Travers

bushfire & ecology

bushfire protection assessment

Rezoning Application
Lot 229 DP 847847
Cnr. Paraweena Road and
Kanangra Drive,
GWANDALAN

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

FPA AUSTRALIA
Certified Business
Bushfire Planning
& Design

October 2013

Bushfire Protection Assessment

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GWANDALAN

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Date:	31 October 2013
File:	A13096B

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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 guideline *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.

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EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for the proposed rezoning of Lot 229 DP 847847, located on the corner of Paraweena Road and Kanangra Drive, Gwandalan. The proposal is to rezone the land from 7b – Scenic Protection Rural to accommodate a residential subdivision

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 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 the establishment of adequate asset protection zones (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 placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the adjoining forest vegetation located beyond Kanangra Drive to the west and the remnant forest within the rural residential land to the south-east resulting in possible ember attack, radiant heat and potentially flame attack.

The bushfire risk posed to the rezoning proposal however can be mitigated if appropriate bushfire protection measures (including APZs) are put in place and managed in perpetuity.

The assessment has concluded that future development on site will provide compliance with the planning principles of *PBP*.

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GLOSSARY OF TERMS

AHIMS	Aboriginal Heritage Information System
APZ	asset protection zone
AS1596	*Australian Standard – The storage and handling of LP Gas*
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2009*
BCA	*Building Code of Australia*
BSA	bushfire safety authority
EEC	Endangered ecological community
FDI	fire danger index
IPA	inner protection area
LEP	*local environmental plan*
LHCCREMS	*Lower Hunter Central Coast Regional Environmental Management Strategy*
OPA	outer protection area
PBP	*Planning for bush fire protection 2006*
RFS	NSW Rural Fire Service
SFPP	special fire protection purpose

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Introduction 1

Travers bushfire & ecology has been requested by *Optima Development Pty Ltd to* undertake a bushfire protection assessment for the proposed rezoning located at Lot 229 DP 847847, on the corner of Paraweena Road and Kanangra Drive, Gwandalan.

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

The proposal is to rezone the land from 7b – Scenic Protection Rural to accommodate a residential subdivision. It is envisioned the site will be rezoned in part to 2(a) Residential with the residual lot retaining its current 7b – Scenic Protection zoning.

The equivalent zone under the WSC model template DLEP 2013 would appear to be R2 Low Density Residential with a possible E3 Environmental Management Zone over proposed Lot 523 and the proposed additional road reserve and part of proposed road No 1.

The proposed concept plan is shown on Figure 1.1 and includes a residential subdivision to allow for residential lots mostly between 560m^2 and 1091m^2, a large lot within the sewage treatment plant buffer of 4544.7m^2, and a proposed additional road reserve area in the south-west. The proposal includes one (1) internal road and infrastructure services.

Schedule 1 attached, identifies the proposed bushfire protection measures.

Recommendations have also been made for future road design, building construction, water supply and utilities.

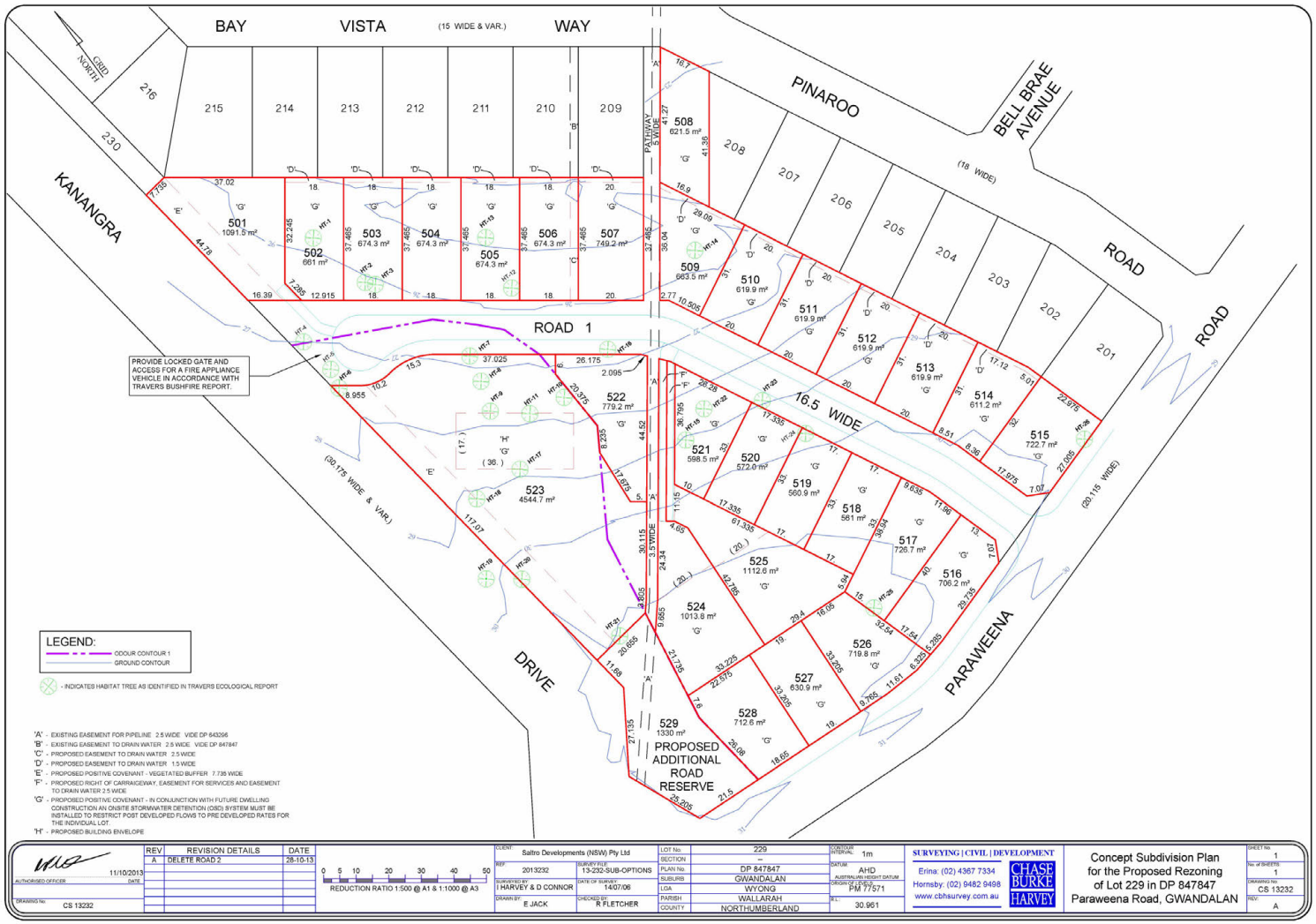


Figure 1 – Proposed subdivision development (Source: *Chase Burke & Harvey 2013)*

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:

- Wyong Local Environmental Plan 1991
- Draft Wyong Local Environmental Plan 2013
- Flora and Fauna Assessment, 2013 prepared by *Travers bushfire & ecology*
- *Google* aerial photography
- Topographical maps *DLPI of NSW* 1:25,000
- *Australian Standard 3959 Construction of buildings in bushfire-prone areas*
- *Planning for Bush Fire Protection 2006 (PBP)*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies.*

An inspection of the proposed development site and surrounds was undertaken by Nicole van Dorst in October 2013 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 229 DP 847847, on the corner of Paraweena Road and Kanangra Drive, Gwandalan (refer Figure 1.2).

The site is bound to the south and west by public roads. Beyond these roads to the south is residential / commercial development, to the west is bushland vegetation within the Sewerage Treatment works and to the south-east is remnant forest associated with rural residential development.

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

Table 1.1 – Site features

Location	Corner of Kanangra Drive and Parraweena Road, Gwandalan
Local government area	Wyong Shire Council
Grid reference	367675E 6331770N
Elevation	30m AMSL
Topography	Relatively flat landscape with a small slope on the NW boundary.
Geology and soils	Munmorah conglomerate – conglomerate, pebbly sandstone, grey to green shale.
Catchment and drainage	Catchment - Lake Macquarie The subject site drains north west in to Bonny Boy Gully and then into Lake Macquarie. It can also drain straight into Lake Macquarie in heavy storm weather.
Vegetation	Where present, native vegetation has a woodland structure. Trees are around 13-20m tall in most areas where present and with a tree canopy coverage of 20-30% on average. Some areas contained little or no trees with a sparse mid-storey and grassy groundcover. The vegetation on the corner of Kanangra Drive and Parraweena Road has been planted on a road verge mound, evident by a line of trees and an unusual occurrence of *Casuarina glauca.*
Existing land use	Natural bushland with some internal foot/bike trails
Clearing	Parts of the study area have been previously cleared for indicated land uses.

Figure 1.2 – Aerial appraisal

Figure 1.3 – Topography

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 (BCA). 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 *Wyong Shire Council* as being bushfire prone (refer Figure 1.4).

Figure 1.4 – Bushfire prone land map
(Source: Wyong Shire Council)

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.

The proposal is located on land mapped by *Wyong Shire Council* as being 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 (RFS) and to take into account any comments by the Commissioner; and to have regard to the planning principles of *Planning for Bush Fire Protection 2006 (PBP)*

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 proposal is to proceed as an amendment to the current *Wyong LEP 1991* as outlined below.

Wyong Local Environmental Plan 1991

The site is zoned under the current *Wyong LEP 1991* as 7b – Scenic Protection with a small section, providing access to Pinarroo Road zoned as 2(a) residential (refer Figure 1.5).

The proposal seeks to amend the LEP to rezone the land in part to 2(a) residential with the residual lot retaining its 7b – Scenic Protection zoning.

Figure 1.5 – Wyong LEP 1991
(Source: Wyong Shire Council website)

Draft Local Environmental Plan 2012

The site is zoned under the draft *Wyong LEP 2012* as E2 – Environmental Conservation with a small section, providing access to Pinarro Road zoned as R2 Low Density Residential (refer Figure 1.6).

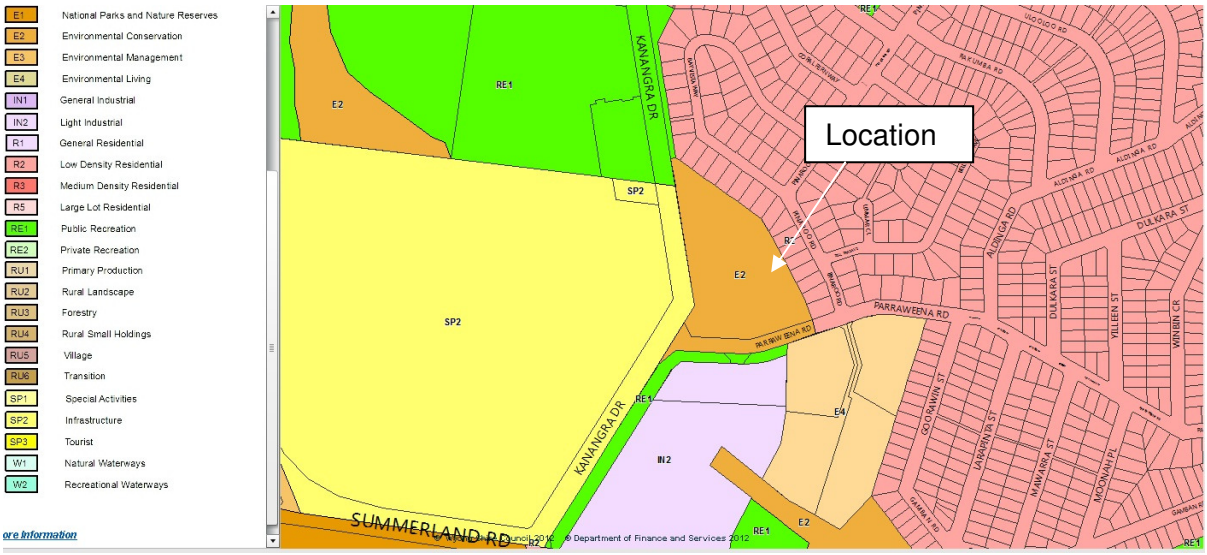


Figure 1.6 – Draft Wyong LEP 2012
(Source: Wyong Shire Council website)

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 RFS planning document entitled *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 APZs for future housing.

3. Specifying minimum residential lot depths to accommodate APZs 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 APZs.

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 Standard AS3959 Construction in bushfire-prone areas 2009 (AS3959)

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 Classes 1, 2 and 3 buildings. The construction manual for the deemed to satisfy requirements is *AS3959.*

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 and cultural constraints

1.6.1 Environmental constraints

The results of the flora and fauna assessment undertaken by *Travers bushfire & ecology* (2013) indicate that no threatened fauna species, no threatened flora species, and no EECs were recorded within the study area. The report included the following mitigation measures

- Undertake a health assessment on trees containing hollows and prioritise to retain these within the subdivision landscape where possible.

- Retain native vegetation within road corridors and encourage local native species landscaping and street-scaping.

The above mitigation measures can be incorporated and must adhere to the requirements of an asset protection zone.

1.6.2 Cultural constraints

A basic search was conducted on the Aboriginal Heritage Information System (AHIMS). The results show that there are no identified Aboriginal sites of significance within Lot 229 DP 847847 or within 50m of the site.

Bushfire Threat Assessment 2

To assess the bushfire threat and to determine the required width of an APZ 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,* 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 140m from a proposed site boundary and can be summarised as:

- Forest vegetation located beyond Kanangra Drive to the west.

- Remnant forest located beyond Parraweena Road to the south-east. *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation to the south-east exhibits these qualities and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforests category outlined in *PBP*.

Please note that the existing vegetation within Lot 523 is proposed to be managed to the standards required for an asset protection zone and as such will not pose a bushfire threat to the site.

The following photographs depict the hazardous vegetation surrounding the site:

Photo 1 – Remnant forest vegetation to the south-east

Photo 2 – Managed land further south – east separating the remnant vegetation from further unmanaged land beyond the residential properties in the south.

Photo 3 – Forest to the west beyond Kanangra Drive

Photo 4 – Managed / grass to the north-west (north of RFS station)

2.2 Effective slope

The effective slope is assessed for a distance 100m from the location of any habitable dwellings. 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:

- 0–5 degrees down slope to the south-east and west

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 2.1 below provides a summary of the bushfire attack assessment and the minimum required APZs in compliance with BAL 29 building construction standards (*AS3959*).

Table 2.1 – Bushfire attack assessment

Aspect	Vegetation formation within 140m of development	Effective slope of land	Minimum APZ required equivalent to BAL 29 (metres)	APZ provided (metres)
North-east and south	Managed / residential lands	Level to upslope	N/A	>100
South-east (Lot 515/516)	Remnant Forest **Refer Note 1**	0-5 ^{0D}	14	18 (includes Paraweena Road and managed verge)
West (Lot 501)	Remnant Forest **Refer Note 1**	0-5 ^{0D}	14	30 (includes Kanangra Drive and managed verge)
West (Lot 523)	Forest	0-5 ^{0D}	32	32 **Refer Note 2**

*Notes: * Slope is either 'U' meaning up slope or 'C' meaning cross slope or 'D' meaning down slope*

Note 1: *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation to these aspects exhibits these qualities and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforests category outlined in *PBP*.

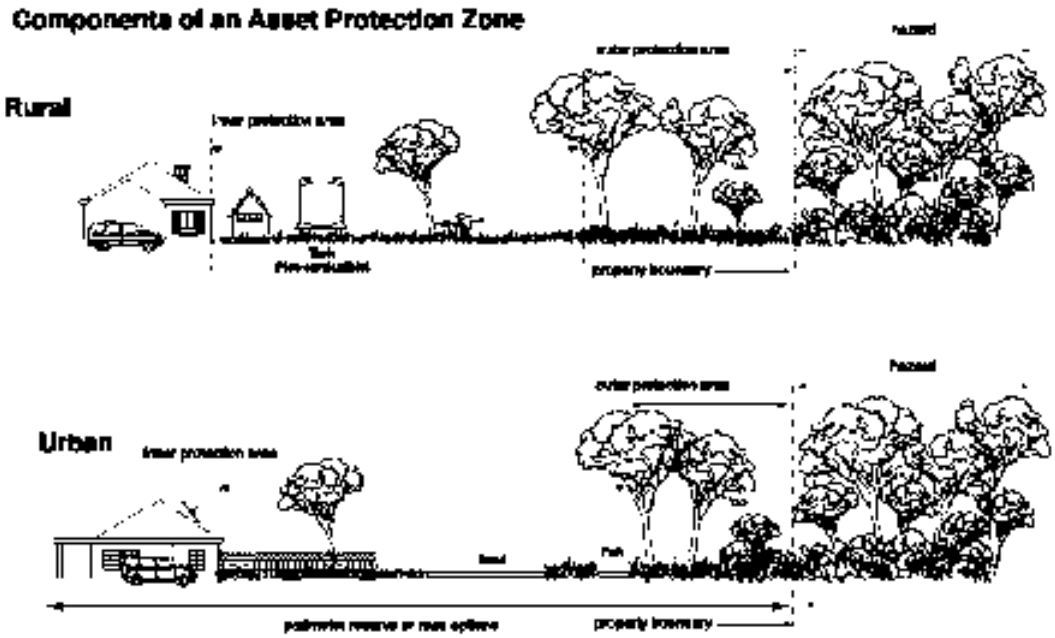
Note 2: Lot 523, in its entirety, is to be managed to the standards of an Asset Protection Zone.

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 APZs.

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

Performance criteria	Acceptable solutions	Complies
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.	Refer Table 2.1. Lot 523, in its entirety, is to be managed to the standards of an Asset Protection Zone
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 - to be made a condition of consent.
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^o.	Yes - Slopes are less than 18^o.

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 2.1 (Section 2.3) of this report comply with these requirements, whilst also considering the final building setbacks as per *AS3959*.

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

The RFS has released an interim amendment to *PBP* in the form of Appendix 3. This amendment follows the adoption on 1 May 2010 of *AS3959* through the *BCA.* This appendix, in conjunction with Table 2.4.2 of *AS3959*, 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 – *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.

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)

Aspect	Vegetation formation within 140m of development	Effective slope of land	APZ provided (meters)	Construction standards
North-east and south	Managed / residential lands	Level to upslope	>100	N/A
South-east (Lot 515/516)	Remnant Forest	0-5 ^{0D}	18	BAL 29 (14–<20m) BAL 19 (20-<29m) BAL 12.5 (29-<100m)
West (Lot 501)	Remnant Forest	0-5 ^{0D}	30	BAL 12.5 (29-<100m)
West (Lot 523)	Forest	0-5 ^{0D}	32	BAL 29 (32–<43m) BAL 19 (43-<57m) BAL 12.5 (57-<100m)

*Notes: * Slope is either 'U' meaning up slope or 'C' meaning cross slope or 'D' meaning down slope*

3.3 Hazard management

Should the development be approved, the owner or occupier of each lot will be required to manage the APZ to the specifications of Council's approval.

In terms of implementing and / or maintaining APZs, there is no physical reason that would constrain hazard management from being successfully carried out by normal means (e.g. mowing / slashing).

The APZs are to be managed in accordance with the RFS guidelines *Standards for Asset Protection Zones (RFS, 2005),* with landscaping to comply with Appendix 5 of *PBP.*

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

3.4 Access for fire fighting operations

The proposed internal public road layout will link with Parraweena Road in the south, with emergency access available to Kanangra Drive in the north-east via a locked gate. The locked gate is a requirement of Wyong Council in order to limit traffic flow onto Kanangra Drive. This gate can have the RFS lock.

Proposed Lots 524 & 525 will be accessed via a minimum 50m long battle-axe driveway.

Table 3.3 outlines the performance criteria and acceptable solutions for future public roads within future subdivision design, whilst Table 3.5 outlines the requirements for property access.

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

Performance criteria	Acceptable solutions	
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.	Yes
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 8m 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 500m in urban areas. Traffic management devices are constructed to facilitate access by emergency services. Public roads have a cross fall not exceeding 3^{o}. All roads are through roads. If unavoidable, dead end roads are not more than 200m in length, incorporate a minimum 12m 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 6m and are minimal in number to allow for rapid access and egress. The minimum distance between inner and outer curves is 6m. Maximum grades for sealed roads do not exceed 15^{o} and an average grade of not more than 10^{o}. Minimum vertical clearance of 4m above the road at all times.	Internal road widths are to comply with Table 3.4 below. Road 1 is a public road with a locked gate at its western end. This gate will have a RFS lock and be able to be opened in emergencies.
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.	

Performance criteria	Acceptable solutions	
Roads that are clearly sign posted (with easily distinguishable names) and buildings / properties that are clearly numbered.	Public roads >6.5m wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5-8m wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5m 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 3.5m wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.	Yes – can be 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 2.6m 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.	Yes – can be a condition of consent

Table 3.4 – Minimum widths for public roads that are not perimeter roads

Curve radius (inside edge) (metres width)	Swept path (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

Table 3.5 – Performance criteria for property access (*PBP* guidelines pg. 22)

Performance criteria	Acceptable solutions	Complies
Access to properties is provided in recognition of the risk to fire fighters and / or evacuating occupants.	At least one alternative property access road is provided for individual dwellings (or groups of dwellings) that are located more than 200m from a public through road.	Complies
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles. All weather access is provided.	Bridges clearly indicate load rating and pavements and bridges are capable of carrying a load of 15 tonnes. Roads do not traverse a wetland or other land potentially subject to periodic inundation (other than a flood or storm surge).	N/A. There are no proposed bridges and roads do not traverse wetlands or land subject to inundation.
Road widths and design enable safe access for vehicles.	A minimum carriageway width of 4m for dwellings with a distance of greater than 70m from the nearest hydrant point to the most external part of a proposed building. *Note: No specific access requirements apply in a urban area where a 70m unobstructed path can be demonstrated between the most distant external part of a dwelling and the nearest part of the public access road that supports the operational use of fire fighting vehicles (road speed limit <70kph).* In forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long x 2m wide (min. width 6m). A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches. Internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum outer radius of 12m. Curves have a minimum inner radius of 6m and are minimal in number to allow rapid access/egress. The minimum distance between inner and outer curves is 6m. The cross fall is not more than 10^{o}. Maximum grades for sealed roads do not exceed 15^{o} and not more than 10^{o} for unsealed roads.	Yes – Can be a condition of consent. Proposed battle-axe driveways will require compliance with this acceptable solution.

3.5 Water supplies

Town reticulated water supply is available to the property in the form of an underground reticulated water system.

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

Table 3.6 – Performance criteria for reticulated water supplies (*PBP* 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.

3.6 Gas

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

Table 3.7 – Performance criteria for gas 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 AS1596 (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 10m 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 2m 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.

3.7 Electricity

Table 3.8 outlines the required performance criteria for electricity supply.

Table 3.8 – 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 (30m), 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).

Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 229 DP 847847, located on the corner of Paraweena Road and Kanangra Drive, Gwandalan.

Our assessment found that bushfire can potentially affect the site from the adjoining forest vegetation located beyond Kanangra Drive to the west and the remnant forest within the rural residential land to the south-east, resulting in possible ember attack, radiant heat and potentially flame attack.

The bushfire risk posed to the rezoning proposal however can be mitigated if appropriate bushfire protection measures (including APZs) are put in place and managed in perpetuity.

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 proposal is provided within existing perimeter roads Kanangra Drive and Paraweena Road.
Provision, at the urban interface, for the establishment of adequate APZs for future housing.	APZs have been recommended in compliance with BAL 29 (AS3959, 2009).
Specifying minimum residential lot depths to accommodate APZs for lots on perimeter roads.	Future subdivision design is to allow for the minimum APZs as recommended within Table 2.1 and as depicted within Schedule 1 attached.
Minimising the perimeter of the area of land interfacing the hazard, which may be developed.	Compliant.
Introduction of controls which avoid placing inappropriate developments in hazardous areas.	Future development consists of residential dwellings and is appropriate for the level of bushfire risk.
Introduction of controls on the placement of combustible materials in APZs.	Compliant – can be made a condition of consent.

The following recommendations are provided to ensure that future residential development is in accordance 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 2.1 and also as generally depicted in Schedule 1.

Lot 523, in its entirety, is to be managed to the standards of an Asset Protection Zone.

Recommendation 2 - Fuel management within the APZs is to be maintained by regular maintenance of the landscaped areas, mowing of lawns in accordance with the guidelines provided in Appendix 1, and as advised by the RFS in their publications.

Recommendation 3 - 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 4 – Public and property 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 5 – 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 and 3.7 of this report).

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Plan of Bushfire Protection Measures

S1

Legend

- Site boundary
- Proposed Building Envelope
- Proposed road reserve
- Locked gate for emergency access
- Managed land
- Remnant forest
- Forest
- Asset Protection Zone

Aerial source: NearMap (05.07.2013)

0 25 50 m

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 & MXD REFERENCE	DATE & ISSUE NUMBER	SCALE & COORDINATE SYSTEM
Kanangra Drive, Gwandalan A13096_BF001	31/10/2013 Issue 1	1:1,500 @A3 GDA 1994 MGA Zone 56

TITLE

Schedule 1 - Bushfire Protection Measures

Document Path: B:\Pete_Travers\Projects\A13096_Gwandalan\MXDs\A13096_BF001.mxd

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Management of Asset Protection Zones

A1

The RFS advises that when living in a bushfire prone environment APZs are required to be provided between hazardous fuels and a dwelling.

The RFS provides basic advice in respect of managing APZs in several documents namely *Planning for Bush Fire Protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

APZs provide a level of defendable 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.

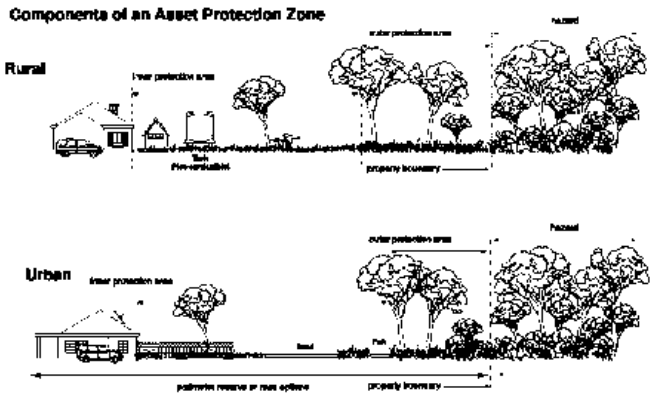
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

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	0-200mm	Litter layer (leaves & twigs)
Aerial fuels	200-3,000mm	Shrubs and grasses
Canopy fuels	>3,000mm	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 5m away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0-4t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m^2 (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.

Shrub cover	Fuel weight
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 20m in height the canopy is separated from the land surface by some distance. In an open woodland the low canopy height (usually <5m) 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 5m	No trees	No trees
Between 5-10m	One tree per 100m^2	2 trees per 100m^2
Between 10-20m	<10 tree per 400m^2	<10 trees per 400m^2

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 4-6t/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.

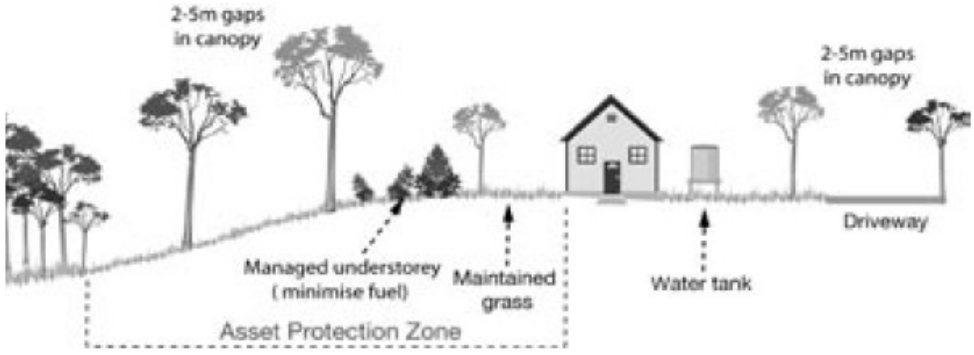
- Raking or manual removal of fine fuels - ground fuels such as fallen leaves, twigs (less than 6mm diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- 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 2-5m. A canopy should not overhang within 2-5m 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.

- Trees 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 2m 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 crushed tile; and
- The following 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.