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# Travers

bushfire & ecology

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## bushfire protection assessment

Rezoning Application  
Lot 1 DP 1139826  
Ralston Avenue, Belrose

Under Section 117(2) Direction No 4.4  
of the EP&A Act

December 2012  
(REF: A11127B)



## Bushfire Protection Assessment

**Rezoning Application  
Lot 1 DP 1139826  
Ralston Avenue, Belrose**

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### Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. The advice does advise on matters published by the *NSW Rural Fire Service* in their guidelines '*Planning for bush fire protection 2006*' and other advice available from that organisation.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

## EXECUTIVE SUMMARY

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

The site is identified within Warringah Local Environmental Plan (LEP) 2011 as 'deferred land' and as such LEP 2000 applies until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into Warringah's standard LEP 2011.

It is proposed that the developable area of the site will be rezoned to accommodate a variety of residential dwellings that will meet the existing and likely future housing demand within the local area. The Concept Plan Report and indicative development concept plan provides for approximately 169 lots, which are anticipated to be an average of 600m<sup>2</sup>. The actual dwelling mix and type will be determined at the development application stage.

The balance of the developable area of the site will comprise the public open space, stormwater management and asset protection zones (APZ) for bushfire protection. Each of these elements has been designed in an integrated manner to enable the recreational use of these spaces and to utilise the natural landscape as a defining element of the visual character and mitigate any potential impacts on water quality.

This report identifies matters for consideration for the planning proposal and highlights the required bushfire protection measures (including asset protection zones (APZs) for future development under the *Environmental Planning and Assessment Act 1979, Section 117 Direction 4.4* and in accordance *Planning for bush fire protection 2006 (PBP)* and *Community Resilience Practice Note 2/12 Planning Instruments and Policies*.

The key principle for the proposal is to ensure that future development is capable of complying with *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments 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. The previous fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic design, 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 by a suite of bushfire protection measures which when implemented can be 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*.

The final report will be much enlarged and make greater discussion on the points raised above.

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## GLOSSARY OF TERMS

APZ	asset protection zone
<i>BCA</i>	<i>Building Code of Australia</i>
BSA	Bushfire Safety Authority
FDI	Fire Danger Index
IPA	inner protection area
<i>LEP</i>	<i>Local Environmental Plan</i>
OPA	outer protection area
<i>PBP</i>	<i>Planning for bush fire protection, 2006</i>
<i>NSW RFS</i>	<i>NSW Rural Fire Service</i>
SFPP	special fire protection purpose
<i>AS3959 (2009)</i>	<i>Australian Standard – Construction of buildings in bushfire-prone areas.</i>

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## REFERENCES

SCHEDULE 1 – Bushfire Protection Measures

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# Introduction

# 1

*Travers bushfire & ecology* has been requested by *Mathews Civil* to undertake a bushfire protection assessment for the proposed rezoning located at Lot 1 DP 1139826, located at the end of Ralston Avenue, Belrose.

The proposal is located on land mapped by *Warringah Council* as being bushfire prone. *Direction 4.4, Planning for bush fire protection* identifies matters for consideration for planning proposals that will affect, or are in proximity to land mapped as bushfire prone.

As such the proposal is subject to the requirements of Section 117(2) of the *Environmental Planning and Assessment Act 1979 (EP&A Act)* which requires Council to consult with the Commissioner of the *NSW Rural Fire Service* and to take into account any comments by the Commissioner.

## 1.1 Aims of the Assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with *PBP*
- Provide advice on planning principles, including the provision of perimeter roads, asset protection zones (APZs) and other specific fire management issues
- Review the potential to carry out hazard management over the landscape, taking into consideration the proposed retention of trees within the final development plans.

## 1.2 Project Synopsis

It is proposed that the developable area of the site will be rezoned to accommodate a variety of residential dwellings that will meet the existing and likely future housing demand within the local area. The Concept Plan Report and indicative development concept plan provides for approximately 169 lots, which are anticipated to be an average 600m<sup>2</sup>. The actual dwelling mix and type will be determined at the development application stage.

The balance of the developable area of the site will comprise the public open space, stormwater management and asset protection zones (APZ) for bushfire protection. Each of these elements has been designed in an integrated manner to enable the recreational use of these spaces and to utilise the natural landscape as a defining element of the visual character and mitigate any potential impacts on water quality.

In addition to the proposed development area, the proponent is offering an approximate 118 ha protection offset surrounding the development to be retained and is likely to be rezoned as Environmental Protection. The land proposed for conservation includes the areas immediately surrounding the Belrose Waste Management Facility and extensive sandstone escarpment slopes immediately adjoining Garigal National Park. The proposed offset area is an ecological significant landscape which is known to contain threatened flora, fauna and sensitive vegetation areas and is subject to a separate report.

The proposal includes an indicative concept plan (as depicted within Figure 1.1) and as such the bushfire constraints have been highlighted and asset protection zones (APZ) have been recommended, based on this plan. Recommendations have also been made for future road and fire design, fuels management, traffic management, emergency management, building construction, water supply and peripheral land management.

### 1.3 Information Collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Warringah Local Environmental Plan 2011
- Warringah Local Environmental Plan 2000
- Flora and Fauna Assessment, 2012 prepared by *Travers bushfire & ecology*
- *Google* aerial photography
- Topographical maps *DLPI of NSW* 1:25,000
- *Planning for bush fire protection 2006 (NSW RFS)*
- Australian Standard 3959 *Construction of buildings in bush fire prone areas*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies.*

An inspection of the proposed development site and surrounds was undertaken by John Travers on several occasions in 2011 and 2012 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

### 1.4 Site Description

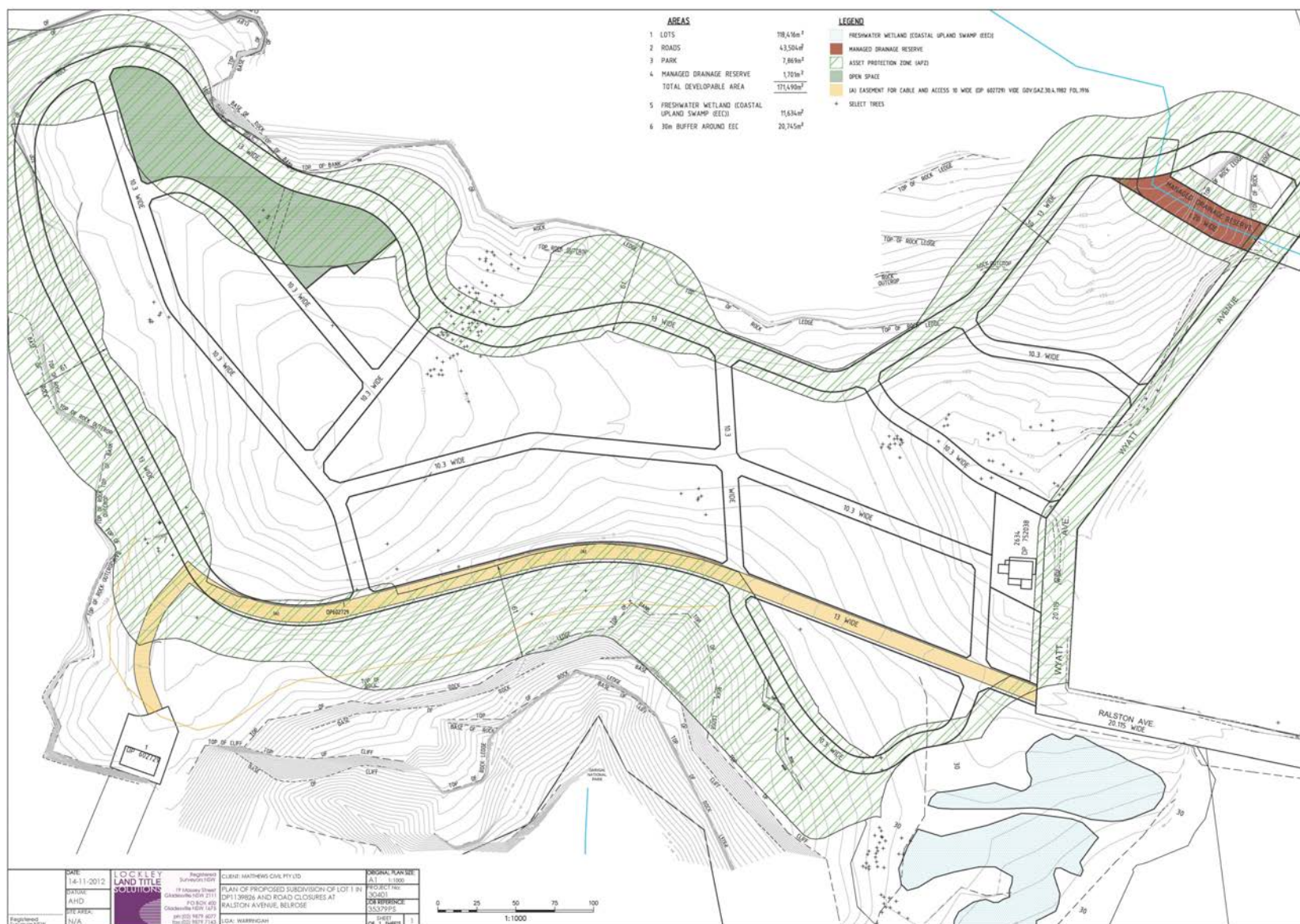
The site is located at Lot 1 DP 1139826, Ralston Avenue, Belrose (refer Figure 1.2).

The proposed development area is located on a plateau area of approximately 17 ha. The development area is proposed to be accessed from residential areas to the east via Ralston and Wyatt Avenue.

The remaining perimeter to the north, west and south is gentle to steep sloping sandstone escarpments that consist of a variety of vegetation formations ranging from forest to heathland communities.

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.







**Table 1.1 – Site features**

<b>Location</b>	Lot 1 DP 1139826
<b>Size</b>	Approximately 17ha (development land only)
<b>Local government area</b>	Warringah
<b>Grid reference</b>	333600E 6266800N
<b>Elevation</b>	Approximately 150-170m AHD
<b>Topography</b>	Situated upon a plateau area with minor slopes, increasing near the northern and southern subdivision boundary.
<b>Geology and soils</b>	Geology; Sandstone Soils; Lambert Soil Landscape, Somersby Soil Landscape and Hawkesbury Soil Landscape
<b>Catchment &amp; drainage</b>	French's Creek (to the south) and Fireclay Creek (to the north) into Middle Harbour Creek.
<b>Vegetation</b>	Coastal Sandstone Heath and Sydney Sandstone Ridgetop Woodland (predominately)
<b>Existing land use</b>	Private land and residential
<b>Clearing</b>	Clearing for the existing residence and asset protection zones, and any road, track and existing electrical structure



**Figure 1.2:** Aerial Appraisal of investigation area

## 1.5 Legislation and Planning Instruments

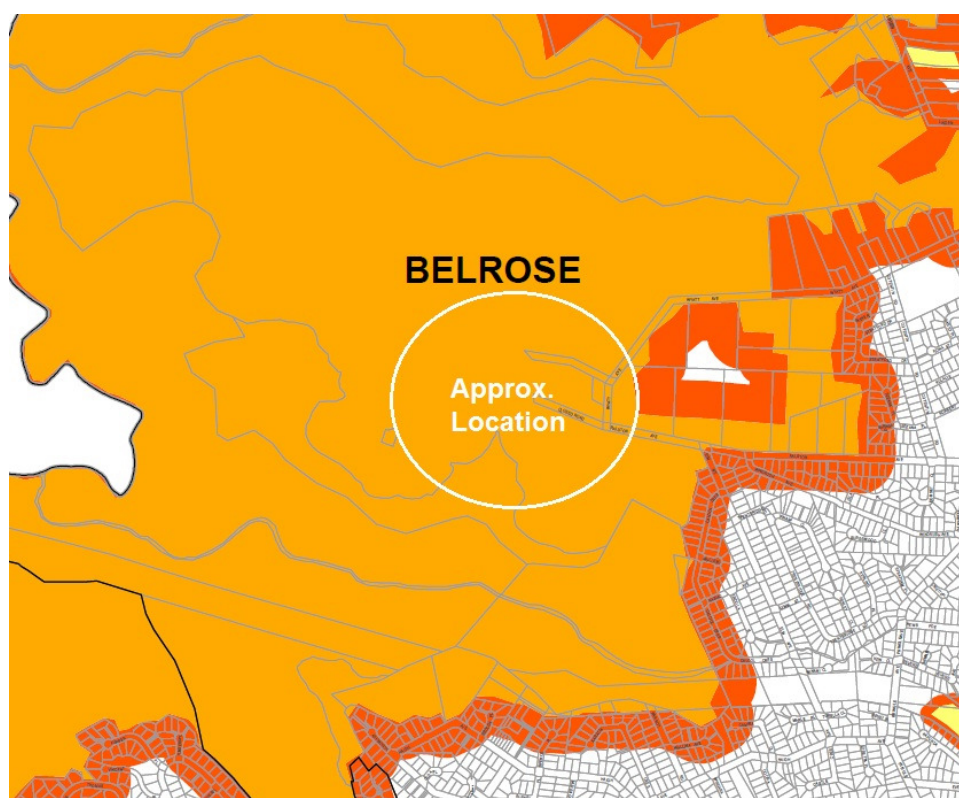
### 1.5.1 *Environmental Planning and Assessment Act 1979 (EP&A Act) and bushfire prone land.*

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *Building Code*

of Australia. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

Bushfire prone land maps provide a trigger for the development assessment provisions. The proposed rezoning is located on land that is mapped by *Warringah Council* as being bushfire prone (refer Figure 1.3).

*PBP* (pg 4) stipulates that if a proposed amendment to land use zoning or land use affects a designated bushfire prone area then the Section 117(2) Direction No 4.4 of the *EP&A Act* must be applied. This requires Council to consult with the Commissioner of the *NSW RFS* and to take into account any comments by the Commissioner and to have regard to the planning principles of *PBP* (detailed within Section 1.5.3).



**Figure 1.3:** Bushfire Prone Land Map  
(Source: Warringah Council)

### **1.5.2 Local Environmental Plan (LEP)**

A LEP provides for a range of zonings which list development that is permissible or not permissible, as well as the objectives for development within a zone.

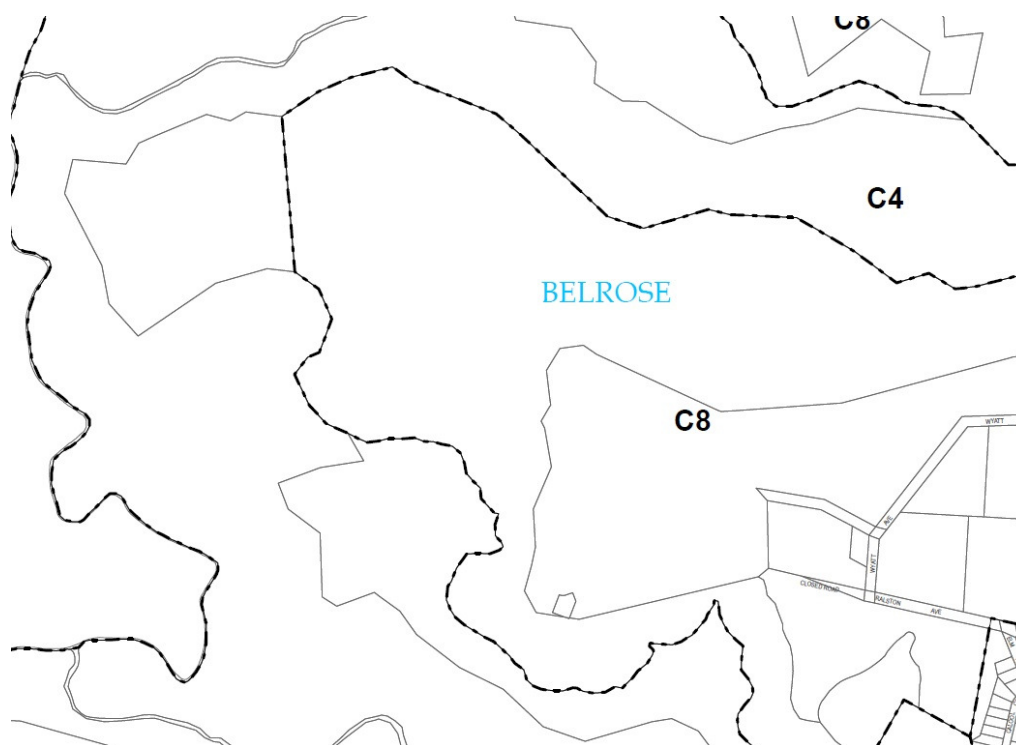
The site is identified on the Warringah LEP 2011 Land Application Map as a 'deferred matter'. LEP 2000 applies to all deferred land until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into Warringah's standard LEP 2011.



### Warringah Local Environmental Plan (LEP) 2000

The site is zoned under *Warringah LEP 2000* as Locality C8 – Belrose North (refer Figure 1.4). The land surrounding the property to the north, south and west is zoned under the current LEP 2011 as E1 – National Parks and Reserves.

The proposal seeks to amend the *LEP 2000* and contribute to the planning process to bring this land into Warringah's standards LEP. The proposal is to rezone the central development area as residential whilst maintaining the land surrounding the development as an offset area likely to be rezoned as Environmental Protection.



**Figure 1.4:** Warringah LEP 2000  
(Source: Warringah Council website)

The proposal, including the provision of APZs, would seek to comply with the objectives of the proposed rezoning.

#### **1.5.3 Planning for bush fire protection 2006 (PBP)**

Bushfire protection planning requires the consideration of the *NSW RFS* planning document entitled *Planning for bush fire protection 2006 (PBP)*. *PBP* provides planning principles for rezoning to residential land as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

*PBP* outlines the following planning principles that must be achieved for all rezoning proposals:

1. Provision of a perimeter road with two way access which delineates the extent of the intended development.
2. Provision, at the urban interface, for the establishment of adequate asset protection zones for future housing
3. Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads
4. Minimising the perimeter of the area of land interfacing the hazard, which may be developed
5. Introduction of controls which avoid placing inappropriate developments in hazardous areas, and
6. Introduction of controls on the placement of combustible materials in asset protection zones.

In addition to the above, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas.

The proposed rezoning has been assessed in compliance with the following measures to ensure that future development is capable of complying with *PBP*:

- Asset protection zones
- Building construction and design
- Access arrangements
- Water supply and utilities
- Landscaping
- Emergency arrangements

#### **1.5.4 Building Code of Australia (BCA) and the Australian Standards AS3959 - 2009**

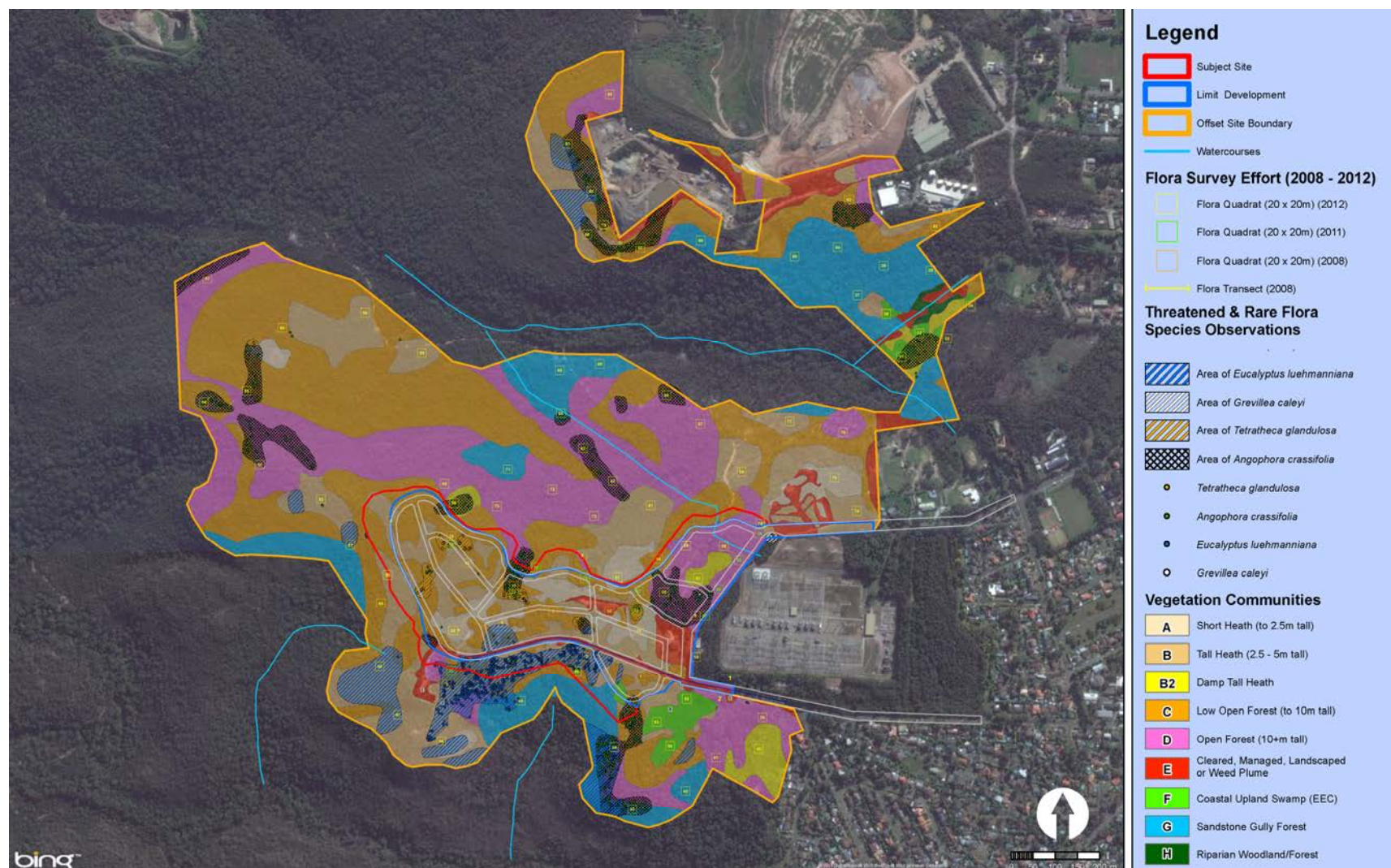
The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and deemed-to-satisfy provisions. For residential dwellings these include Class 1, 2 and 3 buildings. The construction manual for the deemed-to-satisfy requirements is the *Australian Standard AS3959 2009*.

Although consideration of *AS3959* is not specifically required in a rezoning proposal, this report (Section 3.2) provides the indicative setbacks for each dwelling construction level and can be used in future planning for master plans and / or subdivision proposals.

### **1.6 Environmental & Cultural Constraints**

#### **1.6.1 Environmental Constraints**

The proposed development is in accord with the ecological constraints and offset analysis prepared by *Travers bushfire & ecology* (November 2012) – see ‘survey effort’ constraints plan at Figure 1.4.



**Figure 1.4:** Vegetation Communities, Flora & Fauna Survey Effort  
(Source: Travers bushfire & ecology, 2012)



# Bushfire Threat Assessment

## 2

To assess the bushfire threat and to determine the required width of an asset protection zone for a development, a review of the elements that comprise the overall threat needs to be completed.

*PBP* provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

### 2.1 Hazardous fuels

*PBP* guidelines require the identification of the predominant vegetation 'formation' in accordance with David Keith (2004) to determine APZ distances for subdivision developments. However, when determining construction standards in accordance with *AS3959 – Construction in bushfire-prone areas* AUSLIG Pictorial Analysis is used to determine the vegetation, and hence APZ setbacks and building construction standards (refer Section 3.2 of this report).

The hazardous vegetation is calculated for a distance of at least 140 metres from a proposed development boundary and is summarised within Table 2.1 below.

**Table 2.1 – Vegetation Descriptions**

Vegetation Community (TBE, 2012)	Vegetation Formation (David Keith & PBP)	AUSLIG Pictorial Analysis (AS3959, 2009)
Short Heath	Short heath	Shrubland
Tall Heath & Damp Tall Heath	Tall heath	Scrub
Low Open Forest	Dry sclerophyll Forest	Forest
Open Forest	Dry sclerophyll Forest	Forest
Cleared, managed, landscaped, weed plume	N/A	N/A
Coastal Upland Swamp	Freshwater wetland	Scrub
Sandstone Gully Forest	Dry sclerophyll Forest	Forest

These vegetation formations and their location are depicted within Schedule 1 attached.

Generally forest vegetation is located on the periphery of the proposed development boundary to the north, south and east. Pockets of tall heath vegetation are also present particularly to the south-west. The freshwater wetland formation (Coastal Upland Swamp) is located in the south-east of the development lands.

The following photographs depict the hazardous vegetation surrounding the site.





**Photo 1** – Low open forest



**Photo 2** – Coastal Upland Swamp with fringing low open forest in the background.



## 2.2 Effective Slope

The effective slope is assessed for a distance 100 metres. Effective slope refers to that slope which provides the most effect upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined.

The effective slope within the hazardous vegetation is variable but is summarised as:

- Level to upslope within the narrow strip of forest vegetation between the electrical substation and the development lands in the east
- $>18^{\circ}$  downslope within the forest to the south, west and north-west
- Varying slope of between 0–5 and up to 10 degrees to the north-east.

## 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). It is our experience that BAL has market resistance due to cost of construction (\$15,000-\$25,000).

We suggest that BAL 19 be considered but this would require larger APZ's to be provided in order to offset higher construction costs. We estimate BAL 19 costs to be \$10,000 - \$18,000 for two storey construction). See Section 3.2 below for further details. Remember we are talking here about those dwellings located on the actual perimeter of the development not the internal dwellings.

**Table 2.2 – Bushfire attack assessment**

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required (BAL 29 - equivalent)	Compliance
1 - 3	East	Forest	Level to upslope	25 metres	Yes
4	South-east	Tall Heath	0 - 5 ° D	15 metres	Yes
4 5	South-west South	Forest	$>18^{\circ}$ D	61 metres	Yes
6	South	Forest	5 - 10 ° D	39 metres	Yes
6	West	Forest and Tall Heath/ Shrub	$>18^{\circ}$ D	61 metres	Yes

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required (BAL 29 - equivalent)	Compliance
6 & 7 (includes open space)	North	Forest	>18 ° D	61 metres	Yes
7	North-east	Forest	0 - 5 ° D (for 30m)	32 metres	Yes (minimum APZ of 32 metres is provided for the effective slope whilst maintaining a separation of 80m from >18 degree slope)
8	North (western portion)		11 ° D (for 20m)		
8	North (eastern portion)	Forest	>18 degrees	61 metres	
9	North	Tall Heath / Scrub	15-20 ° D	21 metres	Yes
2	North-west				
1	North-west	Forest	5 - 10 ° D	39 metres	Yes
1	North or South	Internal Riparian Corridor	Level	11 metres	Yes (based on rainforest classification with fire run potential of less than 50 metres)

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



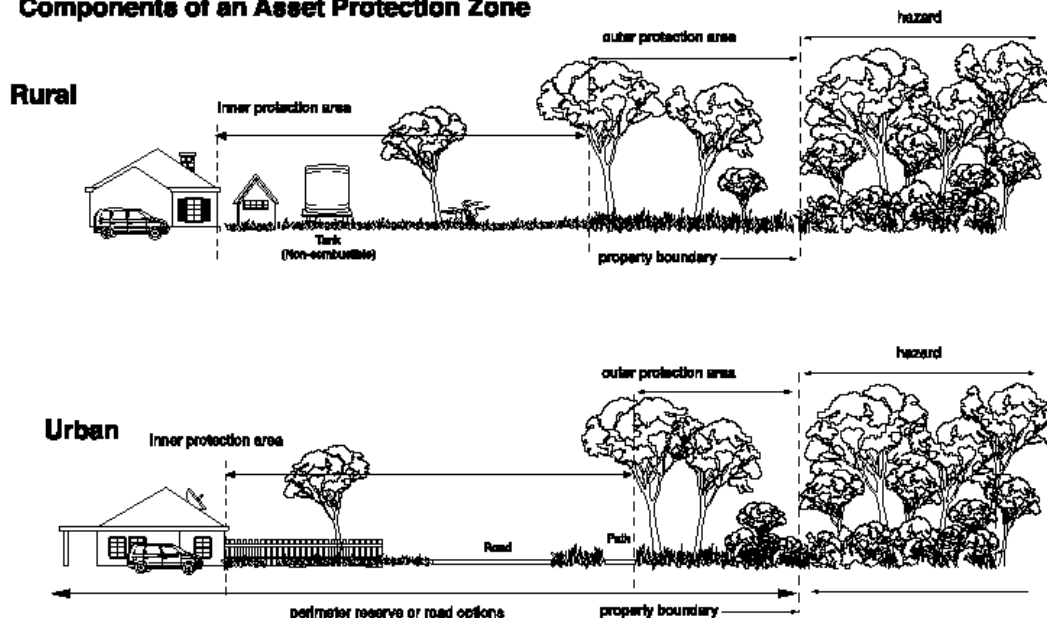
# Specific Protection Issues

## 3

### 3.1 Asset Protection Zones (APZs)

APZs are areas of defensible 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 defensible space is graphically represented below:

#### Components of an Asset Protection Zone



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  $29 \text{ kW/m}^2$  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 <sup>2</sup>	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 <i>Standards for Asset Protection Zones (NSW RFS 2005)</i>	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 appear to exceed 18 degrees, these areas are rock ledges and can be incorporated into APZ management.

### 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 *NSW RFS* has released an interim amendment to *PBP 2006* in the form of Appendix 3. This amendment follows the adoption on 1 May 2010 of *AS3959 (2009)* through the *Building Code of Australia (BCA) 2010*. This appendix, in conjunction with Table 2.4.2 of *AS3959 (2009)*, is used to determine construction considerations when building on bushfire prone land.

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 3.2 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.

**Table 3.2 – Determination of Bushfire Attack Level (BAL)**

Super lot ID	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Provided	Construction Standards
1 - 3	East	Forest	Level to upslope	25 metres	BAL 29 (25-<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
4	South-east	Tall Heath	0 - 5 ° D	15 metres	BAL 29 (11-<17m) BAL 19 (17-<25m) BAL 12.5 (25-<100m)
4 5	South-west South	Forest	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6	South	Forest	5 - 10 ° D	39 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
6	West	Forest and Tall Heath/ Shrub	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6 & 7 (includes open space)	North	Forest	>18 ° D	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
7  8	North-east  North (western portion)	Forest	0 - 5 ° D (for 30m)  11 ° D (for 20m)  >18 degrees	32 metres	BAL 29 (32-<43m) BAL 19 (43-<57m) BAL 12.5 (57-<100m)
8	North (eastern portion)	Forest	>18 degrees	61 metres	BAL 29 (61-<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
9 2	North North-west	Tall Heath / Scrub	15-20 ° D	21 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
1	North-west	Forest	5 - 10 ° D	39 metres	BAL 29 (21-<31m) BAL 19 (31-<43m) BAL 12.5 (43-<100m)
1	North or South	Internal Riparian Corridor	Level	11 metres	BAL 29 (11-<16m) BAL 19 (16-<23m) BAL 12.5 (23-<100m)

Notes: \* Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope

### 3.3 Hazard Management

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.

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. It is envisaged the latter will be managed by way of a positive covenant entered into at DA stage.

A fuel management plan will need to be prepared and adopted to provide assurance that all APZ's will be managed in perpetuity.

Together with peripheral fire trails located external to the development landscape there will be a need to apply a permanent *strategic bushfire management zone* (SBMZ) between those trails and the developments asset protection zones. This landscape will require regular burning (every 7 years) in line with the *bushfire environmental assessment code*. The SBMZ will link directly to the *Warringah bushfire risk management plan* which is prepared by Council and the RFS and other larger land owners. This document is the government's risk plan that determines future works to minimise bushfire risk to communities and environmental assets e.g. creeks and species).

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.

### 3.4 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.

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

Given the extent of the surrounding bushland it is recommended that the existing fire trail network be upgraded to provide a peripheral trail system some 100 metres external to the outer edges of the asset protection zones.

Interim recommendations for fire trail extensions are depicted within Schedule 1.



**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	<p>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.</p> <p>Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas.</p> <p>Traffic management devices are constructed to facilitate access by emergency services.</p> <p>Public roads have a cross fall not exceeding 3 degrees.</p> <p>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.</p> <p>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.</p> <p>The minimum distance between inner and outer curves is 6 metres.</p> <p>Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees.</p> <p>Minimum vertical clearance of 4 metres above the road at all times.</p>	<p>Compliant - The concept plan depicts a perimeter road which ranges in road reserve width of 10.3m wide in the southeast and 13 metres wide in the south, north and west.</p> <p>Can be made compliant - Carriageway widths are required to be 8 metres wide and plans will need to replicate this. All perimeter public roads must be 8 metre wide carriageway. 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.</p> <p>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.</p> <p>Compliant - The perimeter road will be linked with the internal road network at intervals of less than 500 metres.</p> <p>Compliant - There are no dead end roads.</p>
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
Roads that are clearly sign posted (with easily distinguishable names) and	Public roads >6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water.	Complaint – can be made a condition of consent

Performance Criteria	Acceptable Solutions	Compliance
buildings / properties that are clearly numbered.	<p>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.</p> <p>Public roads &lt;6.5 metres wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.</p> <p>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.</p>	
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	<p>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.</p> <p>Public roads directly interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.</p>	Complaint – 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

### 3.5 Water Supplies

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

Table 3.5 outlines the performance criteria and acceptable solutions for reticulated water supply.

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

Performance criteria	Acceptable Solutions
Water supplies are easily accessible and located at regular intervals	<p>Reticulated water supply to urban subdivision uses a ring main system for areas with perimeter roads.</p> <p>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.</p> <p>Hydrants are not placed within any road carriageway</p> <p>All above ground water and gas pipes external to the building are metal, including and up to taps.</p> <p>The provisions of parking on public roads are met.</p>

### 3.6 Gas

Table 3.6 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	<p>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.</p> <p>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.</p> <p>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.</p> <p>Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.</p>

### 3.7 Electricity

Table 3.7 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	Where practicable, electrical transmission lines are underground  Where overhead electrical transmission lines are proposed: <ul style="list-style-type: none"><li>• Lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas: and</li><li>• No part of a tree is closer to a power line than the distance set out in accordance with the specification in <i>Vegetation Safety Clearances</i> issued by <i>Energy Australia</i> (NS179, April 2002).</li></ul>
Regular inspection of lines in undertaken to ensure they are not fouled by branches.	

### 3.8 Evacuation

Evacuation capability is a 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 such that all perimeter roads, connections to internal roads are many and external egress to the main road has opportunity for not clogging and causing restrictions in good traffic fluidity for any uncontrolled evacuations.

The egress roads of Ralston Avenue and Wyatt Avenue are both 20m in width and are capable of providing a fluid traffic flow in times of emergency. It is recommended that Ralston Road 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 suffice.

The main road intersection/s onto Forest Road are controlled by lights and their long length provides a significant zone of protection for residents of the new development zone when and or if they are evacuating their homes.



# Conclusion & Recommendations

## 4

### 4.1 Conclusion

A bushfire protection assessment 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 *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments 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.

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 following planning principles.

**Table 4.1: Planning Principles**

Planning Principles	Recommendations
Provision of a perimeter road with two way access which delineates the extent of the intended development.	The concept development plan provides for a perimeter road with two way access and two alternate egress routes to the east onto Ralston and Wyatt Avenues.
Provision, at the urban interface, for the establishment of adequate asset protection zones for future housing	APZ's have been recommended in compliance with BAL 29 (AS3959, 2009).
Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads	Future subdivision design is to allow for the minimum APZ's as recommended within Table 2.2 and as depicted within Schedule 1 attached.

Planning Principles	Recommendations
Minimising the perimeter of the area of land interfacing the hazard, which may be developed	The concept plan has minimised the perimeter exposed to bushfire to the extent available. This is restricted by topography and other environmental constraints. The development site will be adjoined by an electrical substation in the east reducing the bushfire threat posed from this aspect.
Introduction of controls which avoid placing inappropriate developments in hazardous areas	Proposed future development will consist of residential dwellings and is appropriate for the level of bushfire risk.
Introduction of controls on the placement of combustible materials in asset protection zones.	Compliant –can be made a condition of consent.

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 the 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** - A detailed *fuel management plan* will need to be prepared to manage all asset protection zones not located within urban allotments and or public roads i.e. public parklands and external residual private land retained by the proponent. 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** – Peripheral lands to the development should be designated as a *bushfire strategic management zone* for a width of approximately 100m and edged by a fire trail. This zone should be linked into the *Warringah bushfire risk management plan* as a permanent zone for protecting 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.

**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)

## REFERENCES

- Australian Building Codes Board (2010) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2.
- Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research.
- Councils of Standards Australia AS3959 (2009) – *Australian Standard Construction of buildings in bush fire-prone areas*.
- Hon Brad Hazard (7 June 2012) – *Planning proposal to rezone land at Boundary Road, Medowie from 1 (c1) Rural Small Holdings Zone to 1(c5) Rural Small Holdings, 1(c4) Rural Small Holdings and 7(a) Environmental Protection*.
- Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.
- Rural Fire Service (2006) - *Planning for bush fire protection– a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.
- Rural Fire Service (2006) - Bushfire Attack Software on RFS Web site.
- Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack*. RFS Development Control Service.
- Travers, J. (2003) *The Ecological Management of Asset Protection Zones at Wallarah Peninsula – A Case Study*.
- Umwelt, 2012. *Ecological Assessment for Rezoning Application Lots 93 – 96 Boundary Road, Medowie*.







# Plan of Bushfire Protection Measures

S1





**Legend**

Subdivision boundary

Super Lot (created by TBE)

Proposed roads

Site boundary

Concept firetrails

Riparian Corridor (20m width)

Area of *Grevillea caleyi*

Asset Protection Zone

**Vegetation Formations**

Short Heath (to 2.5m tall)

Tall Heath (2.5 - 5m tall)

Forest

Cleared, Managed, Landscaped or Weed Plume

Freshwater Wetland (Coastal Upland Swamp (EEC))

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

**PROJECT**

Belrose

**REFERENCE**

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**SCALE**

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**DATE (ISSUE)**

04.12.12

**TITLE**

**Schedule 1 - Bushfire Protection Measures**





# Management of Asset Protection Zones

# A1

The *NSW Rural Fire Service (RFS)* advises that when living in a bushfire prone environment asset protection zones are required to be provided between hazardous fuels and a dwelling.

The *NSW RFS* provides basic advice in respect of managing asset protection zones in several documents namely *Planning for bush fire protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

Asset protection zones (APZs) provide a level of defensible space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

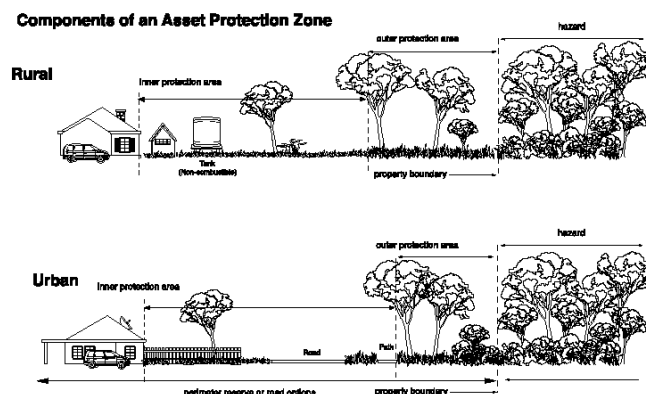
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

**Table 1 – Fuel Layers**

Fuel Layer Name	Location of Layer in vertical Column	Type of Fuel
Ground Fuels	Below ground level	Peatmoss (always below the surface)
Surface Fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



### ***Inner Protection Area (IPA)***

This area is *almost free* of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an IPA if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an IPA in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example the larger the shrubs the less clumping may occur in a given area.

As a general, rule trees are allowed within an IPA but only where those trees are at least 5 metres away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0 – 4 t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m<sup>2</sup> (10mx10m) can have up to 20% of this area composed of shrubs.

If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

<b>Shrub cover</b>	<b>Fuel Weight</b>
10-30 %	2.5 tonnes / ha
35-50 %	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

### ***Presence of Trees within an Inner Protection Area***

A tree may occur within an IPA if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a 'tall open forest' where the trees are generally above 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

Similarly in 'open forests' the height of the forest is sufficiently removed from the shrub layer. As a general rule trees are allowed within an IPA where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a westerly aspect.

In respect of trees that can be located in an IPA Table 2 provides guidelines.

**Table 2 – Tree Density in Inner Protection Area**

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
Within 5 metres	No trees	No trees
Between 5-10 metres	One tree per 100 m <sup>2</sup>	2 trees per 100 m <sup>2</sup>
Between 10-20 metres	<10 tree per 400 m <sup>2</sup> .	<10 trees per 400 m <sup>2</sup>

### **Outer Protection Area (OPA)**

This zone is designed to stop the development of 'intense' fires and the transmission of 'severe' radiated heat.

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as *Forest Oaks* (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

In most cases the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6 t/ha.

### **Managing the APZ**

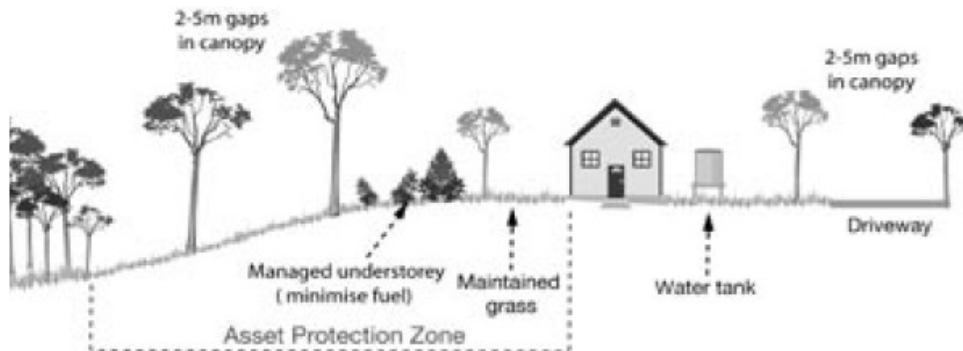
Fuel management within the APZs should be maintained by regular maintenance such as

- Mowing grasses regularly - Grass needs to be kept short and, where possible, green.
- Raking or manual removal of fine fuels - Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.
- Removal or pruning of trees, shrubs and understorey - The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.
- Tree or tall shrubs may require pruning upon dwelling completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

In addition, the following general APZ planning advice should be followed:

- Ensure that vegetation does not provide a continuous path to the house.
- Plant or clear vegetation into clumps rather than continuous rows.
- Prune low branches two metres from the ground to prevent a ground fire from spreading into trees.
- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and
- The following *NSW RFS* illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the *performance criteria* of APZs.



*Figures courtesy of NSW RFS 2006.*