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7 March 2022
Our ref: 22HNC_1174
Your ref: SPI20211117000198

Anna Jones
NSW Rural Fire Service
Locked Bag 17
Granville NSW 2142

Dear Anna,

RE: Request for Additional Information Response — Proposed Residential Subdivision – Callala Bay Expansion Area

This letter provides the additional information requested by the NSW Rural Fire Service (RFS) dated 7 February 2022 (reference SPI20211117000198) and specifically matters regarding evacuation. The RFS Request for Additional Information (RAI) is provided as Appendix A.

The RFS response included in their assessment that the Strategic Bush Fire Study (SBFS) that the RFS was "not currently satisfied that the proposal is consistent with the directions" i.e. Section 4.4 Directions under Section 9.1 of the *Environmental Planning and Assessment Act 1979*. The additional information required is provided along with comment on the RFS conclusions and assumptions related to risk within the RAI.

1. Response to RFS general comments

a. "Callala Bay is a high risk isolated location"

High risk is not defined within Planning for Bush Fire Protection 2019 (PBP) and is a largely subjective classification with very poor guiding information within PBP about how to apply the risk ranking consistently and measurably. High risk is a relative term typically associated with other risk such as low, medium, and potentially very high and extreme risk; the risk scale is therefore important but is not defined in PBP. Without a useful definition of high risk, personal perspectives can lead to inappropriate or an unsubstantiated description of the risk in a locality, whereas a SBFS helps understand the risk level without generalised and questionable risk classification.

Callala Bay Village is unlikely to be considered high risk if a state-wide risk ranking system were applied, especially when compared to locations such as Sassafras and most of the Blue Mountains' townships or BAL-40 and BAL-FZ exposed developments (the latter being defined by PBP (p. 21) as high risk).

If Callala Bay Village is considered high risk primarily because it is accessed through forests, then most of the existing and proposed development in forested areas in NSW are high risk. Notably, the strategic planning principles (PBP s.4.1) do not specify that development is inappropriate solely because it has

access through forested areas. A SBFS is therefore the mechanism to help determine, on a case-by-case basis, whether a proposal (development area) is exposed to high risk from an assessment of all risk and risk-mitigation factors, not just forested access.

Describing Callala Bay as isolated is not consistent with the PBP S. 5.1.1. Isolated Subdivision. The proposal abuts an existing large and growing village; a Village that has a large area suitable for open-air and building-based Neighbourhood Safer Places (NSP). It is also not located within rugged, heavily timbered country. It is forested, but it is not rugged compared to escarpments in the Shoalhaven or mountain areas elsewhere in the State. Also, its predominant bushfire threat from nearly all directions requires downhill fire spread and there is no uphill spread of any consequence toward the Proposal Site.

The planning proposal (subdivision) also does not pose significant challenges from a planning and/or bush fire risk perspective. It abuts existing residential development, improves the resilience of the existing residential interface and is located within significant roads well placed and oriented to aid in the containment of bushfires prior to them impacting the site e.g. north-south (Callala Beach Road) and east-west (Forest Road).

The Planning Proposal also does not require firefighters to travel large distances to the Site as it is located a few hundred meters down Emmett Street from the large Callala Bay RFS station and is not too distant from other brigades in each of the nearby villages. It is, and has been, one of the best RFS brigade-serviced areas in the Shoalhaven. Response times are good and brigade membership is bolstered by the growing population. The Callala Bay community is not unduly reliant on outside firefighting resources.

The Proposal clusters allotments between Callala Beach Road and Emmett Street while abutting the older housing stock on the western edge of the existing Village. A PBP compliant perimeter road to the north secures the complete perimeter of the Proposal Site. Future allotments are of a residential scale and will not result in bushfire penetration through the allotments as can occur with larger allotments and rural residential development. APZs larger than required under the Acceptable Solutions in PBP exist in the most-fire prone direction to the west.

It is therefore not accurate to describe the Proposal Site as isolated simply on the basis that the "only safe path of travel is eastward" and the only alternate path is "traversing approximately 15 km of heavily forested areas" to the west. Eastward is not the only safe path and alternate evacuation routes are safe under a wide range of bushfire attack scenarios as discussed below.

b. "the only safe path is eastward into the existing village"

This comment is not valid as it does not consider the bushfire threat context. Also, as a generalised comment, it is not supported by evacuation experience and published research which typically show all available evacuation routes are used, subject to a bushfire proximity and other factors. The Proposal offers more than one egress direction and the eastward option into the existing Village is not the only safe option and it is not the finding of the SBFS, or the additional information provided herein.

Evacuation risk assessment requires much more consideration than the simple extent of forests on evacuation routes. It typically includes consideration of hazard (slope and vegetation), egress routes (distance, travel time and risks), egress destination (e.g. potential Neighbourhood Safer Place (NSP) compliant locations), number and demographic of evacuees, and importantly evacuation risks under a range of bushfire attack scenarios. To assume the only safe pathway is eastward without adequately considering these and other factors is incomplete.

Fundamental to considering bushfire evacuation options are the Design Fires under which evacuation option are assessed. PBP identifies FFDI 100 as the weather input for the Shoalhaven as one of the Design Fire considerations, but equally important in evacuation risk assessment is the ignition point and footprint of the Design Fires. For bushfires taking half a day or longer to reach the Proposal Site early evacuation is safe and feasible in at least four very different directions (Figure 1) i.e. south to Callala Beach, East to Callala Bay or Currarong, north to Culburra or Nowra, and west to the highway (Nowra).

Early evacuation in each of the four directions is feasible under an FFDI 100, but as with all evacuation decisions, it is dependent on the predicted time to fire impact (i.e. proximity of the fire). A fire that would close all four major evacuation directions would need to be many kilometres wide and predicted to run directly toward the Village. Fires of this width take many hours and typically days to develop, in which case one of the four evacuation routes can be safely used for early evacuation.

A good historical example occurred in the 2019/20 bushfires, when a major fire occurred north-west of Callala Bay (around Worrigee) and this is the direction from which Callala Bay is at highest bushfire risk. During the extended period that this fire (and others in the region) posed a threat to the villages of Callala Bay and Callala Beach, their residents safely moved in and out of the area in a northward direction via Callala Beach Road and Callala Bay Road. Emmett Street was not specifically required as an egress route. This highlights that even in the worst fire season in NSW history and with an emergency level bushfire nearby in the most problematic direction from the Proposal Site, that an eastward egress along Emmett Street is NOT the only safe egress.

Furthermore, there is no bushfire history that indicates the only safe path of evacuation from the Proposal Site is along Emmett Street into Callala Bay Village. There are times in a bushfire where any egress route may become unsafe and that is why fire authorities Australia-wide advocate 'early evacuation as the safest option'. However, evacuation risk is significantly lowered when multiple egress routes are available and particularly when they occur in vastly different directions such as on the Proposal Site. Specific comments on the evacuation options exiting the Proposal Site and further afield are made later in this letter.

The feasibility of six different evacuation destinations/routes has also been considered. Figure 2 to Figure 5 show the radiant heat flux thresholds required by the RFS for Neighbourhood Safer Places (NSP) (RFS 2017) and shows that there are six destinations with the potential for providing at least outdoor NSP shelter i.e. Callala Bay, Callala Beach, Currarong, Culburra and Nowra (via Forest Road to highway or Culburra Road). Each of these locations have areas where an outdoor NSP can be provided. A Nowra figure is not provided as it is a large urban area.

The 2kW/m^2 and 10kW/m^2 areas shown in Figure 2 to 5 are indicative and calculated using FFDI 100, forest vegetation and 5-degree downslopes. The indicative 2kW/m^2 line is 150 m wide and the 10kW/m^2 line is 63 m wide. Suitable waterfront outdoor NSP areas are available in Callala Bay, Culburra, Currarong and Callala Beach. Evacuation plans can be prepared to identify these evacuation destination options.

2. Response to RFS specific comments

a. All evacuation traffic will be eastward along Emmett Street

This is incorrect. Evacuation can occur safely to the west onto Callala Beach Road and either north onto Forest Road where options exist to go east, north or west, or south into Callala Beach. The only time eastward evacuation is likely to be restricted to Emmett Street is when a bushfire impact on the Proposal

Site is imminent or firefighters are operating off Callala Beach Road, and this would typically be considered a time that is 'too late to evacuate' in any direction.

b. Emmett Street is the only east - west road through the village and congestion issues are already apparent without the additional traffic generation

Emmett Street is the only eastward egress leaving the subject site, but it is not the only road available to complete eastward traffic movement. Australia Ave offers egress via Sydney Ave onto Lackersteen Street at the eastern end of Emmett Street, and Chisholm Street via Sheaffe Street offers another alternative to the outdoor NSP options at the Callala Bay Village waterfront.

A traffic engineer report (Stantec 2022) is provided as Appendix B. It assessed a 1-hour and 2-hour traffic evacuation period and assumed 100% evacuation. These are very conservative bushfire risk assumptions as evacuation times are often much longer and publish research always finds that a significant proportion of residents stay and defend. The 'stay and defend' rate on the Proposal Site also is likely to be reasonable high as about 66% of the proposed lots are located beyond the conservatively mapped 10 kW/m^2 line (Figure 2).

Page 1 of the Traffic Assessment (Appendix B) states *"… that no issues, relating to existing traffic performance, were identified in the traffic assessment"*.

c. Emmett Street, along the southern interface of the planning proposal area, is impacted by forested vegetation

This is not unusual in bush fire prone areas and is not a singular reason to exclude the proposed development. The forest exposure is a few hundred metres and evacuating past it when it is burning is unsafe, never recommended or undertaken by fire authorities, and bushfire planning should never be based upon that assumption. Appropriate evacuation planning should be based upon 'early evacuation' or 'stay and defend', there is no other acceptable planning design consideration. The small forest exposure along Emmett Street is not a problem for early evacuation.

d. It is unclear where within the existing village evacuating residents would take refuge. Existing public building and places Callala Bay are sited on the southern side of the village with potential impact from bush fire within the southern hazard area.

Figure 2 shows the 2kW/m^2 and 10kW/m^2 areas within Callala Bay Village. There are several suitable locations for NSP within the Village including the shopping centre, community hall and along the waterfront and these locations are shown in Figure 2.

e. Further information should be provided to demonstrate the two roads on either side of proposed C3 zoned land will not directly adjoin retained forested vegetation.

These two roads are suitable for early evacuation despite being located next to vegetation. It does not matter whether it is forest or a lesser risk vegetation, evacuation when that vegetation is burning is unsafe and would not be part of the evacuation plan associated with future development. These roads are safe when evacuation is early, and they are not used if residents choose to stay and defend.

Emergency responders have options to ingress and egress the proposed site via fire trails to the east and west off the northern boundary of the Proposal Site. This removes the need for emergency responders to rely on the Site access off Emmett Street if it is unsafe during the passage of a bushfire.

f. Assessment of the proposed and existing road network to deal with evacuating residents and responding emergency services

As discussed above, Emmett Street is not the only safe and practical egress direction from the Proposal Site and emergency services have two additional access options. This provides reliable options for emergency responders while resident early evacuation is occurring. There is no foreseeable traffic congestion associated with early evacuation on Callala Beach Road (north or south) and the Traffic Engineer report (Appendix B) assessed the unlikely event of all evacuees from the Site being required to egress eastward along Emmett Street.

The Stantec Traffic Engineer report (Appendix B) concluded that *"the longest time it would take for a vehicle to exit the Site and get on to Callala Bay Road … would be approximately 150 seconds."* This 2.5-minute evacuation time is not unreasonable and does not constitute a high risk under PBP Section 4.1, especially given the other evacuation options available for the Site.

g. Assessment of the location of key access routes and direction of travel

Figure 1 shows the key egress routes available to destinations outside of Callala Bay Village that can meet an outdoor NSP standard. Notably these landscape wide routes go in all four cardinal directions; north, east, south and west. This provides viable early evacuation destinations regardless of the direction of the bushfire threat.

The likelihood of all four egress directions being closed at the one time is small. The likelihood is below that implicit in the broad principles for strategic planning within PBP which simply requires compliance with PBP, which in this instance would be providing more than one access.

Access on any bushfire prone land in NSW will be unsafe for short periods of time during the passage of a bushfire. This also characteristic of appropriately safe development on bushfire prone lands and it does not mean a site has a risk level inappropriate for development.

There is no evidence (historical or otherwise) that frequent closure of the Callala Beach Road egress is likely, and this egress opens all major evacuation destinations beyond Callala Bay Village.

h. Assessment of the potential for the development to be isolated in the event of a bush fire.

Any development in a bushfire prone area has the potential to be isolated for periods of time.

In the extraordinary bushfires of 2019/20, access to the Princes Highway and along Coonemia Road (northward route to Nowra) was closed due to a bushfire near Culburra Beach at the same time as the larger bushfire along Forest Road toward the Highway. The wider locality of coastal villages at Callala Bay, Callala Beach and Currarong were isolated for about 48 hours during this event. The 2019/20 'isolation' was over a large area and amid a time when most towns, villages and city centres in the Shoalhaven were isolated, with many being for much longer periods.

The potential for the Proposal Site to be isolated from Callala Bay Village is very low and if it occurred would be short-lived as the emergency egress via the fire trails to the north-east and north-west of the Site would prevent complete isolation.

Fire history records for the Shoalhaven commenced in 1938 and were reasonably well kept from 1970. There is no known record of the proposed site or Callala Bay itself being isolated apart from the wider issues identified in 2019/20.

There are no fire pathways evident from fire history, ignition risks or terrain/hazard analysis that suggest the Proposal Site poses an unusual bushfire risk. The four major egress directions (Figure 1) are a significant factor in reducing the risk of isolation.

i. Assessment of any existing or potential community refuge buildings and/or areas both within the planning proposal site and within the existing village.

No existing refuge building has been identified within Callala Bay Village by the RFS, however there are clearly several options including those identified in Figure 2. Apart from the forest abutting Emmett Street adjacent to the Proposal Site (discussed in point e above), the access roads to these local potential refuge areas are an adequate distance from the hazard and have an acceptable radiant heat exposure e.g. <10kW/m^2.

A community refuge building is not currently proposed for the Proposal Site as 66% of proposed lots are located beyond the predicted 10 kW/m^2 line (Figure 2).

j. Consideration should be given to additional eastward egress from the pp site into the existing village area.

When the land to the east of the Proposal Site was subdivided, the Development Consents issued by Shoalhaven City Council (SCC ref SF5799 and SF5930) required the following along the northern boundary of Callala Bay:

- a 40 m wide area for "Bushfire Fuel Reduction" to act as an APZ;
- a 12 m wide "Right of Carriageway" to act as a fire trail; and
- a 12 m wide easement for water supply over the water main.

These easements are shown on DP732705, DP772178, DP777916, and DP789141 and burden Lot 53 DP772178 and Lot 20 DP1263402 which currently exist to the north and west of the existing Village.

Currently, the fire trail and APZ do not meet the required standards and the landowner is in the process of bringing these up to current standards (e.g. PBP 2019, RFS 2019).

This APZ and fire trail will allow an emergency service egress to the north-east of the Proposal Site and an access route for emergency services independent of Emmett Street. There are several connection points between the proposed linear reserve and the public road network along this northern boundary of Callala Bay Village. Another 'emergency use only' fire trial connection can be provided to Callala Beach Road from the north-west corner of the Proposal Site providing another useful emergency service access route.

Furthermore, there is nothing within the Stantec Traffic Assessment (Appendix B) that suggests that additional eastward egress to the Callala Bay Village is necessary to facilitate evacuation. The predicted maximum delay of 2.5 minutes evacuating onto Callala Bay Road (less to Callala Bay Village centre) is an insignificant delay in an early bushfire evacuation that typically takes hours.

3. Vegetation screening along Callala Beach Road

The APZ required along the western side of the Proposal Site has been measured from the vegetation screening along Callala Beach Road and has been based upon forest vegetation, and not a lesser category of hazard.

4. Additional risk mitigation measures

The Planning Proposal and future subdivision proposal complies with the Acceptable Solutions within PBP. It has four landscape-wide directions of potential egress: two public access roads off Emmett Street and two fire trails for emergency service use (to the NE and NW). A range of suitable evacuation destinations exist (3 villages, 1 township and the urban centre of Nowra) with each in very different directions and therefore less likely to be cut off at the same time.

A Bush Fire Emergency Management and Evacuation Plan can be prepared for any future DA for subdivision that includes triggers for early evacuation and the appropriate refuge destination under different bushfire scenarios.

5. Conclusion

The additional information provided herein in response to the RFS Request for Additional Information demonstrates that the Planning Proposal can comply with Planning for Bushfire Protection 2019 and specifically Section 4 Strategic Planning.

Rod Rose
Senior Principal - Bushfire
FPAA BPAD Accredited Practitioner No. BPAD1940-L3

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

References

NSW Rural Fire Service (RFS). 2017. Neighbourhood Safer Places – Guidelines for the Identification and Inspection of Neighbourhood Safer Places in NSW.

NSW Rural Fire Service (RFS). 2019. *NSW RFS Fire Trail Standards V1.1*. RFS, Sydney Olympic Park.

Stantec 2022. *Planning proposal for residential subdivision at Callala Bay – Bush fire Evacuation (Traffic)* Report dated 4 March 2022 by Desmond Ang (Transport Engineer)

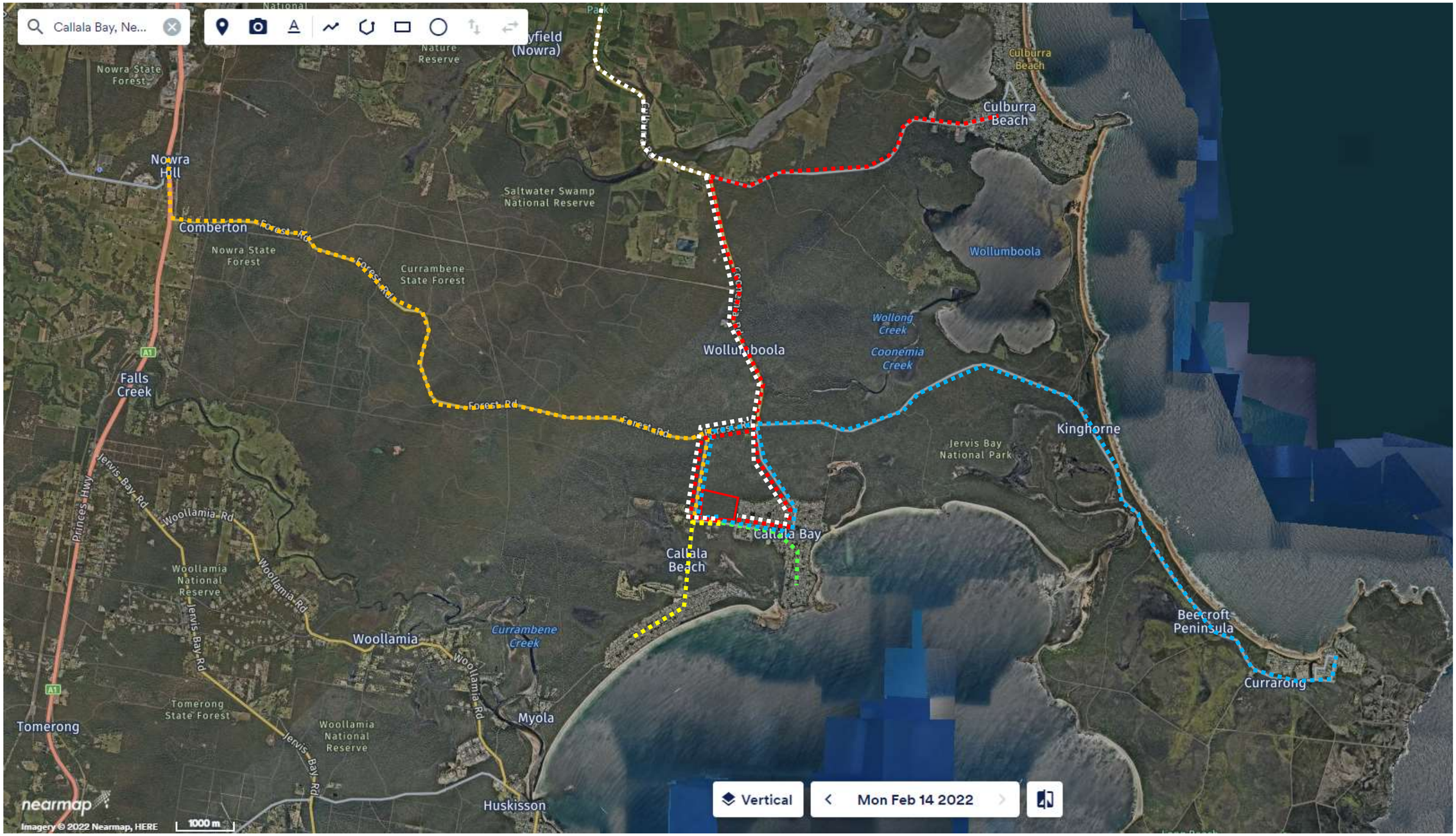

Figure 1: Egress options and estimated travel times (Google Maps)

Subject land

- West to Highway (12 minutes to BTU road rest bay)
- East to Callala Bay (4 minutes to Community Hall)
- East to Currarong (16 minutes)
- South to Callala Beach (3 minutes)
- North-east to Culburra (16 Minutes)
- North to Nowra via Pyree (18 minutes to Nowra)

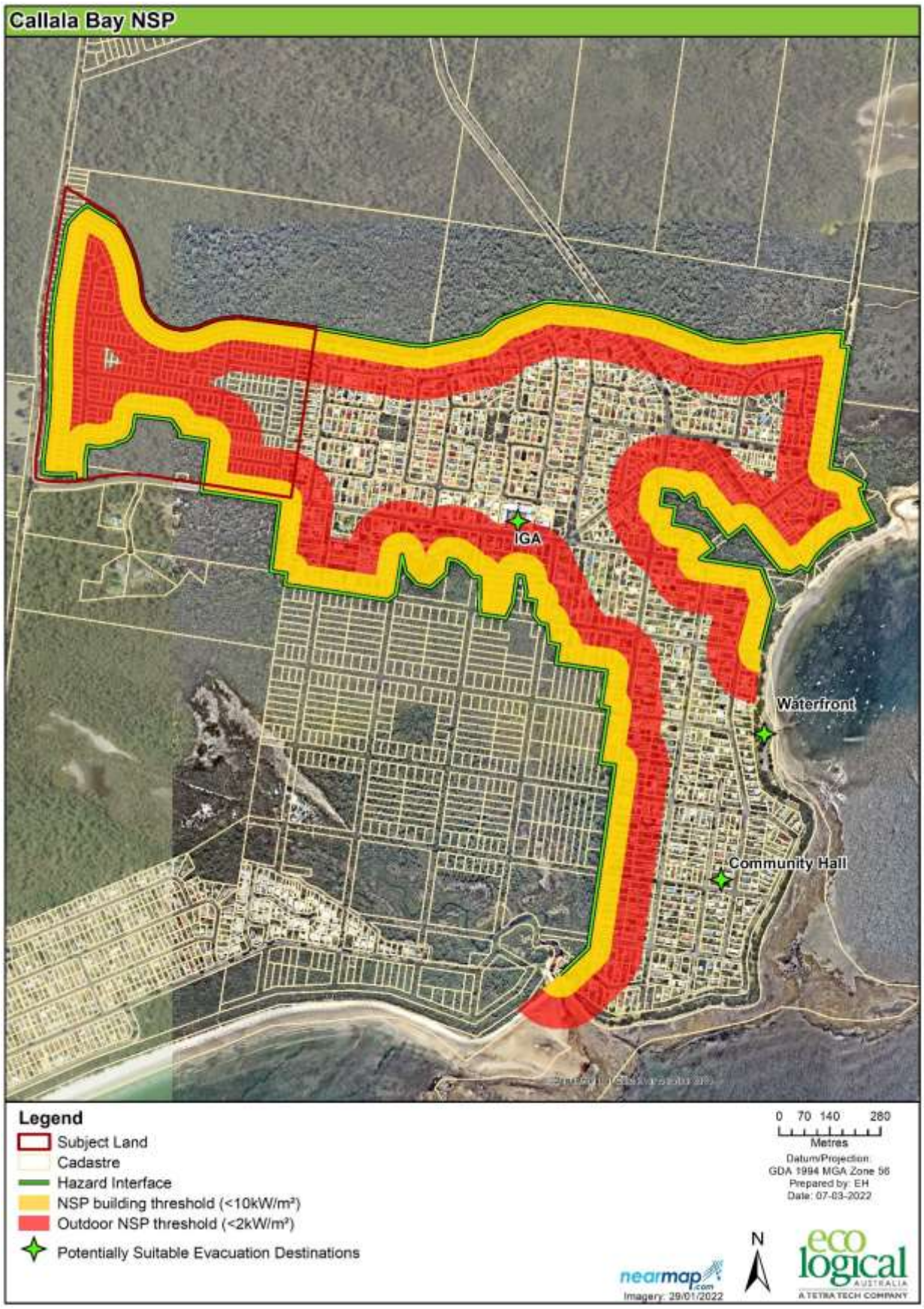

Figure 2: Callala Bay Potential Areas for NSP

Figure 3: Callala Beach Potential areas for NSP

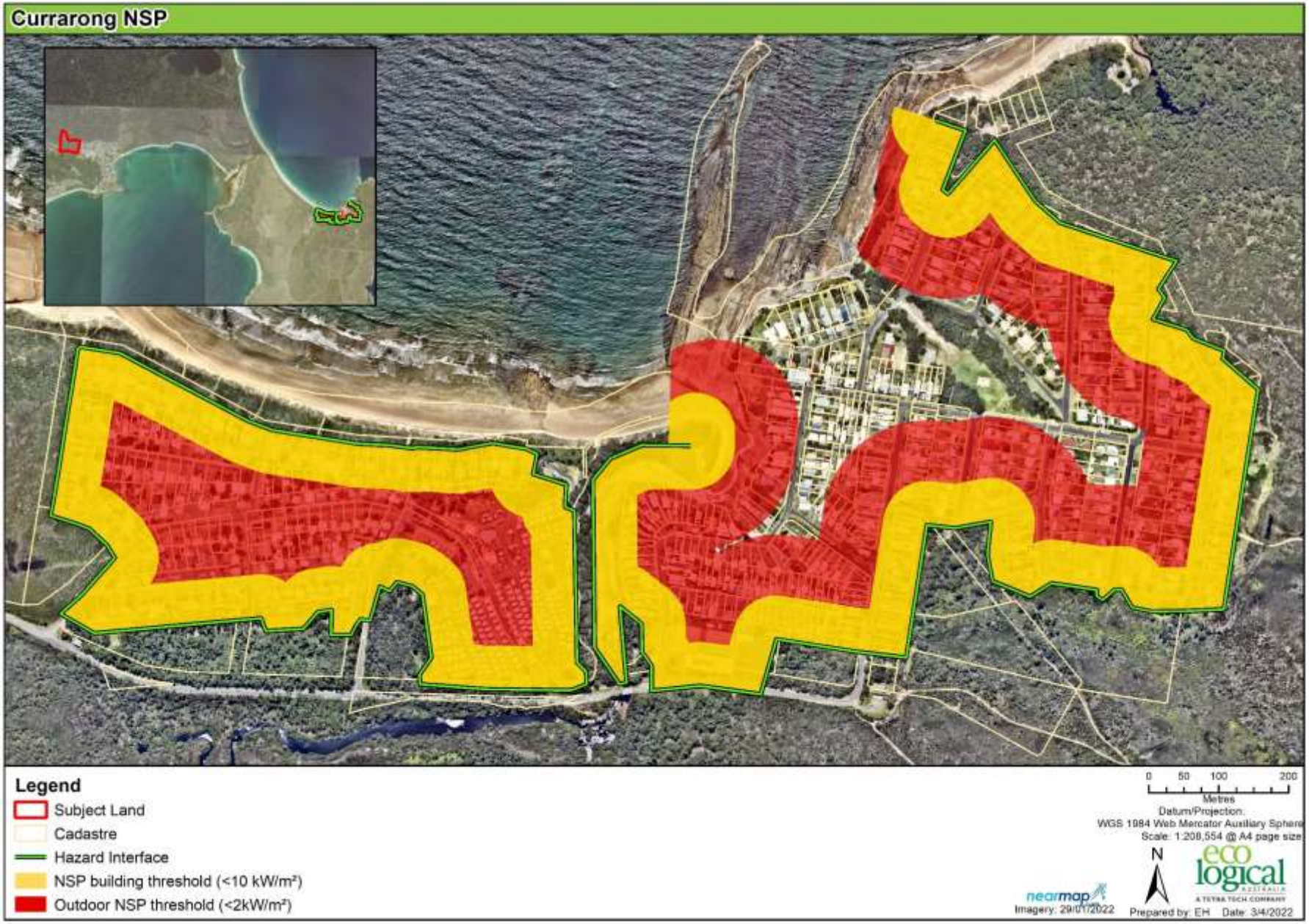

Figure 4: Currarong Potential Areas for NSP

Figure 5: Culburra Beach Potential Areas for NSP

Appendix A - RFS Request for Additional Information (RAI)

NSW GOVERNMENT

NSW RURAL FIRE SERVICE

Shoalhaven City Council
PO Box 42
NOWRA NSW 2541

Your reference: PP028
Our reference: SPI20211117000198

ATTENTION: Rebecca Jardim

Date: Monday 7 February 2022

Dear Sir/Madam,

Strategic Planning Instrument
LEP Amendment – Planning Proposal
Planning Proposal (PP028) to amend Shoalhaven Local Environmental Plan (LEP) 2014 to rezone land owned by the Halloran Trust in the Callala Bay, Wollumboola and Kinghorne localities. PP028 seeks to rezone land to the west of Callala Bay to enable residential development and to rezone the balance to environmental conservation.

I refer to your correspondence dated 16/11/2021 inviting the NSW Rural Fire Service (NSW RFS) to comment on the above Strategic Planning document.

The NSW RFS has considered the information submitted and provides the following comments.

The New South Wales Rural Fire Service (NSW RFS) has reviewed the proposal with regard to Section 4.4 of the directions issued in accordance with Section 9.1 of the *Environmental Planning and Assessment Act 1979*.

The objectives of the direction are:
(a) to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and
(b) to encourage sound management of bush fire prone areas.

The direction provides that a planning proposal must:
(a) have regard to Planning for Bushfire Protection 2006,
(b) introduce controls that avoid placing inappropriate developments in hazardous areas, and
(c) ensure that bushfire hazard reduction is not prohibited within the APZ.

Based upon an assessment of the information provided, the NSW RFS is not currently satisfied that the proposal is consistent with the directions.

The Strategic Bush Fire Study (SBFS) identifies bush fire constraints largely surrounding the area with forested vegetation to the north, south and west. Callala Bay is considered a high risk isolated location with potential paths of travel to Princes Highway involving traversing approximately 15km of heavily forested areas. In the event

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of an evacuation of the planning proposal site the only safe path of travel is eastward into the existing village. The statements within part 7 of the SBFS prepared for the planning proposal do not adequately address evacuation of the future residents within the planning proposal area. The strategic planning stage of development is the appropriate time to assess these issues.

The following issues are identified:

- All evacuation traffic will be eastward along Emmet Street
- Emmet Street is the only east - west road through the village and congestion issues are already apparent without the additional traffic generation
- Emmet Street, along the southern interface of the planning proposal area, is impacted by forested vegetation
- It is unclear where within the existing village evacuating residents would take refuge. Existing public building and places Callala Bay are sited on the southern side of the village with potential impact from bush fire within the southern hazard area.
- Further information should be provided to demonstrate the two roads on either side of proposed C3 zoned land will not directly adjoin retained forested vegetation.

The proponent and SFBS should provide further information to support the proposal through considering mitigative measures and densities that are reflective of the risks associated with the site. Such measures should be guided by an assessment of:

- the proposed and existing road network to deal with evacuating residents and responding emergency services;
- the location of key access routes and direction of travel
- the potential for the development to be isolated in the event of a bush fire.
- an assessment of any existing or potential community refuge buildings and/or areas both within the planning proposal site and within the existing village.
- consideration should be given to additional eastward egress from the pp site into the existing village area.

NSW RFS is of the opinion that the proposal should not progress to exhibition stage prior to resolution of the issues above.

<u>Road interface entry options – advice requested by Council</u>
Council have requested specific comments from NSW RFS in relation to the screening options along Callala Beach Road.

At this very preliminary stage, it appears that the potential flame length applied to predominant vegetation west of Callala Beach Road will exceed the distance to the proposed vegetated screen, therefore any asset protection zone should be measured from the vegetation screen and not from the western side of Callala Beach Road. Please note a short fire run and/or remnant bushland assessment applied in isolation to the vegetated screen, in accordance with A1.11 of *Planning for Bush Fire Protection 2019*, is unlikely to be supported.

For any queries regarding this correspondence, please contact Anna Jones on 1300 NSW RFS.

Yours sincerely,

Martha Dotter
Supervisor Development Assessment & Plan
Built & Natural Environment

Appendix B – Traffic Engineer Report

Stantec

Addendum

To:	James Harris	From:	Desmond Ang
	ALLEN PRICE & SCARRATTS PTY LTD		Stantec Australia
		Date:	7 March 2022

Reference: Planning proposal for Residential Subdivision at Callala Bay – Bush fire Evacuation (Traffic)

This addendum has been prepared in response to NSW Rural Fire Service (NSW RFS) comments dated 7 February 2022 and should be read in conjunction with the traffic report (*300303256_ta_220127 final.docx*). The issues identified by the RFS are as follows:

- All evacuation traffic will be eastward along Emmett Street.
- Emmett Street is the only east – west road through the village and congestion issues are already apparent without the additional traffic generation.
- Emmett Street, along the southern interface of the planning proposal area, is impacted by forested vegetation.
- It is unclear where within the existing village evacuating residents would take refuge. Existing public building and places Callala Bay are sited on the southern side of the village with potential impact from bush fire within the southern hazard area.
- Further information should be provided to demonstrate the two roads on either side of proposed C3 zoned land will not directly adjoin retained forested vegetation.

A traffic assessment was undertaken for the existing conditions of the road network near the proposed development. As detailed in Section 6.8 of the traffic report, SIDRA analysis for the intersection of Emmett Street and Lackersteen Street indicates that the intersection operates at a very good Level of Service (LoS) A with minimal delays during the peak periods. It is noted that no issues, relating to existing traffic performance, were identified in the traffic assessment.

In general, there are a number of evacuation routes from the site and from Callala Bay Village, as outlined in the ELA response. This submission is written on the assumption that all evacuation traffic will travel eastward along Emmett Street.

This addendum assesses the following:

- Proposed and existing road network to deal with evacuating residents and responding emergency services.
- The location of key access routes and direction of travel.
- The longest time it would take for the residents to leave the village from the site and onto Callala Bay Road, by private vehicle, in the event of a bush fire.

1.1 TRIP GENERATION

The study area has been broken into the areas shown within Figure 1 in order to determine the movements at the intersections.

Assumptions used for this assessment:

- **Traffic Management** – It is expected that the evacuation will be under traffic management and that the appropriate measures will be established to facilitate safe and efficient movements.
- **Emergency Access**: As shown in Figure 1, there will be a route from Callala Bay Road to the North-eastern corner of the site for emergency service ingress only, if required. In addition, it has been assumed that all vehicles on the road network are evacuating using the left lane only, allowing entry by emergency services if necessary.
- **Trip Generation** – The bush fire evacuation has been assumed to occur with 100% of dwellings within the study area occupied. For this assessment, it has been assumed that all trips would be generated from residential land uses.
- **Trip Generation** – Each dwelling will generate one vehicle movement. Any dwellings accommodating six or more people will generate two vehicle movements.
- **Trip Generation** – Based on the number of dwellings from the south of Lackersteen Street / Emmett Street intersection (Area G), there will be about 500 trips travelling northbound from the south and some 20 trips travelling northbound from the east of the intersection. It is expected that the 20 trips will be generated from dwellings along the east of the intersection.
- **Trip Generation –** Trips generated from Area F is assumed to depart from Sydney Avenue.

Reference: 300303256_bushfire_evacuation_traffic

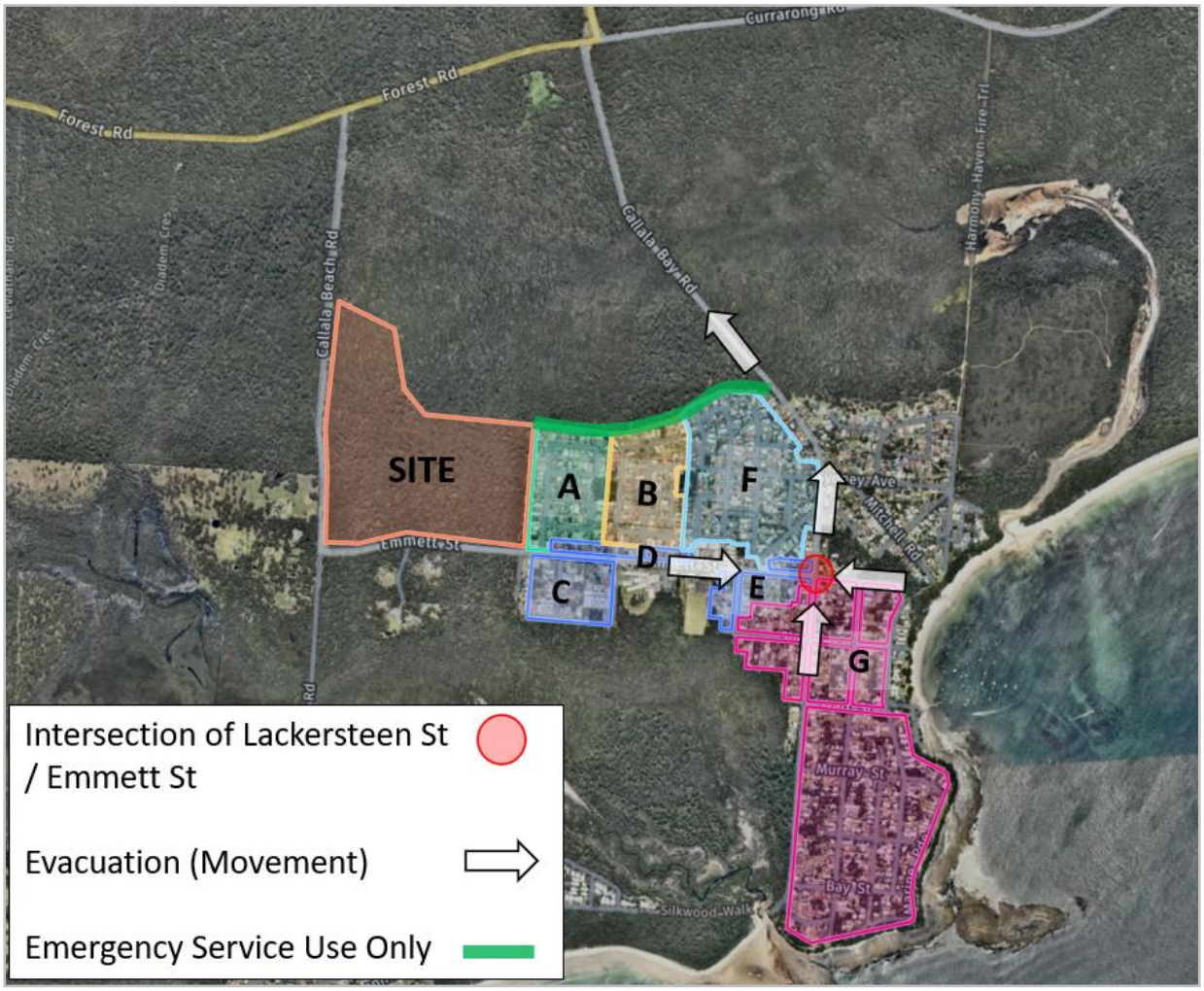

Figure 1: Existing Dwelling Zones

Using 2016 Census data, it has been identified that approximately 2.5% of all dwellings within the Callala Bay area have six or more persons residing in the premises. It has been assumed that all dwellings will generate one vehicle movement during a bush fire, with any dwelling accommodating six or more people generating two vehicle movements. Therefore, a trip rate per dwelling of 1.03 vehicles has been applied to the study area.

The existing areas and proposed subdivision (from west of Lackersteen Street and Emmett Street intersection) are shown to accommodate approximately 677 dwellings, generating about 694 vehicle movements from the west of the intersection, as noted in Table 1.

Table 1: Estimated Number of Dwellings in Study Area and Trip Generation (from the west of the intersection)

	A	B	C	D	E	Site	Total
Dwellings	104	113	43	23	35	359	677

Vehicle Trips	107	116	44	24	36	368	694

9.2 TRAFFIC ANALYSIS

An analysis of the carriageway capacity has been undertaken for the roadways within the study area for the future traffic volumes plus the development traffic. The results of the assessment are provided within Table 2. The concept of Carriageway capacity and level of service is detailed in **Appendix A**.

Table 2: Level of Service for Roadway

Location	Lanes	Evening Peak			
		NB/EB Volumes	LoS	SB/WB Volumes	LoS
Lackersteen Street (North of Emmett Street)	2 lanes undivided	0	-	0	-
Lackersteen Street (South of Emmett Street)	2 lanes undivided	500 (NB)	A	0	-
Emmett Street (East of Lackersteen Street)	2 lanes undivided	20 (NB)	A	0	-
Emmett Street (West of Lackersteen Street)	2 lanes undivided	694 (NB)	B	0	-

Based on the results from Table 2, Lackersteen Street and Emmett Street is expected to operate at a relatively good performance with slight delays. It is noted that it has been assumed that traffic management measures are in place to facilitate safe and efficient movements.

A SIDRA analysis has been undertaken for the intersection of Lackersteen Street / Emmett Street in the event of an evacuation. SIDRA inputs for this analysis are based on the trip numbers in Table 2. It is expected that traffic generated would be from the residential land use.

As part of this assessment, the following scenarios have been analysed:

- Scenario 1: All residents will evacuate over a 60-minute period. It is understood that, based on typical evacuations, the likelihood of this scenario happening is relatively low.
- Scenario 2: All residents will evacuate over 120-minute period.

The results of the analysis are provided within Table 3 with the detailed results presented in **Appendix B**.

Table 3: Bush Fire Evacuation SIDRA Results

Scenario	Intersection	Approach	Degree of Saturation (%)	Average Delay (s)	Level of Service
1	Lackersteen Street / Emmett Street	East Approach	14%	29.6	C
		West Approach	92.2%	27.4	A
		South Approach	25.4%	0.0	B
2	Lackersteen Street /	East Approach	2.3%	9.5	A

	Emmett Street	West Approach	33%	9.5	A
		South Approach	12.7%	0.0	A

The SIDRA results show that the intersections are expected to operate in an acceptable manner, with some delays expected in Scenario 1 and minor delays in Scenario 2. These delays are expected considering that the south approach is the major (priority) road in this priority controlled intersection.

Summary

The longest travel path for a vehicle to exit the site (in the eastward direction) and depart Emmett Street is approximately 1.0 km. Assuming an average travel speed of 30km/hr, the vehicle is expected to take approximately two minutes (120 seconds) to traverse the midblock sections and reach Callala Bay Road. In order to do so, a vehicle travelling from the site would need to give way at the intersection of Lackersteen Street and Emmett Street.

The intersection was recorded to have an average delay of approximately 29.6 seconds in a worst case Callala Bay Village evacuation scenario (Scenario 1). Based on the above, the longest time it would take for a vehicle to exit the site and get on to Callala Bay Road and would be approximately 150 seconds.

As discussed, the time taken to depart the Callala Bay village, for refuge areas in other locations such as those identified in the ELA response to the RFS, is expected to vary depending on the extent of the wider area evacuation, the location of where people are evacuated to, and the traffic management that is implemented during the evacuation.

Regards,

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Attachment A – Concept of Carriageway capacity and level of service
Attachment B – SIDRA results

Concept of Carriageway Capacity and Level of Service

The capacity of major streets within an urban area can be based on an assessment of their operating Level of Service.

Level of service is defined by Austroads as a "qualitative measure of the effects of a number of features, which include speed and travel time, traffic interruptions, freedom to manoeuvre, safety, driving comfort and convenience, and operating costs. Levels of service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) as follows:

***LEVELS OF SERVICE**

A - Free flow (almost no delays);

B - Stable flow (slight delays);

C - Stable flow (acceptable delays);

D - Approaching unstable flow (tolerable delays);

E - Unstable flow (congestion; intolerable delays); and

F - Forced flow (jammed).

A service volume, as defined by Austroads, is the maximum number of vehicles that can pass over a given section of roadway in one direction for one hour while operating conditions are maintained at a specified level of service. It is suggested that ideally arterial and sub-arterial roads should not exceed service volumes at level of service C. At this level, whilst most drivers are restricted in their freedom to manoeuvre, operating speeds are still reasonable and acceptable delays experienced. However, in urban situations, arterial and sub-arterial roads operating at Level of Service D are still considered adequate. Traffic Volumes along urban roads with interrupted and uninterrupted flow conditions are included in **Table A-1** and **A-2** respectively.

Table A-1: Level of Service Interrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

DESCRIPTION	LEVEL OF SERVICE				
	A	B	C	D	E
2 Lane Undivided	540	630	710	810	900
4 Lane Undivided	900	1050	1200	1350	1500
4 Lane Undivided with Clearways	1080	1260	1440	1620	1800
4 Lane Divided with Clearways	1140	1330	1520	1710	1900
4 Lane Divided with Clearways, limited access and limited intersections	1610	1870	2140	2410	2670
6 Lane Undivided	1440	1680	1920	2160	2400
6 Lane Divided with Clearway	1740	2030	2320	2610	2900

Table A-2: Level of Service Uninterrupted Flow Conditions along Urban Roads (One Way Hourly Volumes)

DESCRIPTION	LEVEL OF SERVICE				
	A	B	C	D	E
4 Lane Undivided (13m)	1260	1470	1680	1890	2100
4 Lane Undivided with Clearways	1510	1760	2010	2270	2520
4 Lane Divided with Clearways	1600	1860	2130	2400	2660
4 Lane Divided with Clearways, limited access and limited intersections	2250	2620	3000	3380	3740
6 Lane Undivided	2020	2350	2690	3020	3360
6 Lane Divided with Clearway	2440	2840	3250	3660	4060

DESCRIPTION	LEVEL OF SERVICE				
	A	B	C	D	E
6 Lane Divided with Clearways, limited access and limited intersections	3375	3930	4500	5070	5610

* 40% higher than base volumes in Table C-1

Guidelines for Evaluation of Intersection Capacity

The RTA has included in the "Guide to Traffic Generating Developments" (Dec 1993, Issue 2) a section on the assessment of intersections. The assessment of the level of service of an intersection is based on the evaluation of the following Measures of Effectiveness:

(a) Average delay (seconds/veh) (all forms of control)

(b) Delay to critical movement (seconds/veh) (all forms of control)

(c) Degree of saturation (traffic signals and roundabouts)

(d) Cycle length (traffic signals)

The latest SIDRA software was used to calculate the relevant intersection parameters.

The best indicator of the level of service at an intersection is the average delay experienced by vehicles at that intersection. For traffic signals, the average delay over all movements should be taken. For roundabouts and priority control intersections (with Stop and Give Way signs or operating under the T-junction rule) the critical movement for level of service assessment should be that with the highest average delay.

With traffic signals, delays per approach tend to be equalised, subject to any over-riding requirements of signal co-ordination as well as to variations within individual movements. With roundabouts and priority - control intersections, the critical criterion for assessment is the movement with the highest delay per vehicle. With this type of control the volume balance might be such that some movements suffer high levels of delay while other movements have minimal delay. An overall average delay for the intersection of 25 seconds might not be satisfactory if the average delay on one movement is 60 seconds.

The average delay for level of service E should be no more than 70 seconds. The accepted maximum practical cycle length for traffic signals under saturated conditions is 120 - 140 seconds. Under these conditions 120 seconds is near maximum for two and three phase intersections and 140 seconds near maximum for more complex phase designs. Drivers and pedestrians expect cycle lengths of these magnitudes and their inherent delays in peak hours. A cycle length of 140 seconds for an intersection which is almost saturated has an average vehicle delay of about 70 seconds, although this can vary. If the average vehicle delay is more than 70 seconds, the intersection is assumed to be at Level of Service F.

Table A-3 sets out average delays for different levels of service. There is no consistent correlation between definitions of levels of service for road links as defined elsewhere in this section, and the ranges set out in Table D1. In assigning a level of service, the average delay to motoring the public needs to be considered, keeping in mind the location of the intersection. For example, drivers in inner-urban areas of Sydney have a higher tolerance of delay than drivers in country areas. **Table A-3** provides a recommended baseline for assessment.

Table A-3: Level of Service Critera for Intersections

Level of Service	Average Delay per Veicle (seconds/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 - 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, required other control mode

The figures in **Table A-3** are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

The intersection degree of saturation (DS) can also be used to measure the performance of isolated intersections. At intersections controlled by traffic signals, both queue length and delays increase rapidly as DS approaches 1.0. An upper limit of 0.9 is appropriate. When DS exceeds 0.8 - 0.85, overflow queues start to become a problem. Satisfactory intersection operation is generally achieved with a DS of about 0.7 - 0.8. (Note that these figures are based on isolated signalised intersections with cycle lengths of 120 seconds. In co-ordinated signal systems DS might be actively maximised at key intersections). Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay. Suggested criteria for the evaluation of the capacity of signalised intersections based on the Degree of Saturation are summarised in **Table A-4**.

Table A-4: Criteria for Evaluating Capacity of Signalised Intersections*

Level of Service	Optimum Cycle Length (Seconds) (Co)	Volume/Saturation Y	Intersection Degree of Saturation X
A/B - Very good operation	< 90	< 0.70	< 0.80
C - Satisfactory	90-120	0.70-0.80	0.80-0.85
D - Poor but manageable	120-140	0.80-0.85	0.85-0.90
E/F - Bad, extra capacity required	>140	>0.85	> 0.90

** Source: Roads & Traffic Authority (2002)*

MOVEMENT SUMMARY

Site: 101 [EmmettStreet- LackersteenStreet - Bushfire(60min)]

EmmettStreet/LackersteenStreetIntersection
Stop(Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Lackersteen Street												
2	T1	526	0.0	0.254	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach		526	0.0	0.254	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
East: RoadName												
6	R2	21	0.0	0.140	29.6	LOS C	0.4	2.8	0.87	1.00	0.87	39.9
Approach		21	0.0	0.140	29.6	LOS C	0.4	2.8	0.87	1.00	0.87	39.9
North: Lackersteen Street												
9	R2	1	0.0	0.001	7.4	LOS A	0.0	0.0	0.50	0.55	0.50	51.9
Approach		1	0.0	0.001	7.4	NA	0.0	0.0	0.50	0.55	0.50	51.9
West: Emmett Street												
10	L2	731	0.0	0.922	27.4	LOS B	19.5	136.3	0.91	1.92	3.56	41.5
Approach		731	0.0	0.922	27.4	LOS B	19.5	136.3	0.91	1.92	3.56	41.5
All Vehicles		1279	0.0	0.922	16.1	NA	19.5	136.3	0.54	1.11	2.05	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Emmett Street - Lackersteen Street - Bushfire (120min)]

Emmett Street / Lackersteen Street Intersection
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Lackersteen Street												
2	T1	263	0.0	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		263	0.0	0.127	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
East: RoadName												
6	R2	11	0.0	0.023	12.4	LOS A	0.1	0.5	0.55	0.93	0.55	48.8
Approach		11	0.0	0.023	12.4	LOS A	0.1	0.5	0.55	0.93	0.55	48.8
North: Lackersteen Street												
9	R2	1	0.0	0.000	6.2	LOS A	0.0	0.0	0.34	0.51	0.34	52.4
Approach		1	0.0	0.000	6.2	NA	0.0	0.0	0.34	0.51	0.34	52.4
West: Emmett Street												
10	L2	365	0.0	0.330	9.5	LOS A	1.6	11.2	0.44	0.89	0.44	51.3
Approach		365	0.0	0.330	9.5	LOS A	1.6	11.2	0.44	0.89	0.44	51.3
All Vehicles		639	0.0	0.330	5.6	NA	1.6	11.2	0.26	0.52	0.26	54.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.