Proposed Subdivision of 158-164 Old Bathurst Road, Emu Plains

Flood Emergency Response Strategy

ACOR Consultants Pty Ltd

October 2022

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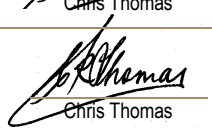
Project: **Proposed Subdivision of 158-164 Old Bathurst Road, Emu Plains**
Flood Emergency Response Strategy

Rev	Description	Author	Review	Advisian Approval	Date
A	**Draft Report**	LT L To	LC L Collins		16/03/2022
B	**Final Report**	LC L Collins	CRT C Thomas	 Chris Thomas	7/04/2022
C	**Revised Final Report**	LC L Collins	CRT C Thomas	 Chris Thomas	7/10/2022

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Appendices

1 Introduction

Penrith City Council (Council) is planning an industrial subdivision of the former Rocla site at 158-164 Old Bathurst Road, Emu Plains. The proposed redevelopment site is located on the western floodplain of the Lower Nepean River as shown in **Figure 1-1**.

The site is bound by the T1 Western Railway Line to the south, Old Bathurst Road to the north, David Road to the west, and two currently undeveloped lots to the east (*refer* **Figure 1-2**). It is understood that Council intends to subdivide the 16 hectares of land to create 40 industrial lots, which will involve some localised cut and fill earthworks. Additionally, Transport for NSW (TfNSW) intends to construct a commuter carpark on the two lots located immediately to the east of the site.

Penrith City Council engaged ACOR Consultants Pty Ltd (ACOR) to document planning and engineering matters for the project as part of a Development Application, including the consideration of flood-related constraints.

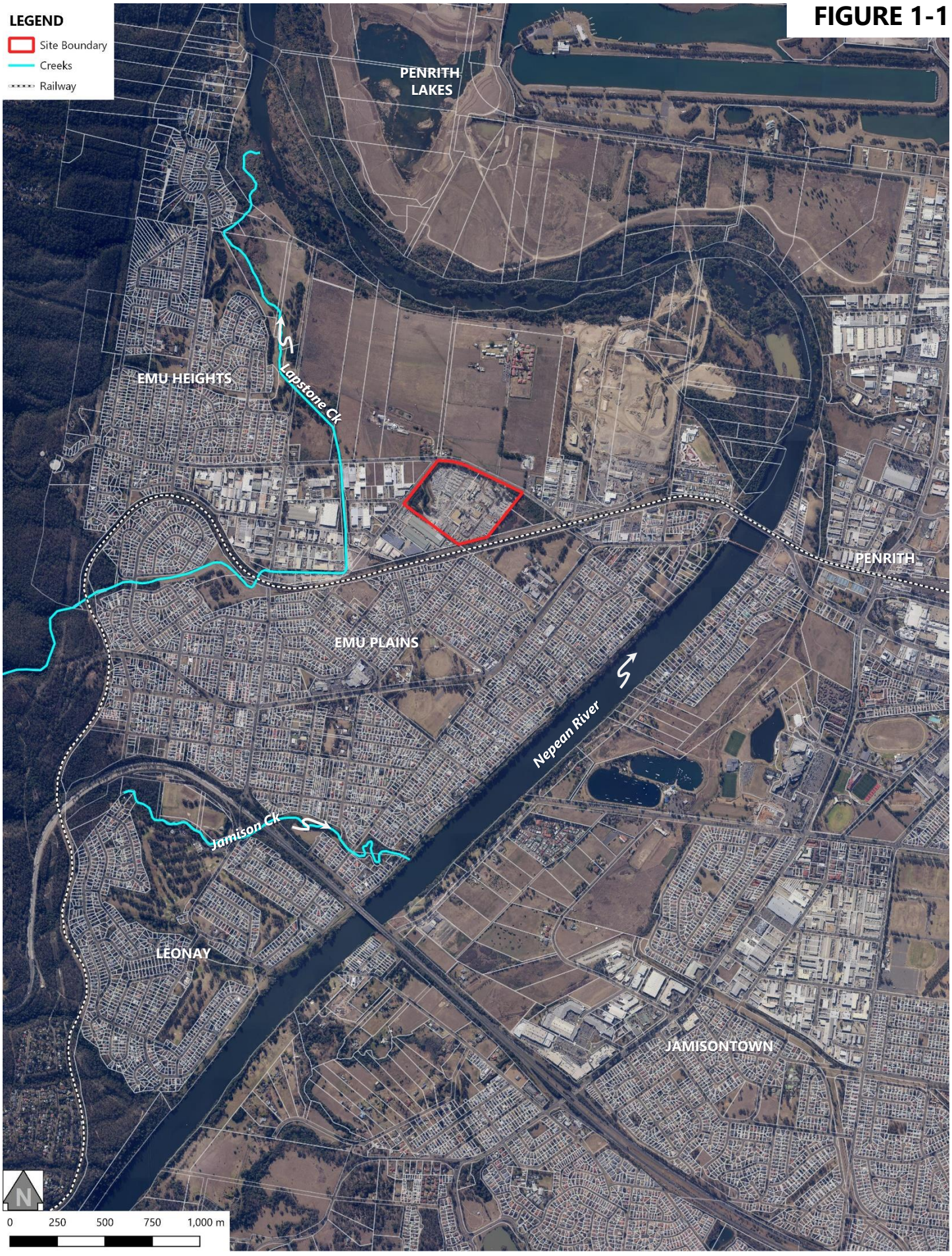
Flood modelling and mapping completed as part of the *Nepean River Flood Study* (Advisian, 2018) indicates that the site and its access roads would be partially inundated during the 1% Annual Exceedance Probability (AEP) design flood and would experience progressively more severe inundation in rarer floods up to the Probable Maximum Flood (PMF). Part C3 Section 3.5 of the Penrith Development Control Plan 2014 (DCP 2014) requires that "flood safe access and emergency egress is to be provided to all new industrial developments" so that evacuation of all tenants and workers can occur in an orderly fashion. DCP 2014 defines *flood safe access* as "when the depth of flooding over vehicular driveways and roads is limited to approximately 0.25 m with low velocities".

In recognition of this requirement, ACOR engaged Advisian Pty Ltd (Advisian) to prepare a Flood Emergency Response Strategy (FERS) for the purpose of determining whether safe evacuation from the site could be achieved should a severe flood occur. If it can be achieved, the FERS is also to provide information, recommendations, and protocols for effecting that safe evacuation.

This report documents the outcomes from an assessment of potential flood evacuation routes and the available warning times that would be afforded. It also documents information, recommendations, and diagrams suitable for subsequent use in a Flood Emergency Response Plan which would be prepared and approved prior to occupation of the site.

Advisian was also engaged to complete a Flood Impact Assessment (FIA) for the site which is detailed in a separate report.

FIGURE 1-1



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SITE LOCATION
[LOWER NEPEAN RIVER FLOODPLAIN]

FIGURE 1-2

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PROPOSED SUBDIVISION LAYOUT AT SUBJECT SITE

2 Background and Existing Flood Behaviour

2.1 Previous Flood Related Studies

A brief overview of relevant studies defining flood behaviour in the Nepean River floodplain is provided in the following.

- ***Nepean River Flood Study*** **(Advisian, 2018)**
  - The characteristics of flooding of the Lower Nepean River within the Penrith Local Government Area (LGA) are documented in the Nepean River Flood Study (Advisian, 2018) which was prepared for Penrith City Council. This report documents the model and design flood levels currently adopted by Council.
  - The flood study relied on the results of flood modelling undertaken using a two-dimensional flood model that utilised the 'RMA-2' software and evolved over a period of several years. Hydrologic inputs consisted of hydrographs from the RUBICON 1D model of the Lower Nepean and Hawksbury River system (Webb McKeown 1994) which were applied as boundary conditions at the upstream boundary of the RMA-2 model.
- ***Hawkesbury-Nepean Valley Regional Flood Study*** **(WMAwater, 2019)**
  - The *Hawkesbury-Nepean Valley Regional Flood Study* (*Regional Flood Study*) was completed for Infrastructure NSW (INSW). It covers a large geographic area extending from Wallacia to Broken Bay and focuses on regional scale flooding and decision making. It does not supersede more detailed local studies such as the *Nepean River Flood Study* (Advisian, 2018).
  - The *Regional Flood Study* adopted an updated version of the existing 1D RUBICON hydraulic model (Webb McKeown 1994). A 'Monte Carlo' approach to hydrologic modelling was adopted, generating thousands of potential events to mimic the variability of actual floods in the valley, including the variability of initial water levels in Warragamba Dam.
  - INSW has subsequently engaged a consultant to complete a Hawkesbury-Nepean Regional 2D Flood Model using the TUFLOW software. This work is ongoing.
- ***Lower Nepean River Floodplain Risk Management Study*** **(Advisian, 2019-present)**
  - Following the completion of the *Nepean River Flood Study* (Advisian, 2018) Advisian was engaged by Council to undertake the *Lower Nepean River Floodplain Risk Management Study & Plan* (FRMS&P).
  - As part of the FRMS&P a 2D TUFLOW hydraulic model has been developed and calibrated and used to simulate design flood events with Monte-Carlo based hydrograph inputs derived by the *HNV Regional Flood Study* (WMAwater 2019).
  - The TUFLOW model and its results have not currently been adopted for flood planning in the Penrith LGA. Before considering their adoption, Council is looking to better understand differences between the TUFLOW and RMA design flood results. There is also a desire for consistency with the INSW Hawkesbury-Nepean Regional 2D Flood Model which has not yet been completed.
  - For the purposes of this FERS and the associated FIA (Advisian, 2022) the two-dimensional TUFLOW hydraulic model developed for use in the Lower Nepean River FRMS&P and its outputs have been adopted. It was considered that this model offers advantages over the

RMA model for this purpose while exhibiting comparable flood conditions in the vicinity of the site for key design flood events.

2.2 Flood Affectation at the Site

The development site is located on the western floodplain of the Lower Nepean River at Emu Plains. Flood extent mapping at Emu Plains for design events ranging from the 1% Annual Exceedance Probability (AEP) to the Probable Maximum Flood (PMF) is shown in **Figure 2-1**.

The Nepean River channel in this area is deeply incised and floods up to and including a 2% AEP magnitude remain contained within the channel. The 1% AEP flood breaks out and spills across the floodplain into urban areas at some locations including at Emu Plains. Modelling of the 1% AEP flood indicates that floodwaters would 'back-up' from the Nepean River and inundate low-lying areas at the western and eastern edges of the site by passing through culverts beneath Old Bathurst Road and by overtopping the road itself.

The flood hazard that the site and the surrounding road network would be exposed to continue to worsen with increasing flood magnitude. Under existing conditions, the 1 in 200 AEP flood would inundate the entire site to depths in the range of about 0.3 to 1.1 m, however the extent and depth of inundation of the site would be significantly reduced post-development due to filling. Site conditions in the 1 in 500 AEP flood would be unsafe for all people and vehicles, while at the peak of the PMF the site would be several metres underwater and Old Bathurst Road would be inundated to the west as far as Wedmore Road; a distance of about 1.25 km from the site.

Old Bathurst Road is the key access route to the site. In flood events of a 1% AEP magnitude and greater it would be inundated at an earlier time during the flood than the site itself. Accordingly, to avoid tenants and staff from becoming trapped at the site and then potentially affected by flooding, it would be necessary to evacuate the site before inundation of Old Bathurst Road occurs.

The Old Bathurst Road access to the site would take several hours to become inundated once floodwaters begin rising in the adjacent Nepean River. As a result, there is adequate opportunity for the site to be evacuated if flood warnings and river levels are carefully monitored and the evacuation is suitably managed.

2.3 Hawkesbury-Nepean Flood Plan (SES, 2015)

The Hawkesbury Nepean Flood Emergency Sub Plan (SES, 2015) (the Flood Plan) is a sub plan of the State Emergency Management Plan (EMPLAN). It describes special arrangements covering prevention and preparedness measures, the conduct of flood operations and the transition to recovery for floods in the Hawkesbury-Nepean Valley.

Evacuation arrangements are described in Annex D (SES, 2020) of the Flood Plan. The road evacuation routes for the Emu Plains 'sector' are shown in **Figure 2-2**. Evacuation from the site would involve either by heading west along Old Bathurst Road and continuing to Blaxland (i.e., following the route indicated for Emu Heights), or by heading west along Old Bathurst Road before turning left (south) onto Russel Street and left (east) onto the M4 Motorway.

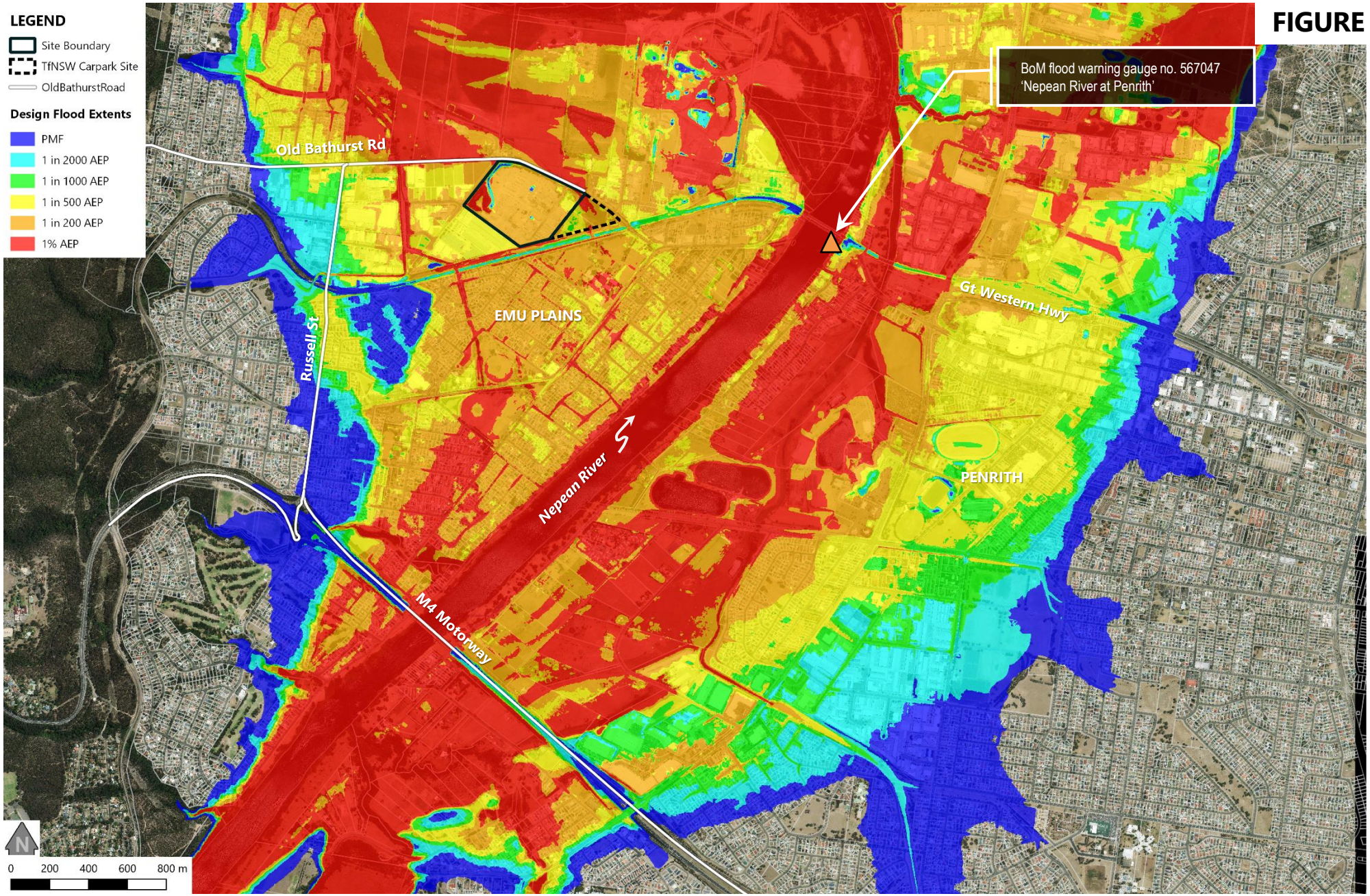
The Flood Plan also lists facilities that would be potentially suitable for use as evacuation centres but notes that only one or two of these evacuation centres would be opened at any one time based on the requirements for the event. The nearest potential evacuation centres to the west (Blue Mountains) and east (Penrith) of the site are presented in **Table 2-1**.

Table 2-1 Potential facilities that may be able to be used as evacuation centres during minor to moderate Hawkesbury-Nepean flood events (*source: SES, 2015*)

LGA	Location	Address	Relevant Sectors
Penrith	Penrith High School	High St, Penrith	Penrith Penrith South
	Jamison High School	Evan & Maxwell Sts, Penrith	Penrith Penrith South
	Nepean College of TAFE – Kingswood	12-44 O'Connell St, Kingswood	Penrith Penrith South
Blue Mountains	Glenbrook Bowling Club	8 Hare St, Glenbrook	Emu Plains
	Blaxland High School	Coughlan St, Blaxland	Emu Plains
	Winmalee High School	High School Drive, Winmalee	Emu Plains Yarramundi

It is expected that in major and extreme Nepean River floods the Penrith locations may not be operable, while the Blue Mountains locations would remain unaffected.

FIGURE 2-1



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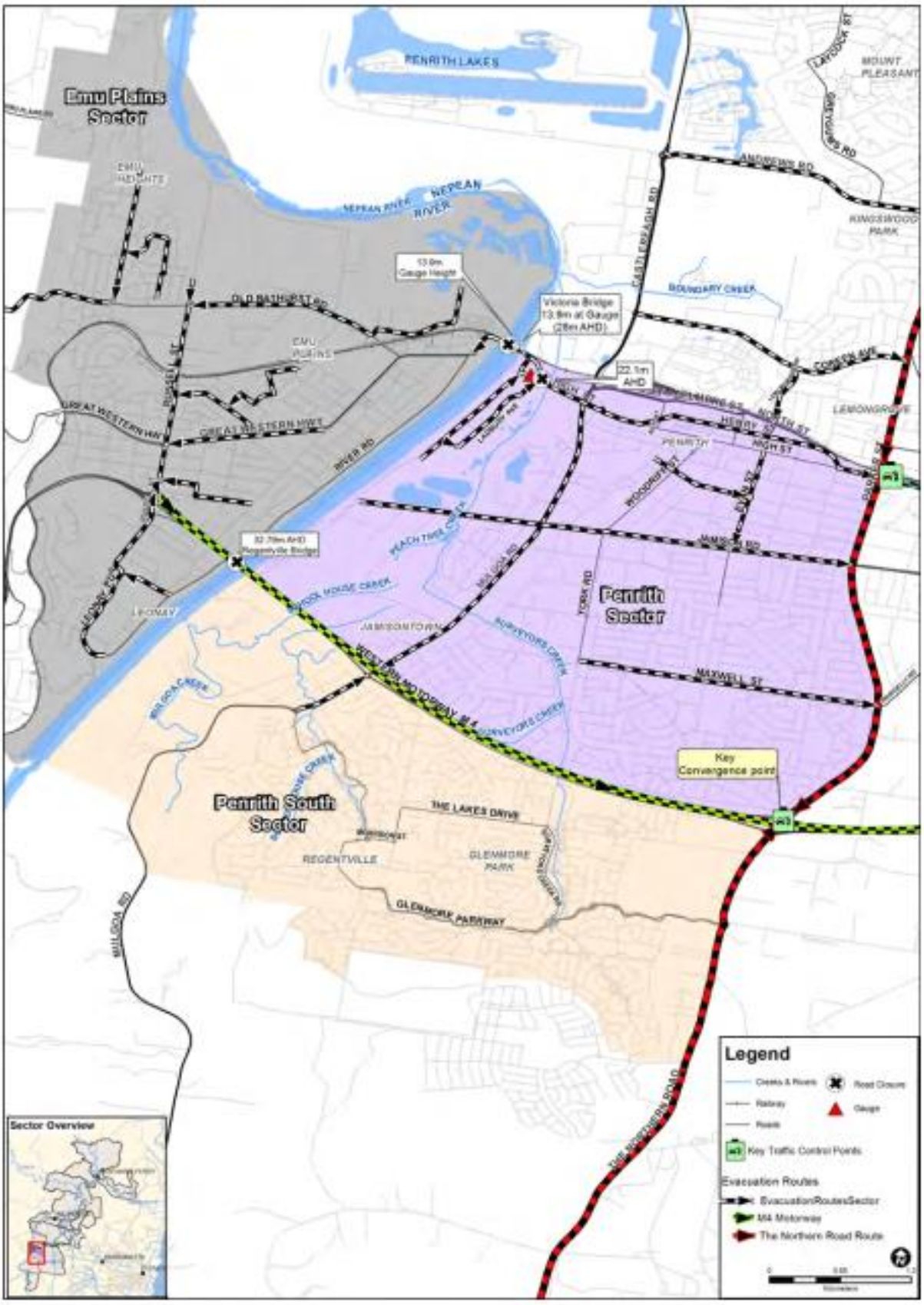
SIMULATED DESIGN FLOOD EXTENTS AT EMU PLAINS AND PENRITH

FIGURE 2-2



Map 10: Emu Plains and Penrith - Evacuation Routes

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EMU PLAINS AND PENRITH EVACUATION ROUTES [SOURCE: SES, 2020]

3 Flood Emergency Response

3.1 The Need for Flood Evacuation

The results of flood modelling indicate that Old Bathurst Road begins to be overtopped by floodwaters in a 1% AEP flood, while the majority of the proposed redevelopment site does not begin to be inundated until floodwaters reach the 1 in 200 AEP flood level or higher. During flood events of these magnitudes and larger, inundation of Old Bathurst Road will occur earlier in the flood than inundation of the site itself.

Therefore, from a flood emergency response perspective, the site would be classified as a 'low flood island'; that is, an area that would first become isolated by floodwaters due to inundation of its access roads and surrounds before becoming inundated itself should the floodwaters continue rising (e.g. NSW Department of Environment and Climate Change, 2007).

Flood conditions at the site would begin to pose a significant risk to life in a 1 in 500 AEP flood, and would be extremely hazardous in a PMF. Accordingly, it is not appropriate to shelter-in-place at the site during a flood event.

Therefore, in order to avoid tenants and staff being trapped at the site and then potentially being exposed to hazardous flood conditions, it will be necessary to complete evacuation of the site before inundation of Old Bathurst Road commences.

3.2 Land Use and Flood Risk

Intensification of residential development in 'low flood island' areas is generally not supported given the potential for residents to become stranded by rising floodwaters, especially in the case where high-hazard conditions exist during the PMF such as in the Emu Plains area. This stance is taken due to the fact that flooding may occur during the night and without adequate warning time. If residents become stranded, then rescue by boat or air may be required which would increase the burden on NSW SES resources and potentially endanger SES personnel.

However, safe and effective evacuation of the proposed industrial subdivision, without additional burden on the SES, will be achievable in light of the following:

- The associated industrial developments will only be occupied during business hours and will not include any overnight accommodations.
- Each future industrial development is proposed to have a dedicated Flood Warden who will be responsible for monitoring flood warnings on a day-to-day basis according to the requirements of this FERS. They will be able to trigger any required evacuation from the business with sufficient warning time prior to flood evacuation routes being cut by floodwaters, and/or advise site personnel and visitors to avoid attending the business if there is an active flood warning in place prior to the commencement of work for the day.
- The Flood Warden for each business will also be responsible for flood awareness and education activities for site personnel, such as training/information sessions and printing/distributing evacuation route posters and flyers.

It is also acknowledged that site workers or visitors to a business are likely to evacuate more readily and rapidly when instructed (or avoid the area altogether) compared to occupants of a residential

development, which will naturally take longer to be convinced that evacuation is required and will take additional time to gather valuables and belongings before evacuating.

3.3 Consideration of the PMF for Emergency Response Planning

The PMF event is typically used to inform emergency response planning as it generally has a higher rate-of -rise than other events and presents a worst-case scenario in terms of flood extent and hazard. This ensures that available flood warning and evacuation times are not overestimated, and that the selected evacuation route extends to a safe location beyond the limits of the floodplain.

Before proceeding with developing a flood emergency response strategy based on the PMF alone, a review of simulated water level hydrographs at the location of the Nepean River at Penrith (Victoria Bridge) gauge was undertaken for all available design floods. This review confirmed that the PMF exhibits the highest rate-of-rise and is therefore appropriate for determining available flood warning and evacuation times.

3.4 Potential Evacuation Routes for Assessment

There are two primary options for flood evacuation of the site to high ground outside the PMF extent. A third option (Option 3) was investigated but found to be inappropriate for flood evacuation. These routes are shown in **Figure 3-1** and **Figure 3-2** and are described as follows.

- Option 1: Old Bathurst Road to Blaxland Route
  - Exiting the site via David Road and turning left (west) onto Old Bathurst Road, before continuing westbound along Old Bathurst Road towards Blaxland at least as far as Wedmore Road. This can occur via the western exit onto Johns Road. The distance to travel outside of the PMF extent is about 1.6 kilometres.
  - Evacuees could continue west to Blaxland High School which is a potential evacuation centre.
- Option 2: M4 Motorway via Russell Street Route
  - Exiting the site via David Road and turning left (west) onto Old Bathurst Road, before turning left (south) onto Russell Street and continuing to the M4 Motorway. At the M4 Motorway evacuees could head east or west. If continuing in an easterly direction along the M4, land outside the PMF would be reached about 5 kilometres from the site, near the Mulgoa Road intersection with the M4. In a westerly direction land outside the PMF would be reached about 3 kilometres from the site, just a few hundred metres after entering the M4.
- Option 3: Great Western Highway Route (not recommended)
  - Exiting the site via David Road and turning right (east) onto Old Bathurst Road, before travelling eastbound along Old Bathurst Road and onto the Great Western Highway. Those evacuating via this route would need to continue along the Great Western Highway in an easterly direction, crossing the Nepean River and travelling through Penrith toward Kingswood, at least as far as Evan Street. The distance to travel outside of the PMF extent is about 3.6 kilometres.
  - This evacuation route would become inundated more quickly and more frequently than Option 1 and Option 2 and is therefore considered inappropriate for flood evacuation.

3.5 Evacuation Protocols

3.5.1 Inundation of Evacuation Routes

Evacuation would need to be completed prior to inundation of the proposed evacuation routes occurring.

Safety design criteria detailed in ARR 2019 indicates that it could be safe to drive a vehicle into floodwaters that are less than 0.15 metres deep and flowing at velocities less than 2.0 m/s. However, it is Advisian's position that it is not advisable to drive a vehicle into floodwaters of any depth. This is because it is difficult for a driver to estimate the depth and velocity of floodwaters. Therefore, it is recommended that evacuation protocols be based on achieving complete evacuation before the evacuation route is overtopped in order to avoid a circumstance where a vehicle is driven through floodwaters more severe than the ARR 2019 safety design criteria.

Accordingly, for the purposes of this FERS, the evacuation routes were deemed to be 'cut' as soon as inundation of the roadway that is to serve as the evacuation route is predicted to occur.

The western evacuation routes (Option 1 and Option 2) are first cut at Point A, which is on Old Bathurst Road near Lapstone Creek about 500 metres to the west of the site (*refer* **Figure 3-1**). Additional locations along Russell Street (Option 2) were analysed and it was found that the lowest of these ('Point B' - Russell Street near Pyramid Street) would not become inundated until about 5.5 hours after Old Bathurst Road during a PMF event. Accordingly, inundation of Old Bathurst Road provides the cut off for evacuation from the site via both the Option 1 and Option 2 routes.

The eastern evacuation route (Option 3) is first cut at Point C, which is on the Great Western Highway near Ladbury Avenue, about 300 metres after crossing the Victoria Bridge (*refer* **Figure 3-1**). The Option 3 route would become inundated earlier in a typical flood and more frequently than the Option 1 and Option 2 routes. Accordingly, it should not be used for evacuation during a flood emergency.

3.5.2 Flood Warning Gauge

During the Probable Maximum Flood (PMF) both evacuation routes would be cut. However, advanced warning time would allow for off-site evacuation.

The trigger for off-site evacuation is based on the Bureau of Meteorology (BoM) flood warning gauge number 567047 'Nepean River at Penrith'. This gauge is located on the eastern bank of the Nepean River immediately upstream of the Great Western Highway bridge crossing (Victoria Bridge) and is approximately 1.3 kilometres due east of the site (*refer* **Figure 3-1**).

Key gauge heights at the 567047 gauge are summarised in **Table 3-1**.

Table 3-1 Key gauge heights at Gauge No. 567047 (Nepean River at Penrith)

Name	Gauge Height (metres relative to local datum)	Gauge Level (mAHD)
Minor Flood Level	3.9	18.0
Moderate Flood Level	7.9	22.0
High St near Ladbury Av, Penrith, inundated (Evacuation Route Option 3)	9.05	23.2
Major Flood Level	10.4	24.5
Old Bathurst Road, Emu Plains, inundated (Evacuation Route Options 1 & 2)	11.4	25.5
Russell Street, Emu Plains, inundated (Evacuation Route Option 2)	13.6	27.7

3.5.3 Available Warning Times

Flood level hydrographs at Point A, Point B and Point C, as well as the Nepean River gauge (no. 567047), are plotted in **Figure 3-3** for the PMF event. A summary of the predicted warning and evacuation times for the PMF is as follows.

- 9.5 hours would be available from when the Minor Flood Level is reached at the 567047 gauge to when floodwaters cut off the eastern evacuation route (Option 3) at Point C.
- 2.6 hours would be available from when the Moderate Flood Level is reached at the 567047 gauge to when floodwaters cut off the eastern evacuation route (Option 3) at Point C.
- 3.5 hours would be available from when the Major Flood Level is reached at the 567047 gauge to when floodwaters cut off the western evacuation routes (Options 1 and 2) at Point A (Old Bathurst Road).

As is evident from **Table 3-1**, the evacuation route referred to as Option 3 would become inundated before the Major Flood Level is reached.

3.5.4 Recommended Evacuation Strategy

Evacuation of the site in an eastbound direction along the Great Western Highway toward Penrith (Option 3) is not recommended for the following reasons:

- The eastern evacuation route is inundated more quickly and more frequently than the western routes (Options 1 and 2)
- The eastern evacuation route involves crossing the Nepean River as well as travelling through the commercial district of Penrith. This introduces additional risk, and it is possible that the roads would be more heavily trafficked.
- The eastern evacuation route would already be cut when the Major Flood Level is reached at the 567047 gauge. This evacuation route would still be open when the Minor and Moderate Flood Levels are reached. However, the adoption of the Minor or Moderate Flood Level as an evacuation

trigger may result in evacuation orders being issued too often. This would inconvenience site operations and too many 'false alarms' may lead to complacency amongst workers and staff.

- Should any workers wish to evacuate to their home or the homes of relatives or friends located on the eastern side of the Nepean River this can be more safely done via the M4 Motorway route (i.e., Option 2).

Accordingly, evacuation in a westbound direction (Option 1 and Option 2) is recommended as the preferred evacuation route.

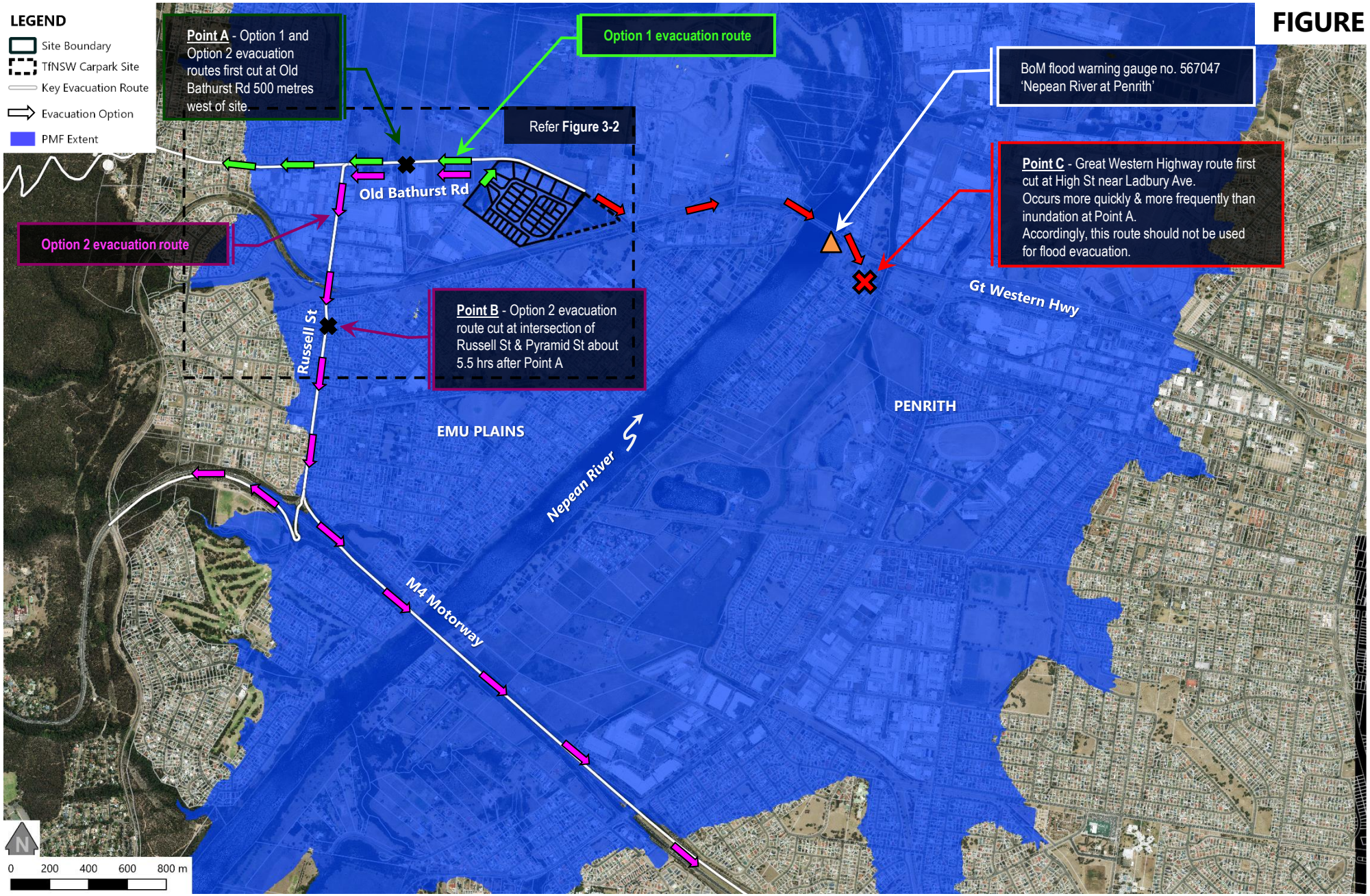
It is recommended that site preparations should commence when a Major Flood warning is issued by BoM for the Nepean River at Penrith, or once the Moderate Flood Level is reached at the 567047 gauge. Site preparation would involve securing of machinery and equipment or moving items onto higher ground if possible. This would also involve notifying site personnel of possible evacuation. During this time, the flood levels at the 567047 gauge should be closely monitored to assess the rate of rise of floodwaters. The flood level hydrographs in **Figure 3-3** show that for an event that manifests to become a PMF, the Major Flood Level would be reached approximately 6 hours after the Moderate Flood Level.

Formal evacuation of the site should be triggered when the Major Flood Level is reached at the 567047 gauge. A total of 3.5 hours would then be available for workers and staff to evacuate along Old Bathurst Road towards Blaxland, or along

This amount of warning time is considered adequate given that the individual lots are relatively small and the distance to be travelled is short. It would be feasible for the Flood Warden of each business (*refer* **Chapter 4**) to ensure that the entire lot is evacuated in a timely manner.

The progression of inundation during the PMF event over a period of several hours after the time of the proposed evacuation trigger (i.e., the Major Flood Level being reached) is shown in **Figure 3-4**.

FIGURE 3-1



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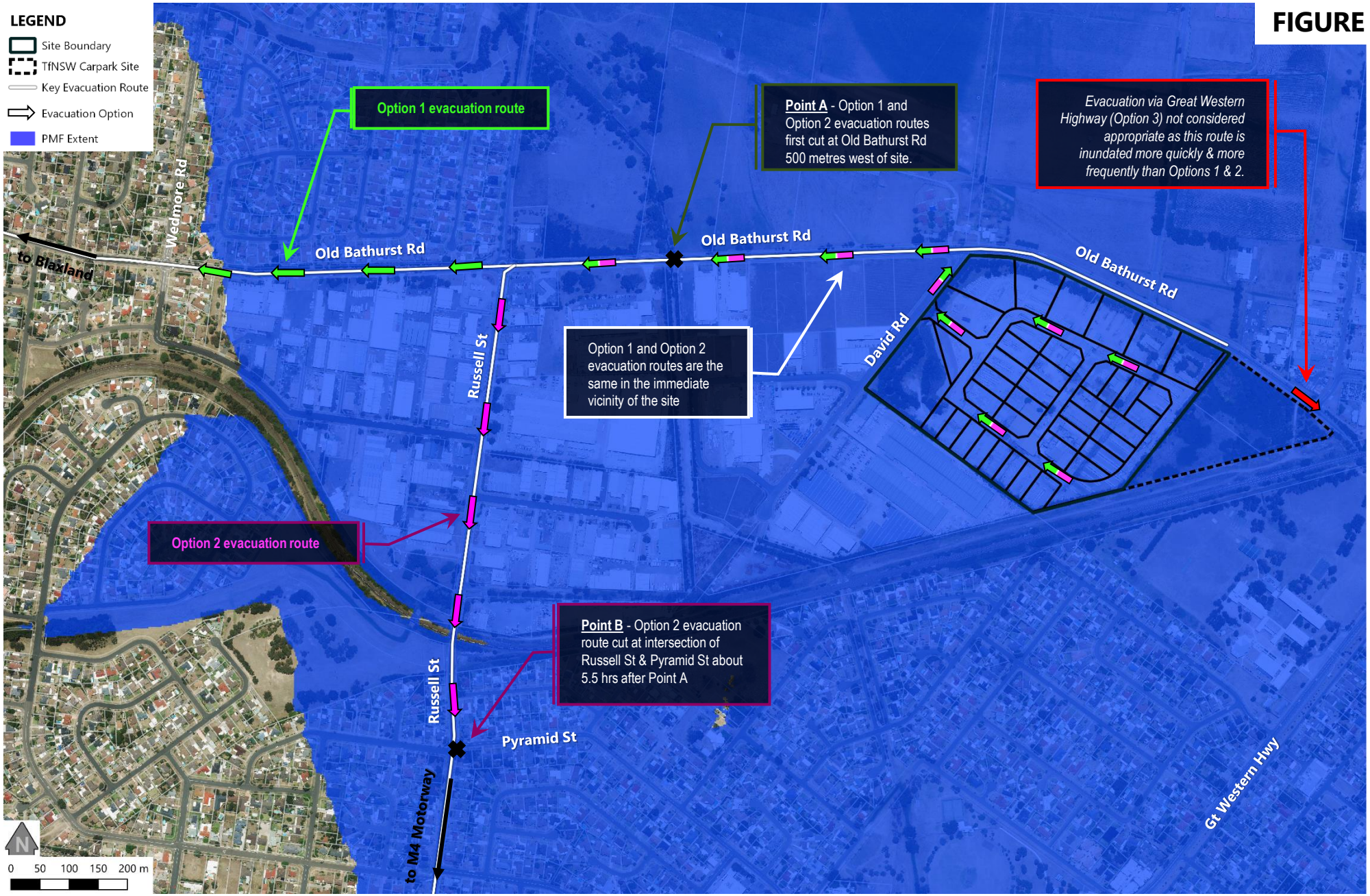
POTENTIAL FLOOD EVACUATION ROUTES FROM SITE TO LAND OUTSIDE THE PMF

FIGURE 3-2



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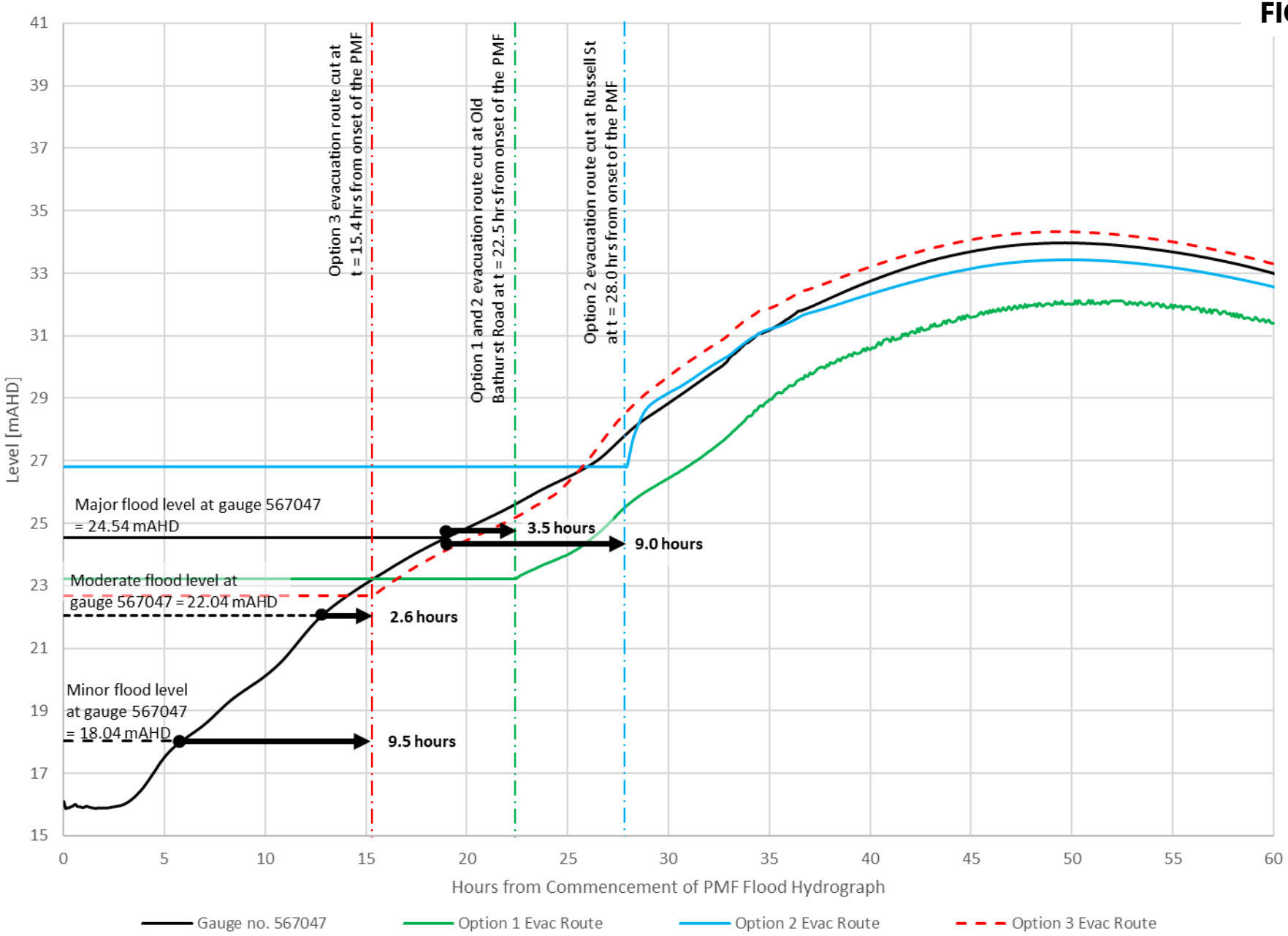
POTENTIAL FLOOD EVACUATION ROUTES FROM SITE TO LAND OUTSIDE THE PMF

FIGURE 3-3



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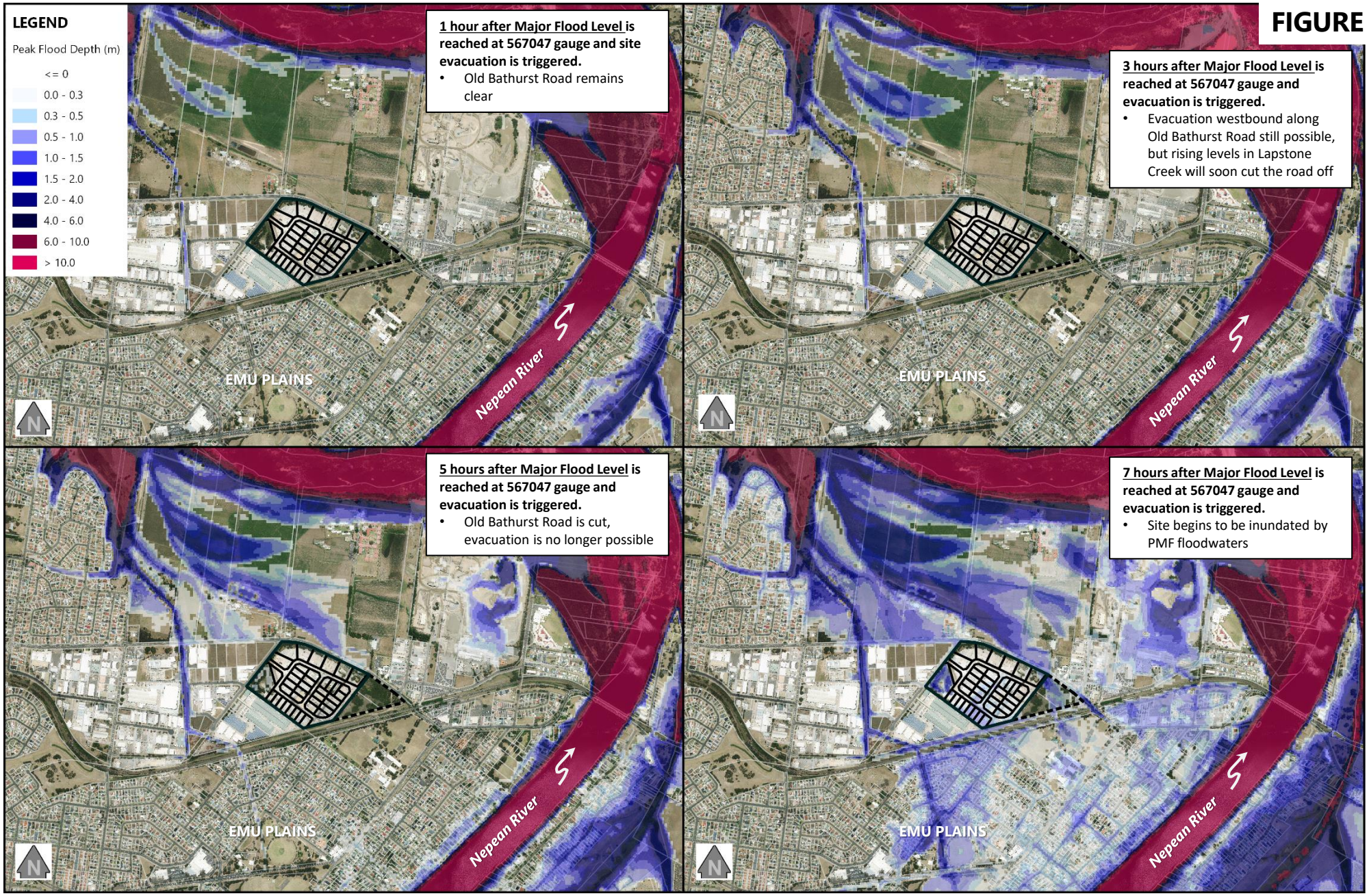
PMF LEVEL HYDROGRAPHS FOR THE NEPEAN RIVER AT PENRITH GAUGE (567047) AND KEY LOCATIONS ALONG EVACUATION ROUTES

FIGURE 3-4



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PROGRESSION OF INUNDATION EXTENTS DURING THE PMF EVENT

4 Flood Preparedness and Awareness

4.1 Flood Warden and the FERP

A Flood Warden is to be nominated for each business to take carriage of the Flood Emergency Response Plan (*to be prepared based on this Flood Emergency Response Strategy*) that applies to the lot on which that business is located. The nominated Flood Warden is to be familiar with this FERS and its contents and is to be responsible for implementing emergency response actions during a flood emergency.

A hard copy of the FERS is to be placed in the administration office of each business. The Flood Warden is to have access to a digital PDF copy of the FERS on their personal phone/device so that they can continue to perform Flood Warden duties outside of business hours if required. Hyperlinks contained in the digital version will also enable direct access to specific Bureau of Meteorology (BOM) websites for monitoring of live rainfall and river level data.

A copy of the Emergency Contact Sheet contained in **Appendix A** is to be kept up-to-date with the names and contact details of the nominated Flood Warden and local SES contacts where available. This should occur via an annual audit.

The Flood Warden is to follow the protocols outlined in **Appendix B**.

4.2 Flood Emergency Signs / Posters

Flood emergency signs are to be printed and posted at each industrial lot. The signs are to comprise a map showing evacuation routes from the industrial estate via Old Bathurst Road towards Blaxland and via Russell Street to the M4 Motorway. This map can be posted within and near the entrance to the industrial lots and in common areas.

It is recommended that the map of the evacuation route from the industrial estate is printed as a flyer and distributed to each employee / worker to keep in their respective vehicles. This would allow each person to have clear instructions on how to safely evacuate the site even if they are not familiar with the flood emergency signs.

A copy of the draft flood emergency poster / flyer is attached in **Appendix C**.

4.3 Off-Site Evacuation Strategy

The Flood Warden is to work with the administrator at each business to establish and document a strategy to facilitate evacuation of workers in the most efficient, timely and safest manner during a flood emergency.

It is envisaged this may involve the following:

- Warning the employees to stop work and prepare for evacuation
- Ensuring the driveway to the lot is clear at all times
- Handing out flyers for external evacuation routes from site when the evacuation warning is triggered

Further information on the triggers for when the Flood Warden is to initiate evacuation procedures is outlined in **Section 3.5.4**.

The evacuation triggers are also summarised in the protocols in **Appendix B**.

4.4 Flood Awareness and Training

Staff and workers are to be made aware of the existing flood risk and emergency response protocols. A flood risk information session for workers is to be held annually, along with an internal evacuation drill.

In general, the site should be kept in a neat and tidy state to minimise the risk of obstacles during an evacuation. Buildings should maintain clear egress, and industrial equipment should be stored securely to remove the chance of it being washed away from the site by floodwaters and causing a hazard to downstream areas.

4.5 FERS Review

This Flood Emergency Response Strategy is to be reviewed following a major flood emergency that triggers any internal or off-site evacuation of the school.

It is also recommended that the response triggers and actions be reviewed once Penrith City Council has finalised and adopted the *Lower Nepean River Floodplain Risk Management Study*, which may include revised predictions for large floods.

5 Flood Recovery and Clean-up

The following flood recovery actions are to be undertaken in the aftermath of major flooding of the Nepean River, or where any associated evacuation of the site has occurred.

- If off-site evacuation has occurred, when it is safe to do so, the Flood Warden is to return to the site and inspect the premises for any signs of damage. This includes potential storm damage, such as leaking roofs or damage to local powerlines by wind or fallen trees.
- Call SES on 13 25 00 if assistance is required to gain access.
- Any areas that were inundated during the flood, including inside or outside, are to be taped-off by the Flood Warden or SES to prevent access until:
  - A licensed electrician or electrical authority (e.g., Ausgrid) has attended the area to confirm that all electrical threats have been eliminated or has otherwise completed any required repairs to damaged electrical systems.
  - The area has been cleared of flood debris, floodwaters removed and professionally cleaned in order to address any sanitation issues.

The site is only to be reopened for staff and workers once the above items have been addressed and it is safe to resume work.

6 Conclusions and Recommendations

This Flood Emergency Response Strategy has been prepared for the proposed industrial subdivision at 158-164 Old Bathurst Road, Emu Plains. It has been developed with reference to flood data derived from simulations of design floods using the TUFLOW hydraulic model that has been developed as part of Council's *Lower Nepean Floodplain Risk Management Study* (*in draft, 2022*).

Modelling results indicate that Old Bathurst Road, which is the primary access to the site, would be inundated in a severe flood before any inundation of the site itself occurs. From a flood emergency response perspective, the site would therefore be classified as a 'low flood island'; that is, an area that would first become isolated by floodwaters due to inundation of its access roads and surrounds before becoming inundated itself should the floodwaters continue rising.

Flood conditions at the site would begin to pose a significant risk to life in a 1 in 500 AEP flood, and would be catastrophic in a PMF. Accordingly, it is not appropriate to shelter-in-place at the site during a flood event.

In order to prevent tenants and staff from becoming trapped at the site and then potentially being exposed to hazardous flood conditions, it will be necessary to complete evacuation of the site before inundation of Old Bathurst Road begins to occur.

The preferred evacuation route is west along Old Bathurst Road toward Blaxland. Land outside of the PMF flood extent would be reached at Wedmore Road, which is about 1.6 kilometres west of the site. If road conditions permit, evacuees could continue west to Blaxland.

An alternative evacuation route identified in Annex D of the Hawkesbury-Nepean Valley Flood Plan (SES, 2020) would be west along Old Bathurst Road, then south along Russell Street to the M4 Motorway. If continuing in an easterly direction along the M4, land outside the PMF would be reached about 5 kilometres from the site, near the Mulgoa Road intersection with the M4. In a westerly direction land outside the PMF would be reached about 3 kilometres from the site, just a few hundred metres after entering the M4.

It is recommended that evacuation begin when a Major Flood Level is reached at the 'Nepean River at Penrith' gauge. This would allow about 3½ hours for evacuation to occur prior to inundation of Old Bathurst Road (assuming floodwaters continue to rise).

In order to minimise the risk to future occupants of the site, it is recommended that the strategy set out in this report be incorporated into a 'Flood Emergency Response Plan' that can be adopted by the businesses that are created on each of the lots within the proposed subdivision. Each FERP should be required to be submitted by those businesses as a condition of occupation.

7 References

Advisian (*2018)*, '*Nepean River Flood Study*', prepared for Penrith City Council.

Advisian (*in draft, 2022)*, '*Lower Nepean River Floodplain Risk Management Study and Plan*', prepared for Penrith City Council.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) (*2019*), '*Australian Rainfall and Runoff: A Guide to Flood Estimation*', © Commonwealth of Australia (Geoscience Australia), (ARR 2019).

NSW Department of Environment and Climate Change (2007), '*Flood Risk Management Guideline: Flood Emergency Response Planning Classification of Communities*'.

NSW State Emergency Services (2014), '*Hawkesbury Nepean Flood Emergency Sub Plan; a Sub Plan of the State Emergency Management Plan (EMPLAN)*'.

NSW State Emergency Services (2014), '*Hawkesbury-Nepean Valley: NSW SES Evacuation Arrangements Annex D*', supporting document to the Hawkesbury-Nepean Flood Plan.

Penrith City Council (*2014*), '*Penrith Development Control Plan 2014*', (Penrith DCP 2014).

WMAwater (*2019)*, '*Hawkesbury-Nepean Valley Regional Flood Study*', prepared for Infrastructure NSW.

Appendix A
Emergency Contact Sheet

TABLE A EMERGENCY CONTACT SHEET

Name	Organisation	Role	Contact
N/A	State Emergency Services (SES	To contact if emergency assistance is required	132 500
N/A	Emergency Services	Fire/Ambulance/Police (to call in a life-threatening emergency)	000; or 112 from mobiles
<insert name>	<insert business>	Flood Warden	<insert contact>
<insert name>	<insert business>	Administrator	<insert contact>
<insert name>	<insert business>	Other staff tasked with actions during a flood emergency	<insert contact>
N/A	Nepean Hospital	Hospital (east of site)	4734 2000
N/A	Blue Mountains District ANZAC Memorial Hospital	Hospital (west of site)	4784 6500
N/A	Bureau of Meteorology (BOM)	National Directory for Flood Warnings	1900 926 113

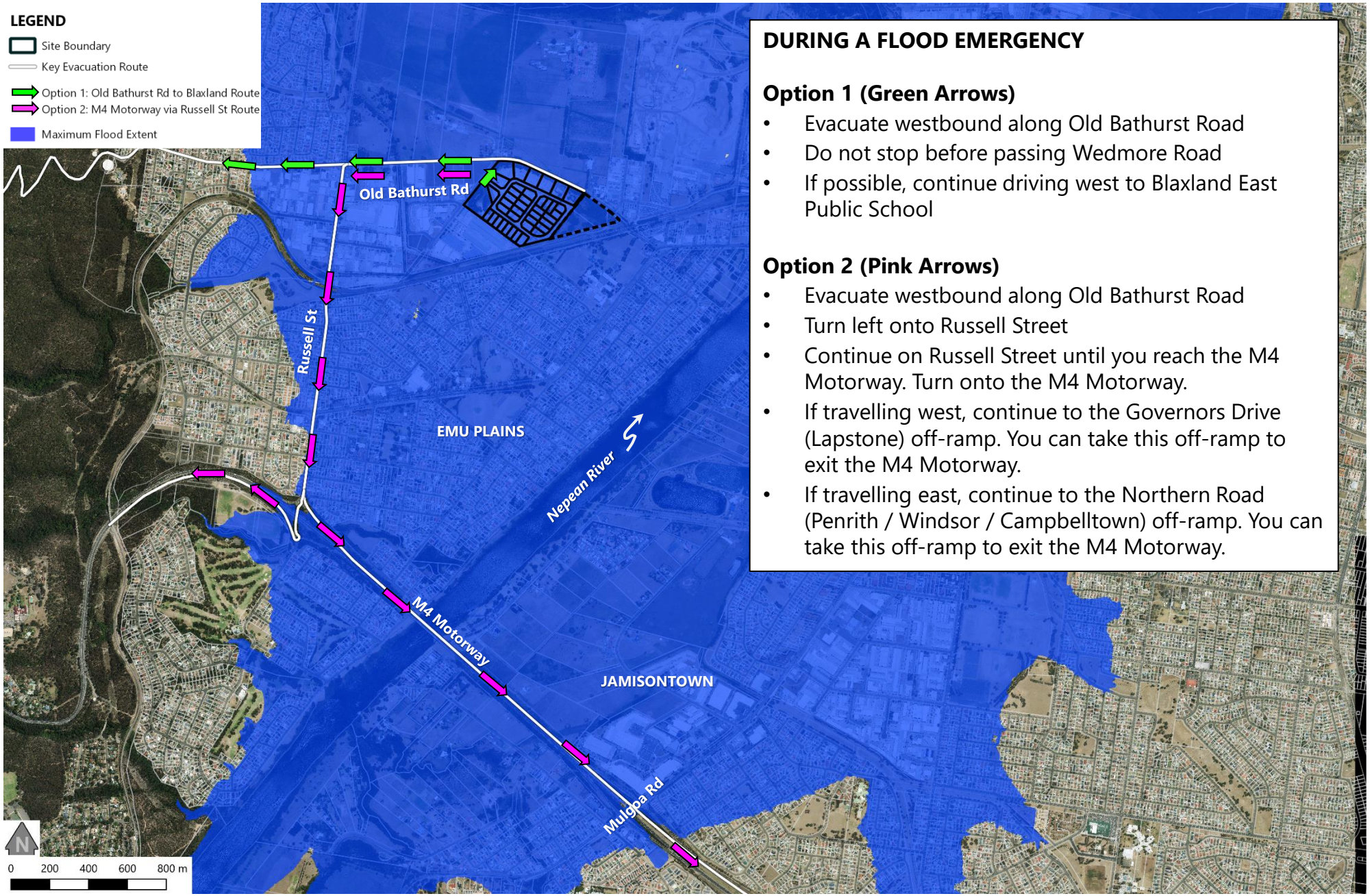
Appendix B
Flood Emergency Response Triggers / Actions

TABLE B EMERGENCY RESPONSE TRIGGERS AND ACTIONS

TRIGGER	ACTIONS FOR THE FLOOD WARDEN
Check daily	Monitor general weather and flood warnings from BOM: *http://www.bom.gov.au/nsw/warnings/* Note: weather 'watch' indicates that conditions are favourable for an event to occur, while weather 'warnings' indicate that the conditions are occurring or imminent.
SES Flood Evacuation Order (*to be followed if issued at any stage*)	Follow all instructions issued by the NSW SES or Local SES Penrith Unit. If ordered by SES, commence off-site evacuation as per protocols below. Phone SES on 13 25 00 if in need of assistance. Phone 000 if there is a life-threatening situation.
BOM **Flood Warning** issued for the Nepean River	Flood Warden or nominated person to monitor Nepean River levels and flood warnings at the 'Nepean River at Penrith' gauge (no. 567047). **Nepean River at Penrith – Station Number 567047** ▪ Table Format: *http://www.bom.gov.au/fwo/IDN60233/IDN60233.567047.tbl.shtml* ▪ Chart Format: *http://www.bom.gov.au/fwo/IDN60233/IDN60233.567047.plt.shtml*
	If a Moderate Flood Warning is issued: ▪ Issue a warning to all site personnel that evacuation may be required in the coming hours. ▪ Consider whether staff are required on-site, particularly those that live in areas to the east of the Nepean River. If applicable, advise staff to stay at home and not come to work that day. ▪ Consider early evacuation of personnel to their homes.
	If a Major Flood Warning is issued: ▪ Issue a warning to all site personnel that evacuation may be required in the coming hours. ▪ For staff that are not present at the site, advise them to stay at home and not come to work that day. ▪ Consider early evacuation of personnel to their homes.

TRIGGER	ACTIONS FOR THE FLOOD WARDEN
Nepean River **Gauge Height reaches 7.9 metres** (Moderate Flood Level)	At least 9.5 hours warning time is expected before the westbound evacuation route along Old Bathurst Road is inundated. At least 6 hours is expected before the Major flood level is reached. Monitor for road closures at Old Bathurst Road, Russell Street and the M4 Motorway. *https://www.livetraffic.com/* Commence **site preparation**: ▪ Issue a warning to site personnel that evacuation may be required in the coming hours. ▪ Work with site personnel to secure machinery and equipment, moving them to higher ground if possible. ▪ Provide a copy of the evacuation route flyer to site personnel (*refer* **Appendix C**). Flood Warden to continue to monitor gauge levels, current BOM flood warnings, and flood height predictions for the Nepean River at Penrith gauge (no. 567047)
Nepean River **Gauge Height reaches 10.4 metres** (Major Flood Level)	If not already actioned, commence **off-site evacuation** from the site: ▪ Exit site via western access point at David Road. Turn right (north) onto David Road and travel to intersection with Old Bathurst Road. Turn left (west) onto Old Bathurst Road and travel westward. ▪ Continue west until reaching high ground at Wedmore Road; or ▪ Turn left (south) onto Russell Street, travel south to the M4 Motorway and then continue either west towards Glenbrook or east towards Regentville. At least 3.5 hours evacuation time is expected to be available before the evacuation route is inundated.
	Before 8:00 AM on a business day: If the triggers occur overnight / early in the morning, the Flood Warden is to notify site personnel to stay home for the day.
Once floodwaters have receded from the site	Follow the flood recovery and clean-up protocols outlined in **Section 5**.

Appendix C
Flood Emergency Poster / Flyer



DURING A FLOOD EMERGENCY

Option 1 (Green Arrows)

- Evacuate westbound along Old Bathurst Road
- Do not stop before passing Wedmore Road
- If possible, continue driving west to Blaxland East Public School

Option 2 (Pink Arrows)

- Evacuate westbound along Old Bathurst Road
- Turn left onto Russell Street
- Continue on Russell Street until you reach the M4 Motorway. Turn onto the M4 Motorway.
- If travelling west, continue to the Governors Drive (Lapstone) off-ramp. You can take this off-ramp to exit the M4 Motorway.
- If travelling east, continue to the Northern Road (Penrith / Windsor / Campbelltown) off-ramp. You can take this off-ramp to exit the M4 Motorway.

Prepared by:

EVACUATION ROUTES DURING A FLOOD EMERGENCY