



# **Goulburn Mulwaree Council**

**Flood Impact and Risk Assessment (FIRA)-  
Planning Proposal to re-zone 407 & 457 Crookwell  
Road, Goulburn**

**REZ\_0001\_2223**

**(PP-2023-414)**

**April 2025**

**Prepared by Goulburn Mulwaree Council**

<b>Version Table</b>		
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1	16 <sup>th</sup> May 2024	Gateway
2	9 January 2025	Agency Consultation
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## 1. Introduction

This Flood Impact and Risk Assessment (FIRA) has been prepared in accordance with the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) publication, *Flood Impact and Risk Assessment – Flood Risk Management Guideline LU01*, 2023. This FIRA should be read in conjunction with the Planning Proposal PP-2023-414 for 407 & 457 Crookwell Road and supporting documentation.

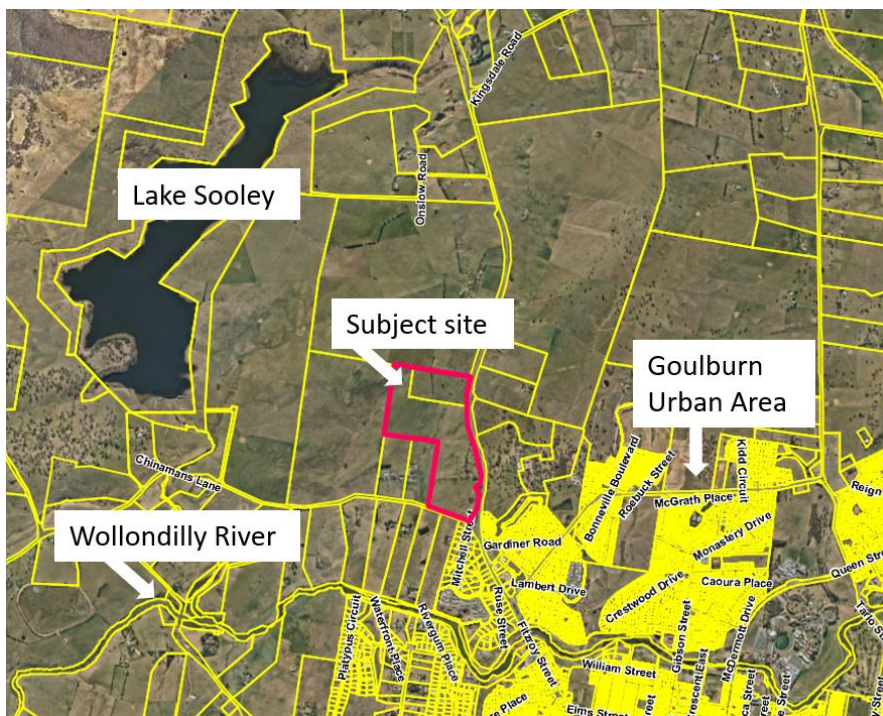
This FIRA is a “simple” assessment in accordance with Section 2.8 of the Guidelines as it is being prepared at a preliminary stage of a larger development to assist in informing future planning noting that a development application will also need to be prepared and submitted.

The preparation of this preliminary FIRA has also considered the following guidelines from the *Flood Risk Management Toolkit*:

- [EM01- Support for Emergency Management Planning](#)
- [FB01- Understanding and Managing Flood Risk](#)
- [MM01- Flood Risk Management Measures](#)

## 2. Need for a flood impact risk assessment.

This planning proposal seeks to rezone an area of 50.70 hectares of rural land situated to the north of Goulburn, within the Sooley precinct of the *Urban and Fringe Housing Strategy*, which is currently zoned RU6 Transition. A site location plan is illustrated in [Figure 1](#).



*Figure 1: Site location plan*

The subject site comprises three existing lots (Lots 70, 73 & 77 DP 1006688) accessed via Crookwell Road and Chinaman's Lane. The site is mostly cleared grazing land and contains a dwelling, outbuildings and four (4) dams.

The planning proposal is proponent led and seeks to rezone the site to R2 Low Density Residential and R5 Large Lot Residential, as identified within Council's *Urban and Fringe Housing Strategy*. Council has amended the proposal, with portions of the site affected by water courses and overland flood prone land now proposed to be zoned RE1 Public Recreation (for the part the site that contains biodiversity value and/or subject to overland flooding to be dedicated to Council as a future public reserve) and C2 Environmental Conservation (for the part of the site subject to overland flooding that are within areas proposed to be within a future private lot). The rezoning is to facilitate future urban residential subdivision, the site having the capacity for approximately 248 low density residential lots and 8 large lot residential lots. The overland flood prone land, up to the Probable Maximum Flood (PMF) is included within the RE1 and C2 zones identified above.

The proposal also seeks to amend the minimum lot size from 10 hectares to 700m<sup>2</sup> for the R2 Low Density Residential area proposed, and 4,000m<sup>2</sup> and 2 hectares for the R5 Large Lot Residential area proposed.

The Planning Proposal includes the consideration of each of the relevant requirements of Ministerial Direction 4.1 Flooding.

The exhibition version Planning Proposal document is available to view in **Appendix 1**.

The proponents' concept subdivision plan identifies a two hundred and fifty six (256) lot subdivision, with open space areas located along the path of natural drainage lines, in addition to a clustered area containing remnant native vegetation holding moderate biodiversity value. The site will be accessed via Crookwell Road and Chinaman's Lane with a proposed Auxiliary Left/Channelised Right (AUL/CHR) intersection treatment. The proponents' updated concept subdivision plan is presented in **Figure 2** and **Appendix 2c**.



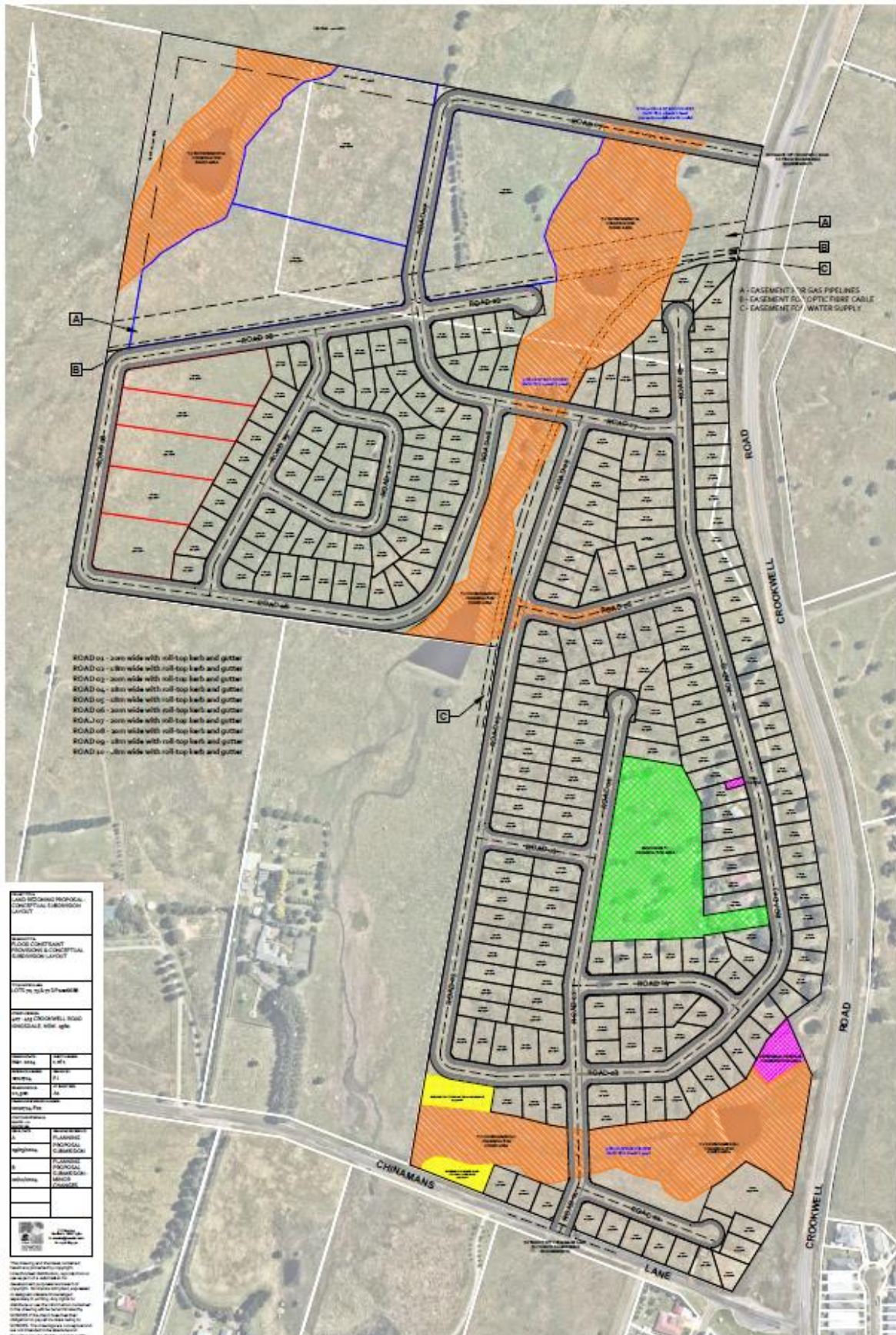
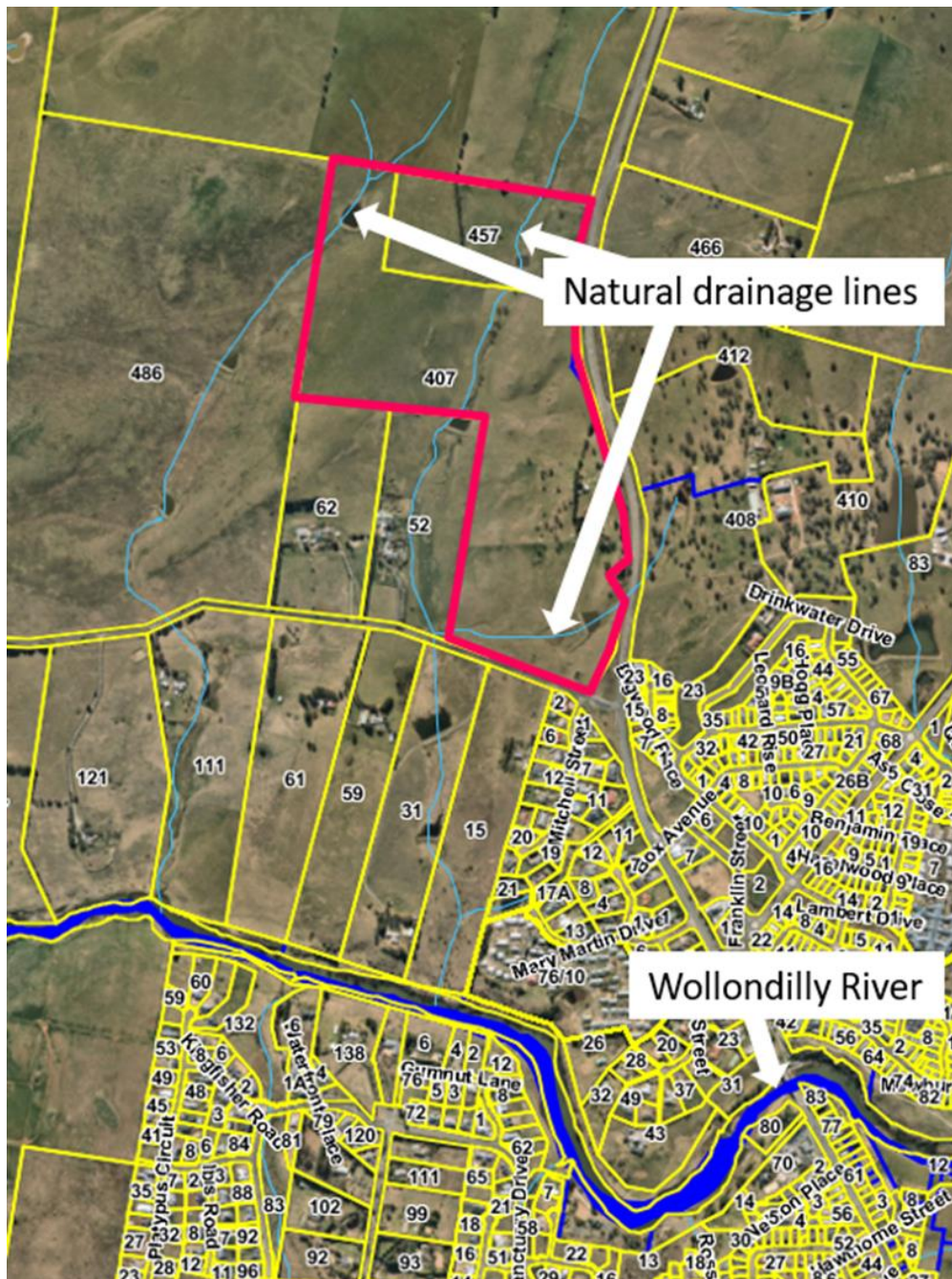


Figure 2: Proponents Concept Subdivision Plan



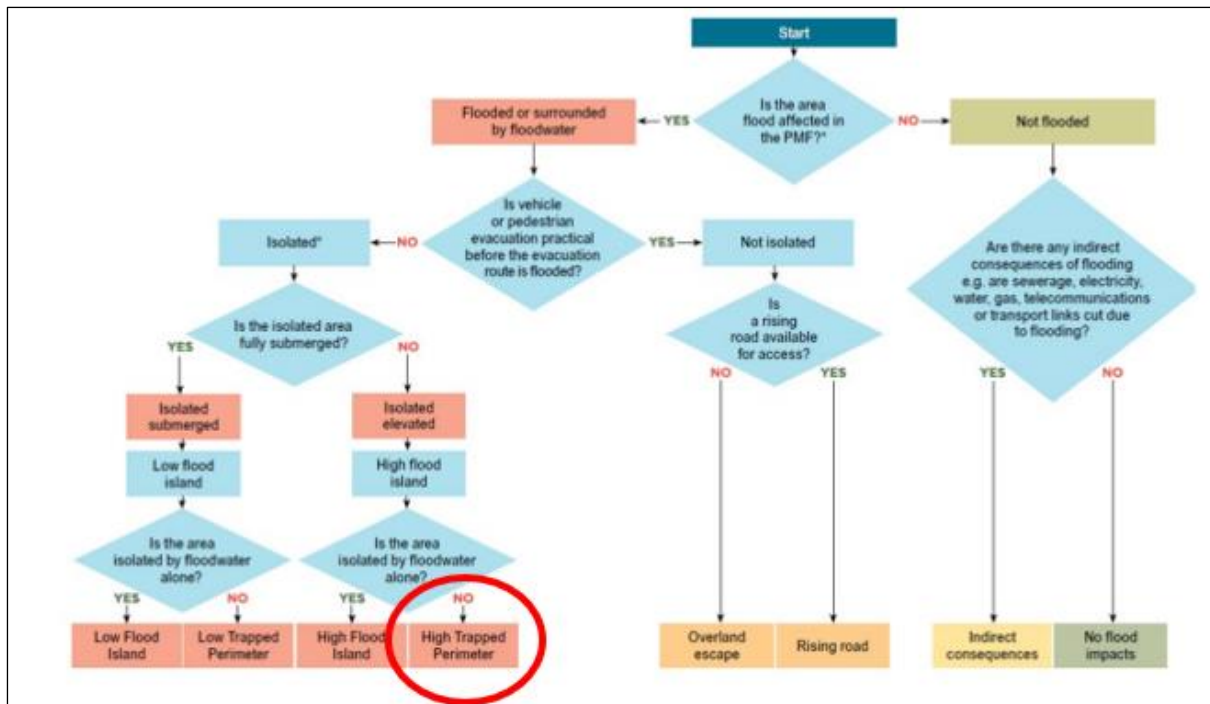
A portion of the site is burdened by an easement that contains a high pressure gas main pipeline that runs in an east-west direction (owned by APA). The land is also burdened by non-perennial watercourses. Parts of these are proposed to be zoned RE1 Public Recreation, to provide public open spaces for future residents.

The site is located immediately to the north of the Goulburn Urban Area and approximately 750 metres north of the Wollondilly River. **Figure 3** below shows the location of each non-perennial watercourse and the Wollondilly River relative to the site.



**Figure 3:** Location of Drainage Channels

Prior to any mitigations identified in this FIRA it is considered that the site would be classified as a high trapped perimeter using the flood emergency response classifications in EM01 as per the **Figure 4** below. Portions of the site are currently flood affected; however, the site adjoins the urban fringe and is adjacent to the Mistful Park Commercial area.



**Figure 4:** Flood Emergency Response Classifications – Prior to Mitigations

### 3. Consultation

Council has undertaken consultation in general terms in relation to flood impact and risk in Goulburn and the approach required when considering planning proposals for rezoning rural land on the town’s periphery to residential. Council held two Goulburn Flooding Technical Working Group meetings between Council, SES and NSW DPE staff in October – November 2023 with representatives from NSW SES, NSW DPE (Planning) and NSW DPE (Biodiversity Conservation Division- Flooding). These meetings focused on planning proposals south of the Hume Highway and on the Goulburn central business district (CBD). It should be noted that the overall approach of all agencies towards rezoning land which may be directly or indirectly affected by flooding has informed this FIRA.

This FIRA is a preliminary assessment. Consultation has been undertaken with NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) and the NSW SES during the State agency consultation process associated with the planning proposal. Council’s approach to impose restrictive rezoning over flood prone land is supported. The post-development conditions considered later in this report and in Appendix 15b demonstrate that the site has capability to accommodate future residential development, which will be considered in further detail upon the lodgement of a future Development Application (DA). As all flood prone land, up to and including the PMF will be rezoned to restrictive zones C2 or RE1, future occupants can safely shelter in place and there is no need to evacuate other than if required in the event of a medical emergency. As mentioned later in this report, central Goulburn cannot be accessed from north Goulburn/the subject site during a 0.2% AEP flood event, therefore the most appropriate evacuation point is the developing commercial precinct at Mistful Park, located within approximately 450 metres from the subject site, which contains services such as a medical centre, supermarket, childcare centre, commercial building and service station.



A future DA for subdivision will be required to demonstrate how future residential development will result in negligible impacts between pre and post development stormwater impacts. The design of future road crossing points over natural drainage lines must enable safe access during a PMF event and ensure non adverse off-site impacts.

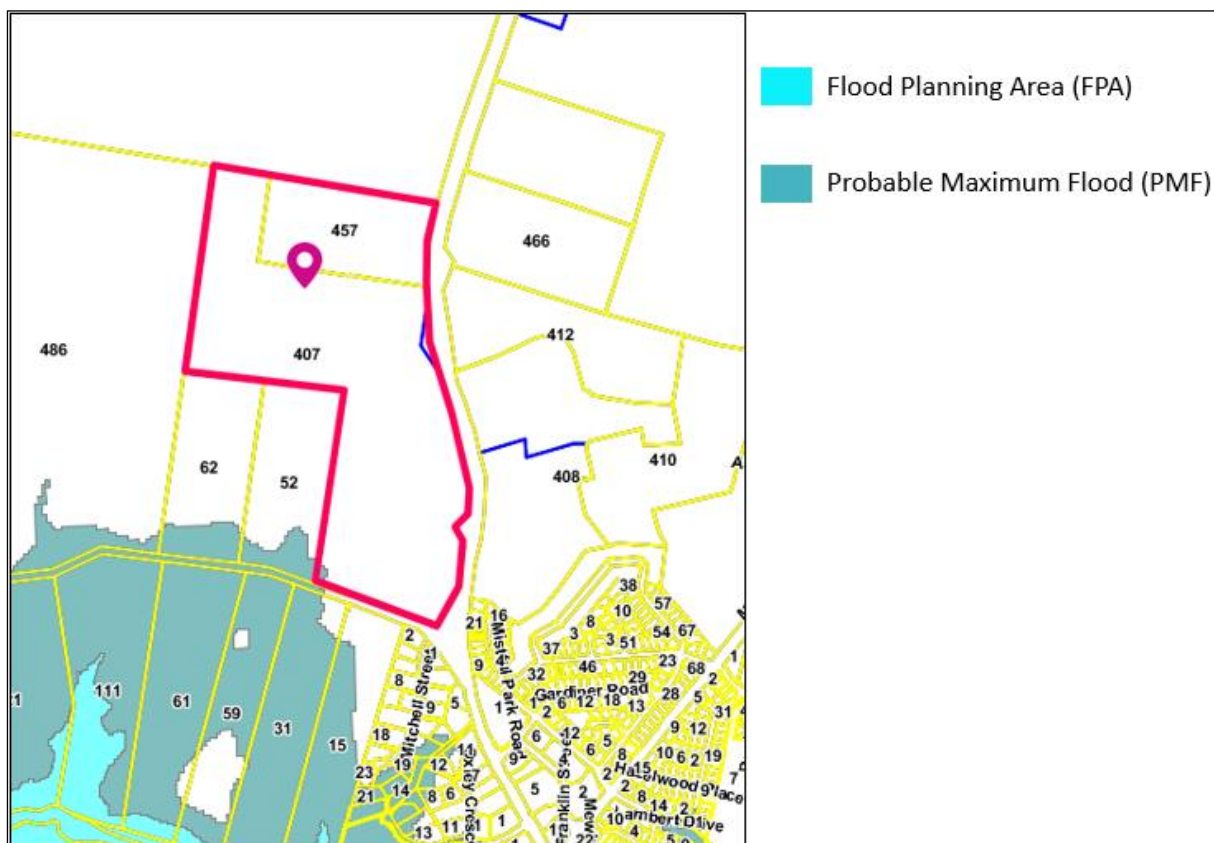
#### 4. Available Flood Studies and Existing Assessment Requirements

[The Goulburn Floodplain Risk Management Study and Plan](#) (*The Flood Study*) was adopted by Council on 16 August 2022 and was developed in collaboration with the former Department of Planning and Environment- Environment, Energy and Science. The Flood Study was prepared by GRC Hydro in accordance with and consistent with:

- The *NSW Flood Prone Land Policy*;
- The principles of the *Floodplain Development Manual 2005*, and
- *Considering flooding in land use planning guideline 2021*.

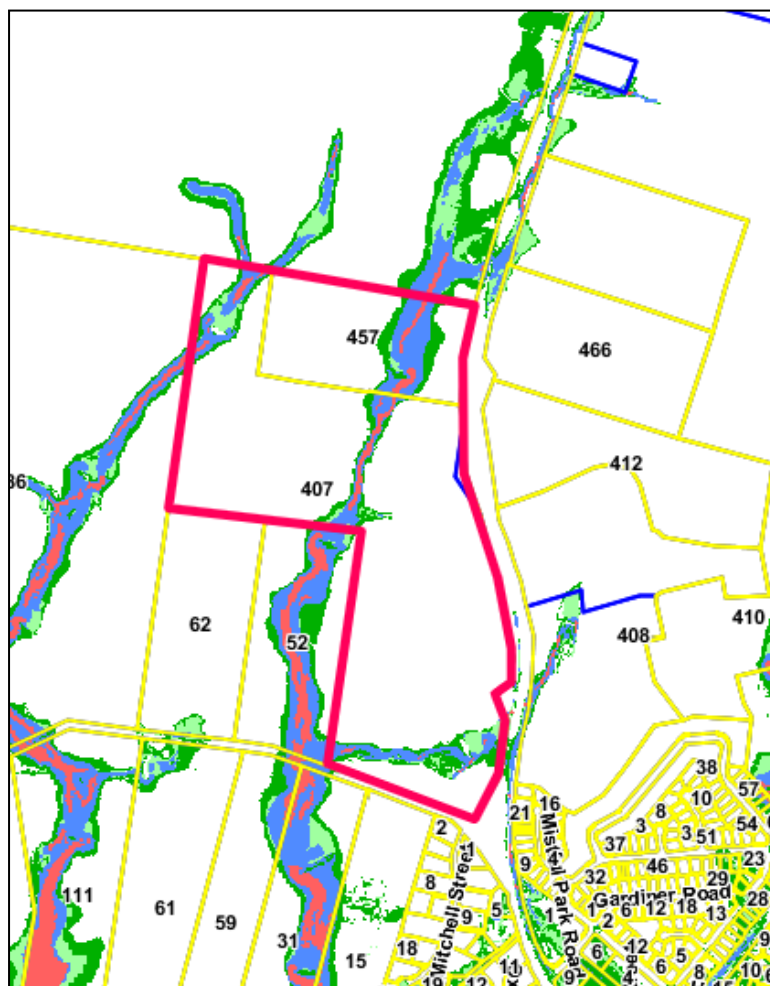
The study area includes the subject site but only models the extent of riverine and major tributary flooding. This site is not identified as being subject to riverine flooding for any design event, other than a very small portion of the south-west corner of the site that is impacted by the Probable Maximum Flood (PMF) (refer [Figure 5](#)). Riverine flooding from the Wollondilly River does restrict access to central Goulburn from this precinct during a PMF Event. Evacuation to central Goulburn, however, is not necessary as the Mistful Park commercial area is located within close proximity to the site and access can be gained to this location during a PMF.

The Flood Study also included a Development Control Policy which applies controls to both flood prone land within the Flood Study boundaries and areas outside the scope of the Study.



**Figure 5:** FPA and PMF Wollondilly River in Relation to Subject Site

The Flood Study and Goulburn Mulwaree Development Control Plan 2009 (GM DCP 2009) flood policy implements Flood Planning Constraint Categories (FPCC) which groups similar types and scales of flood related constraints. Four FPCC's have been established to separate areas of the floodplain from the most constrained and least suitable areas for intensification of land use. The FPCC's are presented in [Figure 6](#) and [Figure 7](#) below:



**Figure 6:** Extent of Flood Prone Land – Overland Flooding Modelling Using FPCC

Category	Summary
FPCC1	FPCC1 identifies the most significantly constrained areas, with high hazard or significant flood flows present. Intensification of use in FPCC1 is generally very limited except where uses are compatible with flood function and hazard.
FPCC2	FPCC2 areas are the next least suitable for intensification of land use or development because of the effects of flooding on the land, and the consequences to any development and its users.
FPCC3	FPCC3 areas are suitable for most types of development. This is the area of the floodplain where more traditional flood-related development constraints, based on minimum floor and minimum fill levels, will apply.
FPCC4	FPCC4 is the area inundated by the PMF (extent of flood prone land) but outside FPCC1-3. Few flood-related development constraints would be applicable in this area for most development types. Constraints may apply

	to key community facilities and developments where there are significant consequences to the community if failed evacuations occur.
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**Figure 7: Flood Planning Constraint Categories (FPCC)**

The *GM DCP 2009* flood policy applies different flood planning controls depending on the proposed land use category to ensure that new development does not increase flood risk.

Council has initiated the preparation of the *Goulburn Overland Flooding Risk Study and Management Plan* for Goulburn following a successful funding application through the NSW Department of Planning and Environment Floodplain Management Grants program. This project is expected to be finalised in December 2025. However, as an interim measure, Council commissioned overland flood modelling. This modelling utilised the same data and methodology as the riverine flood modelling and mapping within the mainstream Flood Study. This has resulted in a mapping layer which illustrates the location and likely extent of overland flooding and the relative risk to life and property. The overland flood mapping also includes Flood Planning Constraint Categories (FPCC) which have been identified by the same consultant who prepared *The Flood Study* (GRC Hydro). This modelling is currently used to inform Council as to the potential for flooding and flood risk beyond riverine areas.

The overland flood model maps are available to view on the Council's website at: <https://www.goulburn.nsw.gov.au/Development/Plans-Strategies#section-10>

Both the Flood Study and the overland flow modelling have accounted for climate change utilising the ARR2019 methodology to determine the projected increase in precipitation intensity. These details have been utilised to determine increased rainfall for the 5%, 1%, 0.05% and PMF for flood events up to 2090 and incorporated into the riverine and overland flow modelling. A freeboard for future habitable development has also been applied, in consideration of climate change and other risk factors.

The adopted [\*Goulburn Floodplain Risk Management Study and Plan\*](#) (*The Flood Study*) has assessed riverine flooding and associated risk in Goulburn. The extent of this study area includes the subject site which is not directly impacted by riverine flooding (due to its elevation). The site is included in the area where overland flow modelling has been undertaken as a separate project outside of the Goulburn Flood Study. It illustrates that portions of the site are inundated by overland flooding but this inundation aligns with the locations of the non-perennial water courses.

The overland flow modelling, illustrated in [Figure 6](#), indicates that the identified drainage channels experience flood inundation.

A *Localised Flood and Overland Flow Study* (**Appendix 15a and 15b**) was submitted in support of the proposal which also models pre and post development overland flows. This Study has also accounted for Climate change in accordance with ARR2019.

Council's Overland Flood Modelling and the submitted *Localised Flood and Overland Flow Study*'s identification of the presence of overland flow inundation on site, makes clear the subject site is flood prone to some extent and as such Ministerial Direction 4.1 applies.

The *NSW Flood Prone Land Policy's* (*The Flood Policy*) primary objective is to reduce the impacts of flooding and improve community resilience. The policy recognises that flood prone land is a valuable resource and proposals for rezoning should be the subject of careful assessment which incorporates consideration of local circumstances.

The policy requires:

- a merit-based approach to be adopted for all development decisions in the floodplain;



- a reduction in flooding impacts and liability on existing developed areas
- limiting the potential for flood losses in all areas proposed for development by the application of ecologically sensitive planning and development controls.

The *Flood Risk Management Manual (the Manual)* requires planning proposal authorities to consider the principles of the Manual and advice provided in the supporting Toolkit. The Manual establishes the following Vision:

*“Floodplains are strategically managed for the sustainable long-term benefit of the community and the environment, and to improve community resilience to floods”.*

and the following 10 principles for flood risk management:

1. Establish sustainable governance arrangements;
2. Think and plan strategically;
3. Be consultative;
4. Make flood information available;
5. Understand flood behaviour and constraints (for the full range of floods);
6. Understand flood risk and how it may change (for the full range of floods);
7. Consider variability and uncertainty;
8. Maintain natural flood functions;
9. Maintain flood risk effectively, and
10. Continually improve the management of flood risk.

*The Manual* highlights the requirement for a robust understanding and analysis of risk which can then be deployed to determine whether the risk is acceptable and determine if additional action is required to further reduce identified residual risk.

The *Flood Risk Management Toolkit (the Toolkit)* provides more detailed guidance on how to meet the objectives of *The Flood Policy* and Manual and these documents have been considered in the development of this planning proposal. The following documents in the Toolkit are especially pertinent to this planning proposal:

- [EM01- Support for Emergency Management Planning](#)
- [LU01- Flood Impact and Risk Assessment](#)
- [FB01- Understanding and Managing Flood Risk](#)
- [MM01- Flood Risk Management Measures](#)

The proposal’s consistency with *The Flood Policy*, *The Manual* and *Toolkit* are largely addressed separately in the sections responding to Ministerial Direction 4.1 in the accompanying Planning Proposal.

In relation to this site, the main issues identified for consideration in this Flood Impact Risk Assessment are **site access/evacuation** and the **safe occupation** of proposed residential lots.

## 5. Warning Times, Evacuation, Isolation, Duration

In accordance with *EM01 Support for emergency management planning*, evacuation is considered in the context of this site, with emergency management responses tested.

As stated in the NSW SES’ *Goulburn Mulwaree LGA Local Flood Plan*, consultation with NSW SES is required as a part of the strategic planning for flood affected land to avoid additional

risk. Council has undertaken further consultation with the NSW SES in relation to the planning proposal and this FIRA, and has been considered in part 3 above.

This FIRA considers:

- The potential for this community to be isolated
- the availability for warning in this location/warning times
- evacuation capability
- compatibility with the existing EM response strategy
- whether occupants are safe and self-sufficient in the event of a flood
- Ability to self-evacuate to a place of safety

The main consideration is the potential for this community to be isolated and an evacuation route from the site to a suitable destination. It should be noted that the entirety of Goulburn (north of the Wollondilly River) is cut off from the central portion of Goulburn once flooding reaches a 0.20% AEP (Annual Recurrence Interval) Event (1 in 500) as identified in [Figure 8](#) below which details when each of the bridge crossings become blocked crossing the Wollondilly River to the north.

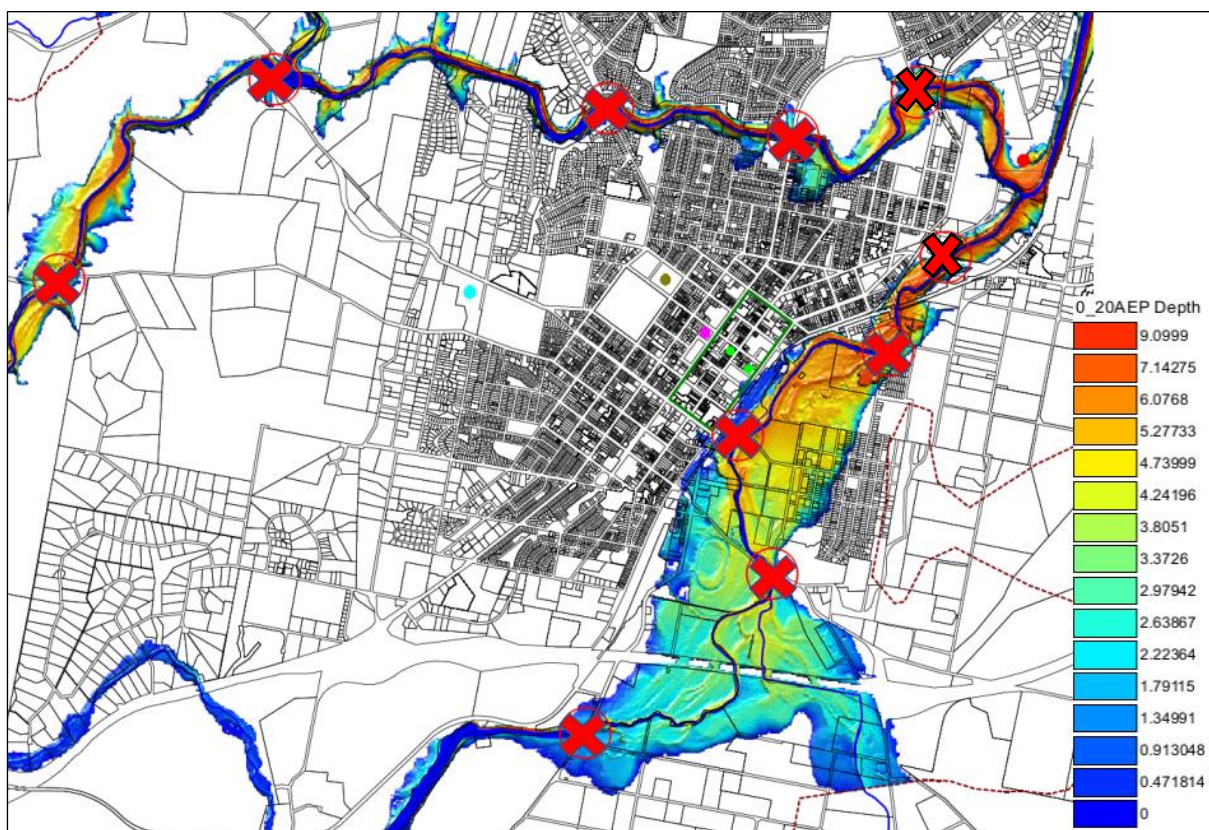


Figure 8: Wollondilly and Mulwaree River Bridges Goulburn – Closures 0.2% AEP

Flash flooding is defined in *Flood Risk Management Guideline AG01* (prepared by the then Department of Planning and Environment) as a *Flood that is sudden and unexpected, often caused by sudden local or nearby heavy rainfall*. It is often defined as *flooding that peaks within 6 hours of the causative rain*.

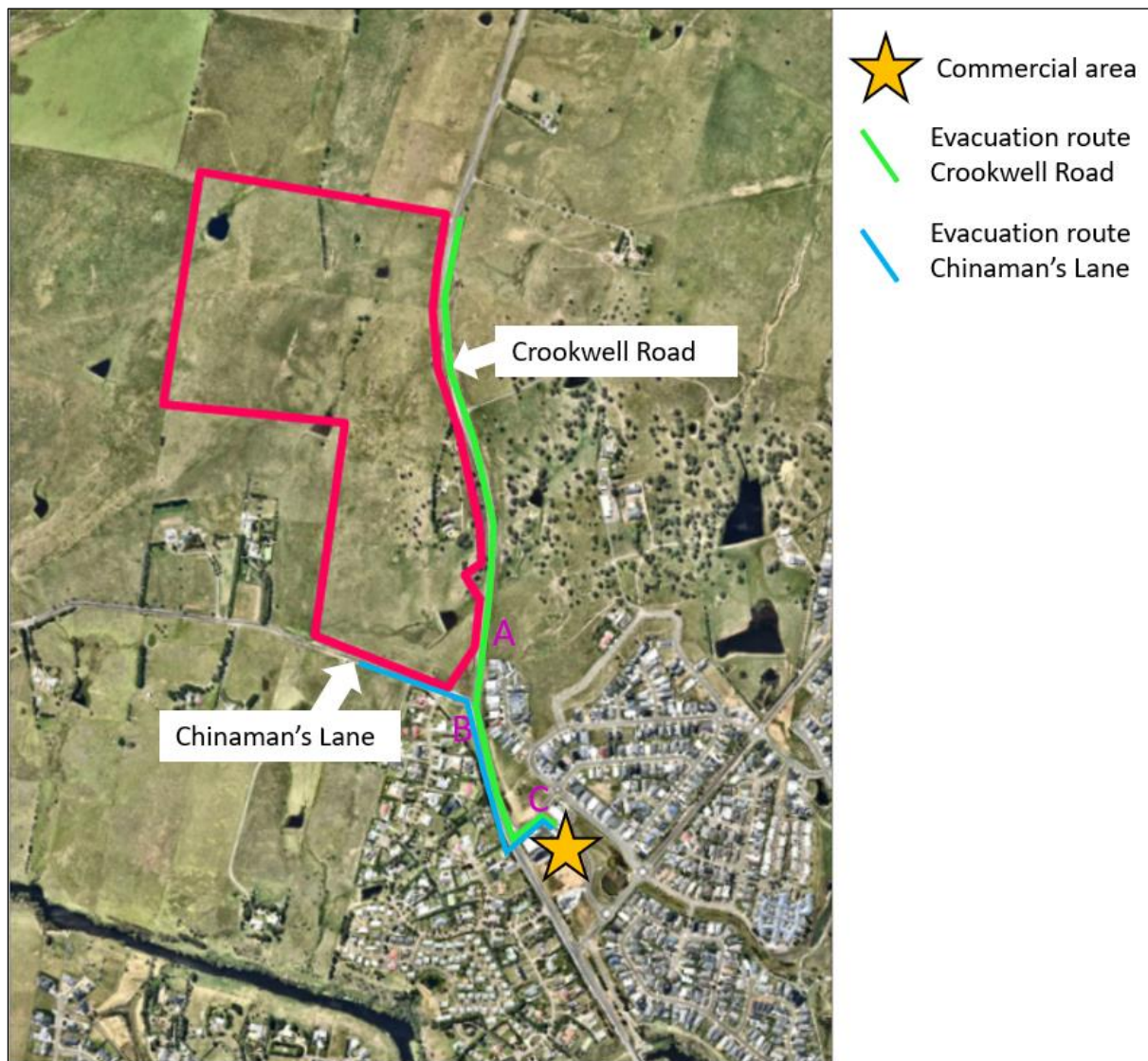
The subject site's elevation varies from 648 - 666 metres, with the Wollondilly River located 16 metres below the lowest elevation of the land. The study area's elevation varies from 648 - 666 metres, with the Wollondilly River located at 632 metres, 16 metres below the lowest elevation of the subject site.



North of Marys Mount Road (and the road itself) is outside of the extent of riverine PMF flood level. Flooding to the north of the river (outside of the major tributaries) is overland flooding and is likely to be characterised as flash flooding (as there will be little to no warning). However, given the relative elevation of the area it is also considered that isolation times outside of riverine crossing points will be of relatively short duration.

## 6. Evacuation Point

The most direct route from the site to a potential evacuation location is from Crookwell Road and Chinaman's Lane (via Crookwell Road) to the Mistful Park commercial area near the intersection of Crookwell Road and Marys Mount Road (380 metres), centred on Box Avenue. This commercial area contains an existing childcare centre, gym/commercial building, car wash and café. Furthermore, a supermarket with medical centre is currently under construction and a site has been approved for a future service station. This commercial area is intended to service the North Goulburn/Sooley precinct and is the most likely source of food or other services during a period of isolation. The following **Figure 9** identifies the evacuation route and destination point, with locations marked A – C where overland drainage results in potential flooding of the road.



**Figure 9:** Evacuation Route- Subject Area to Commercial Area (Box Ave)



**Table 1** below identifies the worst depths and velocities, during a PMF event, in the vicinity of each flood crossing point marked A – C between the site and the new commercial area centred on Box Avenue.

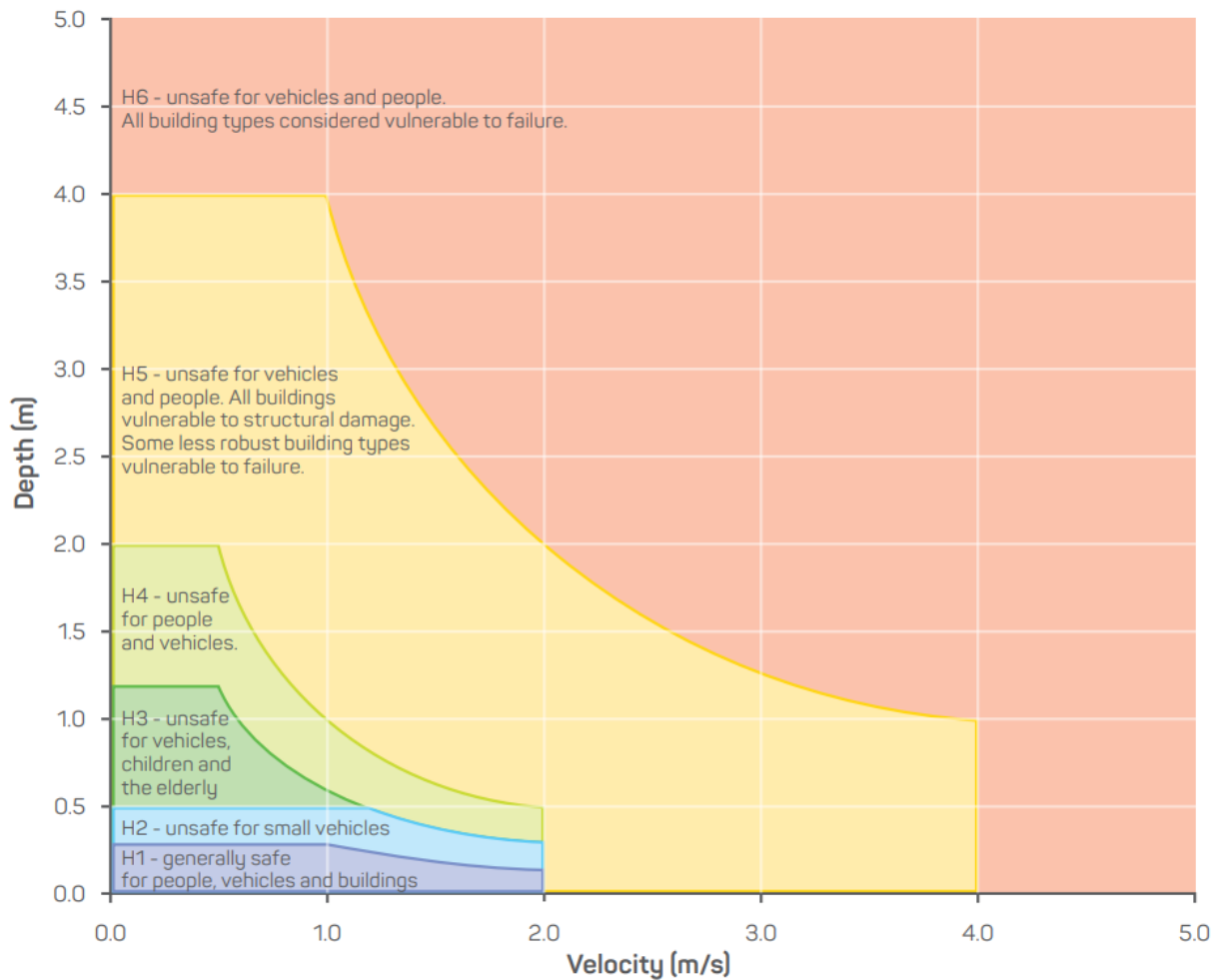
**Table 1:** Overland Flooding Points PMF and Hazard Ratings – Site to New Commercial area.

	<b>A</b>	<b>B</b>	<b>C</b>
Depth (m)	0.264	0.040	0.087
Velocity (m/s)	2.215	1.150	1.559
Hazard Category	H5	H1	H1

The hazard categories used are from the Australian Emergency Handbook 7, with the vulnerability thresholds as specified in **Figure 10** and **Figure 11** below.

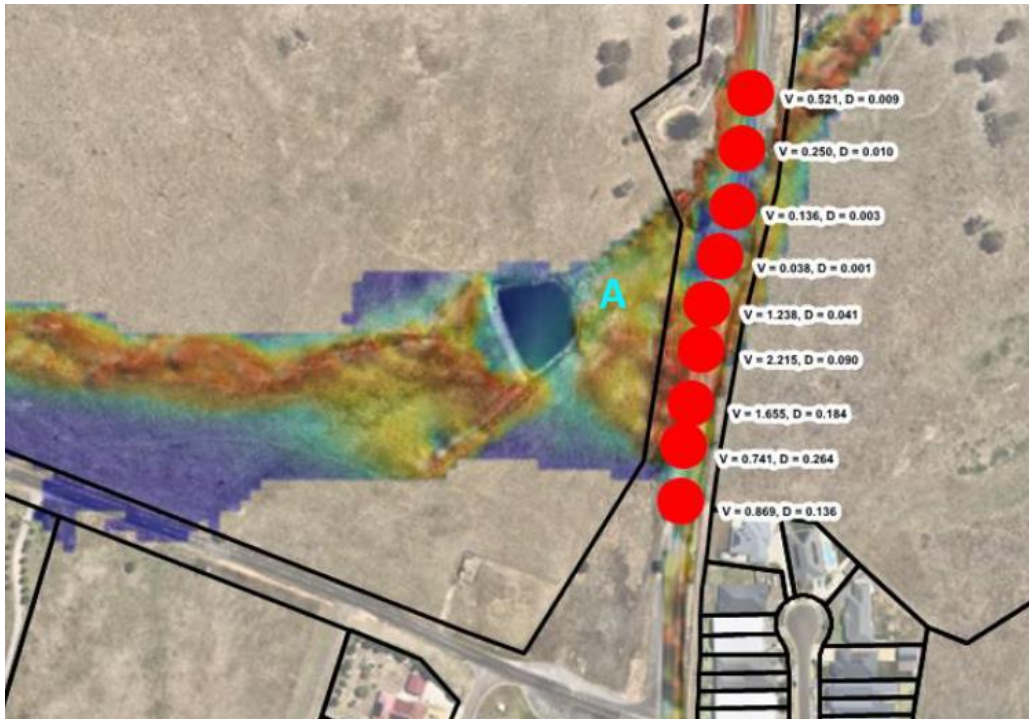
Hazard Classification	Description
<b>H1</b>	Generally safe for vehicles, people and buildings.
<b>H2</b>	Unsafe for small vehicles.
<b>H3</b>	Unsafe for vehicles, children and the elderly.
<b>H4</b>	Unsafe for vehicles and people.
<b>H5</b>	Unsafe for vehicles and people. All buildings vulnerable to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

**Figure 10:** Flood Hazard Vulnerability Thresholds



**Figure 11:** Flood Hazard Curves (Australian Emergency Handbook 7)

The following Council modelling has been applied from Crookwell Road along the site frontage up to the Mistful park commercial area in Box Avenue. See [Figure 12](#) and [Figure 13](#) below. Chinaman's Lane, along the site frontage is minimally flood impacted and is an alternative route for evacuation.



**Figure 12:** PMF Event – Crookwell Road, just north of the Chinaman’s Lane and Crookwell Road intersection. Depths are in metres and velocities are in metres per second.



**Figure 13:** PMF Event- Crookwell Road, just south of the Chinaman’s Lane and Crookwell Road intersection, and Box Avenue. Depths are in metres and velocities are in metres per second.

The modelling shows that for the PMF, depths of flood water over Crookwell Road and Box Avenue do not exceed 26cm at point A, 4cms at point B and 8cms at point C. Therefore, the flood risk for evacuation is low.



It is noted that **Table 1** indicates, at flood crossing point A, a H5 category, by virtue of the velocity of floodwaters. There is an alternative evacuation route via Chinaman's Lane which enables safe evacuation to Mistful Park Commercial Area, without utilising this crossing point on Crookwell Road.

## 7. Warning Times

The concept plan in association with the Council modelling suggests that most parts of the site could achieve access to Crookwell Road and Chinaman's Lane up to a 5% AEP event. For the rest of the site, access is capable of being achieved, subject to engineered designs that would enable access up to and including a PMF flood event, to achieve a low hazard category (for crossing of vehicles).

The precinct is relatively elevated and sits above the flood plain of the Wollondilly River. Drainage corridors on site and along access roads are mostly non – perennial water courses. Whilst some warning may be available for crossing points at the Wollondilly River (where riverine flooding occurs) warning times associated with non-perennial water courses where crossing roads is likely to be short (flash flooding). It is also noted due to the relative elevation of this precinct that durations would be relatively short for isolation within the precinct itself.

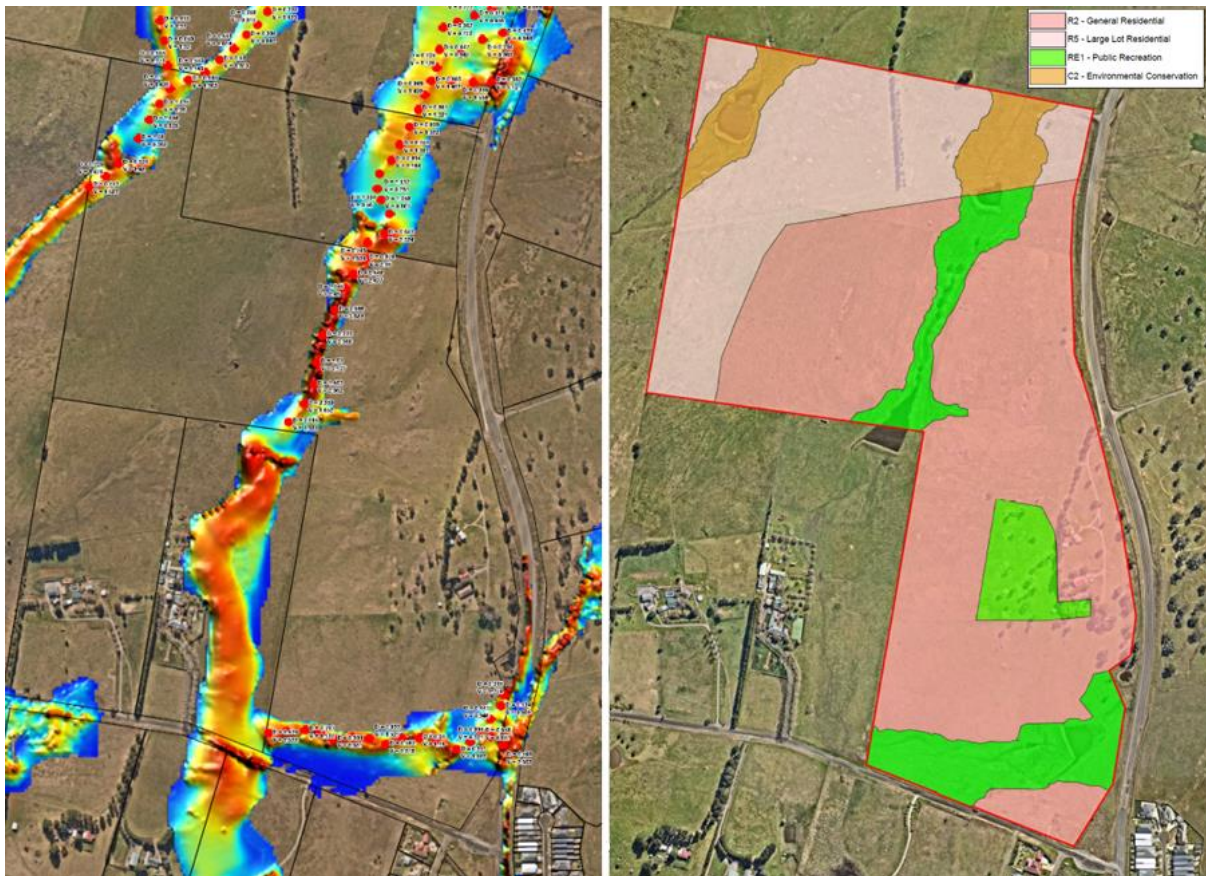
For Crookwell Road and Chinaman's Lane, Council has obtained additional overland flooding information from a flood consultant, including duration information that indicates safe access can be facilitated on these roads, up to and including a PMF event within the least category hazard classification, which is generally safe for vehicles and people. Refer to **Appendix 18**. During a PMF event, water depths are up to 20cms and the warning time is up to 10 minutes, for levels of inundation greater than 0.15 metres. The duration of inundation is 62 minutes. These periods of inundation are very short and despite this, safe evacuation (if required) can be facilitated, given the shallow flood depths.

In summary, the following points are made in relation to evacuation, warning times, isolation, and duration:

- Based on the available overland flood data, access can be achieved to most of the urban zoned lots, up to and including a PMF event.
- Evacuation as per the NSW SES *Goulburn Mulwaree LGA Local Flood Plan* (Refer Section 5.8) would not be required as R2 and R5 zoned land will be outside flood prone areas, up to the PMF.
- The Marys Mount Precinct, being contiguous to the study area, has been identified as an urban release area since 2009 with several large subdivisions under construction.
- This site is contiguous with the Mistful Park urban area, and commercial area which is under development.
- Evacuation (if required) would largely be horizontal – moving across an elevated area above the Wollondilly floodplain.
- The evacuation point to Mistful park commercial area is relatively close to the site (i.e. approximately 380 metres).
- Access can be achieved during a PMF event, for the entire evacuation route, within a low hazard category for people and vehicles.

## 8. Safe Occupation

This planning proposal is seeking the rezoning of part of the existing RU6 Transition zoned site to a residential use. To ensure Ministerial Direction 4.1(2) is satisfactorily addressed and flood prone land is not rezoned from rural to residential, the full extent of overland flow inundation is proposed to be rezoned to RE1 Public Recreation and C2 Environmental Conservation, as explained earlier in this report. The extent is based on a pre development scenario, as illustrated in **Figure 14**.

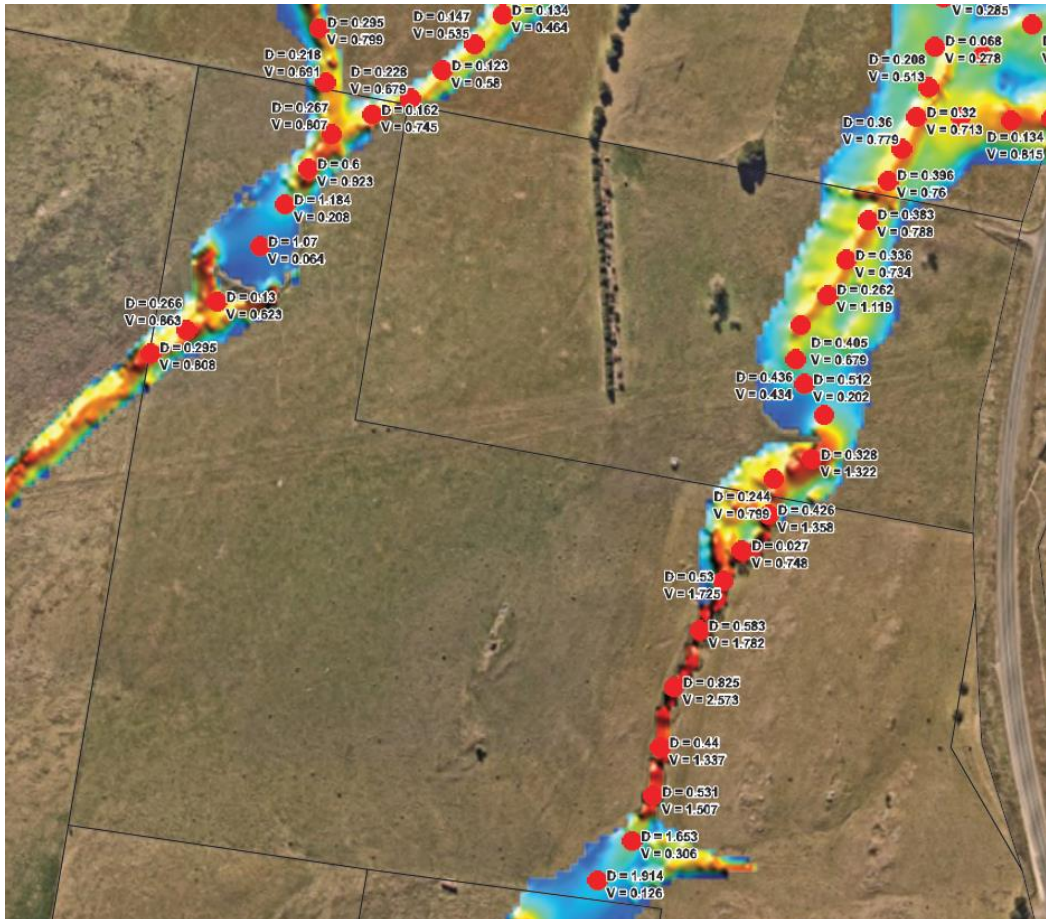


**Figure 14:** Proposed RE1 and C2 zoning and Flood Prone Land (FPCC Categories)

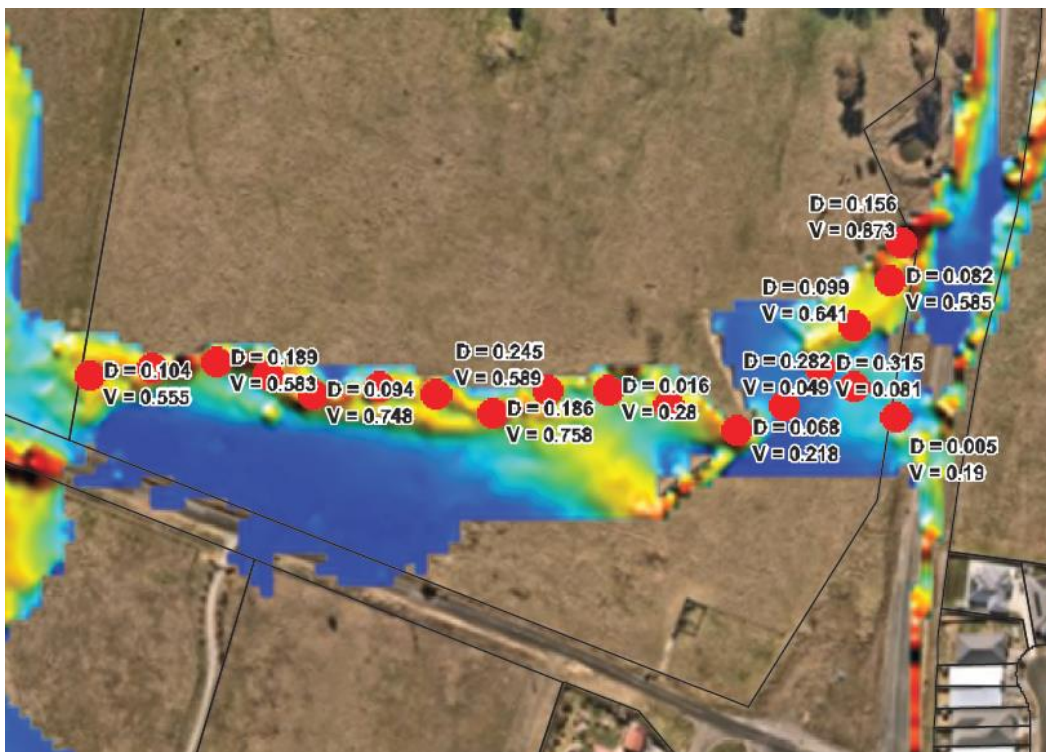
The PMF extent shown on the left hand side in Figure 14 above represents Council's overland flooding data obtained as preliminary data, compiled as part of The Flood Study. There is a high level of similarity between this map and the post- development maps shown in the Localised Flood and Overland Flood Study (Appendix 15b) commissioned by the proponent. The data from this study is presented later in this report.

A more detailed understanding of depths and velocities provided from Council's preliminary overland flood modelling for the 1% AEP are provided in the Figures below.





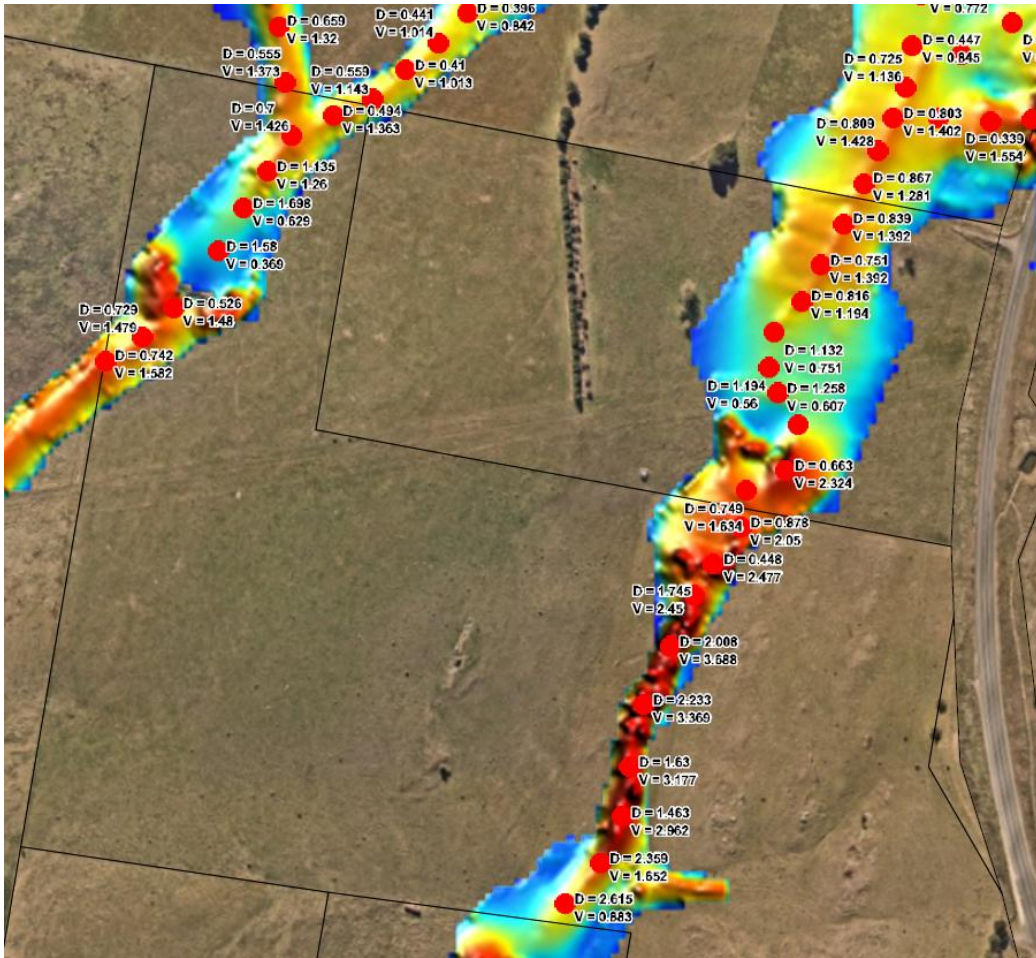
**Figure 15:** Subject Area -1% AEP extent, depths and velocities (northern portion of site)



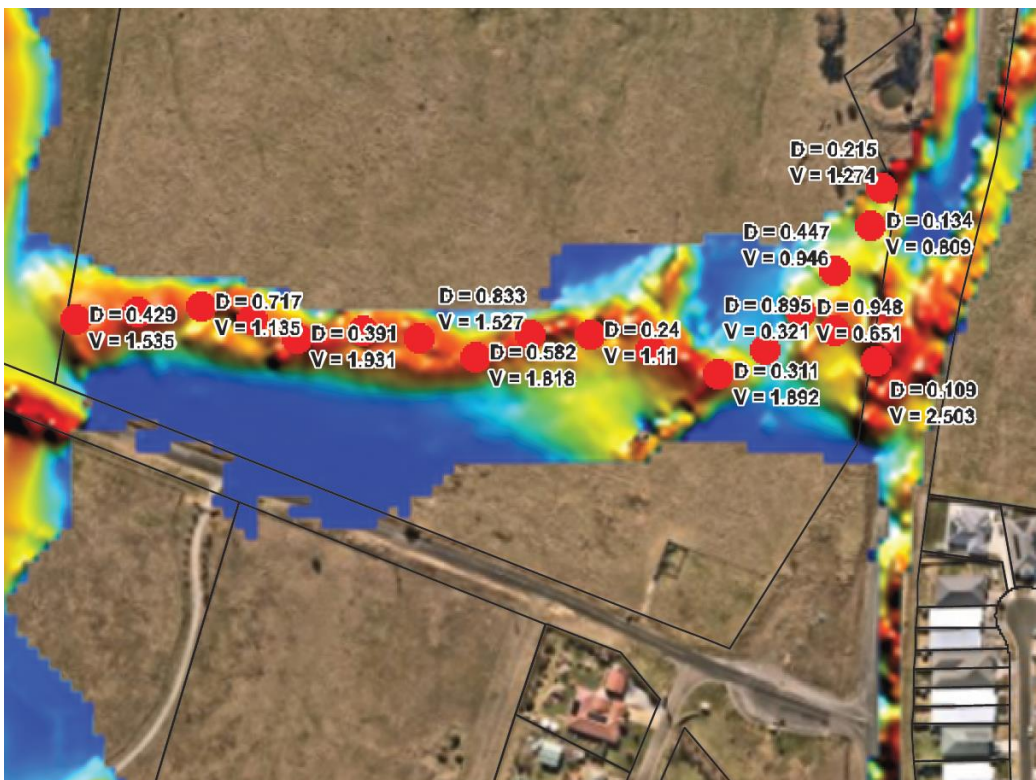
**Figure 16:** 1% AEP extent, depths and velocities (southern portion of site)

The depths and velocities are also provided by the overland flood model for the PMF event as depicted in the Figures below.



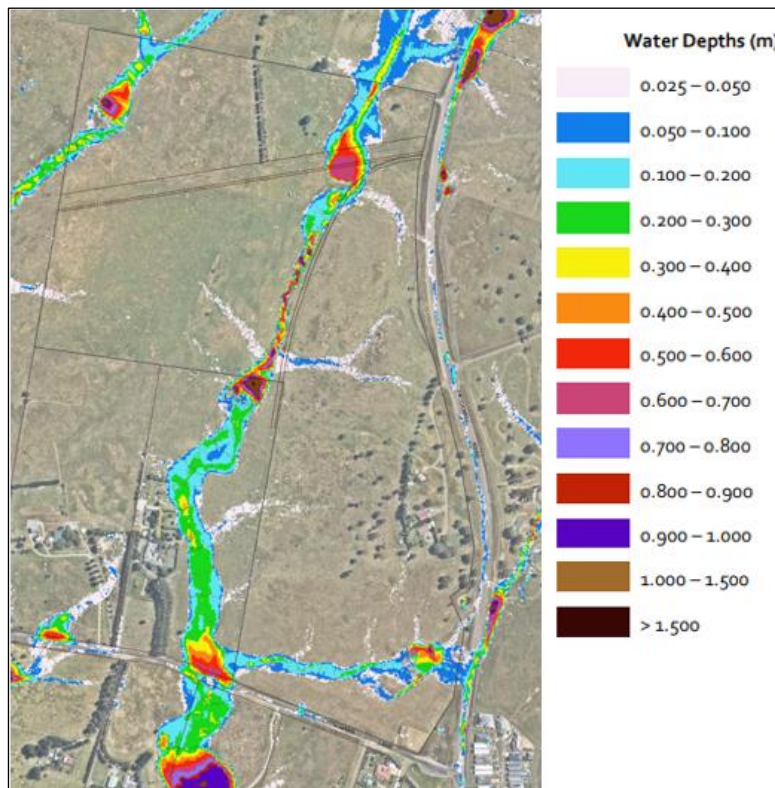


**Figure 17:** Subject Area- PMF event, extent, depths and velocities (northern portion of site)



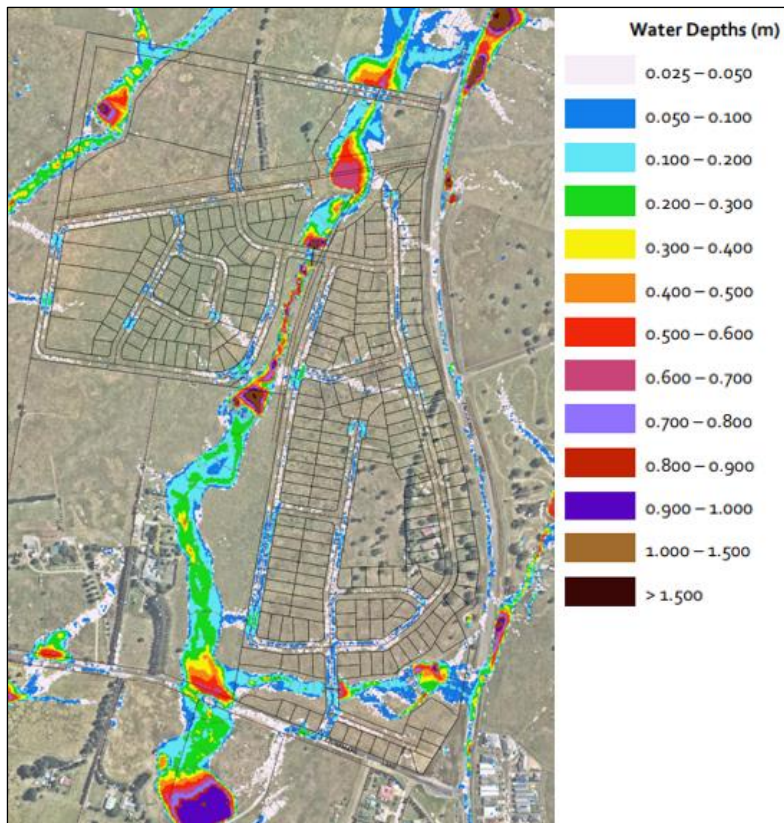
**Figure 18:** PMF event, extent, depths and velocities (southern portion of site)

The submitted *Localised Flood and Overland Flow Study* commissioned by the proponent, modelled pre-development and post development flows for a range of events. The following pre and post development outcomes were modelled for the 1%, 5%, 10%, 0.5%, 0.2% AEP and PMF, and are presented in the Figures below.

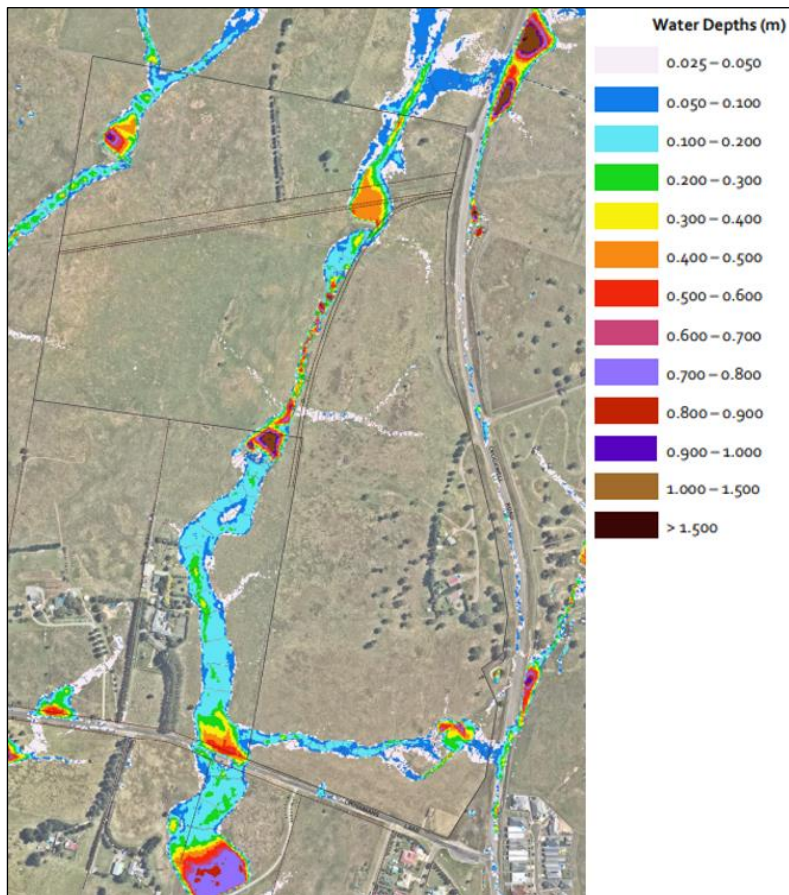


**Figure 19:** 1% AEP Pre-development Depth and Extent



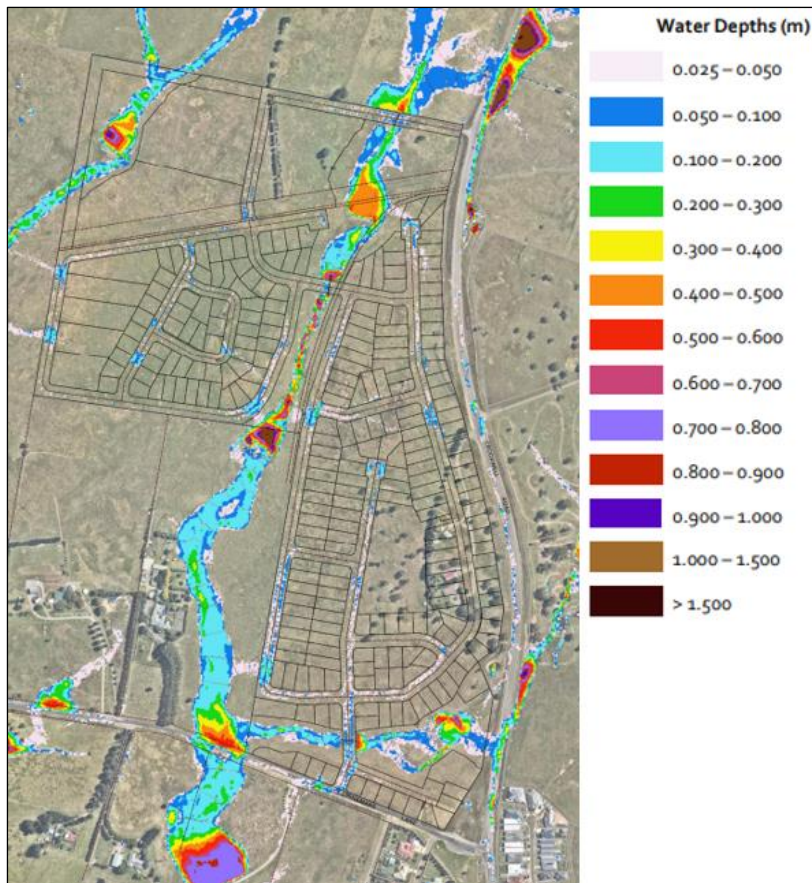


**Figure 20: 1% AEP Post development Depth and Extent**

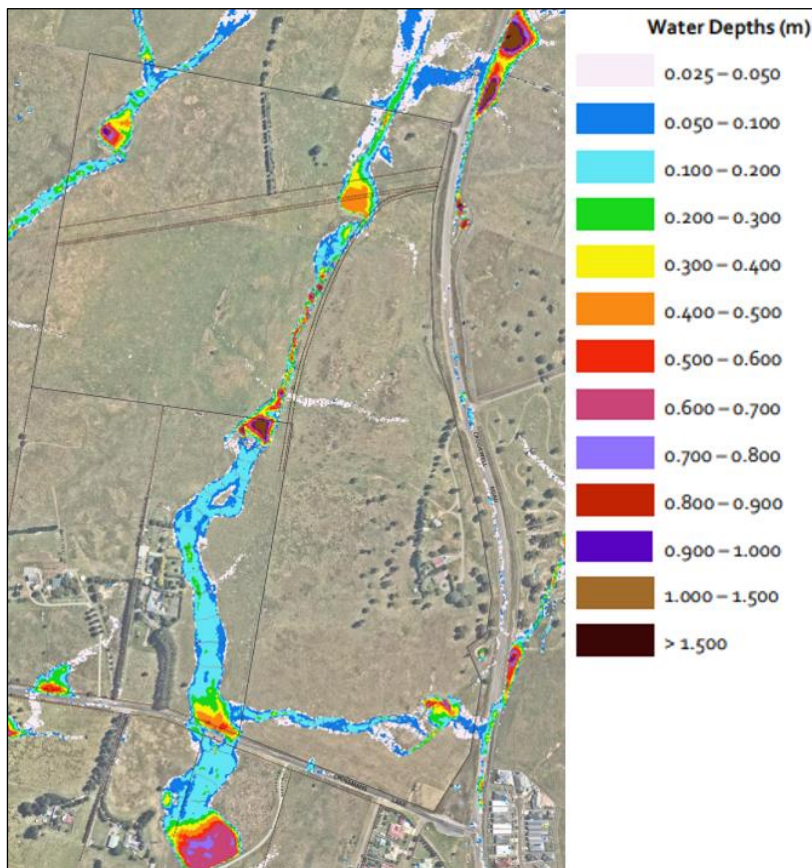


**Figure 21: 5% AEP Pre Development Depth and Extent**

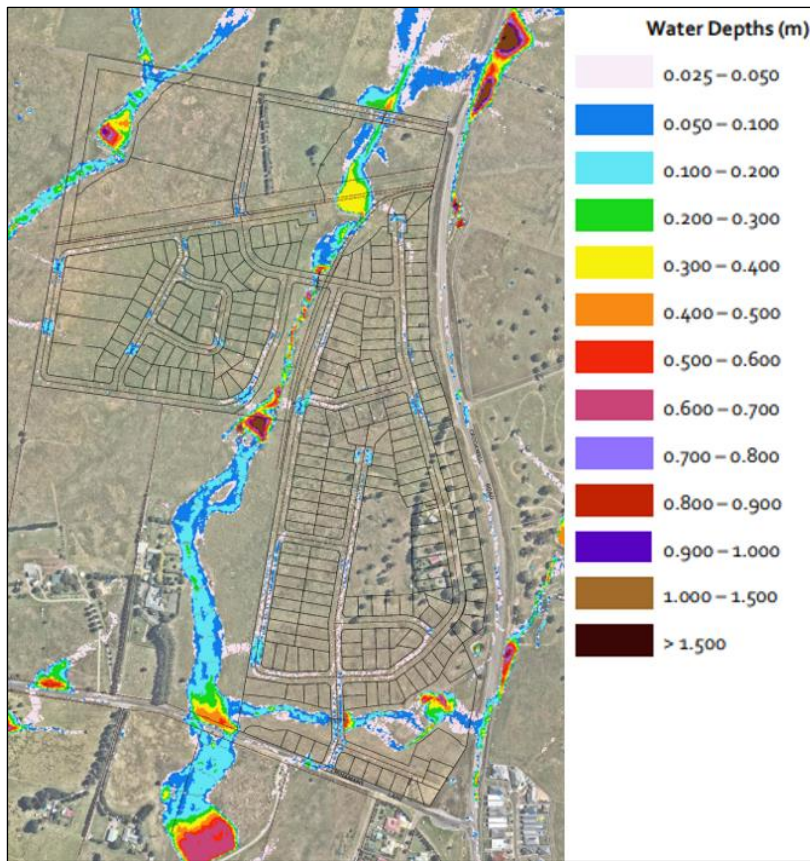




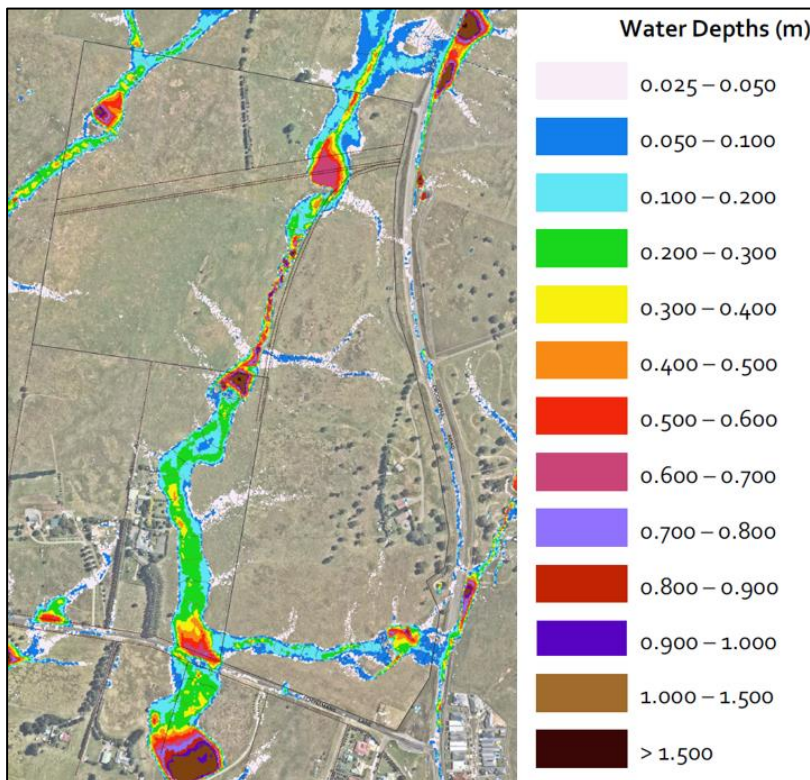
**Figure 22:** 5% AEP Post development Depth and Extent



**Figure 23:** 10% AEP Pre development Depth and Extent

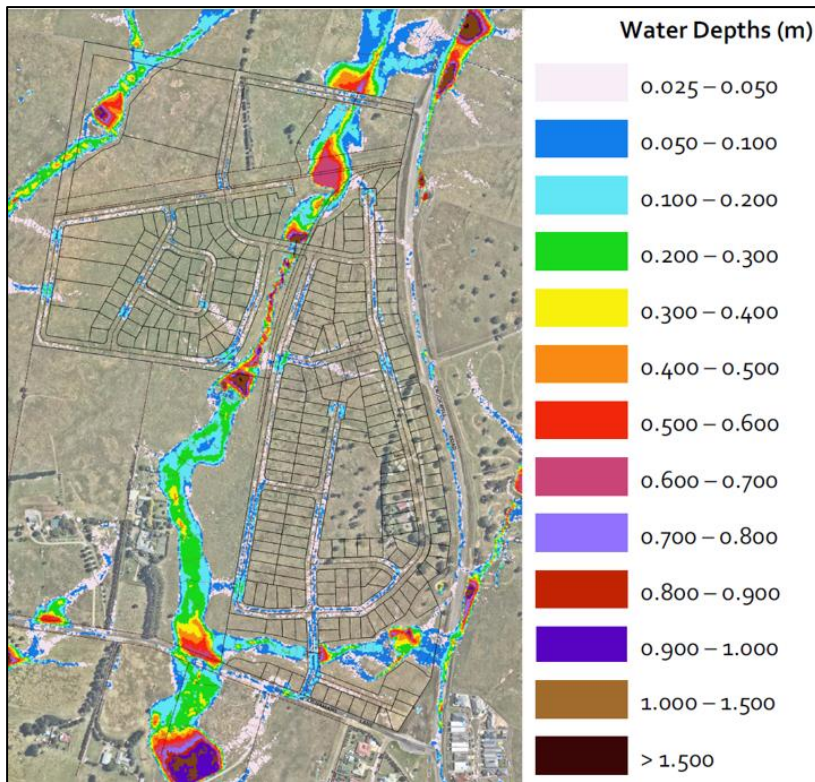


**Figure 24:** 10% AEP Post development Depth and Extent

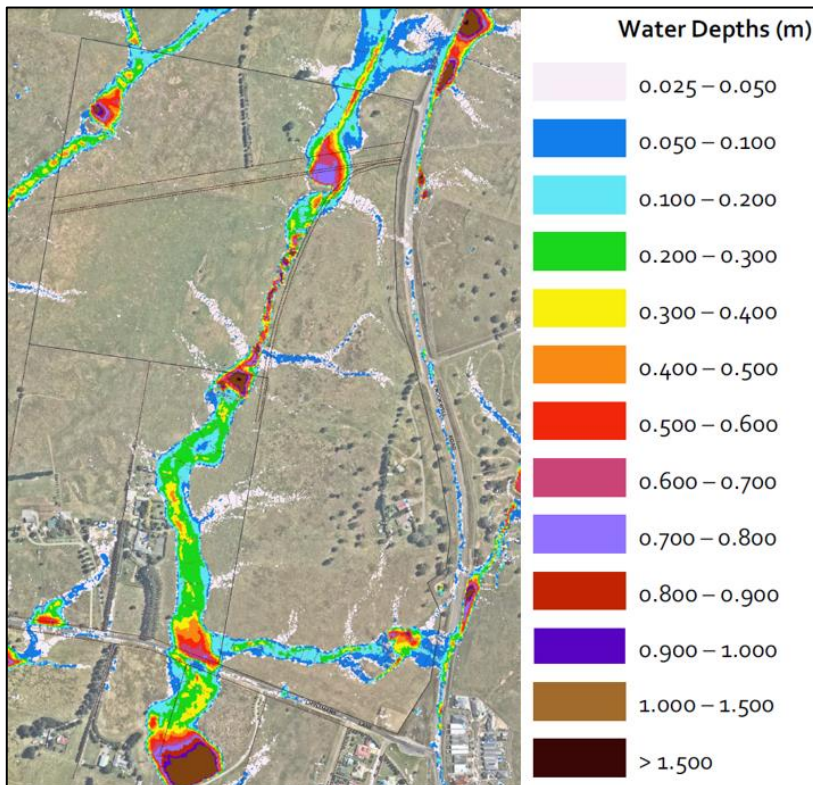


**Figure 25:** 0.5% AEP Pre development Depth and Extent



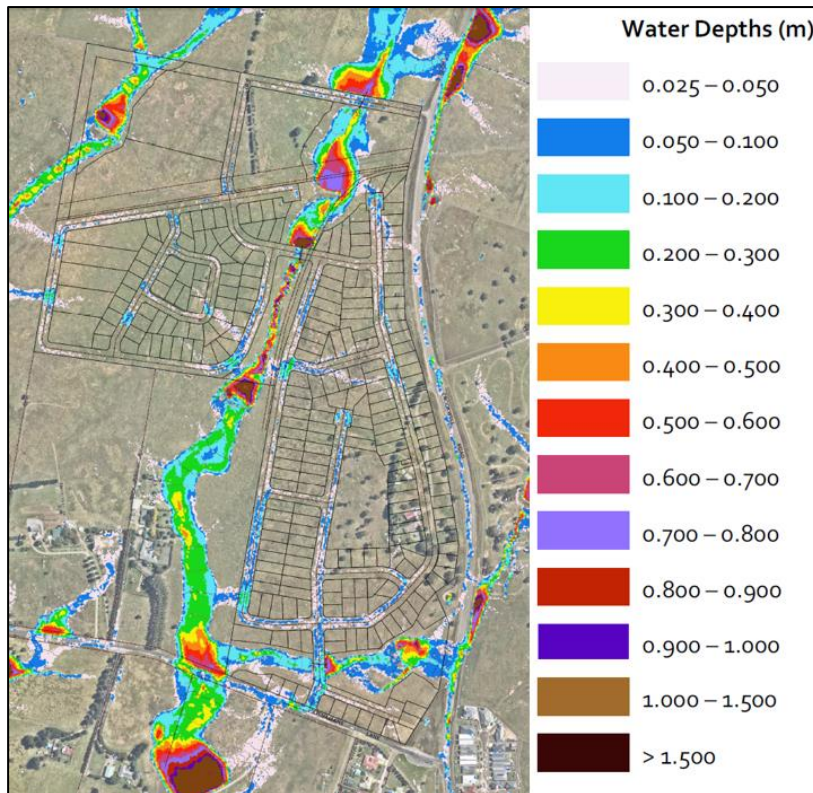


**Figure 26:** 0.5% AEP Post development Depth and Extent



**Figure 27:** 0.2% AEP Pre development Depth and Extent

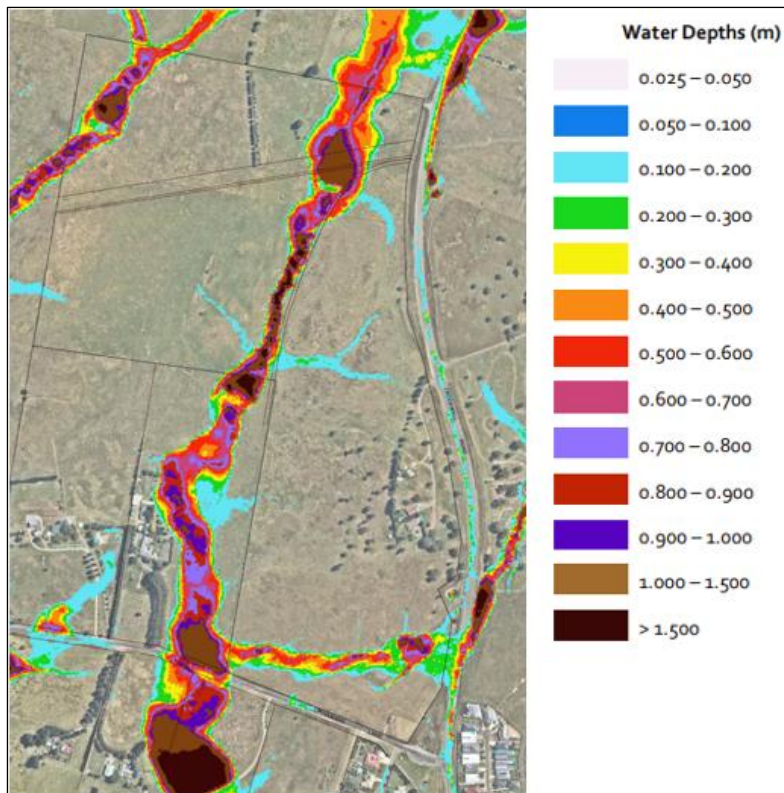




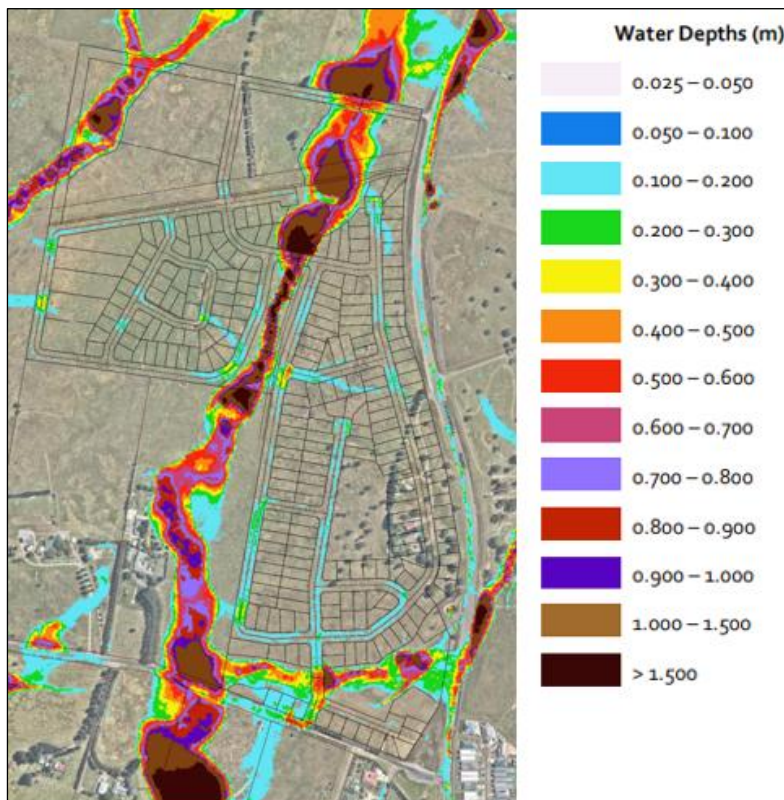
**Figure 28:** 0.2% AEP Post development Depth and Extent

The depths identified for the 1%, 5%, 10%, 0.5% and 0.2% events are shallow, within the low risk H1 hazard category, and safe for people and vehicles.

The PMF pre and post development depths are considered in the Figures below.



**Figure 29: PMF Pre-development Depth and Extent**



**Figure 30: PMF Post-development Depth and Extent**

Depths of overland flow during the PMF event are shallow outside of the channelised areas falling into the lowest hazard category.

It is noted that the modelling includes some land to the north of the site that is not subject to this Planning Proposal (i.e. 515 Crookwell Road) and the PMF post-development model indicates that an increase in flooding is expected immediately downstream of the northern site boundary. There is a Planning Proposal currently being considered (separately) for the northern site and the Flood Impact Risk Assessment (FIRA) submitted for that Planning Proposal includes pre and post development models that demonstrate consistency with the flooding extent and model shown in the submitted *Localised Flood and Overland Flow Study* for the subject Planning Proposal.

The modelling provided for the subject land demonstrates access is capable of being achieved to the proposed residential portions of the site during a PMF event, subject to some future engineering works, including earthworks and formalisation of drainage associated with the subdivision phase. The extent of the PMF is being contained largely within the drainage reserves, i.e. C2 Environmental Conservation and RE1 Public Recreation Zoning, or otherwise low lying waters associated with flash flooding that are capable of being integrated with future roads and other drainage infrastructure.

The submitted *Localised Flood and Overland Flow Study* found:

The post-development modelling undertaken in association with the Study has identified the minimum requirements for road design levels and culvert sizing at the proposed crossing locations, such that 'low-risk' and safe evacuation can be achieved in the design rain events up to and including the 0.2% AEP. This exceeds the minimum requirements of the *GM DCP 2009*, Part 3.8 Flood Affected Lands, Appendix J Flood Policy.

During a PMF it is mainly the sections of the internal road network where they cross the natural drainage lines that issues associated with water depths and flood hazard become apparent.

The design of the internal road network, including the required three (3) crossings over the drainage lines were specifically located at the narrowest section of the drainage line and shallowest depths, to enable suitable road geometry, minimise the amount of civil works required and limit disturbance to the existing overland flow characteristics.

The number and size of box culverts required for each crossing was made suitable to accommodate safe access for flood event including and up to and including the 1% AEP, in accordance with the requirements of the *GM DCP 2009*.

The comparison of the pre and post development modelling (extracts in the above Figures) suggests that the presented concept subdivision does not have an adverse impact on downstream properties. There is little to no change in downstream water levels or extents. It is expected that existing overland flows will be preserved. This is further protected by Council's *Stormwater Drainage and Rainwater Collection Systems Policy* which requires the installation of rainwater tanks, as well as meeting BASIX requirements to assist in managing the peak discharge of stormwater from the site when fully developed.

The Study details that the concept plan has demonstrated capacity, through preliminary modelling undertaken and will not have any adverse post development flooding impacts. Refined future modelling as part of a future Development Application will provide more specific information, particularly in relation to the drainage channel crossings and degree of box culverts required to minimise backwater impacts and minimise disturbance on water flow.

It is noted that the concept design has been altered from that originally submitted to demonstrate capability, however is materially the same as the concept initially submitted with the planning proposal, in terms of the flooding, biodiversity and Aboriginal heritage areas that are proposed to be contained within the C2 and RE1 zones.



## 9. Planning Risk Management Measures – Future Subdivision

As identified in Section 4 of *MM01 – Flood risk management measures*. There are a number of planning measures which can be undertaken to reduce risk, in this case the use of land use zoning and *GM DCP 2009* controls are considered to be an effective means of reducing risk.

As previously outlined the proposed use of the RE1 Public Recreation Zone and C2 Environmental Conservation zone will remove the land that is flood affected. These zones prohibit residential accommodation but allow roads.

The area of land to be zoned C2 Environmental Conservation will not be subject to a minimum lot size and will enable the utilisation of clause 4.1 of the *Goulburn Mulwaree Local Environmental Plan 2009 (GM LEP 2009)*, thereby permitting the subdivision of land where future lots will consist of C2 zone and either R2 or R5 zone.

Furthermore, the *GM LEP 2009* contains the following provisions that relate specifically to flooding:

### 5.21 Flood planning

- (1) The objectives of this clause are as follows—
  - (a) to minimise the flood risk to life and property associated with the use of land,
  - (b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,
  - (c) to avoid adverse or cumulative impacts on flood behaviour and the environment,
  - (d) to enable the safe occupation and efficient evacuation of people in the event of a flood.
- (2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development—
  - (a) is compatible with the flood function and behaviour on the land, and
  - (b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and
  - (c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and
  - (d) incorporates appropriate measures to manage risk to life in the event of a flood, and
  - (e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
- (3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters—
  - (a) the impact of the development on projected changes to flood behaviour as a result of climate change,
  - (b) the intended design and scale of buildings resulting from the development,
  - (c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,
  - (d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.
- (4) A word or expression used in this clause has the same meaning as it has in the *Considering Flooding in Land Use Planning Guideline* unless it is otherwise defined in this clause.
- (5) In this clause—

***Considering Flooding in Land Use Planning Guideline*** means the *Considering Flooding in Land Use Planning Guideline* published on the Department's website on 14 July 2021.

**flood planning area** has the same meaning as it has in the Flood Risk Management Manual.

**Flood Risk Management Manual** means the *Flood Risk Management Manual*, ISBN 978-1-923076-17-4, published by the NSW Government in June 2023.

## 5.22 Special flood considerations

- (1) The objectives of this clause are as follows—
  - (a) to enable the safe occupation and evacuation of people subject to flooding,
  - (b) to ensure development on land is compatible with the land's flood behaviour in the event of a flood,
  - (c) to avoid adverse or cumulative impacts on flood behaviour,
  - (d) to protect the operational capacity of emergency response facilities and critical infrastructure during flood events,
  - (e) to avoid adverse effects of hazardous development on the environment during flood events.
- (2) This clause applies to—
  - (a) for sensitive and hazardous development—land between the flood planning area and the probable maximum flood, and
  - (b) for development that is not sensitive and hazardous development—land the consent authority considers to be land that, in the event of a flood, may—
    - (i) cause a particular risk to life, and
    - (ii) require the evacuation of people or other safety considerations.
- (3) Development consent must not be granted to development on land to which this clause applies unless the consent authority has considered whether the development—
  - (a) will affect the safe occupation and efficient evacuation of people in the event of a flood, and
  - (b) incorporates appropriate measures to manage risk to life in the event of a flood, and
  - (c) will adversely affect the environment in the event of a flood.
- (4) A word or expression used in this clause has the same meaning as it has in the Considering Flooding in Land Use Planning Guideline unless it is otherwise defined in this clause.
- (5) In this clause—

**Considering Flooding in Land Use Planning Guideline**—see clause 5.21(5).

**flood planning area**—see clause 5.21(5).

**Flood Risk Management Manual**—see clause 5.21(5).

**probable maximum flood** has the same meaning as in the Flood Risk Management Manual.

**sensitive and hazardous development** means development for the following purposes—

- (a) caravan parks,
- (b) correctional centres,
- (c) educational establishments,
- (d) emergency services facilities,
- (e) hazardous industries,
- (f) hazardous storage establishments,
- (g) hospitals.

There is no adopted Flood Planning Area (FPA) for this site. In situations such as this the 1% AEP Event plus a freeboard of 0.5m is applied as per Chapter 3 of the *GM DCP 2009* (and Appendix J – Flood Policy). However, the nature of the depth of the PMF on the periphery of the drainage channels would suggest that there is little chance of scaling occurring outside of the PMF extent.

Clause 5.22 of the *GM LEP 2009* is applicable to a future development proposal that is flood impacted, whether or not the use is sensitive and hazardous. Clause 5.22(2)(b) would apply to any Development Application where the assessment process reveals that a flood event would pose a risk to life and requires the evacuation of people or other safety considerations.

Additionally, it should be noted that the *Building Code of Australia (BCA)* specifies minimum floor levels for dwellings, generally being 150mm for slab on ground.

There are four (4) existing farm dams that are to be retained as part of the concept plan, and are included to assist in alleviating adverse stormwater impacts. These dams have been in existence for over 18 years. To safeguard against any potential adverse impact to downstream property from these dams, and ensure the safety of future occupants, development controls will be imposed in the Draft Sooley Precinct DCP to ensure that dams to be retained in a future subdivision proposal are inspected and certified by an appropriately qualified and experienced engineer to ensure that any adverse impacts on downstream residential property is alleviated. If any work is required to be carried out in order to provide engineer certification, that work must be carried out, inspected and certified by an appropriately qualified and experienced engineer.

In summary the main points identified in relation to safe occupation are:

- Where previous concept plans indicated flooding up to and including the PMF, the Planning Proposal has been amended to exclude these areas from residential re-zoning.
- The site is elevated and not affected by riverine flooding.
- Flood affected land will in all events be zoned RE1 Public Recreation and C2 Environmental Conservation. These zones prohibit residential accommodation.
- Flooding is confined to defined overland flow paths. Models undertaken to date have not factored in actual earthworks associated with the subdivision which could further limit extents of small break out areas on the periphery in order to formalise drainage channels.
- Clauses 5.21 and 5.22 of *GM LEP 2009* may be applied.
- The *GM DCP 2009* and Flood Policy will apply to any further subdivision.
- The *GM DCP 2009* requires a FPA of 0.5m (above 1% AEP) for areas not affected by riverine flooding as per current requirements.
- The *BCA* also specifies minimum floor levels for dwellings (regardless of other planning provisions).
- It is considered that the site has the capacity to be developed with all lots having access and dwellings located above flood affected land.
- Controls are imposed in the Draft Sooley Precinct DCP to account for potential impacts from existing dams on future downstream residential property, and ensure safety of occupants.

## 10. Ability of Residents to Be Self Sufficient During Events

Residents would be able to self-evacuate and travel within the precinct subject to some crossing of roads at low hazard categories (H1-H2) in a 1% AEP. During a 1% AEP event,



residents would have access to the Mistful Park commercial area in Box Avenue (the evacuation point).

In relation to self-sufficiency, the proposed sites south of the high-pressure gas main pipeline (i.e. a large majority of the site) are intended to be served by Council's reticulated water and sewer network. Lots north of the pipeline are not to be serviced and future development will require the incorporation of independent water and on-site waste-water management systems. Water provision is gravity fed and given the elevation of the site and proximity to Council's reservoirs; water provision is unlikely to be affected. Furthermore, being located within the Sydney drinking water catchment typically requires the provision of roof water tanks to new dwellings.

Given the relative elevation of the site to Council's sewer system, the provision of sewer is likely to still be available, although there is likely to be no capacity at the Goulburn wastewater treatment plant to treat sewer should it become inundated in a PMF.

## **11. Compatibility with Emergency Response Plans**

The context of flooding on the site as already discussed would suggest that evacuation generally as per the NSW SES *Goulburn Mulwaree LGA Local Flood Plan* (Refer Section 5.8) would not be required. Dwellings will not be inundated; therefore, evacuation would not be desirable as per the Local Flood Plan, unless due to a medical event.

## **12. Additional Impact on Emergency Services**

As discussed earlier, the site is contiguous to the Marys Mount Precinct and Mistful Park commercial area. This commercial area is partially developed and the *GM DCP 2009* contains provisions for specific uses to be included to provide for the needs of residents. Development Consent has been issued for all required uses identified and construction has commenced.

The site is within an elevated precinct above the riverine flood plain of the Wollondilly River. Safe occupation of dwellings is achievable during all flood events including the PMF. Therefore, no evacuation is required except during a medical emergency.

It is noted that emergency services are located in central Goulburn (south of the Wollondilly River) including NSW Police, Goulburn Base Hospital, NSW Ambulance.

The new SES Operations Centre is located on the northern side of the Mulwaree (Hetherington Street) and is further separated from the central section of Goulburn, noting Sydney Road is cut off during a PMF event.

Some NSW Police support may be available in association with the Police Academy which is located on the northern side of the Wollondilly River.

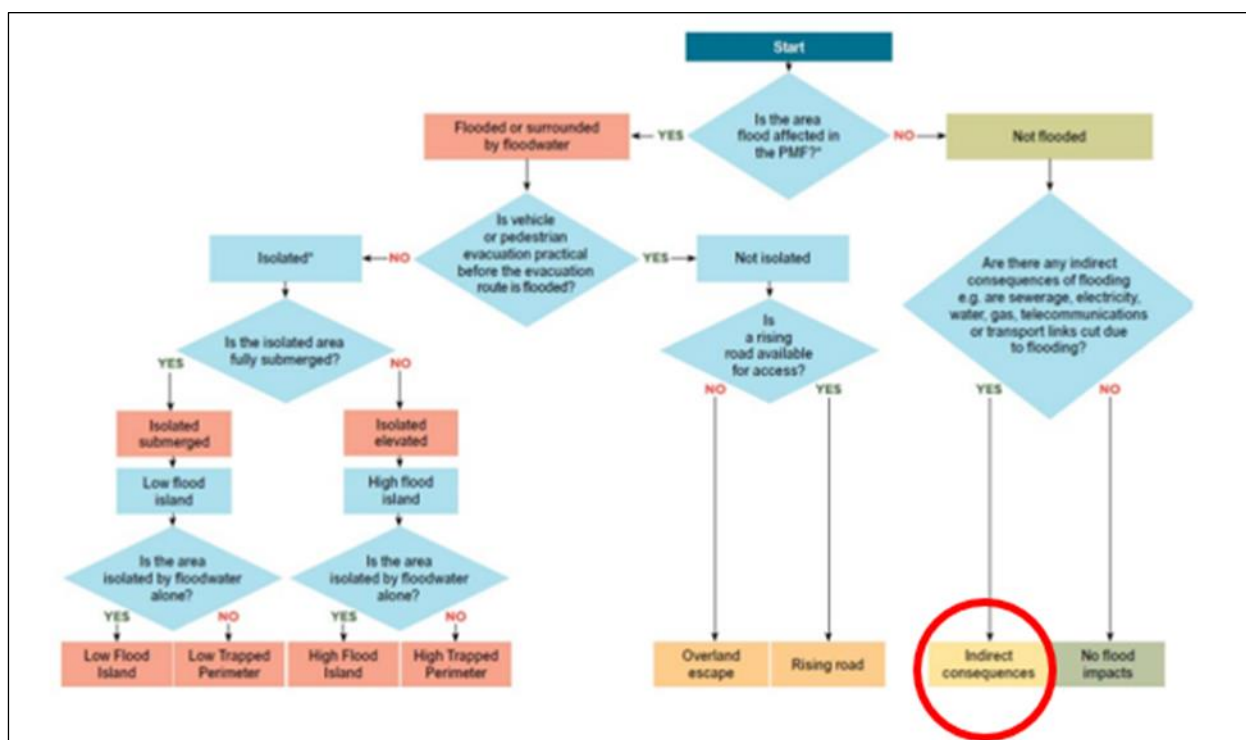
## **13. Conclusion**

The application of the RE1 Public Recreation zone and C2 Environmental Conservation zone, the potential for additional earthworks to formalise drainage corridors to within the RE1 zone extents, the application of clauses 5.21 and 5.22 of the GM LEP and a 0.5m FPA as per the

GM DCP 2009 and Flood Policy are mitigations to avoid adverse risk from overland flooding. The development of flood free areas above the PMF for dwellings and most of the road network on this site is considered achievable.

This part of the Sooley Precinct is located above the Wollondilly floodplain and is therefore not subject to riverine flooding. The area would be cut off from central Goulburn in a 0.20% AEP Event. However, there are sufficient services available in the Mistful Park commercial area to meet the needs of residents if access south of the Wollondilly River is not possible.

The mitigations identified in this FIRA, if implemented, would result in indirect consequences only applying to this site due to flooding. Once the mitigations are in place, the hazard classification following the development process (refer [Figure 31](#)) would result in an improved outcome i.e., the site being not flooded with indirect consequences as per [Figure 31](#) below.



**Figure 31:** Flood Emergency Response Classifications – Post Mitigations Identified in this FIRA

In summary, the Planning Proposal demonstrates consistency with all the requirements of Direction 4.1 as demonstrated in [Table 2](#) below.

**Table 2:** Table summarising compliance with Ministerial Direction 4.1 Flooding

Ministerial Direction	Summary of compliance
Direction 4.1(1) and (5)	<p>The Planning Proposal is consistent with the Policy, Guideline and Manual as referenced in this Direction, and the Goulburn Mulwaree Development Control Plan (DCP) Chapter 3.8 Flood Affected Land, guided by the Goulburn Floodplain Risk Management Study and Plan 2022.</p> <p>All residential zoned land is flood free and therefore can accommodate a future dwelling and ancillary development within</p>

	<p>flood free land. Shelter in place can be safely facilitated.</p> <p>Evacuation (if required) can be facilitated within hazard classification H1, up to and including a 0.05% ARI flood.</p>
Direction 4.1(2) and (3)	<p>Overland flood prone land does not form part of The Flood Study, and therefore, there is no defined FPA. However, there are provisions within Chapter 3.8 of the DCP that apply to areas outside The Flood Study.</p> <p>All flood prone areas up to and including the PMF will be zoned to restrictive C2 Environmental Conservation or RE1 Public Recreation. These land use zones do not permit any residential accommodation and ancillary development. Permissible land uses are very limited.</p> <p>In addition to the above, the <i>Goulburn Mulwaree Local Environmental Plan (LEP)</i> contains provisions to safeguard against any future adverse impacts on flood behaviour, the safety of people, and the environment. There are also provisions in place for sensitive and hazardous uses, ensuring that safe occupation and efficient evacuation can be facilitated.</p>
Direction 4.1(4)	<p>The proposal does not seek the uses to which the special flood considerations apply. Flood prone areas within the subject land, up to and including the PMF will be re-zoned to restrictive C2 Environmental Conservation and RE1 Public Recreation thereby significantly reducing the development potential of this land. The provisions of clause 5.21 and 5.22 will further mitigate against any development that will impact on risk to life, impact on safe occupation or adversely impact the environment for example impacts on flood behaviour.</p>



Council considers the flood risk associated with the development of this site to be low and acceptable. All future residential development will be located above the PMF and safe occupation can be facilitated. If required, safe evacuation can occur within a low hazard classification.

It is not expected that there will be potential for increased government spending in the event of a flood, as the risk is low and the ability to shelter in place can be facilitated, as well as the need to evacuate (if required).

A future development proposal for subdivision will be required to further consider how future roads and watercourse crossings will be designed in accordance with the *GM DCP 2009* Chapter 3.8 Flood affected lands. This will include the consideration of detailed engineering designs.

## 14. Appendices

Appendices included within this planning proposal are listed in the table below:

<b>Appendix 1</b>	Exhibition version Planning Proposal 407 & 457 Crookwell Road
<b>Appendix 2c</b>	Updated concept subdivision plan
<b>Appendix 15a</b>	Localised Flood and Overland Flood Study
<b>Appendix 15b</b>	Updated Localised Flood and Overland Flow Study dated 10 December 2024
<b>Appendix 18</b>	North Goulburn Planning Proposals- overland flooding affectation of roads