Attachment 3
to
Item 154

Molino Stewart Pitt Town Flood Evacuation Advice

Date of meeting: 13 September 2022
Location: Council Chambers
Time: 6:30 p.m.

MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

29 January 2019

Mr Bassam Ghantous
BJ Ghantous & Co Pty Ltd
PO Box 299
Windsor NSW 2756

Dear Bassam,

Re: Flood Evacuation Advice for Mitchell Road, Pitt Town

Thank you for inviting Molino Stewart to provide flood evacuation advice for the proposed development at 30 Mitchell Road, Pitt Town. This letter sets out:

- The background to your development proposal and the reason for the flood evacuation analysis
- the approach to modelling flood evacuation constraints to the development
- my expert opinion on the capacity of the site's development based on flood evacuation considerations alone.

Background to the Proposed Development

You are proposing a rezoning of your land in Mitchell Road along with neighbouring blocks (Lots 1, 2, 3 & 4 DP1057585, Lots 1 (part), 2 & 3 DP 808945 and (part) Lot 2 DP 555257) to permit residential subdivision.

Your planning proposal of 2013 proposed the subdivision of the land into minimum lot sizes of 1,000m^2 to create 116 residential lots. Hawkesbury City Council resolved not to support that planning proposal as it stated in its report to the Ordinary Council Meeting of 10 March 2015 that "there is insufficient strategic and economic justification for the proposed increase in lot yield."

However, Council encouraged a revised proposal with lower lot yields. Your revised planning proposal of March 2015 (Ghant Developments) proposed a subdivision to minimum lot sizes of 1,500m^2 to create 76 residential lots. This was supported in the report to the Ordinary Council Meeting of 10 March 2015.

Either planning proposal would facilitate construction of the section of the Pitt Town Flood Evacuation Route which runs between your blocks and the neighbouring blocks without the need for financial contributions from local or State Government. The Flood Evacuation Route is shown in Figure E4.11 of the Pitt Town Development Control Plan (Attachment 1).

A planning proposal for the 1,500m^2 lot yield was submitted for gateway determination but in March 2016 the Department of Planning advised that it had determined the planning proposal should not proceed because it "does not adequately address the current flood and flood evacuation risk associated with the development of land at Pitt Town."

It went on to state "The Department encourages Council to resubmit the planning proposal should it be revised to consider the recommendations of the Hawkesbury-Nepean Flood Management Taskforce which are expected later this year. Those recommendations will be relevant to the cumulative impacts of planning proposals on the viability of flood evacuation in the Hawkesbury Local Government area."

It went on to say "Should the proposal be resubmitted, it is recommended that it be amended to address the following:

1. A detailed flood study and revised Floodplain Risk Management Plan is required to more fully address flood risk and evacuation constraints in accordance with the requirements of s117 Direction 4.3 Flood Prone Land, the daft North East Subregional Strategy, and A Plan for Growing Sydney.

   The study should include an evacuation capacity assessment considering regional and cumulative impacts, and be prepared in consultation with the State Emergency Services and Hawkesbury-Nepean Valley Flood Management Taskforce."

To date, nothing has been released by the Hawkesbury-Nepean Flood Management Taskforce which would enable the detailed flood study and revised Floodplain Risk Management Plan to be prepared and there is no indication as to when that might occur.

You have therefore requested that I prepare a flood capacity assessment as a starting point to progress discussions between yourself, Hawkesbury Council, the Department of Planning, NSW SES and The Taskforce.

Flood Evacuation Planning

The NSW SES flood response strategy for the Hawkesbury Nepean Valley is set out in its Hawkesbury Nepean Flood Emergency Sub Plan (NSW SES, 2015). It involves evacuating all residential, business and other premises that are at risk of flooding and directing evacuees to Sydney Olympic Park. It is expected that most evacuees will find their own temporary accommodation with friends and relatives or at commercial accommodation outside of the floodplain. Those who cannot will be assisted at Sydney Olympic Park.

To achieve orderly and timely evacuation, the NSW SES has divided the floodplain into sectors and subsectors with designated evacuation routes. Your proposed development is part of the Pitt Town Sector which has its evacuation route out of the floodplain via Old Pitt Town Road.

Currently the lowest point along this route lies at 16m AHD. The NSW SES therefore plans to evacuate the whole of Pitt Town Sector before this level is reached because the sector becomes an island surrounded by floodwaters and in the most extreme floods there would only be a very small area in Pitt Town which would be above 26.3m AHD and therefore above the reach of floodwaters.

The Bureau of Meteorology is currently advising the NSW SES that in extreme floods it can give at least 9 hours warning of forecast flood levels with a reasonable degree of accuracy based on fallen rainfall measurements and stream gauge readings. It can make river level forecasts using forecast rainfall but this is not sufficiently accurate for the NSWSES to be willing to rely upon them to order a mass evacuation.

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 an Evacuation Timeline Model for its evacuation planning purposes (Opper et al., 2009). This model assumes that the maximum rate at which vehicles can travel along evacuation routes in flood generating weather conditions is 600 vehicles in an hour per lane of traffic.

The model also includes some other assumptions including:

- NSW SES personnel will be mobilised based on forecast rainfall and will be ready to issue an evacuation order as soon as a forecast of 16m AHD or higher is issued by the Bureau based on fallen rain.
- 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
- There will be an average delay of one hour while message recipients decide whether the order applies to them and a further one hour delay as they get ready to evacuate
- There may be delays along the evacuation route due to accidents, breakdowns or water, trees or power lines across the road and the duration of these delays will increase with the amount of traffic evacuating

The model was used by NSW SES more than a decade ago to assess the capacity for additional urban development in Pitt Town. It initially prepared a report for Hawkesbury City Council which I independently reviewed for Council and then, based on some additional analysis provided by me, The NSW SES provided revised advice to Council in a letter dated 16 January 2007. That letter stated "the SES's time line model indicates that a maximum of 1,100 additional lots could be developed within the Pitt Town Sector."

That assessment was based on the following scale of development as at the date of the 2006 Census.

Sub-Sector	Exist Dwellings	Occupiable Vacant Lots	Total	Evacuation Cut-Off	Level 1 Must Start	Level 2 Must Start
Pitt Town Central	430	46	476	16m	**11m** (4 Dw <11m)	11.5m
Pitt Town S/East	60	28	88	13.4m for some properties	10m(2 Dw <11m)	11.5m
Pitt Town North	5	ii	D	7.3m	ASAP	N/A
Pitt Town East	25	4	29	Rising Grade	8m (Dw 8-25m)	Progressive
Pitt Town South	22	0	22	1 1 m	7m (Dw 7-20m)	N/A
Pitt Town Bottoms	47	0	47	6.3m	ASAP (Dw 5-11m)	N/:\
Sector Total	**589**	78	**667**	N/A	N/A	

Level 1 and Level 2 refer to terminology used in its Flood Emergency Plan in 2005 which made a distinction between small scale local flooding (Level 1) which required only directly threatened premises to evacuate and regional flooding (Level 2) which would require the whole of Pitt Town to evacuate.

The NSW SES report underpinned the approval of the Vermont Living subdivision which introduced a further 659 lots. Theoretically then there should remain capacity for the development of 441 additional lots.

The NSW SES has not fundamentally changed its evacuation modelling process since then although it has access to a more sophisticated computer modelling tool than in the past. What has changed is the NSW SES approach to determining the existing number of dwellings in an area. This is best illustrated by considering the land subject to this development proposal.

The subject land is currently subdivided into eight lots but only has four dwellings. In the past the NSW SES would have counted that as eight dwellings evacuating as per the table on the preceding page which shows the count of actual dwellings and the number of occupiable vacant lots.

However, they now take a different approach. They would say that because the land is currently zoned R5 it permits subdivision into 2,500m^2 lots which could yield 47 lots. Therefore the additional 39 lots (not counted in the eight lots in 2007) would have to be subtracted from the remaining capacity of 441 lots. This would reduce the remaining capacity to only 402 additional lots.

Of course there would be land other than the subject site which also has this subdivision potential under the existing zoning, further reducing the spare evacuation route capacity.

If the proposed 1,500m^2 lot subdivision were allowed then there would be a total of 76 lots created, an increment of 26 dwellings over the current situation (47 lots permissible under existing zoning).

Current NSWSES Evacuation Numbers

In December 2018, upon request, NSWSES provided Molino Stewart with its revised estimate of vehicles which will need to evacuate from Pitt Town during different levels of flooding. It provided residential vehicle numbers and employee vehicles which would need to evacuate. Employee vehicle numbers were provided for the years 2018, 2024, 2041 and 2056 and increase each year. A single set of residential numbers were provided but that is assumed to represent the full development of the Pitt Town Sector under existing zonings although the rate of that full development is not discussed. In other words, it assumes that the subject site has 47 residential dwellings and all similarly zoned land has been fully subdivided.

The following tables summarise these numbers by subsector in the PMF and total per event.

Total Number of Evacuating Vehicles in 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**

Total Number of Vehicles Evacuating per Event

Event	***Level at Windsor (m AHD)***	***Residential Vehicles***	***Employee Vehicles***	***Total Vehicles***
1 in 5 AEP	10.4	37	19	56
1 in 10AEP	12.2	99	86	185
1 in 20AEP	13.7	249	133	382
1 in 50AEP	15.8	586	218	804
1 in 100AEP	17.3	768	255	1,023
1 in 200AEP	18.3	826	277	1,103
1 in 500AEP	19.6	881	297	1,178
1 in 1000AEP	20.4	951	309	1,260
1 in 2000AEP	22.1	1,122	319	1,441
1 in 5000AEP	23.8	1,388	325	1,713
PMF	26.2	2,959	350	3,309

While these tables suggest that a total of 3,309 vehicles will need to evacuate in a PMF, the situation not quite as simple as that.

Attachment 2 is a map provided by NSW SES showing each of the subsectors and the low points along the evacuation route for each of those subsectors. My interpretation of that map is:

- The whole of Pitt Town Bottoms would have to be evacuated before 6.3m AHD was reached
- The whole of Pitt Town North would have to be evacuated before 7.3m AHD was reached
- The whole of Pitt Town South would have to be evacuated before 11.9m AHD was reached
- Some of Pitt Town South East would have to be evacuated before 15m AHD was reached
- The whole of Pitt Town Central would have to be evacuated before 15.9m AHD was reached

In addition to the premises which need to evacuate before their route is cut by flooding, there will be some premises in the abovementioned subsectors and possibly in other subsectors which would flood before their evacuation route is cut and therefore would need to evacuate even earlier than suggested above.

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.

Evacuation Modelling Calculations

Attachment 3 is a hydrograph of the design 72 hour PMF flood at Windsor gauge. This is indicative of the fastest rate of rise which may have to be responded to in an evacuation. Most floods would rise more slowly and a few may rise more quickly but it is the fastest rising hydrograph which is currently publicly available.

The above listed evacuation route levels are marked on the hydrograph and the corresponding times at which each is cut can be read from the time axis along the bottom. They are (to the nearest half hour):

- Pitt Town Bottoms - 6.3m AHD – 17hrs
- Pitt Town North - 7.3m AHD – 18.5hrs
- Pitt Town South - 11.9m AHD – 27 hours
- Pitt Town South East - 15m AHD – 33.5 hours
- Pitt Town Central - 15.9m AHD – 35 hours

Based on advice from the Bureau of Meteorology, evacuation of each of these subsectors would be ordered about 9 hours before these levels are reached.

The subject site is within the Pitt Town Central Subsector and its evacuation would not be called until about t=26hrs. By this time all of Pitt Town Bottoms (120 vehicles) and Pitt Town North (22 vehicles) would have to have completed their evacuations and Pitt Town South would hold have 1 hour remaining before its evacuation route was cut. Given that people are not expected to leave their premises within the first two hours of an evacuation order being given and the 99 vehicles from Pitt Town South have ample time to evacuate before their route is cut, it would be reasonable to assume that Pitt Town South evacuation traffic will not be using the evacuation route at the same time as that from Pitt Town Central.

On that basis, there is not likely to be more than 3,068 vehicles evacuating at the same time as Pitt Town Central subsector. In fact there could possibly less than this if there are premises in the remaining subsectors which could flood so early that they will be gone before Pitt Town Central begins evacuating or that flood so late Pitt Town Central's evacuation route is cut before those from the other subsectors need to begin evacuating. However, to be conservative, 3,068 vehicles have been used in the evacuation modelling which represents the maximum number of vehicles evacuating if all of the land in the area were fully developed to its current zoning potential. Currently, there would be far fewer vehicles than this.

The NSW Timeline Evacuation Modelling Tool has been used for the evacuation calculations with the outputs from the tool provided in Attachment 4. This shows that there would be 0.4 hours surplus time which equates to capacity for 240 additional vehicles which is 100 additional dwellings at 2.4 vehicles per dwelling or 133 additional dwellings at 1.8 vehicles per dwelling.

As the proposed development would only result in 26 more dwellings than is permitted under the existing zoning, there is sufficient capacity within evacuation routes for Pitt Town to accommodate the additional evacuation traffic generated.

Conclusion

Using the latest evacuating vehicle estimates provided by the NSWSES and the NSWSES Timeline Evacuation Model it has been demonstrated that there should be sufficient existing

evacuation route capacity to accommodate the incremental evacuation traffic from a 1,500m^2 lot subdivision of the subject site.

Should people at the site fail to evacuate by vehicle before their evacuation route is cut, they would have rising road access for pedestrian evacuation to the high flood island above the reach of the PMF within the Vermont Living Estate to their west.

Yours faithfully

For Molino Stewart Pty Ltd

Steven Molino

Principal

Enclosures: 1

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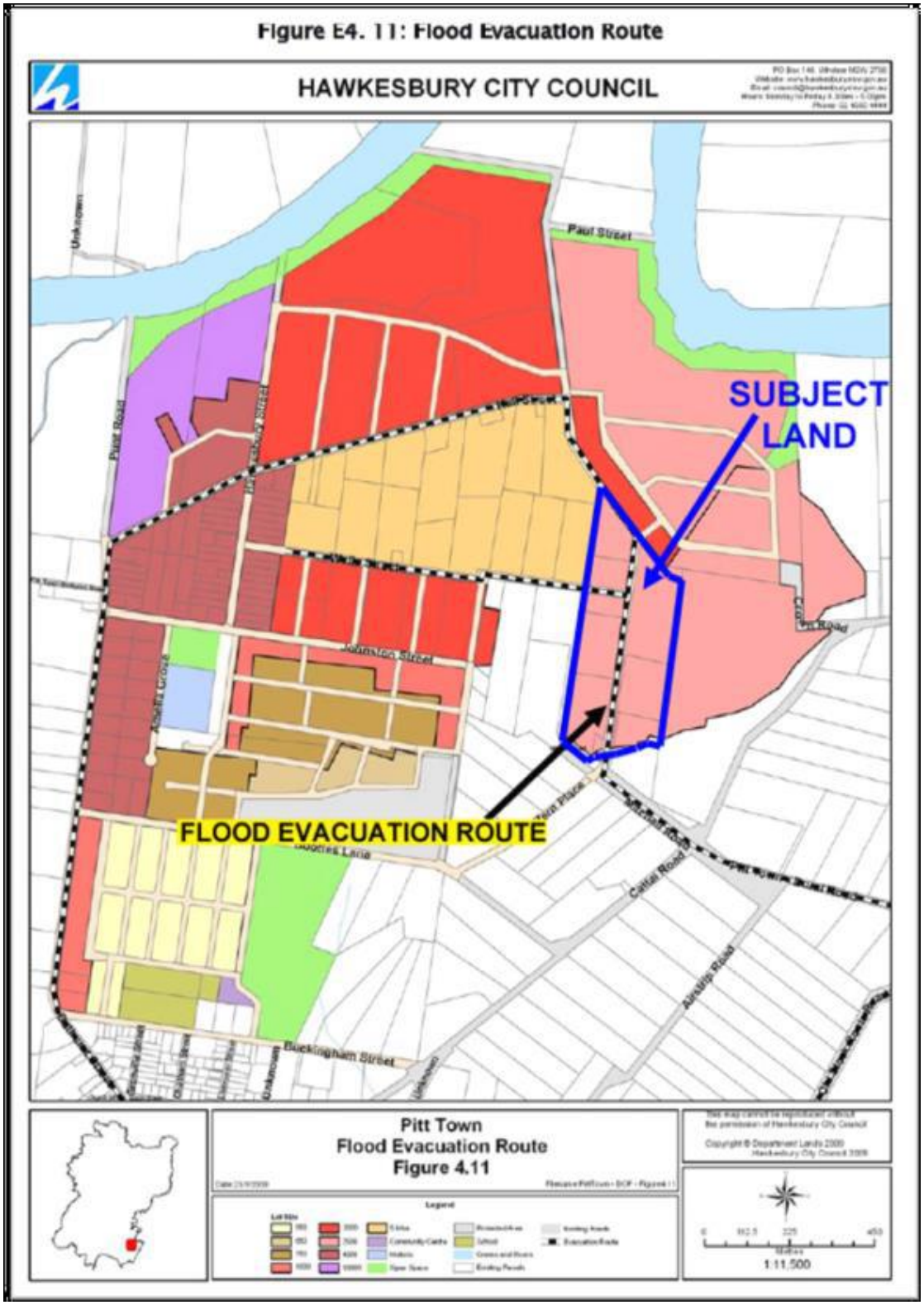
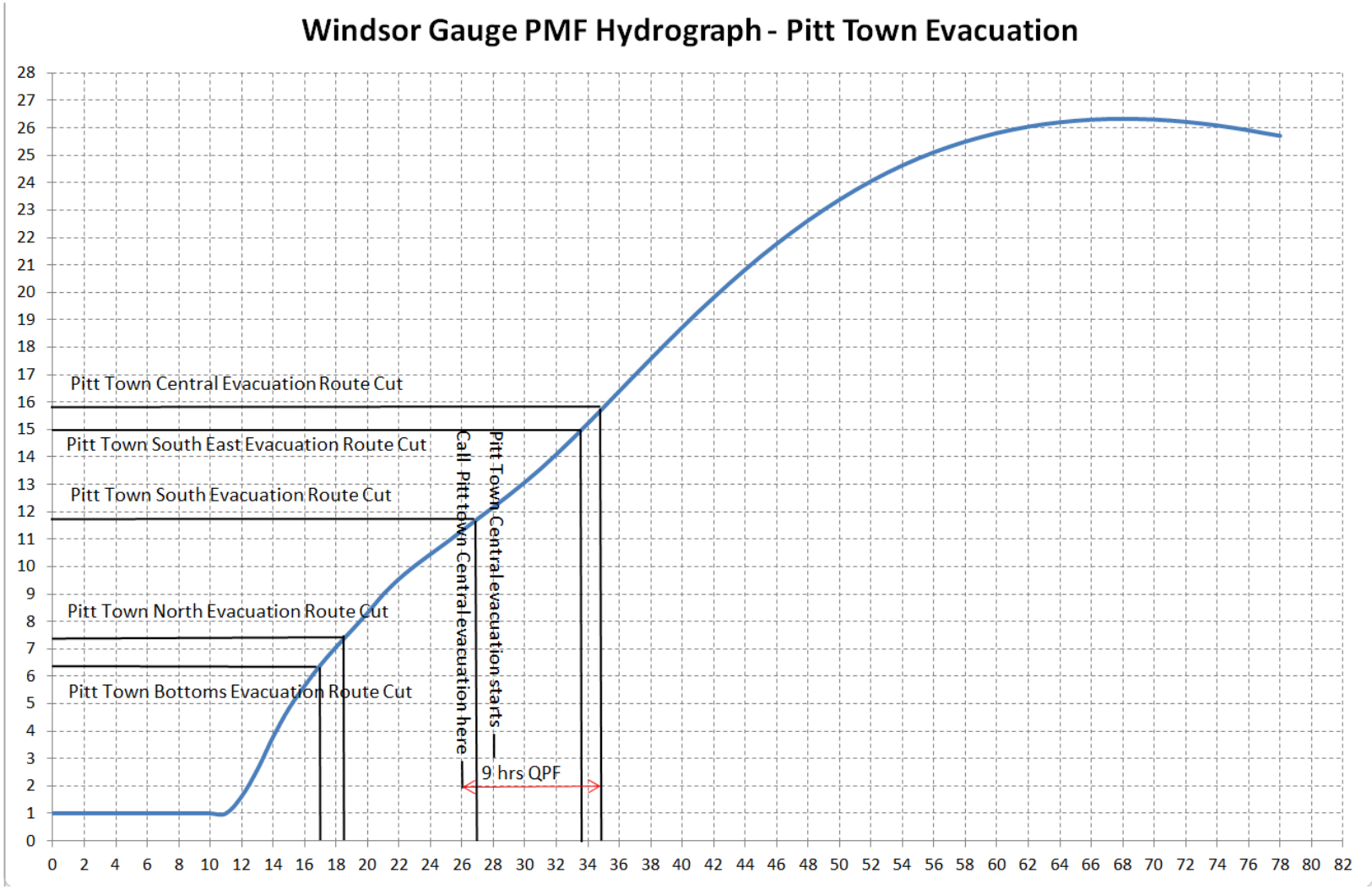
Attachment 1: Extract from Pitt Town DCP showing flood evacuation route and subject site



Attachment 2: Pitt Town Subsectors and Evacuation Route Low Points

Attachment 3: Windsor PMF Hydrograph and Pitt Town Evacuation Route Low Points



Attachment 4: Results from NSWSES Timeline Evacuation Modelling Tool

Development Name:	Pitt Town	
Date:		9/01/2019
Calculation ID:	Job 0996	
Notes:		
Data Type	**Input Data**	**Data Source**
Residential		
Number of Dwellings		
Vehicles Per Dwelling		
(OR) Total Number of Residential Vehicles	2801	From NSW SES supplied data Dec 2018 but excluding Pitt Town Bottoms, Pitt Town South and Pitt Town North
percentage of census respondents not reporting		E.g. 2011 Census
Residential Vehicles	2801	Calculated
Commercial		
Number of Business Premises		E.g. ILP Version 3 Revision 2 example
Vehicles Per Business		From NSW SES supplied data Dec 2018 but excluding Pitt Town Bottoms, Pitt Town South and Pitt Town North
(OR) Total Number of Commercial Vehicles	267	
Commercial Vehicles	267	Calculated
Total Vehicles (TV) = residential + commercial	3068	Calculated
Evacuation Route		
Number of Lanes	1	
Evacuation Route Capacity (RC) (veh/hr)	600	Calculated
Evacuation Timing (hrs)		
Warning Acceptance Factor (WAF)	1	SES recommended value
Warning Lag Factor (WLF)	1	SES recommended value
Travel Time (TT) = TV/RC	5.1	Calculated
Traffic Safety Factor (TSF)	1.5	SES recommended value
Total Time Required to evacuate (TR)	8.6	Calculated
Time Available (hrs)		
BOM Forecast Time	9	
Flood Travel Time	0	
Total Time Available (TA)	9	Calculated
Surplus Time (ST) = TA-TR	**0.4**	Calculated
Flood Emergency Response Classification	High Flood Island	

Key
Development specific data which needs to be inputted
SES recommended values from Worksheet 2- variation needs to be justified
Calculated Outputs