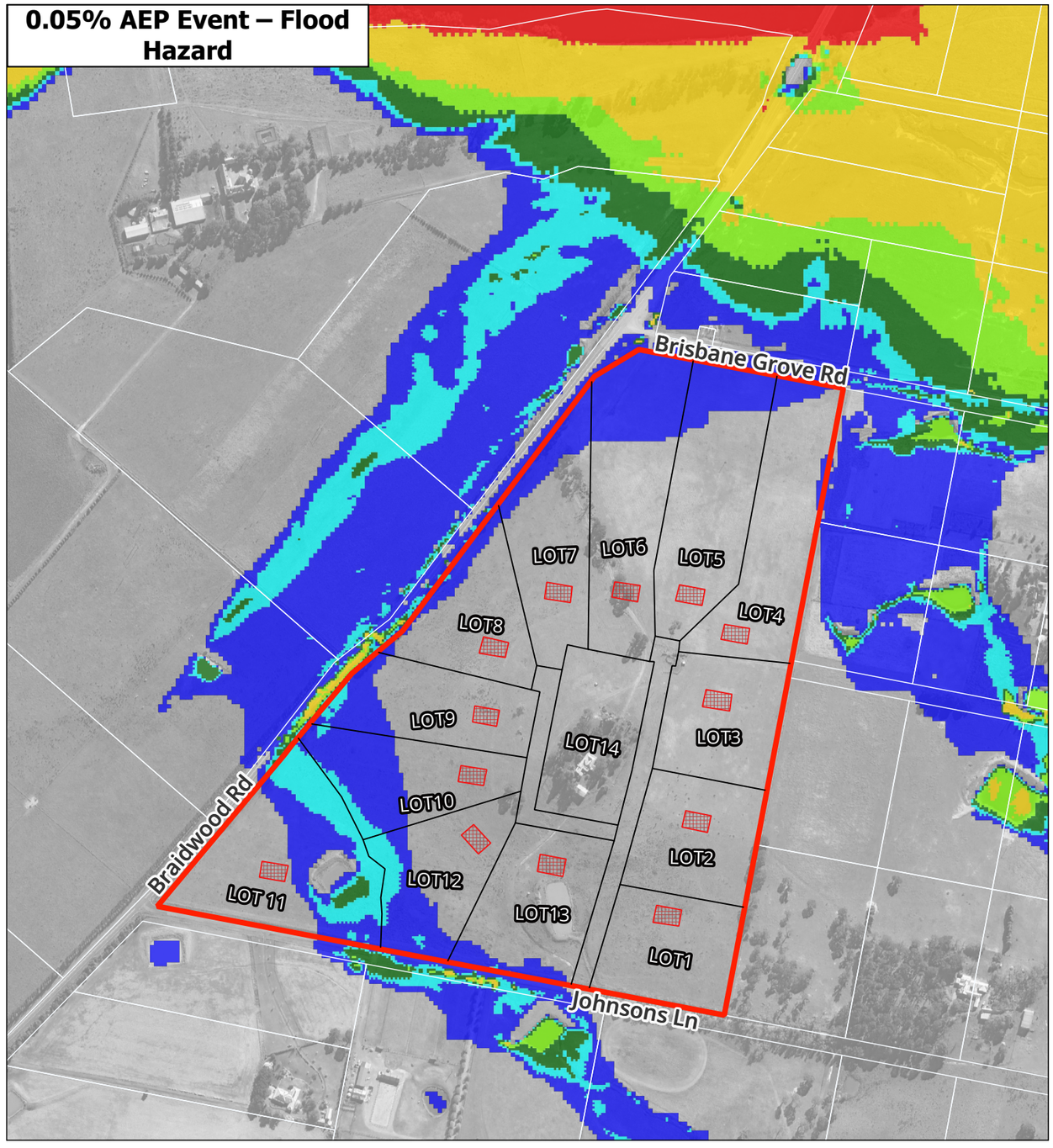
grc HYDRO

TITLE: **Existing Conditions – 0.2% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B5**

0.05% AEP Event – Flood Depth/Levels



0.05% 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

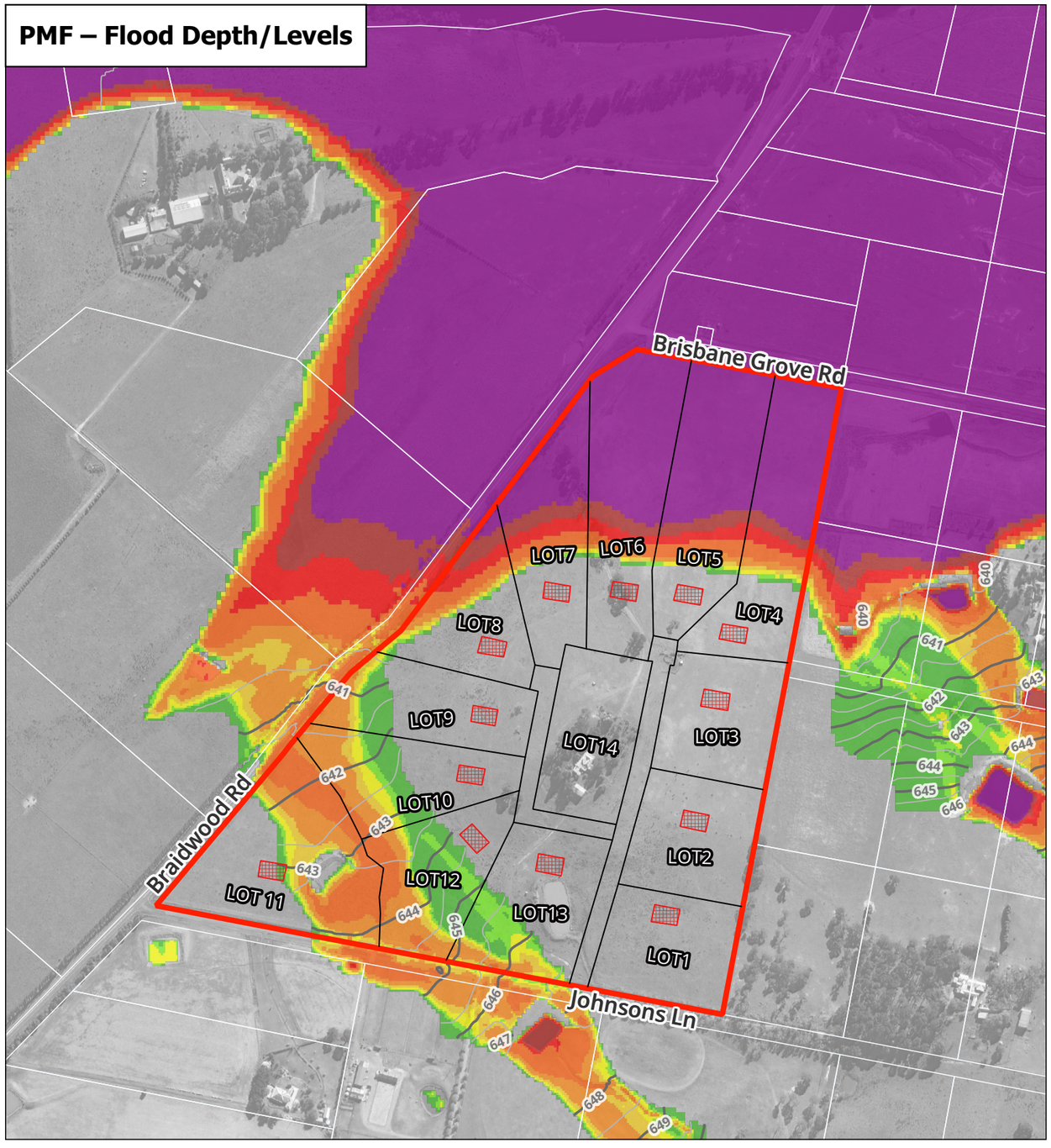
N
W
E
S

0 300 600

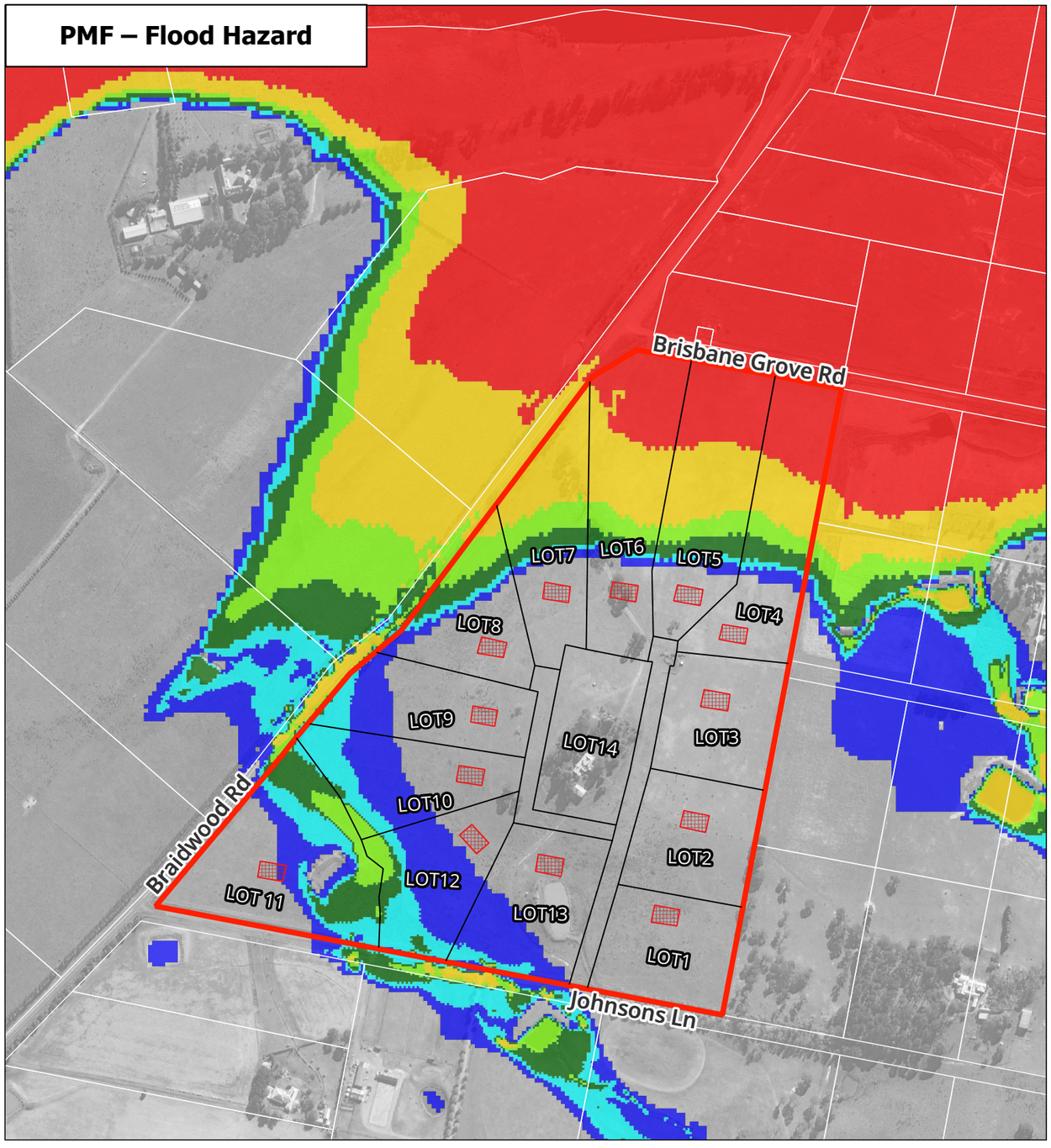
grc HYDRO

TITLE: **Existing Conditions – 0.05% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B6**

PMF – Flood Depth/Levels



PMF – 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

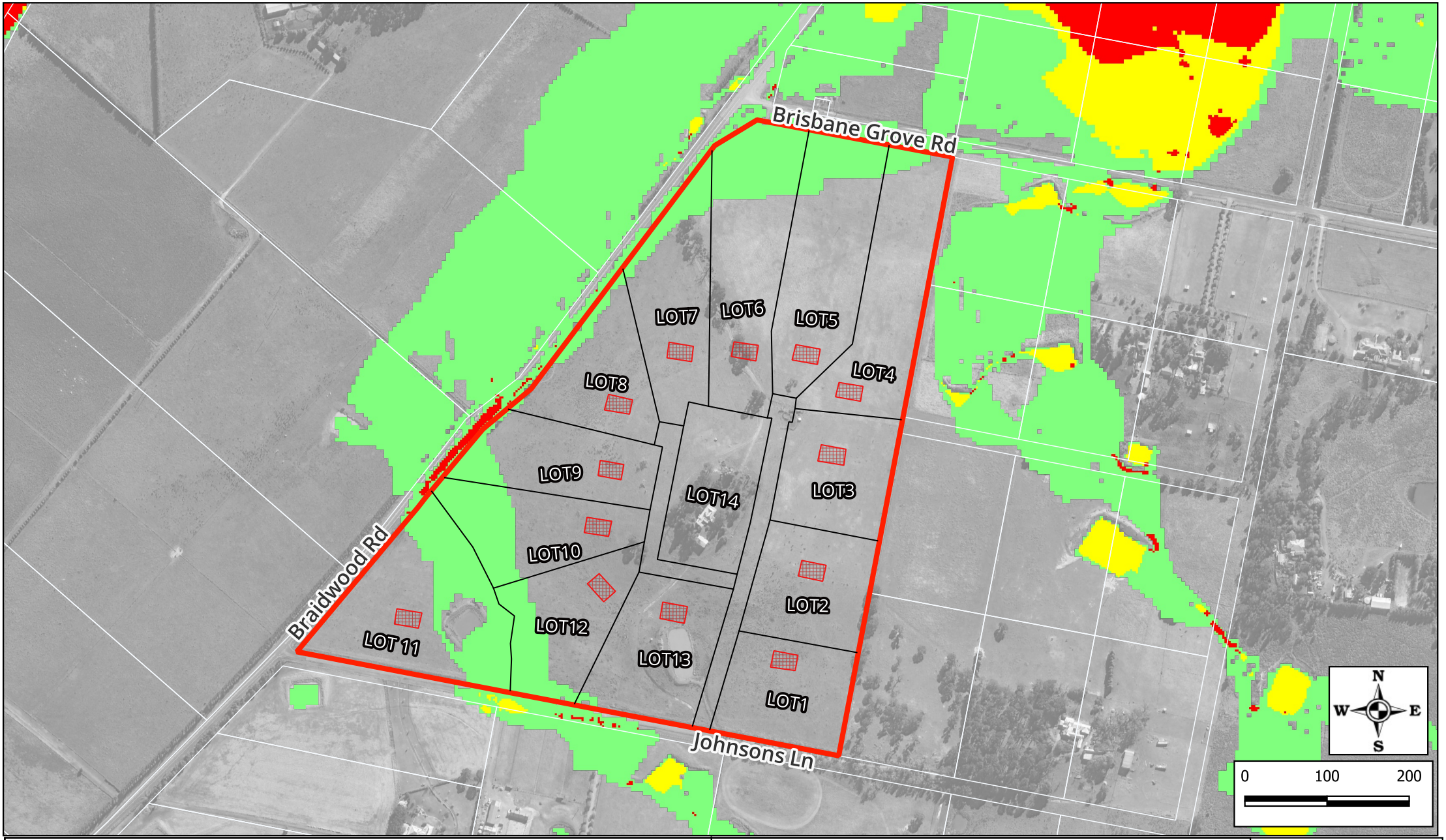
- H1
- H2
- H3
- H4
- H5
- H6

N W E S

0 300 600

grc HYDRO

TITLE: **Existing Conditions – PMF Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **B7**



Hydraulic Category
- Flow Conveyance
- Flood Storage
- Flood Fringe

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

TITLE: **Existing Conditions - Flood Function**		
PROJECT: **2 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **B8**

grc HYDRO

Subject Site

Cadastral Boundaries

Concept Lot Layout

Concept Building Envelopes

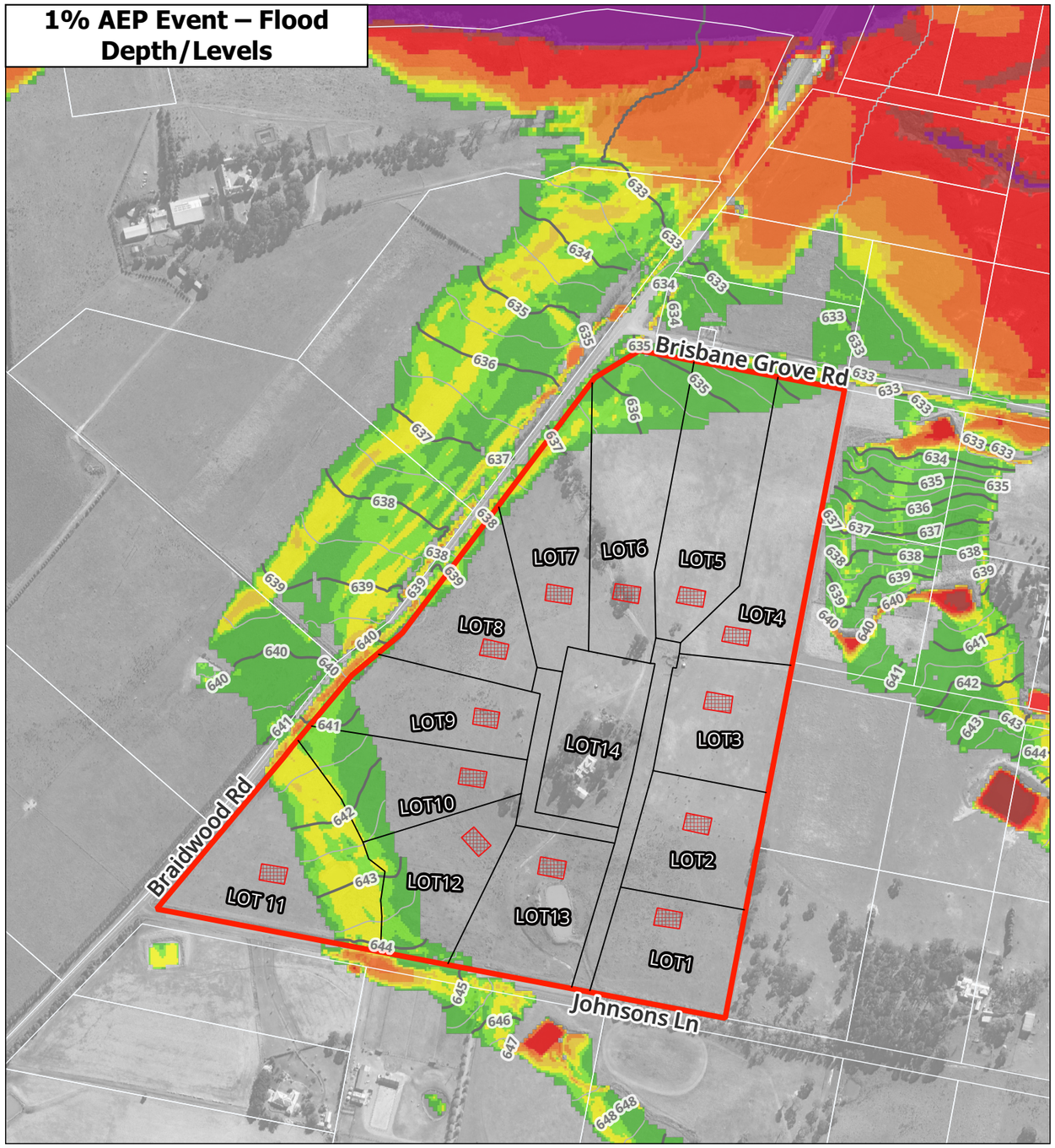
Flood Planning Area

TITLE: **Flood Planning Area Map**		
PROJECT: **2 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: 1:6,000	FIGURE No. **B9**

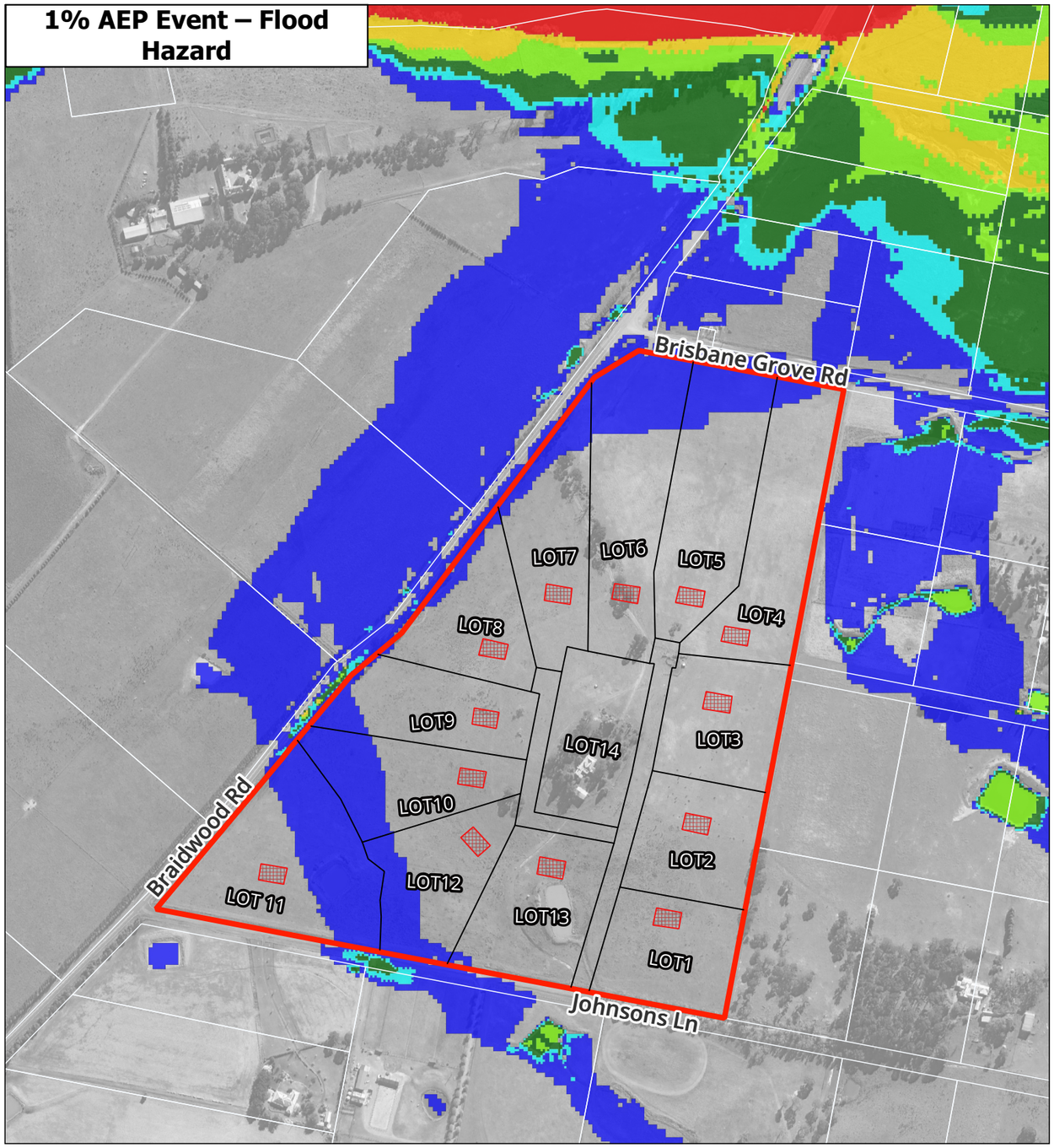
grc HYDRO

Appendix C

1% AEP Event – Flood Depth/Levels



1% 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

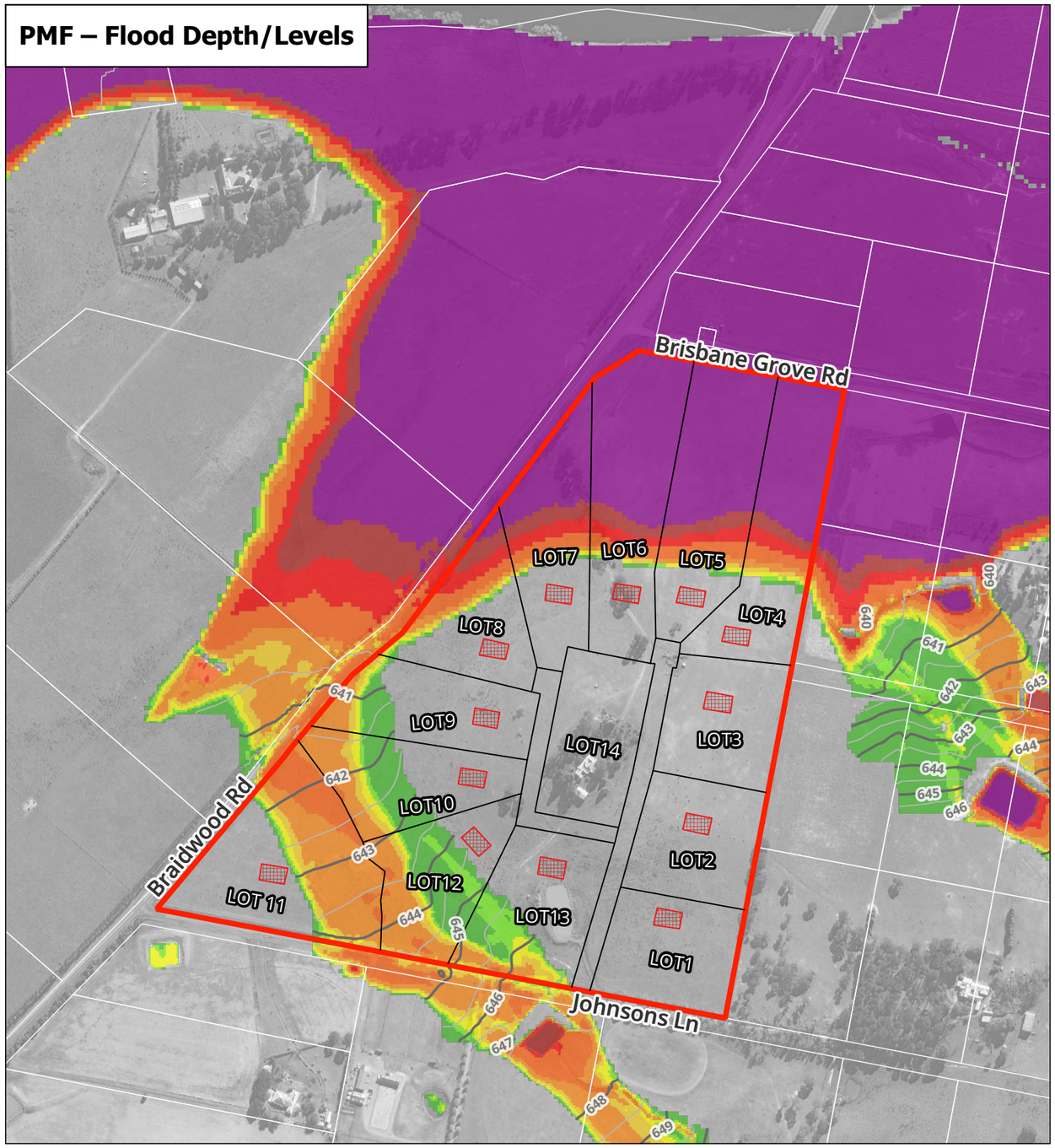
N W E S

0 300 600

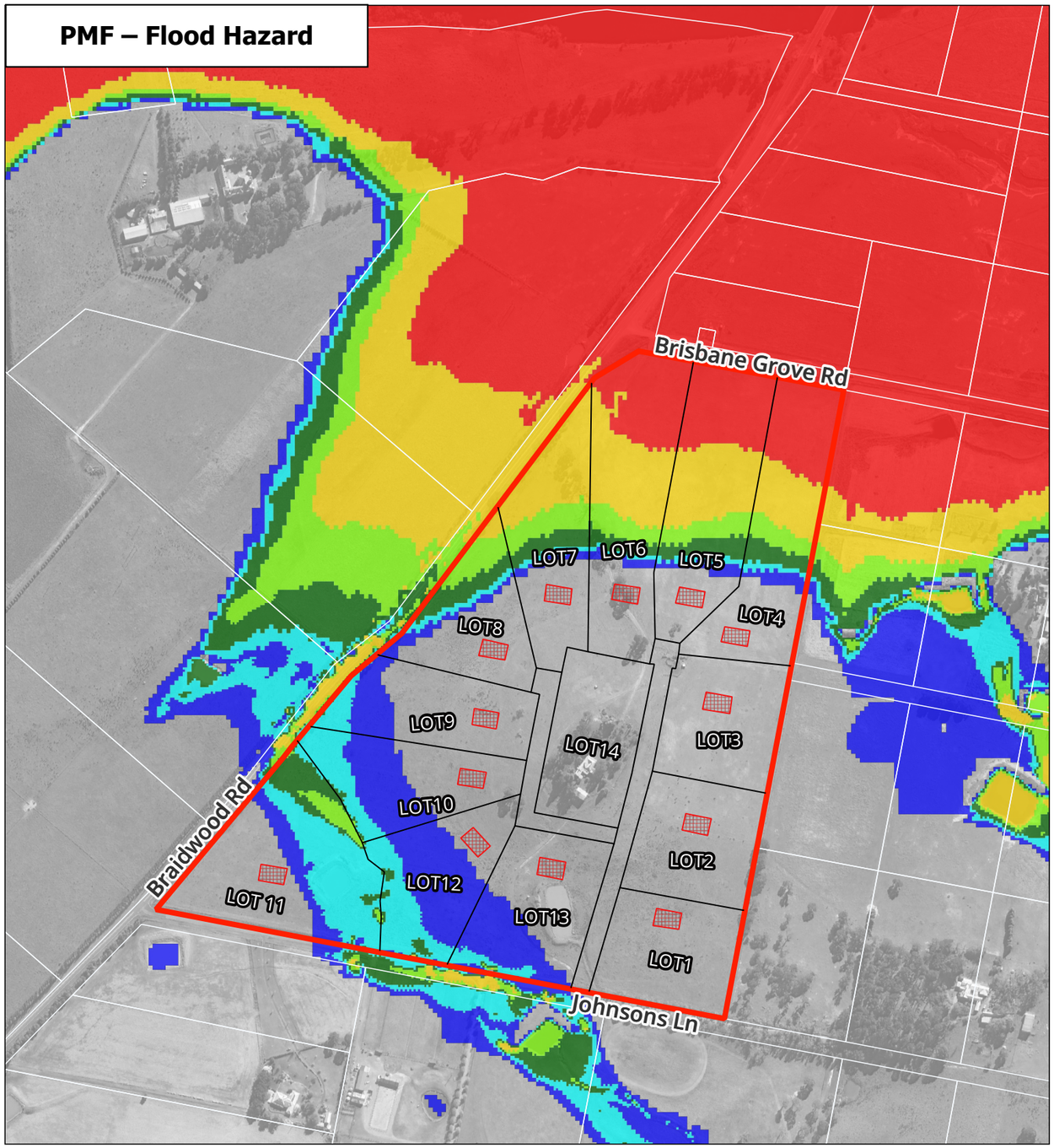
grc HYDRO

TITLE: **Developed Conditions - 1% AEP Event – Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **C1**

PMF – Flood Depth/Levels



PMF – 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

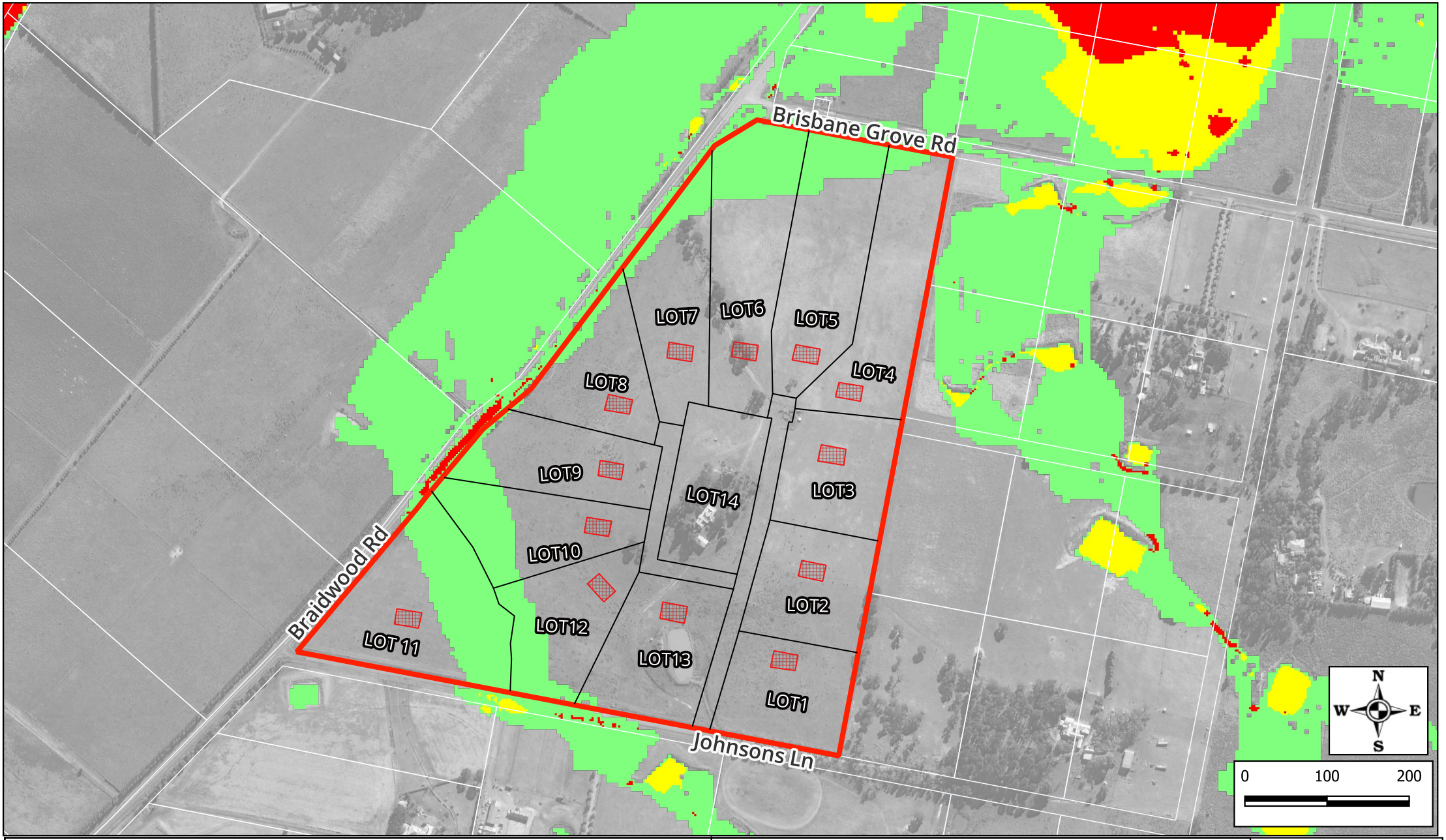
- H1
- H2
- H3
- H4
- H5
- H6

N W E S

0 300 600

grc HYDRO

TITLE: **Developed Conditions – PMF Flood Depth/Levels and Hazard**	PROJECT: **2 Brisbane Grove Road, Goulburn**	PROJECT No. **230048**	DATE: **12-2023**	SCALE: **1:6000**	FIGURE No. **C2**



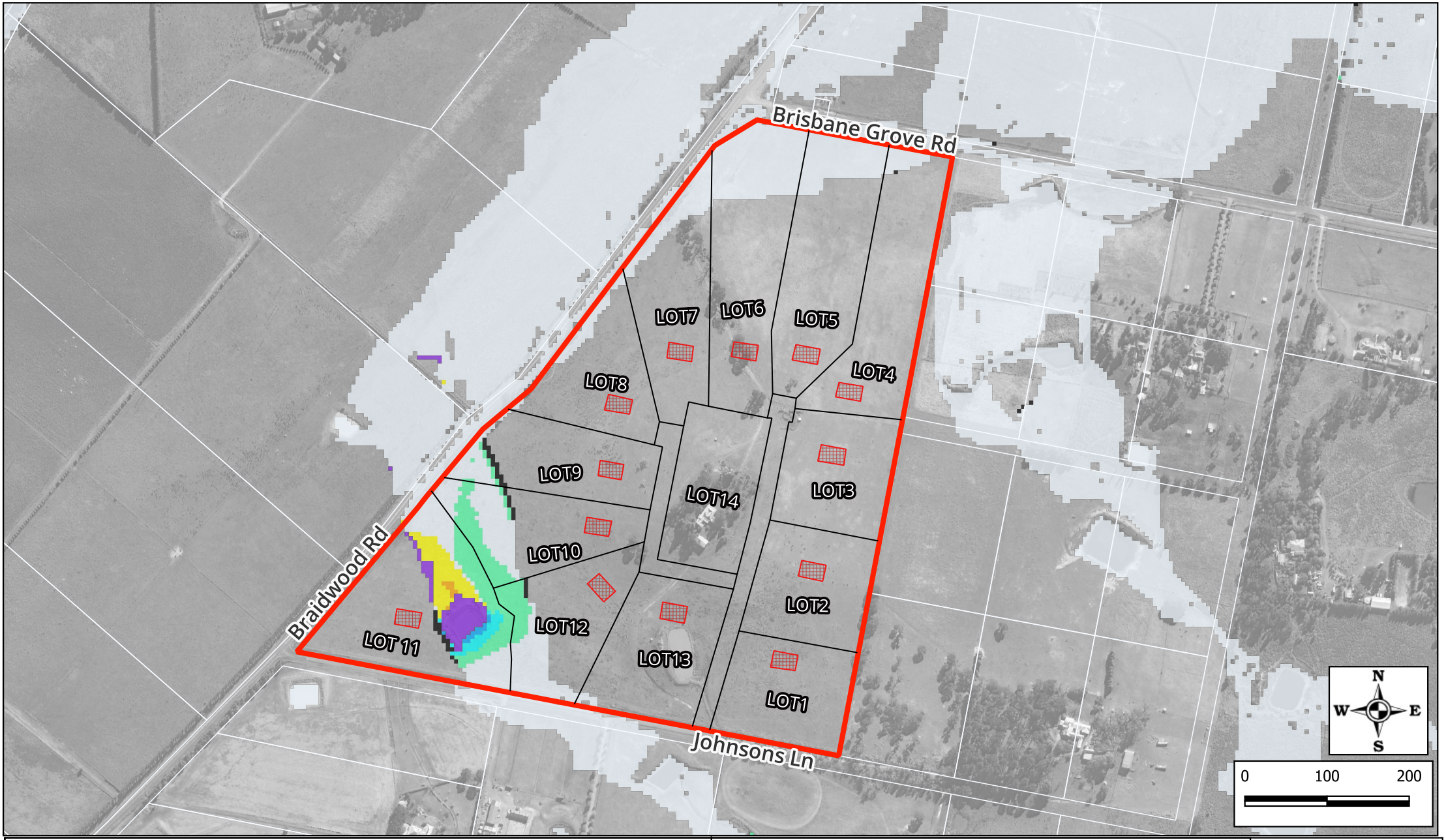
Hydraulic Category
- Flow Conveyance
- Flood Storage
- Flood Fringe

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

TITLE: **Developed Conditions - Flood Function**		
PROJECT: **2 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **C3**

grc HYDRO

Appendix D

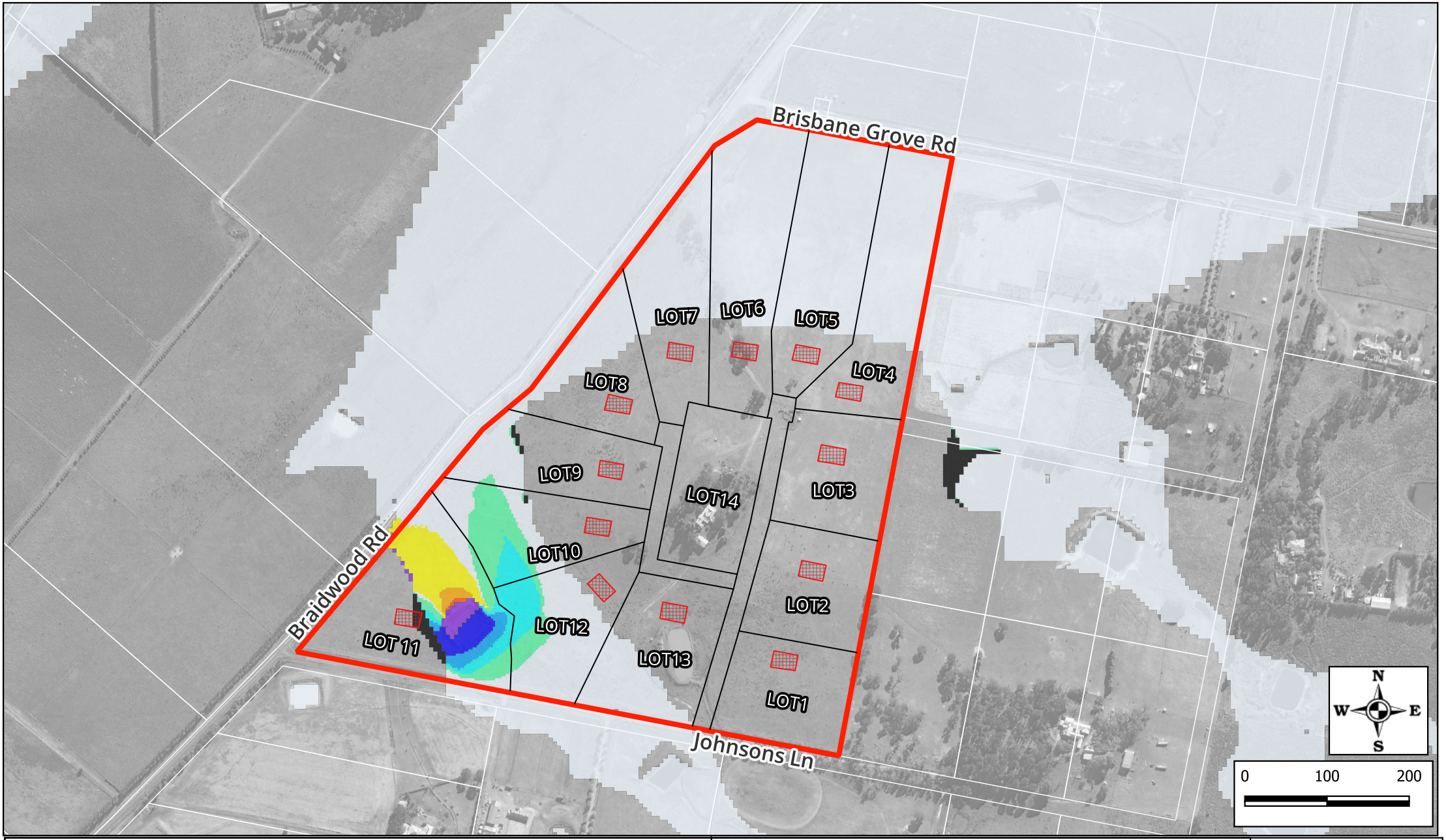


Impact (m)
- < -0.3
- -0.3 to -0.2
- -0.2 to -0.1
- -0.1 to -0.01
- No Impact
- 0.01 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- > 0.3
- No Longer Flooded
- Newly Flooded

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

TITLE: **1%AEP Flood Level Impact**		
PROJECT: **2 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **D1**

grc HYDRO



Impact (m)
- < -0.3
- -0.3 to -0.2
- -0.2 to -0.1
- -0.1 to -0.01
- No Impact
- 0.01 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- > 0.3
- No Longer Flooded
- Newly Flooded

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

TITLE: **PMF Flood Level Impact**		
PROJECT: **2 Brisbane Grove Rd, Goulburn**		
PROJECT No. **230048**		
DATE: **12-2023**	SCALE: **1:6,000**	FIGURE No. **D2**

grc HYDRO

Attachment A

Department of Planning and Environment

Your Ref: PP-2021-6932
Our ref: DOC23/117423

David Kiernan - Senior Strategic Planner
Goulburn Mulwaree Council
Locked Bag 22
GOULBURN NSW 2580

By email: David.kiernan@goulburn.nsw.gov.au

Dear Mr Kiernan

Subject: PP-2021-6932 to amend Goulburn Mulwaree Local Environmental Plan 2009

The Department of Planning and Environment (DPE), Biodiversity and Conservation Division (BCD) has reviewed the documents provided with this application.

We advise that as the planning proposal involves the rezoning of flood prone land, it needs to be considered in accordance with *Local Planning Direction 4.1 Flooding*, issued under section 9.1(2) of the *Environmental Planning and Assessment Act 1979*, and the NSW Government's Flood Prone Land Policy as set out in the *Floodplain Development Manual* (2005). The policy aims to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce private and public losses resulting from flooding utilising ecologically positive methods wherever possible.

As significant parts of the area covered by this planning proposal can be impacted by flooding and many sites have the potential to be full inundated, it will pose a significant flood risk to future occupants. It is not clear if flood access or evacuation is possible, there is no evidence of consultation with the NSW State Emergency Service (SES) and the planning proposal has not addressed the requirements of the section 9.1(2) Local Planning Direction 4.1 and the *Floodplain Development Manual*.

As such, BCD **objects** to the planning proposal as presented. Attachment A sets out detailed comments on the planning proposal including guidance to enable the planning proposal to be progressed in a manner consistent with the requirements of the section 9.1(2) *Local Planning Direction 4.1* through the preparation of a Flood Impact and Risk Assessment.

With regards to biodiversity, the two hollow bearing remnant snow gum (*Eucalyptus pauciflora*) trees on site should be retained and not impacted by future development. This is to meet the objectives of the *Biodiversity Conservation Act 2014* (the BC Act) which are to avoid impacts to biodiversity in the first instance.

If you have any further questions about this issue, please contact Mr John Bucinskas, Senior Team Leader, Water, Floodplains and Coast, South East, Biodiversity and Conservation Division on 02 4224 4153 or by email john.bucinskas@environment.nsw.gov.au.

Yours sincerely

16/02/2023

MICHAEL SAXON
Director South East
Biodiversity and Conservation Division

ATTACHMENT A – Detailed comments on planning proposal - 3 Brisbane Grove Rd, Goulburn

The DPE-BCD, Water, Floodplains and Coastal (WFC) team has reviewed the documentation associated with this Planning Proposal and offers the following advice for consideration by Council in progressing the matter.

Floodplain Risk Management Comments:

The planning proposal involves the rezoning of flood prone land and therefore needs to be considered in accordance with Section 9.1(2) Direction 4.1 and the NSW Government's Flood Prone Land Policy as set out in the *Floodplain Development Manual*, 2005 (FDM). The policy aims to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce private and public losses resulting from flooding utilising ecologically positive methods wherever possible.

We have reviewed the Planning Proposal dated November 2022 (Post Gateway Version) and Water Cycle Management Study dated 19 October 2021 (supplied as Appendix 7a of the proposal) and have identified issues relating to the adequacy of flood investigations and consistency with Section 9.1(2) Direction 4.1 and the principles of the FDM. We note that there is no Flood Impact and Risk Assessment (FIRA) accompanying the proposal and the following key flood risk issues have not been assessed:

- the impact of flooding on the proposed development across a full range of flood events up to the Probable Maximum Flood (PMF)
- the impact of the proposed development on flood behaviour (particularly downstream flood impacts as a result of potential encroachment into the floodplain, land use and land form changes)
- the impact of flooding on the safety of people for the full range of floods including issues linked with evacuation
- the implications of climate change on flooding.

The Water Cycle Management Study does not demonstrate consistency with the local planning direction. While the proposal seeks to apply a C2 Environmental Conservation Zone to the southern drainage corridor to maintain the biodiversity in the area, the Water Cycle Management Study has not addressed the requirements of Section 9.1(2) Direction 4.1.

We note that the Water Cycle Management Study considered the 1 per cent Annual Exceedance Probability (AEP) local tributary design event. However, the assessment is not clear in demonstrating flooding from the larger Mulwaree River catchment or the interaction of flooding from both catchments. As such, the modelling is inadequate in assessing flood behaviour for the 1 per cent AEP design flood event, establishing a flood planning area and incomplete in assessing flood behaviour over the range of events up to the PMF.

It is also unclear if the flood modelling considered the range of factors that affect flood behaviour. The study should address the potential for flood impacts to be caused by the development in accordance with the requirements of Section 9.1(2) Direction 4.1. The study should also consider rehabilitation of the riparian corridor to ensure longer term ecologically sustainable outcomes for the waterway and their implication on flood extents as well as impacts of climate change. Council should also consult further with NSW Department of Natural Resources Access Regulator (NRAR) on the suitability of land-use zones for watercourses and establish suitable development setback requirements from watercourses and riparian lands in addition to flood hazard considerations.

The Water Cycle Management Study has elected to use Australian Rainfall and Runoff: A Guide to Flood Estimation (2019) methodologies to model the local catchment. The assessment lacks rigorous investigation into the suitability of this methodology and into the consequent implications

on flood risk. Council should ensure that any Flood Impact and Risk Assessments supporting a planning proposal are appropriately compared with best available information including Council's adopted flood studies and plans prepared under the Floodplain Management Program.

Based on Council's adopted FRSMP, Council is aware that parts of the proposal area and access roads (Braidwood Road, Brisbane Grove and Johnsons Lane) are inundated in the PMF. This has implications to the safety of future occupants of that land including any emergency management requirements and the need to evacuate. The planning proposal provides no evidence or information regarding evacuation of the floodplain or consultation with the NSW State Emergency Service (SES) and as such, public safety implications of the planning proposal is not clear and requires further assessment.

To address the flood related issues, we suggest that this planning proposal be supported by a FIRA that demonstrates consistency of the planning proposal with the requirements of the section 9.1(2) Local Planning Direction 4.1 Flooding and the Floodplain Development Manual. Further guidance material for preparing a FIRA can be found at https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/flood-risk-management-impact-risk-assessment-220057.pdf.

Further to our recent advice to other planning proposals referred on large areas of nearby lands, the cumulative impact of floodplain development involving significantly increased residential use of the floodplain requires strategic consideration by council and the NSW State Emergency Service (SES). Flood emergency access and evacuation planning is not clear and numerous lots with residential elements will be fully inundated. It is therefore considered prudent for Council to have in place an overall plan of future proposed growth areas to support its planning proposals and to address the impacts of flooding on the safety of future residents via an update of its Floodplain Risk Management Study and Plan (FRMS&P) and in accordance with advice from the SES on flood emergency management arrangements.

Summary:

As parts of the area covered by this planning proposal is impacted by flooding up to the PMF, there is a significant flood risk posed to future occupants of the flood prone land. It is not clear if evacuation is possible, there is no evidence of consultation with the SES and the planning proposal has not demonstrated consistency with the section 9.1(2) *Local Planning Direction 4.1 Flooding* and the Floodplain Development Manual. As such the Department has no choice but to object to the planning proposal as presented and trusts that this advice provides sufficient guidance upon which to enable a Flood Impact and Risk Assessment to support this planning proposal.

If further technical advice is required on floodplain risk management issues, council or the determining authority for this planning proposal should not hesitate to contact the South East WFC team, DPE-BCD.

Biodiversity Comments:

We have the following comments regarding the application for consideration.

- The development does not occur on land identified by the Biodiversity Values Map.
- The development proposes to impact on less than 0.1 hectares (ha) of native vegetation. This does not exceed the Biodiversity Offset Scheme Entry Threshold.
- The report provides sufficient evidence that there is no significant threatened species habitat on the site.
- As such, the development does not require a Biodiversity Development Assessment Report (BDAR).

Given the above and based on the information presented in the application, the conclusion presented that there is minimal risk of harm to threatened species and communities, appears

reasonable. We do however recommend that the two remnant Snow Gum (*Eucalyptus pauciflora*) trees be retained and protected. As hollow bearing trees in an otherwise cleared landscape, they have significant habitat value for local threatened species.

Water Floodplains and Coast (WFC)
Floodplain Risk Management
Brisbane Grove Subdivision Planning Proposal Update
Date: 18 April 2023

We have reviewed the updated planning proposal report (Planning Proposal to rezone and amend Minimum Lot Size on Lots along Brisbane Grove Road, Goulburn (March 2023)) in relation to the planning proposal on 137 Brisbane Grove and we offer the following advice for consideration by council.

Floodplain Risk Management Comments:

We acknowledge the additional flood information provided in this updated report and that Council has provided sub-sections in the report on how each Local Planning Direction for 4.1 Flooding has been addressed in this proposal. We also acknowledge the evacuation assessment including evacuation route maps that were provided for the 5% AEP, 1% AEP and PMF events. The information provided in this report utilises the information presented in the 2022 *Goulburn Floodplain Risk Management Study and Plan (FRMS&P)*. The report however lacks a thorough flood risk assessment of the safety of occupants and emergency management across the full range of flood events, specifically in the rarer events (i.e. larger than the 1% AEP).

Safe occupation and emergency management

The planning proposal should address the safe occupation of the development for the full range of floods. We note that Lots 2, 3 and 4 DP62157, which are proposed to be rezoned as R5 are completely inundated in the PMF. The primary strategy for emergency management requires residents to be able to evacuate to an area above the PMF that has adequate facilities. However, the proposal states that a safe, flood free evacuation route to Goulburn Urban Area cannot be provided as the roads are severely inundated during the PMF.

As an alternative to site evacuation, the proposal examines a shelter in place strategy for the PMF affected lots but was deemed unsuitable due to the significant depth of inundation. The report states a PMF flood depth range up to 0.8 to 8.5 m deep across the site which varies from 6 m to 9 m above the 1% AEP flood. The planning proposal needs to demonstrate how emergency management services will provided including access to all proposed residential lots including those planned to be located above the PMF. Based on the short warning time, flood isolation presents a significant risk to life that could be managed through better subdivision design including any road and bridge design requirements and upgrades that are required for flood access.

Due to the large differences in flood levels, depths and consequently extents between the 1% AEP and PMF, Council would benefit from further assessment of flood evacuation that considers events the full range of floods up to the PMF including the 0.5% and 0.2% AEP. The assessment should examine the period of isolation across the range of flood events up to and including the PMF and assess areas within or closer to the proposal site that is outside the PMF as a potential refuge area. Consultation with the State Emergency Service is necessary in ensuring public safety criteria meet emergency response requirements for this planning proposal.

Further guidance for the flood evacuation risk assessment can be found in section A2.5.1 to section A2.5.3 of the in the Department of Planning and Environment Support for Emergency Management Planning - Flood Risk Management Guide EM01

(https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/flood-risk-management-emergency-management-planning-support-220055.pdf).

Flood boundary and planning constraints

Upon reviewing the Flood Planning Constraints Categories (FPCC) boundaries in the planning proposal, it appears that Lot 2 DP62157, Lot 3 DP62157 and Lot 4 DP62157 have been categorised as a FPCC4. However, based on the PMF hazard mapping shown on Figure 04 of the 2022 Goulburn FRMS&P, flooding across these lots is classified as H6 hazard and therefore *'unsafe for vehicles and people. All building types considered vulnerable to failure'*. Due to the nature of the hazard, it does not appear that the risks on these lots have been adequately considered.

The planning proposal as presented is therefore considered to be inconsistent with local planning direction 4.1(3)(c) and we recommend that Council revise the planning constraints category mapping and update its Flood Impact and Risk Assessment in the planning proposal to account for both riverine and overland flow flooding including consultation with the State Emergency Service.

Other floodplain matters

The updated planning proposal report has now been structured to contain sub-section that demonstrate details on how the proposal addresses each of the Local Planning Direction for 4.1 Flooding. We note however that the heading to address Direction 4.1(3)(d) to (g) have been incorrectly referenced in the report. We recommend that Council review the headings under section *3.6.7 Direction 4.1 Flooding* to reflect the correct local planning direction.

Additionally, we recommend that the use of probability in analysing the flood risk specifically during the PMF should include focus on the consequences as well and the probability of occurrence, particularly as the consequences relate to public safety risk and cannot be ignored.

Summary

As the proposal fails to provide effective evacuation up to the PMF and demonstrate the safe occupation on several fully inundated lots in the PMF, there is a significant flood risk posed to future occupants of the flood prone land. The large differences in flood levels and depths between the 1% AEP and PMF warrants Council to undertake a flood risk assessment for the planning proposal that considers the range of floods up to the PMF. This could include the 0.5% and 0.2% AEP to establish if the flood related public safety risk can be managed and any modifications necessary to the planning proposal to achieve this outcome. The flood risk assessment should explicitly establish consistency with the principles of the Floodplain Development Manual and requirements of the relevant flood related local planning direction. Given the high potential of risks to life in a flood emergency we consider that council should consult with the State Emergency Services and include their inputs into finalising the flood impact risk assessment for this planning proposal.

Department of Planning and Environment

Your Ref: PP-2021-7390
Our ref: DOC23/19578-7

David Kiernan
Senior Strategic Planner
Goulburn Mulwaree Council
Locked Bag 22
GOULBURN NSW 2580

By email: david.kiernan@goulburn.nsw.gov.au

Dear Mr Kiernan,

Subject: PP-2021-7930 to amend Goulburn Mulwaree Local Environmental Plan 2009

The Department of Planning and Environment (DPE) - Biodiversity and Conservation Division (BCD) has reviewed the documents provided with this application.

We advise that as the planning proposal involves the rezoning of flood prone land, it needs to be considered in accordance with Local Planning Direction 4.1 Flooding, issued under section 9.1(2) of the *Environmental Planning and Assessment Act 1979,* and the NSW Government's Flood Prone Land Policy as set out in the *Floodplain Development Manual* (2005). The policy aims to reduce the impact of flooding and flood liability on individual owners and occupiers, and to reduce private and public losses resulting from flooding utilising ecologically positive methods wherever possible.

As significant parts of the area covered by this planning proposal can be impacted by flooding and many sites have the potential to be full inundated, it will pose a significant flood risk posed to future occupants. It is not clear if flood access or evacuation is possible, there is no evidence of consultation with the NSW State Emergency Service (SES) and the planning proposal has not addressed the requirements of the section 9.1(2) Local Planning Direction 4.1 and the *Floodplain Development Manual*.

As such, BCD **objects** to the planning proposal as presented. Attachment A sets out detailed comments on the planning proposal including guidance to enable the planning proposal to be progressed in a manner consistent with the requirements of the section 9.1(2) Local Planning Direction 4.1 through the preparation of a Flood Impact and Risk Assessment.

If you have any further questions about this issue, please contact Mr John Bucinskas, Senior Team Leader Water, Floodplains and Coast, South East on 4224 4153 or at john.bucinskas@environment.nsw.gov.au.

Yours Sincerely

7/02/2023

Michael Saxon
Director South East, Biodiversity and Conservation Division
Environment and Heritage Group

ATTACHMENT A – Detailed comments on planning proposal - 137 Brisbane Grove Rd, Goulburn NSW

Floodplain Risk Management Comments

We have reviewed the Planning Proposal dated October 2022 and Water Cycle Management Study dated 23 November 2021 (supplied as Appendix 7a of the proposal) and have identified issues relating to the adequacy of flood investigations and consistency with Local Planning Direction 4.1 Flooding, issued under section 9.1(2) of the *Environmental Planning and Assessment Act 1979,* and the principles of the Floodplain Development Manual (2005). There is no Flood Impact and Risk Assessment (FIRA) accompanying the proposal, and the following key flood risk issues have not been assessed:

- The impact of flooding on the proposed development;
- The impact of the proposed development on flood behaviour (particularly downstream flood impacts as a result of potential encroachment into the floodplain, land use and land form changes);
- The impact of flooding on the safety of people for the full range of floods including issues linked with evacuation;
- The implications of climate change on flooding; and
- The implications of the full range of possible floods up to the Probable Maximum Flood (PMF).

The Water Cycle Management Study does not demonstrate consistency with the section 9.1(2) Local Planning Direction 4.1. While the proposal seeks to apply a C2 Environmental Conservation Zone to some drainage corridors and flood prone areas to maintain the biodiversity in the area, the Water Cycle Management Study has not addressed the requirements of the section 9.1(2) Local Planning Direction 4.1.

We note that the Water Cycle Management Study considered the 1% Annual Exceedance Probability (AEP) local tributary design event. However, the assessment is not clear in demonstrating flooding from the larger catchment and co-incident flooding from the tributary. As such, the modelling is inadequate in assessing flood behaviour for the 1% AEP design flood event, climate change, establishing a flood planning area and incomplete in assessing flood risk over the full range of events up to the Probable Maximum Flood (PMF).

It is also unclear if the flood modelling considered the range of factors that effects flood behaviour. The study should address the potential for flood impacts to be caused by the development, including likely landform modifications in accordance with the requirements of the section 9.1(2) Local Planning Direction 4.1. The study should also consider factors impacting flood behaviour (including levels and flows) such as rehabilitation of the riparian corridor to ensure longer term ecologically sustainable outcomes for the waterway as well as impacts of climate change. Council should also consult further with the NSW Department of Natural Resources Access Regulator (NRAR) on the suitability of land-use zones for watercourses and establish suitable development setback requirements from watercourses and riparian lands in addition to flood hazard considerations.

The Water Cycle Management Study has elected to use *Australian Rainfall and Runoff: A Guide to Flood Estimation* (2019) methodologies to model the local catchment. The assessment lacks adequate investigations into the suitability of this methodology and into the consequent implications on flood risk. Council should ensure that the FIRA supporting this planning proposal appropriately compares with best available information including Council's adopted flood studies and Floodplain Risk Management Studies and Plans (FRMS&P) prepared under the NSW Floodplain Management Program.

Council's adopted FRMS&P shows that a large section of this area would be fully inundated in the PMF. This has implications to the safety of future occupants of that land including and the need to assess emergency management risks and requirements such as evacuation. The planning proposal provides no evidence or information regarding emergency management or evacuation

planning of the floodplain or consultation with the NSW State Emergency Service (SES). As such the public safety implications of the planning proposal are not clear and require further assessment.

To address the flood related issues, this planning proposal needs to be supported by a FIRA that demonstrates consistency of the planning proposal with the requirements of the section 9.1(2) Local Planning Direction 4.1 and the *Floodplain Development Manual*. Further guidance material for preparing a FIRA can be found at https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/flood-risk-management-impact-risk-assessment-220057.pdf

As there appears to be quite a number of planning proposals being recently referred on large areas of nearby lands, the cumulative impact of floodplain development in this area, particularly flood emergency access, is not clear. It would be useful for strategic planning outcomes, for Council to provide an overall plan of future rezonings with its planning proposals and to update its FRMS&P to understand and strategically manage associated and cumulative flood risks, preferably prior to allowing further floodplain development.

Summary

As significant parts of the area covered by this planning proposal are impacted by flooding and many sites could be fully inundated in floods up to the PMF, there is a significant flood risk posed to future occupants. There is little evidence that the public safety risk from an emergency management perspective has been considered including flood access, evacuation or consultation with the SES. Overall, the planning proposal has therefore not demonstrated consistency with the section 9.1(2) Local Planning Direction 4.1 or the Floodplain Development Manual. As such BCD has no choice but to object to the planning proposal as presented. BCD trusts that this advice provides sufficient guidance upon which a FIRA can be prepared to support this planning proposal.

If further technical advice is required on floodplain risk management issues, Council or the determining authority for this planning proposal should not hesitate to contact BCD.

Biodiversity Comments

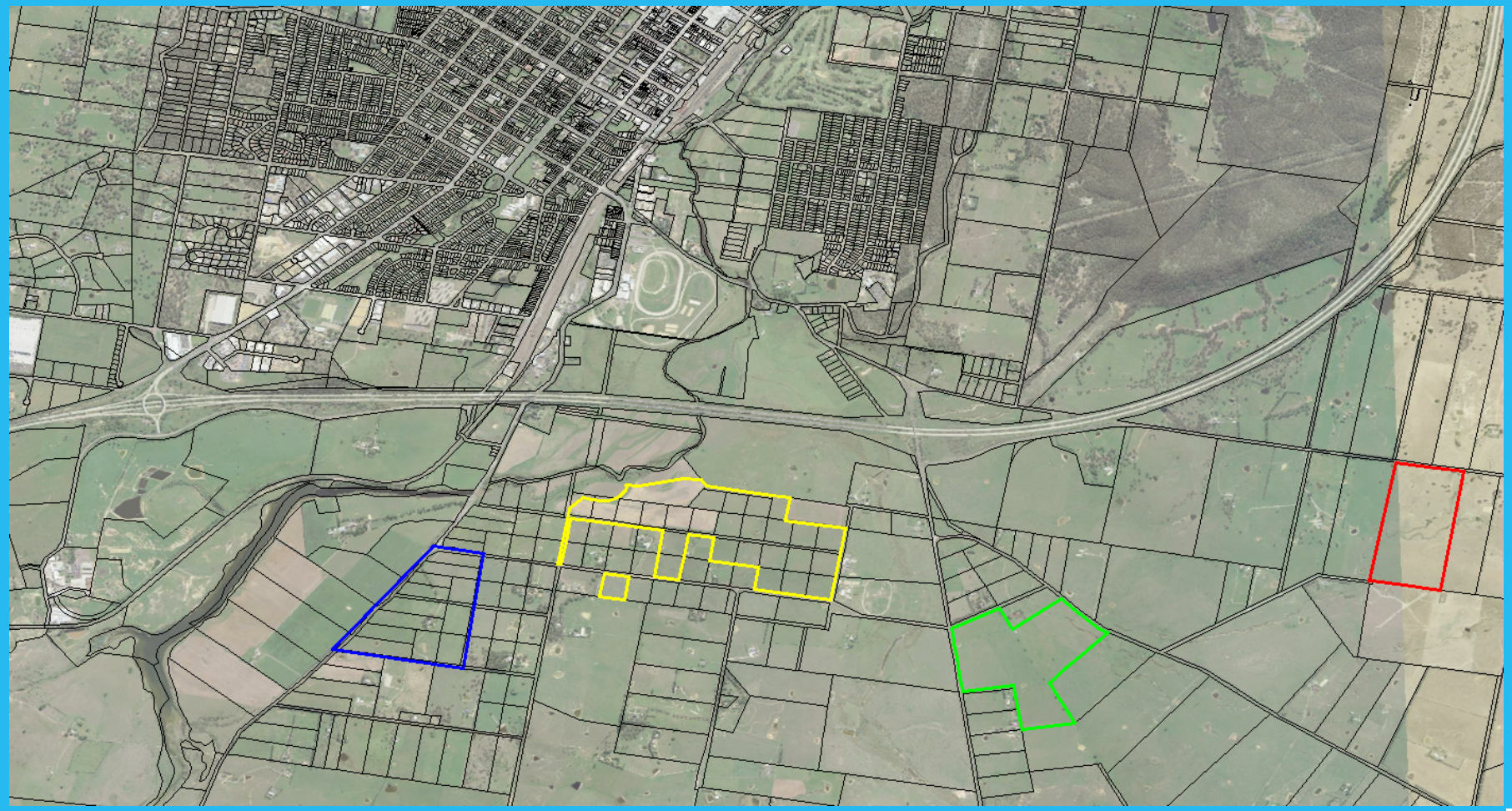
The report provides sufficient evidence that there is no significant threatened species habitat on the site.

Given that the development does not occur on land identified by the Biodiversity Values Map and it will impact on less than 0.1ha of native vegetation, the development does not require a Biodiversity Development Assessment Report (BDAR).

Based on the information presented in the application, the conclusion presented that there is minimal risk of harm to threatened species and communities, appears reasonable. There is sufficient detail provided to support the zoning requested.

Attachment B

Goulburn Planning Proposal for Rezoning



Support for Emergency Management Planning

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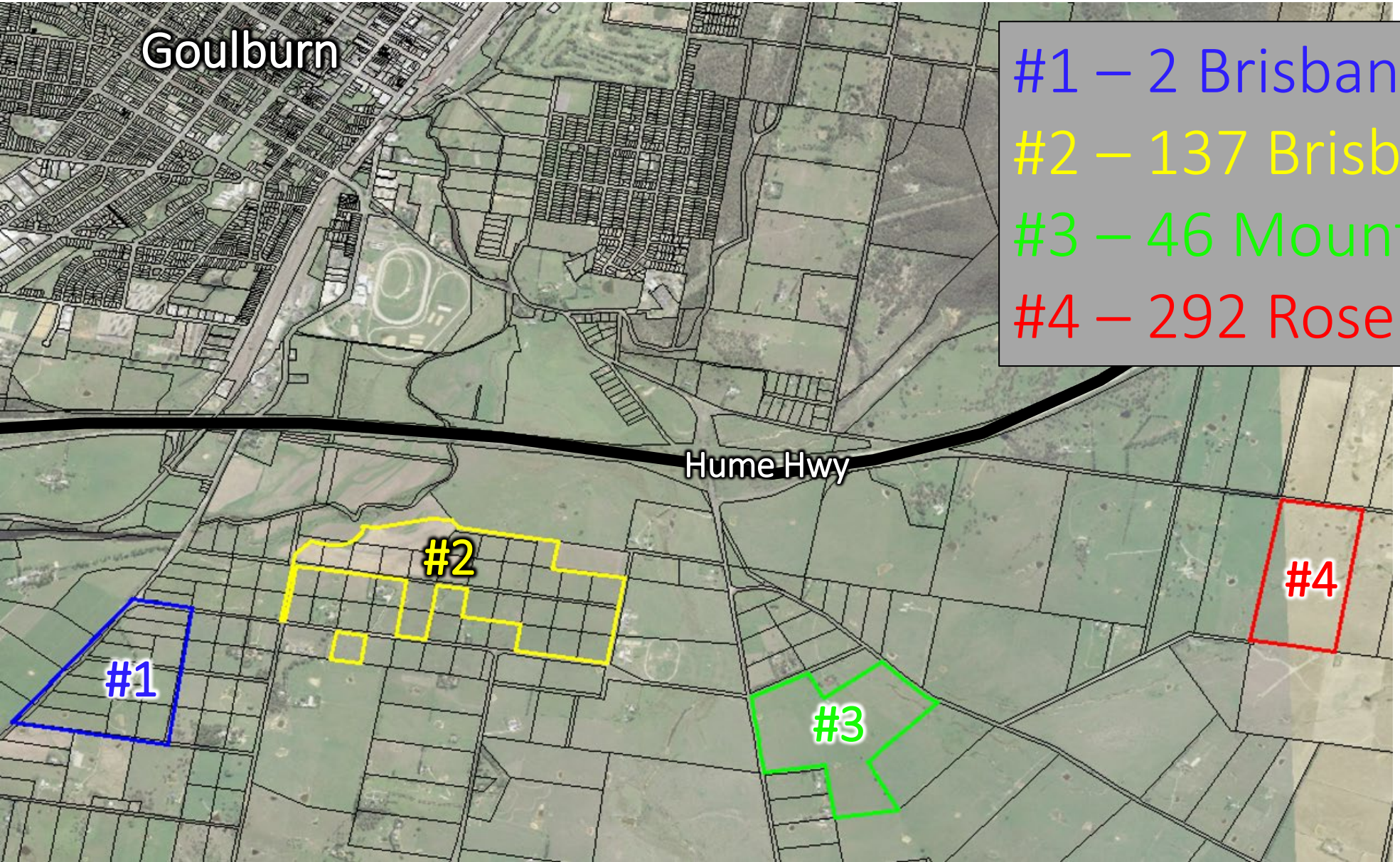
Talking Points

- *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

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Introduction

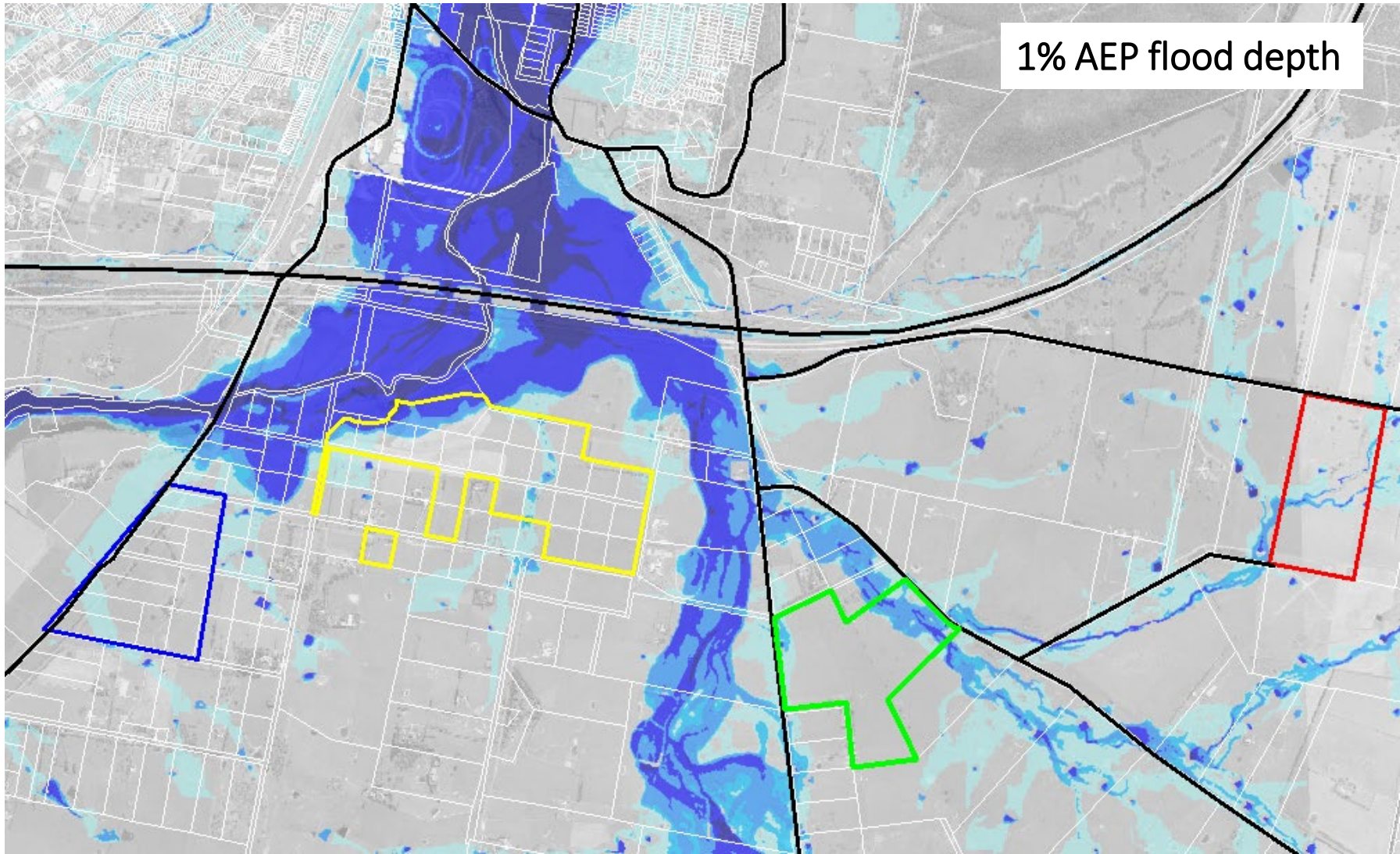
- *Current zoning is RU1 Primary Production – limited development potential*
- *Proposed rezoning to R5 Large Lot Residential – minimum lot size of ~2ha*
- *Rezoning would allow for an additional ~60 large lot residential dwellings*
- ***Areas of flood prone land are present within and surrounding the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

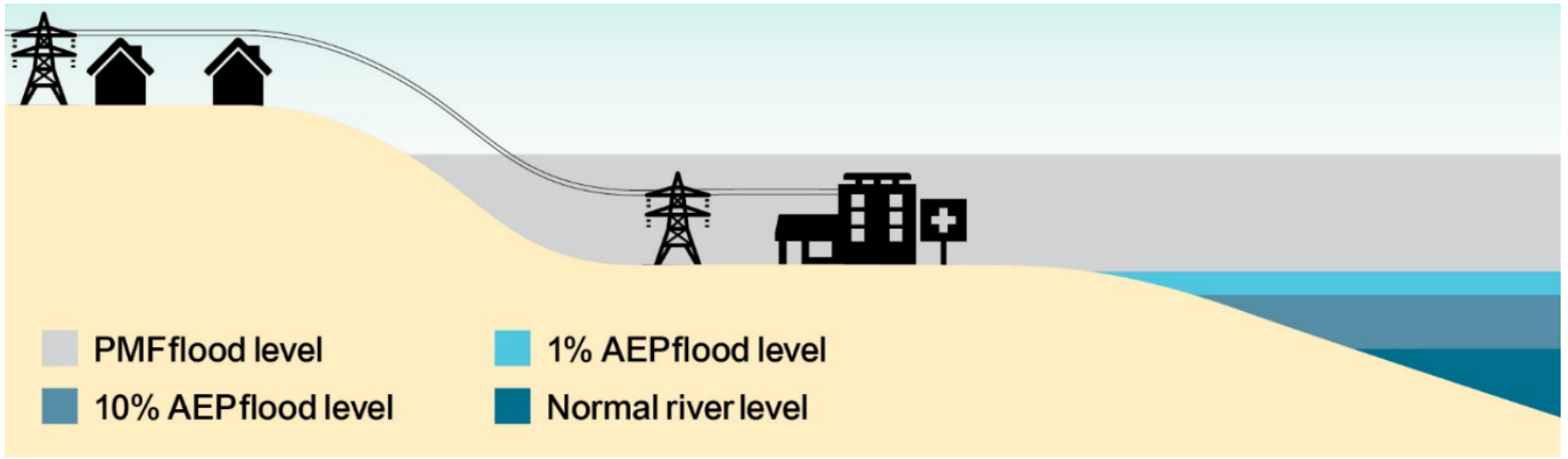


Flood Risk Assessment

- *Flood risk is correlated with road inundation:*
  - Frequency
  - Duration

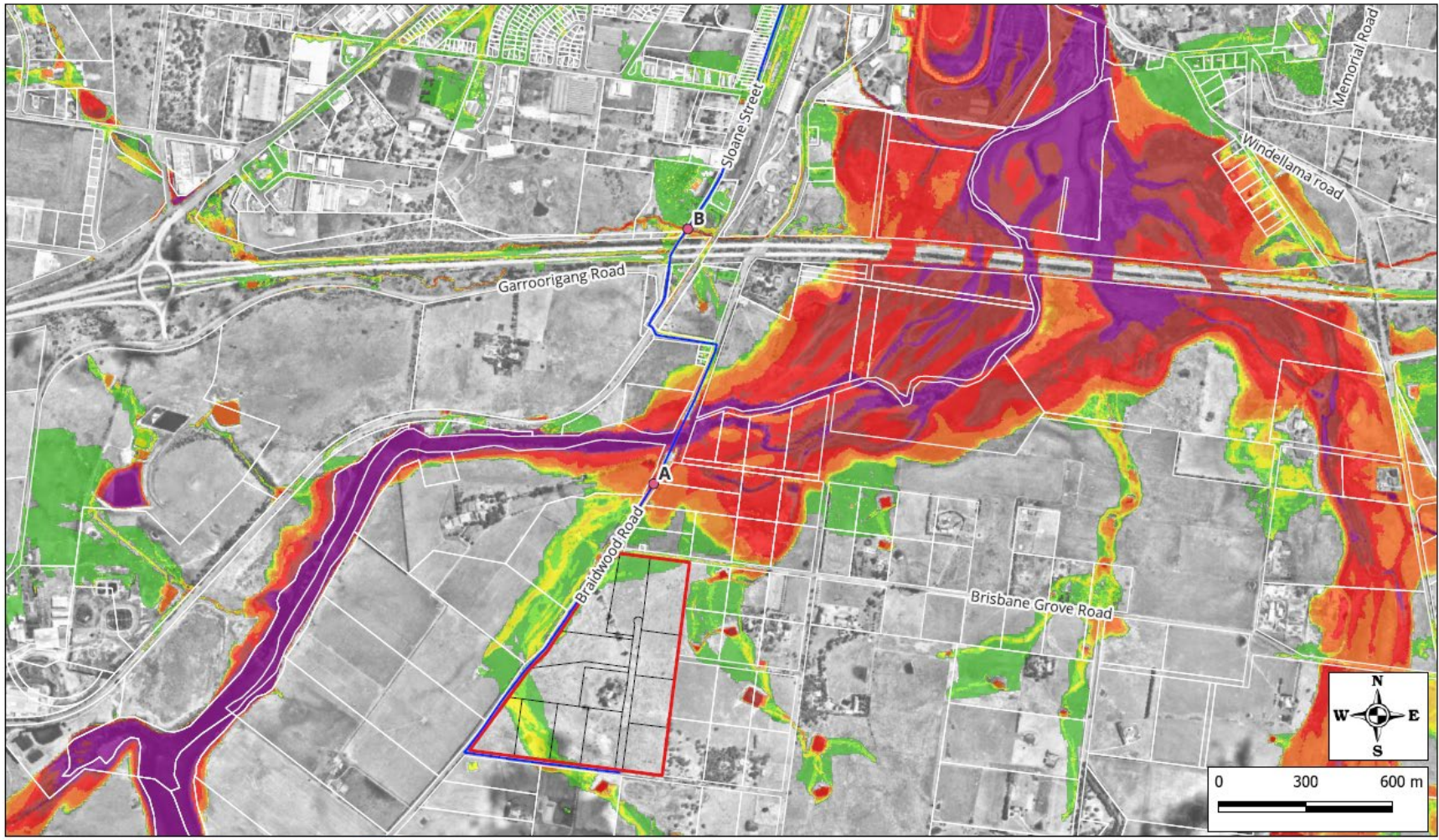
C2.3 Indirectly affected areas

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.



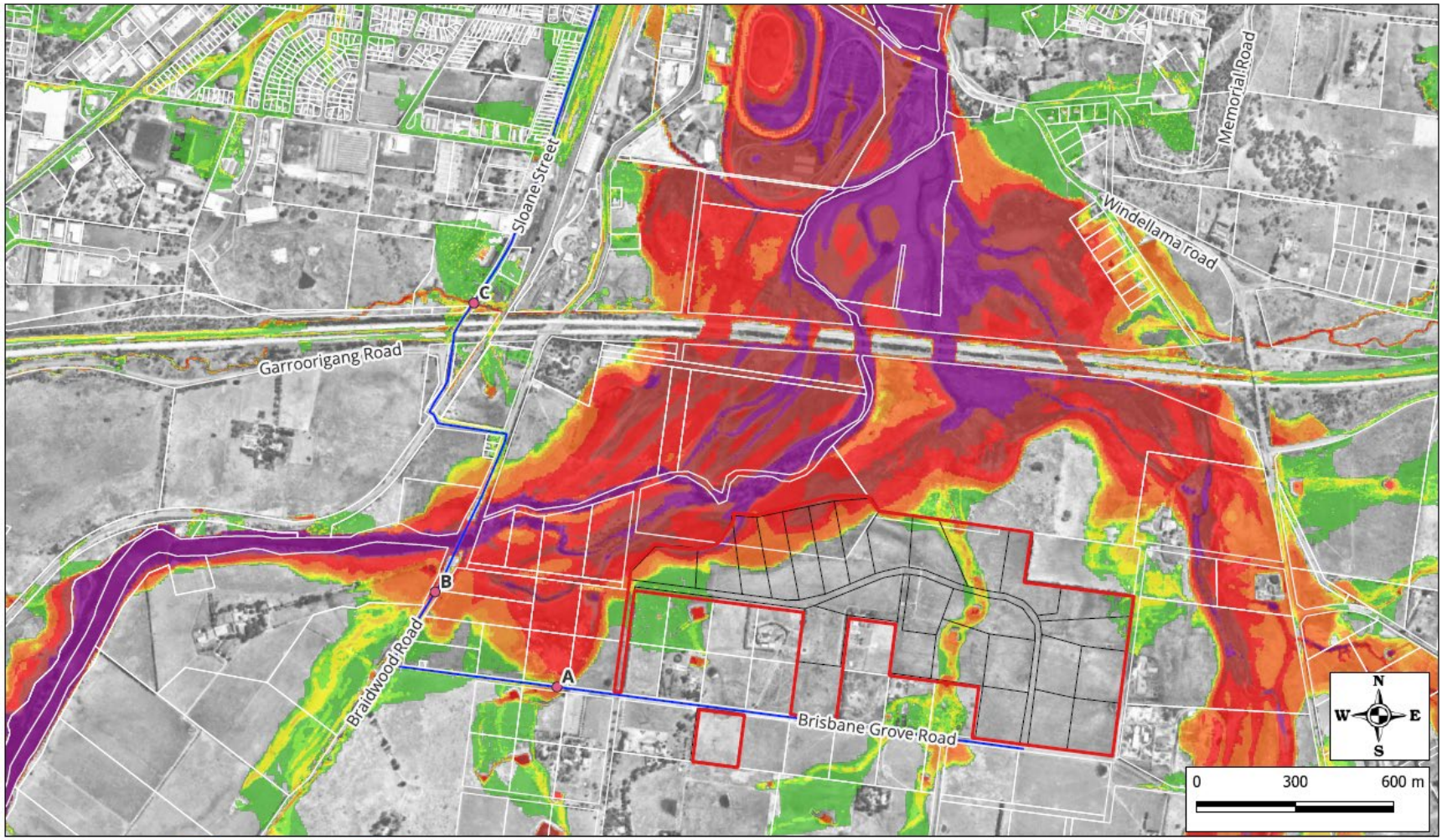
Flood Risk Assessment

- *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*



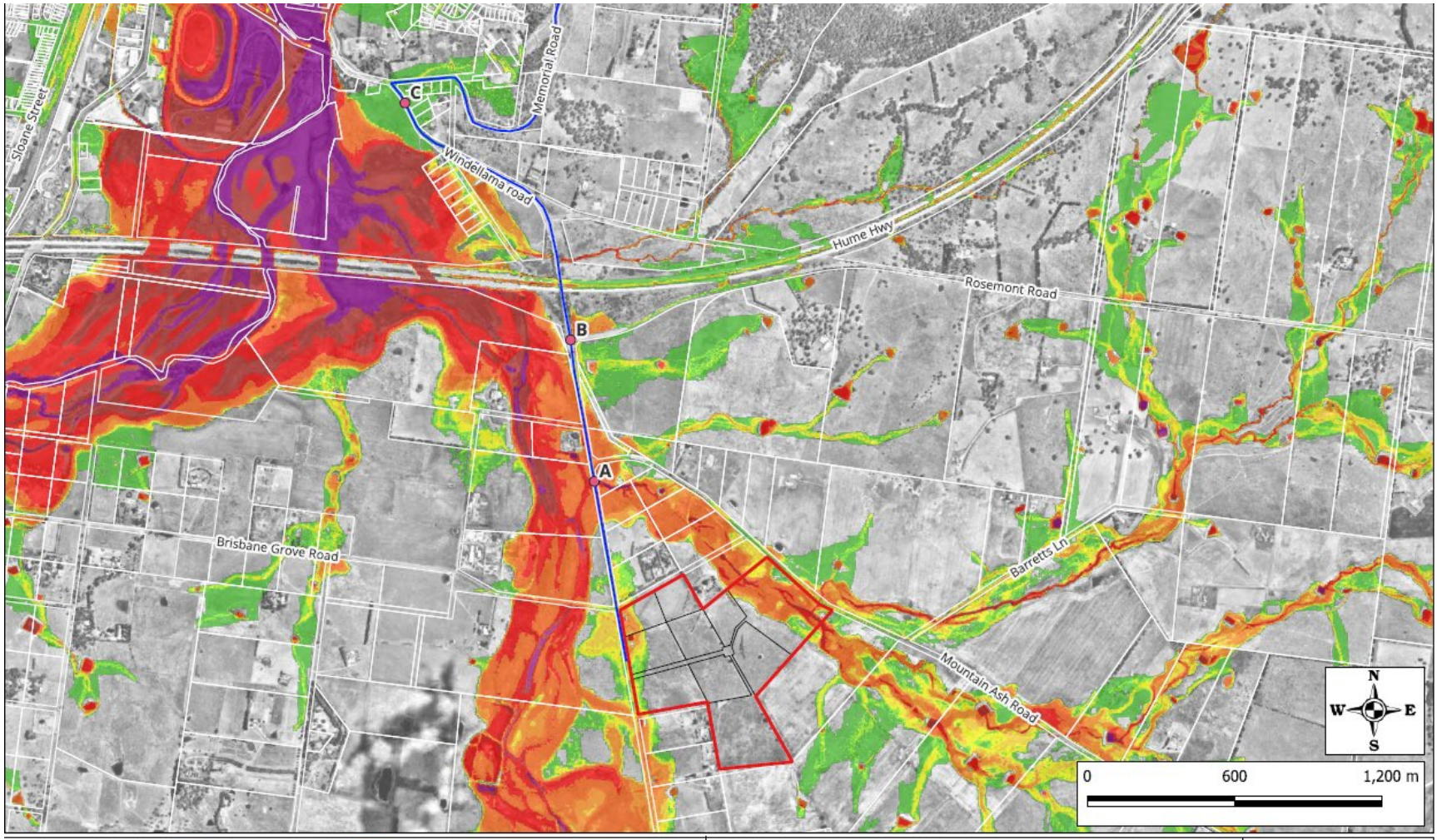
Flood Risk Assessment

- *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*



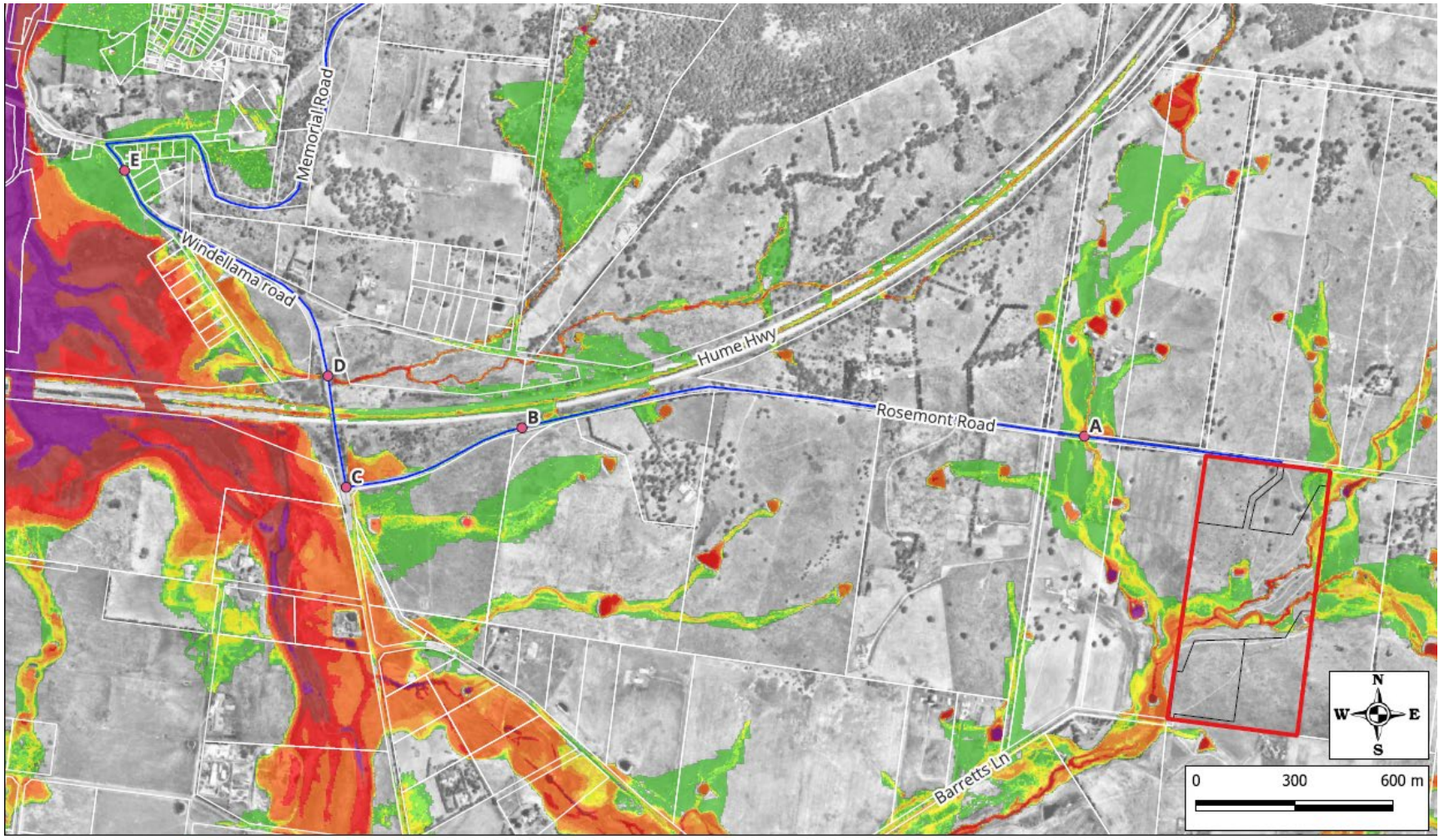
Flood Risk Assessment

- *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*



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*



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.

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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	- 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	- 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.	Potential Management measures: - 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	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.

Risk Management Considerations	Management Options
Addressing secondary risk for fire and medical emergencies during floods	Consult with Ambulance NSW and NSW RFS to assess the level of risk and to determine risk management measures if/where appropriate.
	Potential management of secondary risks during flooding: - 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 LEP clauses to provision for additional fire protection in homes where access is lost 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

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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	1. Introduction 2. Flood Risk Assessment 3. EM01 – Support for Emergency Management Planning 4. Conclusions and Discussion

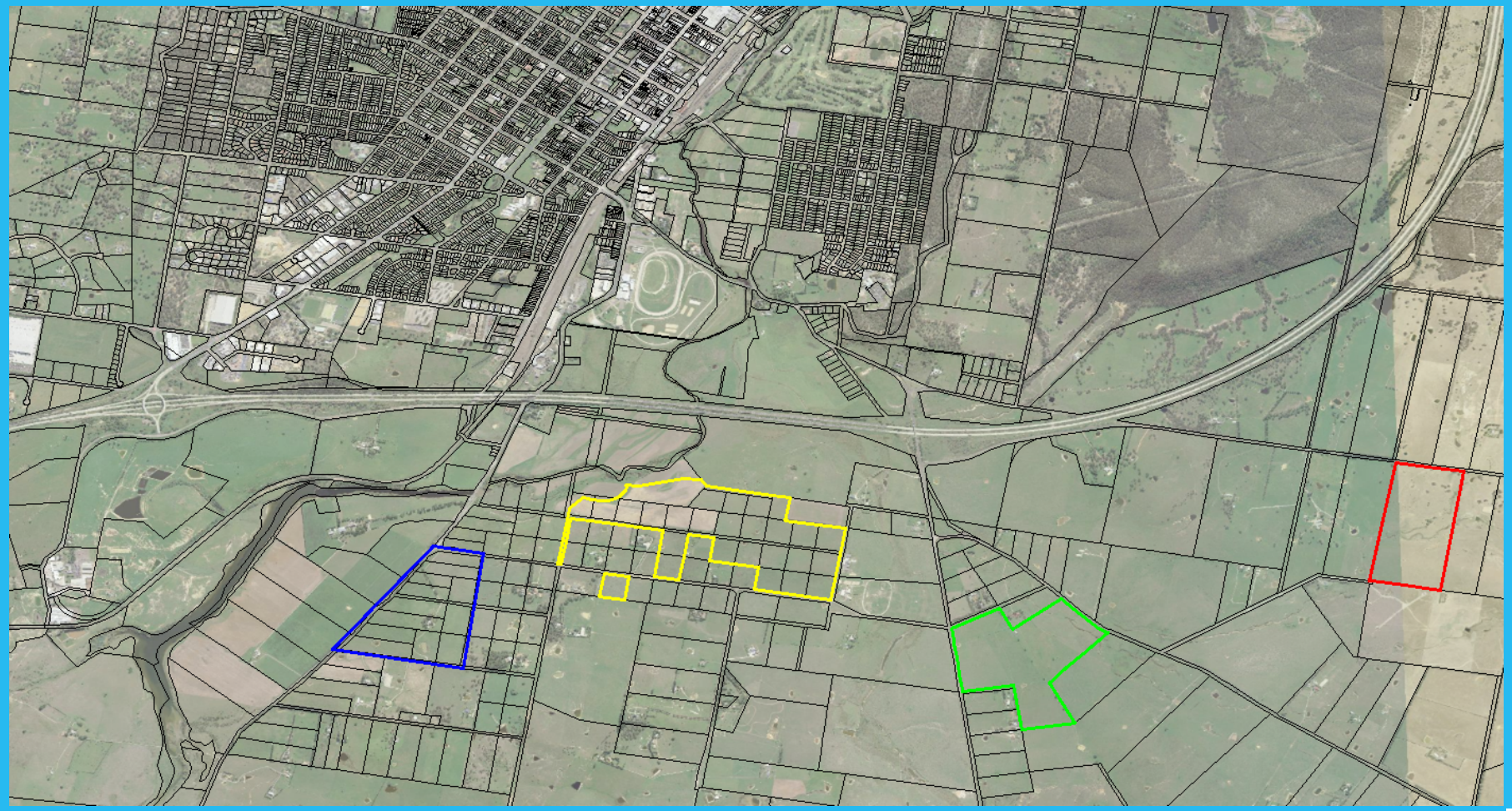
#	Item	Action (if any)
1	GRC Hydro: • GRC Hydro go through presentation (attached) - P230823_Goulburn_PP_Stakeholder_Consultation_GRCHydro.pdf	-
2	RFS attendees: • RFS request a copy of the presentation for review. GRC Hydro agree to provide.	GRC Hydro
3	RFS note: • Bush fires and flooding events are 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: • 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: • 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:
	• 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:
	  o Use a helicopter to access if weather permits;
	  o Request boat access with assistance from the NSW SES;
	  o Request access using NSW RFS trucks.
	• NSW Ambulance advise that significant improvements in cardiac patent outcomes is achieved if AED (Automated external defibrillators) are readily available.
		-
		NSW Ambulance

	Council: • Consider the potential for a requirement for future dwellings to own and maintain AEDs are a risk management measure. GRC Hydro / Council to discuss mechanism.	Council / GRC Hydro
	RFS note that: • RFS appliances are equipped with AEDs and first aid trained personnel.	
	NSW Ambulance suggest: • 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.	
	GRC Hydro request: • Suggestions from NSW Ambulance and RFS for additional potential risk management measures. • Feedback is requested in 2-3 weeks' time.	All

Attachment C

Goulburn Planning Proposal for Rezoning



Support for Emergency Management Planning

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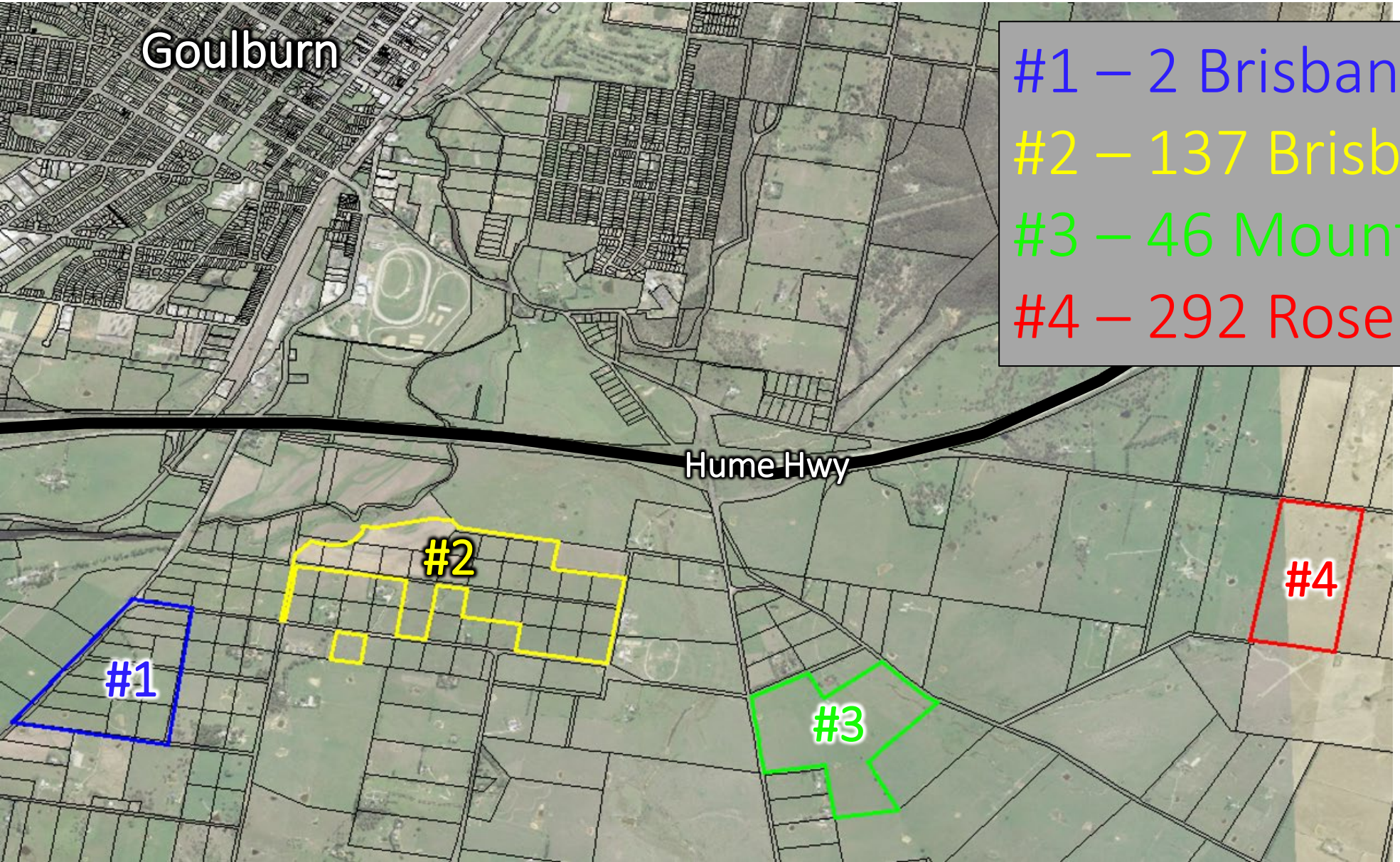
Talking Points

- *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

grc HYDRO

Introduction

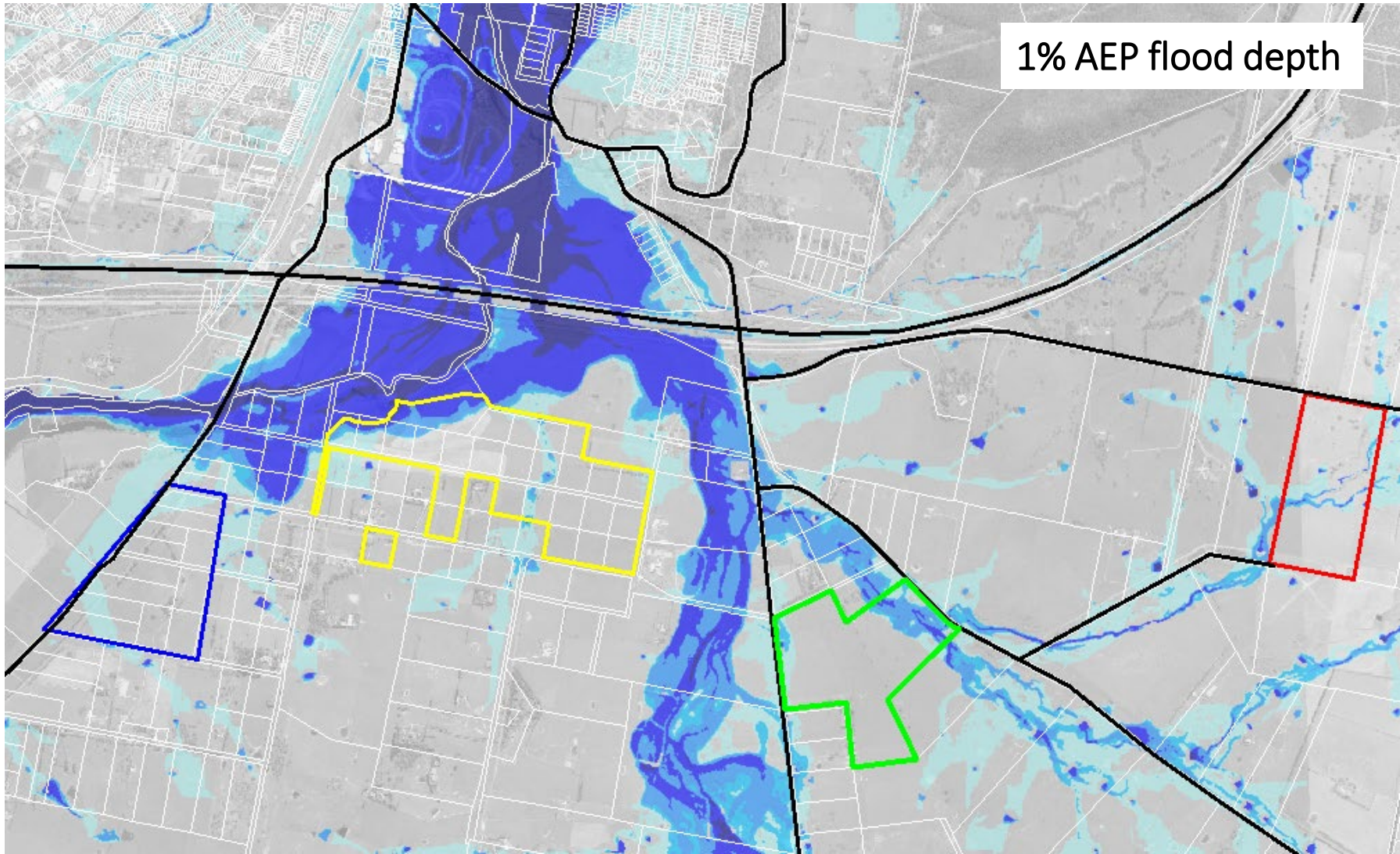
- *Current zoning is RU1 Primary Production – limited development potential*
- *Proposed rezoning to R5 Large Lot Residential – minimum lot size of ~2ha*
- *Rezoning would allow for an additional 39 large lot residential dwellings*
- ***Areas of flood prone land are present within and surrounding the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

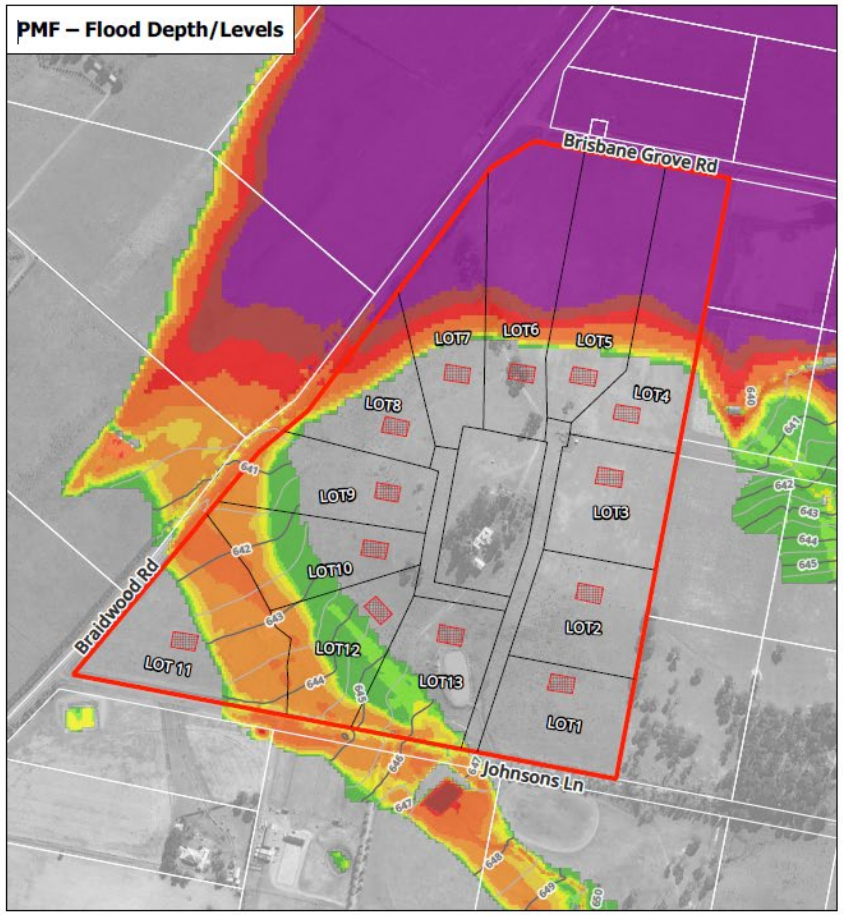
Flood Risk Assessment

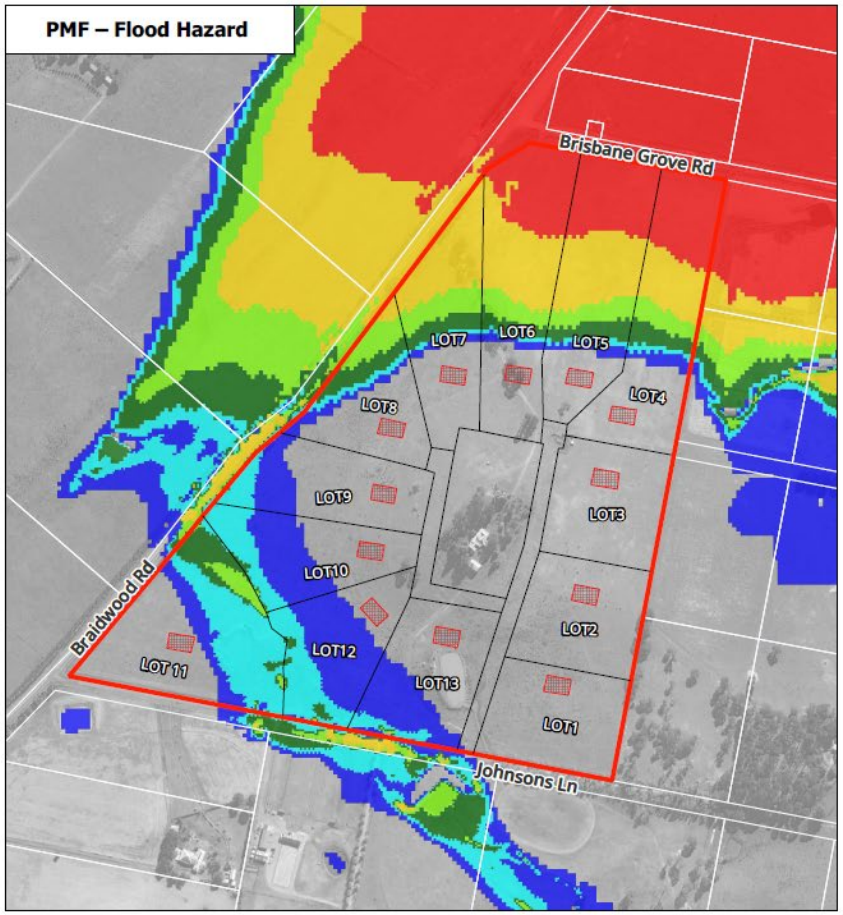
- *Land within FPA zoned to C2 – limited development potential*
- *Future development required to be outside of the floodplain – no risk of flooding up to the PMF*
- *Road flooding can reduce access*
- *Future developments are in 'indirectly affected areas'*



Flood Risk Assessment

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





Subject Site
Cadastral Boundaries
Concept Lot Layout
Concept Buildings 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

N W E S

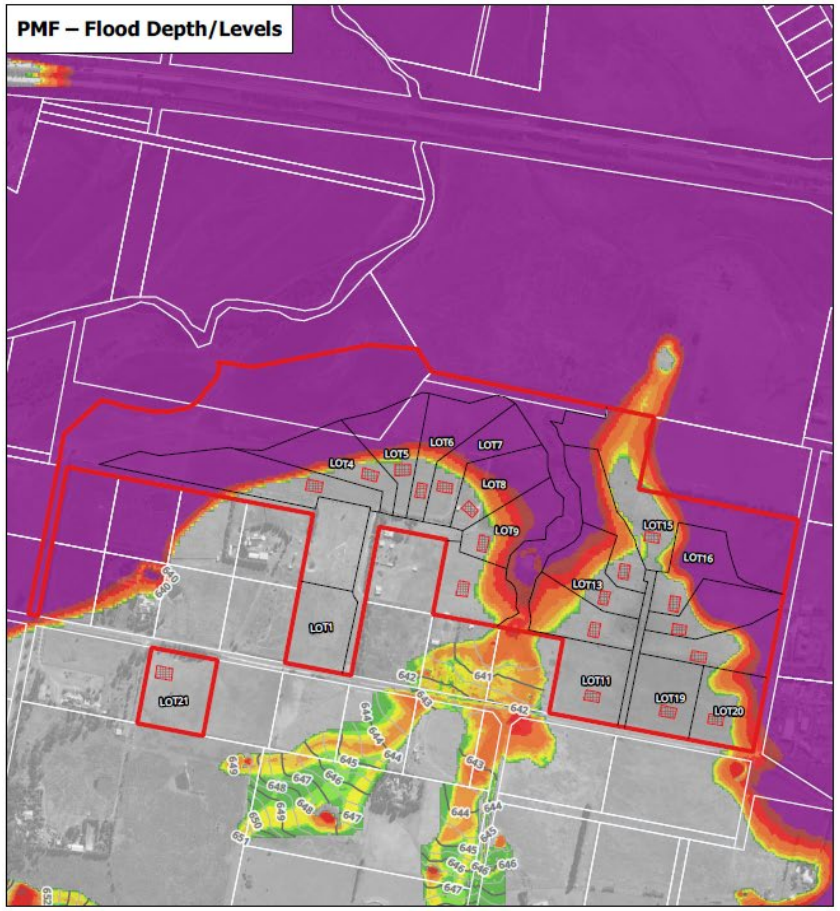
0 200 400 m

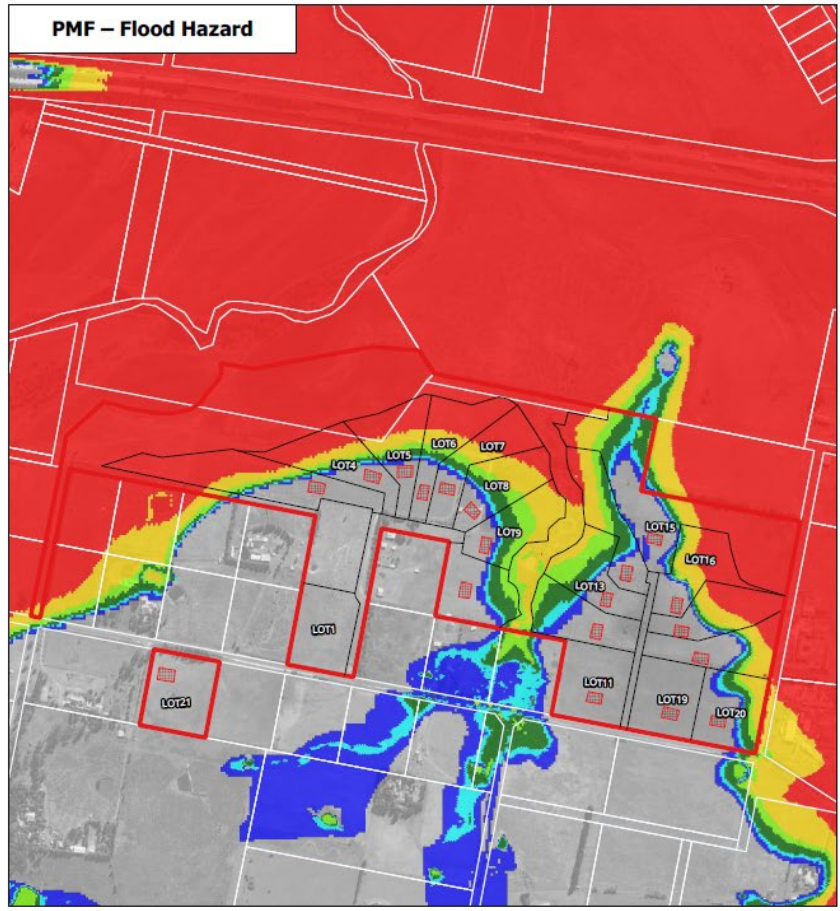
grc HYDRO

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

Flood Risk Assessment

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





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

N
W E
S

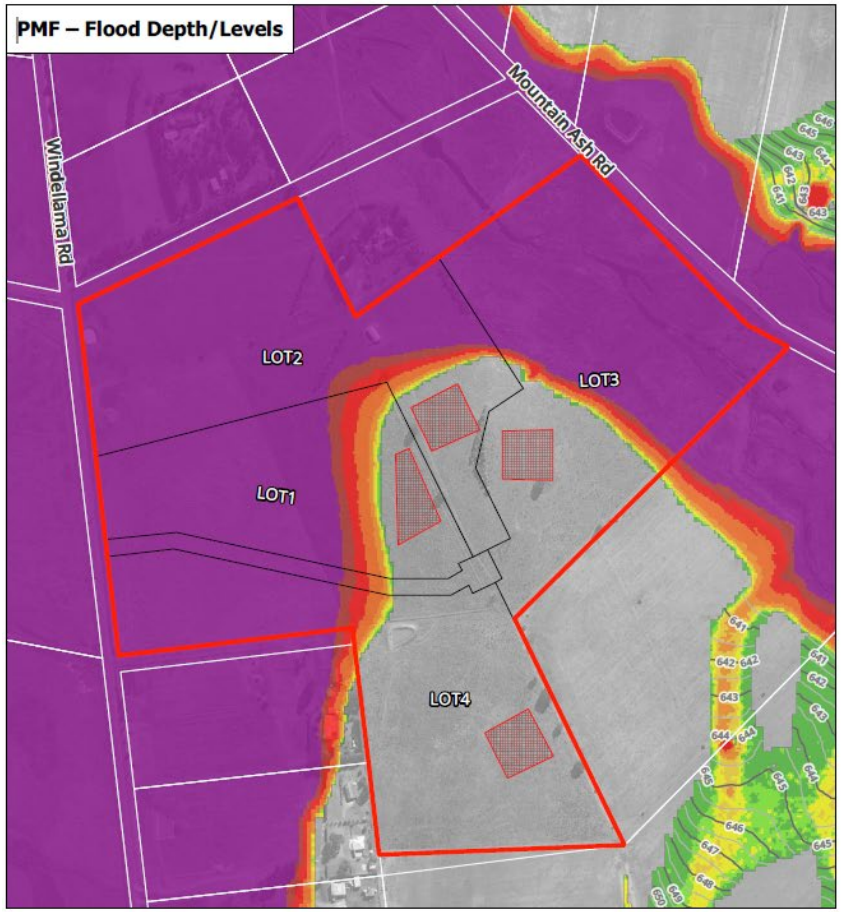
0 500 1000

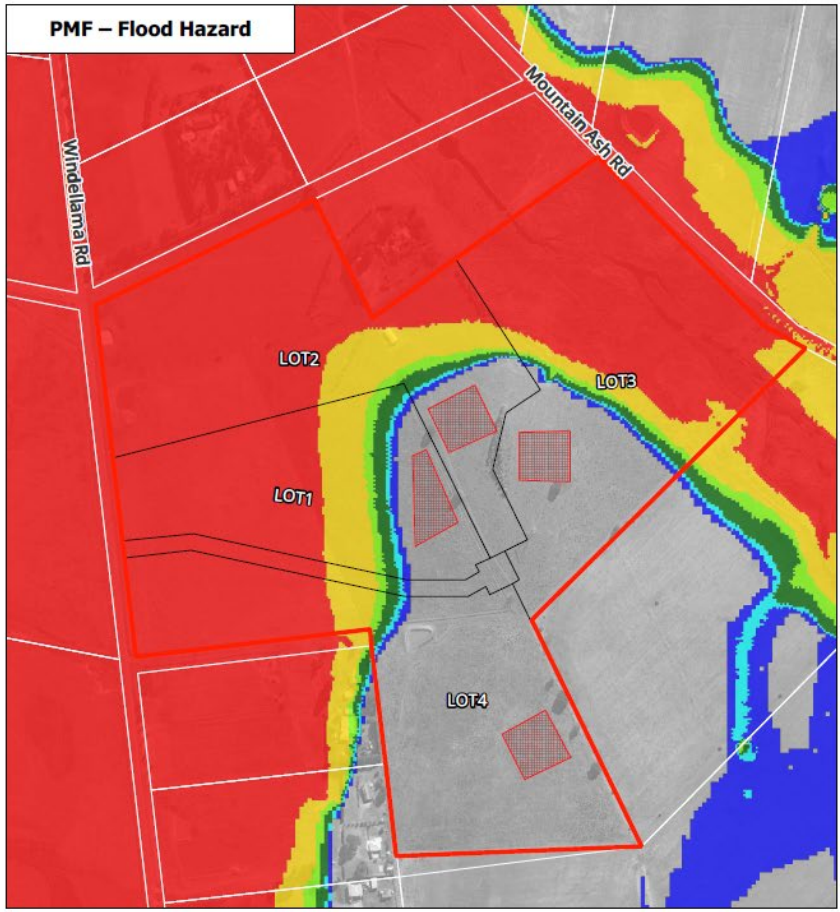
grc HYDRO

TITLE: Existing Conditions – PMF – Flood Depth/Levels and Hazard	PROJECT: 137 Brisbane Grove Road, Goulburn	PROJECT No. 230048	DATE: 11-2023	SCALE: 1:8500	FIGURE No. A7

Flood Risk Assessment

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





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

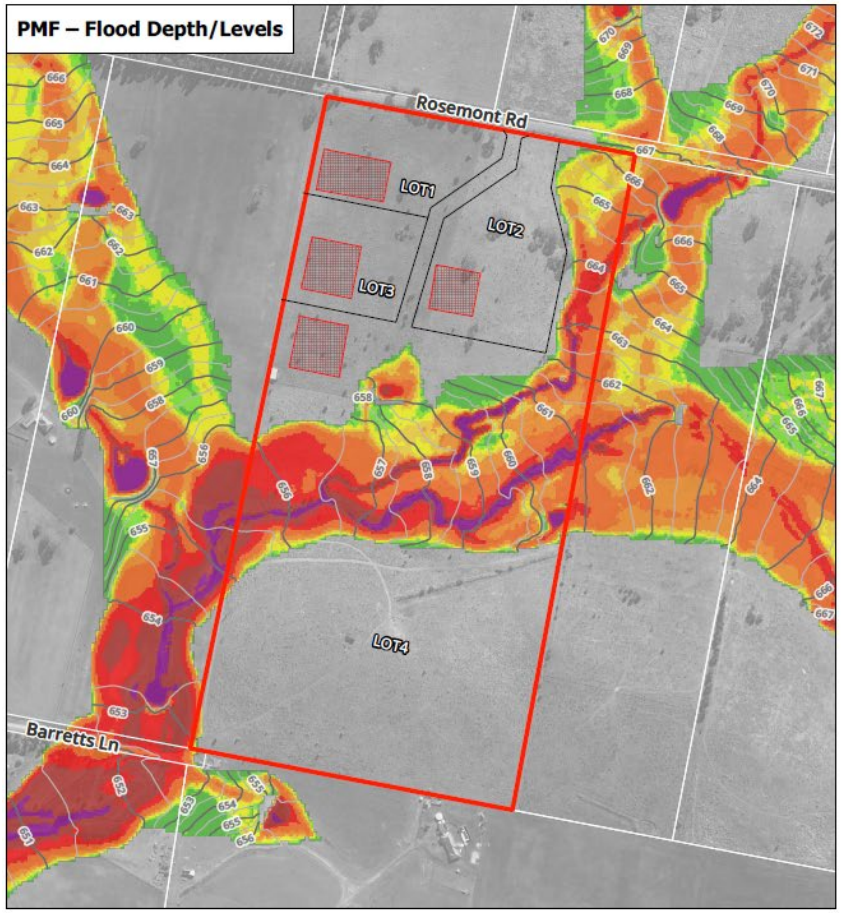
N W E S

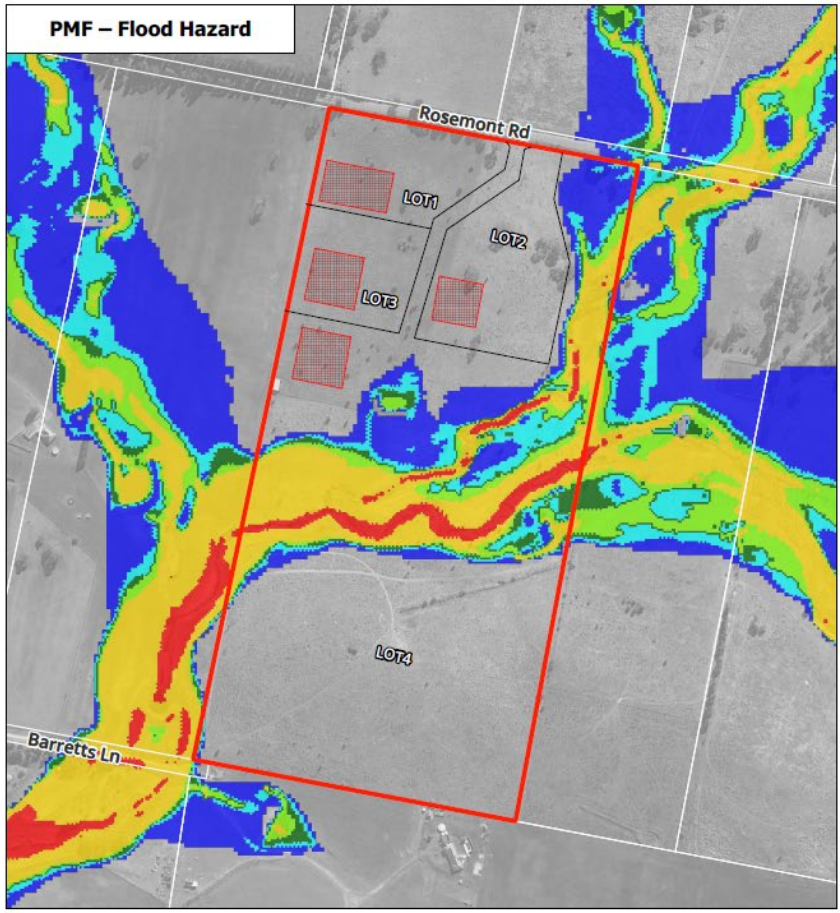
0 300 600

TITLE: Existing Conditions – PMF – Flood Depth/Levels and Hazard	PROJECT: 46 Mountain Ash Road, Goulburn	PROJECT No. 230049	DATE: 11-2023	SCALE: 1:5000	FIGURE No. A7

Flood Risk Assessment

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





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

N W E S

0 300 600

grc HYDRO

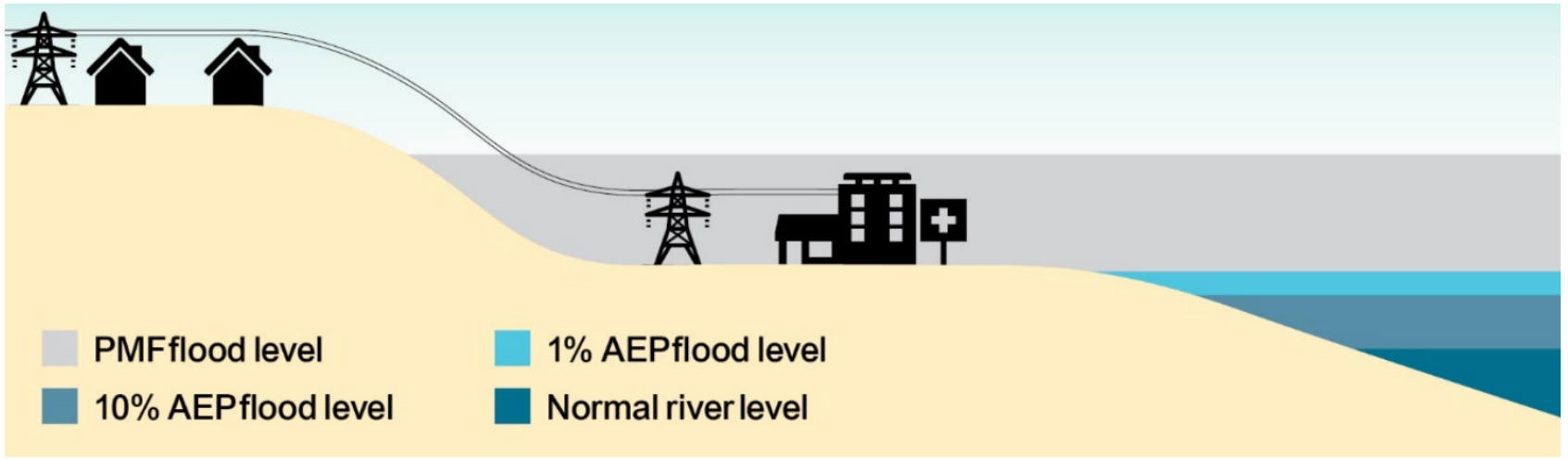
TITLE: Existing Conditions - PMF - flood depth/levels and Hazard	PROJECT: 292 Rosemont Road, Goulburn	PROJECT No. 230049	DATE: 11-2023	SCALE: 1:5000	FIGURE No. A7

Flood Risk Assessment

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

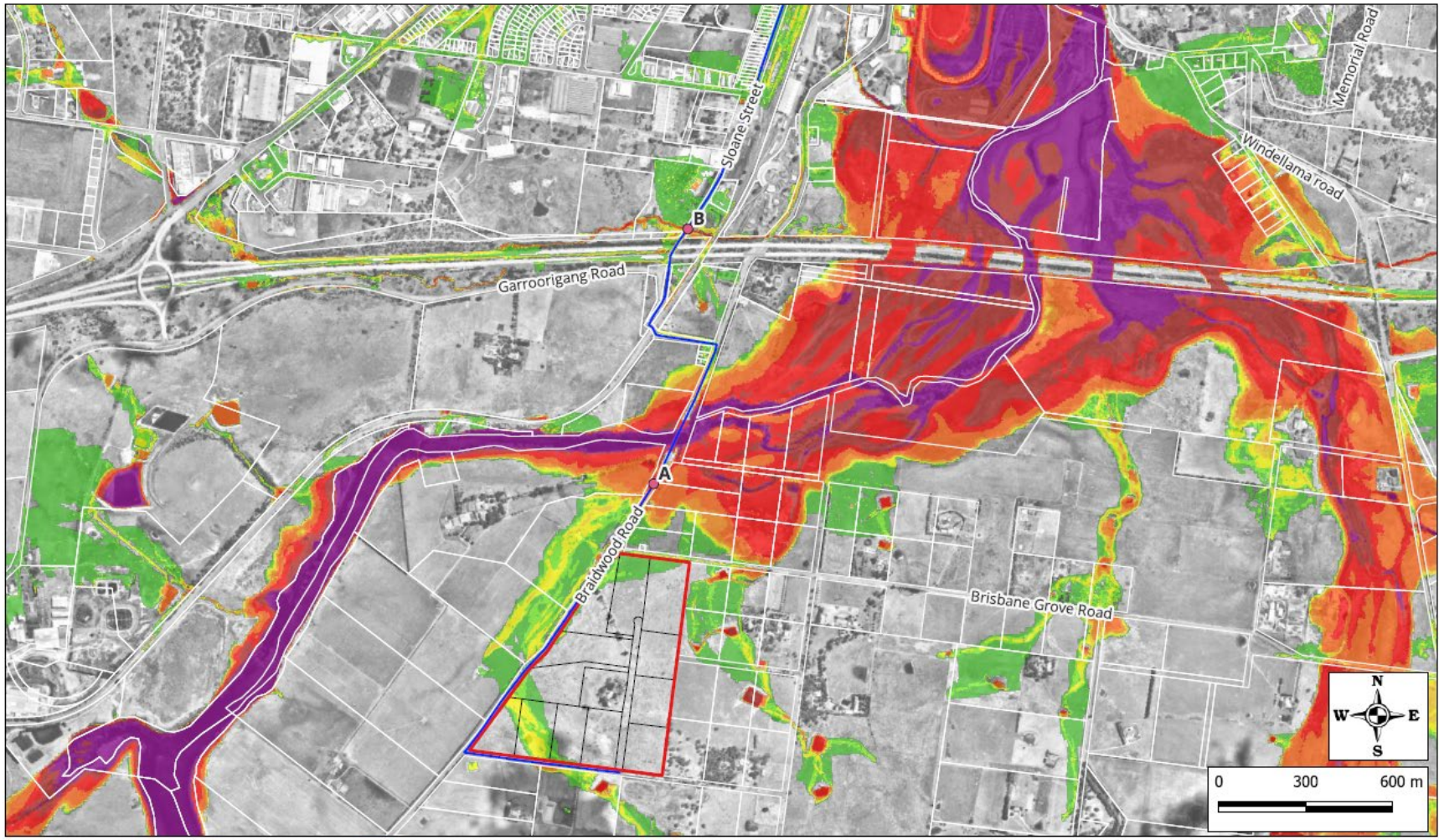
C2.3 Indirectly affected areas

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.



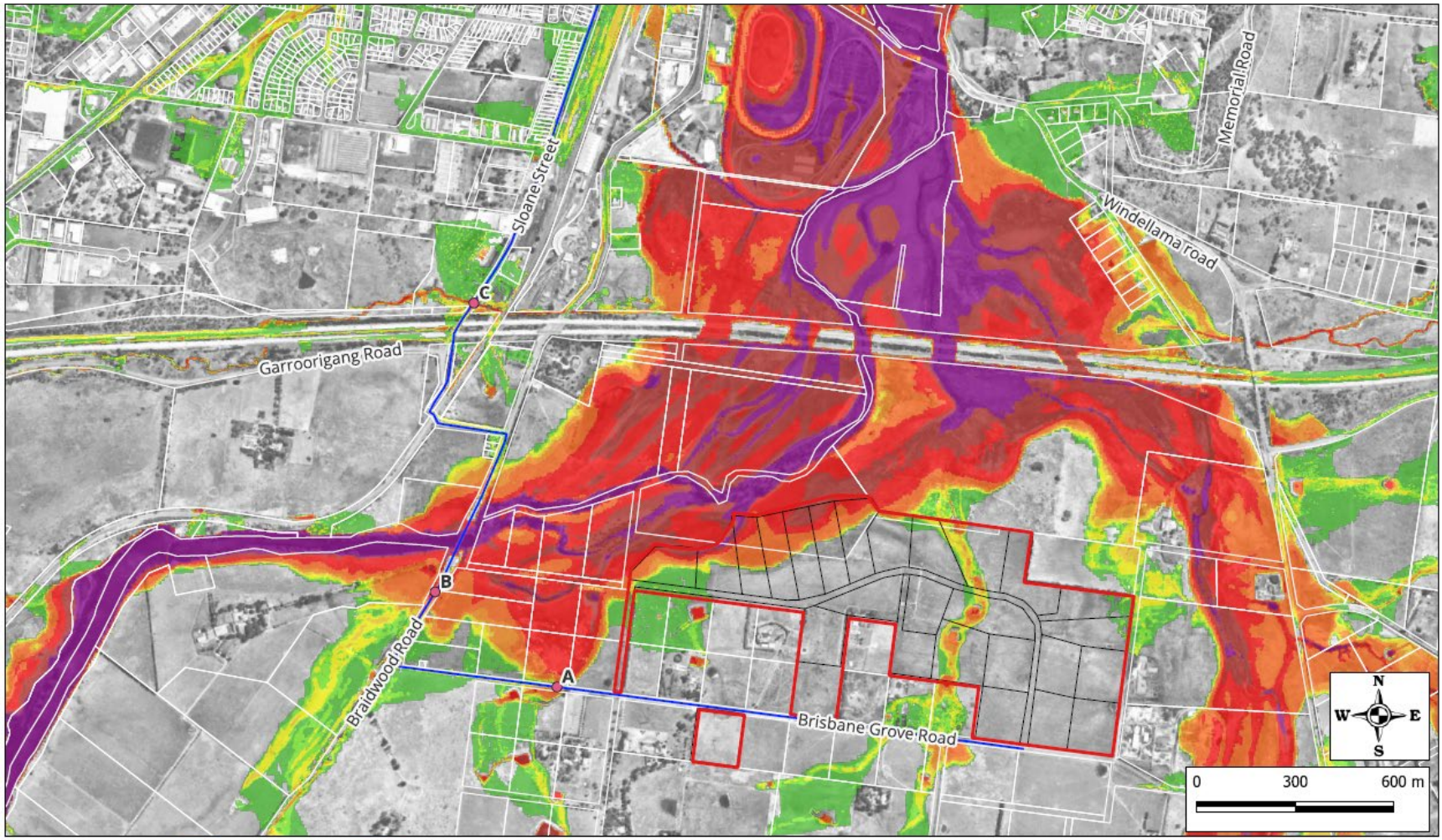
Flood Risk Assessment

- *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*



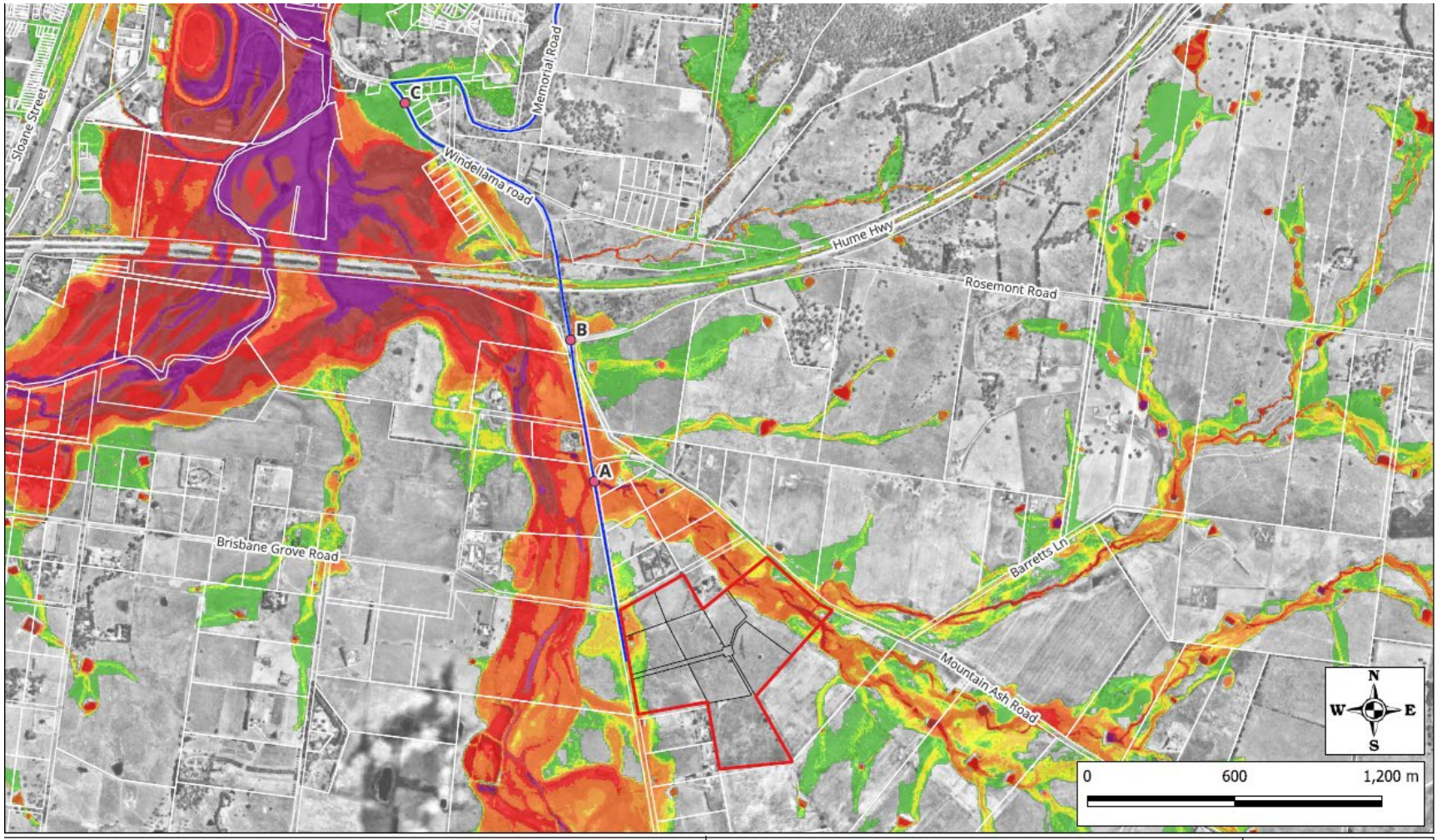
Flood Risk Assessment

- *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*



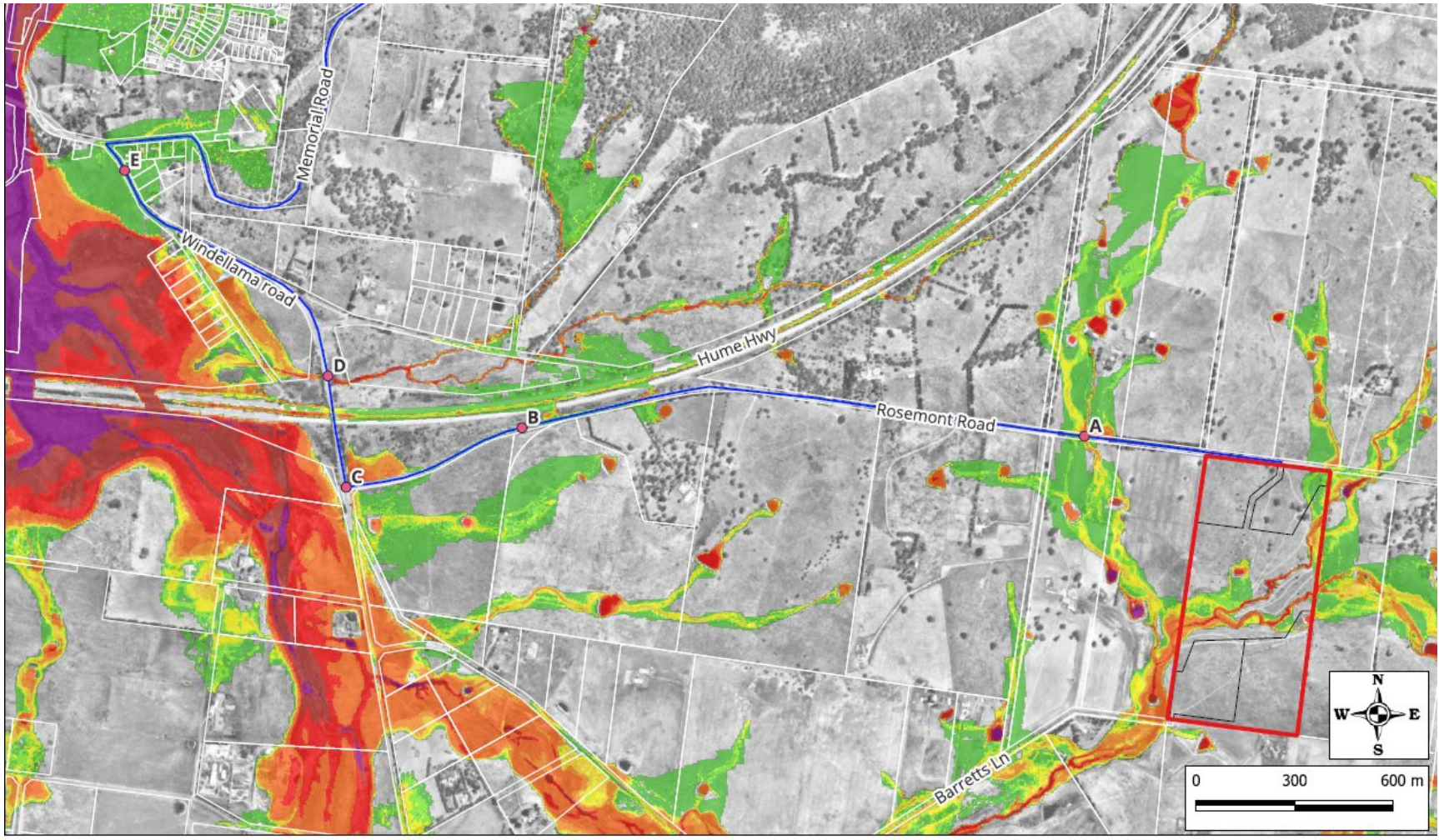
Flood Risk Assessment

- *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*



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*



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.

grc HYDRO

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	- 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	- 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.	Management measures: - 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	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.

- 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 patent 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 medial 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***

grc HYDRO

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

Tel: +61 409 833 039
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

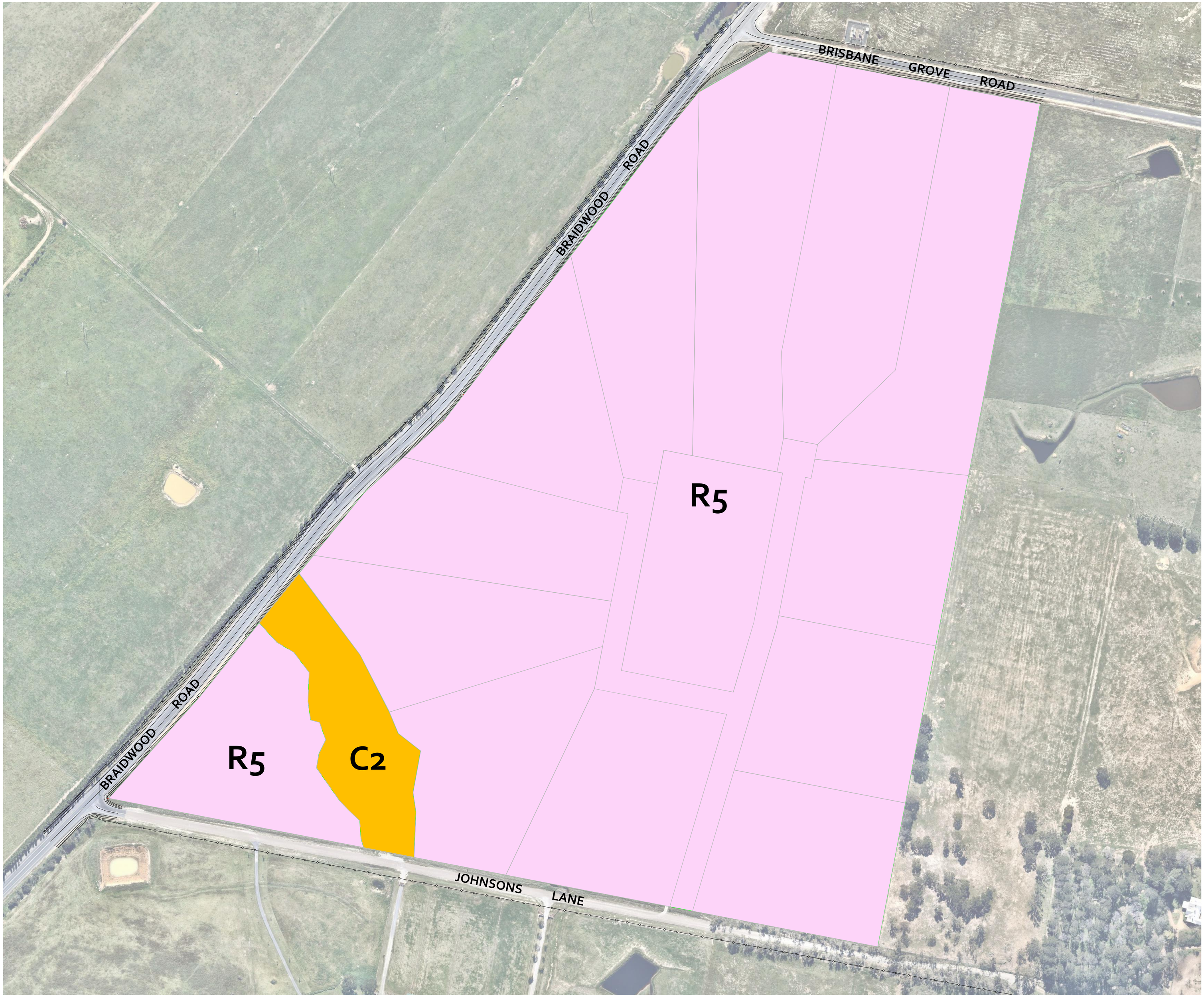
Apologies: Nil

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	1. Introduction 2. Flood Risk Assessment 3. EM01 – Support for Emergency Management Planning 4. Discussion

#	Item	Action (if any)
1	GRC Hydro: • GRC Hydro go through presentation (attached) - P021123_Goulburn_PP_NSWSES_Consultation_GRCHydro.pdf	-
2	SES: • 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: • 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: • 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: • 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: • 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.	- - - - -

	• 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.	-

Attachment D



N

PROJECT TITLE:
LAND REZONING APPLICATION

DRAWING TITLE:
PROPOSED LAND USE ZONE BOUNDARIES AND DEFINITIONS

TITLE PARTICULARS:
LOTS 61 - 64 & 71 - 77 DP976708 and LOT 60 DP1090981

STREET ADDRESS:
2 BRISBANE GROVE ROAD
BRISBANE GROVE. NSW. 2580

DRAWING DATE:	SHEET NUMBER:
Dec. 2023	1 of 1
REFERNCE NUMBER:	DRAWN BY:
0030321	PJ
DRAWING SCALE:	AT SHEET SIZE:
1:1,500	A1

DRAWING REFERENCE NUMBER:
0030321-02G

AMENDMENT No. / DATE	DRAWING REFERENCE
A	PRELIMINARY PLAN - DRAFT ONLY
16/12/2023	

SOWDES
P.O Box 619
Goulburn, NSW. 2580
E: sowdes@sowdes.com
M. 0438 863 401

METRES
0 10 20 30 40 50 100

BRISBANE GROVE ROAD

BRAIDWOOD ROAD

LOT 6
3.16 Ha

LOT 5
3.00 Ha

LOT 7
2.35 Ha

LOT 4
2.91 Ha

LOT 8
2.00 Ha

LOT 9
2.05 Ha

LOT 14
2.02 Ha

LOT 3
2.00 Ha

LOT 10
2.06 Ha

LOT 11
3.48 Ha
(2.06 Ha R5)

LOT 12
2.05 Ha

LOT 13
2.26 Ha

LOT 2
2.00 Ha

LOT 1
2.00 Ha

BRAIDWOOD ROAD

JOHNSONS LANE

N

PROJECT TITLE:
LAND REZONING APPLICATION

DRAWING TITLE:
CONCEPTUAL LOT PLAN WITH PROBABLE MAXIMUM FLOOD AND FLOOD PLANNING AREAS CONSIDERED.
ALL LOTS HAVE A MINIMUM OF 2 HECTARES IN R5 ZONING.

TITLE PARTICULARS:
LOTS 61 - 64 & 71 - 77 DP976708 and LOT 60 DP1090981

STREET ADDRESS:
2 BRISBANE GROVE ROAD
BRISBANE GROVE. NSW. 2580

DRAWING DATE:	SHEET NUMBER:
Dec. 2023	1 of 1
REFERNCE NUMBER:	DRAWN BY:
0030321	PJ
DRAWING SCALE:	AT SHEET SIZE:
1:1,500	A1

DRAWING REFERENCE NUMBER:
0030321-02B

AMENDMENT No. / DATE	DRAWING REFERENCE
A	PRELIMINARY PLAN - DRAFT ONLY
16/12/2023	

SOWDES
P.O Box 619
Goulburn, NSW. 2580
E: sowdes@sowdes.com
M. 0438 863 401

PEACH COLOURED DIAGONAL HATCHING = C2 ZONED LAND. ALL OTHER LAND WITHIN THE PROPOSED LOTS TO BE ZONED R5.

METRES
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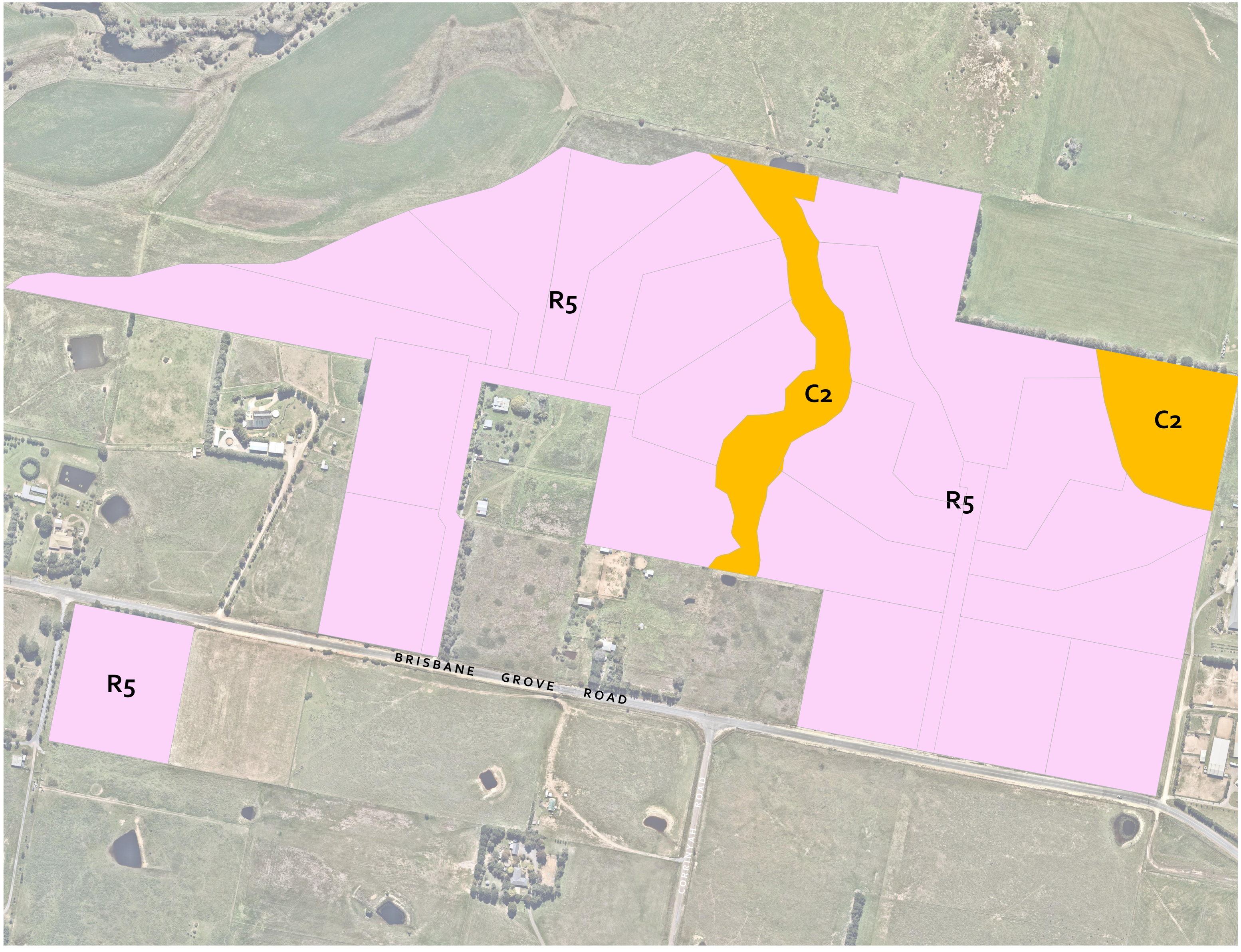

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PROJECT TITLE:
LAND REZONING APPLICATION

DRAWING TITLE:
PROPOSED LAND USE ZONE BOUNDARIES AND DEFINITIONS

TITLE PARTICULARS:
LOTS 2 to 6 D62157, LOT 2 DP1180093, LOTS 10 to 19, 21, 39, 43 to 45 & 54 DP976708, and LOT 29 DP750015

STREET ADDRESS:
2 BRISBANE GROVE ROAD
BRISBANE GROVE. NSW. 2580

DRAWING DATE:	SHEET NUMBER:
Dec. 2023	1 of 1
REFERNCE NUMBER:	DRAWN BY:
0050421	PJ
DRAWING SCALE:	AT SHEET SIZE:
1:2,000	A1

DRAWING REFERENCE NUMBER:
0050421-02E

AMENDMENT No. / DATE	DRAWING REFERENCE
A	PRELIMINARY PLAN - DRAFT ONLY
16/12/2023	

SOWDES
P.O Box 619
Goulburn. NSW. 2580
E: sowdes@sowdes.com
M. 0428 863 402

METRES
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PROJECT TITLE:
LAND REZONING APPLICATION

DRAWING TITLE:
CONCEPTUAL LOT PLAN WITH PROBABLE MAXIMUM FLOOD AND FLOOD PLANNING AREAS CONSIDERED.
ALL LOTS HAVE A MINIMUM OF 2 HECTARES IN R5 ZONING

TITLE PARTICULARS:
LOTS 2 to 6 D62157, LOT 2 DP1180093, LOTS 10 to 19, 21, 39, 43 to 45 & 54 DP976708, and LOT 29 DP750015

STREET ADDRESS:
2 BRISBANE GROVE ROAD
BRISBANE GROVE. NSW. 2580

DRAWING DATE:	SHEET NUMBER:
Dec. 2023	1 of 1
REFERNCE NUMBER:	DRAWN BY:
0050421	PJ
DRAWING SCALE:	AT SHEET SIZE:
1:2,000	A1

DRAWING REFERENCE NUMBER:
0050421-02B

AMENDMENT No. / DATE	DRAWING REFERENCE
A	PRELIMINARY PLAN - DRAFT ONLY
16/12/2023	

SOWDES
P.O Box 619
Goulburn. NSW. 2580
E: sowdes@sowdes.com
M. 0428 863 401

PEACH COLOURED DIAGONAL HATCHING = C2 ZONED LAND.
ALL OTHER LAND WITHIN THE PROPOSED LOTS TO BE ZONED R5.

METRES
0 10 20 30 40 50 100 200