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BUSHFIRE THREAT ASSESSMENT REPORT

Special Fire Protection Purpose Development

Palm Lake Resort
Re-zoning
Approved Caravan Park for Long Term Accommodation

Lot 10 DP 1190061
Pacific Highway East, Banora Point

17 June 2014

FPA AUSTRALIA
Certified Business
Bushfire Planning & Design

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DOCUMENT CONTROL

Revision No.	Date	Description	Prepared	Checked	Authorised
A	17.06.2014	Final	Peter Thornton	HAT	Peter Thornton

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1.0 EXECUTIVE SUMMARY

The bushfire assessment has demonstrated that the future development of long term dwellings will be consistent with infill development. The report also demonstrates that compliance with the specific objectives of Special Fire Protection Purpose developments can be achieved as well as the criteria for 'exceptional circumstance'.

In order to ensure that a better outcome is provided the report recommends the following to be provided as a s96 to the current consent on site:

- Sites 1 – 14 currently under construction in addition to the flame zone requirements approved in 2009 are to be provided with bushfire shutters that have been tested in accordance with AS 1530.8.2 and installed in accordance with the test reports.

- Previously approved flame zone sites (currently sites 73-76) that have not yet been constructed will be required to comply with the BAL FZ AS 3959-2009.

- Proposed additional sites within the rezoned area are to be limited to single storey having an underside to eave height of not greater than 2.5m. The dwellings are to be constructed to BAL FZ AS 3959-2009.

- A 3m (when measured from ground level on the dwelling side of the wall) high concrete tilt up wall is to be constructed along the entire rear boundary of Lots 73 – 76, 1 – 14 and the future proposed lots within the proposed rezoned area.

- A 3m wide easement is to be provided on the adjoining property to the rear of Lots 73 – 76, 1 – 14 and the future proposed lots within the proposed rezoned area. The easement is to be provided in an 88b instrument and the APZ to comply with Planning for Bushfire Protection 2006. Two egress points are to be provided to the east and west of the proposed wall.

- Water supply and utilities are to comply with s4.1.3 PBP2006.

- Evacuation planning is to be upgraded to address the future sites and additional bushfire safety measures.

The original development consent will need to be amended via a s96 application to address the above prior to the rezoning being approved or as a condition of rezoning.

2.0 INTRODUCTION

2.1 GENERAL

This report has been prepared to address the requirements of the Section 117 Direction Number 4.4 (1 July 2009) issued under the Environmental Planning and Assessment Act 1979 (EP&A Act 1979) for rezoning of land.

In this regard the report is provided as supporting documentation for consultation by Council with the Commissioner of the NSW Rural Fire Service under s. 56(2)(d) of the EP&A Act 1979. The Section 117 Direction requires the planning proposal to;

(a) have regard to Planning for Bushfire Protection 2006

(b) introduce controls that avoid placing inappropriate developments in hazardous areas

(c) ensure that bushfire hazard reduction is not prohibited within the APZ.

The Direction also requires that the planning proposal should comply with the following;

(a) Provide an Asset Protection Zone (APZ) incorporating at a minimum:

- (i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and
- (ii) An Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road

(b) For infill development (that is development within an already subdivided area) where an appropriate Asset Protection Zone (APZ) cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under the 100B of the Rural Fires Act 1997), the APZ provisions must be complied with.

(c) Contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks.

(d) Contain provisions for adequate water supply for fire-fighting purposes.

(e) Minimise the perimeter of the area of land interfacing the hazard which may be developed.

(f) Introduce controls on the placement of combustible materials in the Inner Protection Area

2.2 SITE APPROVAL HISTORY

- 1967 (14/11/1967) originally approved as a Caravan Park consisting of 139 short and long term sites
- 1986 (17/3/1986) additional 36 long term sites approved in caravan park
- 1994 (24/6/1994) additional 5 long term sites approved in caravan park
- Total of 180 short and long term sites approved across caravan park
- Road reserve was also clear of vegetation
- 2009 (17/12/2009 – section 96 to modify approval to decrease sites to 148 long term sites.
- 20/11/2012 – Crown road reserve closed
- Early 2013 new lot over closed road reserve registered and purchased by WEH
- 11/3/13 Section 96 modification approved to decrease sites to 141 long term
- 15/3/2013 Clubhouse approved
- 26/7/13 Section 96 modification approved to decrease sites to 114 long term
- 23/9/2013 Planning Proposal to rezone old road reserve land lodged to Council
- 13/2/2014 Section 96 modification approved to decrease sites to 112 long term

3.0 PROPOSED RE-ZONING

The Planning Proposal involves an application to rezone the old road reserve forming part of the approved caravan park that now forms part of Lot 10 DP1190061 to "private Recreation". Once rezoned, the intent would then be to lodge a section 96 application to change the caravan park approval to include long term sites along this old road reserve that is currently managed as an Inner Protection Zone.

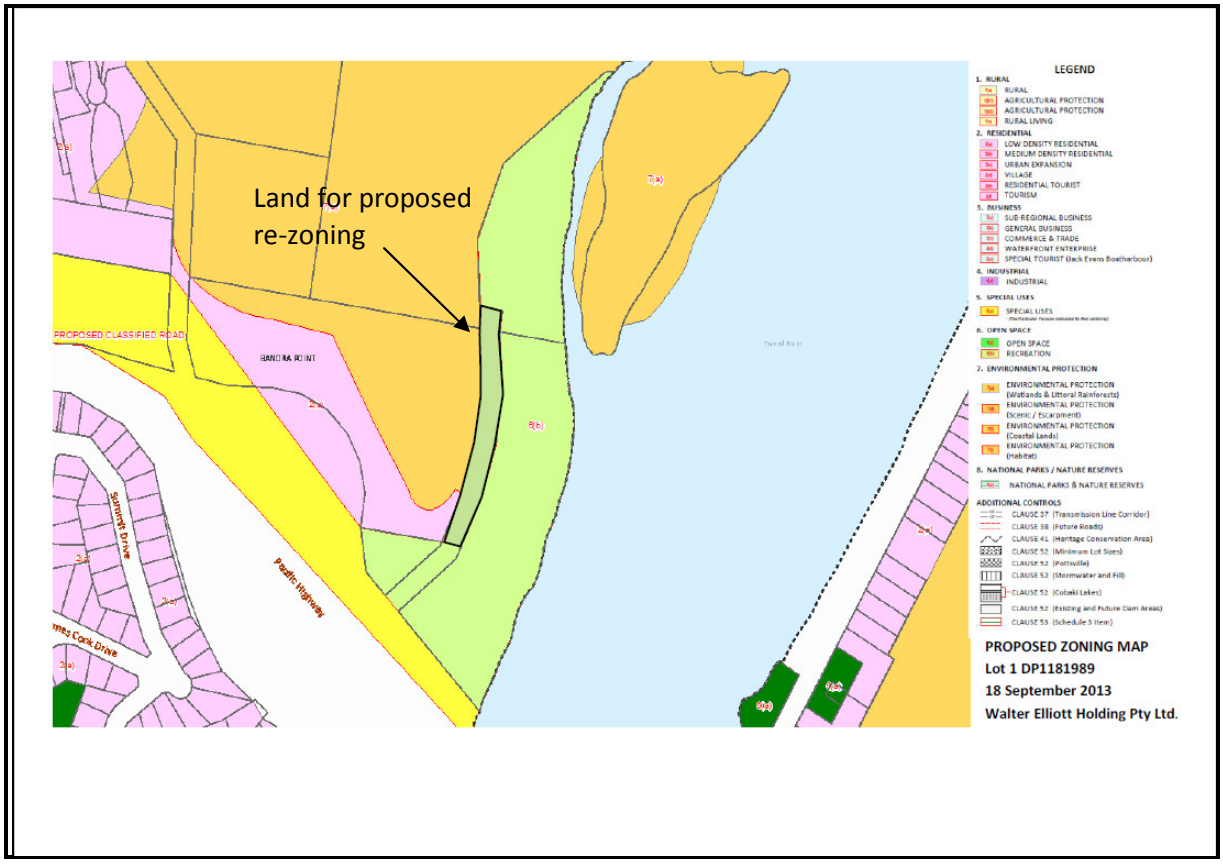


Figure 1 – Area to be rezoned (green with black outline)

3.1 PLANNING FOR BUSHFIRE PROTECTION – INFILL SFPP

The proposal is considered to be consistent with the infill SFPP development definition of Planning for Bushfire Protection 2006 which states:

> *'Infill development – refers to the development of land by the erection of or addition to a residential building (or buildings) which does not require the spatial extension of services including public roads, electricity, water or sewerage and is within an existing allotment'*

The proposed development is for construction of 'buildings' as outlined in the definition and does not require the spatial extension of services including public roads, electricity, water or sewerage. The development is within the existing allotment.

The future dwellings are not capable of complying with Table A2.6 of Planning for Bushfire Protection 2006 for a Special Fire Protection Purpose (SFPP). The report notes Section 4.2.5 of Planning for Bushfire Protection 2006 acknowledges that existing circumstances may make the preferred standards difficult to achieve. In these cases the specific objectives of s4.2.3 are to be followed.

Section 4.2.5 goes further to state that this development should also seek to achieve a better bushfire outcome (such as improved construction standards) than if the development did not proceed and be no closer to the hazard than the existing buildings.

The specific objectives for SFPP pursuant to s4.2.3 PBP2006 are to:

- Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the event, enabling occupants and fire-fighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property protection. They are more likely to be adversely affected by smoke or heat while being evacuated.
- Provide for safe emergency evacuation procedures, SFPP Developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bush fire threats.

The proposed development is for long term accommodation and the use does not provide for assistance in living such as in the case with 'aging in place' developments where occupants have a higher level of care needed and would require specific assistance in evacuating. The proposed occupant characteristics being people over the age of 50 years without specific care provided would be similar to many existing subdivisions throughout NSW. Further, the development has an on-site caretaker and maintenance staff that can activate the evacuation procedures early to ensure that egress from the buildings when the fire front is at the APZ/vegetation interface is not likely to occur. The evacuation would occur when radiant heat levels are well below 10kW/m^2.

A 3m high wall having an FRL of 30/30/30 will provide suitable protection for emergency services and will negate long exposures to the fire front. In the above regard qualification is drawn to the "*Research and investigation into the performance of residential boundary fencing systems in bushfires" being a collaborative project between BlueScope Steel Limited and the Bushfire CRC dated April 2006*. The experiments identified that a temperatures received on the opposite site of a colourbond fence to the heat source was significantly reduced as shown in experiment No. 12 where the peak heat flux on the front face of the fencing being 63kW/m^2, whilst the back face was 4kW/m^2. It is noted that unlike a metal fence a concrete fence will have an FRL. It is considered that the use of a substantial wall as proposed can provide an outcome that is comparative to wider APZs.

Further comparisons of the effect of shielded can be drawn to the Building Code of Australia where BCA Specification C1.1 Clause 2.1 – Exposure to fire-source features states;

'A part of a building element is exposed to a fire-source feature if any of the horizontal straight lines between that part and the fire-source feature, or vertical projection of the feature, is not obstructed by another part of the building that –

(i) Has an FRL of not less than 30/-/-; and
(ii) Is neither transparent nor translucent.

In this regard the requirements for the future dwellings to be constructed to BAL FZ AS 3959-2009 is considered have high levels of redundancies in comparison with the BCA. As outlined in s4.2.3, exceptional circumstances for reduction of APZs required by Appendix 2 of PBP2006 and APZs on adjoining land must be demonstrated in accordance with PBP2006 s3.3.

3.2 PLANNING FOR BUSHFIRE PROTECTION – EXCEPTIONAL CIRCUMSTANCES

As outlined in the Bushfire Engineering Brief and as discussed with NSW RFS on the 6th June 2014 the proposed future dwelling locations resulting from the rezoning will be based on exceptional circumstances. As outlined in Section 3.3 PBP2006: '*it is not possible to be definitive about the full range of such circumstances.....Consideration is on a case by case basis and the applicant should provide clear evidence that, because of the circumstances of the case e.g. location or type of use, strict prescriptive compliance is unreasonable and unnecessary'.*

In the above regard it is considered reasonable to apply exceptional circumstance given the site prior to 2009 was approved as a caravan park and has approval for 180 sites which was reduced to 148 sites. Exceptional circumstances was applied at the time for bushfire requirement and subsequently approved with a number of dwellings within the flame zone and requiring flame zone construction. The flame zone construction however was approved prior to the introduction of AS 3959-2009 and whilst reasonably robust, it is not considered to be equivalent to the current testing standards of AS 1530.8.2 which was introduced with AS 3959-2009.

There have been a number of s96 applications since 2009 which have further reduced the number of dwelling sites down from the approved 148 sites to 112 sites. This report is based on the fact that this application is within the subject site and is not unlike applying exceptional circumstances in 2009 as the development will provide a better outcome and reduced number of sites to 110 sites. Further, the occupant safety is not considered to be significantly compromised given that the alternate solution for construction standards

establishes that the 3m high wall proposed along the northwest boundary will have a Fire Resistance Level (FRL) of 30/30/30 and qualification provided that flame contact is unlikely.

The 24hr caretaker on site with the aid of evacuation planning will allow for safe evacuation away from the hazard, it being noted that the hazard has a vegetation interface of forested wetland that is approximately 150m wide and is separated and surrounded by vegetation such as rainforest and estuarine communities that are considered relatively low hazards. From a holistic view point the hazard in its entirety could not be considered as high a risk as other situations where a forested wetland has extensive fire runs and fire fronts.

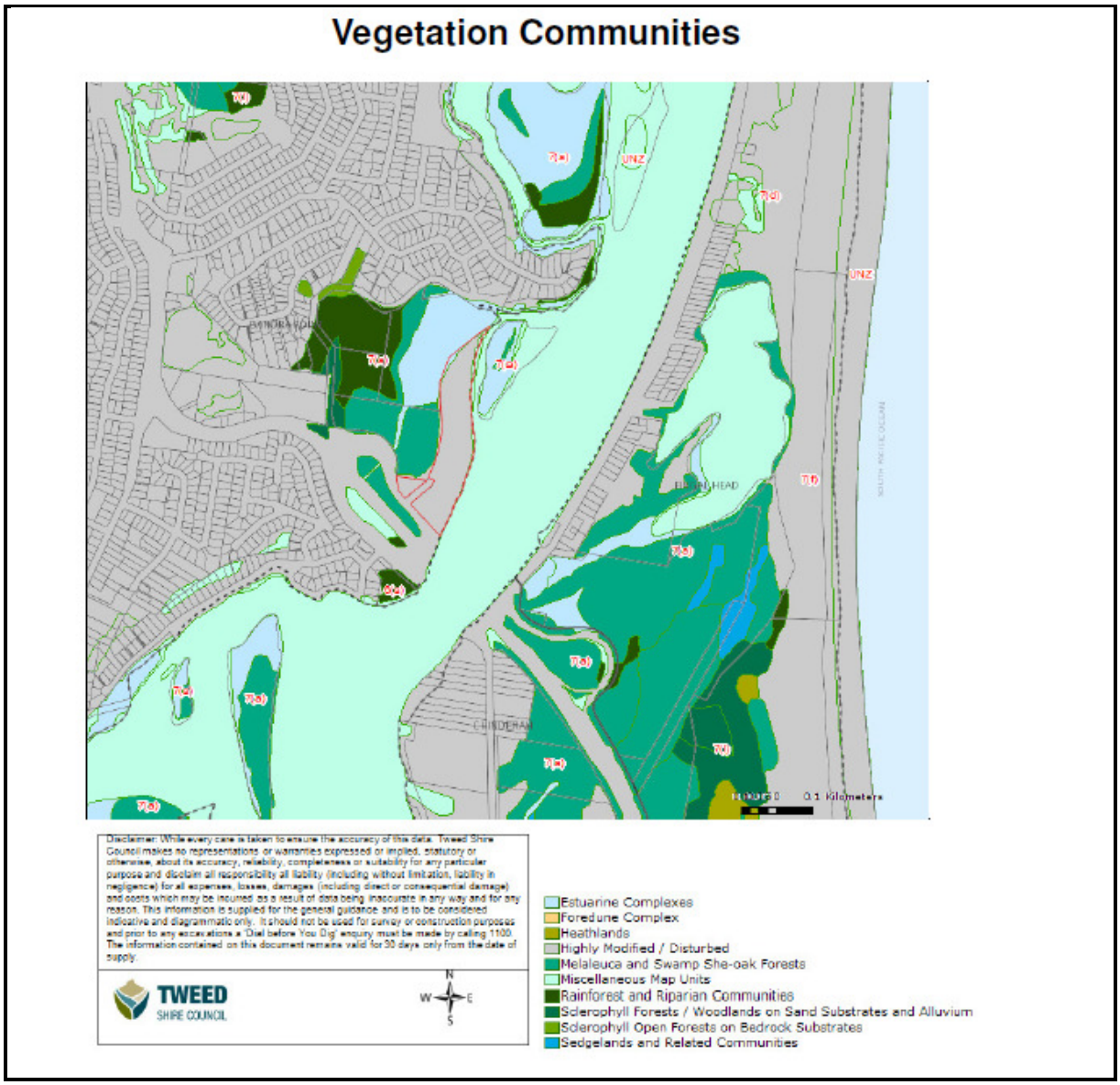


Figure 2 – Vegetation communities as shown on Tweed Shire Council mapping are considered to be reasonably accurate showing forested wetland (aqua) is located in pockets that are separated and adjacent to rainforest (dark green) and estuarine communities (light blue) which are not considered to be a hazard.

Figure 3 – Aerial photograph of site

'For exceptional circumstances to apply the follow principles should be demonstrated:

- *The existing form of development will obtain a better bush fire risk outcome than if the development did not proceed (e.g. through increased construction standards);*
- *The building line should be no closer to that hazard than neighbouring properties;*
- *The extensions should be no closer to the hazard than neighbouring properties;*
- *The proposal is an infill arrangement and site constraints do not allow APZ requirements to be met.*

The existing form of development will obtain a better bush fire risk outcome than if the development did not proceed (e.g. through increased construction standards)

The following points are made to demonstrate that the existing form of development will obtain a better bushfire risk outcome than if the development did not proceed.

- The alternate solution is provided within this report to demonstrate that the future buildings will limit the risk of ignition in a bushfire event with a high level of redundancy as outlined.

- The previously approved flame zone dwellings that are currently under constructed being sites 1 – 14 will be upgraded to be provided with bushfire shutters that comply with AS 1530.8.2 rather than the approved metal shutters.

- The previously approved flame zone dwellings on sites (now identified as 73 – 76) are not constructed and will be required to comply with BAL FZ rather than the approved flame zone construction requirements prior to AS 3959-2009 thereby creating a more resilient building from a quantification position. It is noted that the number of flame zone dwellings in the locations of 73-76 have been reduced from 7 to 4 sites since the last 2009 bushfire report prepared by this office.
- The approved 2m high metal radiant heat shield will be replaced with a 3m high concrete tilt wall having an FRL of at least 30/30/30.
- The dwellings will be restricted to one storey dwelling with the eave height not exceeding 2.5m.
- An additional 3m APZ will be provided adjacent to the entire northwest boundary creating a total APZ of 6m rather than the existing 3m.
- Access to the hazard will be formalised with an easement with two entry points (not currently available) being provided to the west and east to enable emergency vehicles to egress in a forward direction. This will increase the effectiveness of fire brigade intervention.
- The site density will decrease from currently approved 112 sites to 110 sites.

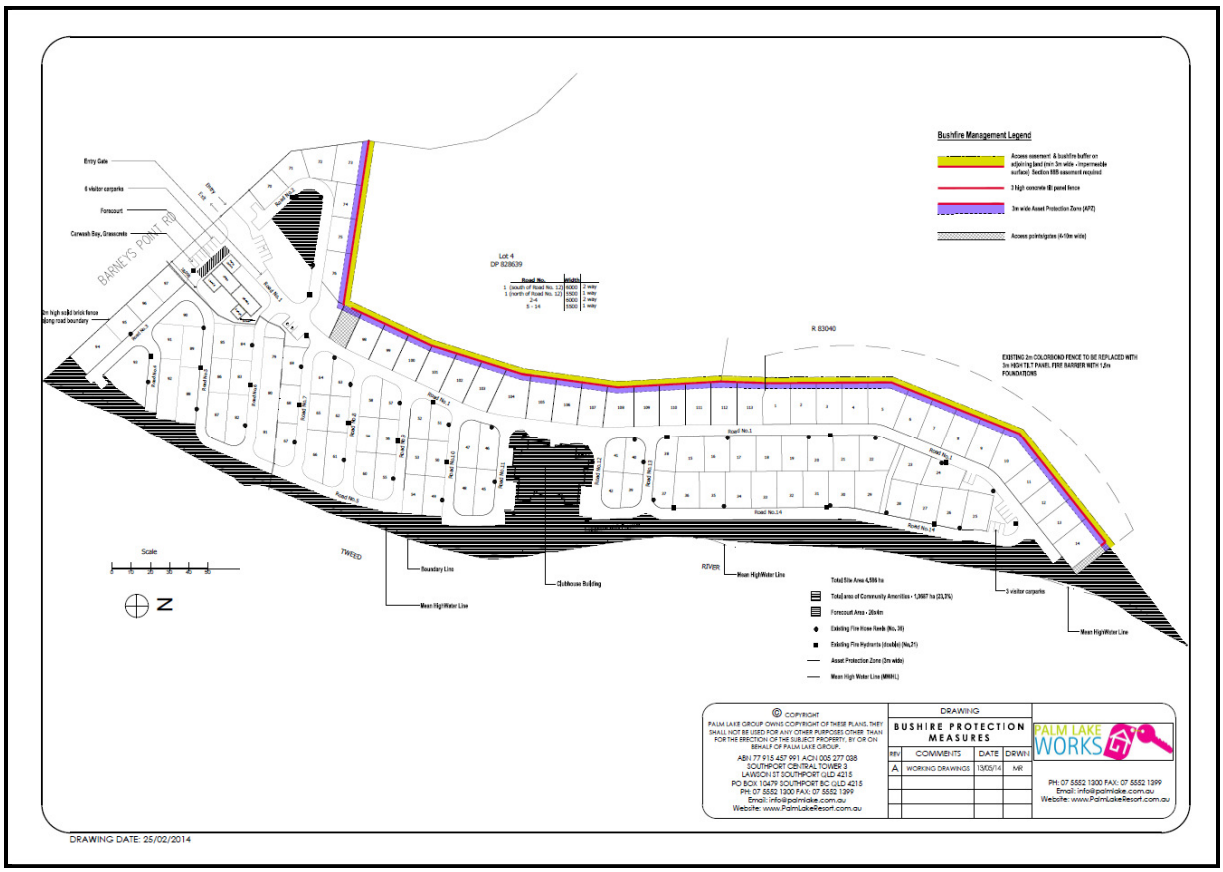


Figure 4 – Proposed 3m high concrete wall (red line), 3m APZ as an easement on adjoining property (yellow) and 3m APZ on subject property (blue)

The building line should be no closer to that hazard than neighbouring properties

The building lines are not closer to the hazard than the existing approved building lines of 3m. The proposed future application for dwellings will in fact have an additional 3m provided by way of an easement on the adjoining land to the northwest.

The extensions should be no closer to the hazard than neighbouring properties

The building lines are not closer to the hazard than the existing approved building lines of 3m. The proposed future application for dwellings will in fact have an additional 3m provided by way of an easement on the adjoining land to the northwest.

The proposal is an infill arrangement and site constraints do not allow APZ requirements to be met.

Previous section has demonstrated compliance with this objective.

4.0 BUSHFIRE THREAT ASSESSMENT

The bushfire hazard to the northwest is a combination of She-oak forest, rainforest and estuarine complexes as identified in the Tweed Shire Council vegetation mapping. The inspection established that the mapping is correct.

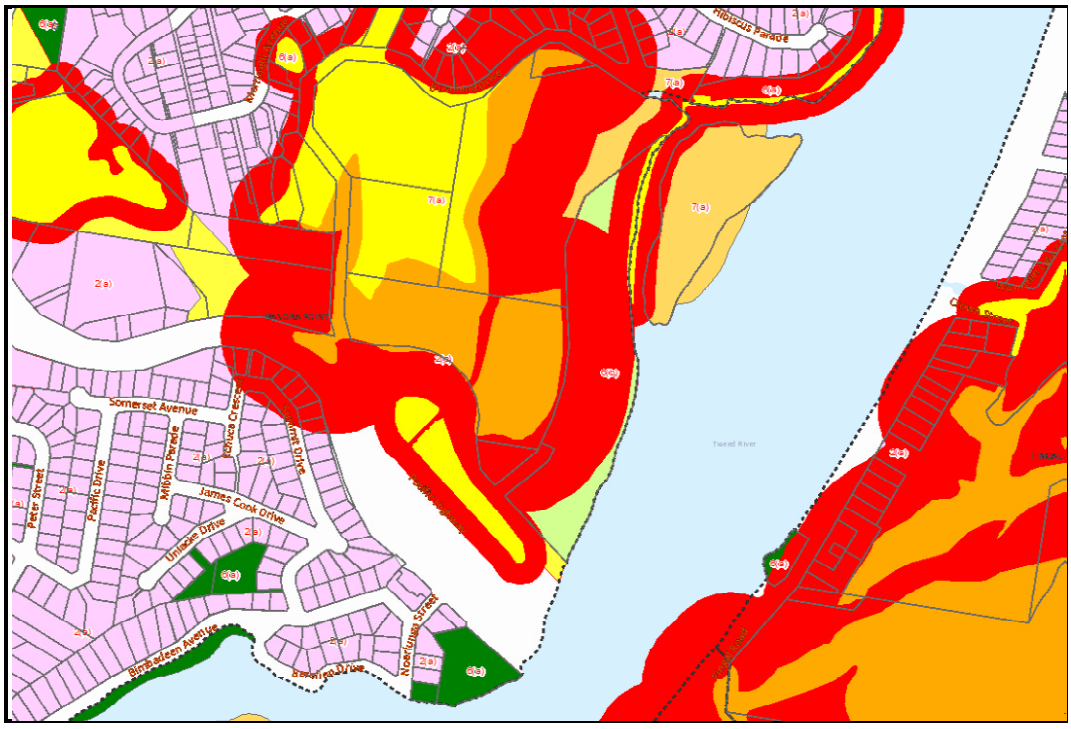


Figure 5 – Tweed Shire Council bushfire prone land map.

Fuel load assessments considering surface, elevated and bark fuels were undertaken at three representative locations pertaining to the bushfire hazard and the proposed area for rezoning with the results as shown in the following tables overpage. Whilst the revised AS 3959-2009 standards classify this vegetation type as forest with a fuel loading of 35t/ha, generally indicative of wet sclerophyll forest and some open forest locations, the bushfire threat assessment will consider the specific vegetation classification and the current and likely fuel loadings in order to determine the appropriate asset protection zone and construction standard pursuant to AS 3959-2009.

It is noted that one of the fuel load indices, bark on trees or "bark (in situ)", is also a significant contributor to fuel load (Gill and Zylstra 2005) although it is significantly more of a contributor to fuel load in some southern states such as Victoria than elsewhere in Australia such as South-east Queensland (Tran 2002). Considering the proximity of the subject property to south-east Queensland (approx. 15km), Tran (2002) is considered relevant as a redundancy to the assessment with regard to the treatment of bark in situ in this report.

Fire History

The site inspection revealed that there were no obvious signs of fire within the vegetated area to the northwest.

The fire history is an important consideration as forest fuels of various types have been found to usually increase to a quasi-equilibrium fuel load as a function of 'time since fire' (Raison et al. 1983). The study and site inspection establishes that the fuel loadings undertaken for this report were at or close to a 100% accumulation rate, it being acknowledged that accumulation rates can fluctuate throughout seasons and therefore an added level of redundancy is built into the final findings.

Chatto (1996) states in the Chiltern Regional Park Fuel Hazard study that Hutson and Veitch (1985) comment that high accumulation rates, correlating with rainfall, for Blackbutt, with decomposition rate constant value of 0.68 yr^{-1}. For eucalypt forests Walker (1981) comments that high decomposition rates, which is generally applicable in Far North Coast of NSW where annual rainfall is 1200 – 1500mm annually, establishes that a maximum fuel accumulation is achieved within 10 years of a fire. Raison et al (1983) found that fine fuel levels reached a maximum fuel accumulation rate in less than 4 years.

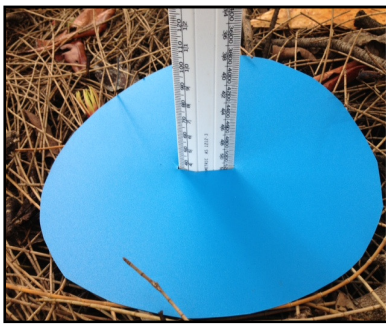
It is considered that it is reasonable to conclude that the maximum fuel accumulation rate or near maximum accumulation rate has occurred given there are no known fires for at least the past 10 years prior to the fuel load sampling conducted in this report.

Overall Fuel Hazard Assessment

The fuel load assessment has been undertaken in line with the Overall Fuel Hazard Guide (Department of Sustainability and Environment Third Edition 1999 – Reprint 2009). Five measurements are averaged to arrive to the final surface fuel load.

Table 1: Fuel Load Estimate (Location 1) – She oak forest

Layer	Description	Rating (low. medium, high)	Equivalent Fuel Load (t/ha)
Surface	Five measurements were undertaken and ranged from 25 – 30mm.	High	10t/ha
Near surface	Grasses approx 400mm in height	High	3t/ha
Elevated	Moderately easy to choose a path through bur brush against vegetation most of the time.	High	3t/ha
Bark (in situ)	Tight bark minimal loose bark	Moderate	1t/ha
			Total 17t/ha



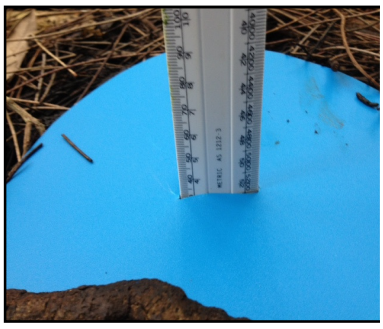


Table 2: Fuel Load Estimate (Location 2) – rainforest she oak forest

Layer	Description	Rating (low. medium, high)	Equivalent Fuel Load (t/ha)
Surface	Five measurements were undertaken and ranged from 25 – 30mm.	High	10t/ha
Near surface	Gaps throughout where near surface fuels are absent	Moderate	2t/ha
Elevated	Easy to choose a path through brush against vegetation occasionally	Moderate	2t/ha
Bark (in situ)	Tight bark minimal loose bark	Moderate	1t/ha
			Total 15t/ha

Table 3: Fuel Load Estimate (Location 3) - Rainforest

Layer	Description	Rating (low. medium, high)	Equivalent Fuel Load (t/ha)
Surface	Five measurements were undertaken and ranged from 25 – 30mm.	High	8t/ha
Near surface	Gaps throughout where near surface fuels are absent	Moderate	2t/ha
Elevated	Easy to choose a path through brush against vegetation occasionally	Moderate	2t/ha
Bark (in situ)	Tight bark minimal loose bark	Low	0t/ha
			Total 12t/ha

Discussion

The fuel loading established that the overall fuel loading ranged from 12-17t/ha with an assessment that was undertaken with some conservatism. It is noted that Planning for Bushfire Protection 2006 identifies Forested Wetland as having a total fuel load of 20 t/ha and open forest having a total fuel load of 25t/ha. The Australian Standard AS 3959-2009 makes the following comment in relation to research undertaken by other states;

CB3 'The vegetation classification system in Section 2 and in this Appendix is based on a national system developed by R. Specht (Ref. 4). Some States and Territories have developed their own systems for vegetation classification, which may vary in extent or description to those provided herein.

For example, in NSW, a system has been established by D. Keith (Ref. 5) and fuel loads have been extensively research for that State. This may not be comparable to other States/Territories, which may have significantly different fuel loads or different descriptions for a similar vegetation classification.

Consultation with relevant fire authorities is import to establish any variations from the values provided in Table B2 below.'

In the above regard this report should be referred to the RFS for confirmation of the testing undertaken in this report. The tests clearly indicate that the fuel loading do not reach 35 t/ha as outlined in AS 3959-2009 for forest. However, the fuel loadings in Location 1 – She Oak Forest were generally consistent with the forested wetland classification and fuel loading in Planning for Bushfire Protection 2006 (PBP2006) currently used by Appendix 2 of PBP2006. The rainforest fuel loadings were generally consistent with AS 3959-2009 with 12t/ha and the area to the north identified as estuarine communities are not considered a hazard pursuant to Planning for Bushfire Protection 2006 or AS 3959-2009.

Further redundancy to the assessment is in the shape of the hazard and the communities within this area. The She Oak forest is to the north western area however is only located in an area of approximately 3ha with the majority of the hazard consisting of rainforest and estuarine communities.

The forested wetland adjacent to the proposed Class 1a residential dwellings will be 6m from the dwelling. As demonstrated, using the methodology of AS 3959-2009 and the fuel loadings for forested wetland pursuant to Appendix 2 Planning for Bushfire Protection 2006 which are consistent with the fuel loading on site, the flame length is forecast to be 11.76m.

The inclusion of a 3m high concrete fence will reduce the flame length by approximately 4m based on the 3m APZ on the forest side of the fence. In turn, the reduced flame length of

7.76m together with the 3m APZ adjacent to the dwelling will mean that potentially the dwelling will be exposed to 4.76m of the flame. This is not dissimilar to that permitted by AS 3959-2009 for BAL 40 construction.

A qualification however can be applied to demonstrate that the dwelling will receive negligible flame contact from a tilted flame and that any flame contact will occur at the roof only as shown in Figure 6. Also as shown in Figure 6 whilst the dwellings will be proposed to comply with the BALFZ AS 3959-2009 the levels of radiant heat below roof level are expected to be much less, it being noted that the concrete fence will have a likely Fire Resistance Level (FRL) of at least 30 minutes. A structural engineer will need to confirm the FRL of the wall and supports.

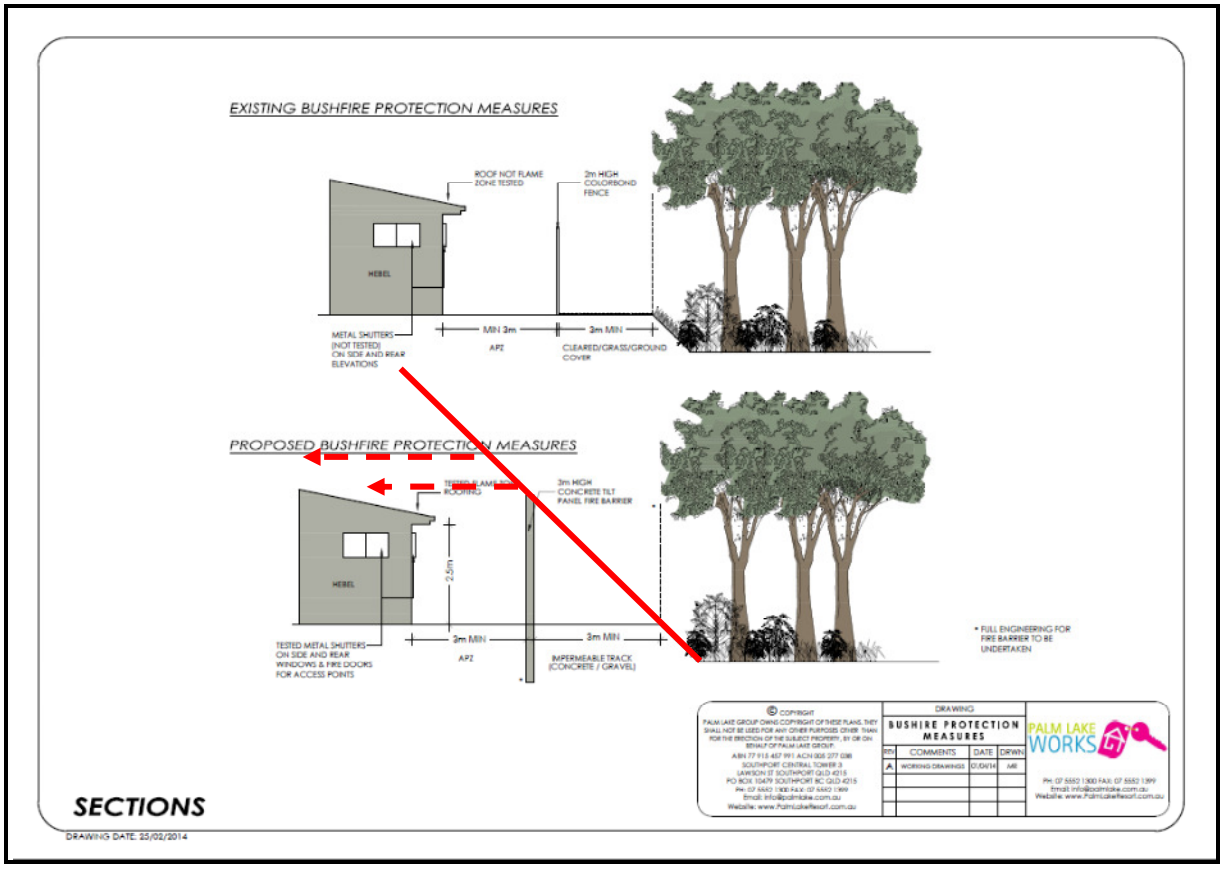


Figure 6 - qualifies that the 3m high concrete radiant heat shield will limit the flame contact to the building with potentially only intermittent flame contact to the roof when the upper section of the flame may be forced horizontal under high wind conditions.

In the above regard qualification is drawn to the "*Research and investigation into the performance of residential boundary fencing systems in bushfires" being a collaborative project between BlueScope Steel Limited and the Bushfire CRC dated April 2006*. The experiments identified that temperatures received on the opposite site of a colourbond

fence to the heat source was significantly reduced as shown in experiment No. 12 where the peak heat flux on the front face of the fencing being 63kW/m^2, whilst the back face was 4kW/m^2. It is noted that unlike a metal fence a concrete fence will have an FRL.

5.0 ALTERNATE SOLUTION – CONSTRUCTION STANDARDS

The alternate solution documents the findings of a bushfire engineering assessment carried out for the proposed dwelling. The application departs from the acceptable solution relating to construction standards specified AS 3959-2009 in that alternate solution establishes the construction standards based on qualification of the bushfire risk and fuel loadings together with the positive impact from a 3m high radiant heat shield.

All other aspects of the development shall comply with the acceptable solution requirements of Planning for Bushfire Protection 2006.

5.1 SCOPE AND ASSUMPTIONS

5.1.1 Scope

The scope of the alternate solution is limited to the departure from the acceptable solution requirements identified in this report.

The report provides recommendations that will reduce the risk of ignition to the building while the fire front passes however as documented:

> *"The goal of absolute safety during a bush fire event is not attainable and despite best effort there is the ever-present risk of personal injury or damage to property. Ultimately, it is the responsibility of the owner/occupier to comply with conditions of consent and to maintain systems designed to mitigate the impacts of bush fire."*

Should a change in proposed boundary or building envelope occur then the development will be needed to verify consistency with the analysis contained within the report.

5.1.2 Assumptions

The Asset Protection Zones will be managed and maintained in perpetuity in accordance with Planning for Bushfire Protection 2006 and reiterated with specific development consent conditions.

The dwellings when constructed will be a Class 1a pursuant to the Building Code of Australia 2014.

5.2 RELEVANT STAKE HOLDERS

- Tweed Shire Council (Consent Authority)
- NSW Rural Fire Service (referral)
- Palmlake (Owners)
- Bushfire Certifiers (Bushfire Consultants)

5.3 SITE DESCRIPTION

Identification of Vegetation Type, Slope and distance pursuant to Planning for Bushfire Protection 2006

The bushfire threat assessment in Section 4 of this report is provided for the alternate solution.

5.4 METHODOLOGY

The assessment method for the alternate solution is consistent with Part 1.0.9 – Assessment Methods in the Housing Provisions of the Building Code of Australia 2014. The report will be assessed in accordance with Part 1.0.9(b)(ii) by using a quantitative analysis consistent with Planning for Bushfire Protection 2006.

5.5 ALTERNATE SOLUTION

The accepted method of establishing the reduced radiant heat flux with the influence of the proposed shielding by a 3m high fence with an FRL of 30/30/30 has been adopted. In this regard the view factor of the shielding calculation has been calculated and subtracted from the view factor when calculated without the radiant heat shield. The flame length is reduced by the height of the proposed radiant heat shield. The methodology of Method 2 AS 3959-2009 has been used with the qualified fuel loading based on the minimal bushfire hazard.
The alternate solution also provides qualification on the likely radiant heat and flame contact with the effect of the 3m high masonry wall.

Fuel Load – As outlined in the bushfire assessment specific fuel loadings of the forested wetland is consistent with 20t/ha as per appendix 2 of PBP2006. This fuel loading will be

used it being noted that some of the interface is rainforest vegetation and estuarine communities.

3m high radiant heat shield – The study will demonstrate the reduction in flame length and radiant heat to the receiver (dwelling) by altering the view factor by excluding the lowest 3m of the forecast flame length. The overall flame length will be reduced by the height of the radiant heat shield.

The methodology adopted in formulating the alternative solution is based on that described in the *International Fire Engineering Guidelines 2005*. The Guidelines provide guidance for the design of alternate solutions for the BCA in order to establish an acceptable level of compliance with the relevant Performance Requirement.

5.6 DESIGN FIRES

The alternate solution will establish three design fires from the northwest of the site. The design fires will calculate the reduction in flame length and radiant heat flux with the construction of a 3m radiant heat shield partly along the boundary. The duration of extreme heat and flame contact would be relatively short given being approximate 2 – 5minutes however following the passing of the fire front the impact of ember and smoke attack can continue to impact the property and in this regard spot fires within the property can still form and be a source of ignition.

The assumptions and methodology have been set for each aspect. The methodology is to use the following formulas to establish the rate of spread, intensity and flame length using Byram formulas and establish the estimated radiant heat flux using the view factor methodology which is the same method used to determine the outcomes for the acceptable solutions pursuant to A2.2 of Planning for Bushfire Protection 2006 and AS 3959-2009.

Formulae used in calculations

R = 0.0012xFDIxWxexp(0.069xS)

I = HxWxR/36

Lf = (13R+0.24W)/2 (McArthur)

Lf = $0.0775*I^{0.46}$ (Byram)

View Factor (Tan 2005)

5.6.1 DESIGN FIRE NO. 1 – NORTHWEST WITHOUT RADIANT HEAT SHIELD

Design Fire No. 1 is undertaken to establish the radiant heat levels to the closest part of the wall of a future dwelling's northwest elevation having an APZ of 6m. The design fire will establish the predicted radiant heat received by the building without the 3m high radiant heat shield.

The fuel loading of 20t/ha will be used as discussed in the bushfire assessment. Further, this fuel loading is consistent with the surface fuels of forested wetland pursuant to Appendix 2 PBP2006. The FDI of 80 will be used however given the location to the coast and the Queensland border this is considered to be further redundancy.

NBC Bushfire Attack Assessment Report V2.0

AS3959 (2009) Appendix B - Detailed Method 2

Print Date: 15/06/2014 **Assessment Date:** 15/06/2014

Site Street Address:	Pacific Hwy Lot 10 DP 1190061, Banora
Assessor:	Peter Thornton; BCA Check Pty Ltd
Local Government Area:	Tweed
Alpine Area:	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Design Fire No. 1

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Level
Surface Fuel Load(t/ha):	15	**Overall Fuel Load(t/ha):**	20

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Upslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	6

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	FLAME ZONE	**Peak Elevation of Receiver(m):**	1.12
Level of Construction:	BAL FZ	**Fire Intensity(kW/m):**	14880
Radiant Heat(kW/m2):	67.35	**Flame Angle (degrees):**	11
Flame Length(m):	11.76	**Maximum View Factor:**	0.98
Rate Of Spread (km/h):	1.44	**Inner Protection Area(m):**	6
Transmissivity:	0.904	**Outer Protection Area(m):**	0

Figure 7 – Design Fire No. 1 without radiant heat shield

The view factor without the 3m high radiant heat shield will be .98.

5.6.2 DESIGN FIRE No. 2 – NORTHWEST RADIANT HEAT SHIELD

Design Fire No. 2 will establish the forecast view factor of the 3m high non-combustible heat shield along the northwest boundary. The view factor is established as being 0.25.

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Local Government Area:	Tweed
Alpine Area:	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Design Fire No. 2

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Level
Surface Fuel Load(t/ha):	4.03	**Overall Fuel Load(t/ha):**	4.03

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Upslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	6

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	MODERATE	**Peak Elevation of Receiver(m):**	1.45
Level of Construction:	BAL 19	**Fire Intensity(kW/m):**	806
Radiant Heat(kW/m2):	16.72	**Flame Angle (degrees):**	76
Flame Length(m):	3	**Maximum View Factor:**	0.25
Rate Of Spread (km/h):	0.39	**Inner Protection Area(m):**	6
Transmissivity:	0.881	**Outer Protection Area(m):**	0

Figure 8 – Design Fire No. 2 with northwest radiant heat shield (1)

The view factor for the design fire 1 without the radiant heat shield is .98 and the maximum view factor for the 3m height radiant heat shield is .25. The amended view factor for the final design fire with a 3m high radiant heat shield in place will be .73.

5.6.3 DESIGN FIRE No. 3 – NORTHWEST WITH RADIANT HEAT SHIELD – AMENDED VIEW FACTOR

NBC Bushfire Attack Assessment Report V2.0

AS3959 (2009) Appendix B - Detailed Method 2

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Site Street Address:	Pacific Hwy Lot 10 DP 1190061, Banora		
Assessor:	Peter Thornton; BCA Check Pty Ltd		
Local Government Area:	Tweed	**Alpine Area:**	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Design Fire No. 3

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Level
Surface Fuel Load(t/ha):	15	**Overall Fuel Load(t/ha):**	20

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Upslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	6

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	FLAME ZONE	**Peak Elevation of Receiver(m):**	1.12
Level of Construction:	BAL FZ	**Fire Intensity(kW/m):**	14880
Radiant Heat(kW/m2):	50.17	**Flame Angle (degrees):**	11
Flame Length(m):	11.76	**Maximum View Factor:**	0.73
Rate Of Spread (km/h):	1.44	**Inner Protection Area(m):**	6
Transmissivity:	0.904	**Outer Protection Area(m):**	0

Figure 9 – Design Fire No. 3 with northwest radiant heat shield included in final review.

5.7 ACCEPTANCE CRITERIA

The report will demonstrate using quantification and qualification methods to determine compliance with the performance criteria which states:

> *"It is demonstrated that the proposed building can withstand bush fire attack in the form of wind, smoke, embers, radiant heat and flame contact."*

5.8 DEFENDABLE SPACE

The building will have 6m of defendable space however the 3m high non-combustible fence will provide additional protection from radiant heat after the passing of the fire front.

5.9 ANALYSIS

Based on the proposed methodology the view factor is altered from .98 to .73 as a response to the impact that the 3m high radiant heat shield will have on a potential bushfire event from the northwest.

The flame length without the radiant heat shield is calculated as being 11.76m however this will be reduced by the height of the fence and therefore the revised flame length will be 7.76m in length with the building being located within the final 4.76m of flame. The qualification however showing the dwelling generally at the same height as the 3m wall will mean the roof may receive intermittent levels of flame contact.

The radiant heat level is calculated at approximately 50kW/m^2 to the closest exposed point of the dwelling being the roof however as previously discussed the radiant heat behind the wall is likely to be far less. Further, it is acknowledged that BCA Specification C1.1 Clause 2.1 – Exposure to fire-source features states;

'A part of a building element is exposed to a fire-source feature if any of the horizontal straight lines between that part and the fire-source feature, or vertical projection of the feature, is not obstructed by another part of the building that –

(iii) Has an FRL of not less than 30/-/-; and
(iv) Is neither transparent nor translucent.

In this regard the requirements for the future dwellings to be constructed to BAL FZ AS 3959-2009 is considered have high levels of redundancies.

The 3m high non-combustible fence having an FRL of at least 30/30/30 is to be constructed on the northwest boundary. The bottom of the fence is to be in direct contact with the finished ground level or plinth.

The applicant is proposing a roof system that will be tested to AS 1530.8.2 to resist flame contact and high level of radiant heat.

Further, the report will recommend specific levels of construction and flame zone construction requirements to reduce the risk of ignition to the dwellings to provide additional protection above that currently approved.

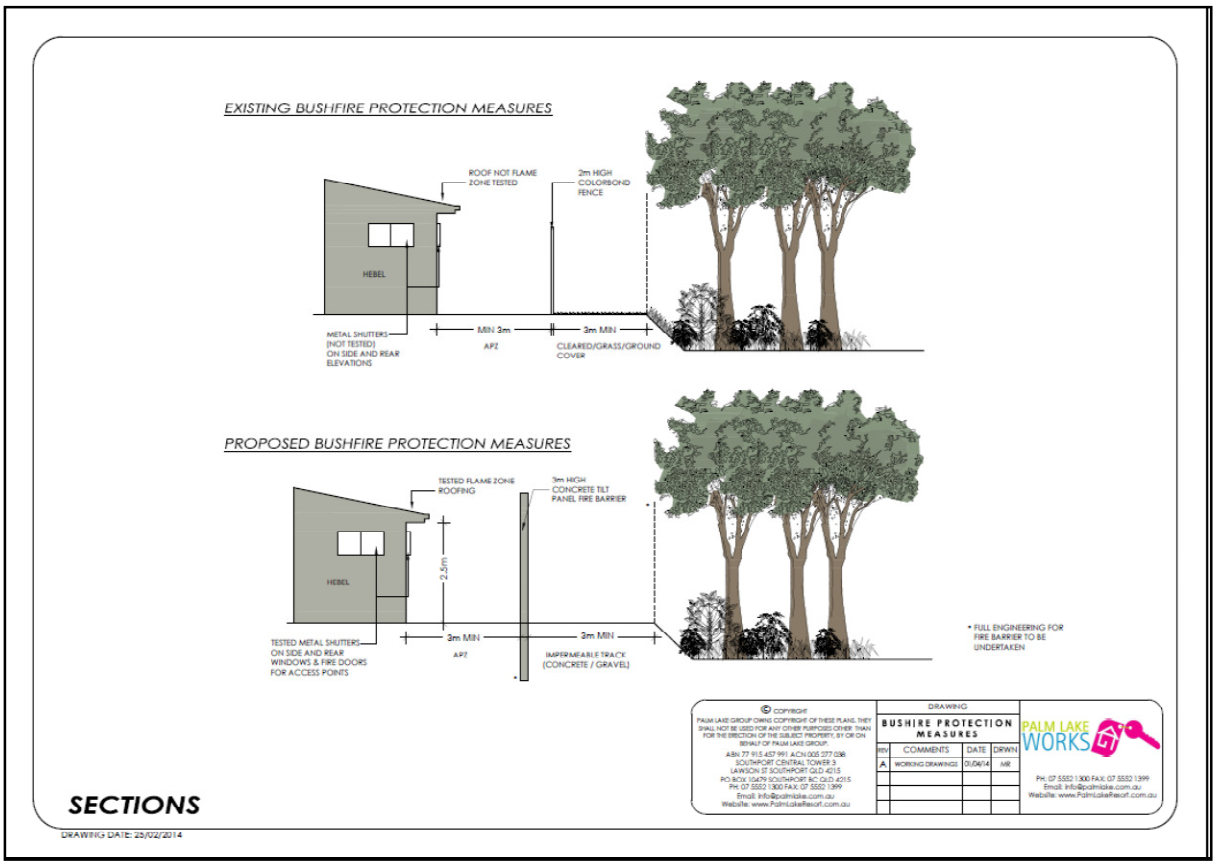


Figure 10 – Comparative analysis of approved radiant heat shield to that proposed.

6.0 ACCESS

Planning for Bushfire Protection 2006 identifies that it is of critical importance for adequate specification of the internal road system for Special Fire Protection Purposes primarily due to the higher densities associated with the development and occupant characteristics.

The internal road system has been previously approved with a Bush Fire Safety Authority (BFSA) and the proposed administration building is located adjacent to the internal road. In turn the internal road is considered adequate it being noted that confirmation will be required that a fire hydrant for the proposed building will be compliant with AS 2419.1-2005.

7.0 WATER AND UTILITY SERVICES

7.1 WATER SERVICES

Reticulated water will be provided to the buildings, it being noted that fire hydrants have been provided throughout the site. Confirmation will be required that a fire hydrant for the proposed building will be compliant with AS 2419.1-2005.

7.2 GAS SERVICES

Acceptable Solution	Comment
Reticulated or bottled gas installed and maintained in accordance with AS 1596 with metal piping used.	To comply if installed
Fixed gas cylinders to be kept clear of flammable material by a distance of 10m and shielded on the hazard side of the installation	To comply if installed
Gas cylinders close to the dwelling are to have the release valves directed away from the building and at least 2m from flammable material with connections to and from the gas cylinder being of metal.	To comply if installed
Polymer sheathed flexible gas supply lines to gas meters adjacent to the buildings are not used.	To comply if installed

7.3 ELECTRICITY SERVICES

Electrical transmission lines if required are to be placed underground.

8.0 LANDSCAPING

The majority of buildings adversely impacted upon in a bushfire event happen through ember attack and in this regard combustible material surrounding the building e.g. landscaping can play a significant part during the event. Adequate management of landscaping is critical to the survivability of an asset and for occupant safety during a bushfire.

It is recommended that landscaping within the recommended APZ be undertaken in accordance Appendix 5 of Planning for Bushfire Protection 2006 and managed and maintained for the life of the development.

9.0 EMERGENCY AND EVACUATION PLANNING

Emergency and evacuation planning is a critical measure for a Special Fire Protection Purpose to provide a higher level of co-ordination and safety for the occupants in a bushfire event. It is extremely important that the emergency plan is constantly monitored and amended when required and that an induction for new occupants be provided as part of the requirement of the emergency plan.

The following table outlines the requirements and comments, it being noted that the development is to fully comply with the acceptable solutions in consultation with the Rural Fire Service.

Performance Criteria	Acceptable Solutions	Comment
Intent may be achieved where:		
An Emergency and Evacuation Management Plan is approved by the relevant fire authority for the area	An emergency/evacuation plan is prepared consistent with the RFS Guidelines for the Preparation of Emergency/Evacuation Plan. Compliance with AS 3745-2002 'Emergency control organization and procedures for buildings, structures and workplaces' for residential accommodation'. NB: The developer should provide a copy of the above document to the local Bush Fire Management Committee for their information prior to the occupation of any accommodation of a SFPP.	To comply and to be approved prior to the issue of an occupation certificate.

Suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan	An Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedures Manual. Detailed plans of all Emergency Assembly Areas including "onsite" and "offsite" arrangements as stated in AS 3745-2002 are clearly displayed, and an annual (as a minimum) trial emergency evacuation is conducted.	To comply and to be approved prior to the issue of an occupation certificate.

An emergency evacuation procedure and detailed plans of all Emergency Assembly Areas (onsite and offsite) are to be prepared in accordance with the RFS Guidelines for the Preparation of Emergency/Evacuation Plan and AS 3745-2002. The emergency evacuation plan is to be submitted to the Rural Fire Service and approved prior to the occupation certificate occupation of the buildings. A copy of the approved document is to be provided to the local Bush Fire Management Committee for their information prior to occupation of the buildings.

10.0 CONCLUSION

This report has addressed all matters required for rezoning and has been through the bushfire engineering brief consultative process with the NSW RFS. This report is to be referred to the NSW RFS for consent.

Disclaimer

This report was prepared for the purposes and exclusive use of the stated client to accompany a submission of a rezoning application of the subject property for future residential Class 1a dwellings only, and is not to be used for any other purpose or by any other person or Corporation. BCA Check Pty Ltd accepts no responsibility for any loss or damage suffered howsoever arising to any person or Corporation who may use or rely on this report in contravention of the terms of this clause.

Reporting has been based on the relevant Council and Rural Fire Service Guidelines; however, recommendations given in this report are based on our site investigation at the time of reporting. In some cases site conditions may change dramatically within a few years due to rapid vegetation re-growth and invading weed species.

References:

NSW Rural Fire Service and Planning NSW (2006), *Planning for bushfire protection, A guide for councils planners fire authorities developers and homeowners.* Rural Fire Service NSW Australia.

Standards Australia, (2009), AS3959 *Construction of buildings in bushfire prone areas,* Australian Standards, Sydney.

Legislation:

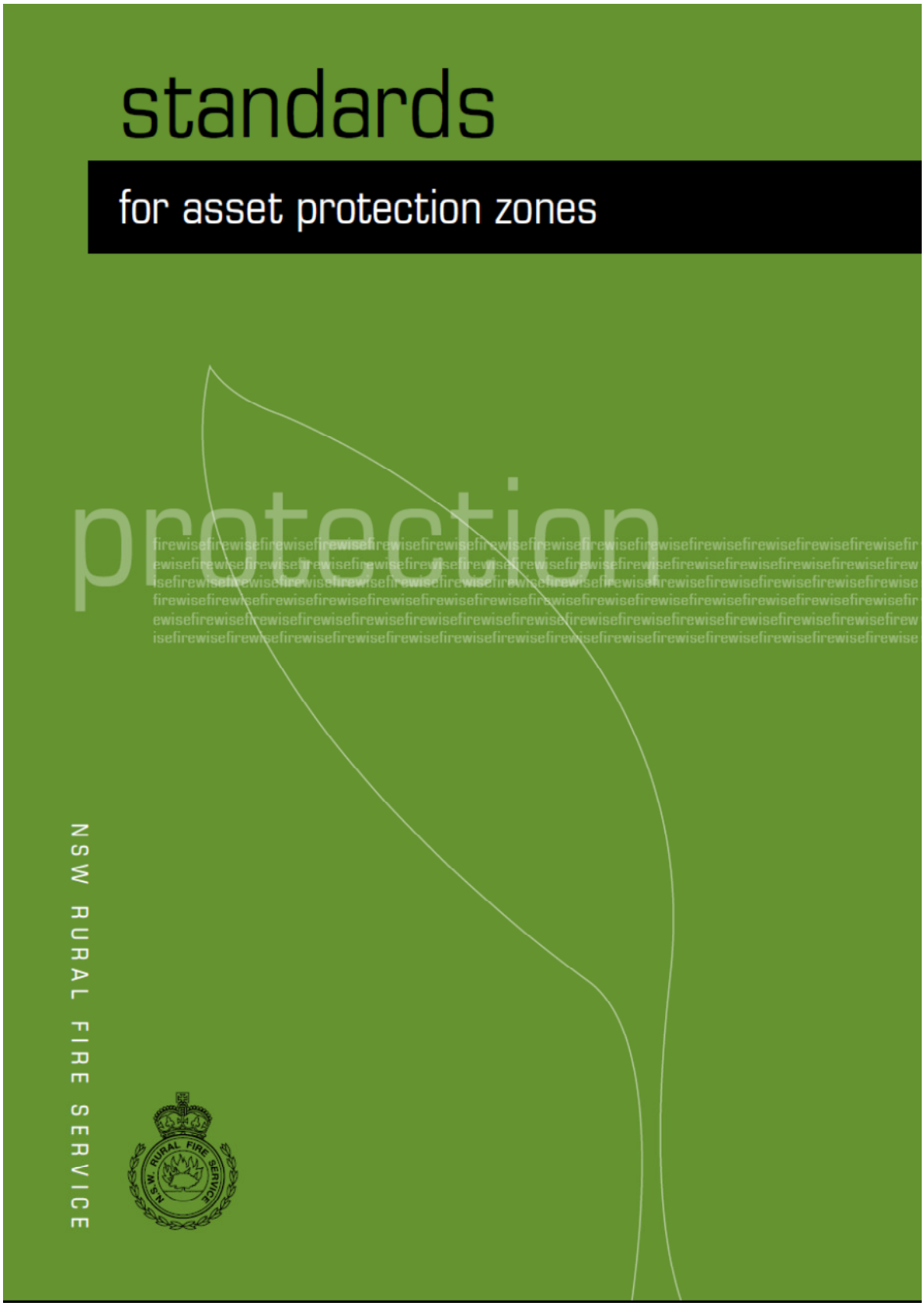
Environmental Planning and Assessment Act 1979 and Regulations 2000. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.

Rural Fires Act 1997. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.

Rural Fires Regulation 2002. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.

APPENDIX A

Standards for Asset Protection Zones (RFS 2005)


standards
for asset protection zones
protection
NSW RURAL FIRE SERVICE

STANDARDS FOR ASSET PROTECTION ZONES

INTRODUCTION

For thousands of years bush fires have been a natural part of the Australian landscape. They are inevitable and essential, as many Australian plants and animals have adapted to fire as part of their life cycle.

In recent years developments in bushland areas have increased the risk of bush fires harming people and their homes and property. But landowners can significantly reduce the impact of bush fires on their property by identifying and minimising bush fire hazards. There are a number of ways to reduce the level of hazard to your property, but one of the most important is the creation and maintenance of an Asset Protection Zone (APZ).

A well located and maintained APZ should be used in conjunction with other preparations such as good property maintenance, appropriate building materials and developing a family action plan.

WHAT IS AN ASSET PROTECTION ZONE?

An Asset Protection Zone (APZ) is a fuel reduced area surrounding a built asset or structure. This can include any residential building or major building such as farm and machinery sheds, or industrial, commercial or heritage buildings.

An APZ provides:

- a buffer zone between a bush fire hazard and an asset;
- an area of reduced bush fire fuel that allows suppression of fire;
- an area from which backburning may be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.

Potential bush fire fuels should be minimised within an APZ. This is so that the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy.

WHAT WILL THE APZ DO?

An APZ, if designed correctly and maintained regularly, will reduce the risk of:

- direct flame contact on the asset;
- damage to the built asset from intense radiant heat; and
- ember attack on the asset.

WHERE SHOULD I PUT AN APZ?

An APZ is located between an asset and a bush fire hazard.

The APZ should be located wholly within your land. You cannot undertake any clearing of vegetation on a neighbour's property, including National Park estate, Crown land or land under the management of your local council, unless you have written approval.

If you believe that the land adjacent to your property is a bush fire hazard and should be part of an APZ, you can have the matter investigated by contacting the NSW Rural Fire Service (RFS).

There are six steps to creating and maintaining an APZ. These are:

1. Determine if an APZ is required;
2. Determine what approvals are required for constructing your APZ;
3. Determine the APZ width required;
4. Determine what hazard reduction method is required to reduce bush fire fuel in your APZ;
5. Take measures to prevent soil erosion in your APZ; and
6. Landscape and regularly monitor in your APZ for fuel regrowth.

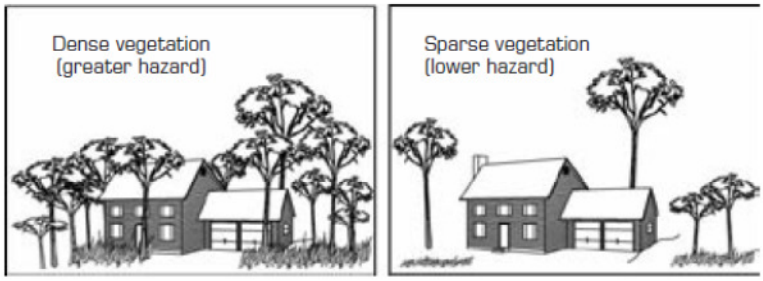
STEP 1. DETERMINE IF AN APZ IS REQUIRED

Recognising that a bush fire hazard exists is the first step in developing an APZ for your property.

If you have vegetation close to your asset and you live in a bush fire prone or high risk area, you should consider creating and maintaining an APZ.

Generally, the more flammable and dense the vegetation, the greater the hazard will be. However, the hazard potential is also influenced by factors such as slope.

- A large area of continuous vegetation on sloping land may increase the potential bush fire hazard.
- The amount of vegetation around a house will influence the intensity and severity of a bush fire.
- The higher the available fuel the more intense a fire will be.



Isolated areas of vegetation are generally not a bush fire hazard, as they are not large enough to produce fire of an intensity that will threaten dwellings.

This includes:

- bushland areas of less than one hectare that are isolated from large bushland areas; and
- narrow strips of vegetation along road and river corridors.

If you are not sure if there is a bush fire hazard in or around your property, contact your local NSW Rural Fire Service Fire Control Centre or your local council for advice.

STEP 2. DETERMINE WHAT APPROVALS ARE REQUIRED FOR CONSTRUCTING YOUR APZ

If you intend to undertake bush fire hazard reduction works to create or maintain an APZ you must gain the written consent of the landowner.

Subdivided land or construction of a new dwelling
If you are constructing an APZ for a new dwelling you will need to comply with the requirements in *Planning for Bushfire Protection*. Any approvals required will have to be obtained as part of the Development Application process.

Existing asset
If you wish to create or maintain an APZ for an existing structure you may need to obtain an environmental approval. The RFS offers a free environmental assessment and certificate issuing service for essential hazard reduction works. For more information see the RFS document *Application Instructions for a Bush Fire Hazard Reduction Certificate* or contact your local RFS Fire Control Centre to determine if you can use this approval process.

Bear in mind that all work undertaken must be consistent with any existing land management agreements (e.g. a conservation agreement, or property vegetation plan) entered into by the property owner.

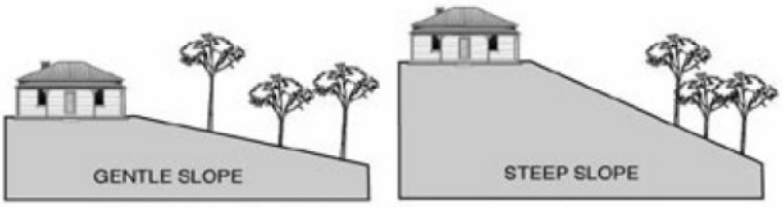
If your current development consent provides for an APZ, you do not need further approvals for works that are consistent with this consent.

If you intend to burn off to reduce fuel levels on your property you may also need to obtain a Fire Permit through the RFS or NSW Fire Brigades. See the RFS document *Before You Light That Fire* for an explanation of when a permit is required.

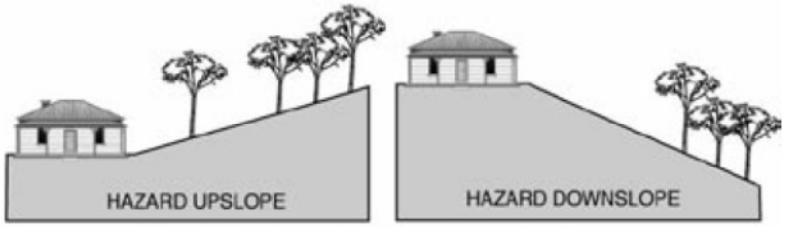
STEP 3. DETERMINE THE APZ WIDTH

The size of the APZ required around your asset depends on the nature of the asset, the slope of the area, the type and structure of nearby vegetation and whether the vegetation is managed.

Fires burn faster uphill than downhill, so the APZ will need to be larger if the hazard is downslope of the asset.



Gentle slopes require a smaller APZ distance than steep slopes



A hazard downslope will require a greater APZ distance then a hazard upslope of the asset

Different types of vegetation (for example, forests, rainforests, woodlands, grasslands) behave differently during a bush fire. For example, a forest with shrubby understorey is likely to result in a higher intensity fire than a woodland with a grassy understorey and would therefore require a greater APZ width.

A key benefit of an APZ is that it reduces radiant heat and the potential for direct flame contact on homes and other buildings. Residential dwellings require a wider APZ than sheds or stockyards because the dwelling is more likely to be used as a refuge during bush fire.

Subdivided land or construction of a new dwelling
If you are constructing a new asset, the principles of *Planning for Bushfire Protection* should be applied. Your Development Application approval will detail the exact APZ distance required.

Existing asset
If you wish to create an APZ around an existing asset and you require environmental approval, the Bush Fire Environmental Assessment Code provides a streamlined assessment process. Your Bush Fire Hazard Reduction Certificate (or alternate environmental approval) will specify the maximum APZ width allowed.

For further information on APZ widths see *Planning for Bushfire Protection* or the *Bush Fire Environmental Assessment Code* (available on the RFS website), or contact your local RFS Fire Control Centre.

STEP 4. DETERMINE WHAT HAZARD REDUCTION METHOD IS REQUIRED TO REDUCE BUSH FIRE FUEL IN YOUR APZ

The intensity of bush fires can be greatly reduced where there is little to no available fuel for burning. In order to control bush fire fuels you can reduce, remove or change the state of the fuel through several means.

Reduction of fuel does not require removal of all vegetation, which would cause environmental damage. Also, trees and plants can provide you with some bush fire protection from strong winds, intense heat and flying embers (by filtering embers) and changing wind patterns. Some ground cover is also needed to prevent soil erosion.

Fuels can be controlled by:

1. 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.

2. mowing or grazing of grass
Grass needs to be kept short and, where possible, green.

3. 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.

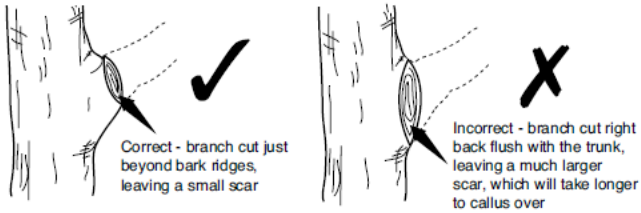
When choosing plants for removal, the following basic rules should be followed:

1. Remove noxious and environmental weeds first. Your local council can provide you with a list of environmental weeds or 'undesirable species'. Alternatively, a list of noxious weeds can be obtained at **www.agric.nsw.gov.au/noxweed/;**
2. Remove more flammable species such as those with rough, flaky or stringy bark; and
3 Remove or thin understorey plants, trees and shrubs less than three metres in height

The removal of significant native species should be avoided.

Prune in acordance with the following standards:

- Use sharp tools. These will enable clean cuts and will minimise damage to the tree.
- Decide which branches are to be removed before commencing work. Ensure that you maintain a balanced, natural distribution of foliage and branches.
- Remove only what is necessary.
- Cut branches just beyond bark ridges, leaving a small scar.
- Remove smaller branches and deadwood first.



There are three primary methods of pruning trees in APZs:

1. Crown lifting (skirting)
Remove the lowest branches (up to two metres from the ground). Crown lifting may inhibit the transfer of fire between the ground fuel and the tree canopy.

2. Thinning
Remove smaller secondary branches whilst retaining the main structural branches of the tree. Thinning may minimise the intensity of a fire.

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3. Selective pruning
Remove branches that are specifically identified as creating a bush fire hazard (such as those overhanging assets or those which create a continuous tree canopy). Selective pruning can be used to prevent direct flame contact between trees and assets.

Your Bush Fire Hazard Reduction Certificate or local council may restrict the amount or method of pruning allowed in your APZ.

See the *Australian Standard 4373 (Pruning of Amenity Trees)* for more information on tree pruning.

4. Slashing and trittering
Slashing and trittering are economical methods of fuel reduction for large APZs that have good access. However, these methods may leave large amounts of slashed fuels (grass clippings etc) which, when dry, may become a fire hazard. For slashing or trittering to be effective, the cut material must be removed or allowed to decompose well before summer starts.

If clippings are removed, dispose of them in a green waste bin if available or compost on site (dumping clippings in the bush is illegal and it increases the bush fire hazard on your or your neighbour's property).

Although slashing and trittering are effective in inhibiting the growth of weeds, it is preferable that weeds are completely removed.

Care must be taken not to leave sharp stakes and stumps that may be a safety hazard.

5. Ploughing and grading
Ploughing and grading can produce effective firebreaks. However, in areas where this method is applied, frequent maintenance may be required to minimise the potential for erosion. Loose soil from ploughed or graded ground may erode in steep areas, particularly where there is high rainfall and strong winds.

6. Burning (hazard reduction burning)
Hazard reduction burning is a method of removing ground litter and fine fuels by fire. Hazard reduction burning of vegetation is often used by land management agencies for broad area bush fire control, or to provide a fuel reduced buffer around urban areas.

Any hazard reduction burning, including pile burns, must be planned carefully and carried out with extreme caution under correct weather conditions. Otherwise there is a real danger that the fire will become out of control. More bush fires result from escaped burning off work than from any other single cause.

It is YOUR responsibility to contain any fire lit on your property. If the fire escapes your property boundaries you may be liable for the damage it causes.

Hazard reduction burns must therefore be carefully planned to ensure that they are safe, controlled, effective and environmentally sound. There are many factors that need to be considered in a burn plan. These include smoke control, scorch height, frequency of burning and cut off points (or control lines) for the fire. For further information see the RFS document *Standards for Low Intensity Bush Fire Hazard Reduction Burning*, or contact your local RFS for advice.

7. Burning (pile burning)
In some cases, where fuel removal is impractical due to the terrain, or where material cannot be disposed of by the normal garbage collection or composted on site, you may use pile burning to dispose of material that has been removed in creating or maintaining an APZ.

For further information on pile burning, see the RFS document *Standards for Pile Burning*.

In areas where smoke regulations control burning in the open, you will need to obtain a Bush Fire Hazard Reduction Certificate or written approval from Council for burning. During the bush fire danger period a Fire Permit will also be required. See the RFS document *Before You Light that Fire* for further details.

STEP 5. TAKE MEASURES TO PREVENT SOIL EROSION

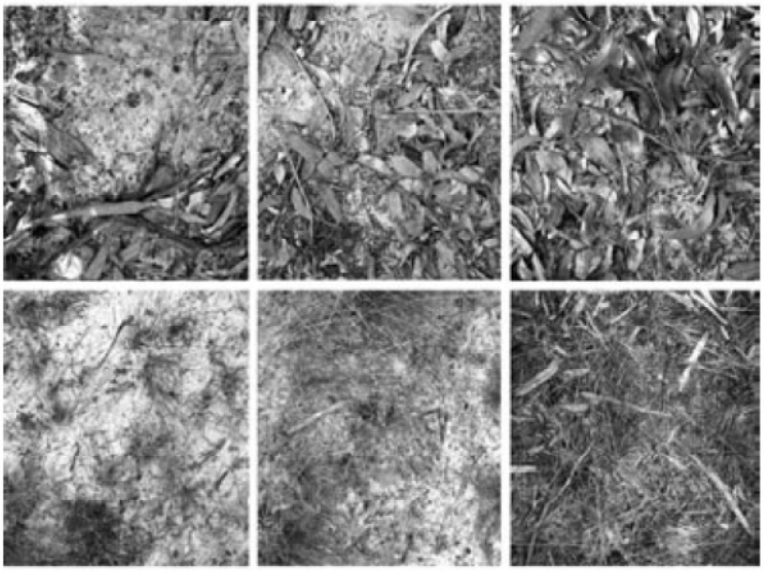
While the removal of fuel is necessary to reduce a bush fire hazard, you also need to consider soil stability, particularly on sloping areas.

Soil erosion can greatly reduce the quality of your land through:

- loss of top soil, nutrients, vegetation and seeds
- reduced soil structure, stability and quality
- blocking and polluting water courses and drainage lines

A small amount of ground cover can greatly improve soil stability and does not constitute a significant bush fire hazard. Ground cover includes any material which directly covers the soil surface such as vegetation, twigs, leaf litter, clippings or rocks. A permanent ground cover should be established (for example, short grass). This will provide an area that is easy to maintain and prevent soil erosion.

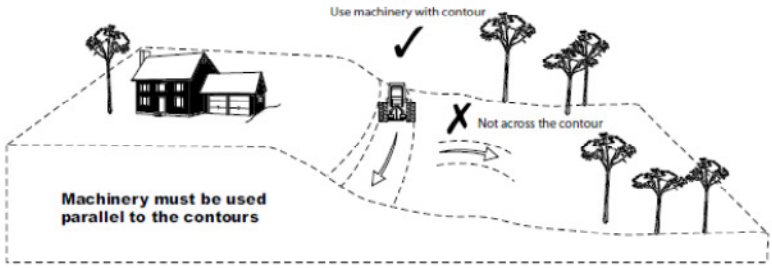
When using mechanical hazard reduction methods, you should retain a ground cover of at least 75% to prevent soil erosion. However, if your area is particularly susceptible to soil erosion, your Hazard Reduction Certificate may require that 90% ground cover be retained.



50% **75%** **100%**

Ground Cover

To reduce the incidence of soil erosion caused by the use of heavy machinery such as ploughs, dozers and graders, machinery must be used parallel to the contours. Vegetation should be allowed to regenerate, but be managed to maintain a low fuel load.

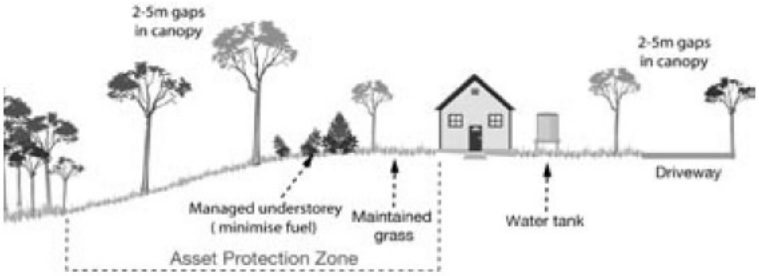


STEP 6. ONGOING MANAGEMENT AND LANDSCAPING

Your home and garden can blend with the natural environment and be landscaped to minimise the impact of fire at the same time. To provide an effective APZ, you need to plan the layout of your garden to include features such as fire resistant plants, radiant heat barriers and windbreaks.

Layout of gardens in an APZ
When creating and maintaining a garden that is part of an APZ you should:

- ensure that vegetation does not provide a continuous path to the house;
- remove all noxious and environmental weeds;
- 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;
- plant and maintain short green grass around the house as this will slow the fire and reduce fire intensity. Alternatively, provide non-flammable pathways directly around the dwelling;
- 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
- avoid erecting brush type fencing and planting "pencil pine" type trees next to buildings, as these are highly flammable.



Removal of other materials
Woodpiles, wooden sheds, combustible material, storage areas, large quantities of garden mulch, stacked flammable building materials etc. should be located away from the house. These items should preferably be located in a designated cleared location with no direct contact with bush fire hazard vegetation.

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Other protective features
You can also take advantage of existing or proposed protective features such as fire trails, gravel paths, rows of trees, dams, creeks, swimming pools, tennis courts and vegetable gardens as part of the property's APZ.

PLANTS FOR BUSH FIRE PRONE GARDENS

When designing your garden it is important to consider the type of plant species and their flammability as well as their placement and arrangement.

Given the right conditions, all plants will burn. However, some plants are less flammable than others.

Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage the ground fire to spread up to, and then through, the crown of the trees.

Plants that are less flammable, have the following features:

- high moisture content
- high levels of salt
- low volatile oil content of leaves
- smooth barks without "ribbons" hanging from branches or trunks; and
- dense crown and elevated branches.

When choosing less flammable plants, be sure not to introduce noxious or environmental weed species into your garden that can cause greater long-term environmental damage.

For further information on appropriate plant species for your locality, contact your local council, plant nurseries or plant society.

If you require information on how to care for fire damaged trees, refer to the Firewise brochure *Trees and Fire Resistance; Regeneration and care of fire damaged trees*.

WIND BREAKS

Rows of trees can provide a wind break to trap embers and flying debris that could otherwise reach the house or asset.

You need to be aware of local wind conditions associated with bush fires and position the wind break accordingly. Your local RFS Fire Control Centre can provide you with further advice.

When choosing trees and shrubs, make sure you seek advice as to their maximum height. Their height may vary depending on location of planting and local conditions. As a general rule, plant trees at the same distance away from the asset as their maximum height.

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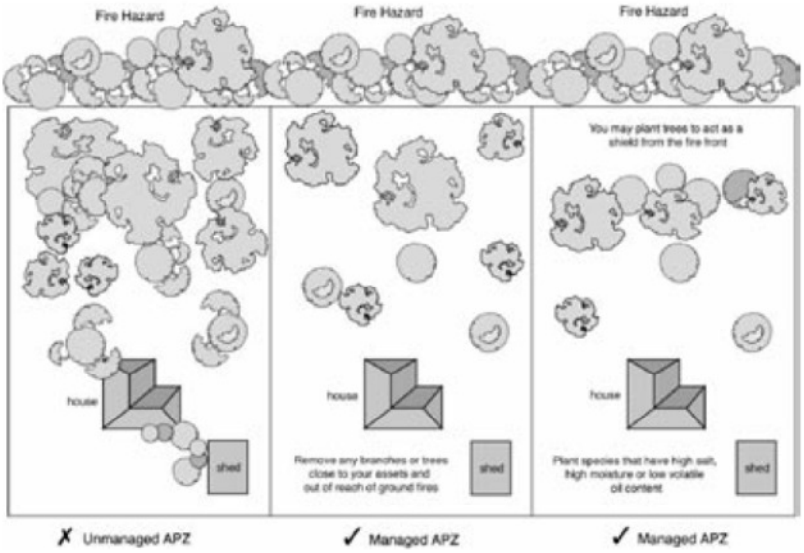
When creating a wind break, remember that the object is to slow the wind and to catch embers rather than trying to block the wind. In trying to block the wind, turbulence is created on both sides of the wind break making fire behaviour erratic.



HOW CAN I FIND OUT MORE?

The following documents are available from your local Fire Control Centre and from the NSW RFS website at **www.rfs.nsw.gov.au.**

- Before You Light That Fire
- Standards for Low Intensity Bush Fire Hazard Reduction Burning
- Standards for Pile Burning
- Application Instructions for a Bush Fire Hazard Reduction Certificate

If you require any further information please contact:

- your local NSW Rural Fire Service Fire Control Centre. Location details are available on the RFS website or
- call the NSW RFS Enquiry Line 1800 679 737 (Monday to Friday, 9am to 5pm), or
- the NSW RFS website at **www.rfs.nsw.gov.au.**

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