

FUEL MANAGEMENT PLAN

LOTS 9-12, PRECINCT 13

**ST PATRICKS ESTATE,
BOWER STREET, MANLY**

**NOVEMBER 2005
(REF. 5254FMP)**

FUEL MANAGEMENT PLAN

FOR

**LOTS 9-12, PRECINCT 13
ST PATRICKS ESTATE,
MANLY**

NOVEMBER 2005

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PREFACE

The subdivision of St Patricks Estate, Manly, has been identified by Manly City Council as requiring the preparation of a Fuel Management Plan for proposed Lots 9-12 of Precinct 13.

The preparation of this Fuel Management Plan draws together the recommendations provided in the previous report by Conacher Travers entitled '*Bushfire Protection Assessment*' (2003) for the subdivision.

It should be noted that the site-specific requirements for this report above that of similar Fuel Management Plans is the determination of the site as the habitat of the Long-nosed Bandicoot. The report endeavours to address both the preservation of viable habitat for the Bandicoots and to provide the necessary Bushfire Protection measures for the occupants of the Estate.

This Plan brings together various policies, guidelines and instructions relative to the fire management of the property and has been designed to be used as a constant reference by the current and future land managers.

The Plan aims to provide a suite of bushfire mitigation measures and to reduce the hazardous fuels that may accumulate over time within the Inner Protection Area and Fuel Managed Habitat Corridor of Lots 9-12, Precinct 13.

Present and future landholders are required to follow the recommendations outlined within this report to reduce the potential fire hazard within their property during fire events and to preserve the habitat requirements of the local Bandicoot population.

Any alteration or addition to the properties that might contravene the requirements or recommendations of either the Bushfire Protection Assessment or the Fuel Management Plan would necessitate the preparation of a supplementary Bushfire Protection Assessment.

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TABLE OF CONTENTS

	FUEL MANAGEMENT PLAN	
SECTION 1	INTRODUCTION	1
	1.1 Aim of the Plan	1
	1.2 Enforcement of Plan	1
	1.3 Location Map	1
	1.4 Fuel Managed Habitat Corridor	1
SECTION 2	BUSHFIRE MITIGATION MEASURES	2
SECTION 3	FUEL MANAGEMENT STRATEGIES	3
	3.1 Environment Management	3
	3.2 Fuel Management of the Site	3
	3.3 Frequency of Works	3
	3.4 Treatment Options	4
	3.5 Hazard Reduction Performance Standards	4
	3.6 Lessor / Lessee Responsibilities	4
SCHEDULE 1	Bushfire Protection Measures	
ANNEXURE 1	Lessor / Lessee Responsibility Demarcation Schedule	
APPENDIX 1	Details of Asset Protection Zones	

SECTION 1

INTRODUCTION

1.1 AIM OF PLAN

- (a) To preserve the habitat requirements of the local Long-nosed Bandicoot population.
- (b) To provide a suite of bushfire mitigation measures to the proposed residential dwellings of Lots 9-12, Precinct 13.
- (c) To reduce the hazardous fuels that may occur within the Fire Protection Zones of Lots 9-12, Precinct 13.
- (d) To maintain the integrity of the residual vegetation and aesthetics of the local area.

1.2 ENFORCEMENT OF PLAN

This plan will form part of a lease agreement over the title of Lots 9-12, Precinct 13. See demarcation schedule – Annexure 1.

1.3 LOCATION MAP

Refer to Schedule 1 of the Bushfire Protection Assessment for Lots 9-12, Precinct 13.

1.4 FUEL MANAGED HABITAT CORRIDOR

The 5 metre wide fuel managed habitat corridor should be fuel managed to an Outer Protection Area standard of 8 tonnes per hectare.

SECTION 2

BUSHFIRE MITIGATION MEASURES

The following is the recommended bushfire mitigation measures:

- (i) The dwellings should be sited outside of the asset protection zones identified in Schedule 1 – Plan of Bushfire Protection Measures of the Bushfire Protection Assessment completed by *Conacher Travers Pty Ltd*.
- (ii) Fuel managed asset protection zones should be provided to the proposed dwelling. Asset protection zones shall be measured from the extremities of the building as described below in Table 1.

Table 1

Aspect	Inner Protection Area (Fuel Free)	Outer Protection Area (Fuel Reduced)	Total Asset Protection Zone Width
South to Lots 9-12	5m	5m Fuel Managed Habitat Corridor	Approximately 10 metres

- (iii) Fuel management should be maintained by regular mowing or maintenance in accordance with the guidelines provided in Section 3.0 of this plan.
- (iv) The application of the Australian Standard AS3959 '*Construction of Buildings in Bush Fire Prone Areas*', in accordance with Part 2.3.4 of the '*Building Code of Australia*' should apply to the proposed dwellings within Lots 9-12.
- (v) Roof gutters and valleys should be leaf proofed by the installation of an external gutter protection shroud or a gutter system that denies all leaves from entering the gutter and building up on that gutter. Any material used in such a system should have a flammability index of no greater than 5 (as measured against AS 1530.2).
- (vi) It is the duty of the owner or occupier of land (lessee/ lessor of Lots 9-12, Precinct 13) to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bushfire on or from, that land (Section 63 (2) *Rural Fires Act*).
- (vii) The lessee/ lessor of Lots 9-12, Precinct 13 should obtain suitable NSW Rural Fire Service publications e.g. "*Guidelines for Asset Protection Zones*" available from the Rural Fire Service Head Office at Rosehill.

SECTION 3

FUEL MANAGEMENT STRATEGIES

3.1 ENVIRONMENTAL MANAGEMENT

Some activities associated with fuel management can have a long-term impact upon ecological systems. The NSW National Parks and Wildlife Service (NPWS) have identified the area as native wildlife habitat and provision has been made to support this habitat stipulation.

Therefore the application of fuel management strategies adjoining Lots 9-12, Precinct 13 should only be carried out in accordance with the Fuel Management Plan and guidelines issued by the NPWS.

A balance has to be established between fuel management and habitat preservation. The optimum fire protection in terms of ground fuels would remove any dry vegetative material before it accumulated, however the foraging strategies of the Bandicoots requires a developed layer of litter and humus as well as a low level of planting as shelter.

Whilst an initial figure can be placed on the suggested depth to weight ratio of the fuel bed, the practical considerations of preserving the Bandicoot population's habitat are such that professional environmental management would assume an adaptive management role with monitoring to ensure guidelines and recommendations suit the physical conditions affecting the site at the time of implementation. Variable factors such as unseasonable weather and the success/failure of planting regimes could dramatically alter the requirements of the site.

Standard measures such as the raised sections of fenceline for Bandicoot movement between sites would have to be preserved, as well as a stipulation that excluded domestic animals from the site. In addition, the species type, growth size and design of plantings should be preserved by successive property owners to ensure the clarity of the Bandicoot Habitat, whilst using fire retardant species in designated areas.

3.2 FUEL MANAGEMENT OF THE SITE

An initial depth to weight ratio for the fuel-bed of the planted Habitat Corridor should be in the order of 25-30mm of accumulated dry material. Maintenance of this area should involve actual measuring of the ground fuel layer to ensure this requirement and physical reduction by way of raking and removal of surplus material. This area should not be allowed to exceed 8 tonnes per hectare.

The landscaped areas adjoining the rear of Lots 9-12 should be maintained by hand or mechanical means to a level not exceeding 8 tonnes per hectare.

3.3 FREQUENCY OF WORKS

The hazard reduction works will be carried out in the asset protection zones according to the following preliminary schedule and is based on fire seasons and does not intend to inhibit the owner from taking a day-to-day management approach to the fuels. Refer Table 2.

Table 2 – Fire Seasons

Time	Elevated Fuels	Surface Fuels
August	✓	✓
November		✓
February		✓

Note: *Elevated fuels: e.g. Shrub/sapling/tree limbs*
Surface Fuels: e.g. Grasses, leaves, twigs and branches

3.4 TREATMENT OPTIONS

The fuel management treatment will be either through mechanical or physical means. Mechanical means includes the use of brush cutters, whipper snipper, push mower, slashers and lawnmowers but not the use of tracked dozers, excavators or similar.

3.5 HAZARD REDUCTION PERFORMANCE STANDARDS

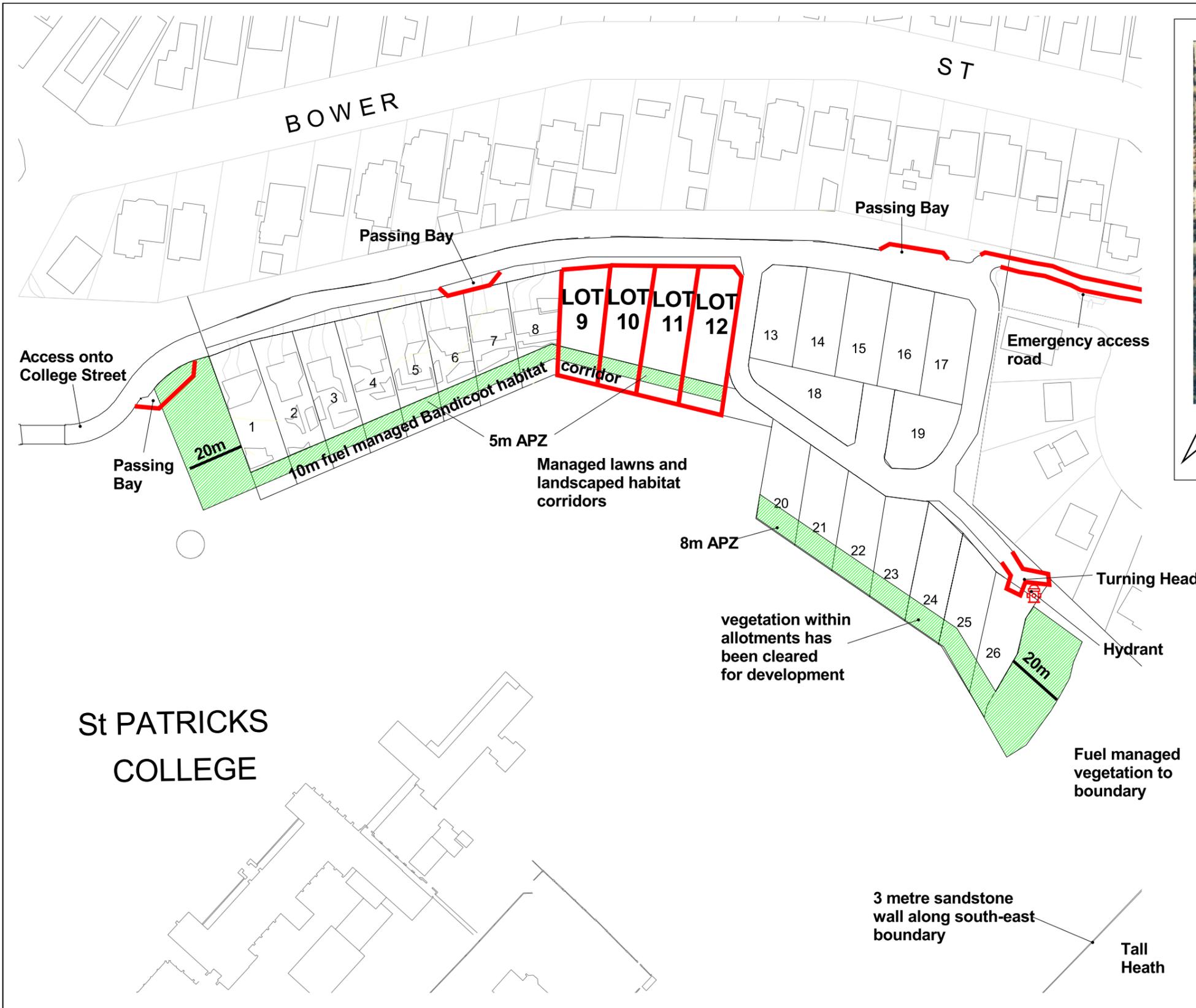
(a) Fuel Managed Asset Protection Zone

The prescriptions for these areas including the lawn and landscaped areas within the allotments have been individually detailed for each allotment (Lots 9-12) by landscape architects. The types of works that are required within this zone are in line with the following:

- (i) In general terms, no new trees are permitted, other than the designated native trees and selected plantings. (See Landscaping Plans by Oculus, Dwg No. DA-L10/A).
- (ii) Shrubs should be maintained to the requirements detailed in the Landscaping Plans.
- (iii) Cutting of all lawn areas to ensure 3t/ha fuel loading.
- (iv) Fuel material build-up should be managed as recommended in Section 3.0 above.

3.6 LESSOR / LESSEE RESPONSIBILITIES

The lessee and lessor are to follow the bushfire hazard mitigation measures outlined in this report in accordance with the responsibility demarcation schedule included in Annexure 4.



*Property boundary subject to final survey
 Source: DLWC 1:25,000 Aerial Photograph,

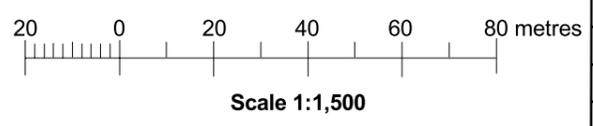
Legend

- Property Boundary
- Asset Protection Zone
- Hydrant

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Drawing No.	5254/S1	Date
Layout / Drawn by	MH	26/04/05
Amendment		Date
A		
B		
C		

**Schedule 1 -
 Bushfire Protection Measures
 Lots 9-12, St Patricks Estate**

Source: Surveyor, Engineers, Architects etc.

ANNEXURE 1

LESSOR / LESSEE RESPONSIBILITY DEMARCATION SCHEDULE

**FUEL MANAGEMENT PLAN
RESPONSIBILITY DEMARCATION SCHEDULE FOR BUSHFIRE MITIGATION MEASURES**

Item	Key Mitigation Measures	Responsibility	
		Lessor	Lessee
General			
1	The dwellings to be sited with the preferred building zone – see Schedule 1	X	
2	Fuel managed asset protection zones to be provided to the proposed dwelling	X	
3	Roof gutter & valleys to be installed with external gutter protection system	X	
4	Annual Inspections by accredited individual	X	
Inner Protection Zone			
5	Lawn areas to be maintained to a level not exceeding 25mm from mineral earth or > 3 tonnes per hectare		X
Outer Protection Zone			
6	Initial depth to weight ratio for the fuel-bed of the planted Habitat Corridor to the south of Lots 1-8 to be in the order of 25mm-30mm of accumulated dry material	X	
7	Maintain fuel bed of the planted Habitat Corridor so as not to exceed 8 tonnes per hectare	X	
8	No new trees are permitted (except where approved by relevant authority)		X

**APPENDIX 1 – DETAILS OF ASSET
PROTECTION ZONES**

APPENDIX 1 – DETAILS OF ASSET (FIRE) PROTECTION ZONES

1.0 INTRODUCTION

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.

The area in which the fuel reduction occurs is referred to as an Asset Protection Zone. Asset Protection Zones are areas that are usually shown on 'plans' adjacent to either cultural or natural assets (eg. dwelling, rainforest). They act to significantly lessen the impact of intense fire. The Asset Protection Zone can be further identified by two sub-zones.

Each has a specific role to play within an asset protection zone. These sub-zone areas are called the Inner Protection Area (Fuel Free Zone) and the Outer Protection Area (Fuel Reduced Zone). The sub-zones characterise the physical appearance of the landscape and in particular the way the combustible fuels shall appear after they are modified. (See Photos 1 - 6).

The Inner Protection Area is always located immediately adjacent to the asset/value at risk. The Outer Protection Area is located between the Inner Protection Area and the bushland.

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

Table 1 – Fuel Layers

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

2.0 INNER PROTECTION AREA (I.P.A)

This area is *almost free* of all fuels, it usually takes the form of grassy areas, car parks, roads, concrete areas, track or trails. It does not imply the wholesale removal of all or every tree - see Table 2 for guidelines on the extent of trees that can occur within this zone.

Rationale: By its very nature this zone is intended to stop the transmission of flame and reduce the transmission of radiated heat by the elimination of available fuel. Thus its Inner Protection Area name. This area also allows airborne embers to fall safely thus stopping further outbreaks of fire to begin.

Fire Fighting Advantage: This zone allows safe fire fighting operations to occur and clear fire control lines to be implemented by fire fighters.

Measurability: A fuel free Inner Protection Area is measured in two ways. The weight of the fuel and the width of the zone. Practitioners measure fuel load in *tonnes per hectare*. It is assessed by measuring the weight of fuel in a small quadrat eg. 300mm by 300mm and equating that to a hectare. The width of the zone is the separating distance between an asset and the bushland.

Performance Standard: A safe load is between 0-3 t/Ha.

Photographic Montage Depicting Inner Protection Area

PHOTO – 1

	<p>Site Description: The site is a paved roadway. It separates two areas of bushland and is normally called in this instance a fire break.</p> <p>Fire Behaviour: No fire could occur on this fire break but the narrow nature of the break would allow fire to pass between the two bushland areas without difficulty.</p> <p>Maintenance: None required due to paved surface. Do not allow shrubs to grow.</p> <p>Fuel Weight: Zero</p>
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PHOTO – 2

	<p>Site Description: The site is mineral earth. There is no fuel on this narrow strip. The narrow strip forms a narrow fire break between two areas of unmanaged bushland.</p> <p>Fire Behaviour: No fire could occur on this mineral earth but the narrow nature of the fire break would allow fire to pass between the two bushland areas without difficulty.</p> <p>Maintenance: Regular raking and removal of litter layer. Do not allow shrubs to grow.</p> <p>Fuel Weight: Zero</p>
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PHOTO – 3

	<p>Site Description: This is a grassed fire trail on level land adjacent to unmanaged bushland. The grass height on the level lands is 20-50 mm.</p> <p>Fire Behaviour: This area, if mowed regularly, would exhibit flame heights not above 300 mm (12 inches). Note: The grass in the bushland zone is approx' 400-500mm in height and would achieve flame heights approximate to 750 -1200mm (depending on fuel loadings and Fire Danger Index).</p> <p>Maintenance: This fuel free zone is able to be managed by normal mowing means. Raking and removal of litter layer; and/or mowing of grasses; and raking and/or mowing. Fuel Weight in photo 4: < 2 T/Ha.</p> <p>Fuel Weight: < 2 T/Ha.</p>
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PHOTO – 4

	<p>Site Description: This is a grassed Inner Protection Area with scattered trees, no shrub larger and minimal understorey. The grass height is maintained to provide < 3 tonnes per hectare.</p> <p>Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.</p> <p>Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.</p> <p>Fuel Weight: < 3 tonnes/hectare.</p>
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Photographic Montage Depicting Inner Protection Area

PHOTO – 5

	<p>Site Description: The site is a grassed Inner Protection Area with large smooth barked tree 5 metres clear of the dwelling. The grass height is maintained to provide < 3 tonnes per hectare.</p> <p>Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.</p> <p>Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.</p> <p>Fuel Weight: < 3 tonnes/hectare</p>
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PHOTO – 6

	<p>Site Description: This site shows a grassed Inner Protection Area with rock and landscaped areas constituting approximately 15% of the Inner Protection Area. Tree more than 5 metres from dwelling with no canopy connection to adjoining trees.</p> <p>Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.</p> <p>Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.</p> <p>Fuel Weight: < 3 tonnes/hectare to grass areas landscaped areas 3-4 tonnes/hectare.</p>
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PHOTO – 7

	<p>Site Description: This site shows an Inner Protection Area which includes a paved Access/Fire Trail. Smooth barked trees < 5 metres from fire aspect of dwelling. Fuel loading to trail zero with grassed areas displaying approximately 3 tonnes/hectare.</p> <p>Fire Behaviour: Fires impacting the bushland to the left of the Access/Fire Trail would loose intensity with the provision of the Inner Protection Area.</p> <p>Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.</p> <p>Fuel Weight: Nil to Access/Fire Trail. 3 tonnes/hectare to grassed area.</p>
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PRESENCE OF SHRUBS IN AN INNER PROTECTION AREA

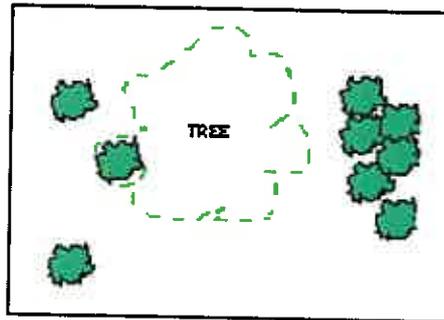
Shrubs may occur within an Inner Protection Area, but only where it is recommended by an experienced bush fire protection manager.

Thus landscaping works within the Inner Protection Area may occur in some instances. Where it is approved to occur, some 10-15 % and in some cases up to 30% of the Inner Protection Area may be able to be landscaped but always away from glass in buildings.

The design of the Inner Protection Area will be dependent on species selection and spatial arrangement.

Note: eg. 10 % means that for every 100 square metres (eg. 10 metres x 10 metres) only 10 % of that area may have a shrub component. The remainder would be free of shrubs see Figure 1. A 10 % landscaped shrub layer would add a further 1.5 tonnes of fuel to the overall hazard weight. To maintain the aggregate below 3 t/ha the ground fuels must be mown grass, or similar.

Figure 1 – Example of Spatial Arrangement in a Inner Protection Area



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 Inner Protection Area if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

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

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

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

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 Inner Protection Area 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 a Inner Protection Area Table 2 provides guidelines.

Table 2 – Tree Density in Inner Protection Area

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

There are variations to Table 2.

- Trees vary in height and tree crown width /depth. Some trees have canopies that extend close to the ground (eg < 5 metres from the ground) whilst other trees have canopies that area high off the ground (> 15 metres off the ground). In some cases these tall trees do not have canopies that are affected by undergrowth / tall shrubs that could cause fire to burn into the canopy. Therefore if trees are isolated they do not form a significant risk.
- Similarly smooth barked trees are less of a hazard than heavily barked trees. The latter can cause fire to run up into the canopy and if there is sufficient wind the resulting fire can be of high intensity.
- Similar to the above, the number of trees per 100 m² depends on an individual assessment being undertaken to determine the 'type / size of tree', and its resultant potential impact upon a dwelling.
- The exposed side of a dwelling is the side that is directly affected by a moving fire particularly when fanned by wind. The non-exposed side of a dwelling is the side where fire is unlikely to come from either from a lack of wind, slope or other factors such as a lack of hazardous fuel.

3.0 OUTER PROTECTION AREA (O.P.A)

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

Physical Appearance: This area assumes all trees will remain but with a modified shrub / grass and litter layer. In some sparse vegetation communities the shrub layer may not require modification.

Fire Fighting Advantage: 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.

Measurability: Practitioners measure fuel load in *tonnes per hectare*. It is assessed by way of measuring the load in a given small quadrat eg. 300mm by 300mm and equating that to a hectare.

Performance Standard: A safe load is between 4-6 T/Ha.

Note: An experienced / qualified bush fire protection practitioner should undertake an individual assessment of a site to determine the requirements within an Asset Protection Zone.

Photographic Montage Depicting Outer Protection Area

PHOTO - 1



Site Description: This area has a low tree and shrub density but a high presence of native grasses. Almost no litter layer present.

Fire Behaviour: The lack of shrubs means that fire behaviour will be less but the presence of the sloping lands and the heavy presence of grass means that fire can burn quickly up the slope with flame heights between 1200-1800mm.

Maintenance: Maintain the grass height. Shrubs can grow to what is pictured in Photo 1.

Fuel Weight: 2-3 T/Ha

PHOTO - 2



Site Description: This area has increased shrub density and the beginnings of those shrubs linking with the tree canopy. Litter layer is present, but less than 3 T/Ha. The shrub layer is approx' 3 T/Ha.

Fire Behaviour: The increase in shrubs means that fire behaviour will be high. Flame heights would be expected to be between 2000mm - 6000mm (depending on fuel loadings and Fire Danger Index).

Maintenance: Maintain the grass height and current density of shrubs.

Fuel Weight: 6 T/Ha.

PHOTO - 3



Site Description: This area has a low tree and shrub density but a high presence of native grasses.

Fire Behaviour: The heavy presence of native grass means that fire can burn quickly through the outer protection area with flame heights of between 1200-3m.

Maintenance: Remove and maintain grass layer/leaf litter by slashing/hand removal.

Fuel Weight: 6-8 tonnes/hectare

PHOTO - 4



Site Description: Outer Protection Area above dwelling showing large rock outcrops, low shrub and tree density.

Fire Behaviour: Fires impacting this area would burn down slope to the dwelling. Flame heights in the order of 1-2 metres.

Maintenance: Management of this area by slashing/hand removal/burning to maintain fuel loading to < 8 tonnes/hectare.

Fuel Weight: < 6 tonnes/hectare
Nil on rock ledges.