2.2.1 Explanation regarding slopes in excess of 20 degrees.

As depicted in Figure 2.3 the majority of the APZ supports slopes of between 0–18 degrees arising from the many sandstone escarpments making up the yellow and blue coloured lands.

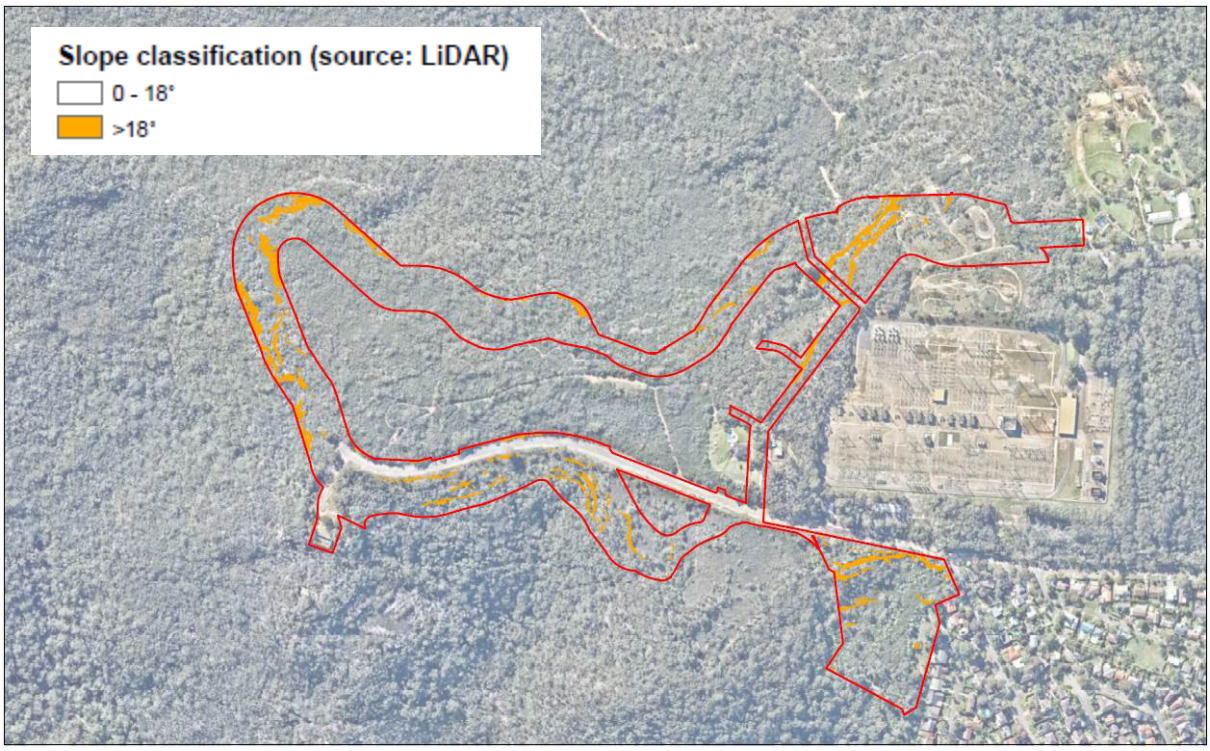


Figure 2.3 – Slopes analysis within the proposed APZ's

2.3 Bushfire Attack Assessment

A Fire Danger Index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest vegetation located within the Greater Sydney region. Table 2.2 below provides a summary of the bushfire attack assessment and the minimum required asset protection zones in compliance with BAL 29 building construction standards (AS3959, 2009).

Table 2.2 – Bushfire attack assessment

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
1	East	Forest	Level to upslope	25 metres northeast / 10 metres east	25m /10m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	North-west	Open forest, Low open forest, Tall heath and Short heath	10 ° D	39 metres	39m Yes	BAL 29 (39–<53m) BAL 19 (53-<69m) BAL 12.5 (69-<100m)

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
	Internal north	Internal drainage	Level	10 metres (refer Note 1)	16 Yes (by an additional 6m)	BAL 29 (11–<16m) BAL 19 (16-<23m) BAL 12.5 (23-<100m)
	South	Duffys Forest protection area	6-8 $^{o\ U}$	25m	25m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
2	South	Forest	Level to upslope	25m	>60m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	North, East & West	Proposed development and road corridor	N/A	N/A	>60m Yes	N/A
3	North	Proposed development and road corridor	N/A	N/A	>100m Yes	N/A
	South-east	Tall Heath	5$^{o\ D}$	15m	31m Yes (by an additional 16m)	BAL 29 (32–<43m) BAL 19 (43-<57m) BAL 12.5 (57-<100m)
		Coastal upland swamp, weed and low open forest	Level	25m	31m Yes (by an additional 6m)	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	South-west	combination of low open forest and sandstone gully forest	20-22° D with short sections of steeper slope 24° D but only 19m in length and inclusive of rocky escarpments	61m	72m Yes (by an additional 11m)	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
4	North, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
	South	Low open forest and Sandstone gully forest and unclassified further south	16-22° D	61m	72m Yes (by an additional 11m)	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
5	East	Proposed development	N/A	N/A	>100m Yes	N/A

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
	South	Tall heath, Low open forest and open forest	Variable closes due to orientation of the contours causing a level slope gradient but in the south-south-east the slopes are greater at 8-15° D	39-49m	73-74m Yes (by an additional 34-25m)	BAL 29 (39–<53m) BAL 19 (53-<69m) BAL 12.5 (69-<100m) BAL 29 (49–<64m) BAL 19 (64-<82m) BAL 12.5 (82-<100m)
	West & north	Low open forest and Sandstone gully forest and Low open forest	15-18° D	49-61m	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6	South, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
	North	Low open forest and Open forest	17° D	61 metres	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
7	North	Low open forest and Open forest	17-20° D	61 metres	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
	South, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
8	South & west	Proposed development	N/A	N/A	>100m Yes	N/A
	North-west	Short heath, Tall Heath / Scrub and Low open forest	13-15° D	19 metres	39m Yes (by an additional 20m)	BAL 29 (19–<28m) BAL 19 (28-<29m) BAL 12.5 (29-<100m)

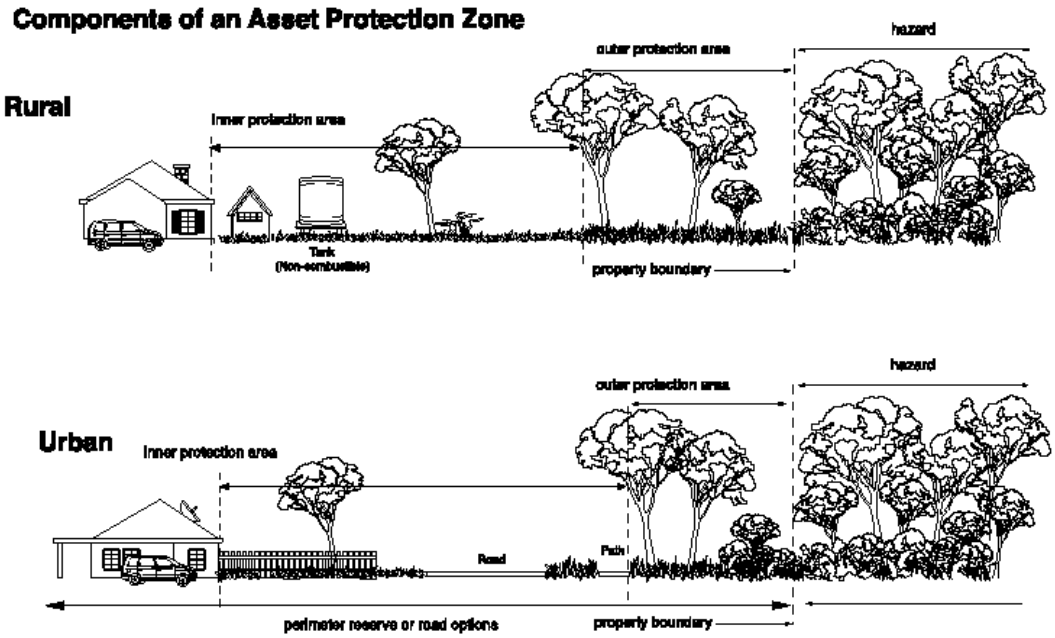
*Notes: * Slope is either 'U' meaning upslope or 'D' meaning downslope*

Specific Protection Issues

3

3.1 Asset Protection Zones (APZs)

APZs are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an *inner protection area* (IPA) and an *outer protection area* (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot be used for habitable dwellings but can be used for all external non-habitable structures such as pools, sheds, non-attached garages, cabanas, etc. A typical APZ and therefore defendable space is graphically represented below:



Source: RFS, 2006

Note: Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure APZs comply with the RFS performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 29 kW/m^2 for residential subdivision developments. This rating assists in determining the size of the APZ in compliance with PBP to provide the necessary *defendable space* between hazardous vegetation and a building.

Table 3.1 outlines the proposals compliance with the performance criteria for APZ's.

Table 3.1: Performance criteria for asset protection zones (*PBP* guidelines pg. 19)

Performance Criteria	Acceptable Solutions	Compliance with PBP
Radiant heat levels at any point on a proposed building will not exceed 29kW/m^2	APZs are provided in accordance with Appendix 2 APZs are wholly within the boundary of the development site	Yes - refer Table 2.2. APZ's provided exceed the minimum requirements of Appendix 2. The APZ's have been determined based on BAL 29 (AS3959)
APZs are managed and maintained to prevent the spread of fire towards the building	In accordance with the requirements of *Standards for Asset Protection Zones* (*NSW RFS* 2005)	Yes – Can be made a condition of consent at development application stage
APZ maintenance is practical , soil stability is not compromised and the potential for crown fires is negated	The APZ is located on lands with a slope of less than 18 degrees.	Yes – APZ's are generally situated on slopes of less than 18 degrees. There are a select few areas where the slopes exceed 18 degrees, these areas are rock ledges and can be incorporated into APZ management. Previous correspondence to the NSW RFS and the preparation of a Fuel Management Plan details the ongoing management of the APZs.

3.2 Building Protection

The construction of buildings in bushfire prone areas is subject to stringent rules pertinent to the building envelope being located on the non-hazardous side of the APZ. The role of the APZ is to provide a safe space to separate the hazard from the building.

In terms of future subdivision approval the minimum APZ must be provided in accordance with Appendix 2 of *PBP.* The APZs provided in Table 2.2 (Section 2.3) of this report exceed these requirements, whilst also considering the final building setbacks as per AS3959 (2009).

Although not required in terms of rezoning the following advice in relation to building construction levels can be used for future planning and development design.

The construction classification system is based on five (5) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5 (AS3959 (2009) – *Construction of buildings in bushfire prone areas*). The lowest level, BAL 12.5, has the longest APZ distance while BAL–FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials which affects costs. This means that BAL 12.5 is much cheaper than BAL 29 when constructing a dwelling. However the length of the APZ's for BAL 12.5 would be too long and a compromise would be BAL 19 being used as a satisfactory development aspiration,

Table 2.2 column 7 above provides an indication of the BALs that are likely to apply for future building construction. These BAL levels are for planning purposes only and will be assessed / confirmed prior to building construction stage.

Approximately 156 residential lots will be created within the R2 zone.

No other permissible uses within the R2 zone will be developed. The privately owned community title development management structure that can limit development type, materials and activities. This would include inappropriate development such as secondary dwellings, bed and breakfast accommodation, boarding houses, childcare centres, educational establishments, group homes and or hospitals. Many of these uses are Special Fire Protection Purpose and are therefore vulnerable to the effects of fire, often difficult to evacuate and more susceptible to smoke impacts and by their very nature should be listed in the community management statement as not permissible.

Based on the assumption of 156 lots this would assume a population increase of 406 persons. (Based on based on the 2011 *Australian Institute of Family Studies* data which advises there is 2.6 persons, on average, per house hold).

The institute advises that in 2011 there were 7,760,000 households in Australia with 71.5% comprised of families, 24.3% were occupied by a person living alone and 4.1% were represented by groups of unrelated persons (share houses). The data from 1986 to 2011 shows the following trends;

- family households declined (77.1% in 1986 to 71.5% in 2011)
- one-person households increased (19% in 1986 to 24% in 2011)
- most of change in the representation of family and one-person households took place during the 10-year period between 1986 and 1996.

3.3 Hazard Management

Fuel management in the form of APZ maintenance will be undertaken in accordance with the fuel management plan and at the cost of the Community Association. There would be no burden upon RFS or other government resources services. The fuel management plan issued with the Planning Proposal confirms this approach and confirms appropriate controls can be implemented.

APZ's will also be provided to the main access routes and transmission lines and a community safe refuge could be provided within the development footprint. These measures have been designed to improve the existing situation for the surrounding community and to support fire fighting operations. The implementation of these measures and the engagement of the Aboriginal community with reduce the already heavy burden on resources.

A community title approach appears to be the favoured approach by the RFS. The community association would be bound under a positive covenant to manage the APZ on an ongoing basis as outlined in the fuel management plan and the community management statement with the terms being agreed during the subdivision development application.

Funding will be via a special fund set aside to support integrated fuel management by professional fuel management staff. Similar arrangements have been successfully implemented within the LGA for bush fire prone areas.

Consultation with the *TransGrid* asset manager team is also intended to effectively manage the surrounding asset protection zones within the *TransGrid* land. *TransGrid* currently undertake hazard management at regular periods to protect their major asset in accord with their comprehensive fire management plan.

Indeed the Planning Proposal seeks to work with the existing bushfire infrastructure and to provide new practical on-ground actions to improve the overall bushfire outcome for both the site and the adjoining residential lands. These actions, through the full extent of the applicants land ownership, will strengthen bush fire preparedness and response for surrounding homes; and will be discussed with the relevant fire authorities prior to any DA submission for subdivision to determine best use of resources.

3.3.1 Management zones

The management zones relate to the need for asset protection, strategic burning and or ongoing land management works. They are discussed in greater detail within the fuel management plan prepared by this firm and dated 2017 from page 31 in Section 5.

Asset protection zones

The asset protection zone includes the land within the proposed development lots, the perimeter roads as well as the residual land external to the development lots. The construction and ongoing management of the APZs will require compliance with the *NSW RFS* guidelines *Standards for Asset Protection Zones (RFS, 2005)* whilst all future landscaping construction will need to comply with Appendix 5 of *PBP.*

A summary of the guidelines for managing APZs are attached as Appendix 1 to this report.

Whilst the owner or occupier of each development lot will be required to manage the APZ to the specifications of the development consent documentation e.g. Council's / NSW RFS approval, it is the residual land that surrounds the concept development plan which will require careful planning to ensure APZ works are carried out and maintained in perpetuity.

The portion of the bushfire asset protection zones that are located external to future private lots will be located on various land tenures, for example, public roadways, parklands as well as residual private lands owned and managed by the community association set up under the provisions of the Community Title Legislation.

Strategic Fire Advantage Zone

The boundaries of the SFAZ has been designed based on the site features that facilitate hazard reduction burning operations. Boundaries include walking tracks fire trails and easements to ensure strategic planned burning can be undertaken in a safe way.

The surrounding land has been subject to a number of hazard reduction burns undertaken by the local fire authorities most recently in 2009/10, 2012/13 and 2016.

These burns have been undertaken in a safe manner based on the current circumstances on ground using existing fire trails and walking tracks. This planning proposal seeks to work with the existing infrastructure and to provide new linkages to improve the overall bushfire outcome for both the site and the adjoining residential lands. These linkages will be discussed with the relevant fire authorities prior to any DA submission for subdivision to determine best use of resources.

Fire trail works if required will be undertaken in accordance with the design specifications outlined in *PBP 2006* and in accordance with construction standards set by the RFS and or Warringah-Pittwater Bushfire Management Committee. These guidelines (as outlined in the FMP) include construction of fire trails with a minimum trafficable width of 4m with an additional 1m wide strip on each side of the road kept clear of bushes and long grass, a

maximum grade of 15º (preferably 10º) and a minimum clearance of 4m to any overhanging obstructions, including tree branches.

Land Management Zone

This land will be managed by MLALC in accord with offset conditions issued by OEH. Essentially this will relate to ecological burn regimes and weed management works.

A management plan will be prepared as a response to the biocertification process.

3.4 Fuel Management

A fuel management plan (FMP) has been prepared with its implementation and ongoing management being the responsibility of the community association. The FMP has been undertaken to facilitate the ongoing management of bushfire hazards within the proposed E3 zoned land especially focusing on the asset protection zone (APZ) landscape adjoining the R2 lands to provide assurance that all APZ's will be managed in perpetuity.

It is estimated that the initial works to create the APZ will be in the vicinity of $200,000-$250,000. Ongoing management of the APZ is likely to be in the vicinity of $120,000 after purchase of required machinery.

Amendments to the FMP will be the responsibility of the landowner and should be approved by *Northern Beaches Council*.

The implementation of the APZs will require modification of 10.15ha of the E3 land (including *TransGrid* Easements). Attention has been given to the varying landscape character and the need to provide habitat function through the retention of various landscape elements such as trees, shrubs, sandstone outcrops, etc.

In addition, a prescribed burning program is proposed in land entitled the Strategic Fire Advantage Zones (SFAZ) and Land Management Zones (LMZ). Hazard reduction burning is to be undertaken in consultation with surrounding landholders (Community Association & National Parks).

Ongoing management of the APZ is likely to be in the vicinity of $120,000 after purchase of required machinery. It is envisaged that some APZ works will occur by the development contractors at project start up whilst more sensitive works would be undertaken. For example, roadway and in-lot setback (5.18ha) would be undertaken by contractors, whilst E3 lands APZ (10.15ha) would be undertaken by *Community Association.* APZ management is detailed in Figure 3.1.

- The APZ located on E3 lands (10.15ha) and an additional 2.34ha internal to E3 lands will be managed by *Community Association* (69.5%)
- the public roadway comprises 19.3% (3.46ha) of the APZ
- the private allotments comprise 9.6% (1.72ha) of the APZ and are managed by the private allotment owners.
- the portion of RE1 lands comprise 1.7% (0.3ha) of the APZ and is managed by council as on open space park.

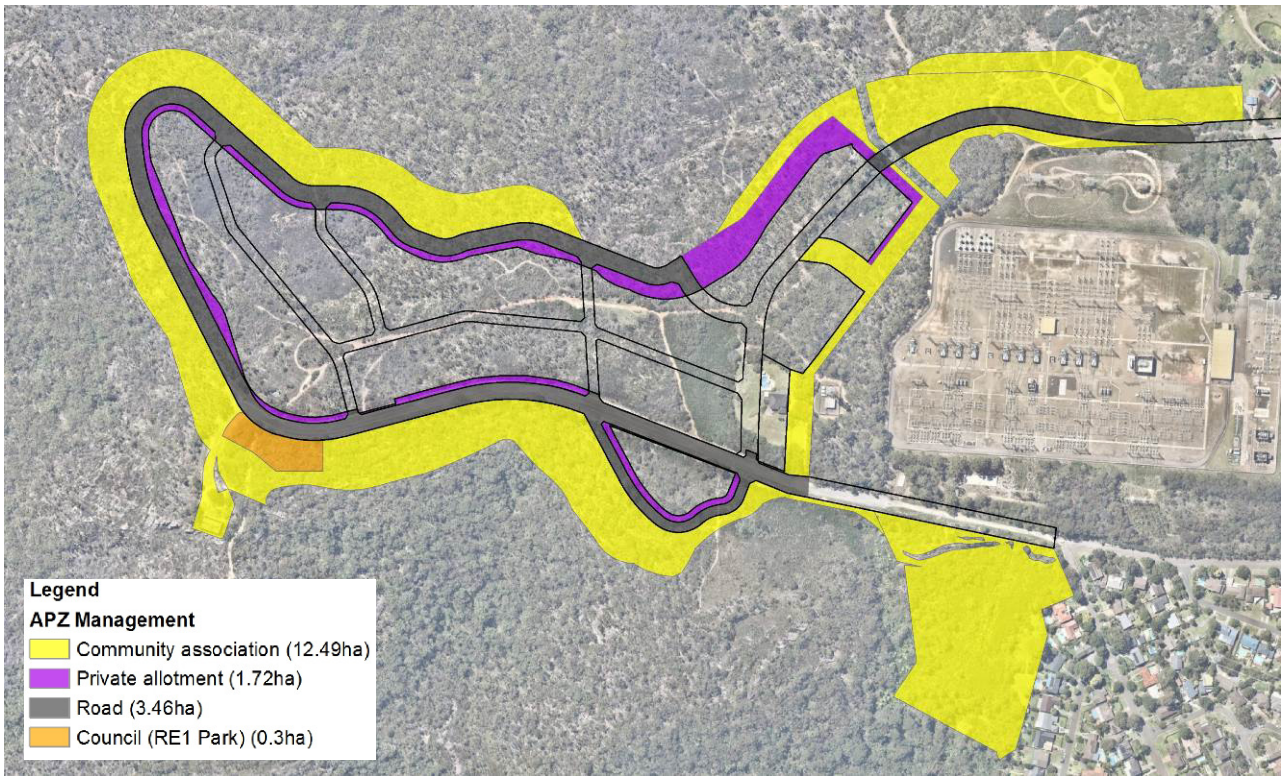


Figure 3.1 - APZ management

Upon initiation of the APZ within the E3 lands a detailed mapping exercise should be undertaken to define the management treatments across the five (5) APZs zones. This will be the basis of the future works sheets for the APZ zones and the auditing protocols.

Note: No works will be required in the *Coastal Upland Swamp* in APZ 4 – refer to FMP 2017 (TBE) for further details.

Training

Training should be undertaken to initiate work concepts and standards of care and / or construction of the APZ to assure adequacy with NSW Rural Fire Service (RFS) APZ standards; and to maintain habitat opportunities for insitu wildlife.

Ongoing auditing of works required

To ensure that regular reviews are undertaken, the FMP has an operational life span of 5 years. At the completion of this time period, the plan will be formally reviewed.

Given the expected residential development program for the project will be over 2-3 years, the FMP should be reviewed six monthly during the development stages of the project and annually after project stabilisation.

Of particular note will be the need to monitor lands that have been sold by the developer and are not built upon and therefore may cause an interim hazard for neighbouring allotments that have built houses. This can be a major impediment to hazard management and the management of those hazards must be dealt with quickly.

Plan monitoring

Monitoring will be undertaken on an annual basis with an audit review prepared by an independent bushfire adviser. The suggested schedule for maintenance of these tracks is outlined in the FMP.

This FMP will enable the land managers to understand the vegetated landscape and apply practical prescriptions to ensure that the future residents and neighbours are able to live safely.

There are a number of ways to evaluate the effectiveness of the FMP. The monitoring of the issues outlined below will determine the level of success from the implementation of the plan. It will also prove how effectively the actions recommended by the plan have reduced the impact of adverse fire events and management.

Plan success

The issues which will govern the FMP's success are:

- protection of life and property from the adverse effects of fire
- maintenance of reduced hazardous fuel levels in strategic locations associated with the residential settlements
- the demonstrated ongoing and effective management of the E3 APZ
- the retention of insitu habitat elements and wildlife utilisation within the E3 APZ
- maintenance of biodiversity through the appropriate management of fire regimes
- management of existing fire trails
- communication of management decisions in respect of the FMP 2015-21 and its implementation program.

3.5 Access for Fire Fighting Operations

Future residential development within the site will require access Ralston and Wyatt Avenue in the east to connect with the existing public road structure of Belrose. The two way road system is critical to bushfire planning be successful in any emergency event.

Road hierarchy must be designed to achieve sufficient traffic flow in order to enable an emergency evacuation in quick time and the proposed road system achieves that aspiration.

The planning proposal complies with the principles for rezoning of residential land as well as the acceptable solutions outlined in PBP for subdivision developments.

PBP requires the perimeter road to form part of the APZ (refer page 20 of PBP). *PBP* does not provide any recommendations for APZ's adjacent to roads. In this firms experience where we have recommended APZ's adjacent to roads the recommendation has not been followed through within the conditions of consent by the assessing authority.

As outlined in PBP the purpose of the road system to:

- provide firefighters with easier access to structures, allowing more efficient use of firefighting resources
- provide a safe retreat for fire fighters; and
- provide a clear control line from which to conduct hazard reduction burning

Whilst the perimeter roads are susceptible to flame impingement the planning proposal complies with the purpose of the road system allowing for safe retreat for fire fighters into the internal road system 'spine road design'.

In regard to the evacuation routes from the development several areas located under electrical easements were not identified to contain APZs in the previous version of the Planning Proposal. These areas are already permitted to be cleared under the provisions of the electrical easement (*Transgrid*) and therefore do not require rezoning and or approval through the Planning Proposal or development application process. In hindsight this created confusion with regard to ecological offsets and APZ's required for the PP.

To resolve any confusion these areas are now mapped as APZ's and resolve the pinch points noted by the RFS. The pinch points are not being affected by sensitive vegetation communities and or sensitive habitat features and have APZ's provided.

A plan is provided at Figure 3.1 is illustrative of the changes.

Specifically the changes involve;

Ralston Avenue

Part of the area south of the Ralston Avenue landscape is classified as 'coastal upland swamp' which is a wet swamp with vegetation rarely exceeding 1.5 metres and mostly between 1.0-1.5m. This is clearly an area of very low hazard and subsequently allows for a reduced asset protection zone. Figure 3.2 depicts this landscape and its extent.

A small area of heath (20m in width) is adjacent to the swamp and will remain. A small APZ will be located between the heath and the road corridor.

The vegetation within the electrical easement south of Ralston Avenue is a transition from heath to forest and a large part of that area will be managed as an APZ.

This means the whole of the southern edge of Ralston Avenue will be managed as an APZ.

The vegetation on the *TransGrid* (north) side of Ralston Avenue is a narrow vestige of uphill slope (up from the road) and is mostly less than 10-12m in width. Only small portions are greater widths and again these are upslope i.e. up from the road.

There is a wider portion at the eastern end of the *TransGrid* land and that land is 180m in length. The evacuation route no 2 does not require passage along that most eastern 180m portion of *TransGrid* vegetation. Rather the evacuation route turns south onto Elm Avenue, midway along the narrow portion of the vegetation, and heads through the suburban area of Belrose – see Figure 3.1.

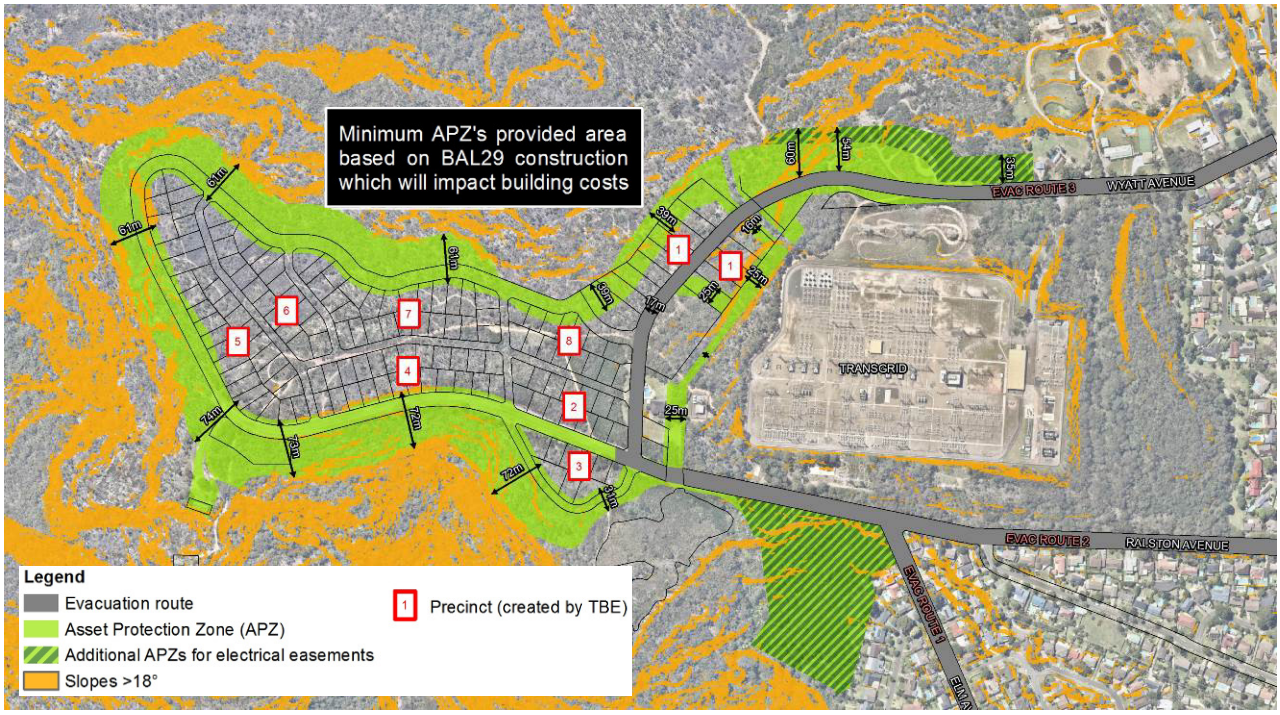


Figure 3.2 - APZs, evacuation route and slopes greater 18 degrees

Wyatt Avenue

The hazardous vegetation north of Wyatt Avenue is affected by heath vegetation (not Forest) and the slopes are predominantly <18 degrees apart from several small sandstone escarpments which are less than 2m in height (field verified by TBE).

Figure 3.1 above depicts the slopes. The <18 degrees are the uncoloured areas whilst the >18 degrees are the orange coloured areas. The >18 degree slopes are sandstone escarpments.

The proposed APZ areas are shown as green shaded areas.

Photo 1 below depicts Wyatt Avenue (facing west towards the beginning of the Planning Proposal land). The mown land to the left is part *TransGrid* land and part Wyatt Avenue verge.

Photo 2 depicts the reverse angle looking east and shows the residential nature of the street.

Photo 1 – Looking west along Wyatt Avenue

Photo 2 - Looking east along Wyatt Avenue

In conclusion *TBE* can confirm that the planning proposal can provide compliance with PBP.

Table 3.3 outlines the performance criteria and acceptable solutions for future public roads within future subdivision design.

Table 3.3: Performance criteria for public roads (*PBP* guidelines pg. 20)

Performance Criteria	Acceptable Solutions	Compliance
Fire fighters are provided with safe all weather access to structures (thus allowing more efficient use of fire fighting resources)	Public Roads are two -wheel drive, all weather roads.	Compliant
Public road widths and design that allow safe access for fire fighters while residents are evacuating an area	Urban perimeter roads are two way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 3.4 below. Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas. Traffic management devices are constructed to facilitate access by emergency services. Public roads have a cross fall not exceeding 3 degrees. All roads are through roads. If unavoidable dead end roads are not more than 200 metres in length, incorporate a minimum 12 metre outer radius turning circle, sign posted dead end and direct traffic away from the hazard. Curves of roads (other than perimeter) have a minimum inner radius of 6 metres and are minimal in number to allow for rapid access and egress. The minimum distance between inner and outer curves is 6 metres. Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees. Minimum vertical clearance of 4 metres above the road at all times.	Can be made compliant - The concept plan depicts a perimeter road which ranges in road reserve width of 17 – 20.115m. All other internal roads have a reserve width of 10.3m. All perimeter public roads must have a carriageway width of 8 metre wide and therefore future plans will need to replicate this. This width enables sufficient capability for fire trucks passing when cars are parked on roadsides. The road cross-sections as shown in the traffic report as well as the urban concept plan and water management/utility services have overall road reserves capable of achieving the RFS carriageway widths. Compliant - The internal roads have a reserve width of 10.3m however these internal roads act as traffic conduits in an emergency and traffic capability is an integral component of bushfire protection planning. Table 3.4 below is taken from PBP and provides the necessary pavement widths. In the case of non perimeter roads a minimum of 6.5 m is required. Compliant - The perimeter road will be linked with the internal road network at intervals of less than 500 metres. Compliant - There are no dead end roads.
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles	The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles (15 tonnes for reticulated water and 28 tonnes for all other areas). Bridges clearly indicate load rating.	Compliant

Performance Criteria	Acceptable Solutions	Compliance
Roads that are clearly sign posted (with easily distinguishable names) and buildings / properties that are clearly numbered.	Public roads >6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5 - 8 metres wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5 metres wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water. One way only public access are no less than 3.5 metres wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.	Compliant – can be made a condition of consent
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within parking bays. Public roads directly interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.	Compliant – can be made a condition of consent

Table 3.4: Road design minimum widths for public roads that are not perimeter roads required by the RFS

Curve radius (inside edge) (metres width)	Swept Path requirements (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

3.6 Water Supplies

Town reticulated water supply will be available to the future development in the form of an underground reticulated water system.

Table 3.6 outlines the performance criteria and acceptable solutions for reticulated water supply.

Table 3.5: Performance Criteria for reticulated water supplies (P*BP* guidelines pg. 27)

Performance criteria	Acceptable Solutions
Water supplies are easily accessible and located at regular intervals	Reticulated water supply to urban subdivision uses a ring main system for areas with perimeter roads. Fire hydrant spacing, sizing and pressures comply with AS2419.1 - 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Hydrants are not placed within any road carriageway All above ground water and gas pipes external to the building are metal, including and up to taps. The provisions of parking on public roads are met.

3.7 Gas

Table 3.7 outlines the required performance criteria for the gas supply.

Table 3.6: Performance Criteria for Reticulated Water Supplies (PBP guidelines pg. 27)

Performance criteria	Acceptable Solutions
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings	Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS 1596 – 2002 and the requirements of relevant authorities. Metal piping is to be used. All fixed gas cylinders are to be kept clear of flammable materials to a distance of 10 metres and shielded on the hazard side of the installation. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal. Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.

3.8 Electricity

Table 3.8 outlines the required performance criteria for electricity supply.

Table 3.7: Performance criteria for electricity services (*PBP* guidelines pg. 27)

Performance criteria	Acceptable Solutions
Location of electricity services limit the possibility of ignition of surrounding bushland or the fabric of buildings Regular inspection of lines in undertaken to ensure they are not fouled by branches.	Where practicable, electrical transmission lines are underground Where overhead electrical transmission lines are proposed: • Lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas: and • No part of a tree is closer to a power line than the distance set out in accordance with the specification in *Vegetation Safety Clearances* issued by *Energy Australia* (NS179, April 2002).

3.9 Evacuation

Evacuation capability is critical when considering bushfire planning for new residential developments. Given the inherent bushfire risk posed to future development, close examination of evacuation routes have been undertaken.

Perimeter roads, connections to internal roads and external egress to the main road limit the potential for traffic congestion therefore maintaining good traffic fluidity for any uncontrolled evacuations. The road design has very specifically created linkages 'from the perimeter road design into the central residential zone' and vice versa, so that traffic flow can move away from the source of fire.

In addition the egress roads of Ralston Avenue and Wyatt Avenue are both 20m in width and are capable of providing fluid traffic flow in times of emergency. It is recommended that Ralston Avenue and Wyatt Avenue (the primary evacuation routes from the subdivision) utilise the widest possible pavement width within the existing 20m road reservation. A pavement width of 13-15 metres would be acceptable.

The main road intersection/s onto Forest Road (via Ralston and Wyatt) both provide controlled intersections. Indeed the long length of Ralston and Wyatt also provide a very long queue capacity for vehicles in an emergency event.

Evacuation can be thwarted by hazardous vegetation occurring near roads and causing pinch points. Figure 2.2 above on page 32 shows the slope of the land and the vegetation occurring on those slopes. The importance of this figure goes to the evacuation routes of Wyatt and Ralston and the lack of steep slopes and high intensity forest vegetation in those areas.

The site is also, as indicated on Figure 3.3 and Figure 3.4 below, are situated in close proximity to the nearest RFS *neighbourhood safer place/s*. The NSP is a place of safety for a person to shelter during the passage of a bushfire. Currently, the nearest NSPs are located at;

- Belrose Public School on the north eastern corner of Ralston Avenue and Contentin Road, Belrose. This is a direct 2 minute drive in an easterly direction along Ralston

Avenue or a 4 minute drive if an alternate route is taken in the event that a bushfire is impacting upon the remnant vegetation within *TransGrid* land.

Figure 3.3 – Neighbourhood Safer Place – Belrose Public School

- Bambara Reserve (Belrose Oval) and Belrose Community Centre on Forest Way (Near Bambara Road), Belrose. This is a 3 minute drive in a southerly drive from Ralston Avenue (refer Figure 7).

Figure 3.4 – Neighbourhood Safer Place – Belrose Community Centre

3.10 Possible 'safer place'

It should be noted that the NSP program is primarily designed for the existing wider community who reside in areas and residential developments that pre-date modern day bushfire development controls and are subject to a higher level of risk mainly due to inadequate asset protection zones, poor access design and no dwelling construction standards.

Future development within the planning proposal area will have a level of bushfire protection that exceeds PBP and hence reliance upon NSP would be less so.

Notwithstanding that there is potential for a NSP location within the planning proposal area as a site is available that can comply with the acceptable solutions (based on an FDI 120) identified in the NSW RFS document entitled '*Neighbourhood Safer Places - Places of Last Resort Guidelines 2012/13 Bush Fire Season*' -see Figure 3.5 below. This area meets the FDI requirements of the program (139m from the hazard source).

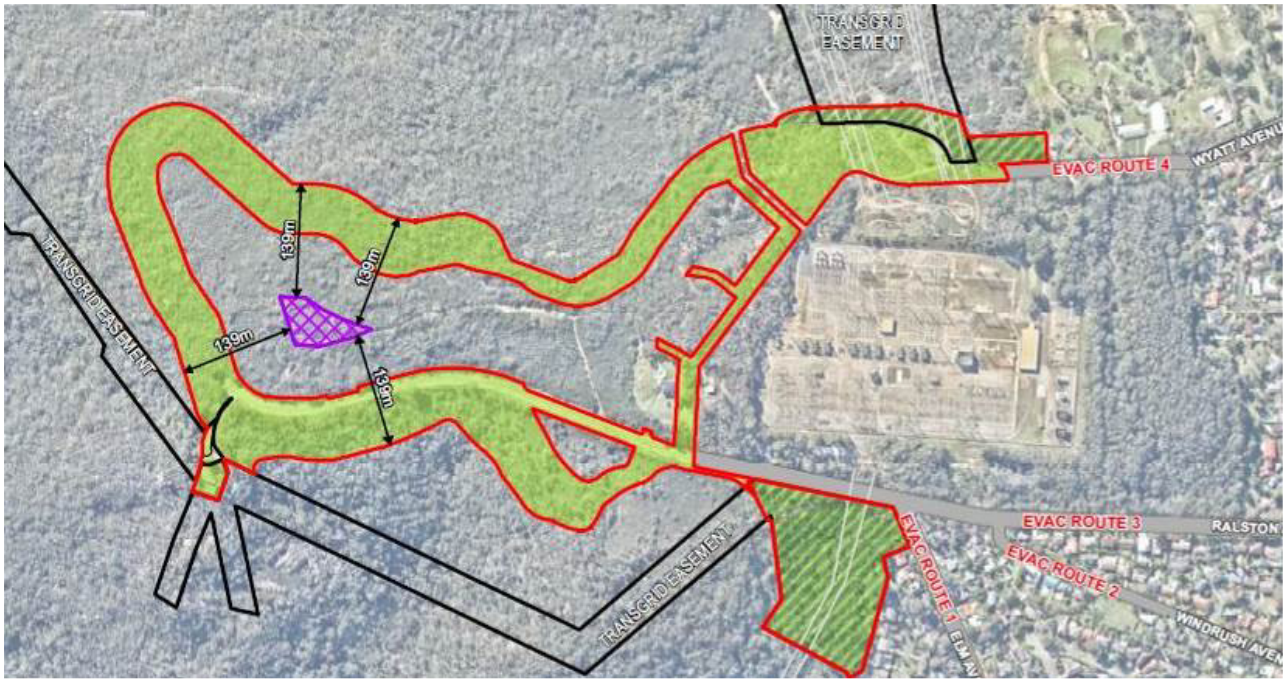


Figure 3.5 – possible location for NSP

Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment (second revision) has been undertaken for the proposed rezoning located at Lot 1 DP 1139826, Ralston Avenue, Belrose.

The key principle for the proposal is to ensure that future development is capable of complying with the *Section 117 Direction* and *PBP*.

Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, allowing for minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments (such as petrol stations) in hazardous areas and the inappropriate placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the surrounding forest and heath vegetation communities resulting in possible ember attack, radiant heat and potentially flame attack, however these issues can be suitable addressed through the implementation of combined bushfire protection measures as outlined below.

The past fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic capability, asset protection, emergency management, fire trail construction, hazardous fuels management, building construction standards, water management and peripheral land management on land owned by the land owner. The bushfire risk posed to the rezoning proposal however can be mitigated if a full suite of bushfire protection measures (including APZs) are implemented and managed in perpetuity.

Upon final design engagement with recommendations made within this report the future development of these lands in accordance with the attached bushfire protection plan (Schedule 1) will provide compliance with the planning principles of *Planning for bush fire protection 2006* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*. Future development on site is to comply with the planning principles identified in Figure 4.1.

In conclusion we can advise that;

- The R2 low density residential zoning is a suitable development class and is unremarkable in comparison to other similar topographical developments.
- The requirements established in *s.177 Direction 4.4 Planning for Bushfire Protection* and *Plan Sydney* have been satisfied.
- Safe evacuation can be provided through three evacuation routes leading through established residential areas and away from the hazard.

- APZs can be provided that exceed the minimum requirements of PBP 2006 and AS3959.

- The wider landscape beyond the APZ will be managed by Strategic Fire Advantage Zones.

- Adequate APZ's adjacent to power lines will be implemented to ensure access is not affected by unmanaged lands.

- The planning proposal will improve bushfire protection measures afforded to existing development through the removal of hazardous vegetation and improved access for firefighting suppression.

- Costs for the development and implementation of bushfire protection measures will be imposed on the landowner and the developer.

- There have been no additional burdens on emergency services demonstrated.

- Environmental constraints have been minimised

Therefore there can be no doubt that the Ralston Avenue planning proposal has been subjected to comprehensive bushfire assessment and fuel management planning initiatives. Coupled with the proposed community association management approach the planning proposal fulfils all the requirements of the Section 117 Direction, PBP, DCN 2/12 and AS3959 and we summarise those points in the table below.

Table 4.1: Planning Principles

Direction 4.4	**Compliance statement**
In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service	**Yes**. The NSW RFS has been consulted with correspondence from the RFS dated 25/2/2015, 26/6/2015, 9/7/2015 and most recently (undated) but received by this firm in November 2016.
A planning proposal must:	
(a) have regard to *Planning for Bushfire Protection 2006*,	**Yes**. A bushfire protection assessment report and fuel management plan were prepared in 2015 along with addendum advice in November 2016 and again in 2017; and in full accord with *PBP*.
(b) introduce controls that avoid placing inappropriate developments in hazardous areas, and	**Yes**. The response to the NSWW RFS on November 4 2016 advised of additional bushfire protection measures beyond those required in *PBP*. Those measures will form the development control measures and be provided within the Area Plan thus designing future residential development appropriate for the level of risk. Importantly the development is not deemed inappropriate) i.e. not a school or retirement village) and the proposed controls are in accordance with PBP to address the level of hazard.

Direction 4.4	Compliance statement
(c) ensure that bushfire hazard reduction is not prohibited within the APZ.	**Yes**. Significant environmental studies have been undertaken to ensure APZs have been excluded from environmentally significant land.
A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:	
(a) provide an Asset Protection Zone (APZ) incorporating at a minimum: (i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and (ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,	**Yes**. The APZs recommended exceed the minimum requirements outlined in *PBP* for subdivision development (i.e. Appendix 2 of *PBP*).
(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks	**Yes**.
(d) contain provisions for adequate water supply for firefighting purposes	**Yes**. Water supply will comply with *PBP*.
(e) minimise the perimeter of the area of land interfacing the hazard which may be developed	**Yes.** The perimeter is located on a level terrace and circumscribes the edge of the downslopes resulting in the best design possible. Intrusions of bushland into the development have been removed and minimised to allow safe evacuation.
(f) introduce controls on the placement of combustible materials in the Inner Protection Area.	Yes – can be a condition of consent at DA stage.

The following recommendations are provided to ensure that future residential development is in accord with or greater than the requirements of *PBP.*

4.2 Recommendations

Recommendation 1 - APZs are to be provided to the future residential development. APZs are to be measured from the exposed wall of any dwelling toward the hazardous vegetation. The minimum APZ must be achievable within all lots fronting the bushfire hazard as nominated in Table 2.2 and also as generally depicted in Schedule 1.

Recommendation 2 – Appropriate APZ setbacks are to be provided for the future development as depicted in Schedule 1 and outlined in Table 2.2. Fuel management within the APZs will need to be maintained by regular maintenance in accordance with the guidelines provided in Appendix 1, and as advised by the *NSW RFS* in their publications.

Recommendation 3 – The surrounding lands are to be maintained in accordance with the Fuel Management Plan (2017) prepared by *Travers bushfire & ecology*. This plan should be linked to the *Warringah bushfire risk management plan* for protection of the community.

Recommendation 4 - Building construction standards are to be applied for future residential dwellings in accordance with *Australian Standard AS3959 Construction of buildings in bushfire prone areas (2009)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 of *PBP.*

Recommendation 5 – Public access roads are to comply with the acceptable solutions provided within Section 4.1.3 of *PBP* (refer Section 3.4 of this report).

Recommendation 6 – A fire trail system should be designed and constructed in order to link with existing peripheral trails (if possible) to ensure the ongoing management of the peripheral landscape (see Rec' 3 above) is maintained in both fire management terms and environmental protection terms. There is ample scope for this to occur.

Recommendation 7 - Water, electricity and gas supply is to comply with the acceptable solutions as provided within Section 4.1.3 of *PBP* (refer Sections 3.5, 3.6 & 3.7 of this report)

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Plan of Bushfire Protection Measures

S1