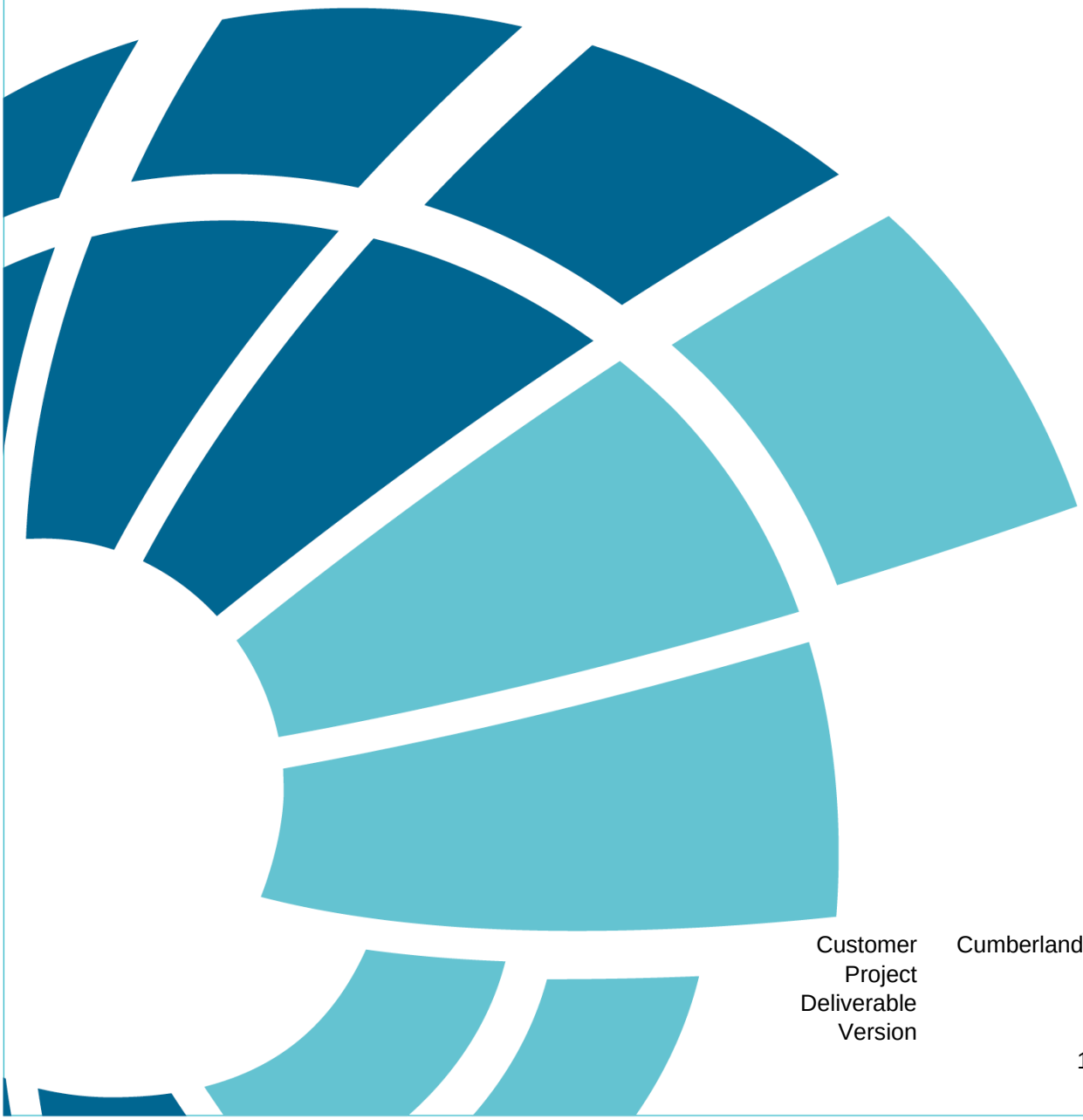
BURNETT STREET NEIGHBOURHOOD CENTRE PLANNING PROPOSAL FLOOD ASSESSMENT



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Author	Kieran Smith, Lorena Woortmann
Checked By	Owen de Jong
Project Manager	Kieran Smith

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1 Introduction

1.1 Background

The existing Burnett Street Neighbourhood Centre is a cluster of 18 lots centred around the intersection of Merrylands Road, Fowler Road and Burnett Street in Merrylands located in the Cumberland Local Government Area (LGA). Covering an area of 9,924m^2 and zoned E1 Local Centre, the lots are comprised of a mixture of convenience, retail and service based shops. Cumberland City Council have identified the existing Burnett Street Neighbourhood Centre as an area for potential development due to the Site's high amenity location, and are currently developing a planning proposal with the aim of expanding the Site's boundary to include 3 additional lots and to deliver changes to planning controls including height, floor space ratio and zoning across the whole area. The proposed development area encompasses the existing Burnett Street Neighbourhood Centre, 2 Ruth Street, 6 Burnett Street, and 2 Fowler Road (herein collectively "the Site".)

The Site is surrounded predominantly by existing residential development, with a large public recreation area to its north-east. The proposed development at the Site is divided into 3 sub-sites, Site 1A (lots bounded by Burnett Street to the east, Kiev Street to the west, and Merrylands Road to the south), Site 1B (lots bounded by Ruth Street to the west, Merrylands Road to the north, and Fowler Road to the east), and Site 1C (lots bounded by Fowler Road to the west and Merrylands Road to the north). The proposed Site layout is shown in Figure 1.1. 2 Ruth Street, 6 Burnett Street, and 2 Fowler Road are marked in blue.

Figure 1.1 Proposed Site Layout (NSW SixMaps)

The Study Area is subject to the Cumberland Local Environment Plan (CLEP) 2021. Under the current CLEP, the Site is designed predominantly as E1 Local Centre, but the planning proposal aims to rezone 2 Ruth Street and 6 Burnett Street from R2 Low Density Residential to E1 Local Centre. The Study Area is located within the Cumberland LGA and subject to the Cumberland Local Environment Plan (CLEP) 2021. Under the current CLEP, the Site is predominantly designated as E1 Local Centre but also includes some R2 Low Density Residential area.

1.2 Description of Existing Site Conditions

The Site lies within the A'Beckett's Creek catchment. Flooding within the catchment is defined by the Holroyd City LGA Overland Flood Study (Lyall & Associates, 2017), the findings of which indicate the Site is affected by overland flows draining to A'Beckett's Creek (located 1.6 km to the east of the Site).

1.3 Proposed Development Framework

Cumberland City Council is preparing an updated planning proposal for the Site with the aim of allowing development to capitalise on the Site's high amenity location to support mixed-use development and to provide around 110 additional dwellings and 15 additional jobs. The updated planning proposal proposes the following:

- Rezone 2 Ruth Street, 6 Burnett Street and 2 Fowler Road from R2 to E1;
- Increase building height at 2 Ruth Street, 6 Burnett Street and 2 Fowler Road from 9m to 17m, and at the remaining lots within the Site from 14m to 17m; and
- Increase floor space ratio at 2 Ruth Street, 6 Burnett Street and 2 Fowler Road as follows:
  - Site 1A – 1.8:1
  - Site 1B – 1.5:1
  - Site 1C – 1.4:1

1.4 Purpose Of This Report

The Site lies within the A'Beckett's Creek catchment and is affected by overland flooding draining to A'Becketts Creek. BMT understands that Cumberland City Council previously submitted a planning proposal for the Burnett Street Neighbourhood Centre in September 2023. In response, the Department of Planning and Environment (DPE) issued a gateway response requesting further flooding analysis and addressing of inconsistencies with Ministerial 9.1 Direction (4.1 Flooding). Accordingly, BMT Commercial Australia Pty Ltd ("BMT") was commissioned to undertake a Flood Impact and Risk Assessment (FIRA) for the proposed works to accompany the Planning Proposal (this report) which documents the methodology and findings of the assessment, including:

- definition of existing (baseline) design flood conditions;
- definition of post-development flood conditions;
- assessment of the potential impacts of the proposed development on existing flood behaviour; and
- preparation of a flood impact assessment report.

2 Existing Flood Behaviour

2.1 Available Flood Studies and Modelling

Overland flooding in the A'Beckett's Creek Catchment was assessed as part of the *Holroyd City LGA Overland Flood Study* (Lyall & Associates, 2017) (hereafter referred as the "Council Flood Study"). A DRAINS hydrologic model and TUFLOW hydraulic model were developed as part of the Council Flood Study and used in this assessment to define historic, existing and future flood conditions within the study area.

2.2 Council Flood Study Model Updates

In order to assess the existing flood conditions at a more localised and detailed scale, modifications were made to the Council Flood Study model to better reflect local, contemporary conditions. This included the following updates for the Site and immediate surrounds.It is noted that the following elements of the modelling were not updated for this assessment:

- Use of AR&R 1987 Data and Methodology
- Temporal Patterns
- Rainfall losses
- Design rainfall
- Blockage
- Hydrologic and Hydraulic model configuration

Refinement of Topographic Data and Manning's Values

Underlying topography within the Council Flood Study was based on Airborne Laser Scanning (ALS) survey captured in April 2013 and 2011 Aerial Photography. As part of this assessment, the underlying topography at the Site and its vicinity were updated based on 2019 LiDAR (with a 1 m resolution) obtained from NSW Government – Spatial Services. The 2019 LiDAR better captures ground levels on and in the vicinity of the Site when compared to Council's Flood Study. Ground elevations on Site range from a low of 26.5m AHD along the northern boundary of Site 1C, towards highs of 28.5 to 29.1m AHD along the western boundaries of Site 1A and 1B.

Mannings's Coefficients were also refined at and in the vicinity of the Site to better represent existing buildings and paved surfaces.

The updated Council Flood Study model, incorporating newer topographic data and refined Manning's Values has been used to define flood behaviour at the Burnett Street Neighbourhood Centre Site and is herein referred to as the 'Existing Scenario' TUFLOW model.

2.3 Existing Flood Conditions

The Existing Scenario TUFLOW model was used to simulate the 5% AEP, the 1% AEP, and PMF Events, and define the on-site flood conditions discussed in this section (see Annex A for mapping). The 0.5% and 0.2% AEP design events were assessed as proxies for potential rainfall increases associated with climate change and are discussed in section 4.2.3 (see Annex D for mapping).

Table 3.1 lists the predicted maximum peak flood level and the location within the Site for each event. Maximum peak flood depths at each site division yielded by the Existing TUFLOW model are listed in Table 3.2. Peak 1% AEP flood levels and depths are shown in Figure 2.1.

Table 2.1 Existing Peak Flood Level (m AHD) – Existing Conditions

Design Flood Event	Peak Flood Level (m AHD) and Location		
	Site 1A	Site 1B	Site 1C
5% AEP	28.1 at the western boundary	28.6 at the western boundary	27.1 at the south-western boundary
1% AEP	28.1 at the western boundary	28.6 at the western boundary	27.2 at the south-western boundary
PMF	28.5 at the western boundary	29.0 at the north-western boundary	27.8 at the south-western boundary
0.5% AEP	28.1 at the western boundary	28.7 at the north-western boundary	27.2 at the south-western boundary
0.2% AEP	28.1 at the western boundary	28.7 at the north-western boundary	27.2 at south-western boundary

Table 2.2 Existing Peak Flood Depth (m) – Existing Conditions

Design Flood Event	Peak Flood Depth (m) and Location		
	Site 1A	Site 1B	Site 1C
5% AEP	0.6 at south-west corner	0.2 at centre-south (between 1E Fowler Road and 2 Ruth St)	0.2 at western boundary
1% AEP	0.6 at south-west corner	0.3 at the existing south-east parking lot	0.3 near north-western boundary
PMF	1.0 at south-west corner	1.1 at the existing south-east parking lot	0.8 at western boundary
0.5% AEP	0.6 at south-west corner	0.4 at the existing south-east parking lot	0.3 at western boundary
0.2% AEP	0.6 at south-west corner	0.5 at the existing south-east parking lot	0.4 at western boundary

2.3.2 Site 1A – Existing Flood Conditions

Site 1A is affected by overland flows draining from the west, along Merrylands Road and through the Site to Burnett Street. Peak flood depths at the Site occur in a sag point on Kiev Road to the west, with other higher depths present along the southern boundary on Merrylands Road. Higher velocities are located along the Merrylands Road corridor for the 5% AEP and 1% AEP event (up to 0.9 m/s in both events)

2.3.3 Site 1B – Existing Flood Conditions

Site 1B is affected by overland flows draining from the south via Ruth Street, through the Site and then onto Merrylands Road. Peak flood depths occur to the south of existing buildings, with higher depths

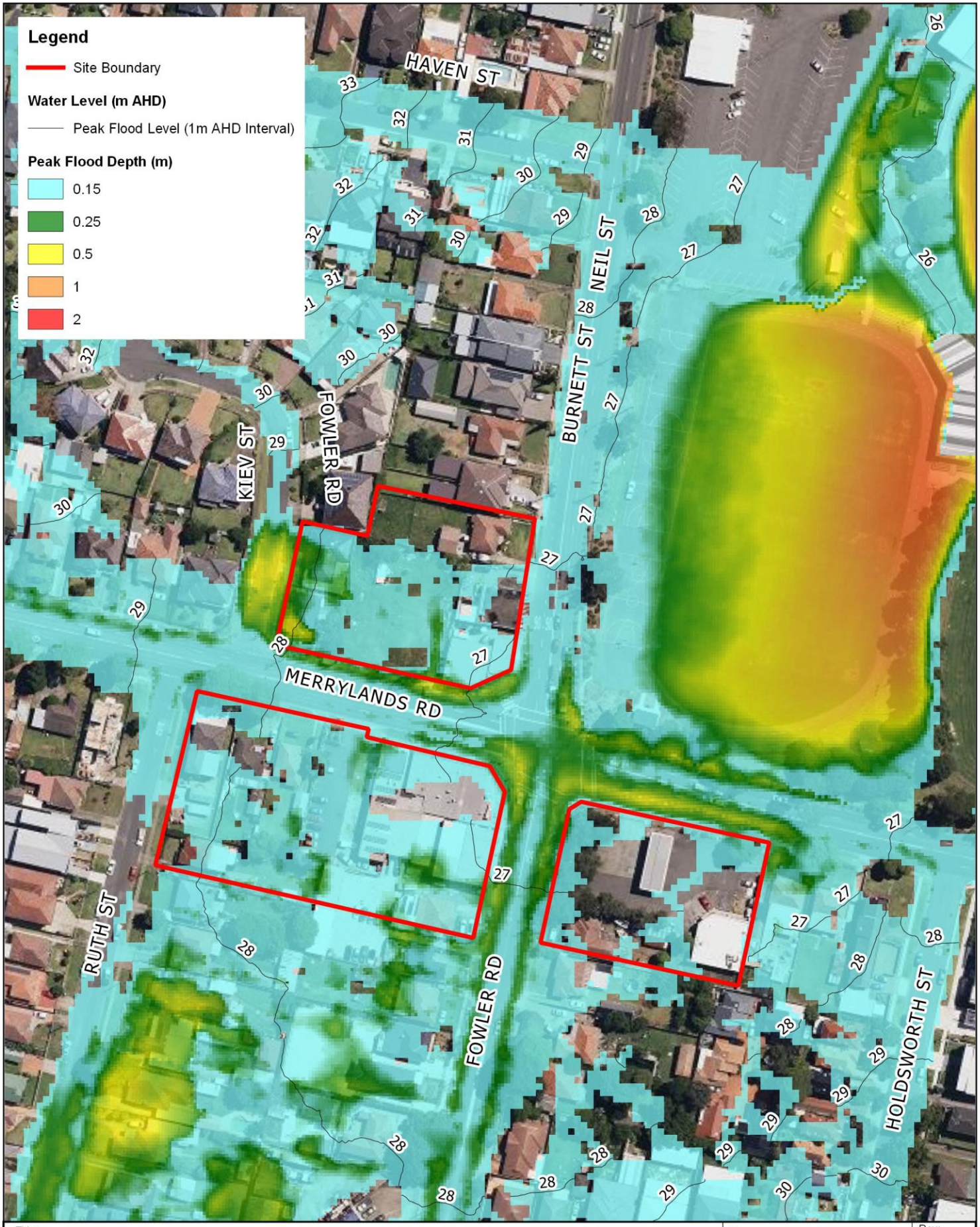
also present on Merrylands Road to the east/north-east of the Site. Higher velocities are concentrated along the eastern boundary on Fowler Road, up to 0.6 m/s in the 5% AEP event and up to 0.8 m/s in the 1% AEP event.

2.3.4 Site 1C – Existing Flood Conditions

Site 1C is minorly affected by overland flows draining along Merrylands Road and Fowler Road. Peak flood depths occur on Merrylands Road to the north of the Site. Higher velocities are concentrated along the western boundary on Fowler Road, up to 0.6 m/s in the 5% AEP event and up to 0.8 m/s in the 1% AEP event.

2.3.5 PMF Flood Conditions

Peak flood conditions scale significantly in the PMF event, as major flowpaths form along both Merrylands Road and Fowler Road. Peak flood depths of up to 0.9 m occur across the 3 sub-sites, with peak flow velocities of up to 3 m/s present along the road corridors.



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Existing 1% AEP Peak Flood Levels and Depths

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3 Post-Development Flood Behaviour

3.1 Model Updates

The proposed development comprises the following works at the Site:

- Clearing of the existing buildings on the three sub-sites
- Construction of three new buildings; and
- Associated infrastructure.

The proposed building extents was incorporated into the Existing Scenario TUFLOW model, and this modified version of the model is referred to as the Post Development Scenario TUFLOW model. The proposed works are shown in Figure 3.1.

Figure 3.1 Proposed Development Works

3.2 Potential Flood Impacts

The Post-Development Scenario TUFLOW model was used to simulate the 5% AEP, 1% AEP and PMF events. Post-development scenario conditions for all events are shown in Annex B.

Modelling results were used to assess and map the relative flood impacts of the proposed development (i.e. peak flood levels from the post-development scenario minus peak flood levels from the existing scenarios).

4.2.1 Peak Flood Level Impacts

Peak 1% AEP flood level impacts shown in Figure 3.2 indicate the proposed development will partially block overland flows draining north-east through the Site, resulting in off-site flood level increases. These increases are most prominent to the south of Site 1B where the development will result in peak flood level increases to private properties in that region.

The proposed development works will also result in peak flood level increases along Fowler Road, Burnett Street and Merrylands Road. It is noted that these increases are localised, proximate to the Site boundary, minor in scale and occur in low depth and velocity areas. Peak flood level increases to roadways or on other land owned by the Council could be considered acceptable for this development given the potential benefits to the community that the proposed works will have within the Study Area and the LGA: providing they do not lead to an increase in flood hazard, as is the case for this development.

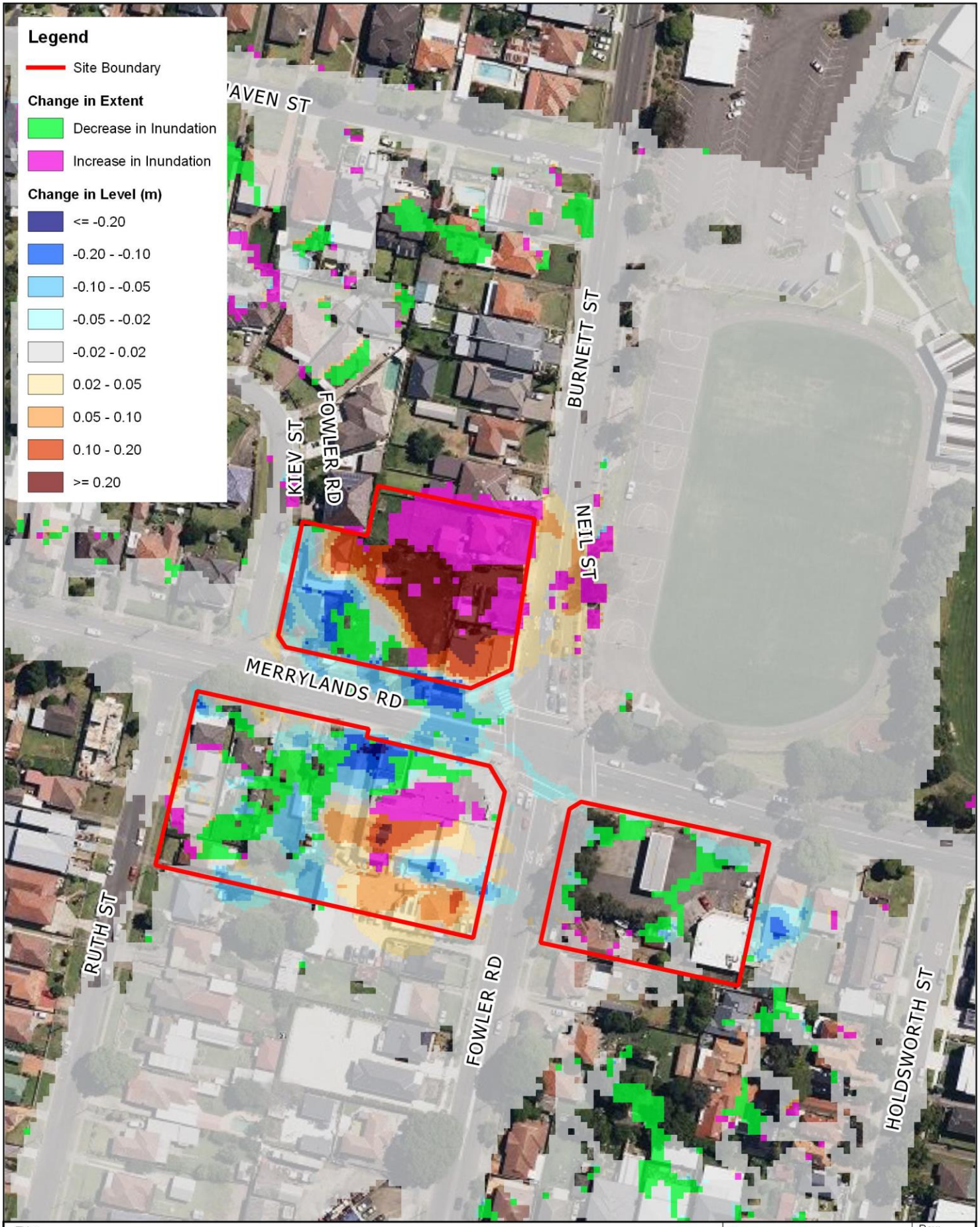
A mitigation scenario has been modelled (see Section 3.5) in order to provide a potential design modification that would further reduce off-site flood level increases in the 1% AEP event should this be required.

4.2.2 Peak Flow Velocity Impacts

Peak 1% AEP flood velocity impacts shown in Figure 3.3 indicate the proposed development works will result in minor re-distribution of velocities on Site and no velocity increases off-site.

4.2.3 Climate Change

Modelling of the 0.5% AEP and 0.2% AEP flood events has been undertaken as part of this assessment as a proxy for potential increases to rainfall intensity associated with climate change. As outlined in Table 2.1 and Table 2.2, minor increases to peak flood conditions would be expected to occur as a result and increase to rainfall intensity.



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Peak Flood Level Impact - 1% AEP Event

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Peak Flood Velocity Impact - 1% AEP Event

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3.3 Flood Hazard

The best practice flood risk management approach to flood hazard mapping (AIDR, 2017) classifies the floodplain into the six distinct hazard classifications (H1 to H6) shown in Table 3.1. These hazard classifications are based on adopted thresholds of flood depth, velocity and depth-velocity product that identify when flood conditions are likely to present a risk to people, vehicles and buildings. A description of each hazard threshold is provided in Figure 3.4.

Table 3.1 Flood Hazard Classification Thresholds (AIDR, 2017)

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

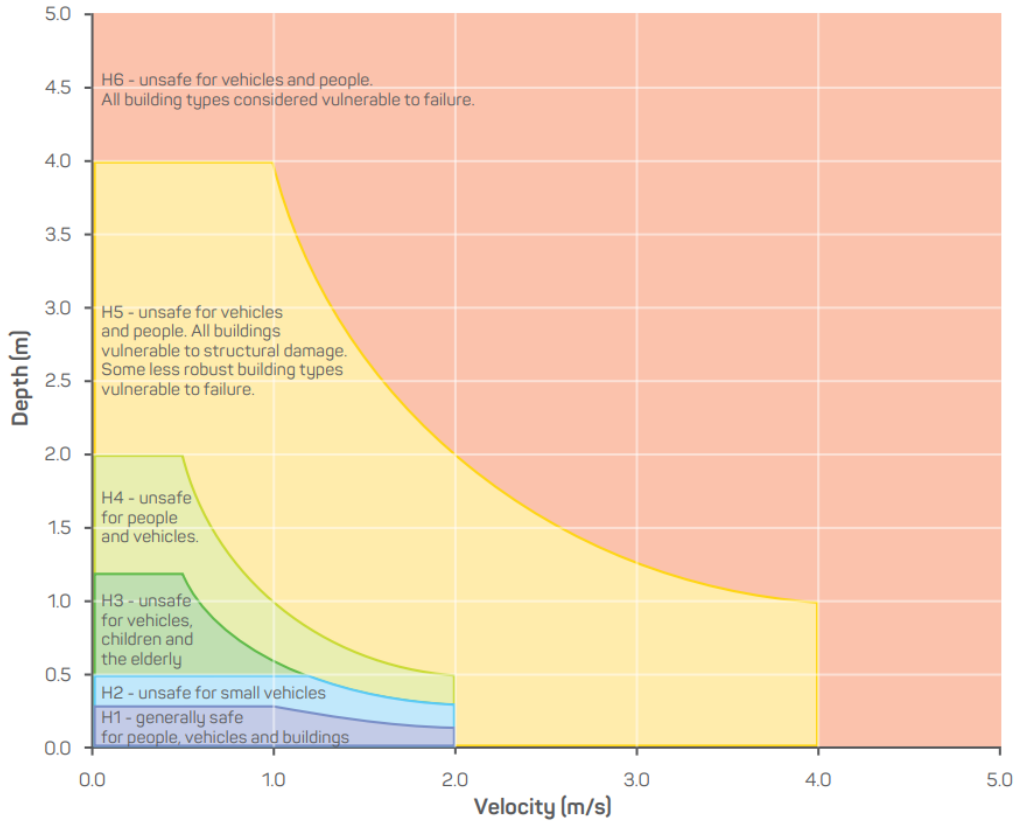
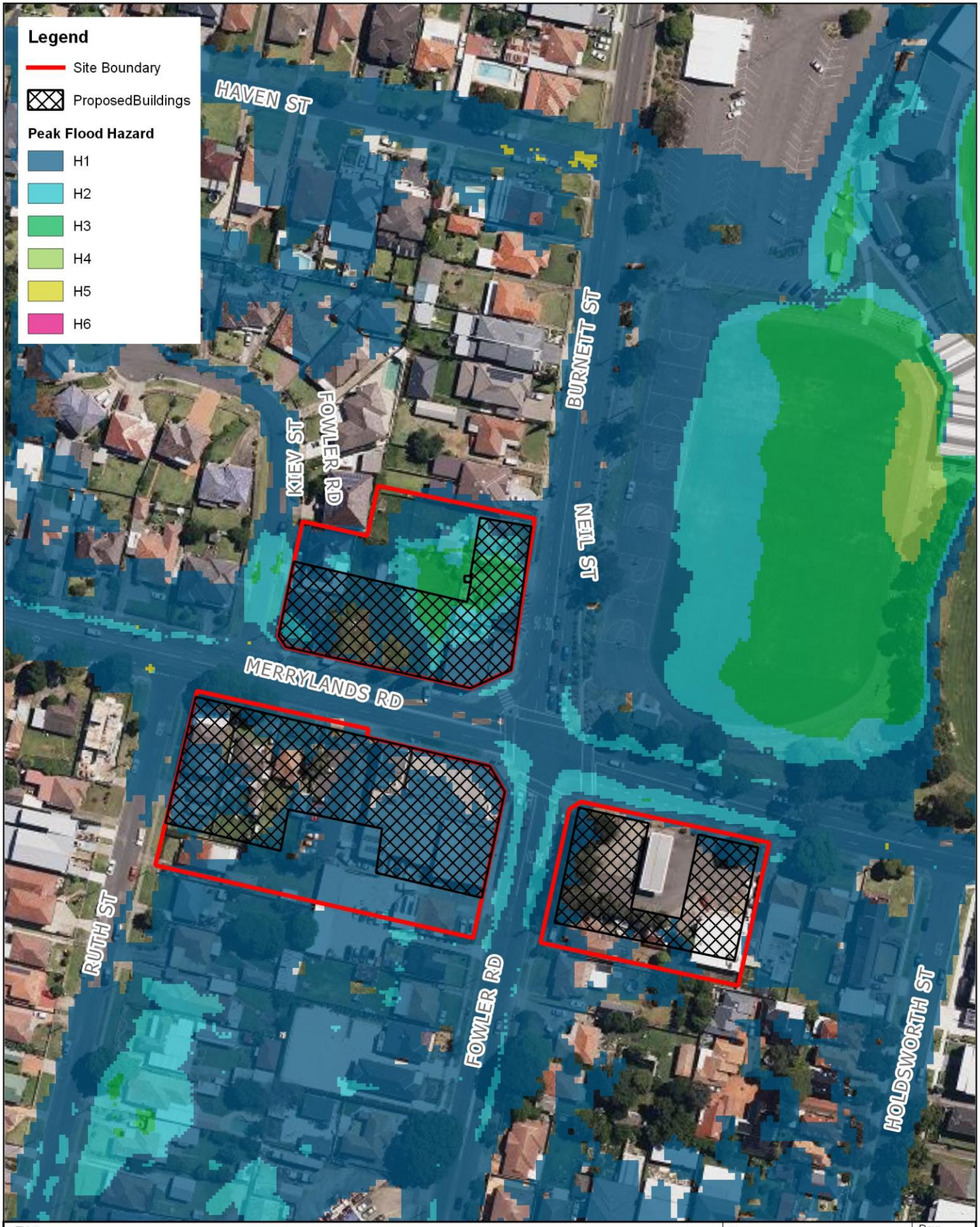


Figure 3.4 Flood Hazard Curves (AIDR, 2017)

As shown in Figure 3.5, post-development scenario modelling results indicate a 1% AEP flood hazard classification of H1 to H3 (i.e. unsafe for vehicles, children and the elderly) at Site 1A and hazard classification of H1 (i.e. generally safe for vehicles, people and buildings) at Site 1B and Site 1C. Classifications along Merrylands Road, Fowler Road and Burnett Street under post-development conditions are typically H1-H2, indicating conditions that may be unsafe for small vehicles. Post-development conditions are very similar to existing conditions.

As shown in Figure 3.6, hazards will scale significantly in a PMF flood event. H5 hazards (considered unsafe for all vehicles and people, with buildings vulnerable to damage) are present along roadways drive by high flow velocities. Portions of high flow are also present along the southern side of Site 1B and the western side of Site 1C driven by the high velocity flows along the roadways expanding into the development Site.



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Post-Development 1% AEP Peak Flood Hazard

Figure: 3.5

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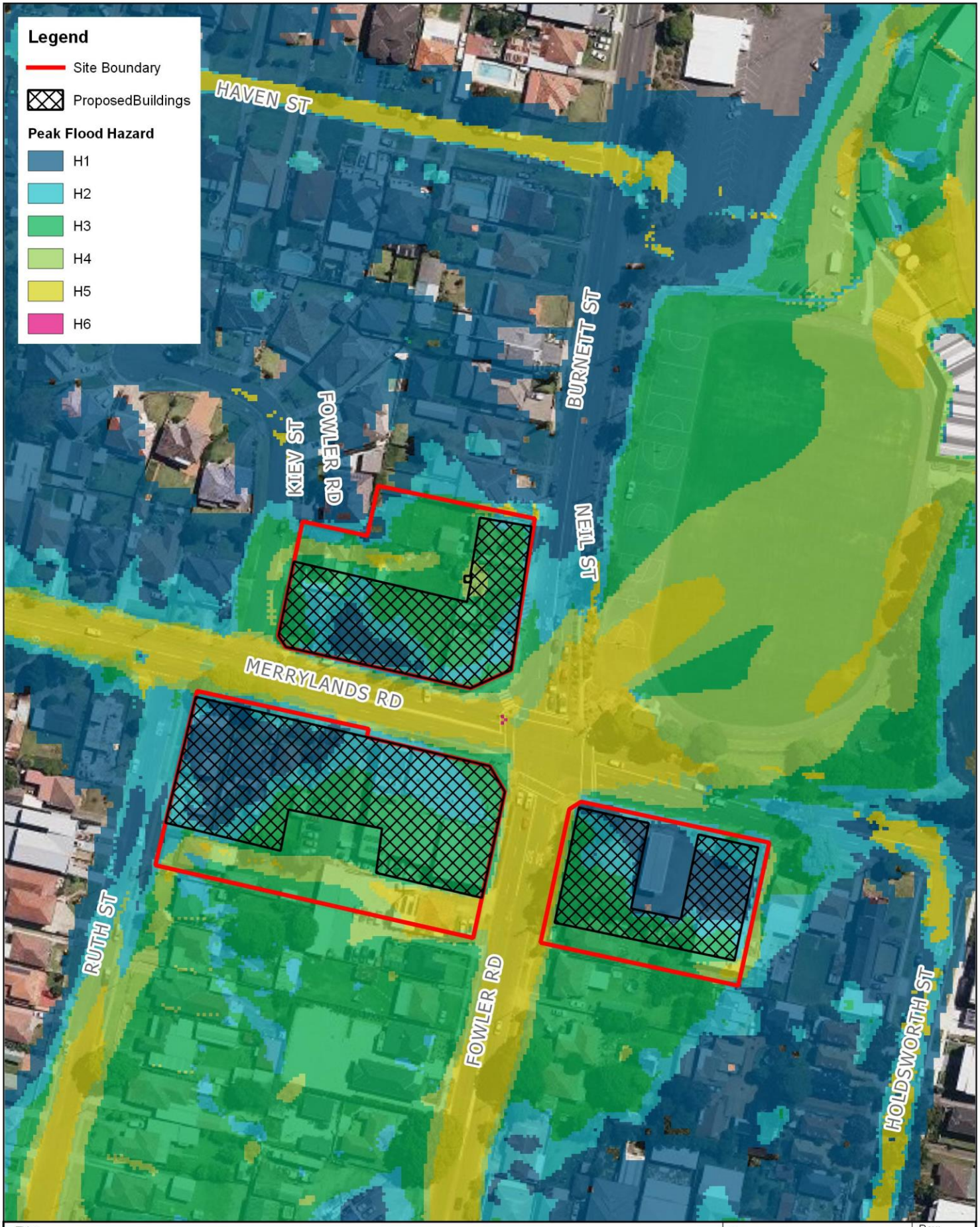

Title:

Post-Development PMF Peak Flood Hazard

Figure: 3.6

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3.4 Hydraulic Categorisation

The Flood Risk Management Manual (NSW Department of Planning and Environment, 2023) defines flood function as follows:

- Floodway – areas which convey a significant portion of water during floods and are particularly sensitive to changes that impact flow conveyance. They often align with naturally defined channels.
- Flood Storage – areas outside of floodways, are generally areas that store a significant proportion of the volume of water and where flood behaviour is sensitive to changes that impact on the storage of water during a flood.
- Flood Fringe – areas within the extent of flooding for the event but which are outside floodways and flood storage areas. Flood fringe areas are not sensitive to changes in either flow conveyance or storage.

The Hydraulic Categorisation for the 1% AEP event at the Site has been extracted from the Holroyd City LGA Overland Flood Study and is shown in Figure 3.7 below. The Figure indicates that a portion of the proposed building at Site 1A will intersect with the floodway.

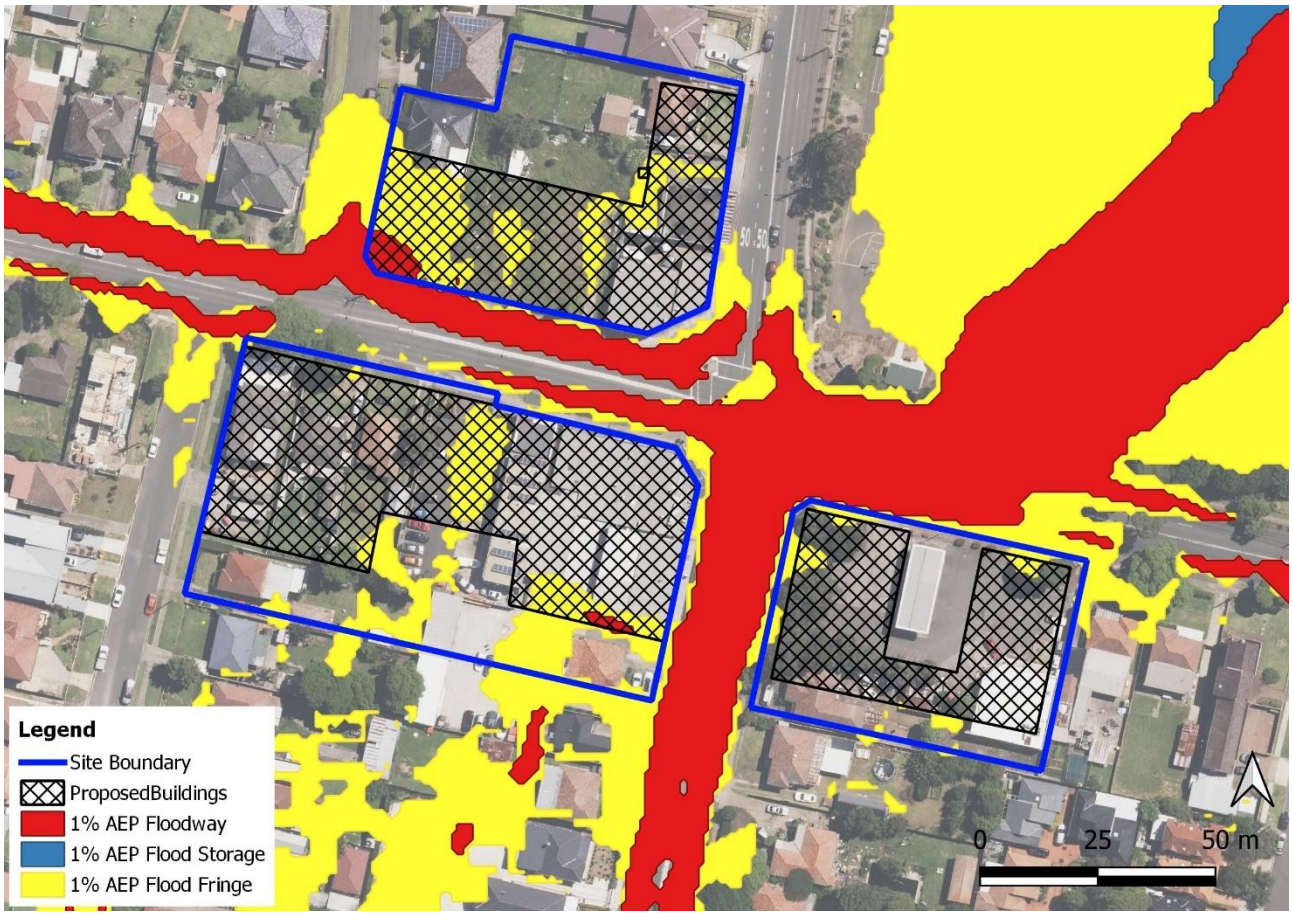


Figure 3.7 1% AEP Hydraulic Categorisation

3.5 Flood Impact Mitigation

As outlined in Section 3.2 development associated with the proposed Burnett Street Neighbourhood Centre Planning Proposal will cause off-site impacts in a number of locations including:

- Properties to the south of sub-site 1B
- Along Fowler Road, Burnett Street and Merrylands Road

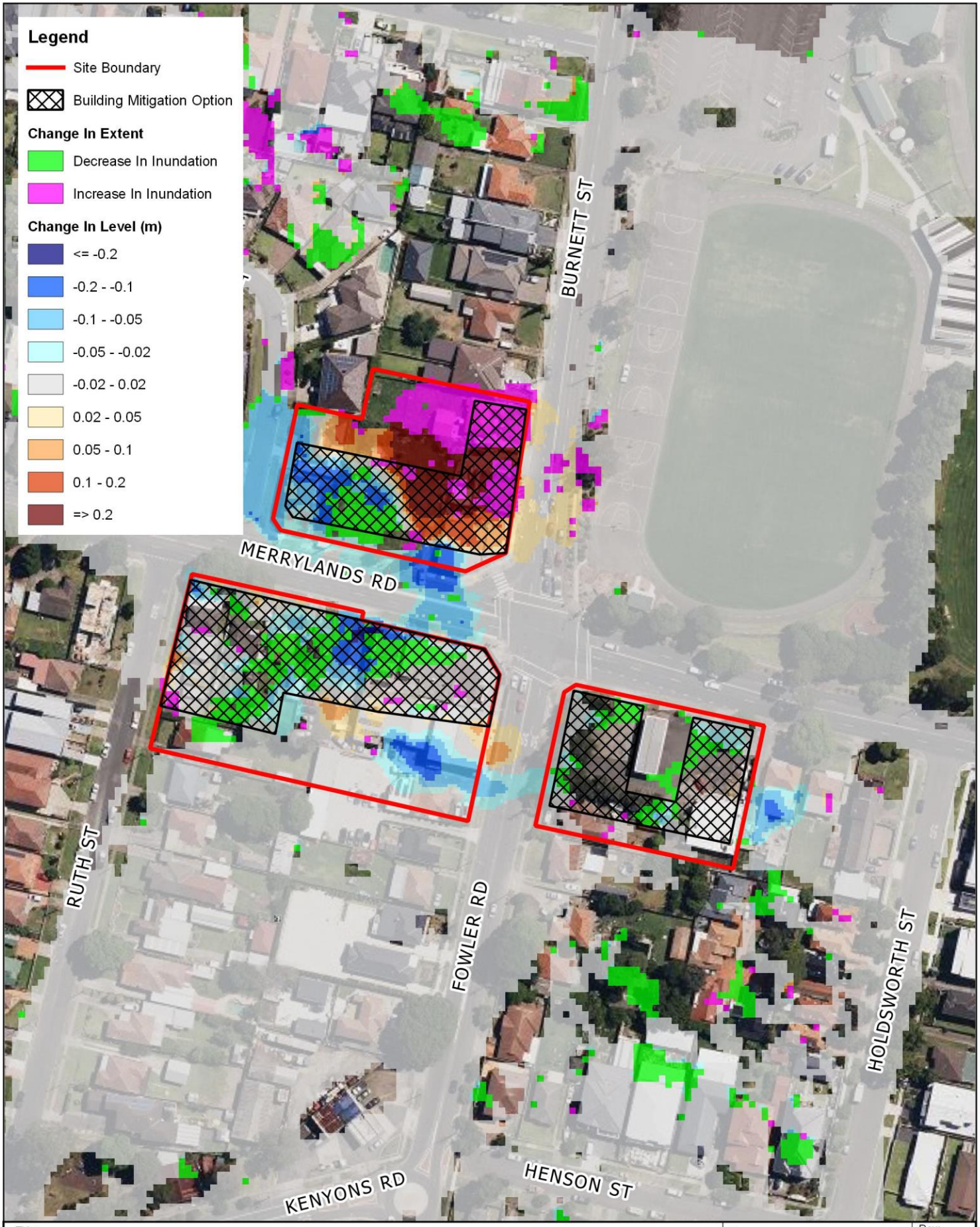
These impacts are localised in nature, but may require mitigation as part of the detailed design to ensure compliance as part of the planning proposal submission.

A preliminary mitigation scenario has been investigated as part of this assessment to remove the peak flood level increases to neighbouring properties. For the mitigation scenario, building polygons were resized or altered in order to reduce the impedance of buildings on major flow-paths, and the model was then re-run for the 1% AEP event. The peak 1% AEP flood level impact for the mitigation scenario is shown in Figure 3.8. The figure indicates that the reduced building extents are effective in mitigating impacts to the south of Site 1B and along Merrylands Road, and will reduce potential impacts on Fowler Street and Burnett Street. It is noted that the reduced building extent will also reduce or remove the potential interaction between the proposed development and the floodway.

This mitigation scenario is a preliminary option only, aimed at demonstrating that reduction in off-site peak flood level impacts can be achieved in the detailed design phase. Mitigation of flood impacts associated with the development (if required) could be achieved on an individual lot basis via several different options, or a combination of options including but not limited to:

- Increases to local stormwater drainage.
- Local terrain changes and the construction of local overland flowpaths.
- A reduction/alteration in building footprints (as demonstrated in this report).

Given the shallow overland flows present in the catchment, reduction/alterations of building footprints would only be required at ground level.



Title:

Peak Flood Level Impact - 1% AEP Event with Building Mitigation Option

Figure: 3.8

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3.6 Flood Emergency Response Considerations

Physical protection of all proposed new buildings to exclude floodwaters for all events up to the PMF is unlikely to be practical, achievable and/or cost effective in every case. For floods larger than the level of protection that is achieved by design, an emergency management plan may be used to assist in mitigation of the residual flood risk to people during extreme floods. A key objective of such a plan is to facilitate evacuation of building occupants to safe locations if there is a risk of floodwater inundation. Enclosed ground floor spaces are prone to higher risk as once the flood protection level is breached the space may fill rapidly, reducing the available evacuation time.

While it is preferable to evacuate off-site if possible, available warning and evacuation time as well as other factors may preclude this option. Due to the likely fast rate of rise associated with overland flow flooding, areas on, adjacent to and along the vehicular egress routes from the Site will be inundated with high hazard floodwaters during extreme events: and sufficient warning time is unlikely to be available to enable safe evacuation. As such, the most practical method of controlling the risk is to provide evacuation to refuge points on-site that are above the level of the PMF and which can be reached quickly and without reliance on automated measures. Finished floor levels will need to be set at the relevant flood planning level (see Section 4.2). As high depth and high hazard floodwaters will be present on-Site and along potential egress routes in extreme flood events, a shelter-in-place arrangement is the most suitable evacuation strategy for the Site. In the event of a flood emergency, where occupants are located on Level 1 of the proposed development, which is elevated metres above the PMF, it is recommended that they remain inside until floodwaters recede. People located on the ground floor should swiftly make their way to Level 1.

During future design it is recommended that a Flood Emergency Management Plan (FEMP) be prepared to formalise flood evacuation planning and strategy with respect to flood intelligence, the flood behaviour presented in this report and relevant procedures. The SES recommends that all flood prone properties prepare their own emergency management plans as SES resources are scarce during emergencies and it is often the case that they cannot service all affected parties in case of flood, particularly given mobilisation time. The FEMP shall be used as a guide for building wardens and other responsible parties nominated in the evacuation strategy. The aim of the FEMP is to inform the future operators of the building of the appropriate response measures required in the event of an extreme flood.

It will be necessary to confirm the number of people expected to occupy the development to establish that there is adequate space, lighting, back-up power, water and toilets available within the allocated flood refuge areas and identify if additional refuge areas need to be allocated. Consideration of the duration of isolation, likely site occupants and their awareness of the potential flood risk will also need to be undertaken as a final flood emergency consideration.

4 Development Controls

4.1 General Flood Planning Requirements

Flood planning requirements for development with the Cumberland City Council LGA are set out in the following documents:

- Cumberland Development Control Plan (DCP) (2021), Part G – Miscellaneous Development Controls, Part G4 – Stormwater and Drainage
  - Section 2.5 Technical details of stormwater and drainage systems, Overland flow paths
  - Section 2.6 Flood Risk Management
- Cumberland Local Environmental Plan (LEP) (2021), Section 5.21 Flood Planning
- Cumberland Flood Risk Management Policy (2021)

Flood related development consent conditions relevant to the Site have been extracted from these policies for this assessment and are shown in Table 4.1 to Table 4.5.

Table 4.1 Cumberland Development Control Plan (2021), Overland flow paths controls

	Cumberland City Council Requirement	BMT comment
C1.	*Designated overland flow paths are to be provided within the development in case of pipe blockage or major storm events to direct runoff to receiving body without impacting the development or other properties.*	The proposed development will involve the construction of some new building footprints along overland flowpaths. Under existing conditions overland flow progresses via existing gaps between buildings. Under proposed post-development conditions this behaviour will be largely maintained with redirection of flow in some locations (see Figure 3.2 and Annex C.)
C2.	*Provision shall be made to ensure runoff up to the 100 year ARI (minor system including overflows from roof gutters), is safely conveyed within formal or informal overland flow paths to the receiving body.*	This assessment is an overland flow flood study. Under both existing and post-development flood conditions overland flow will be conveyed along roadways and local depressions before final discharge into A'Becketts Creek.
C3.	*Where it is not practicable to provide paths for overland flows, the piped drainage system shall be sized to accept runoff up to the 100 year ARI with the blockage factor.*	Not applicable.
C4.	*Development shall not cause flooding of adjoining properties*	The proposed development works will cause flood level increases to the south of Site 1B and along roadway (See Section 3.2). Mitigation of these impacts via a reduction in building extents has been demonstrated in this report

	Cumberland City Council Requirement	BMT comment
		(see Section 3.5) but it is noted that mitigation may be possible via alternate options. Flood impact mitigation should be further considered during the concept design stage.
C5.	*Runoff currently entering the site from upstream properties shall not be obstructed from flowing onto the site and shall not be redirected so as to increase the quantity or concentration of surface runoff entering adjoining properties.*	The proposed development works will cause flood level increases to the south of Site 1B and along roadway (See Section 3.2). Mitigation of these impacts via a reduction in building extents has been demonstrated in this report (see Section 3.5) but it is noted that mitigation may be possible via alternate options. Flood impact mitigation should be further considered during the concept design stage.
C6.	*Where a site includes either an existing or proposed overland flow path, register a restriction on use of land and a positive covenant on the title of the subject property. The covenant should require that the overland flow path on the site:* • *not be altered; and* • *be maintained in good working order.* *Note: In this instance, "overland flow path" includes all structures, pipes, drains, walls, kerbs, pits, grates, fencing and all surfaces graded to convey and/or allow stormwater flows to pass through the site.*	This requirement should be considered during the concept design stage.
C7.	*Where the overland flow rates are high, the requirements outlined in Council's Flood Risk management Policy on flood risk management will need to be satisfied.*	See below.

Table 4.2 Cumberland Development Control Plan (2021), Flood risk management

	Cumberland City Council Requirement	BMT comment
General		
C1.	*The proposed development does not result in any increased risk to human life and does not increase the potential flood affectation on other development or properties*	The proposed development does not result in any increased risk to human life. The proposed development works will cause flood level increases to the south of Site 1B and along roadway (See Section 3.2), but it is noted that mitigation may be possible via alternate options. Flood impact

	Cumberland City Council Requirement	BMT comment
		mitigation should be further considered during the concept design stage.
C2.	*The additional economic and social costs which may arise from damage to property from flooding is no greater than that which can reasonably be managed by the property owner and general community*	The proposed development works will be affected by low-hazard flooding for all events up to the PMF. Providing structural certification of the buildings is undertaken during the concept design phase to ensure they are compatible with higher hazard flooding in the PMF, it is considered that potential flood hazard (and any associated costs) to the development can be effectively managed.
C3.	*The proposal should only be permitted where effective warning time and reliable access is available for the evacuation of an area potentially affected by floods. Evacuation should be consistent with any relevant disaster plans (DISPLAN) or flood plan where in existence.*	As noted in Section 2.3, the proposed development will be affected by low depth floodwaters for all events up to the PMF. Higher depths and flood hazards will be present along roads adjacent to the Site. Given short flood warning times, a shelter-in-place strategy is the proposed flood emergency management response.
C4.	*A 15m setback from the mean high water mark applies to properties fronting Duck River to the east and 10m to Haslams Creek.*	The proposed development is not located along Duck River or Haslams Creek.
C5.	*The proposal does not adversely impact upon the recreational, ecological, aesthetic or utilitarian use of the waterway corridors, and where possible, should provide for their enhancement, in accordance with ecologically sustainable development principles.*	The proposed development does not adversely impact upon waterways.
C6.	*The proposal shall not have a significant detrimental impact on:* • *water quality;* • *native bushland vegetation;* • *riparian vegetation;* • *estuaries, wetlands, lakes or other water bodies;* • *aquatic and terrestrial ecosystems;* • *indigenous flora and fauna; or* • *fluvial geomorphology.*	This requirement should be considered during the concept design stage by an ecological engineer.

	Cumberland City Council Requirement	BMT comment
C7.	*The filling of flood prone land, where acceptable and permitted by this Part, must involve the extraction of the practical maximum quantity of fill material from that part of the site adjoining the waterway.*	This requirement will need to be addressed at the final design stage.
C8.	*The proposed development shall comply with Council's Flood Risk Management Policy.*	See comments in Table 4.4
C9.	*Site specific flood studies shall comply with Council's standard requirements.*	This assessment is a catchment-wide flood study. It has been undertaken as per the requirements outlined in Table 4.1 to Table 4.5 where appropriate.
Fencing		
C1.	*Fencing within the floodplain shall be constructed in a manner that does not affect the flow of floods.*	This requirement will be addressed at the concept design stage.
C2.	*Fencing within a high flood risk precinct (FRP) shall not be permissible except for security/permeable/safety fences of a type approved by Council.*	This requirement will be addressed at the concept design stage.
C3.	*Council shall require a development application for all new solid (non-porous) and continuous fences in the high and medium risk FRPs, unless otherwise stated by exempt and complying development provisions.*	This requirement will be addressed at the concept design stage.

Table 4.3 Cumberland Local Environmental Plan 2021 – Flood Planning

	Cumberland City Council Requirement	BMT comment
(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 the other development or properties, and* *(c) 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.*	a) The Site is largely affected by low-hazard flood fringe waters in the 1% AEP event, but would partially intersect the 1% AEP floodway. Further refinement of the proposed buildings during the concept design should be undertaken to avoid minor encroachment on floodway areas. Structural certification of the buildings to ensure they are compatible with higher hazard flooding in the PMF is also required. b) The proposed development works will cause flood level increases to the south of Site 1B and along roadway (See Section 3.2). Mitigation of these impacts via a reduction

Cumberland City Council Requirement	BMT comment
	in building extents has been demonstrated in this report (see Section 3.5) but it is noted that mitigation may be possible via alternate options. Flood impact mitigation should be further considered during the concept design stage. c) The development will not adversely affect the watercourse.
(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 building result 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.*	a) As per Section 3.2 and Annex D peak flood depths adjacent to the proposed development are not expected to be significantly impacted as a result of climate change. b) The proposed development works will be located within areas of existing development. c) Given short flood warning times, a shelter-in-place strategy is the proposed flood emergency management response. The proposed development works will be located in areas affected by low hazard floodwaters for all events up to and including the PMF. Structural certification of the buildings to ensure they are compatible with higher hazard flooding in the PMF will be required at the concept design stage. Providing this is undertaken, the shelter-in-place strategy is considered appropriate to minimise the risk to life and ensure safe evacuation of people in the event of a flood. d) The proposed development will be primarily affected by low hazard/minor flow flooding

	Cumberland City Council Requirement	BMT comment
		for all events up to the PMF. The development will not be impacted by Coastal Erosion.

Table 4.4 Cumberland Flood Risk Management Policy

	Cumberland City Council Requirement	BMT comment
(1)	*Development applications lodged in accordance with the Environmental Planning and Assessment Act 1979 on land affected by potential flood are to be assessed in accordance with the controls in the Cumberland LEP 2021 and Cumberland DCP 2021, as well as the requirements of this policy, as applicable.*	See Table 4.1 to Table 4.3
(2)	*When assessing flood risk, both mainstream and overland flooding are to be considered.*	The proposed development works are affected by overland flow flooding only.
(3)	*Blockage needs to be included when analysing overland flow paths, pipes, etc. This analysis should be carried out on the basis that all bridges, culverts, pipes, etc. are at least 50% blocked.*	Blockage factors have been applied as per Cumberland Council's Existing A'Becketts Creek Flood Model. A blockage sensitivity assuming 50% blockage of all pipes was undertaken as part of this assessment and found that peak flood levels were within 0.03 m at Sites 1A and 1B and within 0.1 m at Site 1C.
(4)	*A number of major land use categories have been identified for the purpose of floodplain management control. Table 1 (in the Appendix) shows these major categories together with the specific uses under each category (as defined by Cumberland LEP 2021), and the relevant requirements for each category.*	See Table 4.5.
(5)	*Where flood compatible materials are required, refer to Table 2 in the Appendix.*	This requirement will need to be addressed at the concept design stage.
(6)	*Development is to comply with the controls applicable to the proposed land use category and FRPs within which the site is located:* • *Haslams Creek floodplain as specified in Table 3 in the Appendix;* • *Duck River floodplain; and* • *Cooks River floodplain.* *Maps for these catchment areas can be found in the appendix*	The development is classified as a Medium Flood Risk Precinct. See Table 4.5.

Table 4.5 Duck River Floodplain Development Requirements

Planning Consideration	Requirements	BMT Comment
Residential		
Floor Level	• Floor levels of open car parking areas to be equal to or greater than the 20-year ARI plus freeboard. Enclosed car parking must be protected from the 100-year ARI flood • Habitable floor levels to be equal to or greater than the 100-year ARI plus freeboard • Below ground swimming pools should be free from inundation from storms up to the 5-year ARI	• To be addressed as part of the concept design stage • See Section 4.2 • To be addressed as part of the concept design stage
Building Components	• All structures to have flood compatible building components below or at the 100-year ARI flood level	• To be addressed as part of the concept design stage
Structural Soundness	• Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100-year flood.	• To be addressed as part of the concept design stage
Flood Affectation	• The impact of the development on flooding elsewhere to be considered	• Undertaken as part of this assessment.
Evacuation	• Reliable access for pedestrian or vehicles is required from the dwelling, commencing at a minimum flood level equal to the lowest habitable floor level to an area of refuge above the PMF level, either on-site or off-site. • Applicant to demonstrate the development is to be consistent with any relevant DISPLAN or flood evacuation strategy.	• Shelter-in-place recommended as a preliminary flood emergency management strategy. See Section 3.6 for further detail. • SES Cumberland LGA Flood Emergency Sub Plan requires the use of Land Use Planning and Floodplain Risk Management as a prevention/mitigation strategy (undertaken as part of this project).

Planning Consideration	Requirements	BMT Comment
Management and Design	• Site Emergency Response Flood plan required (except for single-dwelling houses) where floor levels are below the design floor level. • Applicant to demonstrate that area is available to store goods above the 100-year flood plus 0.5 m (freeboard) • No external storage of materials below design floor level which may cause pollution or be potentially hazardous during any flood.	• Shelter-in-place recommended as a preliminary flood emergency management strategy. See Section 3.6 for further detail. • To be addressed as part of the concept design stage • To be addressed as part of the concept design stage
Commercial and Industrial		
Floor Level	• Floor levels of open car parking areas to be equal to or greater than the 20-year ARI plus freeboard. Enclosed car parking must be protected from the 100-year ARI flood • Habitable floor levels to be equal to or greater than the 100-year ARI plus freeboard	• To be addressed as part of the concept design stage • See Section 4.2
Building Components	• All structures to have flood compatible building components below or at the 100-year ARI flood level	• To be addressed as part of the concept design stage
Structural Soundness	• Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100-year flood.	• To be addressed as part of the concept design stage
Flood Affectation	• The impact of the development on flooding elsewhere to be considered	• Undertaken as part of this assessment.
Evacuation	• Reliable access for pedestrian or vehicles is	• Shelter-in-place recommended as a

Planning Consideration	Requirements	BMT Comment
	required from the dwelling, commencing at a minimum flood level equal to the lowest habitable floor level to an area of refuge above the PMF level, either on-site or off-site. • Applicant to demonstrate the development is to be consistent with any relevant DISPLAN or flood evacuation strategy.	preliminary flood emergency management strategy. See Section 3.6 for further detail. • SES Cumberland LGA Flood Emergency Sub Plan requires the use of Land Use Planning and Floodplain Risk Management as a prevention/mitigation strategy (undertaken as part of this project).
Management and Design	• Site Emergency Response Flood plan required (except for single-dwelling houses) where floor levels are below the design floor level. • Applicant to demonstrate that area is available to store goods above the 100-year flood plus 0.5 m (freeboard) • No external storage of materials below design floor level which may cause pollution or be potentially hazardous during any flood.	• Shelter-in-place recommended as a preliminary flood emergency management strategy. See Section 3.6 for further detail. • To be addressed as part of the concept design stage • To be addressed as part of the concept design stage

4.2 Flood Planning Levels

Cumberland City Council sets flood related development controls in the Cumberland Flood Risk Management Policy. The policy identifies that habitable floor levels for residential, commercial and industrial developments must be set at or above the 1% AEP flood level plus freeboard.

Final finished floor levels for the developments proposed as part of each of the 3 sub-Sites will need to be confirmed at the concept design stage.

4.3 Compliance With Ministerial Direction

Section 9.1(2) of the Environmental Planning and Assessment Act 1979 Focus Area 4.1 applies to all relevant planning authorities that are responsible for flood prone land when prepare a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land. Ministerial Directions 4.1.3 and 4.1.4 are outlined in Table 4.6 below along with relevant commentary:

Table 4.6 Ministerial Direction 4.1 Flooding

Ministerial Direction	BMT Comment
4.1.3 a planning proposal must not contain provisions that apply to the flood planning area which: a permit development in floodway areas b permit development that will result in significant flood impacts to other properties c permit development for the purposes of residential accommodation in high hazard areas d permit a significant increase in the development and/or dwelling density of that land. 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. 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 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 h permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.	a) The south-western corner of Site 1A will partially intersect with the floodway extent. It is considered that refinement of the proposed development during the concept design to avoid the minor intersection will adequately address this non-conformance. b) Isolated flood level increases are expected as a result of the development works (see Section 3.2). Mitigation of these impacts via a reduction in building extents has been demonstrated in this report (see Section 3.5), but it is noted that mitigation may be possible via alternate options. Flood impact mitigation should be further considered during the concept design stage. c) The development will not be located in high hazard areas. d) Increases to dwelling density will largely fall outside of flood prone land. This requirement will need to be addressed as part of the concept design stage. e) Shelter-in-place has been identified as an appropriate preliminary emergency management strategy (see Section 3.6) for the overall Study Area. Site-specific flood emergency response requirements will need to be addressed as part of the concept design stage. It is understood that none of the uses listed are proposed as part of the development. f) N/A to this development. g) The proposed development works are not 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. h) To be confirmed as part of the concept design stage.
4.1.4 A Planning proposal must not contain provisions that apply to areas between the flooding planning area and probable maximum flood to which Special Flood Considerations apply which: a permit development in floodway areas b permit development that will result in significant flood impacts to other properties c permit a significant increase in the dwelling density of that land	a) The south-western corner of Site 1A will partially intersect with the floodway extent. It is considered that refinement of the proposed development during the concept design to avoid the minor intersection will adequately address this non-conformance. b) Isolated flood level increases are expected as a result of the development works (see Section 3.2). Mitigation of these impacts via a reduction in building extents has been

Ministerial Direction	BMT Comment
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 e are likely to affect the safe occupation of and efficient evacuation of the lot 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.	demonstrated in this report (see Section 3.5), but it is noted that mitigation may be possible via alternate options. Flood impact mitigation should be further considered during the concept design stage. c) Increases to dwelling density will largely fall outside of flood prone land. This requirement will need to be addressed as part of the concept design stage. d) To be confirmed as part of the concept design stage. e) Shelter-in-place has been identified as an appropriate preliminary emergency management strategy (see Section 3.6). It is understood that none of the uses listed are proposed as part of the development. f) The proposed development works are not 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.

4.4 Compliance With Flood Prone Land Policy

The NSW Flood Prone Land Policy is included as Annex E. The primary statement is provided below:

"The primary objective of the NSW Flood Prone Land Policy (this policy) is to reduce the impact of flooding and flood liability on communities and individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible. In doing so, community resilience to flooding is improved."

The proposed Burnett Neighbourhood Centre Planning Proposal will be located in areas that are primarily affected by low hazard flooding. It is recommended finished-floor levels for the final development at the Site be set at the 1% AEP flood level plus at a minimum. This would situate floor levels at sub-Site 1A and 1B above the PMF. It is considered that the development location and these controls will reduce the impact of flooding and flood liability to the properties, limit the potential for flood losses and prevent the sterilisation of land with only minor flood affectation.

4.5 Compliance with Floodplain Development Manual and Flood Risk Management Manual

The Flood Risk Management Manual sets out 10 principles for Flood Risk Management as per the below.

- *Principle 1 Establish sustainable governance arrangements*
- *Principle 2 Think and plan strategically*
- *Principle 3 Be consultative*

- *Principle 4 Make flood information available*
- *Principle 5 Understand flood behaviour and constraints*
- *Principle 6 Understand flood risk and how it may change*
- *Principle 7 Consider variability and uncertainty*
- *Principle 8 Maintain natural flood functions*
- *Principle 9 Manage flood risk effectively*
- *Principle 10 Continually improve the management of flood risk*

The undertaking of a detailed flood assessment for the proposed Burnett Street Neighbourhood Planning Proposal contributes towards achieving Principles 1-7.

In regard to Principle 8, the proposed development areas are predominantly affected by low-hazard shallow overland flows. The natural flood function affecting the proposed development area is broadly low-hazard flood fringe. This behaviour will be maintained under post-development conditions.

In regard to Principles 9 and 10, the following extracts reflect the most relevant objectives of the Burnett Street Neighbourhood Centre Planning Proposal:

- *Limit increases in flood risk related to new and modified development.*
    - *Decisions to place new development in the floodplain generally increases flood risk. This may be due to the risks to the new development and its users. It may also relate to the impacts the development may have on flood behaviour or flood and EM risks to the existing community.*
    - *Consistent with the policy a merit-based approach is recommended in developing and implementing strategic planning through local strategic planning statements (LSPSs) and planning instruments such as local environmental plans (LEPs) and development control plans (DCPs). This involves considering the risks outlined above to limit the potential for increases in flood losses and risks in areas proposed for new development.*
    - *The opportunity to effectively consider flood risk in modifying or rebuilding development should be considered in LEPs and DCPs. This may reduce or limit increases in flood and EM risks relative to the risk to the existing development and its users.*
- *Establish or improve EM arrangements and planning for floods to assist in managing the continuing risk that remains after FRM and land-use planning measures are implemented. This can further limit but generally cannot eliminate the residual flood risk faced by the community.*

The proposed Burnett Street Neighbourhood Centre Planning Proposal will be located in areas primarily affected by low-hazard, shallow overland flooding. Setting of finished-floor levels at the 1% AEP flood level plus freeboard in these areas will place developments at sub-Site 1A and 1B above the PMF level. As outlined in 2.3, only minor scaling of flood affectation is expected to occur with event rarity up to the PMF; although higher hazards would be present in the PMF event itself. Therefore, effective management of current and future flood risk along the proposed development can be achieved by existing flood planning controls (see Section 4.1) and consideration of Emergency Management Planning (see Section 3.6).

4.6 2022 NSW Flood Inquiry Considerations

In March 2022, the NSW Government commissioned an independent expert inquiry into the preparation for, causes of, response to and recovery from the 2022 catastrophic flood event across the state of NSW. The inquiry resulted in 23 findings from which 28 recommendations were made. Commentary in regard to the findings and recommendations relevant to the Burnett Street Neighbourhood Centre is presented below.

Table 4.7 NSW Flood Inquiry Findings and Recommendations

2022 Flood Inquiry Finding	2022 Flood Inquiry Recommendation	BMT Comment
H. Findings – impact to essential services • *The loss of power during the flood events was significant in terms of scale, duration and its compounding effect on other services including telecommunication, sewerage system plants and water supply systems.* • *Similar to the 2019–20 bushfires, the loss of telecommunications services caused the most distress to communities because it affected their ability to request flood rescues, communicate with family and friends, provide warnings and access post-emergency information.*	***9. Recommendation – impact to essential services*** *That, to minimise disruption to essential services, including outages which compromise basic communication coverage, and to ensure access to safe water supply and power during flood events, Government work directly or together with the Australian and other state governments and/or their relevant power and telecommunications regulatory, policy and market bodies to:* • *ensure there are sufficient redundancy options known and made available (for example, backup diesel generators, deployed temporary telecommunications facilities, etc.) to supply power to essential telecommunication infrastructure, alternative telecommunications infrastructure and water treatment facilities*	While these recommendations are at a facility level and state-wide scale, similar principles can be applied at the Site. Placement of any essential infrastructure (i.e. power supplies) above the Probable Maximum Flood Level will help to reduce the chance of a site-specific loss in power and/or communications during a flood event.
L. Findings – flood risk management at all levels • *Broad community memory of disaster is negligible, though sympathy at the time of the event is significant. Collective amnesia in the long tail following a disaster event promotes inertia and inhibits decisive and necessary action in preparing for, responding to, recovering from and building*	***14. Recommendation – flood education*** *That, to build disaster resilience in future generations as floods and other natural disasters are a fact of Australian life, the Department of Education should design, implement and deliver an evidence-based, targeted education campaign (like sun exposure) in schools (new disaster curriculum).*	This assessment has identified the potential flood risk to the Site and proposed flood risk mitigation and management options. Continuing flood-risk education of site end users will aid in preparing for and responding to future flood events at the Site. Education may be achieved through the use of on-site training (such as shelter-in-place drills) as well as signage on the Site indicating the potential for flood affectation. This should be considered as part of the

2022 Flood Inquiry Finding	2022 Flood Inquiry Recommendation	BMT Comment
resilience against future events. • *Individuals, community and Government need to prepare and invest in disaster management proactively not reactively – and be as disaster ready as possible in an environment of uncertainty (knowing that disasters will recur but not when, where or how). And decision-makers need to accommodate the complexity of human behaviour.* • *Government must promote personal agency and capacity through consistent communications and education to create more resilient communities, and to enable better flood (and other disaster) risk management at all levels (individual, community and government). Effective risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure, hazard characteristics and the environment, and should be used to inform decision making across all phases of disaster management, including risk assessment, prevention, mitigation, preparedness and response.*		development of a FEMP in the detailed design stage.
O. Findings – risk-based approach to calculating flood planning level • *Most landholders using the 1% AEP for calculation of the flood planning level for planning purposes in NSW is not adequate, especially in the light of changing rainfall patterns including the intensification of intra- day rainfall, with the consequent risk of greater flash flooding.*	***18. Recommendation – risk-based approach to calculating flood planning level*** *That, to take account of greater knowledge of climate change, Government reinforce its adoption of a risk-based approach to calculating the flood planning level for planning purposes and, through the NSWRA, immediately start a process of revising all flood planning level calculations in the state's high-risk catchments.*	This assessment has been undertaken using a catchment-wide flood study, with consideration of flood events rarer than the 1% AEP (0.5% and 0.2% AEP) and the Probable Maximum Flood. The current Cumberland Flood Planning Level is the 1% AEP flood level plus a 500 mm freeboard. While the commentary provided as part of the inquiry notes that the use of the 1% AEP

2022 Flood Inquiry Finding	2022 Flood Inquiry Recommendation	BMT Comment
• *To understand risk, especially for major flooding events, knowledge of floods at a catchment-wide scale is needed. Councils are generally not adequately resourced or organised to manage either whole-of catchment models or high quality, risk-based flood planning level estimations. Responsibility for this matter needs to return to the State Government. Re-determining flood planning levels will be relatively straightforward in some cases with the result remaining close to the 1% AEP but will need substantial adjustment in others depending on local rainfall intensities, catchment shape and other risk factors.*	*Flood planning level re-determinations for all high-risk catchments should be completed within 3 years. These revised flood planning levels will need to be factored into all development applications (in-progress and new) in those high-risk catchments. The risk profile of high-risk catchments should be revisited at appropriate time intervals to check that levels are current. A review should take place if there has been a significant trigger event (i.e. changed rainfall, development) or at least every 5 years. As well as reviewing the flood planning level, this 5-yearly review should include reviewing any floodplain lease conditions and adjusting them as necessary in the light of better knowledge of climate change impacts. In working out a tolerable, risk-based flood planning level, consideration should be given to the PMF, 1% AEP, 0.02% AEP, existing development, approved but not yet constructed developments, and existing and approved but not yet constructed evacuation routes.* *In coordinating this flood planning level re-determination process, NSWRA should work closely with local councils, DPE, communities, state water authorities and state and national engineering and research organisations. In doing so, the NSWRA should also:* • *extend and then maintain the DPE state-wide flood database and associated visualisation interface. This database, which should link to LandiQ, would support:* - *simulation of extreme rainfall events and resultant flooding* - *identification of 'at risk' river and catchment systems for flash flooding*	alone is not adequate for planning purposes, the adoption and inclusion of a 500 mm freeboard would place habitable floors for Sites 1A and 1B above the PMF and within 0.1 m of the PMF at Site 1C. Consideration could be given during detailed design as to whether all building floor levels could be set about the PMF across the development. As part of future FEMP development, it is recommended that a specific review period is included to ensure that flood risk management of the Site remains current throughout its lifecycle.

2022 Flood Inquiry Finding	2022 Flood Inquiry Recommendation	BMT Comment
	• *support local councils to improve modelling of and ensure adequate and appropriate alarm systems for flash flooding.*	

5 Conclusions and Recommendations

A Planning Proposal is proposed for the Burnett Street Neighbourhood Centre with the aim of allowing development to capitalise on the Site's high amenity location to support mixed-use development and to provide around 110 additional dwellings and 15 additional jobs. The Burnett Street Neighbourhood Centre lies in the A'Becketts Creek catchment and is affected by overland flow flooding draining to the A'Becketts Creek watercourse. Flood models developed as part of Holroyd City LGA Overland Flood Study indicate that the Site has variable flood depths, with peak depths in excess of 0.6 m in low lying areas in the 1% AEP event but is broadly affected by shallow, low hazard flooding for all events up to the PMF. In the PMF event, the area surrounding the Site will become a high conveyance corridor and hazards of up to H5 will be present along roadways and at the boundaries of the sub-Site.

Post-development flood modelling indicates that the proposed works have the potential to cause off-site flood impacts. Mitigation of these impacts via a reduction in building extents has been demonstrated in this report, but it is noted that mitigation may be possible via alternate options which should be further considered during future design stages. Modelling also indicates that the proposed Site will not be heavily impacted by the potential effects of climate change. Shelter-in-place has been identified as an appropriate preliminary flood emergency response strategy, although it is recommended this is investigated further as part of the concept design stage.

This report has demonstrated that the proposed Site is largely compatible with the flooding controls in the Cumberland Development Control Plan 2021, Cumberland Local Environmental Plan 2021, Cumberland Flood Risk Management Policy 2021, Section 9.1(2) of the Environmental Planning and Assessment Act 1979 Focus Area 4.1 flooding, the Flood Prone Land Policy, the NSW Floodplain Risk Management Manual and the 2022 NSW Flood Inquiry. These requirements are addressed as part of Section 4 of this report. The potential intersection of the proposed design with the floodway at the south-west corner of Site 1A will need to be addressed as part of the concept design, although it's noted that the encroachment is relatively minor and compliance should be achievable with a design alteration at the concept stage.

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Cumberland City Council (2021). *Cumberland Local Environment Plan*

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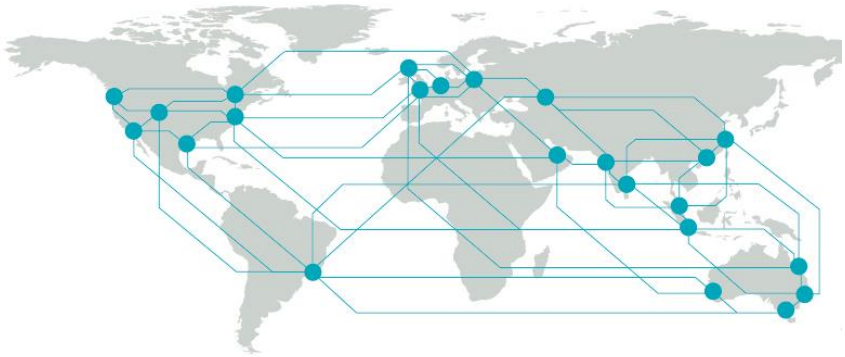
Annex A Existing Flood Conditions Mapping

Annex B Post-Development Flood Conditions Mapping

Annex C Flood Impact Mapping

Annex D Climate Change Mapping

Annex E Flood Prone Land Policy



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Level 4
4-14 Foster Street
Surry Hills
NSW 2010
Australia
+61 2 8960 7755

Registered in Australia
Registered no. 010 830 421
Registered office
Level 5, 348 Edward Street,
Brisbane QLD 4000 Australia

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