RESIDENTIAL DWELLING DEVELOPMENT

LOT 79 DP752017

79 KUMARNA STREET

DUFFYS FOREST. NSW. 2084

BUSHFIRE HAZARD ASSESSMENT

Prepared by SOWDES
25 October 2019

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1. Bushfire Attack Level (BAL) Certificate

Site Address Details	79 Kumarna Street, Duffys Forest. NSW. 2084		
Property Details	Lot 79 DP752017		
Local Council Area	Northern Beaches Council	FDI	100

Type of Proposal		Land Zoning	
✓	New dwelling		Urban residential / Village
	Alterations / additions to existing building	✓	Rural / other

Proximity, Aspect and Vegetative Formation in Relation to the Proposed Development

Category	North Arc NWŸ NŸ NE		South Arc SEŸ SŸ SW		East Arc NEŸ EŸ SE		West Arc NWŸ WŸ SW	
Distance	metres	37	metres	20	metres	22	metres	40
BAL for aspect	BAL	29	BAL	12.5	BAL	40	BAL	12.5
Vegetation formation within 140 metres	✓	Forest		Forest	✓	Forest		Forest
		Woodland		Woodland		Woodland		Woodland
		Tall heaths		Tall heaths		Tall heaths		Tall heaths
		Short heaths		Short heaths		Short heaths		Short heaths
		Rainforest		Rainforest		Rainforest		Rainforest
		Grasslands		Grasslands		Grasslands		Grasslands
		Managed land	✓	Managed land		Managed land	✓	Managed land
Slope under the hazard	Downslope 5° - 10°		Downslope 0 - 5°		Downslope 0 - 5°		Downslope 0 - 5°	

Overall Bush Fire Attack Level and AS3959 Building Construction Requirements

The highest BAL Rating that this development must achieve is:	BAL	40	AS3959 Requirement	Section	8

*** Specific variations exist in NSW in the application of Sections 5 and 6 of AS3959-2018 Construction of Buildings in Bushfire Prone Areas. Refer to Section A3.7 - *Addendum: Appendix 3 Planning for Bushfire Protection*. NSW Rural Fire Service (2010).**

Water Supply Requirements

Development Type	Minimum Water Requirement	Planned	Existing
Reticulated water supply	Distance to nearest hydrant		metres
Residential Lot (< 1000m²)	5000 litre / Lot		
Rural Residential Lot (1000 – 10,000m²)	10,000 litre / Lot		
Large Rural / Lifestyle Lot (> 10,000m²)	20,000 litre / Lot	✓	
Dual Occupancy	2500 litre / Unit		
Townhouse / Unit Style	5000 litre / Unit up to 20,000 litre		

Static Water Supply

Description	Capacity (litres)	Planned	Existing

Gas Supply

Type	Planned	Existing
Reticulated		
Bottled		

Asset Protection Zone Requirements

		Inner Protection Area	Outer Protection Area		
Direction	Vegetation	(metres)		Planned	Existing
North	Forest	22	15	✓	
South	Managed land	20	-	✓	
East	Forest	12	10	✓	
West	Managed land	20	-	✓	

Asset Protection Zone and Bushfire Attack Level Summary

Direction	Vegetation / load		Slope	Distance (m)	Total APZ	BAL
North	Forest	20t/ha	Downslope 5° - 10°	37	37	29
South	Managed land	6t/ha	Downslope 0 - 5°	20	20	12.5
East	Forest	20t/ha	Downslope 0 - 5°	22	22	40
West	Managed land	6t/ha	Downslope 0 - 5°	40	20	12.5

Access and Egress

Description	Condition			
Distance from dwelling to main entrance point Approximately 90 metres	<200 metres	✓	>200 metres	
Internal carriageway construction	Sealed		Unsealed	✓
Service road construction	Sealed	✓	Unsealed	
Alternate access route (if applicable)	The distance from the entrance gateway to the dwelling envelope is less than 200 metres and therefore an alternate egress route is not required			

Comments:
The required asset protection zones are a combination of an inner protection area on all aspects and an outer protection area on the northern and eastern aspects of the nominated dwelling site. A minimum of 20,000 litres of water is required to be dedicated in suitable storage facilities for access by the NSW Rural Fire Service and for firefighting purposes. The distance from the dwelling to the main entrance is less than 200 metres therefore an alternate egress route is not required.

I hereby certify that this assessment has been undertaken in accordance with the procedures and requirements as specified within Section 4.14 of the Environmental Planning and Assessment Act 1979, with particular reference to *Building in Bush Fire Prone Areas, Single Dwellings*. NSW Rural Fire Service 2006, *Addendum: Appendix 3 Planning for Bushfire Protection.* NSW Rural Fire Service (2010), AS 3959-2018 *Construction of Buildings in Bushfire Prone Areas*, and that the proposed development having a maximum **BAL rating of '40'** can satisfy the 'deemed to satisfy' and 'acceptable solutions' provisions of the respective standards and guidelines to be considered as complying development.

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This report is for the intended use of the property owners to determine the appropriate Bushfire Attack Level relating to the proposed development at the address listed on this Certificate. This assessment is not an insurance against potential losses resulting from bushfire events. Changes to the design, site or surrounding environment will influence the accuracy of this assessment and therefore may invalidate this Certificate.

2. List of Abbreviations That May Be Used Throughout This Report

AA3	Addendum: Appendix 3 - Planning for Bush Fire Protection (2010)
APZ	Asset Protection Zone
AS 3959	AS3959 - 2018 Construction in Bush Fire Prone Area
BAL	Bush Fire Attack Level
BCA	Building Code of Australia
BFSA	Bush Fire Safety Authority
BPMs	Bush Fire Protection Measures
CC	Construction Certificate
DA	Development Application
DCP	Development Control Plan
EP&A ACT	Environmental Planning & Assessment Act (1979)
FDI	Fire Danger Index
IPA	Inner Protection Area
LEP	Local Environmental Plan
OPA	Outer Protection Area
PBP	Planning for Bush Fire Protection (2006)
RF Act	NSW Rural Fires Act (1997)
RF Reg	NSW Rural Fires Regulation (2008)
RFS	NSW Rural Fire Service
RHF	Radiant Heat Flux
ROS	Rate of Spread
SEPP	State Environmental Planning Policy
SFPP	Special Fire Protection Purpose

3. Executive Summary.

The subject development land identified as Lot 79 DP752017 - 79 Kumarna Street, Duffys Forest. NSW. 2084 has been assessed in relation to a proposed new residential development in the bushfire weather area of the Northern Beaches Council which has a bushfire danger index (FDI) of 100. With reference to the Northern Beaches Council Bushfire Prone Land Mapping instruments, the development property contains 'Category 1 - (forest and woodland)' bush fire vegetation and consequently the property is subject to the assessment processes for developments that are undertaken within bushfire prone land.

The dominant and assessable vegetation type surrounding the development envelope that is the subject of this assessment is 'Forest', and the slope under the vegetation in the 'worst case scenario' is downslope 5 to 10° to the northwest. Based on the site-specific conditions at the time of compiling this report, the greatest requirement for asset protection zones (APZ) is an inner protection area of 22 metres with an outer protection area of 15 metres which occurs on the northern aspect and the Bushfire Attack Level (BAL) is determined to be '40'.

The construction requirements for a building in a bushfire prone area with an assessed BAL rating of '40' is to be undertaken in accordance with 'Section 8 - Construction for Bushfire Attack Level '40' (BAL- '40') of "AS3959 - 2018 Construction of Buildings in Bushfire Prone Areas" as applicable where that Section specifically stipulates any construction requirements. Additional construction and compliance requirements are detailed in the publication "Planning for Bushfire Protection (2006)" (NSW Rural Fire Service), "Addendum: Appendix 3 Planning for Bushfire Protection (2010)" and "Part 3A Rural Housing Code of the State Environmental Planning Policy (SEPP) - (Exempt and Complying Development Codes) 2008, Subdivision 9 Development standards for particular land, Clause 3A.37; Development standards for bush fire prone land"; which addresses matters such as access and egress, water and gas supply, and general siting and design elements.

If there are any other buildings or structures within 10 metres, or attachments to the main residential dwelling (either at the time of construction or constructed at some time in the future), then the construction standards referenced in this section also apply to such buildings and / or attachments. It is particularly noted that the eastern aspect of the dwelling which has a Bush Fire Attack Level rating of BAL-40 relates to the garage section only which is separated from the main dwelling by a full-height, non-combustible rammed earth wall with separate and discontinuous roof deck to each section of the garage and dwelling. The façade of the dwelling on the eastern aspect is deemed to have a BAL rating of 'BAL-29' – refer to Section 13 for further discussion.

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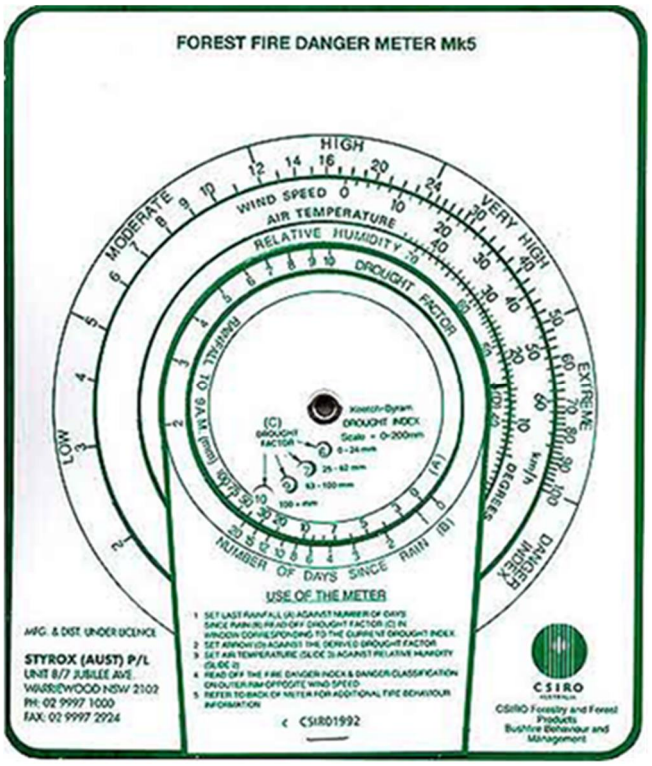
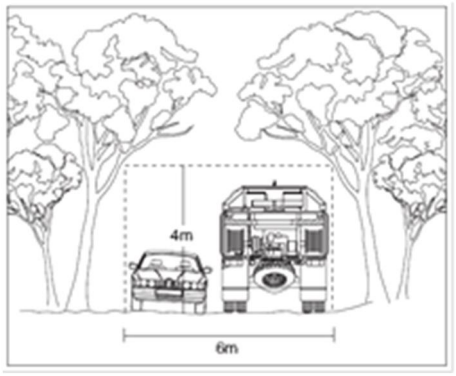
4.	Assessment Methodology.	
	General Information	The methodology employed to undertake a site risk assessment for potential bushfire hazard is consistent with Section 3.5 of "Appendix 3, Planning for Bushfire Protection (April 2010)", "Addendum: Appendix 3 Planning for Bushfire Protection (2010)" and the 'simplified procedure' set-out in Section 2 'Determining the Bushfire Attack Level (BAL)' of "AS3959 -2018 'Construction of Buildings in Bushfire Prone Area". The following six steps are generally undertaken in the assessment of the site: • Determine the relevant FDI (Fire Danger Index) for the local government jurisdiction where the development is to be undertaken • Determine the classified vegetation types. Where there is more than one vegetation type, each shall be classified separately with the worst-case scenario formation applied for assessment purposes • Determine the distance of the site from the classified vegetation types. Normally measured in the horizontal plane from the edge of the nearest building element of the proposed building to the margins of the vegetation type • Determine the effective slope under each of the classified vegetation types. This assessment is for the effective slope under the vegetation and not necessarily the slope between the proposed building site and the vegetation formation as the two can be completely different. • Determine the appropriate Bushfire Attack Level (BAL) for each of the vegetation classifications and for each aspect or elevation of the proposed building from the relevant Tables using the appropriate FDI rating for the local government jurisdiction. • Determine the appropriate construction requirements from within AS3959 -2018 'Construction of Buildings in Bushfire Prone Area' for each of the different vegetation classifications and building elevations. Not all elevations will necessarily have the same construction requirements, however consideration should be given to applying construction standards of the highest BAL rating to the entire structure.

5.	Legislation and Planning Instruments.	
	General Information	The development block is zoned 'RU4' Primary Production Small Lots within the Warringah Local Environmental Plan (2011) (Land Zoning Maps LZN-002) and therefore construction of a dwelling is a permissible activity with consent under the objectives described for the land. This bushfire hazard assessment follows the procedures set-out in the publication "Planning for Bushfire Protection (2006)" (NSW Rural Fire Service) and the relevant supporting document "Addendum: Appendix 3 Planning for Bushfire Protection (2010)" (NSW Rural Fire Service) for determining the appropriate construction requirements for the proposed development in a designate bushfire prone area. The proposed development is considered infill development and therefore Section 4.14 of the EP& A Act (1979) applies which states the following: **4.14 Consultation and development consent--certain bush fire prone land** (1) Development consent cannot be granted for the carrying out of development for any purpose (other than a subdivision of land that could lawfully be used for residential or rural residential purposes or development for a special fire protection purpose) on bush fire prone land unless the consent authority: (a) is satisfied that the development conforms to the specifications and requirements of the document entitled *Planning for Bush Fire Protection, ISBN o 9751033 2 6*, prepared by the NSW Rural Fire Service in co-operation with the Department of Planning (or, if another document is prescribed by the regulations for the purposes of this paragraph, that document) that are relevant to the development (**"the relevant specifications and requirements"**), or (b) has been provided with a certificate by a person who is recognised by the NSW Rural Fire Service as a qualified consultant in bush fire risk assessment stating that the development conforms to the relevant specifications and requirements.

		(1A) If the consent authority is satisfied that the development does not conform to the relevant specifications and requirements, the consent authority may, despite subsection (1), grant consent to the carrying out of the development but only if it has consulted with the Commissioner of the NSW Rural Fire Service concerning measures to be taken with respect to the development to protect persons, property and the environment from danger that may arise from a bush fire. (1B) This section does not apply to State significant development. (2) In this section: **"special fire protection purpose"** has the same meaning as it has in section 100B of the *Rural Fires Act 1997*. In particular reference to item 1(a) above, the major considerations of 'Planning for Bushfire Protection' is the establishment of appropriate asset protection zones around the building, the location and siting of the building, the design considerations in the architecture of the building, construction standards, access and egress, adequate water supply, gas supply, general landscaping and maintenance. The following relevant policies and guidelines have been considered in this site assessment: • "Planning for Bushfire Protection (2006)" and "Addendum: Appendix 3 Planning for Bushfire Protection (2010)" (NSW Rural Fire Service) • "AS3959 - 2018 Construction in Bushfire Prone Areas" • The National Construction Code (formerly the Building Code of Australia (BCA)) • Warringah Local Environmental Plan (2011) • Northern Beaches -Warringah Council Development Control Plan (as amended 2016) • Part 3A Rural Housing Code of the State Environmental Planning Policy (SEPP) - (Exempt and Complying Development Codes) 2008

6.	Fire Weather	
	General Information	The FDI (Fire Danger Index) rating system was developed by McArthur (CSIRO) in the 1960's to help predict the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression according to the various combinations of air temperature, relative humidity, wind speed and both the long and short term drought effects. An FDI of 100 was considered to be the maximum danger rating given the worst possible combination of fire conditions when the Forest Fire Danger Index was initially introduced, and still stands as the fire weather indicator for all NSW local government areas despite the fact that the maximum potential FDI ratings have been calculated well in excess of 100 in some weather districts. The warning classifications have been updated recently in line with improved knowledge of weather and fire behaviour to the extent that the classification system introduced a new level of danger being "Catastrophic" which reflects conditions in excess of an FDI of 100.
	Site Specific Comment	**The Northern Beaches Council is located within the Greater Sydney Region fire area of NSW and therefore has an FDI rating of 100 assumed as a 1:50 year event.**



7.	Access and Egress	
	General Information	Section 4.1.3 (2) of "Planning for Bushfire Protection (2006) - Access (2) - Property Access" requires that an alternate escape route be made available if the distance from the nearest arterial road to the dwelling site is greater than 200 metres, and that the minimum width for internal access roads be four metres plus one metre either side which is maintained to provide a clear opening of four metres between ground level and any overhanging vegetation in accordance with the below Figure. There must also be a turning provision of not less than 12 metres near to the dwelling site which will allow emergency services vehicles clear access to the dwelling.  General construction requirements for internal property access roads in rural areas as prescribed by the NSW Rural Fire Service
	Site Specific Comment	**The development property is accessed from the end of Kumarna Street at Duffys Forest which is an unsealed and unformed crown road that junctions to the northwest of Mallawa Road. It is anticipated that the proponents will be required to bring the Kumarna Street road corridor to a suitable standard for all service vehicles which would include a clear vegetation opening in the horizontal and vertical planes of 6 and 4 metres respectively, and that the road surface will be to an all-weather driving standard.** **The dwelling site is located approximately 90 metres to the south from the front entrance gateway off Kumarna Street and will be accessed from an internal driveway to be formed from improvements to an existing track that traverses through a stand of forested vegetation.** **As the distance from the entrance gateway to the dwelling site is less than 200 metres there is no requirement to provide an alternate egress route from the property, however the nature of surrounding vegetation and the restricted egress along the crown road back to Mallawa Road would suggest that a plan to leave early in a bush fire event be implemented as a matter or priority.**

		The internal carriageway from the entrance to the development envelope will need to satisfy the construction standards as specified in Section 4.1.3(2) of "Planning for Bushfire Protection (2006)" and as described at the commencement of this section. **There will be a one-off requirement prior to occupancy of the dwelling that the carriageway be inspected, and any clearing undertaken 'as necessary' to establish the required clearances in both the horizontal vertical planes. It is a general requirement for the property owners to regularly inspect and maintain the vegetation to the appropriate clearance distances as stipulated in the guidelines, in particular the clear opening provisions.** **It is also noted that the requirements to provide a 12 metre radius turning circle near the building envelope for emergency vehicles can readily be achieved by way of the proposed site design and site layout which will include vehicular linkage to a set of stables and covered sand arena to the southwest of the dwelling. A site plan at the end of this report shows the internal carriageways and access / egress points discussed above.**

Portion of the Northern Beaches Council Bushfire Prone Map showing the extent of 'Category 1' (forest and woodland) bush fire prone vegetation (red shading) and associated buffer zones (yellow shading) within and around the development property.

8. Water Supply

General Information

In rural areas where the development block is not located within a service area that has access to reticulated water supply, the provision of a dedicated and static water supply is considered essential. The provision of a dedicated water supply in rural areas provides opportunities for fire fighters to replenish their tanker supplies and also aims to ensure that there is adequate water provisions for the property owners to undertake their own protection activities. As a general rule the capacity of the static water requirement is based on the Lot size and the type of development, with the typical requirements summarised in the following Table.

It should be emphasised that the water requirements listed in Table 1 are a minimum requirement, and where site specific firefighting systems have been installed such as fire hose reels, drencher systems and other fire suppression measures, additional water storage will be required - and the overall capacity of this additional requirement should be based on a site-specific design. The minimum water storage requirements applicable to this development without any site-specific fire protection detail is highlighted in Table 1.

Table 1. Water supply requirements - adopted from "Planning for Bush Fire Protection (2006).

Development Type	Residential Lots (<1000m²)	Residential Lots (1000 - 10,000m²)	Large Rural / Lifestyle Lots (>10,000m²)	Dual Occupancy	Townhouses / Unit Style (e.g. Flats)
Water Requirement	5,000 litres / Lot	10,000 litres / Lot	20,000 litres / Lot	2,500 litres / Unit	5,000 litres / Unit up to 20,000 litres maximum

Site Specific Comment

It is proposed that in accordance with the guidelines in Section 4.1.3 of "Planning for Bushfire Protection (2006)" a dedicated minimum of 20,000 litres of water storage for firefighting purposes will be installed in tanks made from non-combustible materials. The proponents have indicated that there will be within a single tank having a nominal capacity of 100,000 litres located on the western side of the dwelling that will be used for both the potable water supply and a possible source for firefighting water provisions. The potable water supply will have a suction line that is set at a level approximately 10,000 litres above the base of the tank and there will be a removable hatch at least 300mm square that will provide access for the NSW Rural Fire Service to draw water.

		Additional water storage will be available in a series of at least six 22,500 litre tanks located at the rear of the stables complex that can be used to maintain a full volume of water within the main tank, and as supplementary sources around the property. A private swimming pool and reflection pool are also available as sources of water for firefighting purposes. **For this particular development it is a requirement that a storz outlet having a face diameter of 65mm be connected to the dedicated firefighting water tank and be appropriately installed on the approach (eastern) side of the dwelling to allow access for the rural fire service to draw water from the tank. The storz connection shall be no closer than 10 metres to any building element of the dwelling.** **It is also a requirement that there will be a sufficient number of dedicated hose cocks connected to the firefighting water supply to ensure that all points of the dwelling are able to be protected by a jet of water being delivered from each hose cock at the same time. As a minimum requirement to adequately cover the dwelling, this would require the installation of two hose cocks, located on diagonally opposing corners of the dwelling, with each hose cock fitted with a 30 metre hose.** **Both the storz outlet and the fire hose taps should be coloured in a yellow paint for ease of identification through the smoke and haze of a bushfire event, and all pipework and fittings associated with the fire system that are above ground need to be of metal construction - preferably being medium gauge metals with threaded fittings as distinct from copper pipe with soldered fittings which will separate at temperatures around 700°C.** **To provide a pressurised water supply from the static water storage to the fire protection measures around the property, it is necessary to provide a petrol or diesel operated 'fire pump' with a minimum engine capacity of 5.5 horse power. The use and reliance of electric pumps is unreliable due to the potential loss of electricity supply during bush fire events, and therefore a 'standalone' and reliable means of delivering water at pressure is required.**

		It is important to remember that whilst the protection and defensive measures addressed in this report are principally focused on the requirements for bush fire events, other fires including general household fires can occur at any time and therefore the provisions of this report are intended to extend to all probable fire events. It is for this reason that firefighting measures, such as firefighting pumps being connected to the water supply, should be in place at all times and not simply in the recognised bush fire season.
	Additional Information	The following items are adopted from Section 4.1.3 of "Planning for Bushfire Protection" and are considered mandatory installation conditions across all development types and are to be applied as applicable: • a suitable connection for firefighting purposes is made available and located within the IPA (Inner Protection Area) and away from the structure. A 65mm Storz outlet with a gate or ball valve is provided. • gate or ball valve and pipes are adequate for water flow and are metal rather than plastic. • underground tanks where installed have an access hole of 200mm to allow tankers to refill direct from the tank. A hardened ground surface for truck access is supplied within 4 metres of the access hole. • above ground tanks are manufactured of concrete or metal and raised tanks have their stands protected. Plastic tanks are not used. Tanks on the hazard side of a building are provided with adequate shielding for the protection of fire fighters. • all above ground water pipes external to the building are metal including and up to any taps. Pumps are shielded. • tap connections for handheld hoses to be used in firefighting applications should not be connected to the potable water supply as this supply is normally operated with an electric pump which may not be operative during a fire event. • a petrol operated firefighting pump be connected to the dedicated water supply and regularly checked to ensure proper operation and easy start function. SWIMMING POOLS, CREEKS AND DAMS SHOULD NOT BE USED AS A SUBSTITUTE FOR A DEDICATED STATIC WATER SUPPLY AS THESE SOURCES OF WATER ARE NOT CONSIDERED RELIABLE DURING DROUGHT CONDITIONS.

		Refer to the attachment titled 'Water Consumption Tables' on page 31 of this report which provides an indication and a guide of the supply time for a standard 20,000 litre water supply operating various combinations of sprinklers and handheld hoses. Tables 1 and 2 display the figures for a 20,000 litre static water supply as this is normally the minimum requirement for residential developments in rural environments that do not have access to a reticulated water supply. The proponents should give consideration to details within this document to determine if the minimum water supply requirement of 20,000 litres is satisfactory for the bush fire protection needs based on their planned and perceived protection measures.

Example of a storz connection associated with a dedicated water storage tank used for dedicated firefighting purposes

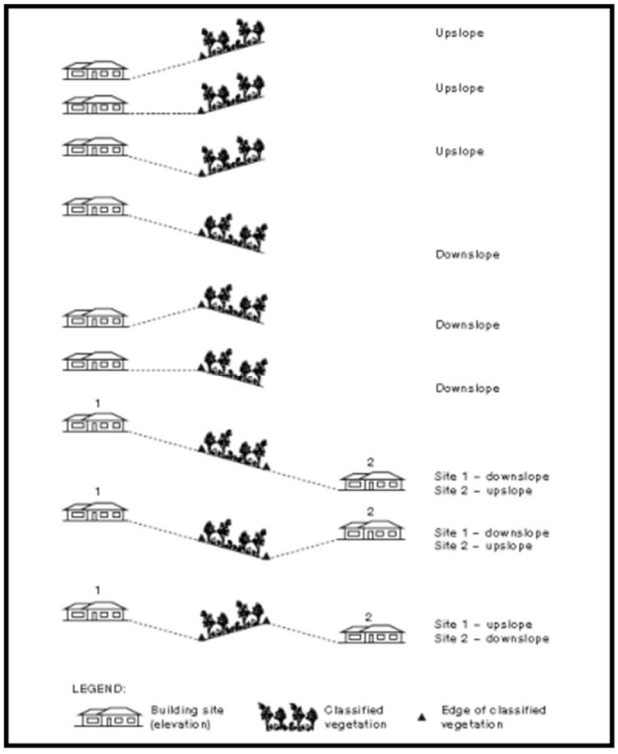
9.	Gas Supply	
	General Information	Gas and other combustible materials should not be stored within the inner protection area of the dwelling or close to significant stands of vegetation formations. In particular, "Planning for Bushfire Protection (2006)" states the following: • reticulated or bottled gas is installed and maintained in accordance with AS 1596 and the requirements of relevant authorities. Metal piping is to be used. • all fixed gas cylinders are kept clear of all flammable materials to a distance of 10 metres and shielded on the hazard side of the installation. • if gas cylinders need to be kept close to the building, the release valves are directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal. • polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not used.
	Site Specific Comment	**It is noted that if proponents intend to install various gas operated appliances throughout the dwelling the property is not serviced by a reticulated gas supply and therefore will be reliant upon LPG gas cylinders. It is anticipated that all plumbing and drainage work will be performed by licensed plumbers and that all gas supply work will be undertaken in accordance with "AS 5601-2010 Gas Installations".** **It is conditional on the installation of LPG gas services that a certificate plate of compliance be installed at the point of the gas connection between the storage bottles and the supply point to the dwelling, and these certificate plates can only be completed by accredited trade certifiers. Connection of the gas supply to the dwelling is not permitted where the certificate plate is not fixed to the building, and this ensures that the installation methods and the material components comply with the relevant codes and standards. It is a requirement to ensure that the dwelling has certificate plates fitted and visible when the bottles are relocated external to the building.**

10.	Vegetation Assessment	
	General Information	The vegetation around the dwelling site has been classified using recommended references including "Ocean Shores to Desert Dunes" (Keith, 2004), "AS3959 - 2018 Construction of Buildings in Bushfire Prone Areas", and "Planning for Bushfire Protection" (2006). Where applicable, the dominant vegetation types and formations have been identified for each aspect or elevation of the proposed dwelling to a distance of 140 metres, or the nearest distance if the assessable vegetation formation is less than 140 metres from the development site. As a general rule of the assessment process, the vegetation assessment that is deemed manageable by the property owners shall only be conducted to the extents of the boundaries of the subject property if the distance to the property boundary is less than 140 metres as the property owners normally do not have any direct control on the vegetation that lies in adjacent properties. Where the distance from the development site to the property boundary is less than 140 metres and the assessable vegetation formation is immediately on the neighbouring side of that boundary, it is presumed that for the lifetime of the development that this vegetation will be a 'constant' within the assessment process irrespective of any agreement between the two property owners to undertake any clearing or maintenance within the area. An exception applies if the area is to be maintained by a supply authority as part of a service easement - such as overhead power lines. Table 2 summarises the vegetation classifications surrounding the development envelope out to a distance of approximately 140 metres.
	Site Specific Comment	**The vegetation formations surrounding the development envelope are dominated by stands of variable quality *Duffys Forest EEC* and non-threatened plant communities on the northwestern, northern, eastern and southern aspects, with managed lands in the adjoining properties on the eastern, southern, southeastern and southwestern aspects.** **The northwestern quarter of the development property has historically been cleared of forested vegetation formations and is subsequently set to a blend of open paddocks and scattered native trees.**

		The northwestern boundary of the property is bordered by the unformed Cullamine Road which is a crown road used for recreational and firefighting purposes associated with the adjoining Kur-Ring-Gai Chase National Park. **The proposed development will necessitate the selective clearing of moderate quality *Duffys Forest EEC* to establish a suitable curtilage and asset protection zone, however the required aspect protection zone has been minimised to protect as much of the forest integrity a possible.** **The vegetation within the established curtilage will be a purpose-designed garden and lawn landscaped area that will provide a defendable space around the dwelling; hence the vegetation assessment is assuming the worst-case formation on each aspect once the development and all required clearing is complete.**

Table 2. Vegetation Assessment.

Direction	Distance (metres)	Vegetation classification, estimated fuel load and slope			
		Vegetation	Fuel load	Slope	Image
North	37	Forest	20t/ha	Downslope 5° - 10°	1
South	20	Managed land	6t/ha	Downslope 0 - 5°	2
East	22	Forest	20t/ha	Downslope 0 - 5°	3
West	40	Managed land	6t/ha	Downslope 0 - 5°	4



Example of the methods used for determining the effective slope under the vegetation formation.

Image 1. View to the north of the development envelope along an existing track (Forest - Downslope 5° - 10°)

Image 2. View of the neighbouring lands to the south of the development envelope (Managed land - Downslope 0 - 5°)

Image 3. View along the eastern boundary from the development envelope with forest inside (Forest - Downslope 0 - 5°)

Image 4. View along the western boundary from the development envelope (Managed land - Downslope 0 - 5°)

11.	Asset Protection Zone	
	General Information	Asset protection zones are areas of reduced fuel accumulation between the assessable vegetation classification and the dwelling site. This separation area provides a defendable space whereby persons attempting to combat the fire will have some protection from the radiant heat that the burning fuel might generate in an intense fire event. The establishment and maintenance of the asset protection zone is required to achieve specific bushfire attack level ratings (BAL) which in turn is used to determine the relevant construction requirements. There are two protection areas within an asset protection zone: the inner protection area and the outer protection area, and the following details should be applied as appropriate to the particular development. The inner protection area is that area immediately around the building envelope that aims to reduce the combustible fuel levels and thereby reduce the possible impacts of direct flame contact and radiant heat to the building elements. The inner protection area should have a tree canopy of less than 15% with no part of any tree within 2 metres of the roofline of the dwelling. Gardens with shrubs and other woody plant materials should not be located under trees such that they could provide a ladder for fire to reach the tree canopy, and they should also not be planted within 10 metres of any exposed window or door of the defendable structure. All trees should be maintained such that there are no limbs below 2 metres from the ground surface. The outer protection area which is normally associated with forested vegetation formation should have a tree canopy of less than 30% and should have the lower strata vegetation mowed and managed to reduce the rate of fire spread. The aim of reducing the density of the tree canopy is to reduce the rate of crown fire spread, and to help filter some of the flying embers by the remaining trees. The following asset protection zones have been calculated with reference to 'Table A2.4 Minimum Specifications for Asset Protection Zones (m) for Residential and Rural Residential Subdivision Purposes (for Class 1 and 2 buildings) in FDI 100 Fire Area (≤29kW/m²)' and 'Table A2.7 Determining Allowable Outer Protection Areas for Forest Vegetation Within an APZ', page 58 of "Planning for Bush Fire Protection" (2006).

		The distances estimated for the inner and outer protection areas using these Tables are the minimum requirements, however there are occasions where the asset protection areas may need to be expanded to satisfy other assessment requirements, for example the bushfire attack level (BAL). It is noted that the measurement to the margins of the asset protection zones are not taken from the centre of the development zone, but rather from the edge of the nearest structural elements on any given aspect, which includes any Class 10 structures (sheds) within 10 metres.

Table 3. Asset Protection Zone requirements.

Direction	Vegetation	Inner Protection Area	Outer Protection Area	Asset Protection Zone
		(metres)		
North	Forest	22	15	37
South	Managed land	20	-	20
East	Forest	12	10	22
West	Managed land	20	-	20

	<u>Site Specific Comments</u>	**The development envelope is surrounded by forested vegetation in an arc from the northwest to the north and around to the east and southeast, whilst the other aspects are dominated by a blend of open grassland with scattered trees, and managed lands in adjoining properties. To establish a suitable dwelling envelope and curtilage selective clearing of existing vegetation will be required to extent necessary to establish adequate protection zones. There is a requirement to maintain all 'grasslands' and future 'managed lands' on the southern and western aspects out to a distance of at least 20 metres to ensure that the Bushfire Attack Level rating does not exceed BAL-12.5 on those aspects. The northern and eastern aspects will require both an inner and outer asset protection area as detailed in Table 3 above.** **It will be incumbent on the property owners to ensure that the asset protection zones as specified in Table 3 are maintained and clear of dead and fallen tree parts and accumulated surface litter and that woody shrubs and opportunistic regrowth vegetation is controlled over the longer period of time. Where grasses and lawns dominate in the future landscaping it will be necessary to keep the height of the grasses within the specified asset protection zones below 100mm during the recognised bushfire season.**

12. Bushfire Attack Level (BAL)

General Information

The Bushfire Attack Level (BAL) is defined as "a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire".

There are several 'levels' within the range of BAL assessments, each with differing construction standards - and these are explained on 'Page 30' of this report for reference purposes.

The following bushfire attack level assessments have been calculated by referencing 'Table 2.4.2 Determination of Bush Fire Attack Level (BAL) - FDI 100 (1090 K)', page 31 "AS3959 - 2018 Construction in Bushfire Prone Areas" based on the appropriate vegetation formations and slopes in relation to the proposed dwelling.

Table 4. BAL rating.

Direction	Vegetation / load		Slope	Distance (m)	Total APZ	BAL rating
North	Forest	20t/ha	Downslope 5° - 10°	37	37	29
South	Managed land	6t/ha	Downslope 0 - 5°	20	20	12.5
East	Forest	20t/ha	Downslope 0 - 5°	22	22	40
West	Managed land	6t/ha	Downslope 0 - 5°	40	20	12.5

Variation to Bushfire Attack Level Assessment

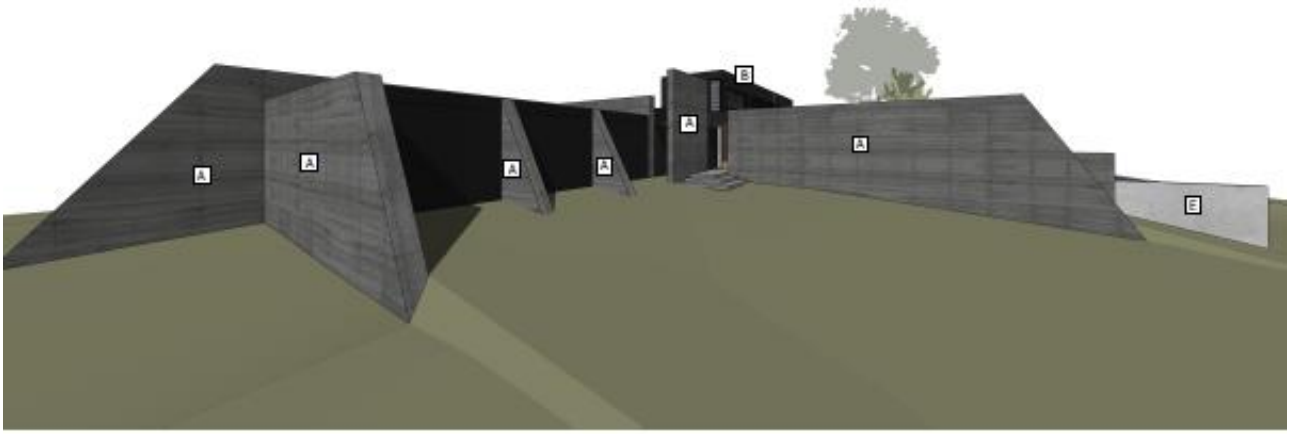
It is noted that in accordance with the provisions of "Planning for Bushfire Protection (2006)" Appendix A3.4 – Step 6; "where more than one façade is exposed to a hazard then the façade with the highest construction requirement is used to determine the appropriate level of construction. All other facades may be reduced by one of level of construction unless that façade is also subject to the same category of bushfire attack".

For this particular development the construction requirements on all aspects of the actual dwelling can be reduced by one level of construction to comply with the requirements of 'BAL 29' if so desired as the garage component is the only portion of the structure with the highest bushfire attack risk rating of 'BAL-40'.

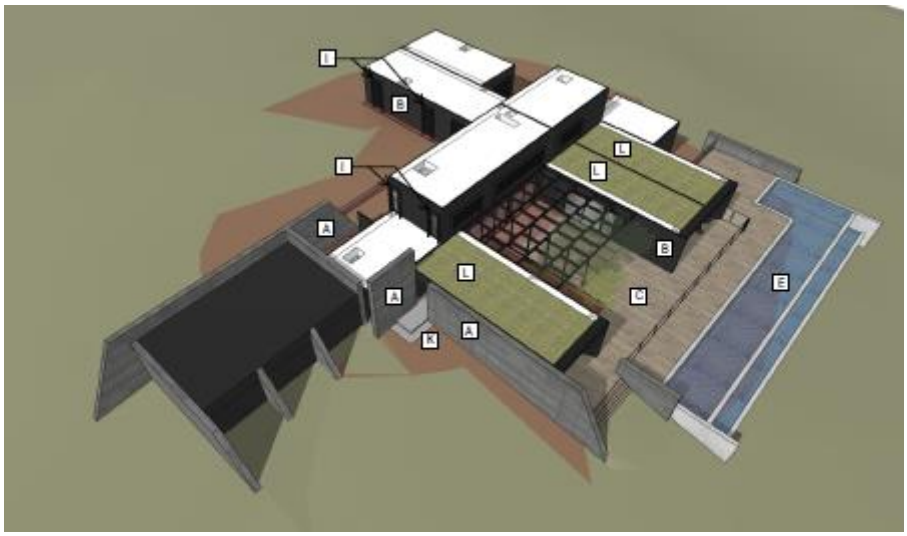
Careful consideration should be given to the potential risks of exposing the dwelling to reduced construction standards before undertaking this option.

13.	Construction Standards	
	General Information	"AS3959 - 2018 Construction in Bushfire prone Areas" sets out the construction requirements for building elements in order to reduce the likelihood of ignition of the building during a bushfire event. The level of building construction is defined as Bushfire Attack Level (BAL) and is equivalent to the BAL rating derived from the above assessment. This development has a BAL rating of '40' and therefore must refer to Section 8 Construction for Bushfire Attack Level 40 (BAL- 40) "AS3959 - 2018 Construction in Bushfire Prone Areas". The incorporation of the construction standards of the Section 8 Construction for Bushfire Attack Level 40 (BAL- 40) are to be applied as appropriate as not all clauses and conditions within that Section may be applicable to the proposed design. In addition to the construction standards set out in Section 8 Construction for Bushfire Attack Level 40 (BAL - 40) "AS3959 - 2018 Construction in Bushfire Prone Areas", the requirements previously discussed in this report pertaining to access and egress, water supply, gas supply and the asset protection zones must also be undertaken as each of the bush fire protection measures must be considered as a 'whole of system' approach to bush fire protection rather than undertaking individual components in isolation.
	Site Specific Comments	**It is noted that in accordance with the provisions of "Planning for Bushfire Protection (2006)" Appendix A3.4 – Step 6; "where more than one façade is exposed to a hazard then the façade with the highest construction requirement is used to determine the appropriate level of construction.** **All other facades may be reduced by one of level of construction unless that façade is also subject to the same category of bushfire attack".** **In particular this relates to the eastern aspect of the dwelling which has a Bush Fire Attack Level rating of 'BAL-40' at the garage portion of the dwelling which is separated from the main dwelling by a full-height, non-combustible rammed earth partition wall with separate and discontinuous roof deck to each section of the garage and dwelling.** **The eastern façade of the actual dwelling is separated from the assessable vegetation formations by approximately 36 metres which produces an effective BAL rating of 'BAL-29'.**

		The only opening to the main dwelling on the eastern façade is a single entrance door which is to be constructed with a steel door frame and door meeting the requirements of BAL-40, *Section 8.5.4 of "AS3959 - 2018 Construction in Bushfire Prone Areas"*
		If there are any other buildings or structures within 10 metres, or attachments to the main residential dwelling (either at the time of construction or constructed at some time in the future), then the construction standards referenced in this section also apply to such buildings and / or attachments.

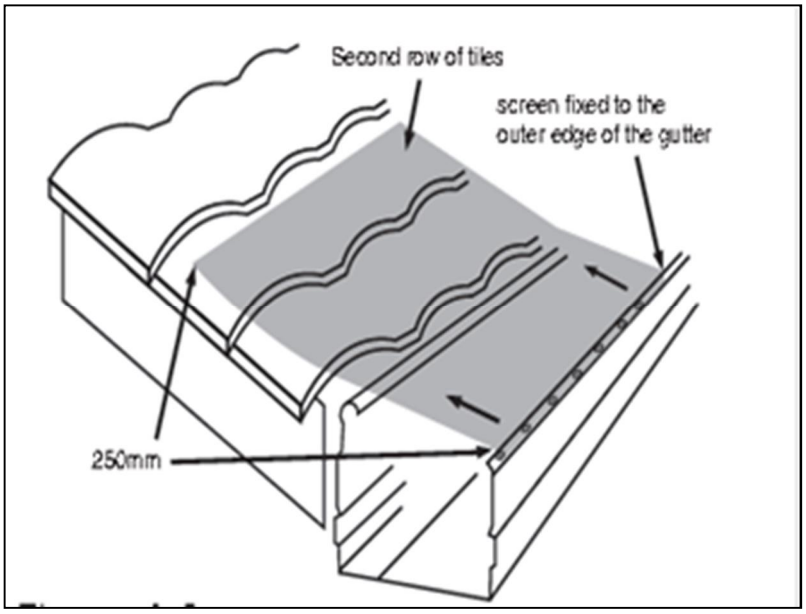


3D conceptual view of the eastern and northeast approach aspect of the proposed dwelling showing the garage section of the structure as the nearest building elements to the forested vegetation on the eastern aspect and the main dwelling set further back. The external walls marked as 'A' are a non-combustible rammed earth construction which as shown are full height to provide screening to the main dwelling. The only opening on the eastern aspect is an entry door which will be constructed to comply with the requirements of Section 8.5.4 of *AS3959 - 2018, Construction of Buildings in Bush Fire Prone Areas.* The remainder of the dwelling has a Bush Fire Attack Level (BAL) rating of 'BAL-29' or less and therefore can be built to 'BAL-29' construction requirements.

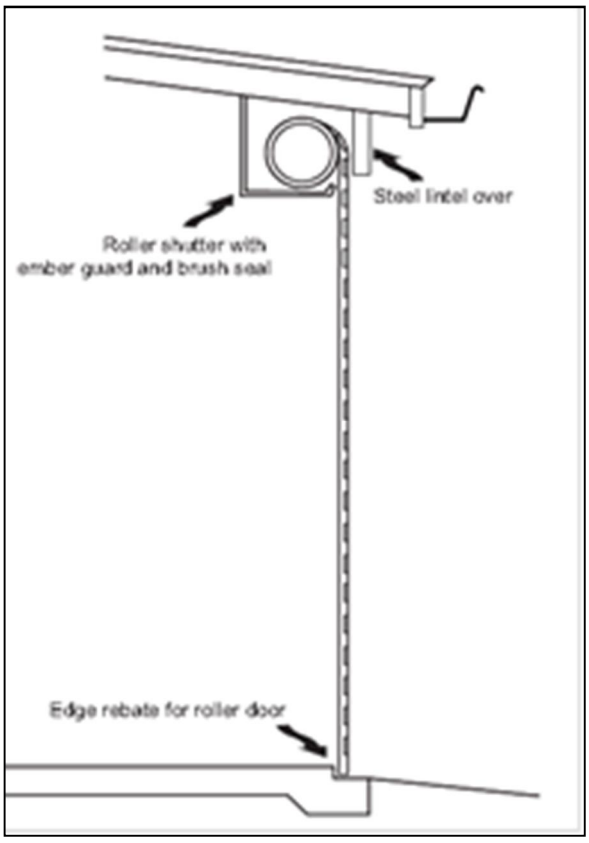


3D conceptual view of the roof sections showing the separation of the garage section from the main dwelling by a full-height partition wall of non-combustible rammed earth construction.

14.	Other General Bushfire Protection Requirements - Siting and Design Principles	
	General Information	The performance of a building during a bushfire attack can be greatly enhanced by adopting the following general siting and design principles as applicable: (NOTE: These are not mandatory requirements) • avoid building on ridge tops and saddles; • building on level ground wherever possible; • where buildings must be constructed on sloping land, they are built on cut-in benches rather than elevated or above fill; • avoid raised floors, utilise concrete slabs (raft construction); • locating the habitable buildings near the property entrance for easier access/egress; • the use of non-combustible fencing (or other class 10a buildings) which is located within close proximity to the main building; • reducing the bulk of a building (height and width) facing a bush fire hazard; • simplifying the design of buildings to reduce the numbers of re-entrant corners; • providing more simplified rooflines; • guttering and gutter valleys being: o installed with gutter guarding having a flammability index of not more than 5, when tested to AS 1530.2; o limited to the lowest possible levels (bottom fascia) to improve access and maintenance; and o covered with a mesh of aluminium bronze or stainless steel with a maximum aperture of 5 mm fixed to the outer edge of the gutter (or valley) and be located beneath the second (or higher) row of tiles or roof sheeting for a distance of 250mm; • use of barriers (e.g. courtyards, fenced off areas for gardens, BBQ areas and the like); and • where garages are located under the roofline of the main building, garage doors are to be ember proofed and employ ember traps and or brushes to prevent the entry of embers into the garage area (see requirements for garages and other structures in above diagram)

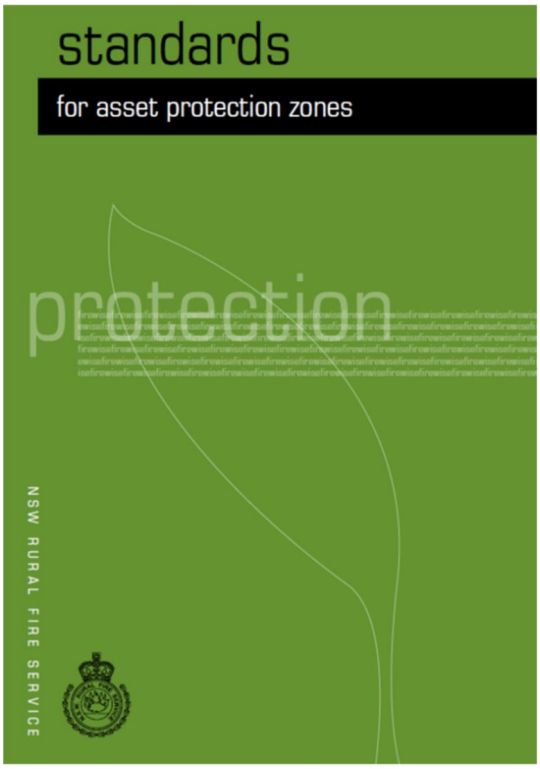


Leafless gutters enhance building performance



Example of a roller shutter door installation

15.	General Maintenance and Landscaping.	
	General Comments	The establishment of gardens and lawns are often a dominant part of the rural lifestyle choice as they help to provide seclusion, shelter and a general beautification of the landscape, however consideration needs to be given to the type and structure of the landscaping components to ensure that they do not form a continuum between the classified vegetation formations and the building elements. Selection of appropriate vegetation types and form for landscaping purposes are important considerations, as is the location and positioning of various plantings. It is important that critical asset protection areas are not compromised by the establishment of landscaping features, and that the longer-term maintenance requirements of established gardens do not in fact add to the potential fire fuel loads around the property. The publication "Standards for Asset Protection Zones" (2006) from the NSW Rural Fire Service provides good advice and guidelines for the establishment of asset protection areas, landscaping and longer term maintenance requirements and should be referenced prior to the design and installation of landscaping features. More Information is available from: http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf



16. Conclusion.

The proposed development has a BAL level rating of '40' and therefore must comply with the construction requirements of 'Section 8 - Construction for Bushfire Attack Level 40 (BAL- 40)' of "AS3959 - 2018 Construction of Buildings in Bushfire Prone Areas" as applicable. Whilst it is possible that only certain sections of 'Section 8 - Construction for Bushfire Attack Level 40 (BAL - 40)' of "AS3959 - 2018 Construction of Buildings in Bushfire Prone Areas" will influence the construction standards for this particular development, adoption of the protection measures regarding access and egress, water supply, gas supply, asset protection zones and 'other bushfire protection requirements' will enhance the changes of surviving a bushfire event.

Measures to ensure that adequate water supply are made available at all times in an approved storage system will help with the preparedness of the occupants of the dwelling to be able to survive not only a bushfire attack, but all fire events. Consideration should always be given to increasing the storage capacity of dedicated water supplies for firefighting purposes as the duration and intensity of potential bush fires are unpredictable, and the ability to adequately and competently undertake firefighting measures will greatly influence the 'stay or go' decision of the property owners. Once the decision to stay has been made (if that is a likely choice) there needs to be adequate resources to fight the fire and to protect lives - and perhaps the greatest resource to achieve this is 'water'. Fires cannot burn well when the available fuel is wet.

Finally, it is advisable that the proponents become familiar with the NSW Rural Fire Service public web site to access the list of tools and information aimed at helping residents in bushfire prone areas to identify and be prepared for bushfire events. Simple processes such as preparing an evacuation plan and maintaining clear and unobstructed carriageways will assist with appropriate responses during times of stress, panic and confusion associated with large bushfire events. Invite the Rural Fire Service coordinator for the local area to the property once development has completed, or when occupancy has commenced, so that they can familiarise themselves with the location of the dwelling, water supply and access, and identify any potential hazards that might exist on the site such as the existence of gas bottles. Any activity that is undertaken to improve awareness and preparedness will become invaluable when an actual bush fire event occurs.

17. BUSHFIRE ATTACK LEVELS (BAL's) EXPLAINED

The 2018 edition of AS 3959 "Construction of Buildings in Bushfire Prone Areas" explains Bushfire Attack Levels (BAL's) as follows:

(a) **BAL—LOW** The risk is considered to be **VERY LOW**.
There is insufficient risk to warrant any specific construction requirements but there is still some risk.

(b) **BAL—12.5** The risk is considered to be **LOW**.
There is a risk of ember attack. The construction elements are expected to be exposed to a heat flux not greater than 12.5 kW/m2.

(c) **BAL—19** The risk is considered to be **MODERATE**.
There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat. The construction elements are expected to be exposed to a heat flux not greater than 19 kW/m2.

(d) **BAL—29** The risk is considered to be **HIGH**.
There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat. The construction elements are expected to be exposed to a heat flux not greater than 29 kW/m2.

(e) **BAL—40** The risk is considered to be **VERY HIGH**.
There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front. The construction elements are expected to be exposed to a heat flux not greater than 40 kW/m2.

(f) **BAL—FZ** The risk is considered to be **EXTREME**.
There is an extremely high risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front. The construction elements are expected to be exposed to a heat flux greater than 40kW/m^2.

18. WATER CONSUMPTION TABLES FOR A STANDARD 20,000 LITRE WATER SUPPLY

Table 1. Flow requirements (l/min) and approximate supply times (hrs) for various combinations of ¾" hose and ¼" adjustable nozzles with brass impact sprinklers drawing from a 20,000 litre water tank with a petrol firefighting pump.

		20 brass impact sprinklers				25mm brass impact sprinklers			
# hoses	0	1	2	3	4	1	2	3	4
1	40 / 8.3	63 / 5.3	86 / 3.8	109 / 3.0	132 / 2.5	100 / 3.3	160 / 2.0	220 / 1.5	280 / 1.2
2	80 / 4.1	103 / 3.2	126 / 2.6	149 / 2.2	172 / 1.9	140 / 2.4	200 / 1.6	260 / 1.3	320 / 1.0
3	120 / 2.7	143 / 2.3	166 / 2.0	189 / 1.7	212 / 1.6	180 / 1.8	240 / 1.4	300 / 1.1	360 / 0.9

Table 2. Flow requirements (l/m) and approximate supply times (hrs) for various combinations of 1" hose and Ę " adjustable nozzles with brass impact sprinklers drawing from a 20,000 litre water tank with a petrol firefighting pump.

		20 brass impact sprinklers				25mm brass impact sprinklers			
# hoses	0	1	2	3	4	1	2	3	4
1	75 / 4.4	98 / 3.4	121 / 2.7	144 / 2.3	167 / 2.0	135 / 2.4	195 / 1.7	255 / 1.3	315 / 1.0
2	150 / 2.2	173 / 1.9	196 / 1.7	219 / 1.5	242 / 1.4	210 / 1.6	270 / 1.2	330 / 1.0	390 / 0.8
3	225 / 1.5	248 / 1.3	271 / 1.2	294 / 1.1	317 / 1.0	285 / 1.1	345 / 0.9	405 / 0.8	465 / 0.7

Legend:

Flow / Time

The duration of a fire attack can vary significantly depending upon the conditions that are prevailing at the time such as vegetation cover, slope and wind. Typically, the first of three stages of a bush fire attack is the ember showers which can last for approximately 30 minutes before the fire front arrives. Secondly is the fire front itself which is normally very quick and measured in 1 to 3 minutes, and finally is the flame attack that follows the fire front which can last for several hours - again depending on the prevailing conditions. It is therefore not unrealistic to predict that a bush fire attack could last for anywhere from between 2 to several hours, and when this is considered in relationship to the figures in Tables 1 and 2, then there is a genuine argument for re-consideration of the volume of water dedicated for firefighting purposes.

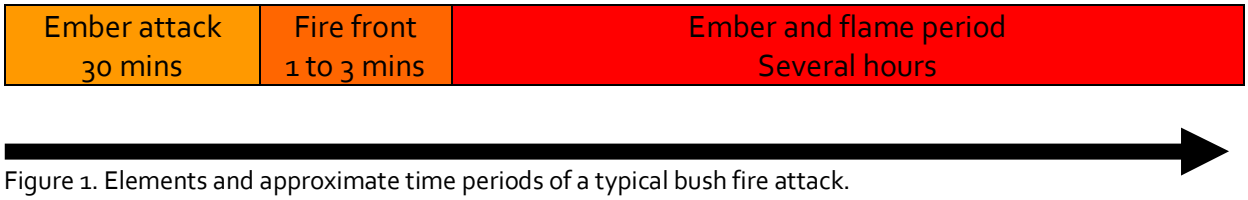


Figure 1. Elements and approximate time periods of a typical bush fire attack.

N

100,000 LITRE INGROUND RAINWATER TANK COLLECTING RUNOFF FROM THE DWELLING ROOF AND SUPPLYING POTABLE DEMANDS

BANK OF 3 x 22,500 LITRE POLY WATER TANKS FOR ALL EXTERNAL IRRIGATION, ANIMAL HUSBANDRY AND POOL WATER DEMANDS.

BANK OF 3 x 22,500 LITRE POLY WATER TANKS FOR ALL EXTERNAL IRRIGATION, ANIMAL HUSBANDRY AND POOL WATER DEMANDS.

ROUND EXERCISE YARD SAND BASE

OPEN HOLDING YARDS

STABLES COMPLEX

DWELLING

GARAGE

POOL - NOMINALLY 100,000 LITRES

REFLECTION POND

COVERED SAND ARENA

OPA 1.5m

Forest - 37m Downslope 5° BAL-29 IPA 22m

Forest - 36m Downslope 0 - 5° BAL-29 IPA 26m

OPA 10m

Forest - 22m Downslope 0 - 5° BAL-40 IPA 12m

OPA 10m

Managed Lands - 40m Downslope 0 - 5° BAL-12.5 IPA 20m

Managed Lands - 40m Downslope 0 - 5° BAL-12.5 IPA 20m

134° 59' 10" 129.63

314° 59' 10" 129.63

155.56 44° 59' 10"

RWT 22,500l ST-1

RWT 22,500l ST-2

RWT 22,500l ST-3

RWT 22,500l ST-OF

RWT 22,500l SA-OF

RWT 22,500l SA-3

RWT 22,500l SA-2

RWT 22,500l SA-1

SW 225 SW 150 SW 100

176 182 183 184 185 186

0 10 20 30
METRES

PROJECT TITLE:
RESIDENTIAL DWELLING DEVELOPMENT

DRAWING TITLE:
BUSH FIRE HAZARD ASSESSMENT SITE PLAN

TITLE PARTICULARS:
LOT 79 DP752017

STREET ADDRESS:
79 KUMARNA STREET
DUFFYS FOREST. NSW. 2084

DRAWING DATE:	SHEET NUMBER:
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A	PRELIMINARY PLAN - DRAFT ONLY
25/10/2019	

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