



Attachment 5 to Item 9.1.1

Flood Risk Advice

Date of meeting: 17 February 2026

Location: Council Chambers

Time: 7:00pm

10 July 2025

Bryan Garland
Chief Development Officer
Johnson Property Group
27 Patrick Drive
Cooranbong NSW 2265

Via email: bryang@johnsonpropertygroup.com.au

Dear Bryan

Our ref: 25050013_L01V01_43_Bootles_Ln_Flood_Risk_Advice

25050013: 43 Bootles Lane – Flood Risk Advice

Thank you for inviting Water Technology to provide flood risk advice for the proposed subdivision at 43 Bootles Lane, Pitt Town. This letter sets out:

- The background to your development proposal and the reason for the flood risk advice
- The flood risks on the site
- Assessment of the capacity of the site's development based on flood risk and evacuation considerations alone.

1 BACKGROUND TO THE PROPOSED DEVELOPMENT

The current lot at 43 Bootles Lane, Pitt Town is a 7.5 ha site which is presently zoned RU2 Rural Landscape. It is predominantly covered by bushland but the south east corner is occupied by a water treatment facility and the western end is cleared land (Figure 1). Under the current zoning the land has an entitlement for the construction of one residential dwelling.

It is proposed to rezone and subdivide the land (Figure 2) to create the following:

- A 3,125 m² lot zoned SP2 Infrastructure for the water treatment facility
- A large 66,926 m² lot zoned C2 Environmental Conservation, retaining the existing entitlement for one dwelling
- Five new lots zoned R2 Low Density Residential at the cleared western end of the site.

The planning proposal would increase the current single dwelling entitlement on the site to an entitlement for 6 dwellings to be constructed: an increment of only 5 dwellings. Based on the 2021 census the average number of motor vehicles per dwelling in Pitt Town is 2.6. Therefore, the 6 dwellings would likely result in approximately 16 cars, which is an increase of 13 vehicles relative to the current dwelling entitlement.

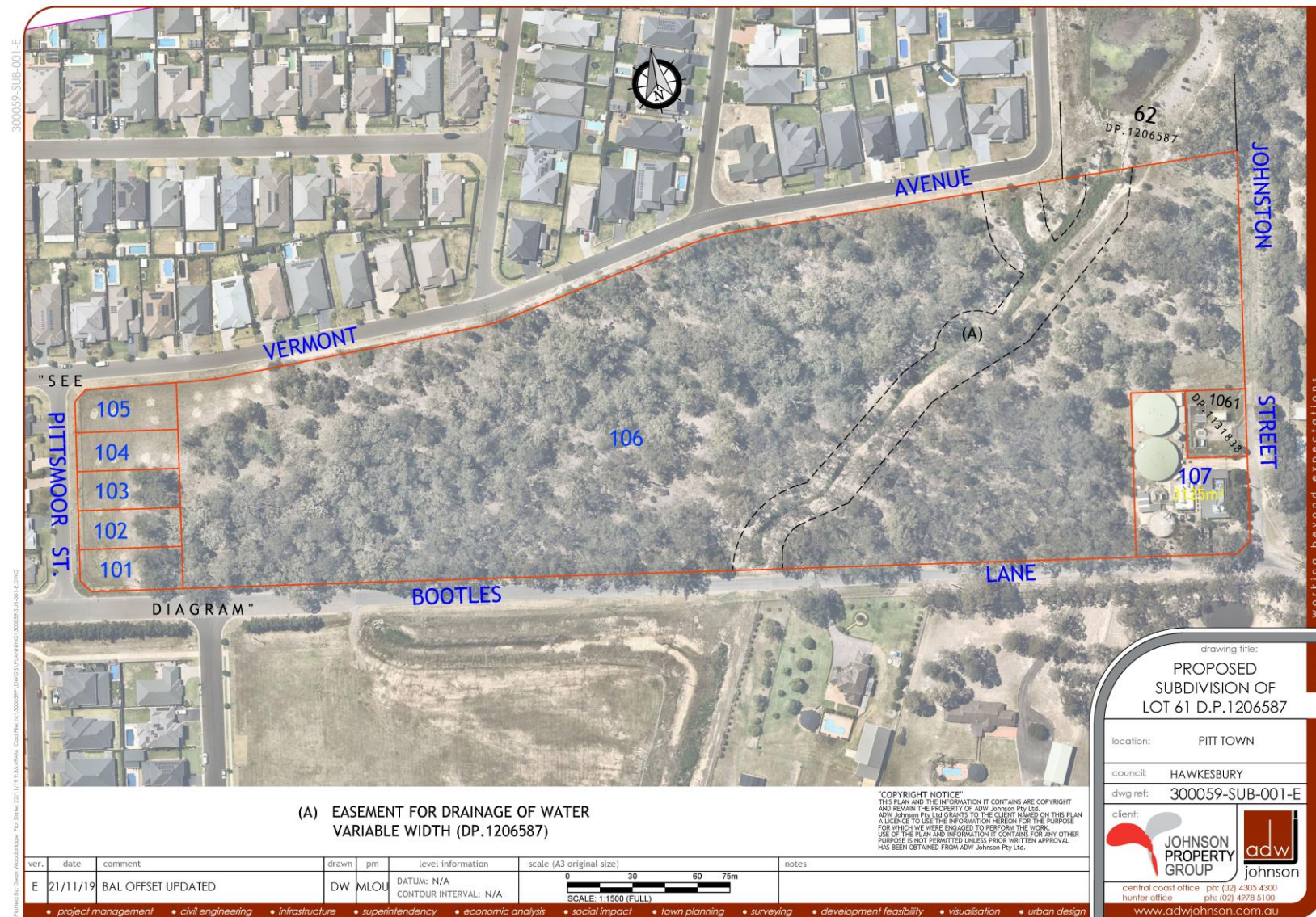


Figure 1 Site Context





2 FLOOD RISK ASSESSMENT

In 2024 the NSW Reconstruction Authority released the *Hawkesbury-Nepean River Flood Study*. This study supersedes previous flood modelling undertaken for the Hawkesbury-Nepean River. The *Hawkesbury Floodplain Risk Management Study and Plan 2025* is based on the 2024 modelling and was adopted by Council in March 2025. Therefore, the consent authority will consider the new flood model results when assessing the planning proposal.

The analysis in this letter is based on the publicly available data from the 2024 flood model results. The riverine flood levels are set out in Table 1 and flood extents are shown in Figure 3, Figure 4, Figure 5 and Figure 6.

Table 1 Flood levels for the site

Event	Flood Level (m AHD)
1% AEP	17.3
0.1% AEP	21.3
0.05% AEP	22.8
PMF	30.6

While the south-eastern corner of the site drops as low as 16.7 m AHD and flooding would be 0.6 m deep during a 1% AEP flood in that location, most of the site would be above the 1% AEP flood as shown in Figure 3. In this event flooding would mostly only impact the lot upon which the water treatment facility has been built, which itself has been constructed above the 1% AEP flood level. The easternmost edges of lot 106 would also be impacted, but this lot would largely be flood free.

Figure 4 shows that even in the rarer event of a 0.1% AEP flood, floodwaters would not reach the lots 101 – 105 and the north-western half of lot 106 would also remain flood free. In the 0.05% AEP (Figure 5) flooding may reach the eastern margins of lots 101 and 102. However, the western portion of these lots would remain flood free, as would the north-western corner of lot 106. Therefore, dwellings could easily be constructed on the proposed lots outside of the flood extent of the 0.05% AEP event.

The PMF on the other hand would completely cover the site (Figure 6). The minimum depth would be in the north-western corner where the new residential dwellings would be constructed. Here the floodwaters would be at least 8 m deep and too hazardous for residents to stay in their dwellings.

Based on the 2024 flood modelling, Pitt Town is a low flood island. This means that the suburb becomes isolated once flood levels reach 16.0 m AHD on the regional evacuation route and if floodwaters continue to rise the flood island can become entirely inundated. Therefore, the NSW SES plans to evacuate the whole of Pitt Town before this evacuation route becomes cut by flooding. The site would become isolated in the 2% AEP flood, meaning that the probability of Pitt Town needing to evacuate in any given year is 2%.

3 FLOOD EVACUATION PLANNING

The NSW SES flood response strategy for the Hawkesbury Nepean Valley is set out in its *Hawkesbury-Nepean Vallet Flood Emergency Plan* (NSW SES, 2020). It involves evacuating all residential, business and other premises that are at risk of flooding and directing evacuees eastward. The *Hawkesbury-Nepean Valley Flood Evacuation Modelling to Inform Flood Risk Management Planning* (2023) report prepared by Infrastructure NSW indicates that 80% of people are expected to evacuate to accommodation with family, friends and commercial accommodation providers while only 20% evacuate to an evacuation centre. Discussion with the NSW SES suggests that fewer than 20% of people may travel to an evacuation centre.

To achieve orderly and timely evacuation, the NSW SES has divided the floodplain into sectors and subsectors with designated evacuation routes. This proposed development is part of the Pitt Town Sector (Figure 7) which has its evacuation route out of the floodplain via Old Stock Route Road and Old Pitt Town Road (Figure 8).

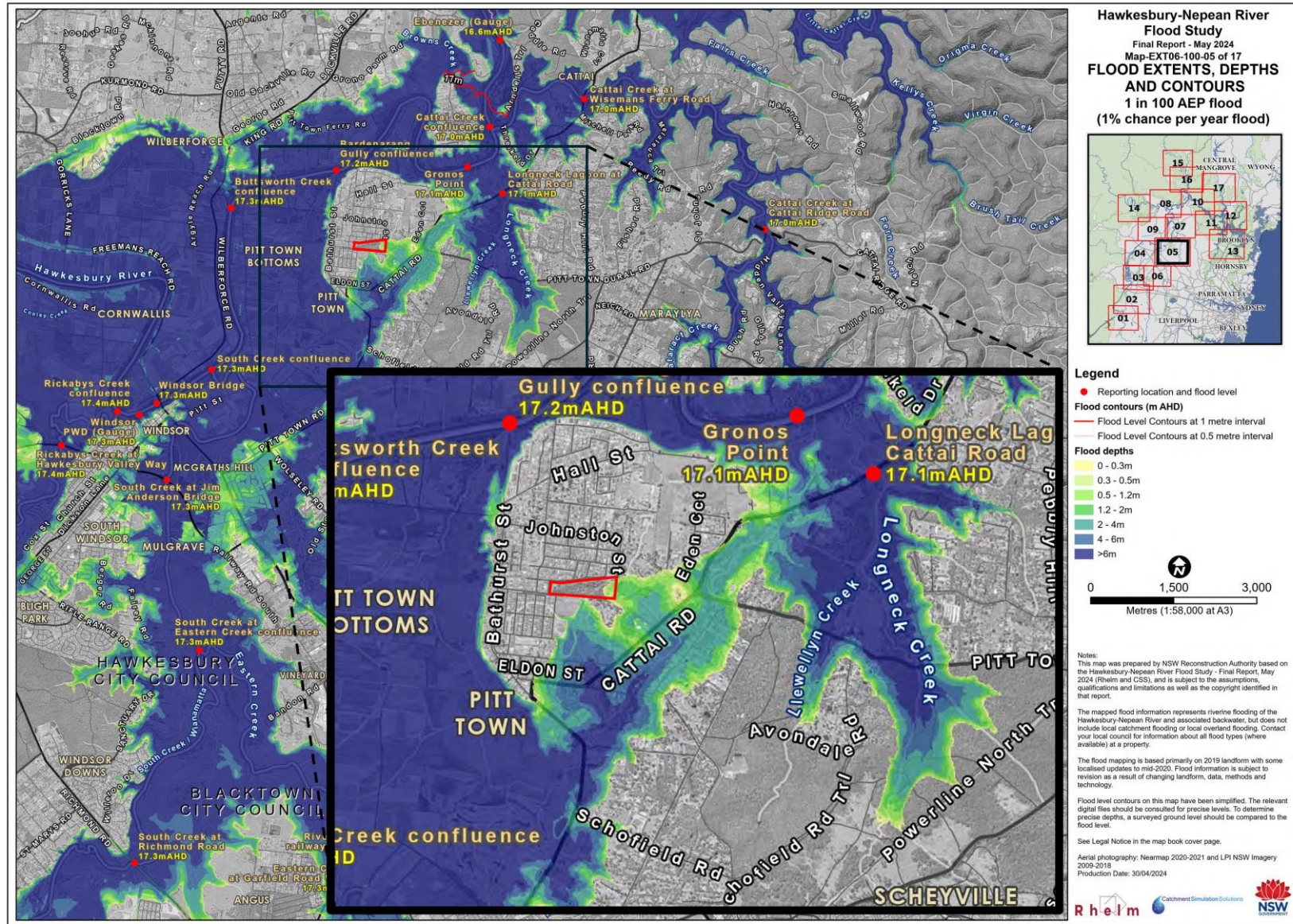


Figure 3 Flood levels and flood depths in the 1% AEP flood

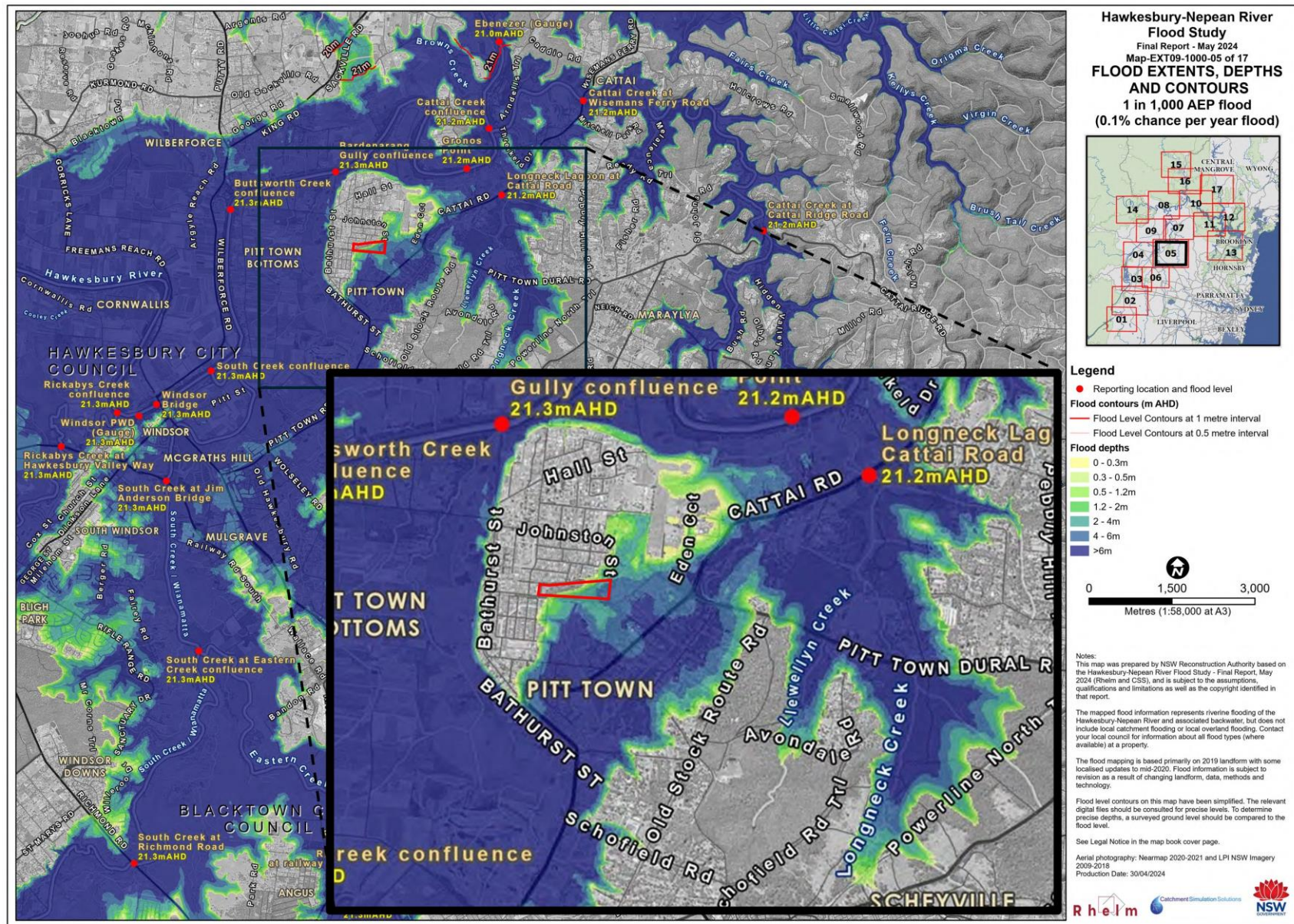


Figure 4 Flood levels and flood depths in the 0.1% AEP flood

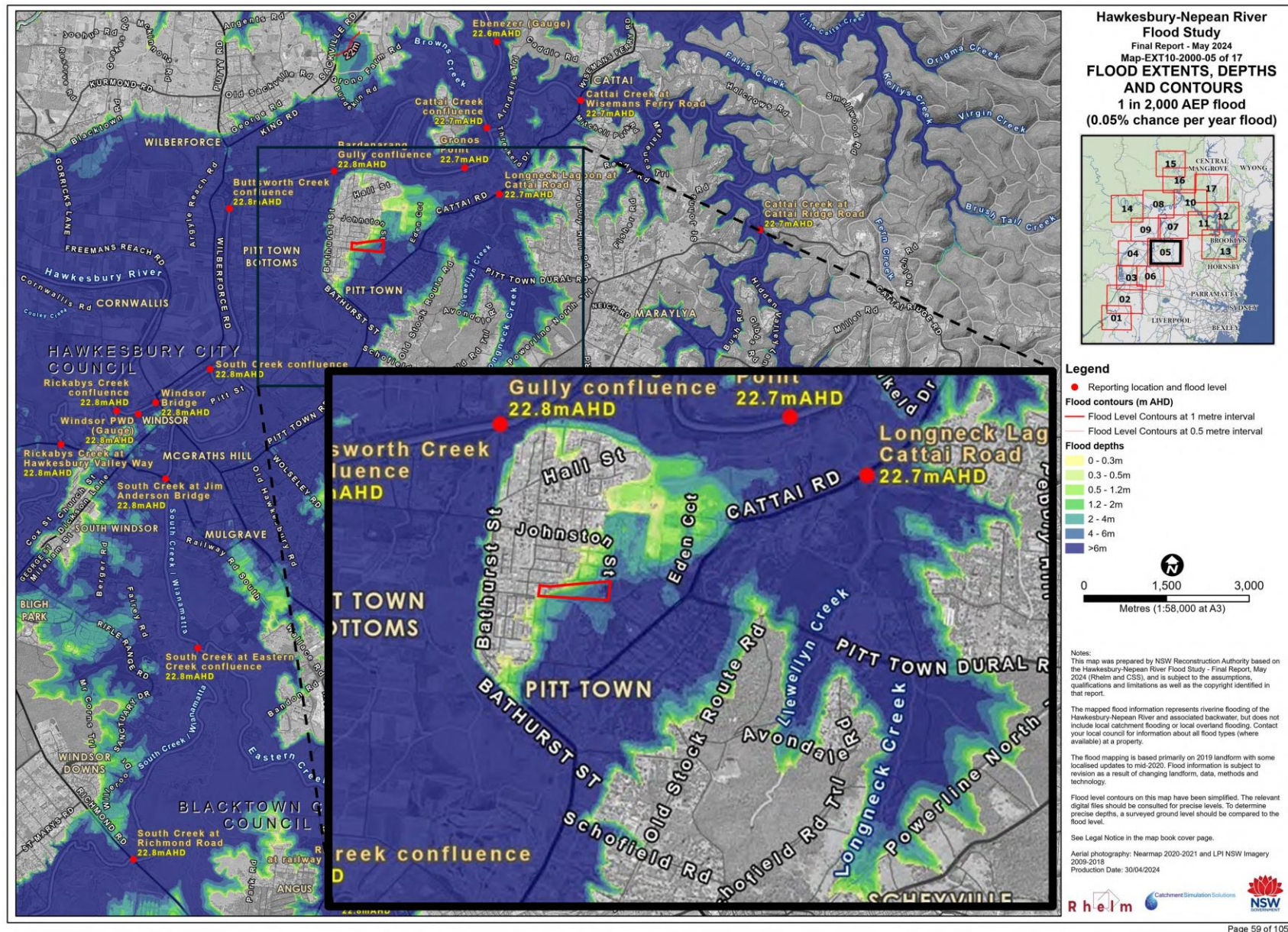


Figure 5 Flood levels and flood depths in the 0.05% AEP flood

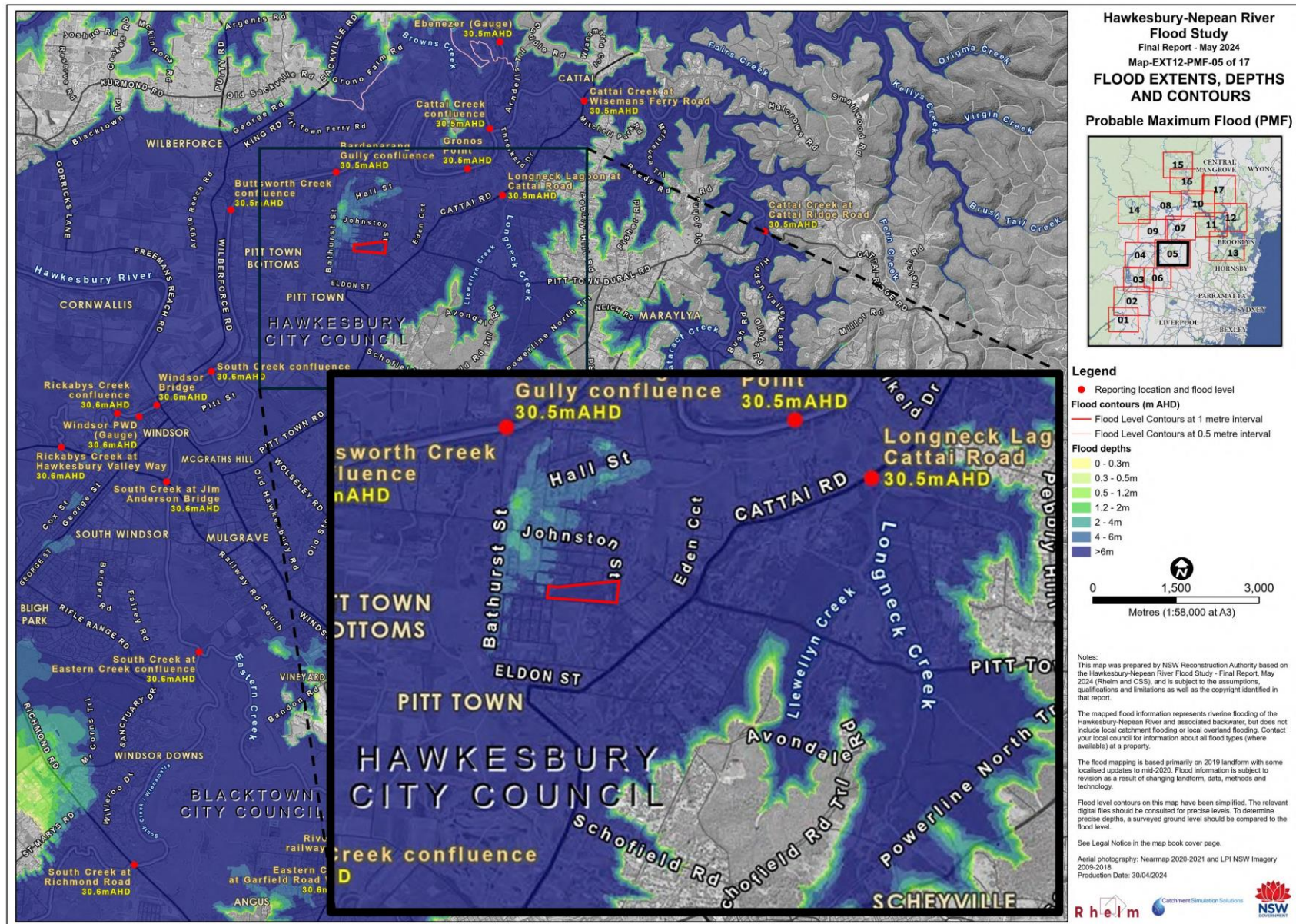


Figure 6 Flood levels and flood depths in the PMF

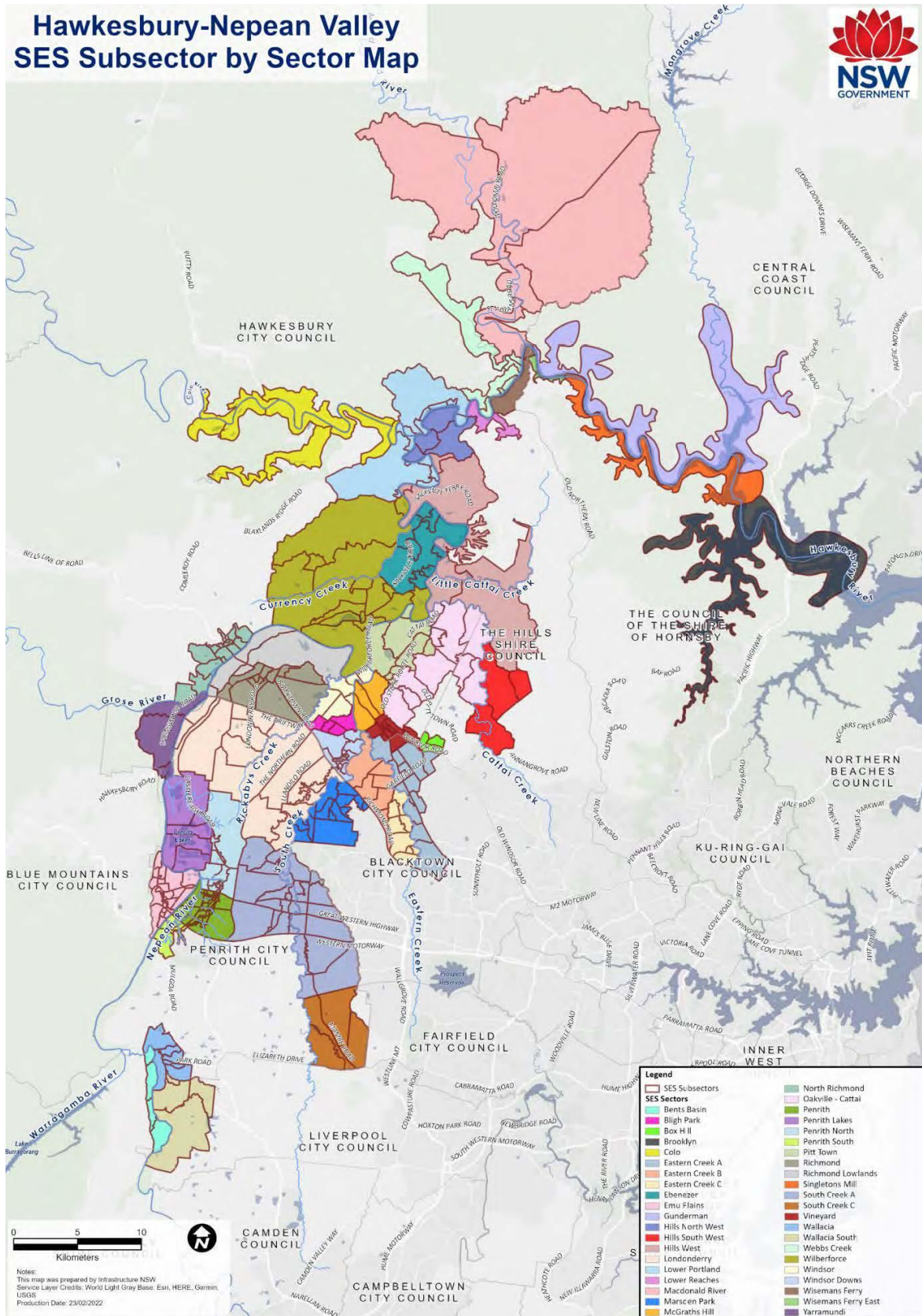


Figure 7 NSW SES evacuation sectors and subsectors

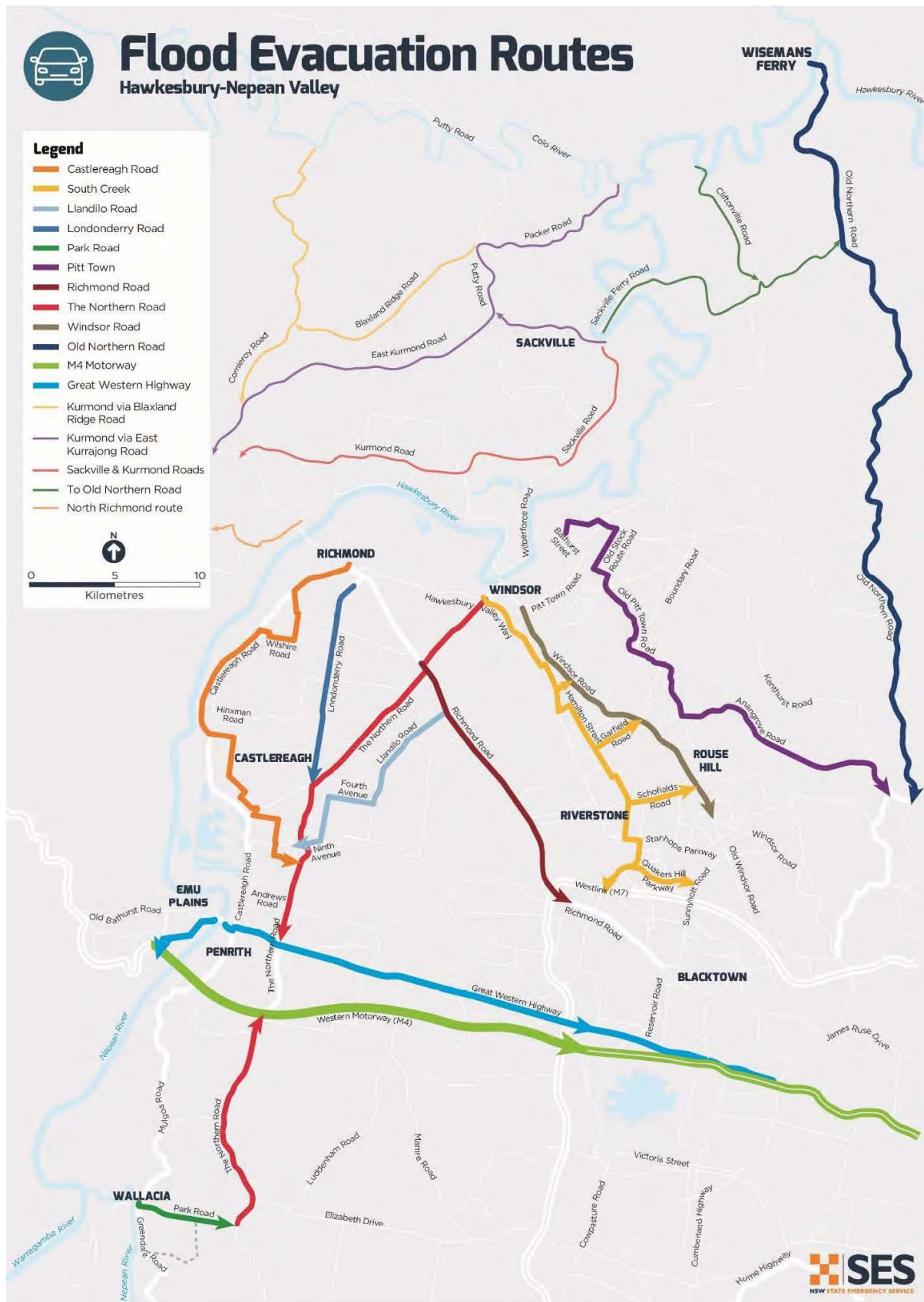


Figure 8 Regional evacuation routes nominated by the NSW SES



Currently the lowest point along this route lies at 16.0 m AHD. The NSW SES therefore will need to evacuate the whole of the Pitt Town Sector before this level is reached.

The *Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.15* (Bureau of Meteorology, 2024) indicates that the Bureau of Meteorology (BoM) has a target warning lead time of 15 hours for floods that are forecast to reach 13.7 m AHD or greater at the Windsor (PWD) gauge. This is a significant improvement on flood forecast capabilities than was available in 2019, when the BoM indicated that it could provide 9 hours of target lead warning time for flooding at Windsor. It means that for any flood that would isolate Pitt Town there should now be at least 15 hours of warning lead time available for evacuation, 6 hours more warning time than was available when previous evacuation analyses for new development at Pitt Town were undertaken by NSW SES and Molino Stewart.

4 FLOOD EVACUATION MODELLING

The NSW SES applies a modelling technique to compare the time needed for evacuation with the time available for evacuation. It uses a Timeline Evacuation Model (TEM) for its evacuation planning purposes (Oppen et al., 2009). The TEM is set out in Annex C of the *Hawkesbury-Nepean Flood Emergency Plan* (NSW SES, 2020) and in Figure 9. This model generally includes the following assumptions for Pitt Town:

- NSW SES personnel will be mobilised based on forecast rainfall and will be ready to issue an evacuation order for Pitt Town as soon as a Flood Warning for 16.0 m AHD or greater at the Windsor gauge is issued by the BoM.
- Evacuation messages will be broadcast but backed up by door knocking to ensure that all evacuees receive the message and that there will be sufficient human resources to complete the door knocking in the required time.
- One hour of Warning Acceptance Factor (WAF) should be applied, which accounts for the community to accept the advice to evacuate
- One hour of Warning Lag Factor (WLF) should be applied, which accounts for the time taken for people to pack their essential items
- A Traffic Safety Factor should be applied, which accounts for vehicle breakdowns or road crashes
- The Traffic Movement component of the model assumes a maximum traffic flow of 600 vehicles per lane per hour.

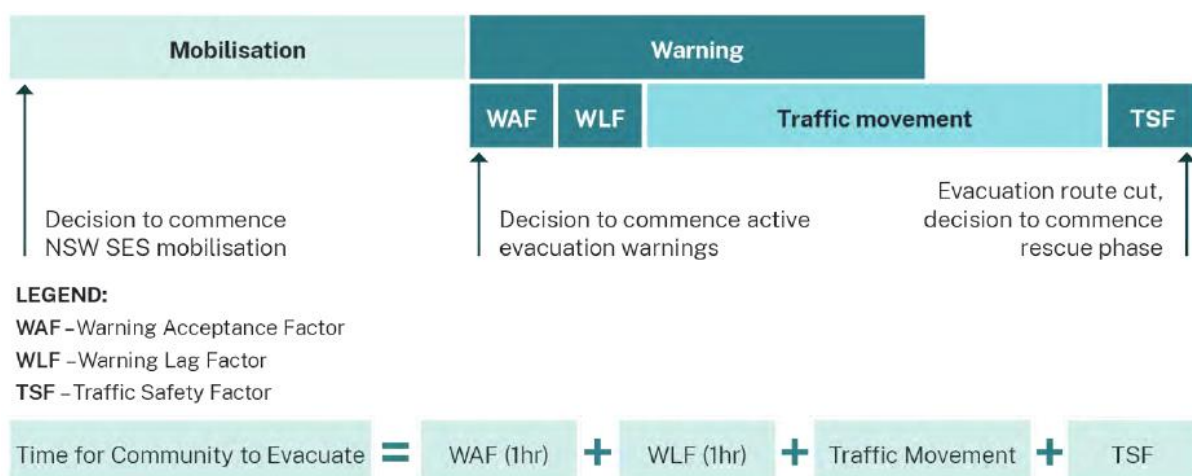


Figure 9 NSW SES Evacuation Timeline components (Infrastructure NSW, 2023)



4.1 Hawkesbury-Nepean Valley Flood Evacuation Modelling

In 2023 Infrastructure NSW, Transport for NSW, the NSW State Emergency Service (NSW SES) and the NSW Department of Planning and Environment (DPE) released the results of regional-scale flood evacuation modelling (FEM) for the Hawkesbury-Nepean Valley (Infrastructure NSW, 2023). The results of the FEM were presented in the *Hawkesbury-Nepean Valley Flood Evacuation Modelling to Inform Flood Risk Management Planning* (HN FEM) (Infrastructure NSW, 2023). Pitt Town and the site are located within the study area of the FEM.

The FEM simulates the NSW SES TEM and evacuation arrangements in a range of scenarios to understand the performance and capacity constraints on the road network in a range of flood events.

The results of the FEM for the present day scenario (defined in the HN FEM as existing development in the year 2018) are shown in Figure 10. These results demonstrate that in the present day scenario there is sufficient capacity for evacuation from the Pitt Town evacuation sector. This is also the case for the committed development scenario for the year 2041 (Figure 11). In the HN FEM “committed development” is an estimate of the development which could take place across the floodplain under existing zonings. Therefore, should Pitt Town be fully developed to the extent permitted under current zoning in existing planning instruments, there would still be sufficient capacity for evacuation from this sector in the year 2041.

Figure 12 shows the results of the FEM for the year 2041 for a scenario that includes both committed and potential development. This scenario includes both development that can occur under the existing zoning and development that has been announced but for which land will need to be rezoned in order for the development to proceed. In this scenario there would be sufficient capacity for evacuation from Pitt Town.

Based on the information publicly available in the HN FEM report (NSW Reconstruction Authority, 2023) it is not possible to update the flood evacuation modelling to accurately measure the impact that zoning for 5 additional dwellings at the site would have on the evacuation of Pitt Town. The HN FEM does not contain sufficient details regarding the following assumptions for the results to be updated based on publicly available data:

- The scale and distribution of existing development in Pitt Town
- The scale and distribution of committed development in Pitt Town
- Whether the committed and potential development scenario includes additional dwellings classified as “potential development”. One of the potential developments incorporated into the FEM is 3,000 dwellings attributable to the Hawkesbury Local Housing Strategy. However, while the HN FEM report indicates that these were distributed in the modelling in the Windsor and Richmond areas, it does not make it clear whether any of those dwellings were distributed to the Pitt Town evacuation sector
- The magnitude of any surplus time available for evacuation from the Pitt Town sector.

However, the results of the FEM indicate that there is evacuation capability from the Pitt Town sector for the year 2041. One of the reasons that Pitt Town evacuation is not sensitive to future development in the floodplain is because it has a regional flood evacuation route which it does not need to share with any other population centres. Therefore, it is only future development in Pitt Town which will impact on the evacuation capability of Pitt Town and it is likely that an increase of 13 vehicles would not significantly impact flood evacuation. The reasoning for this conclusion is elaborated upon in the following section.



Figure 10 Number of people unable to evacuate for existing development in the year 2018 for a 0.1% AEP event (Infrastructure NSW, 2023)

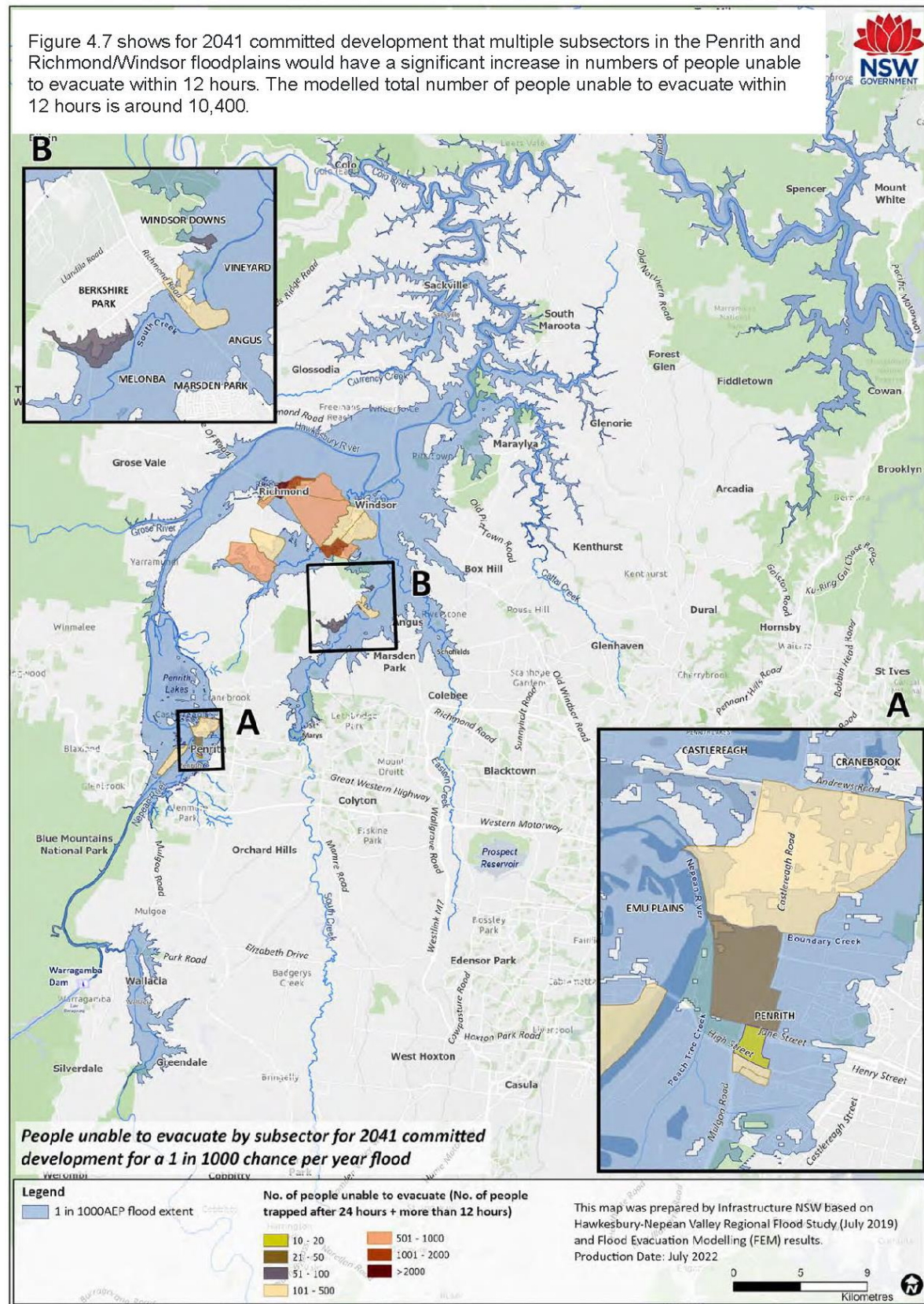


Figure 11 Number of people unable to evacuate for committed development in the year 2041 for a 0.1% AEP event (Infrastructure NSW, 2023)

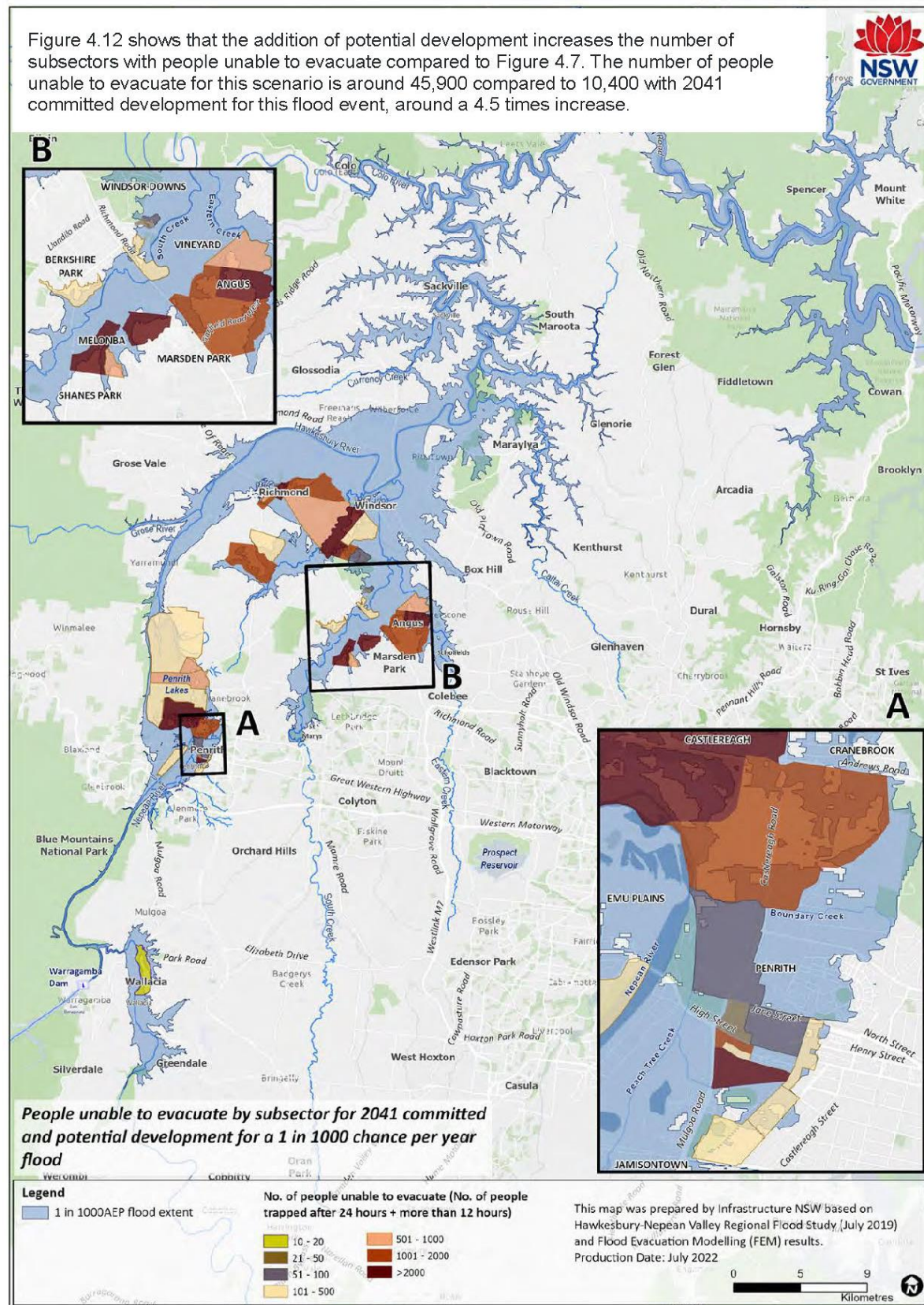


Figure 12 Number of people unable to evacuate for committed and potential development in the year 2041 for a 0.1% AEP event (Infrastructure NSW, 2023)



4.2 Update to 2019 Flood Evacuation Modelling

In 2019 Molino Stewart (now Water Technology) was engaged to undertake flood evacuation modelling for 43 Bootles Lane, Pitt Town, based on the NSW TEM. The below analysis considers how the analysis in *43 Bootles Lane, Pitt Town – Flood Impact Assessment* (Molino Stewart, 2019) can be updated to reflect the proposed rezoning at 43 Bootles Lane.

In December 2018, upon request, the NSW SES provided Molino Stewart with its estimate of vehicles which would need to evacuate from Pitt Town during different levels of flooding. It provided residential vehicle numbers and employee vehicles which would need to evacuate. The number of evacuating vehicles in each subsector in a PMF are set out in Table 2. The 2024 flood modelling indicates that all of Pitt Town would be submerged during a PMF (NSW Reconstruction Authority, 2024), whereas in 2019 the available modelling indicated that a small portion of the suburb would be a high flood island. However, this would not significantly impact the anticipated number of evacuating vehicles as the NSW SES still intends to evacuate the entire Pitt Town sector in a PMF.

Table 2 Total number of evacuating vehicles in the PMF

Subsector	Residential Vehicles	Employee Vehicles	Total Vehicles
Pitt Town Bottoms	83	37	120
Pitt Town South East B	3	1	4
Pitt Town Central	2,598	174	2,772
Pitt Town East	65	23	88
Pitt Town South	68	31	99
Pitt Town South East	135	69	204
Pitt Town North	7	15	22
Total	2,959	350	3,309

The NSW SES TEM assumes that during an evacuation 600 vehicles per lane are able to travel past a point per hour. However, the Infrastructure NSW evacuation modelling undertaken for the HN FEM assumes that 10% of this capacity would be background traffic (2023). Therefore, this evacuation modelling uses a rate of 540 vehicles per lane per hour for evacuating traffic. To be consistent with the FEM for the Hawkesbury-Nepean the below analysis also assumed that evacuating traffic can travel at a rate of 540 vehicles per lane per hour. As there is only a single eastbound lane along the regional evacuation route, it would take 6 hours and 8 minutes (i.e., the Traffic Movement time) for all vehicles to travel past the 16.0 m AHD cut point on the evacuation route. The NSW SES TEM requires that a Traffic Safety Factor of 2.0 hours be used if the Traffic Movement time exceeds 6 hours.

The time needed to disseminate an evacuation warning also needs to be considered. Generally, the NSW SES will broadcast the order by several means but will also initiate door knocking of the target premises if human resources permit. The model assumes that a team of 2 people will be able to warn one dwelling every 5 minutes. It is also assumed that the order to evacuate is not received at a property until it is door knocked and that at any one time there will be properties at different stages of the evacuation sequence. Warning will proceed concomitantly to evacuation, because the warning exercise will continue as the first people warned start evacuating. It is therefore desirable that warning proceeds at a pace sufficiently fast to produce a vehicular evacuation rate of 540 vehicles per hour. In the NSW SES TEM the time required for door knocking only includes the time required to door knock the first dwelling (i.e., 5 minutes) as door knocking of subsequent dwellings will proceed concomitantly with evacuation.



Therefore, based on the NSW SES TEM the time required for evacuation from Pitt Town can be calculated as follows:

$$\text{Time required} = \text{Message Dissemination Time} + \text{Warning Acceptance Factor} + \text{Warning Lag Factor} \\ + \text{Traffic Safety Factor} + \text{Traffic Movement Time}$$

$$\text{Time required} = 5 \text{ min} + 1 \text{ hr} + 1 \text{ hr} + 2 \text{ hr} + 6 \text{ hr and } 8 \text{ min}$$

$$\text{Time required} = 10 \text{ hr and } 13 \text{ min}$$

The time required for all vehicles to evacuate the Pitt Town sector would be 10 hours and 13 minutes. This is 4 hours and 47 minutes less than the warning lead time provided by the BoM for flooding that would cut the regional evacuation route for the sector. Therefore, based on a combination of 2018 vehicle numbers and the current BoM flood forecasting capacity there would be sufficient time available for evacuation of Pitt Town before the suburb becomes isolated, with a buffer of 4 hours and 47 minutes.

The buffer of 4 hours and 47 minutes means that the evacuation route from Pitt Town has capacity for up to 5,625 vehicles (calculated assuming a Traffic Safety Factor of 2.5 hours as the Traffic Movement time for this number of vehicles would exceed 9 hours). This is 2,316 vehicles (or 891 dwellings) more than would have needed to evacuate in the PMF in 2018 based on the numbers provided by the NSW SES. While there may have been an increase in the estimated number of dwellings and businesses in Pitt Town since the vehicle numbers were provided in 2018, and the NSW SES may have added to that number with its allowance for future development in its 2023 modelling, the increase in both of these combined would be small in comparison to the 2,316 vehicle buffer that is available now that the BoM's warning lead time has been extended from 9 hours to 15 hours. The 13 vehicle increase represented by the proposed rezoning would comfortably sit within the 2,316 vehicle buffer and therefore would not compromise the evacuation capability of the existing road network. The addition of 13 vehicles would only result in a 1.5 minute increase in the time required to evacuate Pitt Town, which would only eat into 0.2% of the calculated vehicle buffer.

It should be noted that it is very unlikely that all vehicles in the Pitt Town evacuation sector will need to evacuate at the same time. The Pitt Town Bottoms, Pitt Town North, Pitt Town South and some of Pitt Town South East evacuation subsectors would need to evacuate based on lower triggers as their evacuation routes can be cut by flood levels lower than 16.0 m AHD. Therefore, these subsectors would need to evacuate earlier than the proposed dwellings at 43 Bootles Lane. Furthermore, subsectors such as Pitt Town South East and Pitt Town East have rising evacuation routes so they would be gradually evacuated as forecast levels increase to levels which are likely to flood particular premises. Therefore, in reality some of the vehicles from these subsectors may have already evacuated by the time the NSW SES triggers evacuation of the wider Pitt Town sector based on a Flood Warning for a flood level of 16.0 m AHD or greater at the Windsor gauge. This would reduce the Traffic Movement component in the TEM calculations above, increasing the surplus time available for evacuation in existing conditions and thus increasing the size of the vehicle buffer. This is discussed in further detail in the 2019 *Flood Impact Assessment* (Molino Stewart, 2019).

The proposed rezoning would also not represent a significant additional burden on the NSW SES because the NSW SES already needs to provide warning to Pitt Town. This is generally undertaken using broadcast warnings and targeted use of Emergency Alert, which are issued to an area regardless of how many people are in that area. If the NSW SES undertakes door knocking in Pitt Town, it would take one door knocking crew an extra 25 minutes to door knock the 5 additional dwellings that would be permitted under the rezoning. However, more than one crew would already be required to door knock Pitt Town. Therefore, if at least 5 door knocking teams are allocated to Pitt Town it would only take an additional 5 minutes to door knock the 5 additional dwellings. This would only eat into 1.7% of the surplus time available for evacuation in the sector.



5 CONCLUSION

The planning proposal would introduce an additional 5 dwellings on the floodplain and it would be above the reach of flooding up to at least the 0.05% AEP flood. That is, it would have less than a 1 in 2,000 chance per year of being flooded.

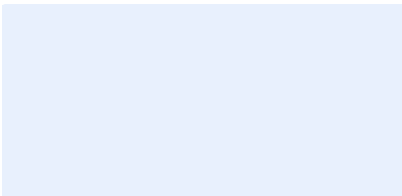
While the site is above the reach of such rare floods, larger floods can occur and it is possible that the site could be subject to high hazard flooding. For this reason the site needs to be evacuated during extreme floods in accordance with the NSW SES Hawkesbury Nepean Flood Plan.

Flood evacuation modelling undertaken by Infrastructure NSW in 2023 suggests that the regional evacuation route from the Pitt Town evacuation sector would have capacity for a full evacuation in the year 2041 in a scenario that includes existing and future committed and potential development.

Further, application of the NSW SES Timeline Evacuation Model based on vehicle numbers provided by the NSW SES demonstrated that in existing (2018) conditions the regional evacuation route has capacity for at least 2,316 additional vehicles. Therefore, there should be sufficient existing evacuation route capacity to accommodate the 5 additional dwellings (13 additional vehicles) proposed by the planning proposal. The principal reason why Pitt Town has so much surplus evacuation capacity is because it does not have to share its evacuation route with other population centres and the Bureau of Meteorology has increased flood forecasting times to 15 hours for extreme floods compared to the 9 hours which was only achievable previously.

The proposed development will also have an insignificant impact on demands on the NSW SES and other emergency service resources that would already be deployed for the evacuation of the rest of Pitt Town.

Yours sincerely



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WATER TECHNOLOGY PTY LTD

Water Technology pays respect to all First Nations peoples, their cultures and to their Elders, past and present.