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bushfire & ecology

bushfire protection assessment

Staged Maximum Security Expansion
Cessnock Correctional Facility
Lindsay Street, Nulkaba

Under Section 79BA of the EP&A Act (1979)

October 2016
(Ref: A16099B)

Bushfire Protection Assessment

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Lindsay Street, Nulkaba

Report Authors:	Nicole van Dorst BPAD Level 2 Emma Buxton *B.Sc*
Plans prepared:	Kelly Tucker, Emma Buxton
Checked by:	John Travers BPAD Level 3 15195 
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This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. This report advises on matters published by the *NSW Rural Fire Service* in their guideline *Planning for Bush Fire Protection 2006* and other advice available from that organisation.

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

ABN 64 083 086 677
PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

t: 02 4340 5331
e: info@traversecology.com.au
www.traversecology.com.au

EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for the proposed three (3) staged maximum security expansion of Cessnock Correctional Facility which will create an additional 1000 beds.

This type of development is considered by the NSW Rural Fire Service (RFS) as being an 'assembly area' as it accommodates a large number of people of various physical capabilities. The RFS requires this type of development to be considered on its merits under section 79BA of the *Environmental Planning and Assessment Act (EP&A Act) 1979.* Although these buildings are not considered a special fire protection purpose (SFPP) development they should be considered as if they are, with consideration of the specific objectives listed in Section 4.2.3 of *Planning for Bush Fire Protection 2006 (PBP).*

PBP dictates that the subsequent extent of bushfire attack that can potentially impact a SFPP building must not exceed a radiant heat flux of 10kW/m^2. This rating assists in determining the size of the asset protection zone (APZ) which provides the necessary defendable space between hazardous vegetation and a building.

The assessment found that bushfire can potentially affect the proposed development from the existing forest vegetation located external to the sites southern boundary and from the vegetation within the site (located to the north and west of the proposed Stage 1 expansion & north-east and west of Stage 2) resulting in possible ember attack and radiant heat attack.

However, the bushfire risk posed to the development can be mitigated as an appropriate combination of bushfire protection measures will be put in place and managed in perpetuity. The bushfire protection measures afforded to the prison are robust with the provision of compliant asset protection zones, hydrant system, smoke detection and emergency services access arrangements as well as well-established evacuation protocols with regular fire drills and a 24 hour presence.

The assessment has concluded that the proposed development will provide compliance with *PBP*.

GLOSSARY OF TERMS

APZ	Asset protection zone
AS1596	*Australian Standard – The storage and handling of LP Gas*
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2009*
BAL	*Bushfire attack level*
BCA	*Building Code of Australia*
BSA	Bushfire safety authority
EEC	Endangered ecological community
EP&A Act	*Environmental Planning & Assessment Act 1979*
FDI	Fire danger index
ha	Hectare
IPA	Inner protection area
m	Metres
OPA	Outer protection area
PBP	*Planning for Bush Fire Protection 2006*
RF Act	*Rural Fires Act 1997*
RFS	NSW Rural Fire Service
SFPP	Special fire protection purpose
TSC Act	*Threatened Species Conservation Act 1995*

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Introduction 1

Travers bushfire & ecology has been requested to undertake a bushfire protection assessment for the proposed staged expansion of the Cessnock Correctional Centre.

The proposed development is located on land mapped by Cessnock City Council as being bushfire prone. This triggers a formal assessment by Council in respect of the NSW Rural Fire Service (RFS) policy against the provisions of *Planning for Bush Fire Protection 2006 (PBP).*

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- review the bushfire threat to the landscape
- undertake a bushfire attack assessment in accordance with *PBP*
- provide advice on mitigation measures, including the provision of asset protection zones (APZs), construction standards and other specific fire management issues
- review the potential to carry out hazard management over the landscape

1.2 Project synopsis

The proposed expansion of Cessnock Correctional Facility includes:

- Stage 1 - 400 Bed Maximum Security Expansion (refer Figure 1.1)
- Stage 2 - 320 Bed Maximum Security Expansion (refer Figure 1.2)
- Stage 3 - 280 Bed Maximum Security Expansion (refer Figure 1.2)

Associated site infrastructure and support facility required for the additional beds will include the upgrade / modification of:

- Gatehouse
- Clinic
- Reception
- Visits
- Workshop / maintenance (industries) and programs
- Protection / management accommodation
- Visitors car park
- Fencing

Figure 1.1 – Stage 1 – 400 Bed

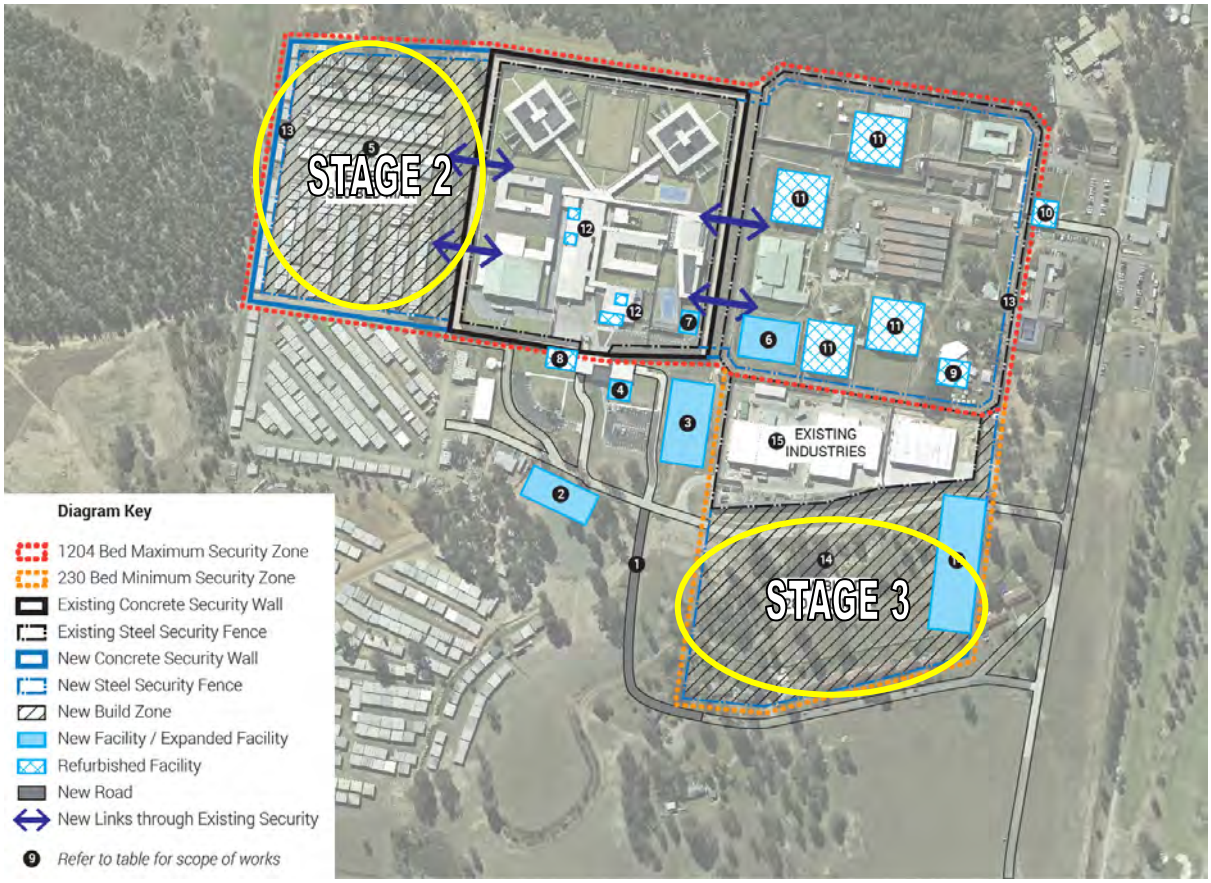

Figure 1.2 – Stage 2 & 3 - 320 and 280 bed

1.3 Information collation

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

- Masterplan prepared by *NBRS Architecture* dated 27 January 2016
- Rapid Build Prison – Cessnock 400 Bed Proposed Expansion Civil Works (dwg no. CV-003) for REF Submission, prepared by *Meinhardt Australia Pty Ltd*, dated 08/09/16
- *Google* aerial photography
- Topographical maps DLPI of NSW 1:25,000
- Australian Standard 3959 *Construction of buildings in bushfire-prone areas (AS3959)*
- *Planning for Bush Fire Protection 2006 (PBP) (RFS).*

An inspection of the proposed development site and surrounds was undertaken by Nicole van Dorst in July 2016 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site description

Cessnock Correctional Centre is a minimum and maximum security facility for male offenders, located to the west of Lindsay Street, Nulkaba within the local government area of Cessnock. The site comprises of a number of parcels of land as follows:

- Lot 1 DP1035135
- Lots 2 and 3 DP76202
- Lots 156 and 186 DP755252; and
- Lot 3 DP 226429

The location of each stage (refer Figure 1.3) is described as follows:

- Stage 1 - 400 Bed Modular Accommodation on the south west side of the site near or over existing demountable buildings.
- Stage 2 - 320 Bed Modular Accommodation to be located on the west side of the newly constructed 240 bed unit where DET modular classrooms are currently stored.
- Stage 3 -280 Bed Modular Accommodation on the south east side of the site in the location of the existing residential cottages.

Figure 1.3 – Aerial appraisal
(Source: Nearmap)

1.5 Legislation and planning instruments

1.5.1 Environmental Planning and Assessment Act (EP&A Act)

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *BCA*. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

Section 79BA of the *EP&A Act* states that development consent cannot be granted for the carrying out of development for any purpose on bushfire prone land unless the consent authority:

- is satisfied that the development conforms to the specifications and requirements of *PBP*
- has consulted with the Commissioner of the NSW RFS concerning measures to be taken with respect to the development to protect persons, property and the environment from danger that may arise from a bushfire.

1.5.2 Bushfire prone land

Bushfire prone land maps provide a trigger for the development assessment provisions. The proposed development is located on land that is mapped by Cessnock City Council as being bushfire prone (refer Figure 1.4).

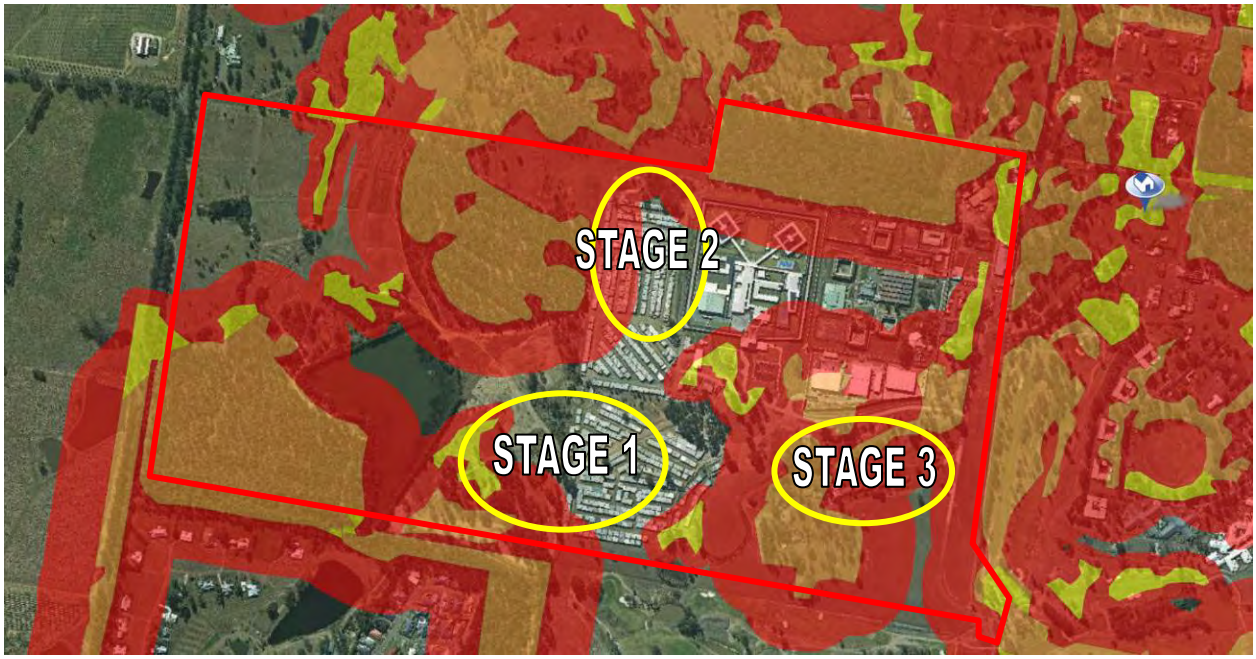

Figure 1.4 – Bushfire prone land map

1.5.3 Planning for Bush Fire Protection 2006 (PBP)

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP. PBP* provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment. More specifically, the aims and objectives for all development located on bushfire prone land should:

1. Afford occupants of any building adequate protection from exposure to a bushfire.

2. Provide for a defendable space to be located around buildings.

3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition.

4. Ensure that safe operational access and egress for emergency service personnel and residents is available.
5. Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the APZ.

6. Ensure that utility services are adequate to meet the needs of fire fighters (and others who may assist in bushfire fighting).

The prison upgrade is a type of development regarded by the RFS as an 'assembly building/s' and as such the proposal should be treated as if it is a special fire protection purpose (SFPP) development. As a result the following additional objectives are to be considered;

7. Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire 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.

8. Provide for safe emergency evacuation procedures. SFPP developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bushfire threats. During emergencies, the risk to fire fighters and other emergency services personnel can be high through prolonged exposure, where door to door warnings are being given and exposure to the bushfire is imminent.

The nature of SFPPs means that occupants may be more vulnerable to bushfire attack for one or more of the following reasons:

- they may be less educated in relation to bushfire impacts
- they may have reduced capacity to evaluate risk and to respond adequately to the bushfire threat
- they may present organisational difficulties for evacuation and / or management
- they may be more vulnerable through stress, anxiety and smoke impacts arising from bushfire threat
- there may be significant communication barriers
- supervision during a bushfire may be difficult
- logistical arrangements for the numbers of residents may be complicated in terms of alternate accommodation, transport, healthcare and food supplies

In addition, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas. The proposal has been assessed in compliance with the following measures:

- asset protection zones
- building construction and design
- access arrangements
- water supply and utilities
- landscaping, and
- emergency management arrangements.

1.5.4 Building Code of Australia (BCA) and the Australian Standard AS3959 Construction of buildings in bushfire-prone areas 2009 (AS3959)

The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and deemed to satisfy provisions. In NSW, construction in bushfire prone areas applies to Classes 2, 3, 4 and 9b buildings or a Class 10a associated with Classes 2, 3, 4 and 9b buildings. The construction manual for the deemed to satisfy requirements is the *AS3959*.

1.6 Environmental and cultural constraints

1.6.1 Environmental constraints

A Flora and Fauna Assessment for the Cessnock Correctional Facility has been undertaken by this firm (October 2016). The study identified eight (8) threatened fauna, one (1) threatened flora species and one (1) endangered ecological community (EEC), Lower Hunter Spotted Gum Ironbark Forest within the study area.

The report concluded that the proposed development will not have a significant impact on any threatened species, populations or EECs and provided the following mitigation measures;

- Revegetation of some 9.8ha of EEC revegetation works and another 12.3ha of enrichment planting works within existing Spotted Gum plantations. All asset protection zones have been excluded from the revegetation areas and take into account the future bushfire risk.
- Habitat tree HT5 is to be retained within the Asset protection zone unless it is dangerous and required removal.

1.6.2 Heritage

There are no known Aboriginal heritage sites of significance which will be impacted upon by this development.

Bushfire Threat Assessment

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

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

2.1 Hazardous fuels & effective slope

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) to determine APZ distances for SFPP developments. The hazardous vegetation is calculated for a distance of at least 140m from a proposed building envelope.

The 'effective' slope which has the most influence on the bushfire risk is assessed for a distance of 100m external to the property boundary.

Hazardous fuels and slopes for each stage of the proposal are detailed below.

Stage 1- 400 Bed Maximum Security Expansion (Rapid Built Prison)

The vegetation within 140m of the Stage 1 development consists of the existing forest vegetation to the south and south-west and remnant forested wetland vegetation (proposed restoration area) adjoining the dam to the west (photos 1 and 2).

The topography within the hazardous vegetation has been determined as:

- Level to upslope within the forest to the south, south-west and north.
- 3 degrees downslope within the remnant forested wetland vegetation located to the west

Photo 1 – Forest vegetation located to the south of the site

Stage 2 – 320 Bed Maximum Security Expansion

The vegetation within 140m of the 320 bed expansion includes:

- Forest to the west.

- Forest to the north-east. The threat posed by this vegetation is reduced by the narrow strip of vegetation (reduced flame width of 30m) within the road reserve. This strip of land is narrow due to the approved APZ to the east as identified in the report prepared by *Australian Bushfire Assessment Consultants* (15/03/2016) (refer Figure 2.1).

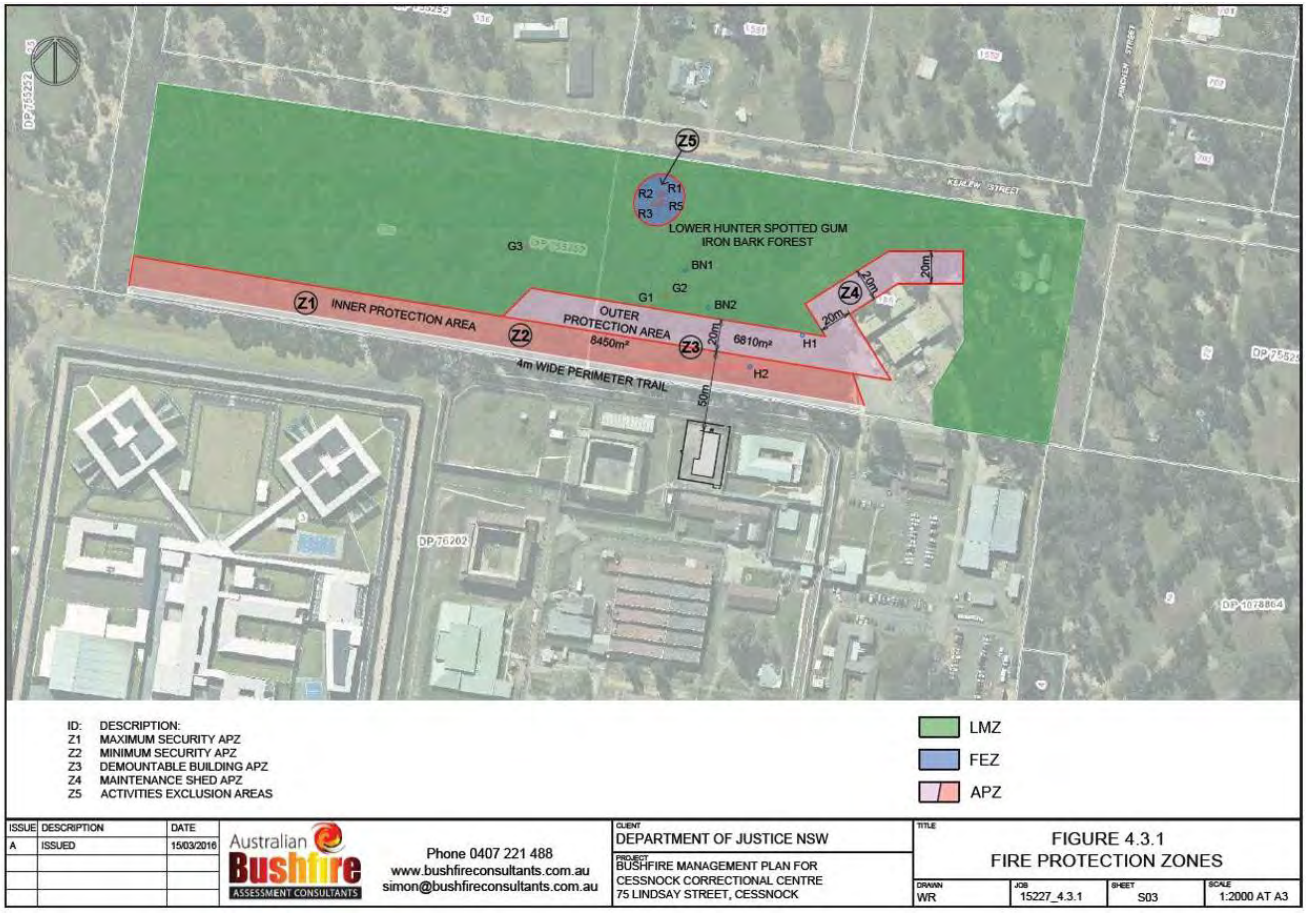

Figure 2.1 – Approved APZ
(Source: Australian Bushfire Assessment Consultants)

The topography within the hazardous vegetation has been determined as

- 2 degrees down slope to the narrow forest to the north-east;
- 2-3 degrees downslope within the forest to the west and south-west.
- Level to upslope within the forest vegetation located over 80m to the north-west

Stage 3- 280 Bed Maximum Security Expansion

The vegetation within 140m of the 280 bed expansion is generally managed with canopy trees to the south and west. The land external to the sites eastern boundary is a managed golf course with canopy trees only.

The topography within the surrounding land is 0 – 5 degrees downslope.

2.2 Bushfire attack assessment

A fire danger index (FDI) of 100 has been used to calculate bushfire behaviour on the site. Tables 2.1-2.3 provides a summary of the bushfire attack assessment, the minimum required APZs of each stage in compliance with Appendix 2 (*PBP*) and the APZ's provided.

Table 2.1 - Bushfire Attack Assessment (refer Schedule 1 attached)

Stage 1–400 Bed Maximum Security Expansion				
Aspect	**Predominant vegetation within 140m of Development**	**Effective Slope of Land**	**APZ required (in accordance with Appendix 2 PBP)**	**APZ provided**
North-east, east and south-east	Managed land	N/A	N/A	>100m
North & north-west	Forest	Level to upslope	60m	100m
South	Forest	Level to upslope	60m	66m
West & south-west	Forest / forested wetland restoration	3 ^{o} D	70m	100m (refer Note 1)

Note 1 – Although the surrounding land to the west, north-west and south-west (within 100m of the site) is managed / canopy trees it is recommended that a 100m APZ is applied. This will ensure that that the land is maintained for the life of the development and will reduced the requirement for BAL levels to be applied to the buildings within the western portion of the 400 bed facility.

Table 2.2 - Bushfire Attack Assessment (refer Schedule 2 attached)

Stage 2 –320 Bed Maximum Security Expansion				
Aspect	**Predominant vegetation within 140m of Development**	**Effective Slope of Land**	**APZ required (in accordance with Appendix 2 PBP)**	**APZ Provided**
North, east and south	Managed land	0-5 ^{o} D	N/A	
North-east	Forest (reduced flame width 30m)	0-2 ^{o} D	70m	60m (Alternative solution approach - refer Note 1)
North-west	Forest	Level to upslope	60m	>100m provided by existing managed grassland areas on adjoining land and within site)
West & south-west	Managed Land	0-2 ^{o} D	N/A	
	Forest		70m	70m (50m IPA + 20m OPA) (refer Note 2)

Notes: * Slope is either 'u' meaning upslope or 'c' meaning cross slope or 'd' meaning downslope

Note 1 – Column 4 in Table 1 outlines the deemed to satisfy APZ distances as outlined in Appendix 2 of PBP. However PBP also allows a performance based approach which considers the on-ground conditions. The 60m APZ to the north-east as shown in Column 5 (graphically depicted in Schedule 2 attached) has been determined using an alternative solution approach. This is based on the specific slope (2 degrees) and the narrow 30m width of the vegetation in the north-east. The results of this assessment are provided below and have been determined using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting.*

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 17/08/2016 **Assessment Date:** 6/06/2016

Site Street Address:	Stage 2 Cessnock Correctional Centre, Cessnock		
Assessor:	Mr Admin, admin		
Local Government Area:	Cessnock	**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: A North-East

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	2 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	60

Fire Inputs

Veg./Flame Width(m):	30	**Flame Temp(K)**	1200

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100

Program Outputs

Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	9.88
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	35587
Radiant Heat(kW/m2):	4.75	**Flame Angle (degrees):**	71
Flame Length(m):	20.91	**Maximum View Factor:**	0.055
Rate Of Spread (km/h):	2.76	**Inner Protection Area(m):**	60
Transmissivity:	0.77	**Outer Protection Area(m):**	0

Table 2.3 - Bushfire Attack Assessment (refer Schedule 3 attached)

Stage 3 –280 Bed Maximum Security Expansion				
Aspect	**Predominant vegetation within 140m of Development**	**Effective Slope of Land**	**APZ required**	**APZ recommended / provided**
North & west	Managed / prison infrastructure	N/A	N/A	
South	Managed land / canopy trees	0-5 ^{o} D	N/A	100m (refer Note 1)
East	Managed Golf Course	N/A	N/A	100m (refer Note 1)

Notes: * Slope is either 'u' meaning upslope or 'c' meaning cross slope or 'd' meaning downslope

Note 1 – Although the surrounding land to the south and east is managed / canopy trees it is recommended that a 100m APZ is applied surrounding the 280 bed extension. This will ensure that that the land is maintained for the life of the development and will eliminate the requirement for BAL levels to be applied to the buildings within Stage 3.

Specific Protection Issues

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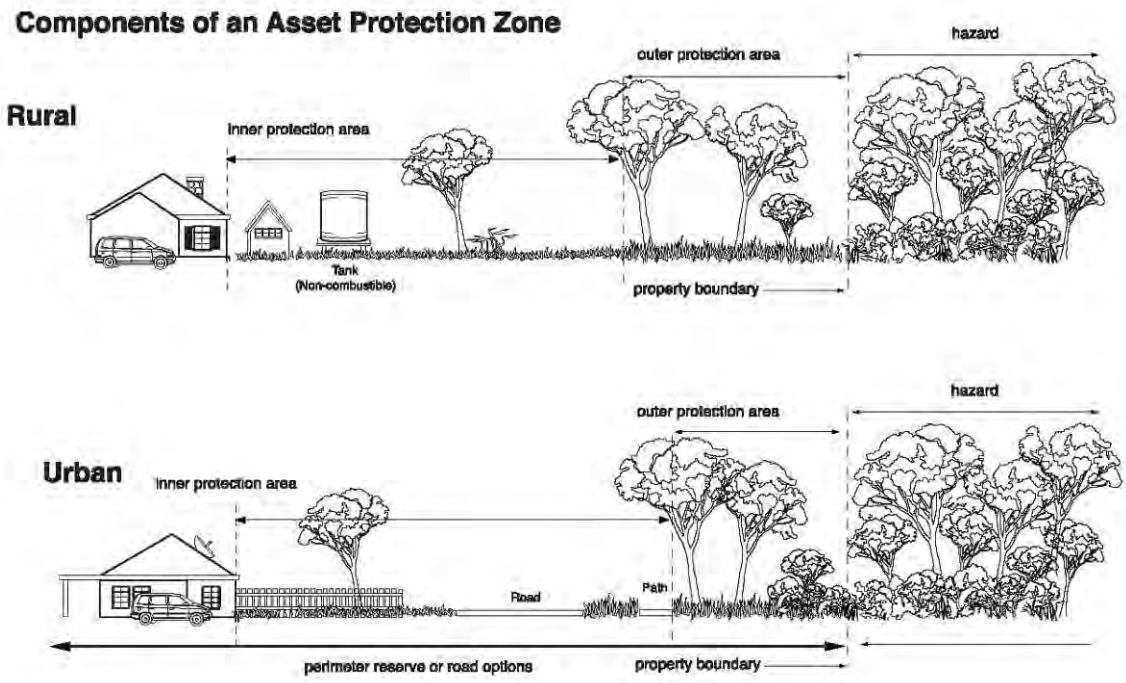
3.1 Asset protection zones

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



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

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

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 10*kW/m*^{2} for SFPP developments. This rating assists in determining the size of the APZ in compliance with Appendix 2 of *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposal's compliance with the performance criteria for APZs.

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

Performance criteria	Acceptable solutions	Complies
Radiant heat levels of greater than 10kW/m^2 will not be experience by occupants or emergency services workers entering or exiting a building.	An APZ is provided in accordance with the relevant tables and figures in Appendix 2 of *PBP.* Exits are located away from the hazard side of the building. The APZ is wholly within the boundaries of the development.	Complies – The majority of APZ's provided are in accordance with Appendix 2 of PBP. The APZ provided to the north-east of Stage 2 development has been determined based on a performance based assessment as outlined in Section 2.2.
Applicant demonstrates that issues relating to slope are addressed: maintenance is practical, soil stability is not compromised and the potential for crown fire is negated.	Mechanisms are in place to provide for the maintenance of the APZ over the life of the development. The APZ is not located on land with a slope exceeding 18^o.	Complies – The APZ consists of landscaped areas, roads and turf areas which require minimal maintenance. The APZ is not located on slopes exceeding 0-5^o.
APZs are managed and maintained to prevent the spread of a fire towards the building.	In accordance with the requirements of *Standards for Asset Protection Zones* (*RFS* 2005).	Complies - to be made a condition of consent.

3.2 Building protection

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

The construction classification system is based on five (5) bushfire attack levels (BALs). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5 AS3959. The lowest level, BAL 12.5, has the longest APZ distance while BAL – FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials.

All buildings located within 100m of the bushfire prone vegetation (as depicted in blue within Schedule 2 (320 bed expansion) attached) are to be constructed in accordance with a BAL 12.5 rating.

Stage 1- 400 Bed Maximum Security Expansion (Rapid Built Prison)

The proposed sports facility and programs building are provided with a 66m APZ to areas proposed for revegetation. These Class 9 buildings do not have specific bush fire provisions applying under the BCA and therefore based on the following mitigation measures do not require BAL construction standards in compliance with AS3959 (2009).

- The sports facility and programs building are not utilised for accommodation and therefore their use is restricted
- The bushfire protection measures afforded to the prison are robust with the provision of compliant asset protection zones, hydrant system and smoke detection system

- Emergency services access arrangements and evacuation protocols are well-established with regular fire drills and a 24 hour presence.
- The buildings are made from non-combustible materials (for security reasons)
- The buildings are monitored 24/7

3.3 Hazard Management

Future development is to ensure that:

- The APZ is to be managed in accordance with *NSW RFS* document *Standards for Asset Protection Zones* available from www.rfs.nsw.gov.au by following the link 'Publications' and 'Hazard Reduction'
- Landscaping within the property is to be undertaken in accordance with Appendix 5 of *PBP* also available from www.rfs.nsw.gov.au by following the link 'Publications' and 'Building in a Bush Fire Prone Area'.

The following provides general maintenance advice for vegetation within the IPA and OPA.

Inner Protection Area (IPA)
Fuel loads within the IPA are to be maintained so it does not exceed 4t/ha.

Trees are to be maintained to ensure;
- Canopy cover does not exceed 15%
- Trees (at maturity) do not touch or overhang the building
- Tree canopies (at maturity) should be well spread out and not form a continuous canopy
- There should be no unmanaged vegetation within 10m of windows, doorways, eaves and gutters
- Lower limbs should be removed up to a height of 2m above ground

Shrubs are to be maintained to ensure;
- Large discontinuities or gaps in vegetation
- Shrubs should not be located under trees
- Shrubs should be in clumps no greater than 5m^2
- Shrubs should be no closer than 10 metres from an exposed window or door.

Grass is to be maintained to ensure:
- A height of 10cm or less
- Leaves and debris is removed.

Outer Protection Area (OPA)
Fuel loads within the OPA are to be maintained so it does not exceed 8t/ha.

Trees are to be maintained to ensure;
- Canopy cover does not exceed 30% (trees may touch each other, however a separation is to be provided between the hazard the APZ)

Shrubs are to be maintained to ensure;
- They do not form a continuous canopy
- Shrubs should be in clumps no greater than 10m^2
- Clumps of shrubs should be separated from each other by 10m

Grass is to be maintained to ensure:

- A height of 10cm or less
- Leaves and debris is removed.

Landscaping to the site is to comply with the principles of Appendix 5 of Planning for Bushfire Protection 2006. In this regard the following landscaping principles are to be incorporated into the development:

- Suitable impervious areas being provided immediately surrounding the building such as courtyards, paths and driveways;
- Restrict planting in the immediate vicinity of the building which may over time and if not properly maintained come in contact with the building;
- When considering landscape species consideration needs to be given to estimated size of the plant at maturity;
- Avoid species with rough fibrous bark, or which retain/shed bark in long strips or retain dead material in their canopies;
- Use smooth bark species of trees species which generally do not carry a fire up the bark into the crown;
- Avoid planting of deciduous species that may increase fuel at surface/ ground level (i.e. leaf litter);
- Avoid climbing species to walls and pergolas;
- Locate combustible materials such as woodchips/mulch, flammable fuel stores away from the building;
- Locate combustible structures such as garden sheds, pergolas and materials such timber garden furniture way from the building; and
- Use of low flammability vegetation species.

3.4 Access for fire fighting operations

The existing access to the site is provided via Lindsay Street onto the existing internal 6m wide access road. Additional proposed access roads will be provided to each Stage. The proposed roads are to have a minimum width of 6.5m. Additional services egress (in support of firefighting access) will be provided around the perimeter of Stage 2 as depicted in Schedule 1 attached. This road has a variable with of 4 – 6m and is for the use of service vehicles only (i.e. not open to the public).

Table 3.2 – Performance criteria for internal roads (*PBP* guidelines pg. 35)

Performance criteria	Acceptable solutions	Complies
Internal road widths and design enable safe access for emergency services and allow crews to work with equipment about the vehicle.	Internal roads are two-wheel drive, sealed, all weather roads.	Yes.
	Internal perimeter roads are provided with at least two traffic lane widths (carriageway 8m minimum curb to curb) and shoulders on each side, allowing traffic to pass in opposite directions.	Perimeter roads located adjacent to bushland areas are for services vehicles only (not open to the public). The width of these roads vary between 4-6m and therefore complies with the performance criteria.
	Roads are through roads. Dead end roads are not more than 100m in length from a through road, incorporate a minimum 12m outer radius turning circle, and are clearly sign posted as a dead end.	Yes.
	Traffic management devices are constructed to facilitate access by emergency services vehicles.	Yes.
	A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	Complies.
	Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress.	Appears to comply.
	The minimum distance between inner and outer curves is 6m.	Appears to comply.
	Maximum grades do not exceed 15^{o} and average grades are not more than 10^{o}.	Complies.

Performance criteria	Acceptable solutions	Complies
	Cross fall of the pavement is not more than 10^{o}.	Complies.
	Roads do not traverse through a wetland or other land potentially subject to periodic inundation (other than storm surge).	Complies
	Roads are clearly sign-posted and bridges clearly indicate load ratings.	Complies.
	The internal road surfaces and bridges have a capacity to carry fully-loaded firefighting vehicles (15 tonnes).	Complies.

3.5 Water supplies

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

Table 3.3 outlines the proposals compliance with the performance criteria for reticulated water supply.

Table 3.3 – Performance criteria for reticulated water supplies (*PBP* guidelines pg. 37)

Performance criteria	Acceptable solutions	Complies
Water supplies are easily accessible and located at regular intervals.	Access points for reticulated water supply to SFPP developments incorporate a ring main system for all internal roads. Fire hydrant spacing, sizing and pressures comply with *AS2419.1*. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority, once development has been completed. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. The provisions of public roads in Section 4.1.3 of *PBP* in relation to parking are met.	Complies - can be made a condition of consent.

3.6 Gas

Table 3.4 outlines the required performance criteria for the proposals gas supply.

Table 3.4 – Performance criteria for gas supplies (*PBP* guidelines pg. 37)

Performance criteria	Acceptable solutions	Complies
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings.	Reticulated or bottled gas bottles are to be installed and maintained in accordance with *AS1596* and the requirements of relevant authorities. Metal piping is to be used. All fixed gas cylinders are to be kept clear of flammable materials and located on the non hazard side of the development. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and away from any combustible material, so that they do not act as a catalyst to combustion. Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.	Complies - can be made a condition of consent.

3.7 Emergency and evacuation planning

Table 3.5 outlines the required performance criteria for the proposal's emergency procedures

Table 3.5 – Performance criteria for emergency and evacuation planning (*PBP* guidelines pg.39)

Performance criteria	Acceptable solutions	Complies
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. *Note: The applicant 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*.	The existing evacuation plan is to be upgraded to include the new beds.
Suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan.	An emergency planning committee is established to consult with staff in developing and implementing and emergency procedures manual. Detailed plans of all emergency assembly areas including onsite and offsite arrangements as stated within *AS3745* are clearly displayed, and an annual trial emergency evacuation is conducted.	Complies - can be made a condition of consent.

Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment has been undertaken for the three (3) staged maximum security expansion of Cessnock Correctional Facility.

The assessment found that bushfire can potentially affect the proposed development from the existing forest vegetation located external to the sites southern boundary and from the vegetation within the site (located to the north and west of the proposed Stage 1 expansion & north-east and west of Stage 2) resulting in possible ember attack and radiant heat attack.

The bushfire protection measures afforded to the prison are robust with the provision of a compliant hydrant system, smoke detection and emergency services access arrangements as well as well-established evacuation protocols with regular fire drills and a 24 hour presence.

The assessment has concluded that the proposed development will provide:

- Compliance with PBP

The following illustrates the proposal's compliance with *PBP.*

4.2 Recommendations

Recommendation 1 - The development is as generally indicated on the attached Schedule 1, 2 & 3 – Plan of Bushfire Protection Measures.

Recommendation 2 - APZs are to be provided to the proposed development. APZs are to be measured from the exposed wall of the buildings toward the hazardous vegetation. The APZs shall be as nominated in Table 2.1, 2.2 & 2.3 and also as generally depicted in Schedule 1, 2 & 3.

Recommendation 3 – Landscaping within the site is to ensure compliance with Appendix 5 of *PBP*. A summary of the guidelines for managing APZs are attached as Appendix 1 to this report and summarise below:

- *Mowing of grass*: Grass needs to be kept short (approximately 5cm in height) and green where adequate water supplies are available.

- *Raking or manual removal of fine fuels*: Ground fuels such as fallen leaves, twigs (less than 6mm in diameter) and bark should be removed on a regular basis. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- *Removal or pruning of trees, shrubs and understorey*: The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and

the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy is not to overhang a dwelling unless specifically approved by the RFS. Native trees and shrubs should be retained as clumps in landscape beds and should not exceed a covering of more than 20% of the IPA.

- Trees or tall shrubs may require pruning upon building completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a building in a bushfire prone landscape requires specific attention to day to day management and owners and / or occupiers should be made aware that whilst landscaping can contribute to a way of life and environmental amenity, the accumulated fuels must be regularly removed.

- Trees may remain within close proximity of a building where it can be demonstrated that the tree is not able to produce a build-up of fuel on the roof of a dwelling due to:

    1. A roof pitch which self sheds leaf litter
    2. Ongoing roof maintenance by staff or contractors
    3. Adequate ember protection has been installed

- Trees that are likely to be structurally unstable such that they could cause a limb to fall would require removal for the RFS to agree to a dwelling in proximity to the trees.

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

- Ensure that vegetation does not provide a continuous ignition path to the building.

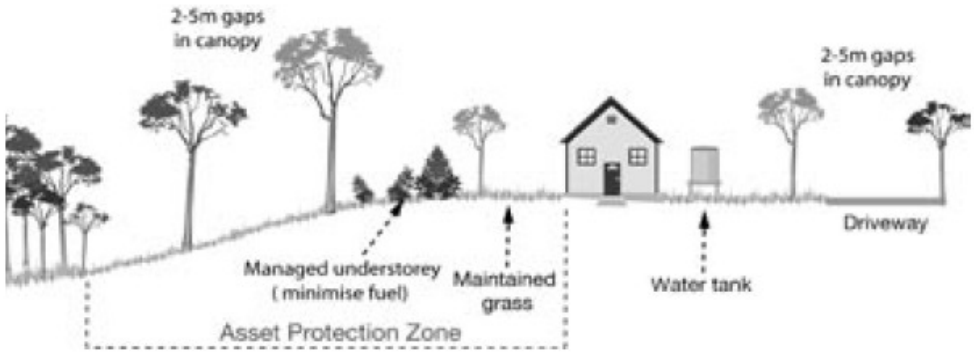
- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the proposed building so that plants will not ignite the dwelling by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non-flammable ground cover such as pebbles and crushed tiles.

- The following RFS diagram depicts one version of an ideal situation. Divergence from this ideal should not be undertaken without expert advice.



Recommendation 4 - The proposed buildings within 100m of the bushfire prone vegetation (for the 320 bed expansion only) are to comply with BAL 12.5 *AS3959* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 *(PBP).*

Recommendation 5 – Access, water, electricity and gas supply is to comply with Section 4.2.7 of *PBP*.

Recommendation 6 – A bushfire emergency / evacuation plan is to be prepared / updated to include the new construction and is to be consistent with the RFS *Guidelines for the Preparation of Emergency / Evacuation Plans.*

Recommendation 7 - The landowner / manager is to be made aware of their liability to manage the development lands for the ongoing protection of themselves and their neighbours (refer Section 63(2) *RF Act*)

Recommendation 8 - Landowners living in bushfire prone areas should familiarise themselves with publications published by the RFS. These are located on the RFS web site www.rfs.nsw.gov.au under 'Publications'.

REFERENCES

Australian Building Codes Board (2010) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2

Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research

Councils of Standards Australia AS3959 (2009) – *Australian Standard Construction of buildings in bushfire-prone areas*

Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change

Rural Fire Service (2006) - *Planning for bushfire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service

Rural Fire Service (2006) - Bushfire Attack Software on RFS web site

Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack.* RFS Development Control Service

Plan of Bushfire Protection Measures

S1, S2 & S3

NEW BUILD
400 BEDS

100m

100m

100m

66m

EXERCISE AREA

PROGRAMS BUILDING

SPORTS FACILITY

FOREST

TITLE

Cessnock Correctional Facility (Entire site boundary)

1:14,000

0 100 200 m

Legend

Stage 1 study area

Cessnock Correctional Facility (Site boundary) (source : LPI)

Contour (1m) (source: LiDAR)

Vegetation

Forest

Forested wetland

Restoration Area for EEC and threatened species

Proposed Asset Protection Zone (APZ)

Travers Bushfire and Ecology (2016)

Asset Protection Zone

Aerial source: Nearmap

Travers bushfire & ecology
www.traversecology.com.au

PROJECT & MXD REFERENCE
Cessnock Correctional Facilty (320 Bed Extension)
A16099_BF003

DATE & ISSUE NUMBER
6/10/2016
Issue 1

SCALE & COORDINATE SYSTEM
1:2,000 @ A3
GDA 1994 MGA Zone 56

0 50 100 m

TITLE

Schedule 1 - Stage 1 Bushfire Protection Measures (400 Bed Expansion)

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

Document Path: N:\GIS STORAGE\N Drive\A16099_Cessnock_Correctional_Centre\MXDs\A16099_BF003.mxd

MANAGED / MOWN GRASS

MANAGED / MOWN GRASS

Forest

Forest

APPROVED 4m WIDE PERIMETER TRAIL & APZ

139m

30m Flame width

18m

60m

100m

70m

20m

100m

NEW BUILD 320 BED

NEW BUILD 320 BED

TITLE

Cessnock Correctional Facility (Entire site boundary)

1:14,000

0 100 200 m

Legend

- Cessnock Correctional Facility (Site boundary) (source : LPI)
- Stage 2 study area
- Proposed 35 - 6.5m wide road
- Contour (1m) (source: LiDAR)

Approved Asset Protection Zone (APZ)

(source: Australian Bushfire Assessment Consultants 15/03/2016)

- Inner Protection Area
- 4m wide perimeter trail

Proposed Asset Protection Zone (APZ)

Travers Bushfire and Ecology (2016)

- Outer Protection Area
- Inner Protection Area

Bushfire Construction Standards

AS3959 (2009)*

- BAL 12.5

Vegetation

- Forest
- Forested wetland
- Restoration area for EEC & threatened species

* Please refer to additional construction requirements for BAL levels which are contained in Addendum Appendix 3 of *'Planning for Bushfire Protection'* (2006).

Aerial source: Nearmap

Travers bushfire & ecology www.traversecology.com.au

PROJECT & MXD REFERENCE
Cessnock Correctional Facilty (320 Bed Extension)
A16099_BF001

DATE & ISSUE NUMBER
15/09/2016
Issue 1

SCALE & COORDINATE SYSTEM
1:2,000 @ A3
GDA 1994 MGA Zone 56

0 20 40 m

TITLE

Schedule 2 - Stage 2 Bushfire Protection Measures (320 Bed Extension)

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

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TITLE

Cessnock Correctional Facility (Entire site boundary)

1:14,000

0 100 200 m

Legend

- Cessnock Correctional Facility (Site boundary) (source : LiDAR)
- Stage 3 study area
- Contour (1m) (source: LiDAR)
- Asset Protection Zone

Aerial source: Nearmap

Travers bushfire & ecology
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PROJECT & MXD REFERENCE
Cessnock Correctional Facilty (320 Bed Extension)
A16099_BF002

DATE & ISSUE NUMBER
15/09/2016
Issue 1

SCALE & COORDINATE SYSTEM
1:3,000 @ A3
GDA 1994 MGA Zone 56

0 50 100 m

TITLE

Schedule 3 - Stage 3 Bushfire Protection Measures (280 Bed Extension)

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

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Management of Asset Protection Zones

A1

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

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

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

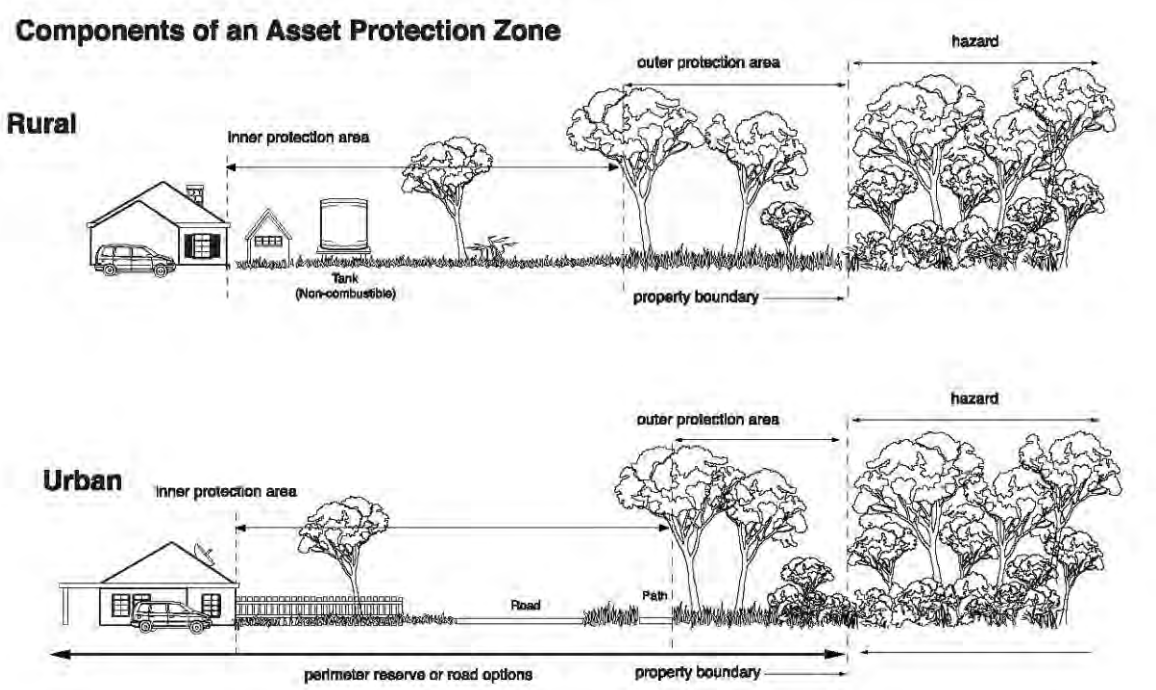
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel layers

Fuel layer name	Location of layer in vertical column	Type of fuel
Ground fuels	Below ground level	Peatmoss (always below the surface)
Surface fuels	0-200mm	Litter layer (leaves & twigs)
Aerial fuels	200-3,000mm	Shrubs and grasses
Canopy fuels	> 3,000mm	Tree canopy

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

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



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

Inner protection area (IPA)

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

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

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

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

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

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

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

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

Shrub cover	Fuel weight
10-30%	2.5 tonnes / ha
35-50%	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

Presence of trees within an inner protection area

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

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

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

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

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

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

Table 2 – Tree density in inner protection area

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

Outer protection area (OPA)

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

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

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

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

Managing the APZ

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

- Mowing grasses regularly - grass needs to be kept short and, where possible, green.

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

- Removal or pruning of trees, shrubs and understorey - the control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy should not overhang within 2-5m of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

- Tree or tall shrubs may require pruning upon dwelling completion in line with *PBP*. Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

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

- Ensure that vegetation does not provide a continuous path to the house.

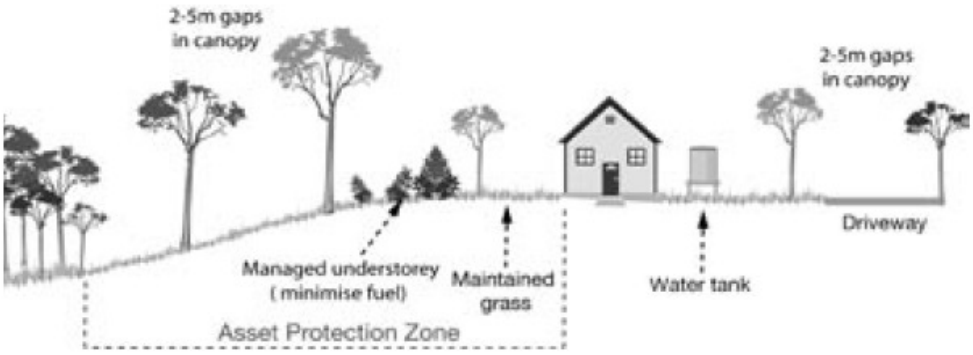
- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low flammability plants and non flammable ground cover such as pebbles and crush tile; and

- The following RFS illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the performance criteria of APZs.



Figures courtesy of NSW RFS 20