22 May 2020

Gina Metcalfe
Acting Director, Central (Western)
Department of Planning, Industry and Environment
GPO Box 39
SYDNEY NSW 2001

Dear Gina,

Re: SREP30 (St Marys) – Amendment No. 3

We refer to your email of 20 May 2020 seeking additional information on the proposed Draft Amendment No. 3 to Sydney Regional Environmental Plan No. 30 – St Marys (SREP 30).

Each of the five items raised have been addressed overleaf. An updated Flood Modelling and Evacuation Report has also been prepared by Molino Stewart and is enclosed at **Attachment A.**

We are mindful that the requests for further information have been sequential and drawn out. We had hoped that our meeting on 6th April 2020 would flush out all remaining queries. If for whatever reason you feel that there is still not enough information to make a determination, I suggest that we meet to discuss and work through the concerns, with experts included if necessary. We are confident that we have supplied enough information for this phase of assessment. Some queries are, in our opinion straying into the development assessment phase and are unusual considerations for a rezoning exercise. A Precinct Planning process and subsequent DA are necessary next steps and can appropriately finalise detail.

We look forward to your earliest determination.

Yours sincerely

Matthew Paduch
Development Manager
Lendlease

Item 1:
Flood levels and evacuation routes
I refer to the covering letter (12.05.20) and Att A: Revised Flood Modelling and Evacuation Report (Molino Stewart 12.05.20)

Within item 1 of the letter:

- It is noted that there are two exceptions to this where there are dips in the vehicular evacuation route (Refer to Figure 7, Attachment A). This is necessary to achieve the dual objectives of the development being at least 0.5m AHD above the 1% AEP flood and to ensure that roads have the required minimum gradients to meet standards for road drainage.
- However, it is noted that this area has continuously rising pedestrian access across the transmission line easement to the west and into land which has continuously rising road gradients.

DPIE comments/requests:

- *Update Figures 3 & 7 of Att A to show the distinct evacuation routes for the different stages (use different colours?). The multiple arrows do not clearly explain which route which stage will take.*
- *Update Figures 3 & 7 with the difference in RLs between the 'low point' and the 1:500 for the two low points in Stage 4C and a section of Stage 6.*
- *Delete any references in the letter and report to pedestrian access being a means of evacuation – this is not supported by the SES. Will this alter any of the conclusions?*

Lendlease Response:

- Figures within the Flood Modelling and Evacuation Report have been updated to better illustrate the evacuation routes for the different development stages.
- An additional east-west road has been introduced to connect the eastern and western sides of the proposed Stage 6 rezoning area. This road traverses the central drainage channel that runs through the centre of the Central Precinct. Refer to Figure 6 and 7 of Attachment A.
- Through the introduction of this additional east-west road, rising vehicular access is now provided for all residential land within the Central Precinct.
- The previously referenced low points in Stage 4b are no longer relevant as all lots located within the eastern side of Stage 6 will now evacuate via the new east-west road.
- All reference to pedestrian access being a means of evacuation have been removed.

Item 2:

Within item 2 of the letter:

- With the use of local roads through Cambridge Gardens and Jordan Springs and the shoulders of the existing routes, all of the traffic from within Jordan Springs East can queue in flood free land until the Northern Road becomes available if this is necessary.
  - There will be less traffic on The Northern Road than has been assumed as many residents in the Hawkesbury will choose not to evacuate.
  - Many of those evacuating from the Hawkesbury, Penrith and Jordan Springs will be travelling to stay with family and friends within the local area and not require use of The Northern Road as an evacuation route.

DPIE comments/requests:

- *Concern is raised as to how people residing in the site will queue for 7 hours. Will additional directions be provided by Lendlease to these residents, or is Lendlease relying on SES evacuation orders? Has any contact been made with the SES or Resilience NSW on establishing assembly points and the ability to provide provisions – such as water etc?*
- *Delete any references in the letter or report around such assumptions that residents in the Hawkesbury will choose not to evacuate or will travel to friends etc in the local area. The assumption is **all** affected will evacuate from the area.*

Lendlease Response:

- These matters are addressed in documents previously provided to the Department including: Flood Evacuation: Temporary Shelters for Evacuating Residents prepared by Molino Stewart dated 25 January 2018; and the subsequent Detailed Evacuation Analysis prepared by Molino Stewart dated July 2018.
- The evacuation analysis contained within these reports has been quite conservative with the intention of demonstrating that under the worst possible combination of circumstances, it would be possible to safely evacuate all of the residents from the Central Precinct and without compromising the safety of others evacuating from the floodplain.
- The analysis has demonstrated that it is highly unlikely that residents evacuating from the Central Precinct will be required to queue in their vehicles, however in the unlikely event that this is required, all residents can safely queue in their vehicles in locations that are located outside of the PMF.
- The Flood Modelling and Evacuation Report does not rely on the assumption that residents may choose to evacuate to family and friends in the local area, even if this is a likely assumption and one that is typically encouraged as a matter of pubic policy. We have made mention of alternative arrangements not to rely on these assumptions, but to emphasise how conservative the assumptions that we do rely on in the model actually are – that is, it is assumed that all residents can and will evacuate via The Northern Road / M4.
- Whilst your suggested changes to the report have been made, it should be acknowledged that the likely scenario is mitigated by residents who will choose to evacuate to family or friends who live within the Hawkesbury and Penrith areas on properties that are located outside of the PMF.
- In this regard, future residents of the Central Precinct will be treated equally with all other flood affected residents within the Hawkesbury Nepean in terms of emergency service response and communications – both in scenario planning and in an emergency event.

Item 3:
Within items 3 & 4 of the letter:

DPIE comments/requests:

- *It is not clear from the figures that all land to be developed for residential purposes is above the 1:500 level. Figure 7 of Att A seems to show the pre-development 1:500 levels? Figure 8 shows the post-development 1:500? This needs to be clarified and the evacuation routes should be overlaid on the post-development 1:500 map. Figure 8 should show the full extent of the stages similar to the other figures.*
- *The statement 'The Central Precinct has been designed in compliance with clause 49(2) of SREP 30 which requires land developed for residential purposes to be above the 1% AEP flood level plus 0.5m' is more about reducing property damage and enabling communities to recover more quickly in flood events up to the 1:500 not just about evacuation.*

Response:

- As previously advised to the Department, there is no requirement for all residential land to be located above the 1:500-year flood. The requirement is that all residential land is located above the 1% AEP flood level plus 0.5m (Clause 49(2) of SREP30). The Central Precinct has been designed in compliance with this.
- All vehicles can evacuate from the Central Precinct along flood free roads in a 1:500-year flood event. This is consistent with SES requirements.
- Figure 7 in the previous report (now Figure 6 in Attachment A) has been updated to include the RL information for the creek crossing which were previously shown on Figure 8. The 1:500- year flood event shown on Figure 6 is post development.

Item 4:

- *Detail how the 'bus only road' will be converted to allow vehicles to evacuate from the site. This should be included in the updates to be made to the report.*
- *Figure 6 of the report refers to Dunheved Road shoulder may need extending. Delete this figure and any references to upgrades of regional roads off-site. The report should only refer to works needed on-site.*

Response:

- The existing bus only road can be made available to vehicles evacuating the site by simply unlocking the vehicle gates. Master keys for the gate are held by Penrith City Council and the local bus companies.
- Figure 6 in the previous report has been deleted and all references to Dunheved Road have been amended.

Item 5:

Management and education of residents who would need to evacuate in an event
Lendlease will be required to consult Council and engage with the Local Evacuation Management Committee and its Local Evacuation Management Officer. Residents need to be educated on evacuation – how it will occur, what will it look like, what are the routes, possible queuing times etc.

- *I refer to the earlier comment: Concern is raised as to how people residing in the site will queue for 7 hours? Will additional directions be provided by Lendlease to these residents, or is Lendlease relying on SES evacuation orders? Has any contact been made with the SES or Resilience NSW on establishing assembly points and the ability to provide provisions – such as water etc?*
- *Where are proposed local evacuation waiting places?*
- *Residents will look to take a direct and familiar route out of the area – they should not be expected to know to travel on and queue in streets unfamiliar as suggested by Figure 5 of the report.*
- *Page 4 of the report:*

> Traffic evacuating from Precinct A will queue on The Main Access Road to Jordan Springs and its shoulder until the queue reaches back to the extent of the PMF. It is recommended tha at the PMF extent signage is erected to indicate to traffic not to queue beyond this point during flooding. There would also be the opportunity to queue traffic within local roads in Jordan Springs between the Main Access Road and The Northern Road. Table 1 lists roads

Please outline your approach to where people would go if they get to the point where they should not be queuing?

Response:

- The location of evacuation waiting places was addressed as part of the detailed assessment and evaluation of evacuation routes and temporary waiting places within Flood Evacuation: Temporary Shelters for Evacuating Residents prepared by Molino Stewart dated 25 January 2018; and the subsequent Detailed Evacuation Analysis prepared by Molino Stewart dated July 2018.
- Lendlease will provide information to purchasers as part of our customer service process, as we do for a range of practical information such as house design guidelines, local wildlife awareness and community facilities. For those residents within or near the PMF information will be provided to help residents plan for a future possible emergency event. However, Lendlease has not included this information in the SREP 30 amendment process for two reasons:
  - It is the intention of Lendlease to subdivide the land into Torrens titles and as such Lendlease will have no contractual ability to provide information to the second or subsequent purchaser of the property. Because we can't provide that in perpetuity comfort, we have not sought to do so as part of a planning process;
  - This is not a matter that is relevant in evaluating or assessing the merits of the proposed SREP amendment.
- Future residents of the Central Precinct will be treated equally to all other flood affected residents in terms of emergency service response and communications – both in scenario planning and in an emergency event.

ATTACHMENT A: Revised Flood Modelling and Evacuation Report prepared by Molino Stewart

MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

22 May 2020

Matthew Paduch
Development Manager,
Communities
Lendlease
Level 2, 88 Phillip Street
Parramatta NSW 2150

Dear Matthew

Re: Information Regarding the Jordan Springs East Rezoning Application – Flood Evacuation

This letter provides information in relation to the management of flood evacuation from the Jordan Springs East development and the implications that a proposed rezoning of approximately 38 hectares of employment land to residential land would have on the existing and historically accepted flood evacuation strategy.

This letter is an update to a similar letter we provided in November 2017 but incorporates responses to subsequent requests for additional information from the Department of Environment and Planning (DPIE). Specifically, it incorporates:

- the conclusions from a more detailed evacuation analysis report we prepared in July 2018 in response to comments received by DPIE from the NSW State Emergency Service (NSWSES)
- information from a report prepared in January 2018 to address a request from DPIE to nominate potential buildings and facilities that could be used as temporary shelters by evacuees who are queuing in their vehicles whilst waiting for their opportunity to evacuate further via The Northern Road
- the results of recent analyses carried out to answer questions which Penrith City Council (PCC) asked about the evacuation of the precinct which were forward by DPIE in March 2020

1.0 Background

Molino Stewart assessed the evacuation capacity of the proposed urban development of Jordan Springs East (formerly Central Precinct) in July 2014 in support of a Bulk Earthworks Environmental Impact Statement and concluded that:

"…the development has been designed in such a way that vehicular evacuation should be possible in advance of the site being flooded by the Hawkesbury Nepean River if residents respond in a timely way to evacuation orders issued by the NSW SES.

Should people not evacuate until flood waters arrive at their dwellings there would be sufficient time for them to walk ahead of flooding from either South Creek or the Hawkesbury River along continually rising evacuation routes."

In undertaking that work it was noted that the precinct is:

"…zoned to contain a mix of residential and employment land uses. In preparing this Flood Evacuation Analysis it has been assumed that the entire Central Precinct would be developed as residential."

Furthermore, the analysis was conducted assuming that the development would have 1,333 dwellings with 1,168 of those dwellings requiring evacuation.

Lendlease now proposes to only have residential development within the precinct and increase the lot yield to 1,626 lots. Some of the precinct has already been developed and the additional lots would be in those areas which are not yet developed. About 18 of the lots will have multiunit dwellings totalling about 328 dwellings across the 18 lots.

This report assesses the capacity of the road network to cater for the evacuation of the Jordan Springs East development were it to be developed with 1,936 residential dwellings. It takes into consideration discussions which were held with the NSWSES Regional Controller, Peter Cinque, on 12 October, 2017.

2.0 Currently Proposed Development and Evacuation Routes

Figure 1 shows the indicative layout plan (ILP) for the development which is now proposed. The development has been divided into six stages which have been further subdivided to reflect the staging of development.

Stages 1, 2, 3, 4A, 4B and 5 are either complete or under Development Applications and Construction Certificate processes.

Stage 2 has 333 dwellings and is completely above the reach of the probable maximum flood (PMF). Although a PMF would isolate this stage from the Main Access Road which leads west through Jordan Springs, it has direct access onto the Bus Only Road which leads south through Werrington. This means that the stage would not be completely isolated by flooding and therefore does not need to be evacuated.

Stage 1 has 394 dwellings. For evacuation management purposes it has been subdivided into a north and south zone labelled in Figure 1 as 1N and 1S. The vehicles from 1N would evacuate via the Main Access Road and those in 1S would evacuate via the Bus Only Road. However, not all of the vehicles from either of these zones need to evacuate because they have road access out of the precinct even during a PMF event.

Those in the northern part of Zone 1N have direct access onto the Main Access Road and those in the southern part of Zone 1S have direct access onto the Bus Only Road. These areas are shown in Figure 2. Between these two zones there are an estimated 105 dwellings which do not need to evacuate from Stage 1. This leaves 71 dwellings from Stage 1 which will evacuate west along the Main Access Road and 218 dwellings which will evacuate south along the Bus Only Road.

There are proposed to be a total of 1,185 dwellings in the remaining stages and all will evacuate west along the Main Access Road (Wianamatta Parkway). .

For the purposes of evacuation planning and analysis the development was divided into Precinct A which has evacuation access to the Main Access Road and Precinct B which has evacuation access to the Bus Only Road. Both precincts are shown in Figure 2.

3.0 Local Evacuation Analysis

The flood evacuation analysis has been undertaken using the SES Timeline Evacuation Model (Opper et al., 2009). The model was developed as an empirical means of consistently estimating the ability of people to safely evacuate by motor vehicle.

A tool has been developed for applying the Timeline Evacuation Model to assess the flood evacuation capability of proposed developments (Molino et al., 2013). It does this by calculating the time required and time available for vehicular and pedestrian evacuations.

For the Hawkesbury-Nepean Valley, the Bureau of Meteorology has previously advised that it can provide at least nine hours warning of any level being reached at Windsor, based on fallen rain. *Resilient Valley, Resilient Community* (INSW, 2017) states that "*the Bureau of Meteorology has advised that it can provide up to 15-hour flood level predictions for large flood events*." To be conservative in this analysis, it has been assumed that only nine hours will be available for evacuation.

The NSW SES has for the past 20 years assumed for evacuation planning in the Hawkesbury Nepean Valley that the flood is rising at a rate equivalent to the 72 hour PMF design flood which rises at about 0.5m per hour within the range of levels which affect development in the Valley. Any flood could rise this quickly, not just a PMF. However, it is understood from presentations by the Hawkesbury Nepean Flood Risk Management Taskforce that some events could rise slightly faster than this but we do not have access to that data.

Should vehicular evacuation fail and pedestrian evacuation be necessary, a flood rising as fast as a 24 hour PMF (1.5m per hour) has been used in the previous pedestrian evacuation analysis for Jordan Springs East and this is certainly faster than rates presented by the Taskforce. That analysis showed that pedestrian evacuation on a rising gradient will be possible and the proposed increase in dwelling numbers would not change this.

The following assumptions have been made with regards to vehicular evacuation:

- All premises below the PMF within the site will be evacuated as well as those in Zone 1S which will be isolated by floodwaters.
- All vehicles at evacuating premise will be evacuated
- All evacuation traffic for Precinct A will travel through the Main Access Road and traffic for Precinct B will evacuate via the Bus Only Road.
- There will be one evacuation lane available on each of these evacuation routes.
- A maximum evacuation rate of 600 vehicles per hour per lane will be achieved on all roads.
- Evacuation traffic will be generated through broadcast warnings and doorknocking at a rate of 600 vehicles per hour from each precinct.
- People will take one hour to accept a warning after they have been door knocked and a further hour to prepare to evacuate.
- The evacuation is orderly and that all parties know what to do, where to go and what to take.
- In accordance with NSW SES Guidelines, a further one hour will be allowed for in evacuation time to account for delays due to car accidents, break downs and other contingencies.

The average number of vehicles per dwelling was determined using the average vehicles per dwelling statistic in the 2016 census for Jordan Springs. This is 1.9 vehicles per dwelling which is a slight increase over the 1.8 vehicles per dwelling used in the 2014 and 2017 estimates which were based on 2011 Census data. However, the census also reports that 2.9 percent of dwellings did not report the number of vehicles at their dwelling. The total number of vehicles was therefore calculated by increasing the vehicle estimates by this percentage.

The resulting calculation is an estimated 2,455 vehicles having to evacuate from Precinct A and 426 vehicles having to evacuation from Precinct B.

The time required to safely evacuate all vehicles is 7.6 hours in Precinct A and 3.7 hours in Precinct B. This provides surplus times of 1.4 hours and 5.3 hours for evacuating Precincts A and B respectively. This shows that there is sufficient time for all of the dwellings to be evacuated ahead of rising floodwaters.

It is noted that the previous evacuation analysis, for what was then called Central Precinct (Molino Stewart, 2014), assumed that the entire development would be residential development rather than partially employment land as is currently the case under SREP 30. This meant that the analysis was based on the evacuation of many more dwellings than was

finally approved. The current proposal requires the evacuation of only 306 more dwellings than was originally analysed.

Furthermore, the analysis makes the simplifying and conservative assumption that there will only be 9 hours available for the evacuation of the whole precinct. In reality there will be much more time than this. The NSWSES will initially only order those dwellings at or near the minimum levels on the site to evacuate based on initial flood forecasts. As flood level forecasts are updated and it becomes apparent that floods are expected to rise higher than initially predicted then those impacted by the revised forecast will be ordered to evacuate. This updating will occur until the peak flood level is forecast.

In a flood rising as fast as the 24hr PMF it could take as long as 30 hours from the time that the first people in Jordan Springs East are ordered to evacuate to the time that the last of them are ordered to evacuate, meaning that there is closer to 39 hours available for evacuation to take place rather than the 9 hours assumed in the analysis.

4.0 Regional Evacuation Considerations

The proposed Jordan Springs East development will require approximately 2,881 vehicles to evacuate during a regional PMF. It is proposed that the traffic from Precinct A will head west from the site using the Main Access Road to Jordan Springs and that from Precinct B will head onto Dunheved Road. Both streams of traffic would head west to The Northern Road then to the M4 and finally to the regional evacuation centre at Sydney Olympic Park if they are unable to find accommodation elsewhere. This is in accordance with the NSW SES evacuation plan for the Valley .

Our analysis suggests that the Northern Road could be at full traffic capacity during this time due to evacuations from North Penrith (Thornton, Waterside and the Coreen Avenue Industrial Area), Penrith, Jamisontown and Londonderry as well as evacuating traffic from the Hawkesbury including; Richmond, Windsor and Bligh Park.

This suggests that the evacuating traffic from Jordan Springs East may need to queue within flood free land until the Northern Road is available to use. Currently the NSW SES, in its emergency planning, assumes that a queued car uses 6 m of road (linearly). This implies that there needs to 17.3 km of road for the traffic to queue.

Traffic evacuating from Precinct A will queue on The Main Access Road to Jordan Springs and its shoulder until the queue reaches back to the extent of the PMF. It is recommended that at the PMF extent signage is erected to indicate to traffic not to queue beyond this point during flooding. There would also be the opportunity to queue traffic within local roads in Jordan Springs between the Main Access Road and The Northern Road. Table 1 lists roads within Jordan Springs which are enroute between these roads and these are shown in Figure 3. It would also be possible to send some traffic out of Precinct A via the NPWS road which provides a further 700m of road on which to queue.

In addition it would be possible to park vehicles temporarily in the car park at Jordan Springs Shopping Centre which would hold 450 cars. This would reduce the total required queue length to 14.6 km.

These roads alone would not be sufficient to queue all of the Precinct A traffic so that the remaining traffic from Precinct A will then need to evacuate south along the Bus Only Road towards Dunheved Road and queue along this route. The traffic from Precinct B will also follow this route. It should be noted that were all of the evacuating traffic to use only one of the two egress points, then there would still be surplus time, therefore the additional traffic towards Dunheved Road will not impact on the ability of everyone to evacuate from the site.

However, Dunheved Road itself would not have sufficient capacity to queue all of this traffic. An additional evacuation route through Cambridge Gardens could provide additional queuing space and allow all of the evacuation traffic to queue in flood free land. Table 2 outlines the

proposed route and it is shown graphically in Figure 4. This route minimises crossing of drainage lines and would be unlikely to be cut from local flood waters.

This regional evacuation strategy has assumed that there would be fully formed shoulders along the Main Access Road and Dunheved Road so that two lanes of traffic could queue on these roads.

Table 3 shows that the available queuing length on all of these roads combined would be approximately 18.5 km which is about 4 km more than the road length required to queue all of the evacuating residential vehicles. This means that there would be no need to queue on the shoulder of Dunheved Road.

(Figure 5) shows the changed configuration of Precinct A and Precinct B to optimise utilisation of the available queuing capacity on roads between JSE and The Northern Road.

It should be noted that the full queuing capacity of these roads will only need to be used if the WHOLE of Jordan Springs East needs to evacuate at the same time AND regional flood evacuation has taken up the full evacuation capacity of The Northern Road when Jordan Springs East is evacuating. This is unlikely as the evacuation of Jordan Springs East can be spread over nearly 40hours and during this time evacuation from Richmond, Windsor and Bligh Park would cease because they will have evacuated earlier or their routes would have been cut by floodwaters.

Table 1. Proposed Jordan Springs Route

Road
Lakeside Parade (sealed)
Greenwood Parkway
Alinta Promenade
Cullen Avenue
Jordan Springs Boulevard
Water Gum Drive

Table 2. Proposed Cambridge Gardens Route

Road
Henry Lawson Drive
Singleton Avenue
Harvest Drive
Greenbank Drive
Pasture Gate Avenue
Hilton Road
Trinity Drive
Northern Road

Table 3. Evacuation Route Queue Lengths

Route	Length of Road Available to Queue (m)	Length With Queue on Shoulder (m)
NPWS Road[+]	700	700
Main Access Road to Jordan Springs	975	1950
Jordan Springs roads	5,966	5,966[+]
Dunheved Road*	3,400	6,200
Cambridge Gardens	3,700	3,700[+]
Total	14,741	18,516

*Includes approximately 600m through Cambridge Gardens with no effective shoulder
[+]There is no effective shoulder along this route

5.0 Queuing Durations

The preceding regional evacuation analysis is quite conservative with the intention of demonstrating that, under the worst possible combination of circumstances, it would be possible to evacuate all of the residents of JSE from the floodplain without loss of life for residents within JSE or without having to compromise the safety of others evacuating from the floodplain.

Additional information and analysis was therefore prepared to respond to the issues that NSW SES raised in letters of 11th May 2018 and 18th May 2018 with regard to the Proposed amendments to Sydney Region Environment Plan No 30 and the Jordan Springs East Precinct Plan, respectively. That additional analysis specifically addressed some comments made by the NSW SES in response to conclusions drawn from earlier analyses. In particular, it provided a more detailed analysis to better describe the conservatism in the former analysis, the range of possible evacuation outcomes and the likelihood of those outcomes. The details are provided in a separate report Jordan Springs East Rezoning Detailed Evacuation Analysis (Molino Stewart, 2018) but are summarised here.

The more detailed analysis showed that the previous simplified analyses overestimated likely queuing times for evacuees from Jordan Springs East which are likely to be no greater than 7 hours and, for those in the higher parts of the development, they are unlikely to have to queue at all. This compares to the 15 hours or so that existing evacuation traffic from Richmond, Londonderry, Windsor or Bligh Park might have to queue while they wait for each other to use The Northern Road. Furthermore, Jordan Springs East is more than 10 times less likely to have to queue than these areas to the north. There is about a 1 in 500 chance per year that any evacuation of Jordan Springs will be necessary at all and less than a 1 in 70,000 chance per year that it would all have to be evacuated.

Because Jordan Springs East does not have to start evacuating until close to when evacuation routes to the north are cut by flooding, queuing times in Jordan Springs East are not particularly sensitive to the number of vehicles evacuating from these other areas, the rate of rise of floodwaters nor the available warning time. Furthermore, because all of the development scenarios at Jordan Springs East would see the whole of the development area developed, just at different densities, the ultimate scale of the Jordan Springs East development only has an impact on the number of evacuees queuing, not on their queuing times.

It is recognised that in some circumstances evacuation traffic from Penrith may need to use The Northern Road at the same time as Jordan Springs East. If this is the case then the Penrith traffic would have more serious clashes with evacuation traffic from Richmond, Windsor, Bligh Park etc. Whatever is done to deal with that contingency will reduce or eliminate the convergence of Penrith evacuation traffic with Jordan Springs East traffic.

It must be stressed that the above analyses were based on the best publicly available flood modelling outputs, evacuating vehicle numbers and emergency response plans which were, and are, available to Lendlease and its consultants. We appreciate that INSW and NSW SES are working with different information but that has not been made available to others so it is not possible to use it even in 2020.

6.0 Facilities for Queued Vehicles

A separate report was prepared by Molino Stewart in January 2018 in response to a request from DPIE to nominate potential buildings and facilities that could be used as temporary shelters by evacuees who are queuing in their vehicles whilst waiting for their opportunity to evacuate further via The Northern Road.

That report identified and mapped 38 existing buildings located between the development site at Jordan Springs East and The Northern Road that could be used to support queued evacuees during an evacuation. These include buildings that could be used by the NSW SES to set up

Evacuation Centres and Assembly Areas, as well as a number of commercial facilities and retail shops that could be used by evacuees to quickly access water, food or toilets.

The potential Evacuation Centres would provide enough capacity to accommodate all evacuees at the same time. However, in most instances, evacuees would have to leave their cars along the evacuation route and walk to the designated premises.

In case the NSW SES chose not to set up Evacuation Centres, evacuees queueing in their vehicles could still access up to 14 commercial facilities/retail shops that, in almost all instances, would be at a short walking distance from the evacuation routes.

It should be noted, however, that there is about a 1 in 500 chance per year that anyone from Jordan Springs will need to evacuate and about a 1 in 70,000 chance per year that they would all have to evacuate. In the worst case scenarios some of the evacuees may be queued for up to 7 hours. Larger traffic queues of comparable duration occur on Sydney's motorways with much greater regularity with no access to any facilities other than road houses which are tens of kilometres apart.

7.0 Evacuation Route Immunity

Questions have also been raised by PCC, through DPIE about the immunity of evacuation routes within the precinct from local flooding and whether the development has any "flood islands."

At this point it is probably beneficial to provide an explanation of the three types of flooding which can affect Jordan Springs and how they are taken into consideration in identifying flood islands and other aspects of evacuation route flood immunity.

There is an unnamed drainage channel which flows through Jordan Springs East (Figure 6) and into South Creek which itself flows into the Hawkesbury River near Windsor. All local rainfall in Jordan Springs East flows into the local drainage channel and events up to the local probable maximum precipitation rainfall are contained within the channel and do not flood the residential developments.

When South Creek floods it spreads out towards Jordan Springs East and floodwaters from South Creek backup into the local drainage channel. The 1% annual exceedance probability (AEP) flood in South Creek ranges from about 20.8m AHD at the southern end of Jordan Springs East to about 19.8m AHD at its northern end. All roads and lots within Jordan Springs East have been filled to be at least 0.5m higher than the 1% AEP flood level as required by the planning instrument. The extent of the 1% AEP flood level plus 0.5m is shown in Figure 2.

When the Hawkesbury River floods it backs up into South Creek but the distance it extends up South Creek depends on the flood level at Windsor. For example the Hawkesbury River 1% AEP flood level at Windsor is 17.3m AHD which is lower than the 1% AEP South Creek flood level at Jordan Springs East which is why the latter was used to set the flood planning level.

Larger floods in the Hawkesbury River will extend further up South Creek but even a 1 in 500 (0.2%) AEP flood at Windsor is only 19.6m AHD which is lower than the 1% AEP South Creek Flood level at Jordan Springs East.

However, a PMF in the Hawkesbury far exceeds a PMF flood in South Creek and it is the Hawkesbury River PMF flood extent which has been used as the basis of estimating evacuation numbers and timing.

Figure 6shows the location of the internal flood evacuation routes within Jordan Springs and the extent of the South Creek 1 in 500 AEP flood combined with the extent of the 1 in 500 flood along the internal local drainage channel. This event is relevant because the NSW SES expects regional (Hawkesbury) flood evacuation routes up to the PMF to have immunity in local floods (South Creek and internal drainage channel) up to the 1 in 500 AEP event.

Figure 6 compares the local 1 in 500 AEP flood levels where the road bridges the internal drainage channels within Jordan Springs. These bridges are marked as points U, V, X, Y and Z on Figure 7. At points Y and Z, the 1 in 500 AEP flood level is that of local flooding in the corridor because at that those locations the 1 in 500 AEP local flood is higher than the 1 in 500 AEP South Creek flood. At these locations the road level is higher than the local 1 in 500 AEP flood level.

However, at points U, V and X South Creek flood levels dominate so it is the South Creek 1 in 500 AEP flood level which is shown.

At V and X the flood level is higher than the road level. There is also a low point in the road (W) between V and X which is at 20.5m AHD and is also cut by 1 in 500 AEP flooding. Therefore, the area to the north east of these points will evacuate towards the crossing at U which will be constructed as part of Stage 6 and will be above the 1 in 500 AEP flood level.

As can also be seen in Figure 6, most of the Jordan Springs East development is above the reach of the South Creek 1 in 500 AEP flood level although this is not a planning requirement.

As far as the existence of flood islands is concerned, the whole of the subdivision earthworks and road layout has been carefully designed so that there is a rising road access from every point in the development to land above the PMF. Figure 7 shows how that will be achieved for Stage 6..Therefore, there are no flood islands in the development.

This also means that the entire development will have a continuously rising pedestrian route to land above the PMF so that should vehicular evacuation fail for any reason people will be able to walk out ahead of rising floodwaters.

8.0 Conclusions

- There is sufficient time to evacuate all vehicles from the proposed Jordan Springs East development in advance of a flood rising as fast as the 72hr design PMF at Windsor.
- With the use of local roads through Cambridge Gardens and Jordan Springs and the shoulders of the existing routes, all of the traffic from within Jordan Springs East can queue in flood free land until the Northern Road becomes available if this is necessary.
- Signage will need to be added to advise traffic not to queue in flood prone land
- The assumptions that we have made are conservative and assume the worst case scenario, in reality it is likely that:
    - Evacuation of Jordan Springs will be spread over almost 40 hours compared to the 9 hours assumed in the original modelling
    - Evacuation of traffic from Richmond, Windsor and Bligh Park is likely to have ceased using The Northern Road when the last of the Jordan Springs East traffic needs to evacuate
    - Evacuation traffic from Jordan Springs would not have to queue for more than 7 hours, most of it for less than this and much of it not at all
- Should evacuees have to queue then they are not far from commercial facilities which can provide them with food and drink and access to toilets if they need them
- There are no flood islands in the development because there is rising road access to areas above the PMF across the whole development.
- All vehicles can evacuation along flood free roads in a 1 in 500 AEP flood in South Creek or the internal drainage channel.
- These is a rising pedestrian route out from the whole development which means people can walk out ahead of rising floodwaters should vehicular evacuation fail for any reason.

Should you have any further queries in relation to this matter, please do not hesitate to contact me.

Yours faithfully

For Molino Stewart Pty Ltd

Steven Molino

Principal

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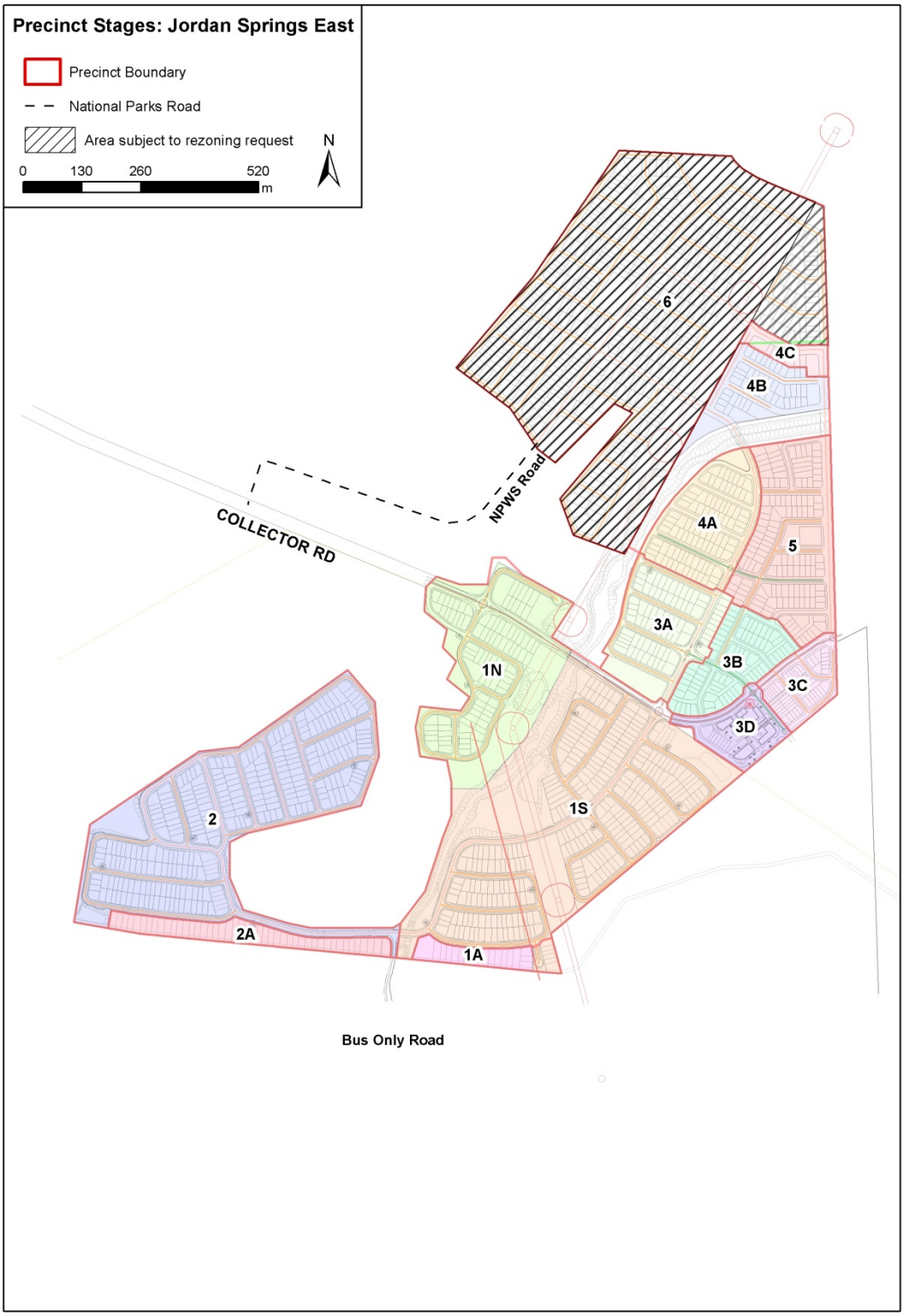


Figure 1: Master plan for Jordan Springs East

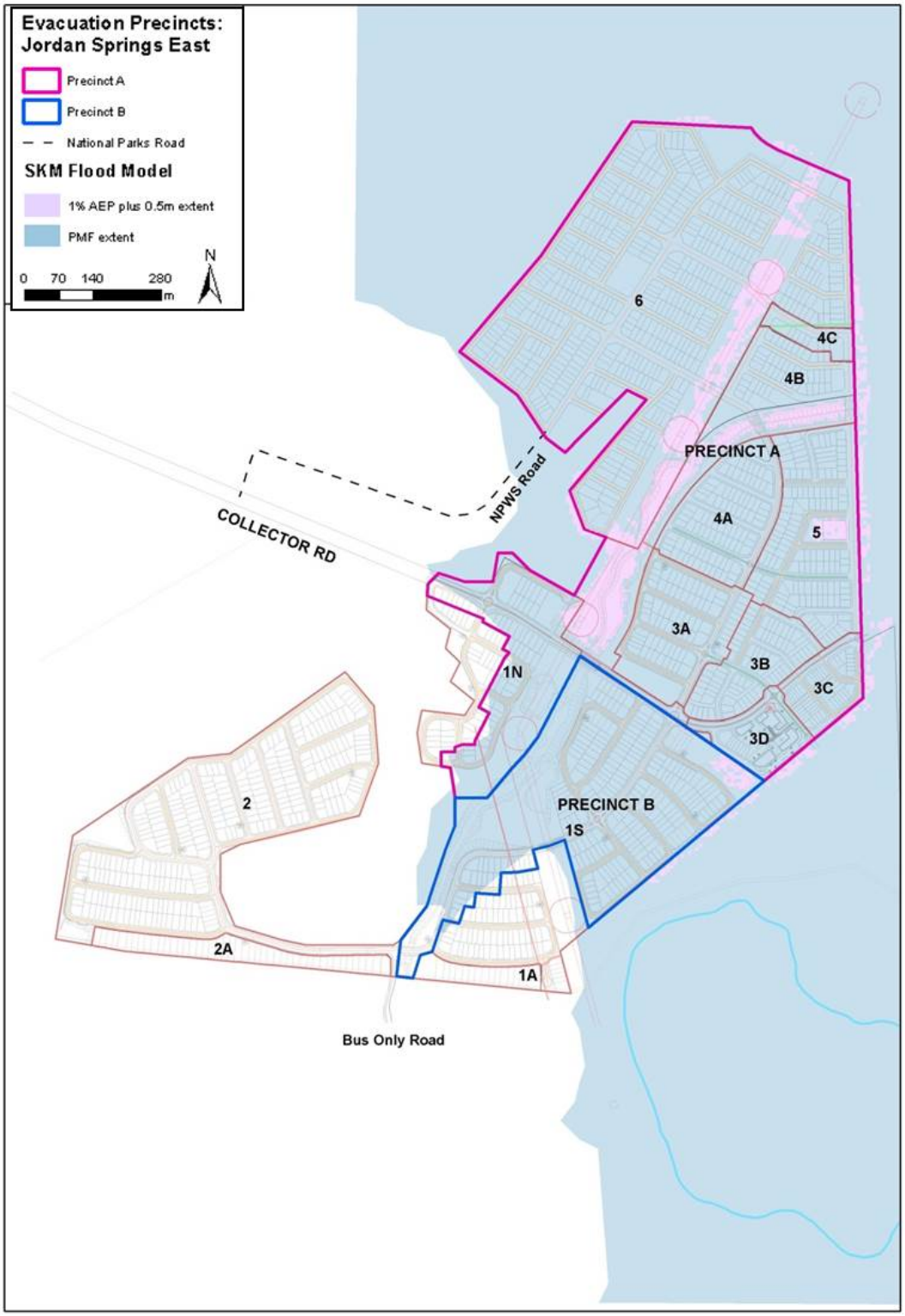


Figure 2: Evacuation sectors and flood extents for PMF and 1% AEP plus 0.5 metres events across Jordan Springs East
(Note: Precinct A and B evacuation boundaries reflect the 2014 evacuation analysis not most recent analysis)

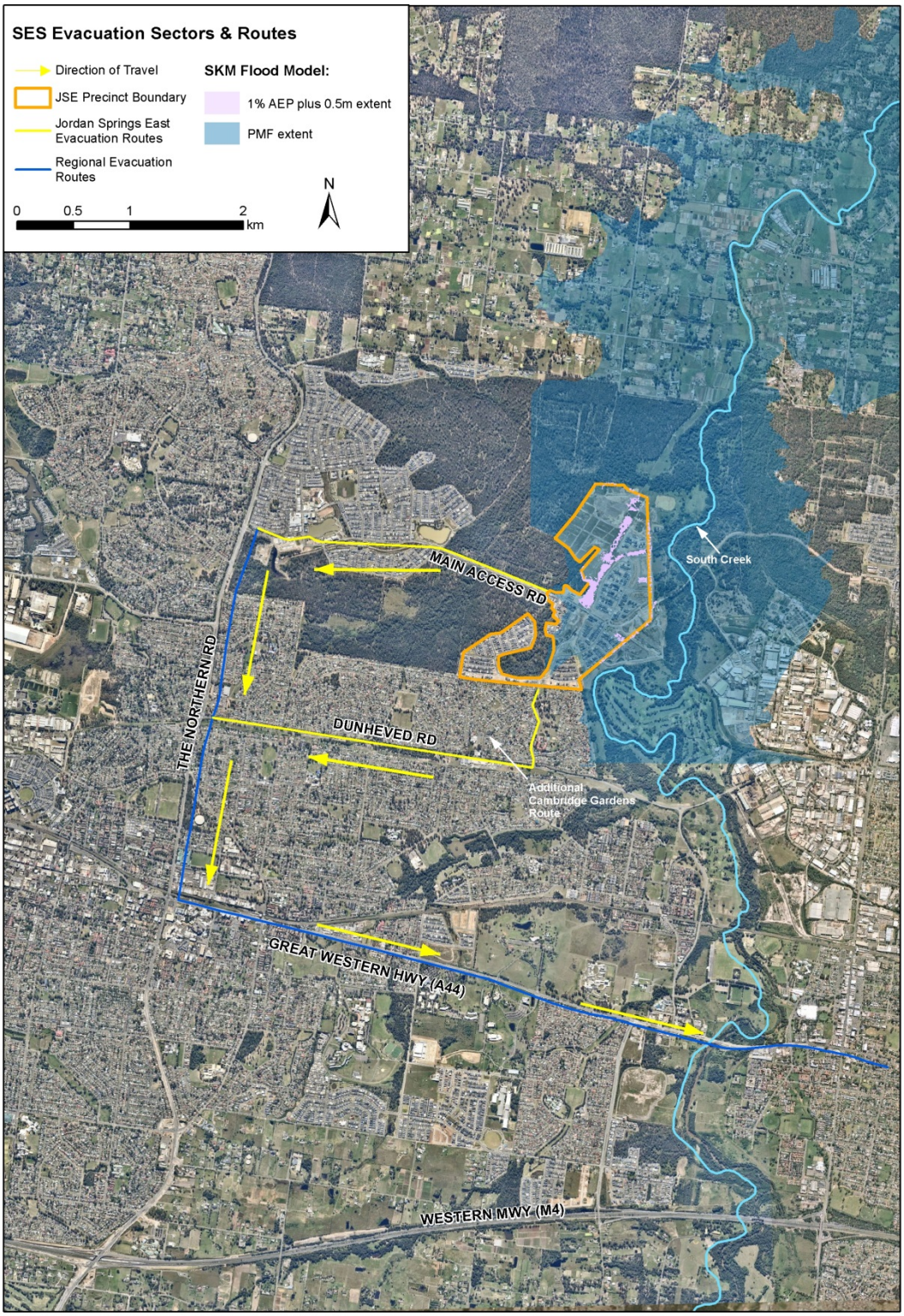


Figure 3: Proposed Evacuation Routes

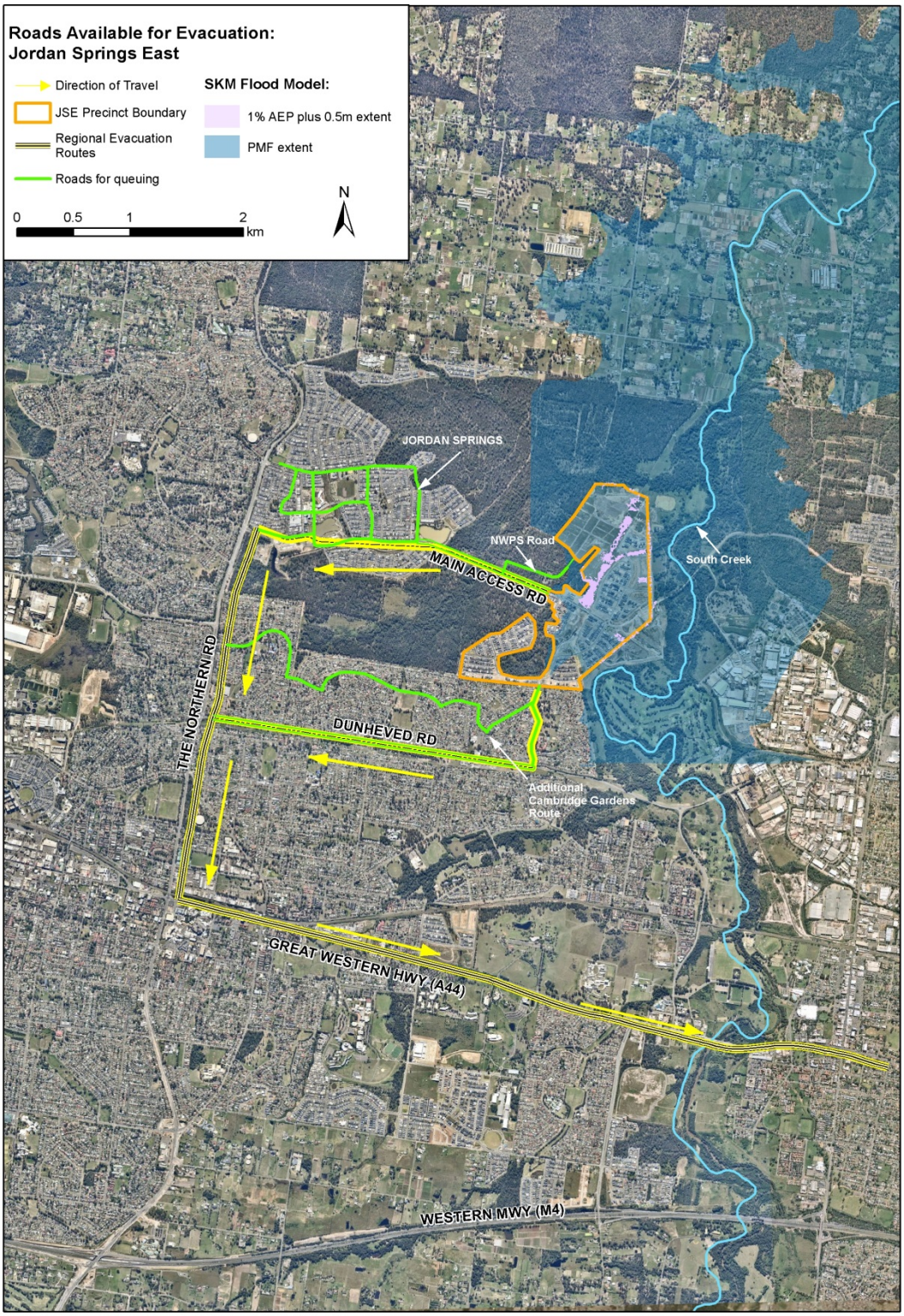


Figure 4: Proposed Roads for Queuing

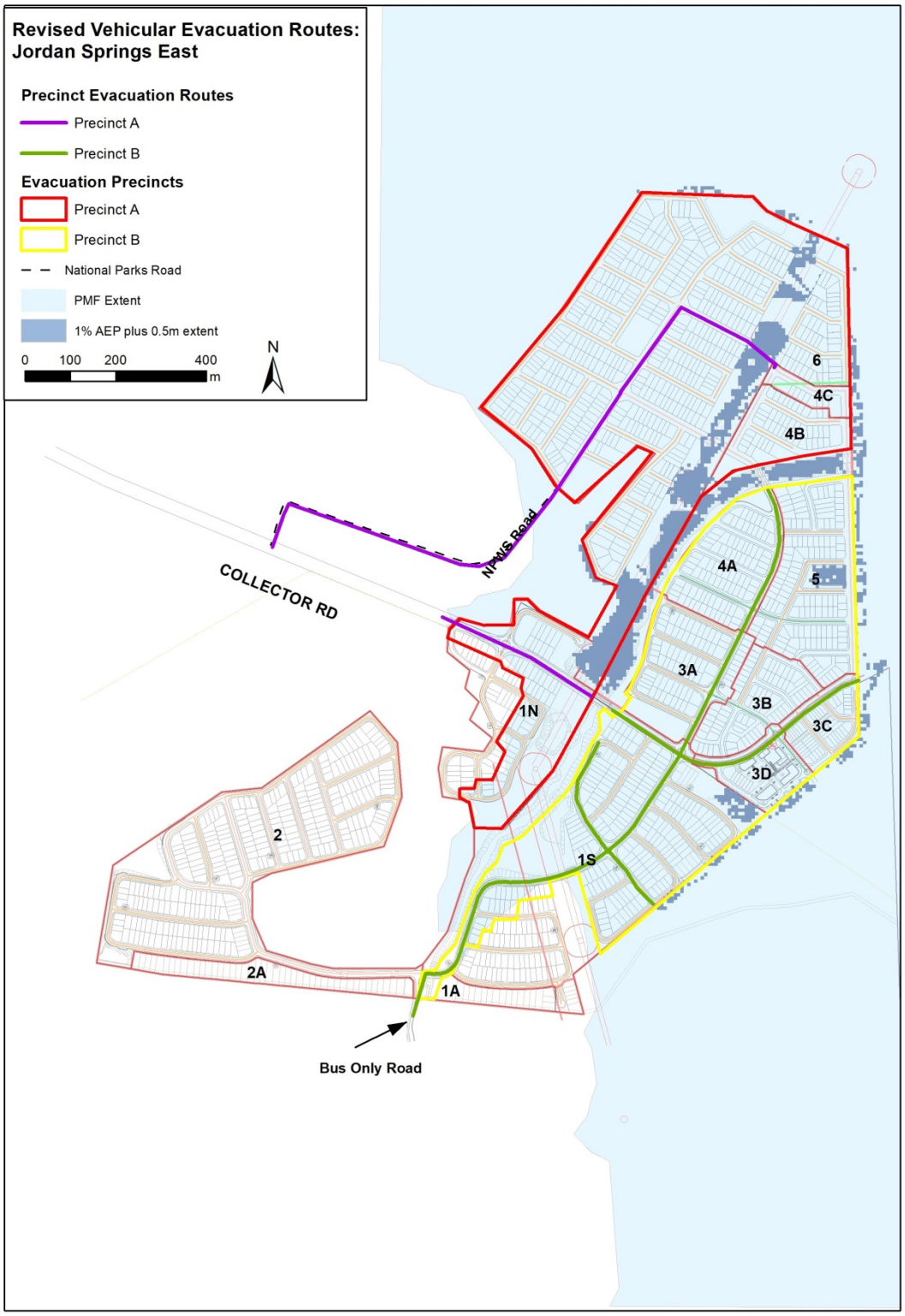
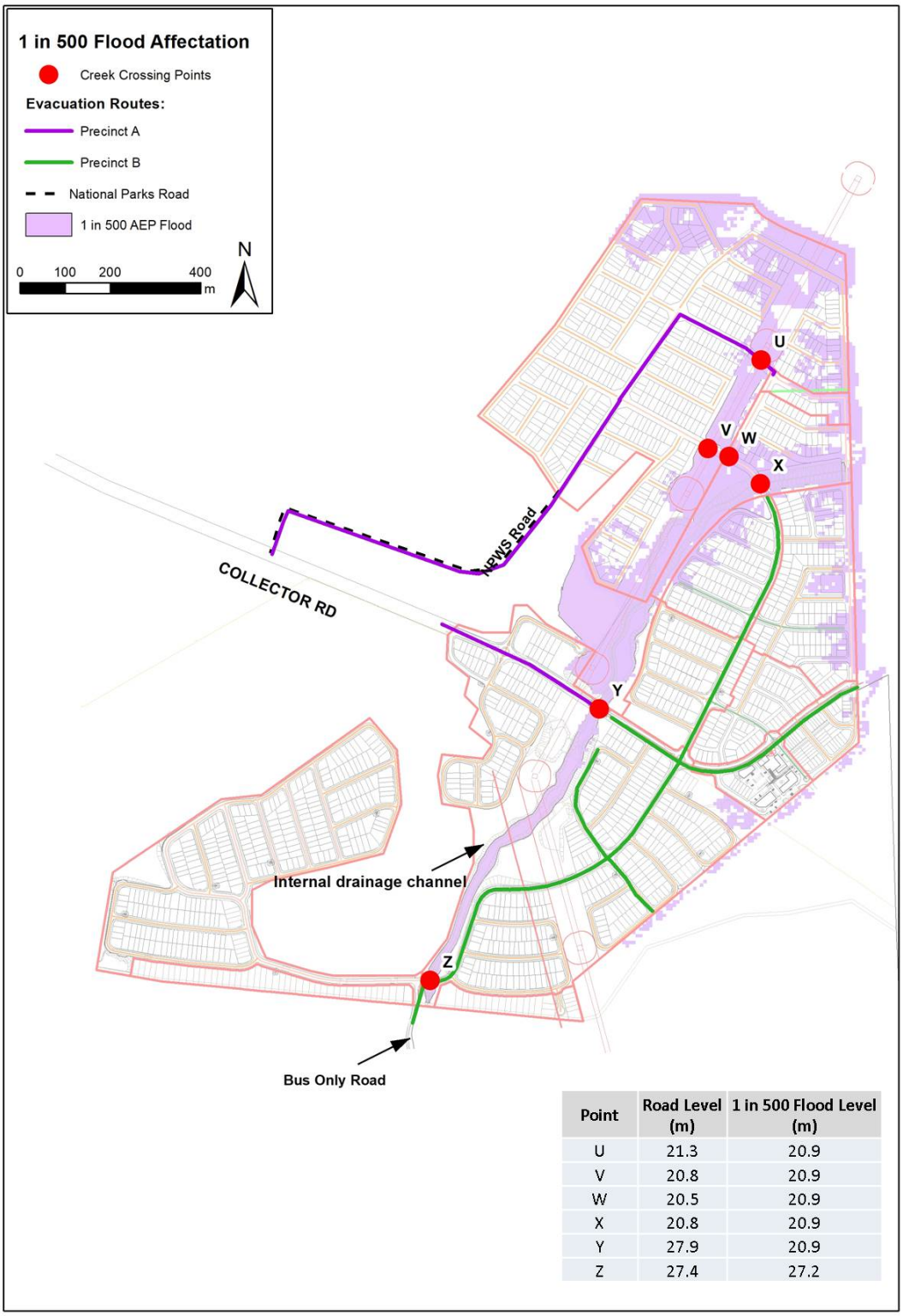


Figure 5: Vehicular evacuation routes within Jordan Springs East



Point	Road Level (m)	1 in 500 Flood Level (m)
U	21.3	20.9
V	20.8	20.9
W	20.5	20.9
X	20.8	20.9
Y	27.9	20.9
Z	27.4	27.2

Figure 6:: 1 in 500 AEP Flood Affectation (post development)

Figure 7:: Rising Road Access out of Stage 6