

HAMMOND GROVE

BY **QUBE**

FIRE MANAGEMENT DOCUMENTS



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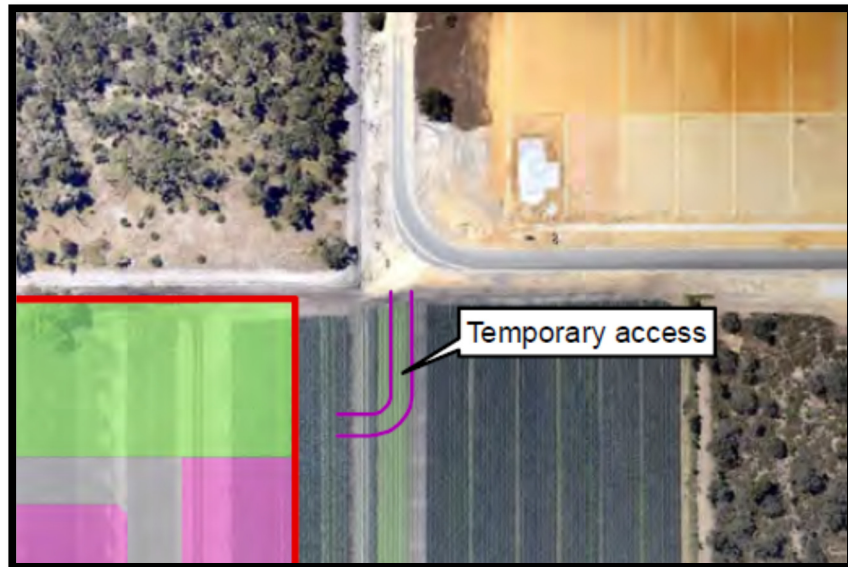
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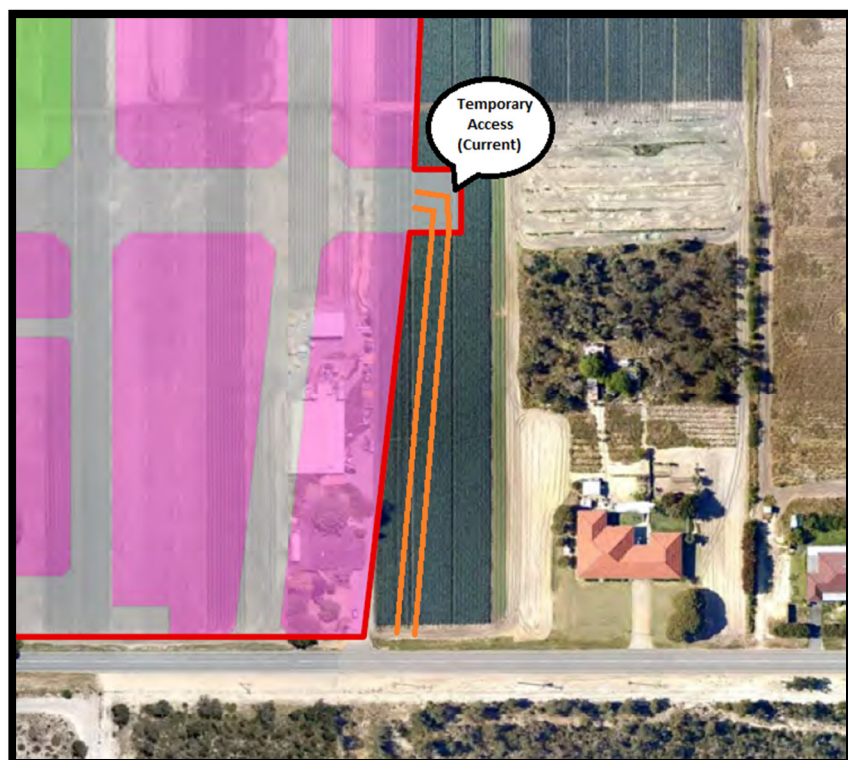
NOTICE OF CHANGE TO FIRE MANAGEMENT PLAN – 05/10/16

Referring to the Fire Management Plan dated October 2014, please note that the temporary access (extract below) to Frankland Avenue has been changed to Wattleup Road. For clarity, the temporary access to Frankland Avenue does not exist. The temporary access now extends to Wattleup Road.

Original Temporary Access – Per Fire Management Plan (October 2014)



Revised (and current) Temporary Access



FIRE MANAGEMENT PLAN

Frankland Avenue

Local Structure Plan

Wattleup Road

Lot 1, 111 and 810 Wattleup Road
Hammond Park
City of Cockburn

October 2014

Prepared for Qube Hammond South Development Pty Ltd
(Revision C)

This report has been prepared by Bushfire Safety Consulting in collaboration with Emerge Environmental Services Pty Ltd (trading as Emerge Associates).

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Revision: A – July 2014
Updated after comment from client.
B – September 2014
Updated after comment from City of Cockburn.
C – October 2014
Updated following minor change to LSP.

Site: Lots 1, 111 and 810 Wattleup Road, Hammond Park

Front cover photo: Aerial photograph of development site

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EXECUTIVE SUMMARY

This Fire Management Plan (FMP) has been prepared to support the preparation of a Local Structure Plan (LSP) for Lots 1, 111 and 810 Wattleup Road, Hammond Park. This area is herein referred to as “the site” and its location is shown in **Appendix 1**. The site is approximately 12 hectares in size and is located approximately 24 km south of the Perth Central Business District (CBD) within the City of Cockburn.

The majority of the site is made up of productive market gardens while Lot 111 contains extensive native regrowth vegetation (shown in **Appendix 2**). There are three existing residences located within the site. The site is bounded by Wattleup Road to the south, largely vegetated residential lots to the west, active market gardens to the east, and Bush Forever Site 392 Harry Waring Marsupial Reserve to the north. Frankland Park, a City of Cockburn “Parks and Recreation” reserve lies south of Wattleup Road; this park area, and the Bush Forever Site north of the site, contains extensive vegetation that may pose long term bushfire hazard considerations for residential development within the site.

The site is zoned “Urban” under the Metropolitan Region Scheme (MRS) and “Development” under the City of Cockburn Town Planning Scheme No. 3 (TPS No. 3). There is a “Parks and Recreation” reserve under both the MRS and TPS No. 3 adjacent to the eastern boundary of the site, associated with the Historic Baldivis Tramway Trail, and an “Other Regional Roads” zone under both the MRS and TPS No. 3 east of the Tramway Trail, associated with the future Hammond Road. The site forms part of the larger Southern Suburbs District Structure Plan Stage 3 developed by the City of Cockburn to guide residential development in the broader area.

Following development, while areas of vegetation will be cleared within the site to facilitate development, the majority of the remnant vegetation outside of the site will remain in the short to long term, and will therefore pose varying bushfire hazards to development within the site. Landholdings to the west, south-west and east of the site are intended for future urban development in accordance with the approved Southern Suburbs District Structure Plan Stage 3 and therefore pose only temporary bushfire hazard considerations. Permanent bushfire hazard considerations are posed by the remnant vegetation within Bush Forever Site No. 392 adjacent to the northern boundary of the site, and Frankland Park south of Wattleup Road.

All areas within 100 metres (m) of the site boundary have been assessed for vegetation classification and bushfire hazard rating levels. It has been determined that all proposed future dwellings arising from the LSP will fall within the acceptable level of risk. The temporary and permanent Building Protection Zones (BPZ) requirements as well as the predicted Bushfire Attack Levels (BALs) have been assessed and shown in **Appendices 11-12**.

Any new dwellings constructed within 100 m of identified classified vegetation will require consideration of the need for increased construction requirements to address *AS3959 Construction of Buildings in Bushfire Prone Areas*. In order to pre-empt this requirement, a BAL assessment will be undertaken as part of the subdivision process to confirm the BAL ratings for each individual new lot created. BAL ratings **should not** be determined for future lots at the LSP stage, as the ultimate lot locations/boundaries will be determined through the subdivision process, and temporary hazards (or even hazards that were expected to be permanent) may not remain at that time. If subdivision proceeds within those areas of the

site designated as Bushfire Prone due to temporary bushfire hazards, prior to the hazards being removed, bushfire hazard management measures (i.e. increased construction standards to meet increased BAL ratings) will be required. Therefore a detailed and specific BAL assessment will need to be completed at the subdivision approval stage for all lots currently determined to be within “Bushfire Prone Areas” (see **Appendix 10**). It is also envisaged that as part of the subdivision process, any lots deemed to require fire management responses through the BAL assessment, will be subject to a notification pursuant to section 70A of the *Transfer of Land Act 1893* placed on the certificate(s) of title indicating that the lot is subject to the requirements of a fire management plan (i.e. increased construction standards to meet increased BAL ratings).

It is expected that the implementation of this FMP will reduce the threat to future residents, visitors and fire fighters in the areas proposed for urban development associated with this FMP.

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1 INTRODUCTION

This Fire Management Plan (FMP) has been prepared to support the preparation of a Local Structure Plan (LSP) for Lots 1, 111 and 810 Wattleup Road, Hammond Park. This area is herein referred to as “the site” and its location is shown in **Appendix 1**. The site is approximately 12 hectares in size and is located approximately 24 km south of the Perth Central Business District (CBD), within the City of Cockburn.

The majority of the site is made up of productive market gardens while Lot 111 contains extensive native regrowth vegetation (shown in **Appendix 2**). There are three existing residences located within the site. The site is bounded by Wattleup Road to the south, largely vegetated residential lots to the west, active market gardens to the east, and Bush Forever Site 392 Harry Waring Marsupial Reserve to the north. Frankland Park, a City of Cockburn ‘Parks and Recreation’ reserve lies south of Wattleup Road; this park area and the Bush Forever Site north of the site contain extensive vegetation that will pose long term bushfire hazard considerations for residential development within the site.

The site is zoned “Urban” under the Metropolitan Region Scheme (MRS) and “Development” under the City of Cockburn Town Planning Scheme No. 3 (TPS No. 3). There is a “Parks and Recreation” reserve under both the MRS and TPS No. 3 adjacent to the eastern boundary of the site, associated with the Historic Baldivis Tramway Trail, and an “Other Regional Roads” zone under both the MRS and TPS No. 3 east of the Tramway Trail, associated with the future Hammond Road. The site forms part of the larger Southern Suburbs District Structure Plan Stage 3 developed by the City of Cockburn to guide residential development in the broader area.

2 AIM

The aim of this FMP is to reduce the occurrence of and minimise the impact of bushfires within the site, thereby reducing the threat to life, property and the environment.

3 STATUTORY AND POLICY FRAMEWORK

The following key legislation, policies and guidelines are relevant to the preparation of fire management plans.

3.1 Bush Fires Act 1954

The *Bush Fires Act 1954* sets out provisions to reduce the dangers resulting from bushfires; prevent, control and extinguish bushfires; and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require landowners and/or occupiers to plough or clear fire breaks, to control and extinguish bushfires and establish and maintain Bush Fire Brigades.

Accordingly, the City of Cockburn publishes annual Firebreak Notices that can be downloaded from:

http://www.cockburn.wa.gov.au/Council_Services/Rangers/Fire_Prevention/default.asp.

3.2 State Planning Policy No. 3.4 Natural Hazards and Disasters

The objectives of the *State Planning Policy No. 3.4 Natural Hazards and Disasters Policy* are to:

- Include planning for natural disasters as a fundamental element when preparing all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies.
- Use these planning instruments to minimise the adverse effects of natural disasters on communities, the economy and the environment.

The Policy determines those areas that are most vulnerable to bushfire and where development is appropriate and not appropriate. The provisions and requirements contained in *Planning for Bush Fire Protection Guidelines - Edition 2* (WAPC et al., 2010) are used in this determination.

3.3 Planning for Bush Fire Protection Guidelines (2010)

The *Planning for Bush Fire Protection Guidelines - Edition 2* was prepared by the Department of Fire and Emergency Services (DFES), the Western Australian Planning Commission (WAPC) and the Department of Planning and Infrastructure. The guidelines are the foundation for fire risk management planning on private land in Western Australia.

The guidelines address important fire risk management and planning issues and set out performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. The guidelines also address management issues including location, design, the development site, setback requirements, Bushfire Attack Level (BAL) ratings, vehicular access and water.

3.4 Draft State Planning Policy 3.7 Planning for Bushfire Risk Management and draft Planning for Bushfire Risk Management Guidelines (2014)

The Department of Planning have recently released draft *State Planning Policy 3.7 Planning for Bushfire Risk Management* (2014) and the draft *Planning for Bushfire Risk Management Guidelines* (2014). The requirements of these documents are largely accommodated within this FMP.

The draft *State Planning Policy 3.7 Planning for Bushfire Risk Management* (2014) is intended to inform and guide decision makers, referral authorities and proponents to achieve acceptable bushfire protection outcomes, including expectations at the different stages of planning.

The draft *Planning for Bushfire Risk Management Guidelines* (2014) provides an update on *Planning for Bush Fire Protection Guidelines - Edition 2* (WAPC et al, 2010) to ensure necessary bushfire management measures are incorporated into proposed development.

4 PROPOSAL AND OBJECTIVES

The proposed LSP provides a framework for residential development within the site (see **Appendix 3**).

Community bushfire safety is a shared responsibility between state and local governments, fire agencies, communities and individuals. The planning and building controls outlined in this FMP, when implemented, will reduce the risk to people and property within the site. How future residents interpret the risk, prepare and maintain their properties and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) will greatly influence the consequences of any bushfire.

The objective of this FMP is to address bushfire management issues within the proposed Wattleup Road LSP. If there is a bushfire within or near the site, implementing this FMP will reduce the threat to occupants, property and emergency response personnel.

Achievable and measurable goals of this plan include ensuring:

- Development is located in an area where the bushfire hazard does not present an unreasonable level of risk to life and property.
- Vehicular access to the development is safe if a bushfire occurs.
- Water is available to the development, so that life and property can be protected from bushfire.
- The development is sited to minimise the effects of a bushfire.
- The development design will minimise the effects of a bushfire.

This document sets out the roles and responsibilities of the developer (Qube), future residents, the City of Cockburn and DFES. It is important that the measures and procedures outlined in this FMP are adopted across the various stages of the land use planning and dwelling construction approvals processes.

This FMP includes:

- A description of the site, the surrounding area, fire climate and bushfire history.
- A summary of research into the related effects of a bushfire.
- A bushfire hazard assessment.
- Means of addressing vehicular access.
- Siting of buildings to include building protection and hazard separation zones.
- Water supply.
- Maps and plans of fire reduction measures.

5 DESCRIPTION OF THE AREA

5.1 General

The majority of the site is made up of productive market gardens while Lot 111 contains extensive native regrowth vegetation (shown in **Appendix 2**). There are three existing residences located within the site. The site is bounded by Wattleup Road to the south, largely vegetated residential lots to the west, active market gardens to the east, and Bush Forever Site 392 Harry Waring Marsupial Reserve to the north. Frankland Park, a City of Cockburn 'Parks and Recreation' reserve lies south of Wattleup Road; this park area, and the Bush Forever Site north of the site, contain extensive vegetation that will pose long term bushfire hazard considerations for residential development within the site.

5.2 Climate and Fire Weather

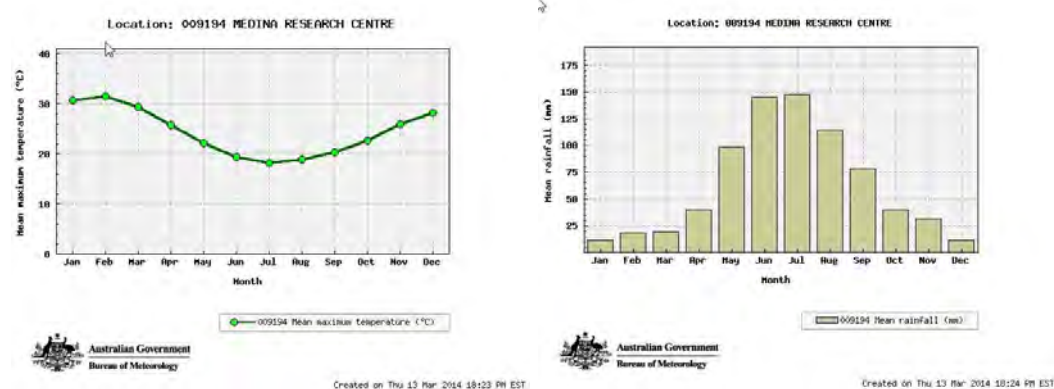
The behaviour of bushfires is significantly affected by weather conditions and they burn more aggressively when high temperatures combine with low humidity and strong winds. In Perth and surrounding coastal areas, the fire risk is greatest from summer through autumn when the moisture content in vegetation is low. Summer and autumn days with high temperatures, low humidity and strong winds are particularly conducive to the spread of fire. This threat is increased if thunderstorms develop, accompanied by lightning and little or no rain.

Research indicates that virtually all house losses occur during severe, extreme or catastrophic conditions (i.e. when the Fire Danger Index is over 50) (Blanchi et al., 2010).

The Bureau of Meteorology (2014) states that extreme fire weather conditions in the Perth region typically occur with strong easterly or north-easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent approximately 60% of extreme fire weather days (events) compared to fewer than 5% associated with southerly winds. About 15% of Perth events occurred in a westerly flow following the passage of a trough.

Very dangerous fire weather conditions often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

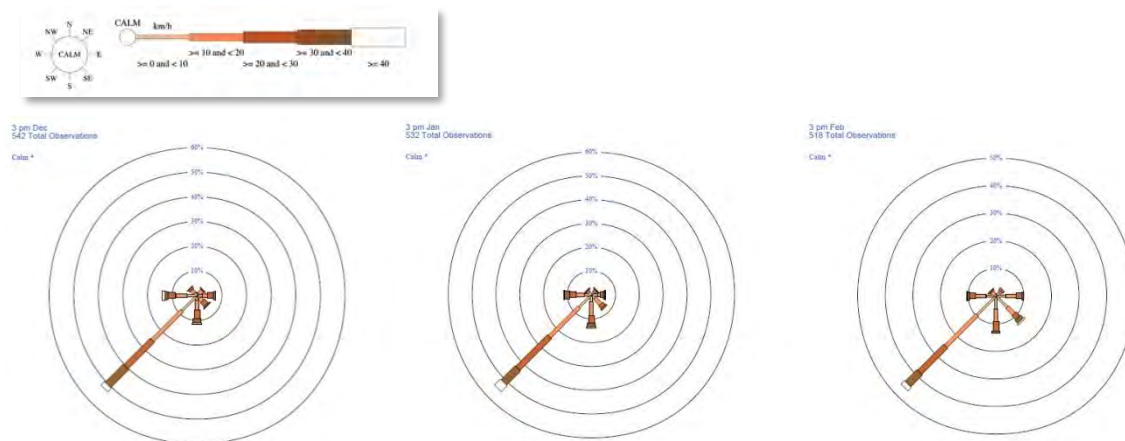
Data from the Medina Research Centre (approximately 7 km south-west of the site) indicate the area experiences warm dry summers and cool wet winters (**Figure 1**), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 31°C in February to 19°C in July.



Source: Bureau of Meteorology

Figure 1: Mean maximum recorded temperatures and mean rainfall for Medina Research Centre Bureau of Meteorology Station between 1983 and 2014

Data from the weather station indicate that the predominant winds near the study site in the summer months at 3 pm are south-westerly (**Figure 2**). Easterly and south-easterly winds are more common in February. Wind strength, direction and frequency from the west and south-west are dominant and occur 45-50 per cent of the time.



Source: Bureau of Meteorology

Figure 2: Rose of wind direction and wind speed in km/h for December, January and February between 1944 and 2010 at the Medina Research Centre Bureau of Meteorology Station

Interpreting Figure 2 – wind speed vs. direction plot

Wind roses summarise the occurrence of winds at a location, showing their strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher is the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Eight directions are used. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/h are used. The length of each segment within a branch is proportional to the frequency of winds blowing within corresponding range of speeds from that direction (BOM, 2010).

5.3 Topography

The topography of the site is gently sloping, with a north-eastern aspect. Contour information available for the site indicates that the site ranges from its highest elevation of 43 mAHD in south-west corner to its lowest elevation of approximately 21 mAHD in the north-east corner. The available contour information for the site is shown in **Appendix 5**.

5.4 Bushfire Fuels

The majority of the site has been historically cleared for broad scale market gardening purposes, therefore vegetation is limited to Lot 111 which was historically cleared, and now contains relatively intact regrowth of open woodland of *Banksia* spp., *Allocasuarina fraseriana* and occasional emergent *Eucalyptus marginata* and *E. gomphocephala* trees (particularly along the northern portion of the lot) over high and low shrubs, forbs and sedges including *Xanthorrhoea preissii*, *Jacksonia* spp., *Hibbertia hypericoides*, *Patersonia occidentalis* and *Mesomelaena pseudostygia*. The central portion of Lot 111 contained fewer

of the overstorey species detailed above and thus was noted to comprise low shrubland to open heath of the same understorey species listed above. The northern two thirds of Lot 111 was largely in 'Good' condition based on the Keighery (1994) scale, on the basis that whilst there was reduced plant diversity and some invasive weeds occurring throughout the vegetation, basic vegetation structure was still evident. The southernmost portion of Lot 111 has been developed and contains scattered native trees and shrubs but was largely in 'Completely Degraded' condition.

There are several areas of vegetation surrounding the site that pose bushfire hazards to the proposed LSP. These areas include woodland vegetation within the adjacent residential lot to the west of the site, the Bush Forever to the north, and Frankland Park south of Wattleup Road.

5.5 Land Use

The site is largely undeveloped having been historically used for mixed market gardening purposes, except for three existing residential dwellings located along Wattleup Road in the south of the site.

The site is zoned "Urban" under the Metropolitan Region Scheme (MRS) and "Development" under the City of Cockburn Town Planning Scheme No. 3 (TPS No. 3). There is a "Parks and Recreation" reserve under both the MRS and TPS No. 3 adjacent to the northern and eastern boundaries of the site, associated with Bush Forever Site No. 392 and the Historic Baldivis Tramway Trail respectively. An "Other Regional Roads" zone under both the MRS and TPS No. 3 is located east of the Historic Baldivis Tramway Trail and is associated with the future Hammond Road alignment. The site forms part of the larger Southern Suburbs District Structure Plan Stage 3 developed by the City of Cockburn to guide residential development in the broader area.

The Historic Baldivis Tramway Trail reserve runs along the eastern boundary of the site however this area is currently covered in active market gardening land uses and does not pose current bushfire hazard implications. Any future revegetation works undertaken by the City of Cockburn within the Tramway Trail is likely to pose bushfire hazard considerations for urban development in the area unless undertaken at a 'Low Threat' standard.

5.6 Assets

In accordance with the proposed LSP the site will support the development of residential lots and two areas of public open space (POS). Once completed, the site will be a residential community. Dwellings exposed to any bushfire hazard will be those located around the perimeter of the site and within 100 m of classified vegetation that is likely to remain in the medium and long term.

5.7 Access

The site has extensive access to both existing and proposed future surrounding public roads, in particular adjoining to Wattleup Road in the south, the future Hammond Road in the east, and the proposed residential developments to the west of the site. The main point of access into the site will be from Hammond Road, once constructed, east of the site. Internally, the site has an interconnected road system to ensure all residents and fire fighters have at least two access options at all times.

A temporary access way will be provided from the north-east of the site, connecting to Frankland Avenue (see **Appendix 3**). This access will be removed once the internal road network connects with surrounding future development, providing the alternative route options.

5.8 Water Supply

Reticulated water will be provided to the entire development. Fire hydrants will be spaced according to Water Corporation and DFES standards and provide emergency services with access to an adequate water supply.

6 FIRE PROBLEM

6.1 Bushfire History

Fires have been common on the Swan Coastal Plain for thousands of years; the anthropological and historical evidence suggests that Aborigines regularly burnt this area (Hallam, 1975; Abbott, 2003).

A recent study has concluded that bushfires may have been in the Australian landscape for 50 million years longer than previously thought. The adaption of eucalypts that allows them to recover from bushfires has been traced back more than 60 million years (Crisp et al., 2011), indicating fire has been in the Australian landscape since that time.

Bushfires are common in the City of Cockburn. As land intensification occurs and residential development replaces areas of native vegetation, bushfire hazard is removed thereby reducing areas that can carry a bushfire, but increasing the likelihood of ignitions either accidental or deliberate in remaining areas of vegetation. Recent bushfire history includes:

- A fire that started near Jan Hammond Park, north of the site, on 20 December 2009 burnt over 4 hectares and fire crews from 11 stations attended including 2 helitacks and a type 1 helicopter.
- A fire in the Beeliar Regional Reserve near Hammond Road, north of the site, on January 11, 2010 travelled on south west winds and came within 200 metres of homes.

Areas of native vegetation adjacent to residential estates are susceptible to frequent bushfires due to the high risk of arson and great potential for accidental ignitions (Walker 1981, Burrows and Abbott 2003).

Given that bushfires are common in the City of Cockburn, this FMP plays a critical role in ensuring that the development of the land appropriately mitigates the risk and threat from fire.

6.2 Bushfire Risk

The risk management process described in AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines* is a systematic method for identifying, analysing, evaluating and treating emergency risks.

Bushfire risk is determined by assessing:

- Bushfire hazard (i.e. vegetation).

- Threat level (i.e. proximity of the hazard to assets and people).
- Vulnerability of the asset.
- Consequence rating (i.e. a rating for the potential outcome once the 'incident' has occurred).
- Likelihood rating (i.e. the chance of an event).

It is beyond the scope of this report to detail a comprehensive bushfire risk assessment according to AS/NZS ISO 31000:2009; however, a comprehensive bushfire hazard assessment is outlined in **Section 6.3**. The threat level is assessed in later sections by determining the Bushfire Attack Levels (BALs) for exposed areas of the development.

The vulnerability of assets such as dwellings is impacted by several factors. Some relate to the way a bushfire behaves at a site, others to the design and construction materials in the building and siting of surrounding elements. Infrastructure, utilities and human behaviour are also factors. Leonard (2009) identified the following factors:

- Terrain (slope).
- Vegetation (overall fuel load, steady state litter load, bark fuels, etc.).
- Weather (temperature, relative humidity and wind speed).
- Distance of building from unmanaged vegetation.
- Individual elements surrounding the building that are either a shield or an additional fuel source.
- Proximity to surrounding infrastructure.
- Building design and maintenance.
- Human behaviour (ability to be present and capacity to fight the fire).
- Access to the building and how that influences human behaviour.
- Water supply for active and/or passive defence.
- Power supply.

It is likely that buildings are lost because of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to AS 3959 *Construction of buildings in bushfire-prone areas* (Standards Australia 2009) are more likely to survive a bushfire than buildings that do not conform to construction standards; however, building survival is not guaranteed.

The vulnerability of people is determined by several factors, including age, fitness levels, gender, level of preparation, and number of occupants who can actively defend a property. The development is comprised of residential dwellings and POS areas, and there are no other vulnerable assets proposed, such as day care centres or aged care centres.

Vulnerability, consequence and likelihood ratings are all determined using a risk assessment matrix which is beyond the scope of this report.

6.3 Bushfire Hazard

Assessing bushfire hazards at a strategic level takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 m, as shown in **Appendix 7**. Fuel layers in a typical forest environment can be broken-down into five segments as illustrated in **Figure 3** below. These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.



Source: Gould et al. (2007)

Figure 3: The five fuel layers in a forest environment that could be associated with fire behaviour

6.3.1 Vegetation Type and Structure

Historical aerials obtained from Landgate indicate that Lots 1 and 810 were completely cleared in 1985 for use as market gardens. These no longer contain any native vegetation. Historical aerials also indicate that the vegetation on Lot 111 was cleared around 1974. Regrowth is then visible between 1981 and 1995, at which point the vegetation within the site was largely cleared a second time. Regrowth is again visible from 2000 onwards.

A site visit undertaken in April 2014 found that despite the high degree of historical disturbance, the vegetation within Lot 111 is relatively intact and contains open woodland of *Banksia* spp., *Allocasuarina fraseriana* and occasional emergent *Eucalyptus marginata* and *E. gomphocephala* trees (particularly along the northern portion of the lot) over high and low shrubs, forbs and sedges including *Xanthorrhoea preissii*, *Jacksonia* spp., *Hibbertia hypericoides*, *Patersonia occidentalis* and *Mesomelaena pseudostygia*. The central portion of Lot 111 contains fewer of the overstorey species detailed above and has thus been noted to comprise low shrubland to open heath of the same understorey species listed above. The northern two thirds of Lot 111 was largely in 'Good' condition based on the Keighery (1994) scale, on the basis that whilst there was reduced plant diversity and some invasive weeds occurring throughout the vegetation, basic vegetation structure is still evident. The southernmost portion of Lot 111 has been developed and contains scattered native trees and shrubs but was largely in 'Completely Degraded' condition.



Figure 4: Open woodland dominant across the site



Figure 5: Low shrubland to open heath in the central portion of the site

Directly north of the site, within the Harry Waring Marsupial Reserve (Bush Forever Site 392), the vegetation was largely in ‘Excellent’ condition. Bush Forever plant community mapping describes the upland vegetation as *Eucalyptus marginata* Open Woodland; *Banksia attenuata* and *B. menziesii* low open woodland to low closed forest. The Reserve also contains significant flora species, *Aotus cordifolia*, *Dodonaea hackettiana* and *Boronia crenulata* (Government of Western Australia 2000).

The densely vegetated lot west of the site contains relatively intact isolated *Eucalyptus marginata* and *Allocasuarina fraseriana* trees over low woodland of *Banksia attenuata*, *Banksia menziesii* and *Jacksonia sternbergiana* over low shrubland to closed shrubland of *Xanthorrhoea preissii*, *Stirlingia latifolia*, *Daviesia nudiflora* and *Hibbertia hypericoides* and open to closed sedgeland of *Mesomelaena pseudostygia*, *Lyginia* sp. and *Desmocladius flexuosus*. Two central patches within this lot contain dense plantations of **Melaleuca* sp. with some native species showing through the dense canopy.

Land south of the site (south of Wattleup Road) supports private residences and Frankland Park, a City of Cockburn local “Parks & Recreation” reserve. This reserve contains similar *Eucalyptus marginata* and *Banksia attenuata* dominated woodlands to those seen within Lot 111 and the Harry Waring Marsupial Reserve to the north of the site. Extensive market garden land uses occur west of the site.

6.3.2 Vegetation in Public Open Spaces

All POS areas will be managed to maintain low fuel levels and therefore low threat status based on AS3959 and *Planning for Bush Fire Protection Guidelines* (WAPC and FESA 2010).

6.3.3 Effective Slope

The effective slope under areas of classified vegetation surrounding the site is in the range of 0-5 degrees upslope adjacent to the eastern boundary of the site and south of Wattleup Road. The effective slope under the woodland vegetation north of the site is downslope 0-5 degrees directly north of Lot 111 and flat for the remainder of the interface. The western interface is adjacent to land with effective upslope gradients, however the vegetation is predominantly intensively managed in this area. The effective slope under areas of classified vegetation is shown in **Appendix 5**.

6.3.4 Bushfire Hazard Assessment – Existing Site Conditions

The vegetation class map (**Appendix 6**) outlines the existing vegetation classifications on the study site and in the surrounding 100 m assessment area as identified in AS 3959.

Descriptions of the vegetation types and structures are outlined in **Section 6.3.1**.

The bushfire hazard assessment levels were determined using Appendix 1 of the *Planning for Bushfire Protection Guidelines - Edition 2* (WAPC et al., 2010).

Most areas in the site have a low bushfire hazard rating due to the extensive market garden land use. However Lot 111 in the west of the site contains areas of 'Extreme' and 'Moderate' hazard associated with areas of woodland, scrub and shrubland (as shown in **Appendix 7**).

Vegetated areas surrounding the site pose the majority of the bushfire hazard applicable to the site. Existing hazards surrounding the site can be seen in **Appendix 7**.

6.3.5 Bushfire Hazard Assessment – Post Development Site Conditions

The Post Development Site Conditions vegetation mapping for the site is shown in **Appendix 8**, and outlines the dominant vegetation types that will remain within the site and surrounding area (within 100m) after development of the site has been completed.

The bushfire hazard assessment levels were determined using Appendix 1 of the *Planning for Bushfire Protection Guidelines - Edition 2* (WAPC et al. 2010).

The post-development bushfire hazard rating changes substantially compared to the pre-development conditions due to the removal of all vegetation within the site to accommodate the development.

Post development bushfire hazard rating levels for the site (see **Appendix 9**) show an 'Extreme' hazard level for surrounding woodland and forest vegetation surrounding the site. Neighbouring vegetation to the west, south-west, and east of the site will pose only a temporary hazard to the development due to the temporary nature of the vegetation. These areas are subject to future urban development in accordance with the approved DSP, and once vegetation is removed to accommodate development, the hazard will no longer apply.

6.4 Bushfire Threat

Bushfires are common in the City of Cockburn and there is a possibility of a bushfire impacting the site primarily from the Bush Forever site north of the site, and Frankland Park south-east of the site. Vegetation west of the site will also be a potential source of bushfire until such time as the vegetation (and therefore the hazard) is removed as per separate planning and approvals processes being undertaken for those lots.

The bushfire threat is best determined by undertaking a Bushfire Attack Level assessment (**Section 7.2.4**). The maximum long-term predicted radiant heat flux exposure for the site is BAL-29 and this area has been allocated for POS on the proposed LSP. Exposed dwellings will have BAL-19 or BAL-12.5 ratings.

6.5 Summary of Bushfire Potential Issues

At the completion of this development and the surrounding urban residential estates to the east, west and south-west, the bushfire hazard will be concentrated entirely to the north and south-east of the site associated with the vegetation in the adjacent Bush Forever site

and in Frankland Park south of Wattleup Road. Vegetation west of the site is subject to separate planning and approvals processes and will pose only a temporary hazard to the site. Once the vegetation is removed to accommodate urban development the hazard is also removed.

These areas of classified vegetation up to 100 m surrounding the site are identified in the Bushfire Prone Areas map (**Appendix 10**).

7 FIRE MITIGATION STRATEGIES

This report adopts an acceptable solution and performance-based system of control for each bushfire hazard management issue. This approach is consistent with Appendix 2 of the *Planning for Bushfire Protection Guidelines - Edition 2* (WAPC et al., 2010). The management issues are:

- Location of the development
- Vehicular access.
- Water.
- Siting of the development.
- Design of the development.

Acceptable solutions are proposed for four out of the five management issues and each illustrates a means of satisfactorily meeting the corresponding performance criteria. A performance-based approach is proposed for the remaining management issue.

7.1 Hazard Management

There are some pasture grass hazards presently within the site. Slashing of the grass fuels within 100 m of the development stages prior to the bushfire season will ensure any excessive grass fuel loads are maintained and managed to result in low bushfire fuel levels. The small areas of scrub and woodland that occur within the site will need to be modified and fuel reduced if they occur within 100 m of the development stages to ensure temporary bushfire hazards do not impose an unreasonable level of risk.

The mitigation of hazards within areas proposed as POS will be largely addressed through the detailed design of the landscaping and the selection of suitable species which comply with the DFES species list (DFES, 2011). The City of Cockburn will manage the long term maintenance of the parkland and reserves that fall within POS areas. This is outlined in **Section 6.3**.

7.2 Bushfire Risk Management

It is not in the scope of this report to detail a comprehensive bushfire risk assessment as per AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines*.

Land use planning bushfire risk mitigation strategies are comprehensively detailed in the following sections by providing responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in the *Planning for Bushfire Protection Guidelines - Edition 2* (WAPC et al., 2010).

The compliant checklist is attached as **Appendix 13**.

7.2.1 Element: Location of the Development

Intent

To ensure that development/intensification of land use is located in areas where bushfire hazard does not present an unreasonable level of risk to life and property.

Acceptable Solution

The majority of the site has a 'Low' bushfire hazard rating due to the expansive areas of grass and weeds. Areas of 'Moderate' and 'Extreme' bushfire hazard located within 100m of the site have an appropriate setback distance applied to them to ensure that the maximum BAL predicted for the site is BAL-29. The majority of proposed dwellings will be rated BAL-LOW, followed by BAL-12.5, BAL-19 and BAL-29.

The exposed dwellings which are located in the bushfire prone area will have the threat mitigated by ensuring those dwellings are compliant with AS 3959 construction standards.

The site will be provided with an adequate water supply and has adequate vehicular access for residents and fire fighters.

7.2.2 Element: Vehicular Access

Intent

To ensure vehicular access serving a subdivision development is safe if a bushfire occurs.

Background

The indicative road network is outlined in the Local Structure Plan (see **Appendix 3**). The proposed road network integrates with the existing roads on the southern perimeter and will link with future road networks to the east and west.

Loop roads are common, providing two access routes, and the interconnected roads create a permeable grid-like pattern. The proposed road network also reflects the anticipated traffic volumes.

Acceptable Solution A2.1: Two Access Routes

The interconnected loop road system provides all residents and fire fighters with at least two road options at all times. The LSP shows one intersection with Wattleup Road, two with future road networks west of the site, and one with the future Hammond Road east of the site, which will provide alternative routes if one option is threatened by fire.

A temporary access way will be provided from the north-east of the site, connecting to Frankland Avenue (see **Appendix 3**). This access will be removed once the internal road network connects with surrounding future development, providing the alternative route options.

Acceptable Solution A2.2: Public Roads

Surrounding public roads and all new public roads and laneways within the site will comply with the minimum standards. The public road standards which will be achieved are:

Minimum trafficable surface: 6 metres.

Horizontal clearance: 6 metres.
Vertical clearance: 4 metres.
Maximum grades: 1 in 8.
Maximum grades over <50 metres: 1 in 5.
Maximum average grade: 1 in 7.
Minimum weight capacity: 15 tonnes.
Maximum crossfall: 1 in 33.
Minimum inner radius of curves: 12 metres.

7.2.3 Element: Water

Intent

To ensure water is available to the development to enable life and property to be defended from bushfire.

Acceptable Solution A3.1: Reticulated Water

The development is located within an Emergency Services Levy (ESL) Category 1 area and is within the Perth Metropolitan Fire District. Fire services require ready access to an adequate water supply during fire emergencies.

The area is provided with a reticulated water supply, together with fire hydrants that will meet the specifications of Water Corporation Design Standard DS 63 and DFES. Fire hydrants on land zoned as residential are required to be sited at or within 200 m of residential dwellings (Class 1a).

The Water Corporation is responsible for all hydrant repairs.

7.2.4 Element: Siting of the Development

Intent

To ensure the siting of the development minimises the level of bushfire impact.

Background

The extent of post-development classified vegetation (**Appendix 8**) is restricted to the following main areas:

- North of the site – forest and woodland vegetation associated with Bush Forever Site No. 392 Harry Waring Marsupial Reserve.
- West of the site – woodland vegetation covering the residential lot west of the site. This lot is intended for future residential development and is currently undergoing separate structure planning processes; therefore this vegetation will pose only temporary hazard considerations.
- South of Wattleup Road – woodland vegetation south of the site associated with Frankland Park, a local 'Parks and Recreation' reserve.

All other POS and drainage areas will be landscaped and managed as maintained public reserves and parklands, and are therefore considered as low threat vegetation areas ('Low' bushfire hazard).

Vegetation that does not trigger a BAL assessment according to AS 3959 includes one or more of the following:

- Vegetation of any type more than 100 m from the site.
- Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.
- Multiple areas of vegetation less than 1 ha in area and not within 20 m of the site or each other.
- Strips of vegetation less than 20 m wide (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.
- Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.
- Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parkland, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and wind breaks.

Building Siting and Predicted Bushfire Attack Levels

AS 3959 *Construction of buildings in bushfire prone areas* has six categories of Bushfire Attack Level, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds.

Methodology and Assumptions

The following indicative BAL assessment has been undertaken to demonstrate what lots are exposed once surrounding land has been developed. This indicative BAL assessment was undertaken by assessing the classified vegetation (both temporary and permanent) and effective slope.

The criteria to determine the BAL is outlined as follows:

Designated FDI:	80
Flame Temperature:	1090
Slope:	Flat, upslope or downslope
Vegetation Class:	Forest, Woodland
Setback distances:	Shown in Table 1 below

BAL Outcome

The following indicative BAL assessments for exposed areas of the development were determined for the site (**Appendix 12**) using the methodology in Appendix A of AS 3959. This methodology is also outlined in the *Planning for Bush Fire Protection - Edition 2* (WAPC, 2010). **Table 1** below shows the BAL assessment for the site. There are no areas in the development exposed to a BAL rating above BAL-29.

Table 1: Indicative Bushfire Attack Level assessment for exposed interface areas

Area of classified vegetation	Vegetation Class	Setback Distance	Effective Slope (°)	BAL Rating
North of Lot 810	Forest	31-42 metres	Flat	BAL-19
		42-100 metres	Flat	BAL-12.5
	Woodland	14-20 metres	Flat	BAL-29
		20-29 metres	Flat	BAL-19
		29-100 metres	Flat	BAL-12.5
North of Lot 111	Woodland	17-25 metres	Downslope	BAL-29
		25-35 metres	Downslope	BAL-19
		35-100 metres	Downslope	BAL-12.5
West of the site	Woodland	14-20 metres	Upslope	BAL-29
		20-29 metres	Upslope	BAL-19
		29-100 metres	Upslope	BAL-12.5
South of Wattleup Road	Woodland	29-100 metres	Upslope	BAL-12.5

Note: See Appendix 10 for AS 3959 Construction Zone details.

An assessment of BAL-29 means 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 (AS 3959). The risk is considered to be high. It is expected that the construction elements will be exposed to a heat flux not greater than 29 kW/m². In this case, the recommended construction sections in AS 3959 are 3 and 7.

An assessment of BAL-19 means the risk is considered to be moderate. It is expected that the construction elements will be exposed to a radiant heat flux not greater than 19 kW/m². There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat (AS 3959). The recommended construction sections in AS 3959 are 3 and 6.

An assessment of BAL-12.5 means the risk is considered to be low. It is expected that the construction elements will be exposed to a radiant heat flux not greater than 12.5 kW/m². There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat (AS 3959). The recommended construction sections in AS 3959 are 3 and 5.

Any new dwellings constructed within 100 m of identified classified vegetation will require consideration of the need for increased construction requirements to address AS3959 *Constriction of Buildings in Bushfire Prone Areas*. In order to pre-empt this requirement, a BAL assessment will be undertaken as part of the subdivision process to confirm the BAL ratings for each individual new lot created. BAL ratings **should not** be determined for future lots at the LSP stage, as the ultimate lot locations/boundaries will be determined through the subdivision process, and temporary hazards (or even hazards that were expected to be permanent) may not remain at that time. If subdivision proceeds within those areas of the site designated as Bushfire Prone due to temporary bushfire hazards, prior to the hazards being removed, bushfire hazard management measures (i.e. increased construction

standards to meet increased BAL ratings) will be required. Therefore a detailed and specific BAL assessment will need to be completed at the subdivision approval stage for all lots currently determined to be within “Bushfire Prone Areas” (see **Appendix 10**). It is also envisaged that as part of the subdivision process, any lots deemed to require fire management responses through the BAL assessment, will be subject to a notification pursuant to section 70A of the *Transfer of Land Act 1893* placed on the certificate(s) of title indicating that the lot is subject to the requirements of a fire management plan (i.e. increased construction standards to meet increased BAL ratings).

Landscaping Considerations

Landscaping can both assist in the survival of a dwelling and be a determining factor in its destruction. Landscaping can protect buildings by forming a barrier or deflector for wind-borne debris and radiant heat. It can also bring the fire directly to the dwelling. Therefore, a degree of care needs to be exercised when selecting and locating landscaping.

All plants will burn under the right conditions and plants do not attain a ‘fire resistance level’ that meets requirements of the Building Code of Australia (BCA). Placing plants too close to a building, under timber decks or next to windows will provide a direct threat to the building. Having a clearance around the building will achieve the desired effect of creating a break between the vegetation and the building. A pathway around buildings may be one way to achieve this requirement. Landscaping can then be established at a suitable distance from the building.

Acceptable Solution A4.1: Hazard Separation

A Hazard Separation Zone (HSZ) is an additional fuel managed zone to create further separation between dwellings and bushfire hazard. It can extend out to 100 metres from buildings. In the LSP proposal, a HSZ does not fit within the design of the proposed development. The requirement for a HSZ is offset by an increase in construction standards and compliance with AS3959, and BAL-29 is not exceeded.

The indicative BAL assessment demonstrated that the proposed BPZ combined with increased dwelling construction standards will achieve acceptable levels of risk for the development.

By achieving this standard it will be possible to construct dwellings to an appropriate standard (i.e. BAL-29 or less) under the Australian Standard (AS 3959 Construction of Buildings in Bushfire-Prone Areas).

Acceptable Solution A4.3: Building Protection Zone

One of the most important fire protection measures influencing the safety of people and property is to create a Building Protection Zone (BPZ) around buildings. The BPZ is a low fuel area immediately surrounding a building. Non-flammable features such as irrigated landscapes, gardens, driveways and roads can form parts of a BPZ.

Recent research into land management and house losses during the ‘Black Saturday’ Victorian bushfires concluded that the action of private landholders who managed fuel loads close to their houses was the single most important factor in determining house survival

when compared with other land management practices, such as broad scale fuel reduction burning remote from residential areas (Gibbons et al., 2012).

This FMP addresses two important bushfire setback issues. The first involves an adequate perimeter BPZ where the site is immediately adjacent to external bushfire hazard. Ensuring a perimeter BPZ will ensure vegetation and fuels within close proximity to buildings are managed to reduce predicted levels of radiant heat flux and improve the survival of buildings.

The second involves the management of risk at each stage of development. Each development stage is provided with acceptable setbacks from temporary bushfire hazards to reduce bushfire attack mechanisms impacting on any completed dwellings. Creating a temporary BPZ during each stage of the development will ensure dwellings on the perimeter of each stage are not exposed to unnecessary risk from a temporary hazard.

The creation of the BPZ areas will ensure the predicted radiant heat flux exposure levels remains at or below BAL-29 for all dwellings.

Managing vegetation in the BPZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

Areas of the development that are immediately adjacent to a bushfire hazard have a 20 m minimum internal (within the site) BPZ (see **Appendix 11**). Where the adjacent hazard is temporary subject to development, the applicable BPZ is temporary. The fuel managed areas of road and drainage reserves will also become BPZ areas because the City of Cockburn's grass slashing program will ensure hazard remains low.

The BPZ must be established and maintained to the following standards:

- Width: 20m minimum as identified in **Appendix 11**.
- Fuel load: reduced to and maintained at 2 tonnes per hectare.
- All tree crowns (or clumps of crowns) are a minimum of 10 metres apart.
- All trees to have lower branches pruned to a height of 2 metres.
- All tall shrubs or trees are not to be located within 2 metres of a building (including windows).
- No tree crowns or foliage (including existing trees and shrubs and new plantings) is to be within 2 metres of any building.
- All fences and sheds are constructed of non-combustible materials (i.e. Colorbond, brick or limestone).
- All shrubs to contain no dead material within the plant.
- No tall shrubs are to be in clumps within 3 metres of any building.
- No trees are to contain dead material in the crown or on the bole.

It is the responsibility of the developer to ensure the BPZ is created by appropriate design, and that construction of buildings is restricted within the identified zone until adjacent hazards are permanently removed.

7.2.5 Element: Design of the Development

Performance Criteria

The design of the development is appropriate to the level of bushfire hazard that applies to the site.

Acceptable Solution A5.2: Performance Criterion P5 Compliance

The development complies with AS 3959 and BAL-29 is not exceeded for any dwelling. BAL-29 areas have been allocated for POS on the proposed LSP.

7.3 Future Development

The FMP is expected to be implemented as part of the future subdivision approval process.

7.4 Access and Fire Breaks

Compliance with the City of Cockburn Firebreak Notice is required across the entire site and public road access must provide two access options at all stages of development.

7.5 Public Education and Community Awareness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. *Prepare. Act. Survive.* (DFES, 2012) provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures are available from <http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/pages/publications.aspx>.

The City of Cockburn provides bushfire safety advice to residents available from their website http://www.cockburn.wa.gov.au/Council_Services/Rangers/Fire_Prevention/. It also provides details on how to become a volunteer at the local volunteer Bush Fire Brigades. Professional, qualified consultants also offer bushfire safety advice and relevant services to residents and businesses in high risk areas.

7.6 Fire Safer Areas

There are no designated Community Fire Refuges in the City of Cockburn, However, at the time of an emergency, the relevant authorities can select an evacuation centre and DFES, the City of Cockburn and Police will provide this information to residents.

A predetermined centre cannot be nominated, because there are no purpose-built structures (such as bunkers) designed to withstand the impacts of a bushfire. This means that the location of an evacuation centre is not determined until the position of the fire and the characteristics of a specific event are considered by authorities. There would be nothing more dangerous than sending residents to a centre which is in the direct path of a fire.

The safest place to be during a bushfire is away from it. Where to go is an important element when people are relocating during a time of emergency (NSW Rural Fire Service, 2004). The preferred option for residents is to designate a destination that is not in a bushfire-prone area and will be safe to travel to before a bushfire attack.

Those who find themselves threatened by a bushfire need options (VBRC, 2009). This may be because their plan to leave is no longer possible, because they cannot reach a place away from the fire front, or their plan to defend their property fails. Residents may also be caught away from their home when a bushfire threatens.

The concept of a 'Neighbourhood Safer Place' and 'Neighbourhood Safer Precincts' has arisen from recommendations by the Victorian Bushfire Royal Commission into the Black Saturday bushfires.

There are many areas within the City of Cockburn that are not bushfire-prone, including landscaped open spaces such as the centrally located POS within the site, and urban areas, but they have not been declared. Obviously a non-bushfire-prone area can provide a safe location for people during a bushfire, but there are no official criteria in Western Australia to determine these areas. As there is no specific criteria to guide this process, DFES's general advice is that when household bushfire survival plans have failed, residents should go to a safer place such as a local open space or building to seek shelter from a bushfire (DFES, 2012).

7.7 Assessment of Fire Management Strategies

The bushfire hazard that could threaten this development is concentrated in the woodland and forest vegetation associated with Bush Forever Site 392 located north of the site, and woodland vegetation within Frankland Park south of Wattleup Road. Vegetation surrounding the site to the west, east and south-west is subject to clearing associated with proposed future urban development and therefore will not pose long term considerations.

Grasslands fuels in the public roadside reserves on the southern interface of the site will be maintained at low threat levels through City of Cockburn's roadside slashing program. Fuels in POS and drainage areas will be managed at a low threat level.

Fire response operations will utilise the reticulated water supply and the extensive loop road network to defend property and life.

7.8 Implementing the Fire Management Plan

7.8.1 Developer's Responsibilities

To maintain a reduced level of risk from bushfire, the developer's responsibilities are to:

- Install the public roads to standards outlined in **Section 7.2.2**.
- Maintain temporary access to Frankland Avenue until such a time as the internal road network is able to connect with surrounding future development.
- On all vacant land, comply with the City of Cockburn Firebreak Notices as published.
- Install reticulated water supply and hydrants to Water Corporation, DFES and the City of Cockburn standards.
- Design and landscape POS areas using species native and/or appropriate to the area and utilising the DFES recommended species list to create a low threat environment.
- For each property on this development exposed to AS 3959 construction standards, lodge a Section 70A Notification on the Certificate of Title in order to alert purchasers and successors in title of the responsibilities of the FMP and bushfire building construction requirements.

- Establish and maintain the BPZs within the site to standards as specified in this document.
- As part of the subdivision approval or Detailed Area Plan preparation process have the proposed lots re-assessed for BAL by a qualified consultant with assessment recommendations to be submitted to the City of Cockburn and accommodated in the lot clearances and/or Detailed Area Plan outcomes.
- Ensure 100 m of vegetation is managed from the perimeter of each construction stage within the overall development site to ensure temporary hazard does not threaten any subdivision stage. Liaise with surrounding landowners to support the management of vegetation within surrounding sites to ensure these hazards do not threaten any subdivision stage.
- At subdivision approval stage, the developer is to provide detailed hydrant plans to the City of Cockburn and DFES local fire station for monitoring.
- Make a copy of this FMP available to each lot owner subject to AS 3959 construction standards, along with the *Homeowners Bush Fire Survival Manual, Prepare, Act, Survive* (or similar suitable documentation) and the City of Cockburn's Firebreak Notice.

7.8.2 Property Owner/Occupier's Responsibilities

The owners/occupiers of the site, as created by the LSP and following subdivision approval process, are to maintain a reduced level of risk from bushfire, and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire. Site owners and occupiers will be responsible for:

- Ensuring that all lots comply with the City of Cockburn Firebreak Notices as published.
- Maintaining each property in good order to minimise bushfire fuels.
- Ensuring that where hydrants are located, they are not obstructed and remain visible at all times.
- Ensuring construction of dwellings complies with AS 3959, if required.
- If dwellings are subject to additional construction in the future, such as renovations, AS 3959 compliance is required.

7.8.3 City of Cockburn's Responsibilities

The responsibility for compliance with the law rests with individual property owners and occupiers, and the following conditions are not intended to unnecessarily transfer some of the responsibilities to the City of Cockburn.

The City of Cockburn shall be responsible for:

- Providing fire prevention and preparedness advice to landowners upon request, including the *Homeowners Bush Fire Survival Manual, Prepare, Act, Survive* (or similar suitable documentation) and the City of Cockburn's Firebreak Notice.
- Ensuring bushfire hazard remains low in the internal POS areas and roadside grassland vegetation is slashed in the annual roadside slashing program.

- Monitoring bush fuel loads in road reserve sites and liaising with relevant stakeholders to maintain fuel loads at safe levels.
- Maintaining public roads to appropriate standards and ensuring compliance with the City of Cockburn Firebreak Notices.
- Reviewing the FMP as necessary.

7.8.4 Water Corporation's Responsibilities

The Water Corporation is responsible for the repair of water hydrants, as needed.

8 CONCLUSIONS

This Plan provides acceptable solutions and responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in *Planning for Bushfire Protection Guidelines - Edition 2* (WAPC et al., 2010). However, community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals.

Dwellings located in the bushfire prone area (i.e. within 100 m of classified vegetation) will have the risk mitigated via compliance with AS 3959 standards. BAL-29 is not exceeded and an internal BPZ is incorporated into the LSP where classified vegetation is immediately adjacent to the site. Road reserves and landscaped POS areas with fuel management programs can also be effective BPZs. A minimum of two access options and internal loop roads, reticulated water supply, and hydrants are provided. The proposed development will fall within the acceptable level of risk.

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10 GLOSSARY

AS	Australian Standard
AHD	Australian Height Datum
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BOM	Bureau of Meteorology
BPZ	Building Protection Zone
DFES	Department of Fire and Emergency Services (was FESA)
ESL	Emergency Services Levy
FESA	Fire and Emergency Services (now DFES)
FMP	Fire Management Plan
HSZ	Hazard Separation Zone
LPS17	Local Planning Scheme No. 17
LSP	Local Structure Plan
POS	Public Open Space
TPS	Town Planning Scheme
VBRC	Victorian Bushfires Royal Commission
WAPC	Western Australian Planning Commission



APPENDICES

Appendix 1: Location Plan

Appendix 2: Site Plan

Appendix 3: Proposed LSP

Appendix 4: Local Context and Surrounding Land Uses

Appendix 5: Site Topography and Effective Slope

Appendix 6: Existing Site Conditions - AS3959 Vegetation Classification

Appendix 7: Existing Site Conditions - Bushfire Hazard Assessment

Appendix 8: Post Development Site Conditions – AS3959 Vegetation Classification

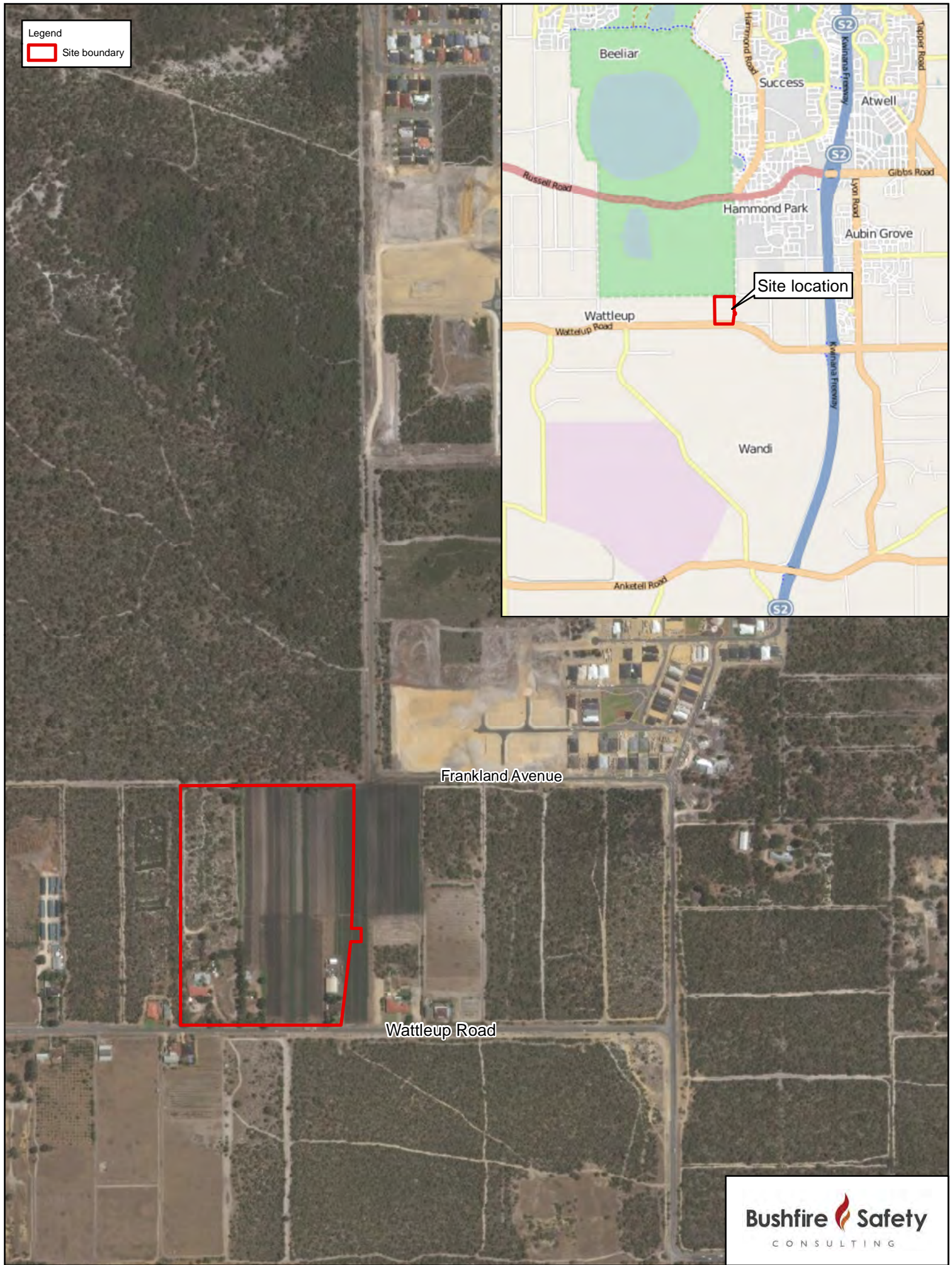
Appendix 9: Post Development Site Conditions – Bushfire Hazard Assessment

Appendix 10: Post Development Site Conditions – Bushfire Prone Areas

Appendix 11: Post Development Site Conditions – Building Protection Zone Requirements

Appendix 12: Post Development Site Conditions – AS3959 Construction Considerations

Appendix 13: Compliance Checklist



Legend
Site boundary

Bushfire Safety
CONSULTING

Appendix 1: Location Plan

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP
Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F01
Drawn: GRO Date: 07/04/14
Approved: CKK Date: 11/07/14
Checked: VMK Scale: 1:8,000@A4
0 75 150 300 Metres

emerge
ASSOCIATES
Integrated Science & Design

- Legend
- Site boundary
 - Existing cadastral boundaries

Bush Forever
Site No. 392

Frankland Avenue

Lot 810

Lot 111

Lot 1

Wattleup Road

Frankland Park

Bushfire Safety
CONSULTING

Appendix 2: Site Plan

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F02

Drawn: GRO	Date: 07/04/14
Approved: CKK	Date: 11/07/14
Checked: VMK	Scale: 1:3,000@A4

0 30 60 120 Metres

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Legend

Site boundary

Local Structure Plan

POS

Residential

Road

Temporary access

Bushfire Safety
CONSULTING

Appendix 3: Proposed LSP

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F03a

Drawn: GRO

Date: 24/10/14

Approved: CKK

Date: 24/10/14

Checked: VMK

Scale: 1:3,000@A4

0

30

60

120

Metres

emerge
ASSOCIATES
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Legend

Site boundary

Existing cadastral boundaries

MRS Zones and Reserves

Other Regional Roads

Parks & Recreation

Urban

Urban Deferred

Bush Forever Site No.392
Harry Waring Marsupial Reserve



Bushfire Safety
CONSULTING

Appendix 4: Local Context and Surrounding Land Uses

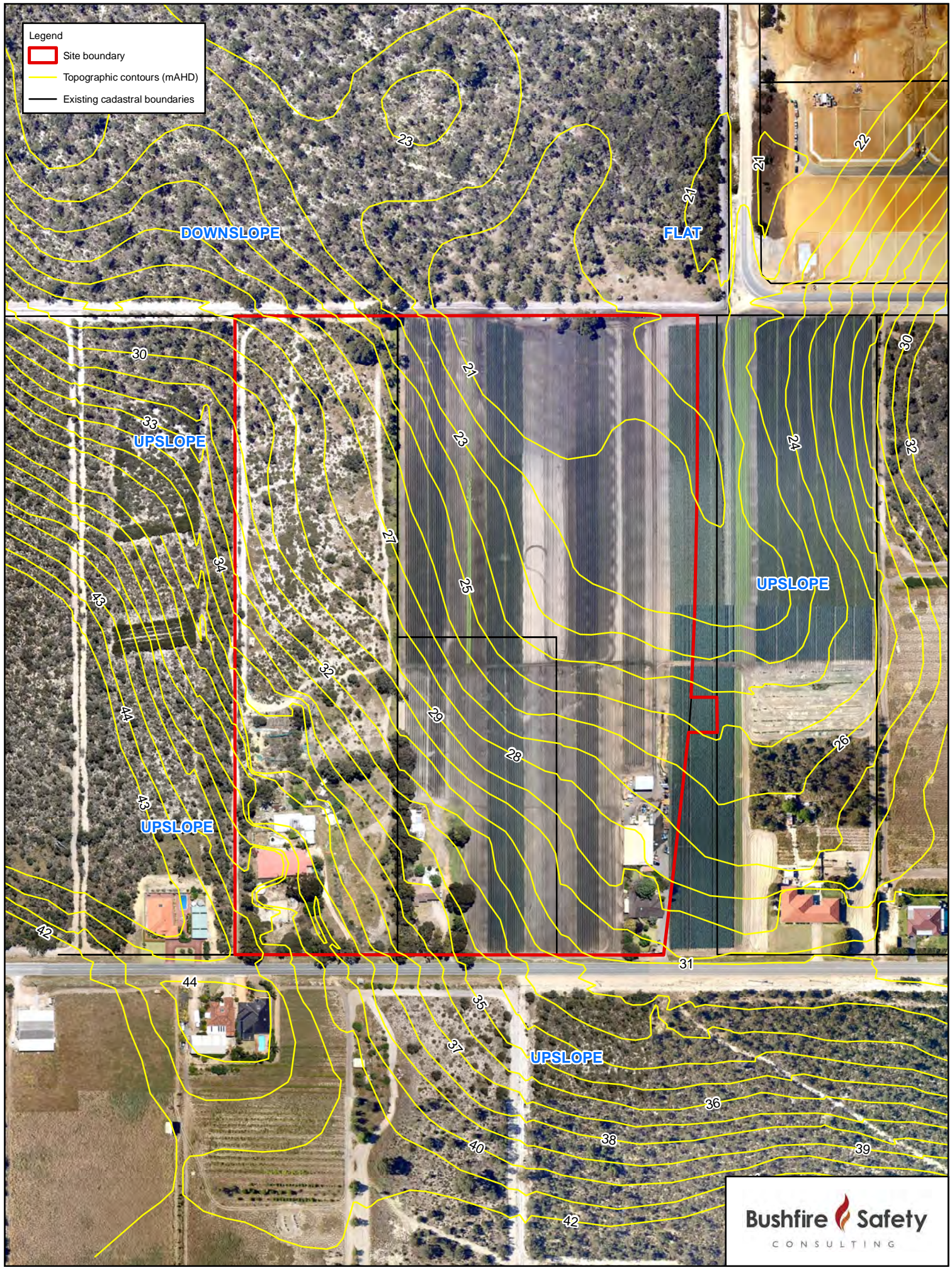
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Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F04	
Drawn: GRO	Date: 07/04/14
Approved: CKK	Date: 11/07/14
Checked: VMK	Scale: 1:3,000@A4

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Legend

- Site boundary
- Topographic contours (mAHd)
- Existing cadastral boundaries

Bushfire Safety
CONSULTING

Appendix 5: Site Topography and Effective Slope

Project:	Fire Management Plan Lots 1, 111 and 810 Wattleup Road LSP
Client:	Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F05			
Drawn:	GRO	Date:	07/04/14
Approved:	CKK	Date:	11/07/14
Checked:	VMK	Scale:	1:3,000@A4

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While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used



- Legend**
- Site boundary
 - 100m assessment boundary
 - Existing cadastral boundaries
 - Vegetation Classification
 - Forest
 - Tall Open Forest / Tall Woodland
 - Open Forest / Low Open Forest
 - Woodland
 - Woodland / Open Woodland
 - Low Woodland / Low Open Woodland / Open Shrubland
 - Shrubland
 - Closed Heath / Open Heath
 - Low Shrubland
 - Pine Plantation
 - Scrub
 - Closed Scrub
 - Open Scrub
 - Mallee/Mulga
 - Tall Shrubland
 - Rainforest
 - Tall Closed Forest / Closed Forest / Low Closed Forest
 - Grassland
 - Unmanaged
 - Unclassified
 - Low Threat
 - Mineral Earth
 - Managed Grassland
 - Plantation

Bushfire Safety
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Appendix 6: Existing Site Conditions - AS3959 Vegetation Classifications	
Project:	Fire Management Plan Lots 1, 111 and 810 Wattleup Road LSP
Client:	Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F14	
Drawn: GRO	Date: 07/04/14
Approved: CKK	Date: 11/07/14
Checked: VMK	Scale: 1:3,000@A4

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While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used



- Legend
- Site boundary
 - 100m assessment boundary
 - Existing cadastral boundaries
 - Bushfire hazard
 - Extreme
 - Moderate
 - Low

Appendix 7: Existing Site Conditions - Bushfire Hazard Assessment

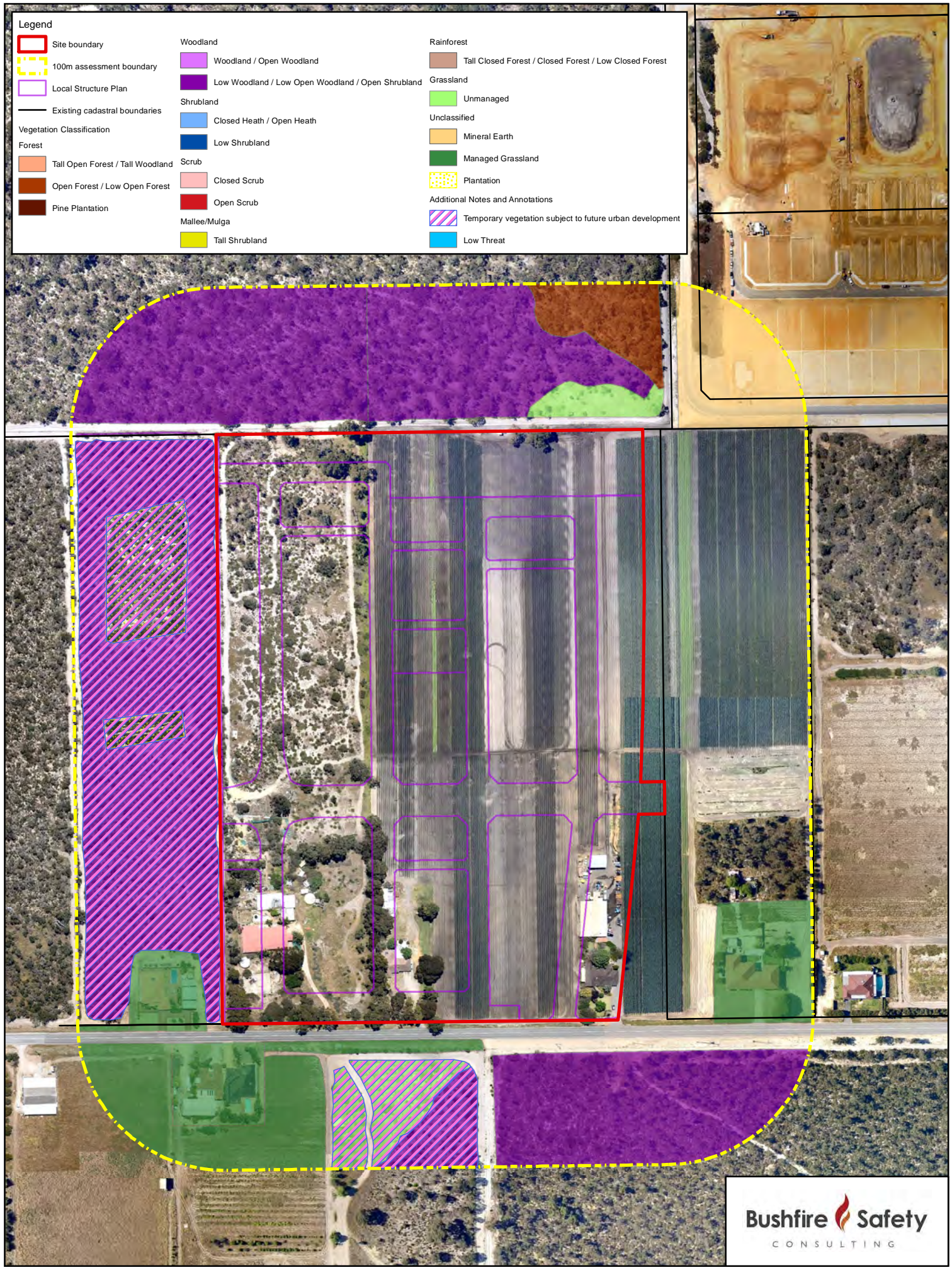
Project:	Fire Management Plan Lots 1, 111 and 810 Wattleup Road LSP
Client:	Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F15	
Drawn: GRO	Date: 06/05/14
Approved: CKK	Date: 11/07/14
Checked: VMK	Scale: 1:3,000@A4
0 30 60 120 Metres	

Bushfire Safety
CONSULTING

emerge
ASSOCIATES
Integrated Science & Design



Legend		
	Site boundary	
	100m assessment boundary	
	Local Structure Plan	
	Existing cadastral boundaries	
Vegetation Classification		
Forest		
	Tall Open Forest / Tall Woodland	
	Open Forest / Low Open Forest	
	Pine Plantation	
Woodland		
	Woodland / Open Woodland	
	Low Woodland / Low Open Woodland / Open Shrubland	
Shrubland		
	Closed Heath / Open Heath	
	Low Shrubland	
Scrub		
	Closed Scrub	
	Open Scrub	
	Mallee/Mulga	
	Tall Shrubland	
Rainforest		
	Tall Closed Forest / Closed Forest / Low Closed Forest	
Grassland		
	Unmanaged	
Unclassified		
	Mineral Earth	
	Managed Grassland	
	Plantation	
Additional Notes and Annotations		
	Temporary vegetation subject to future urban development	
	Low Threat	

Appendix 8: Post Development Site Conditions - AS3959 Vegetation Classifications

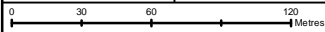
Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



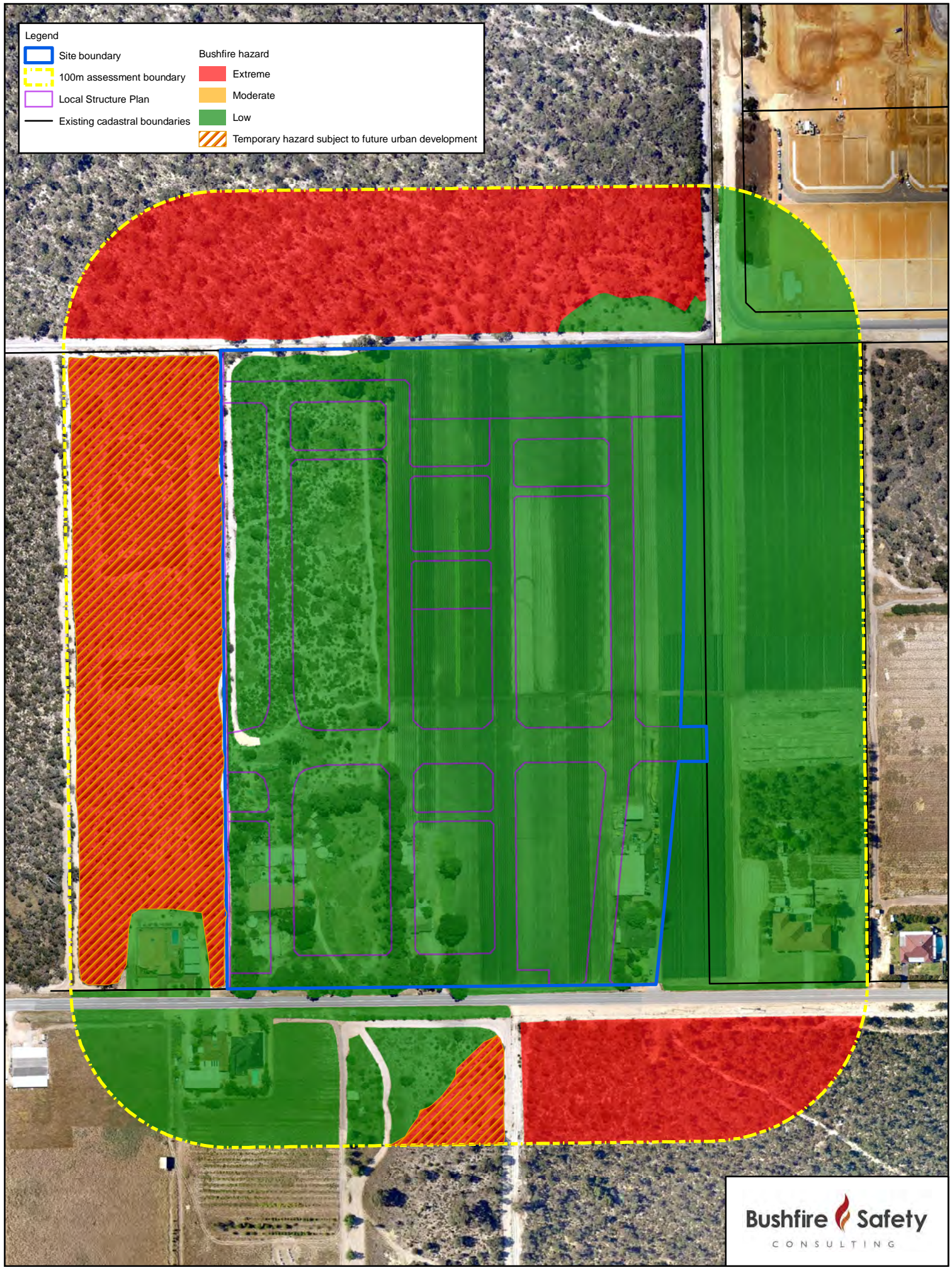
Plan Number: EP14-018(04)--F23a

Drawn: GRO	Date: 24/10/14
Approved: CKK	Date: 24/10/14
Checked: VMK	Scale: 1:3,250@A4



Bushfire Safety
CONSULTING

emerge
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Legend

Site boundary

100m assessment boundary

Local Structure Plan

Existing cadastral boundaries

Bushfire hazard

Extreme

Moderate

Low

Temporary hazard subject to future urban development

Bushfire Safety
CONSULTING

Appendix 9: Post Development Site Conditions - Bushfire Hazard Assessment

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F24a

Drawn: GRO

Approved: CKK

Checked: VMK

Date: 24/10/14

Date: 24/10/14

Scale: 1:3,000@A4

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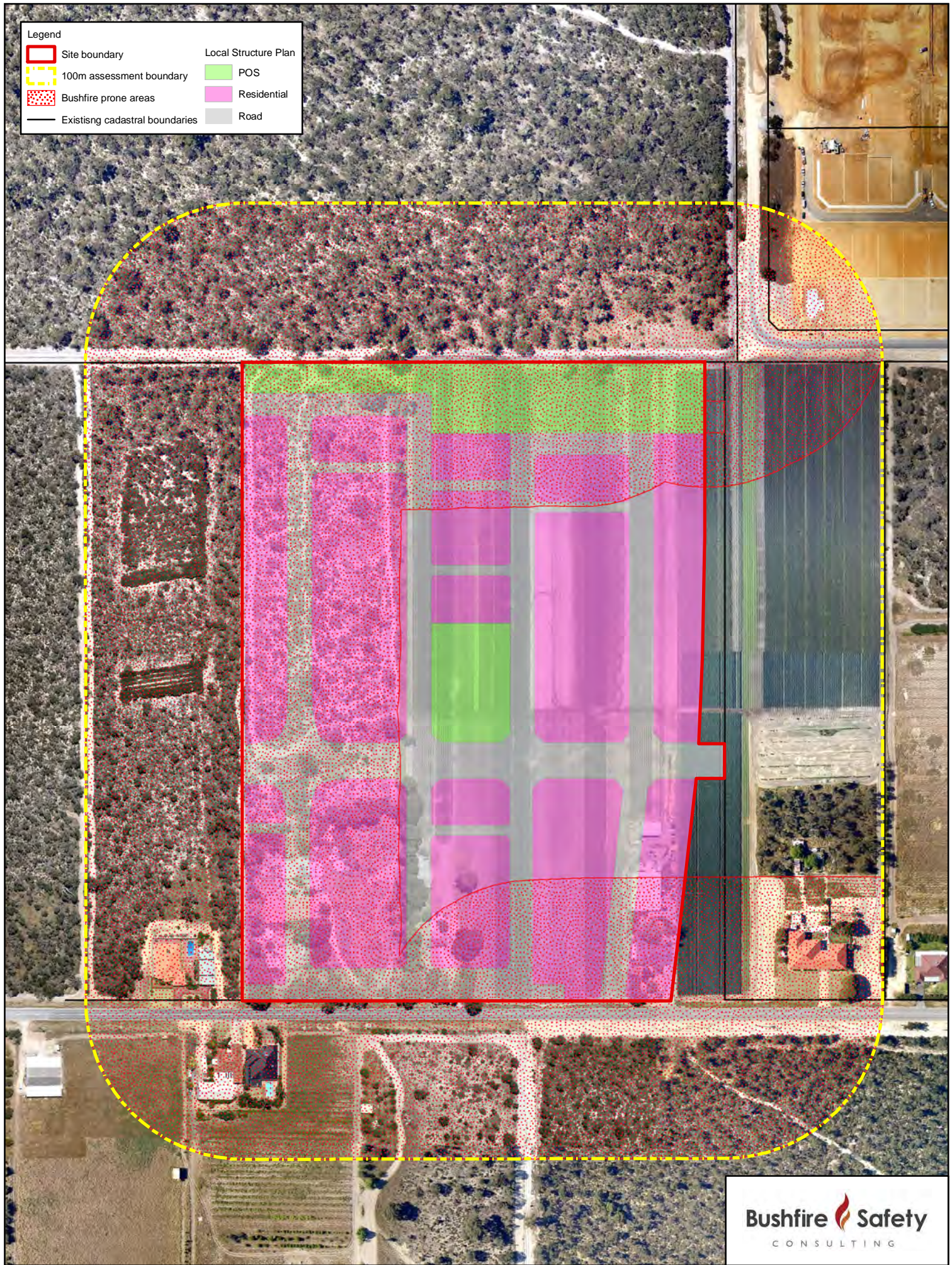
30

60

120

Metres

emerge
ASSOCIATES
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Appendix 10: Post Development Site Conditions - Bushfire Prone Areas

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F25a

Drawn: GRO	Date: 24/10/14
Approved: CKK	Date: 24/10/14
Checked: VMK	Scale: 1:3,000@A4

0 30 60 120 Metres





Legend

Site boundary

100m assessment boundary

Permanent 20m Building Protection Zone

Temporary 20m Building Protection Zone

Existing cadastral boundaries

Local Structure Plan

POS

Residential

Road

Bushfire Safety

CONSULTING

Appendix 11: Building Protection Zone Requirements	
Project:	Fire Management Plan Lots 1, 111 and 810 Wattleup Road LSP
Client:	Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F26a

Drawn: GRO	Date: 24/10/14
Approved: DRAFT	Date: --/--
Checked: VMK	Scale: 1:3,000@A4

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30

60

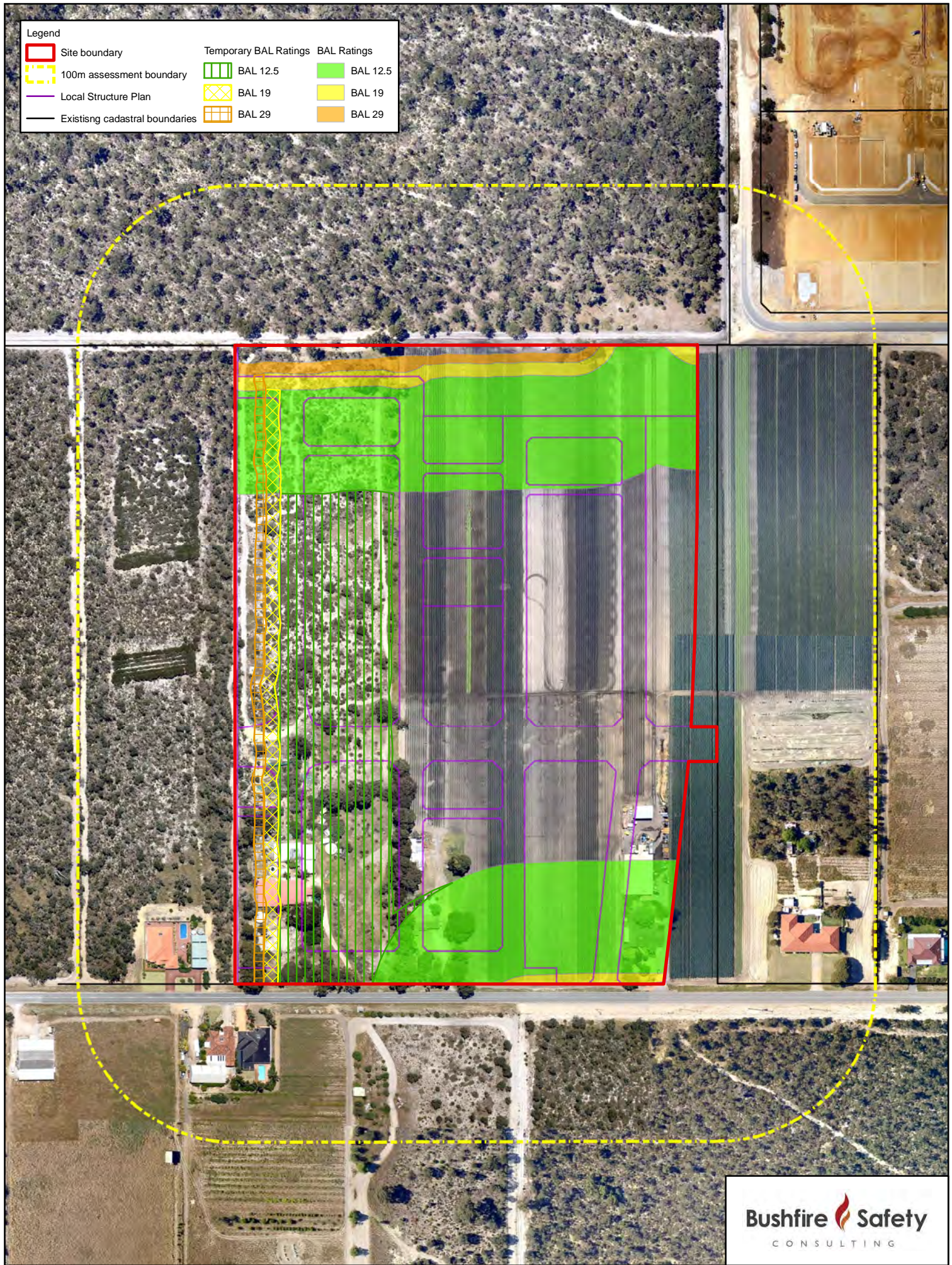
120

Metres

emerge

ASSOCIATES

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Bushfire Safety
CONSULTING

Appendix 12: AS3959 Construction Requirements

Project: Fire Management Plan
Lots 1, 111 and 810 Wattleup Road LSP

Client: Qube Hammond South Development Pty Ltd



Plan Number: EP14-018(04)--F27b

Drawn: GRO Date: 24/10/14
Approved: CKK Date: 24/10/14
Checked: VMK Scale: 1:3,000@A4

0 30 60 120 Metres

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Appendix 13: Compliance Checklist

Element/Question	Response
1: Location	
Does the proposal comply with the performance criteria by applying acceptable solution A1.1?	Yes.
2: Vehicular access	
Does the proposal comply with the performance criteria by applying acceptable solution A2.1?	Yes.
Does the proposal comply with the performance criteria by applying acceptable solution A2.2?	Yes.
Does the proposal comply with the performance criteria by applying acceptable solution A2.3?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.4?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.5?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.7?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.8?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.9?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A2.10?	Not applicable.
3: Water	
Does the proposal comply with the performance criteria by applying acceptable solution A3.1?	Yes.
Does the proposal comply with the performance criteria by applying acceptable solution A3.2?	Not applicable.
Does the proposal comply with the performance criteria by applying acceptable solution A3.3?	Not applicable.
4: Siting of the Development	
Does the proposal comply with the performance criteria by applying acceptable solution A4.1?	Yes.
Does the proposal comply with the performance criteria by applying acceptable solution A4.2?	No. However, the road side grassland vegetation is classed as low hazard and is expected to be slashed prior to the fire season each year to maintain a low hazard in perpetuity.
Does the proposal comply with the performance criteria by applying acceptable solution A4.3?	Yes, every dwelling immediately adjacent to bushfire hazard has a compliant BPZ.

Element/Question	Response
Does the proposal comply with the performance criteria by applying acceptable solution A4.4?	No. However, the performance criteria P4 is achieved, because all dwellings within 100 m of classified vegetation will comply with AS 3959 and BAL-29 is not exceeded.
Does the proposal comply with the performance criteria by applying acceptable solution A4.5?	Not applicable.
5: Design of the Development	
Does the proposal comply with the performance criteria by applying acceptable solution A5.1?	No. However, the proposal does comply with the performance criterion P5, because building construction standards will be increased to comply with AS 3959 to offset the requirement for a HSZ; BAL-29 is not exceeded.
Does the proposal comply with the performance criteria by applying acceptable solution A5.2?	Yes.

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:



Name: Rohan Carboon

Date: 30/09/2014

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT

HAMMOND GROVE ESTATE - STAGE 1

Project Number EP15-063(03)

**Prepared for Qube Property Group
November 2016**

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Document Control

DOC NAME	CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT, HAMMOND GROVE ESTATE – STAGE 1				
DOC NO.	EP15-063(03)–007 VMK				
REVISION	DATE	AUTHOR		REVIEWER	
1	October 2016	Vanessa Keating	VMK	Jen Longstaff	JL
				Rohan Carboon	RC
	Draft Certified BAL ratings – Hammond Grove Stage 1				
A	November 2016	Vanessa Keating	VMK	Jen Longstaff	JL
				Rohan Carboon	RC
	Certified BAL ratings – Hammond Grove Stage 1				
B					
C					

Disclaimer:

This document has been prepared in good faith and is derived from sources believed to be reliable and accurate at the time of publication. Nevertheless, this publication is distributed on the terms and understanding that the author is not responsible for the results of any actions taken based on information in this publication or for any error in or omission from this publication.

The content of this document has been prepared primarily to consider the layout of the development or the appropriate building construction standard, where relevant. The measures outlined are considered to be prudent minimum standards only based on the relevant experience of the author and the standards prescribed by the relevant authorities. The level of implementation of the fire precautions achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a wide range of conditions. An element of risk, no matter how small always remains. The objective of the Australian Standard AS 3959-2009 is to “prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes” (Standards Australia 2009). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Certification of Specified BAL Ratings – Stage 1

This Bushfire Attack Level (BAL) certification for Stage 1 of Hammond Grove Estate has been prepared jointly by Emerge Associates and Bushfire Safety Consulting.

Bushfire Safety Consulting is owned and operated by Rohan Carboon, an experienced bushfire consultant to the urban planning industry. Rohan has provided all technical input and review for the bushfire risk assessment included within this BAL assessment. Bushfire Safety Consulting is a Corporate Bronze Member of the Fire Protection Association of Australia.

This purpose of this BAL Certification report is to review the BAL Assessment (Emerge Associates and Bushfire Safety Consulting 2016) completed for the Hammond Grove Estate, and to either confirm or reassess the BAL ratings for individual lots within Stage 1 based on the classified vegetation present. **Each lot has been considered individually in terms of proximity to classified vegetation, but has been documented within a single combined document.** The BAL ratings provided in this document are considered to be certified, based on the assumptions listed in Table 1 below.

If required, this document can be used by future home owners, builders and the City of Cockburn to ensure future dwellings within Stage 1 are constructed to the appropriate BAL rating, in accordance with AS 3959. **Table 1** outlines the information relevant to the BAL assessment (Emerge Associates and Bushfire Safety Consulting 2016).

Future subdivision stages will have the lot specific BAL ratings certified separately to support the clearance of lot titles.

Table 1: Certification of BAL assessment

CERTIFICATION OF BAL ASSESSMENT (EMERGE ASSOCIATES AND BUSHFIRE SAFETY CONSULTING 2016)			
Summary of site details	Address	Hammond Grove Estate – Stage 1	
	Suburb	Hammond Park	
	Local Government Area	City of Cockburn	
	State	Western Australia	
Relevant Fire Danger Index (FDI)	FDI 80, Table 2.4.3 of AS 3959		
Has a Bushfire Management Plan or BAL Assessment report (or similar) been prepared?	<p>A Fire Management Plan (Emerge Associates and Bushfire Safety Consulting 2014) was prepared to support the Local Structure Plan prepared for the Hammond Grove Estate.</p> <p>A BAL Assessment (Emerge Associates and Bushfire Safety Consulting 2016) was prepared to support the creation of lots and future construction of dwellings within the Hammond Grove Estate. The information in this document certifies the BAL ratings within the Stage 1 development area.</p>		
Assessment method	Method 1, AS 3959		
Assessor details	Emerge Associates and Bushfire Safety Consulting (Rohan Carboon)		
Potential bushfire impacts within 100m of the site, based on AS 3959	Plot 1	Vegetation classification	Forrest (Class A)
		Effective slope	Flat/Upslope
	Plot 2	Vegetation classification	Woodland (Class B)

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

CERTIFICATION OF BAL ASSESSMENT (EMERGE ASSOCIATES AND BUSHFIRE SAFETY CONSULTING 2016)			
		Effective slope	Flat/upslope and downslope 0-5°
	Plot 3	Vegetation classification	Grassland (Class G)
		Effective slope	Flat/upslope and downslope 0-5°
BAL ratings	A BAL Contour Map is provided in Figure 6 , with the relevant BAL ratings for each lot within Stage 1 detailed in Table 2 (below) and Figure 7 . These figures are attached separately to this Appendix.		
Assumptions	<ul style="list-style-type: none"> Existing firebreaks located within Bush Forever Site 392 will continue to be maintained in perpetuity by the relevant management authority. All future public open space and road reserves within the site will be landscaped and maintained to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959. All undeveloped areas within the Hammond Grove Estate will be maintained by Qube to a low threat standard until such a time as development progresses in these areas, to ensure no temporary fuels impact on each internal development stage/s. Grass fuels within private landholdings east of the site will continue to be maintained to a low threat standard until such a time as development progresses within this area in line with separate development approvals. 		

Certified BAL ratings

The BAL ratings determined for individual lots within Stage 1 are shown in **Figure 7** (attached separately to this Appendix), and detailed in **Table 2** below which outlines the specific standard, in accordance with AS 3959, that a dwelling must be built to within an exposed lot.

BAL Ratings

	BAL-FZ
	BAL-40
	BAL-29
	BAL-19
	BAL-12.5
	BAL-LOW

Table 2: Certified BAL ratings for lots within Stage 1

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
330	None identified.	>100 m	N/A	BAL-LOW
452	None identified.	>100 m	N/A	BAL-LOW
453	None identified.	>100 m	N/A	BAL-LOW
454	None identified.	>100 m	N/A	BAL-LOW
455	None identified.	>100 m	N/A	BAL-LOW

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
 HAMMOND GROVE ESTATE - STAGE 1

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
456	None identified.	>100 m	N/A	BAL-LOW
457	None identified.	>100 m	N/A	BAL-LOW
458	None identified.	>100 m	N/A	BAL-LOW
459	None identified.	>100 m	N/A	BAL-LOW
460	None identified.	>100 m	N/A	BAL-LOW
461	None identified.	>100 m	N/A	BAL-LOW
462	None identified.	>100 m	N/A	BAL-LOW
463	None identified.	>100 m	N/A	BAL-LOW
464	Forrest	72.4 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	73.2 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
465	Forrest	82.4 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	81.1 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
466	Forrest	92.4 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	89.5 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
467	Forrest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	98.2 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
468	None identified.	>100 m	N/A	BAL-LOW
469	None identified.	>100 m	N/A	BAL-LOW
470	None identified.	>100 m	N/A	BAL-LOW
471	None identified.	>100 m	N/A	BAL-LOW
472	None identified.	>100 m	N/A	BAL-LOW
473	None identified.	>100 m	N/A	BAL-LOW
474	None identified.	>100 m	N/A	BAL-LOW

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
475	None identified.	>100 m	N/A	BAL-LOW
476	None identified.	>100 m	N/A	BAL-LOW
477	None identified.	>100 m	N/A	BAL-LOW
478	None identified.	>100 m	N/A	BAL-LOW
479	None identified.	>100 m	N/A	BAL-LOW
480	None identified.	>100 m	N/A	BAL-LOW
481	None identified.	>100 m	N/A	BAL-LOW

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:



Rohan Carboon

Bushfire Safety Consulting

9 November 2016

Signature:



Jen Longstaff

Emerge Associates

9 November 2016

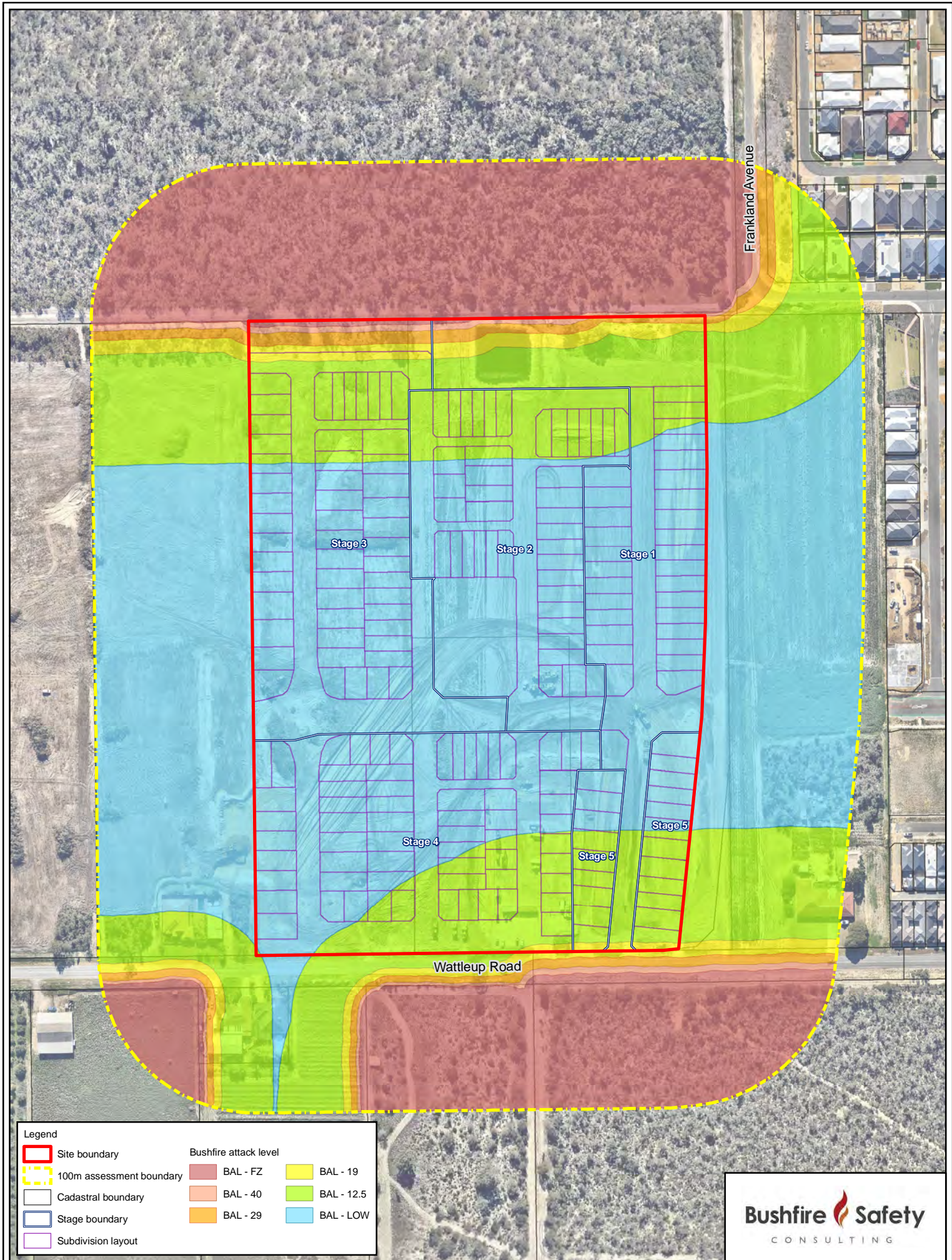


Figure 6: BAL Contour Plan

Project: Bushfire Attack Level Assessment
Hammond Grove Estate

Client: Qube Property Group

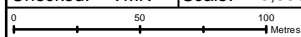


Plan Number: EP15-063(03)--F18

Drawn: KNM Date: 27/09/2016

Approved: KK Date: 11/10/2016

Checked: VMK Scale: 1:3,000@A4



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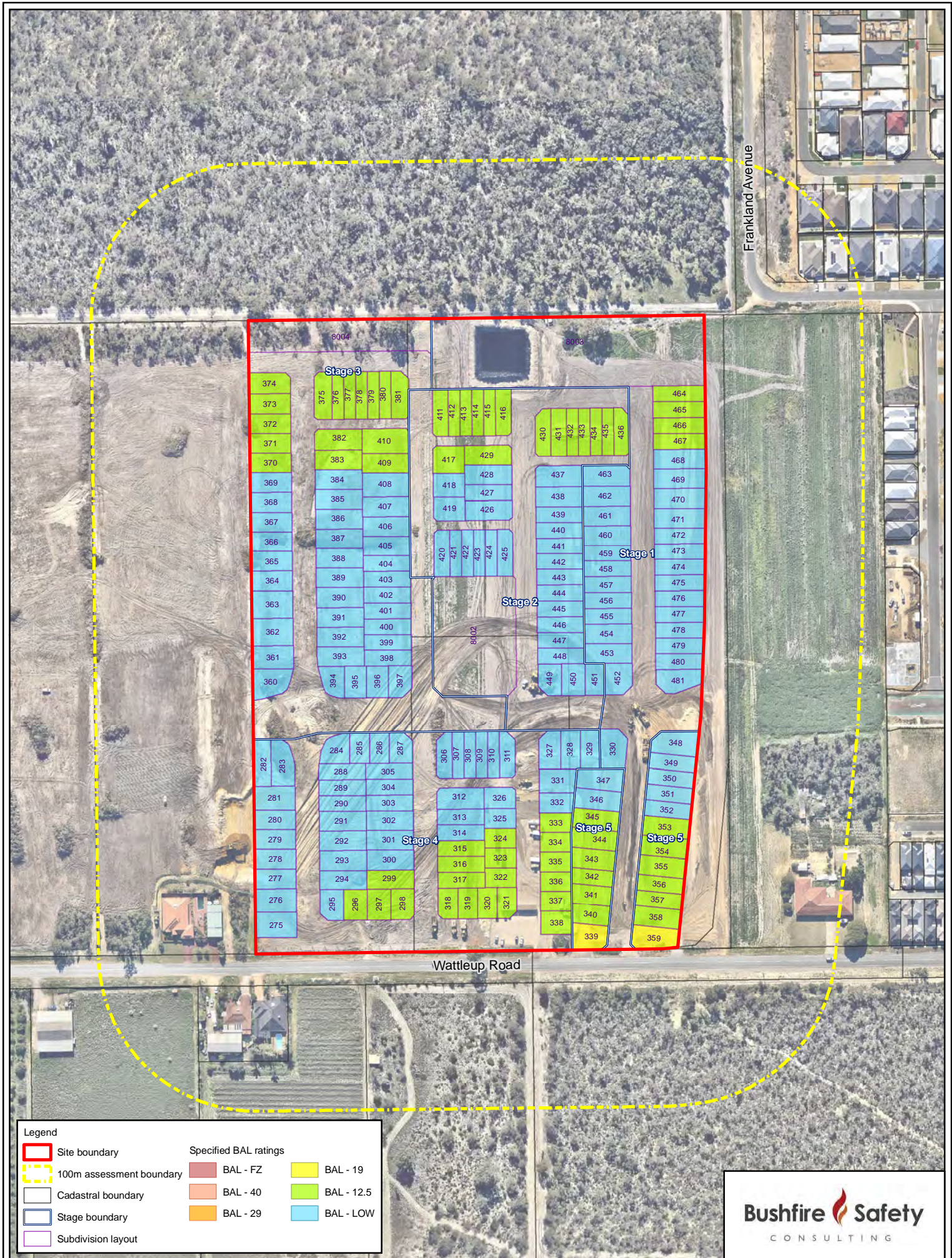


Figure 7: Specified BAL Ratings for Exposed Lots

Project: Bushfire Attack Level Assessment
Hammond Grove Estate

Client: Qube Property Group



Plan Number: EP15-063(03)--F19

Drawn: KNM Date: 27/09/2016

Approved: KK Date: 11/10/2016

Checked: VMK Scale: 1:3,000@A4

0 50 100 Metres

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Additional Information

A large, stylized graphic of flames in light grey lines occupies the lower half of the page. A solid orange horizontal band is positioned across the middle of the page, partially overlapping the flame graphic.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Australian Standard 3959-2009 Construction of buildings in bushfire prone areas (AS 3959)

Australian Standard (AS) 3959 Construction of buildings in bushfire prone areas (AS 3959) (Standards Australia 2009) (AS 3959) specifies requirements for the construction of buildings in Bushfire Prone Areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

The Bushfire Attack Level (BAL) rating is determined through identification and assessment of the following parameters:

- Fire Danger Index (FDI) rating: assumed to be FDI 80 for Western Australia
- All classified vegetation within 100 m of the subject building
- Separation distance between the subject building and the classified vegetation source/s
- Slope of the land under the classified vegetation

The parameters applicable to the site are detailed within **Table 1**.

AS 3959 provides six BAL ratings: BAL-LOW, BAL-12.5, BAL19, BAL-29, BAL-40 and BAL-FZ, which are based on heat flux exposure thresholds. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire-prone areas (as per AS 3959). A summary of each BAL rating, associated heat flux and applicable section of AS 3959 has been summarised in **Table A** below.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
 HAMMOND GROVE ESTATE - STAGE 1

Table A: Summary of BAL ratings, heat flux thresholds and associated construction standards, as outlined within AS 3959

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the subject building and heat flux exposure thresholds	Description of the predicted bushfire attack and levels of exposure	Construction section (within AS 3959)
BAL-LOW	See Clauses 2.2.3.2	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	$\leq 12.5 \text{ kW/m}^2$	Ember attack	3 & 5
BAL-19	$> 12.5 \text{ kW/m}^2$ to $\leq 19 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	$> 19 \text{ kW/m}^2$ to $\leq 29 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	$> 29 \text{ kW/m}^2$ to $\leq 40 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	$\leq 40 \text{ kW/m}^2$	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

Shielding Provisions

Under AS 3959 the construction requirements for the next lower BAL rating determined for a dwelling may be applied to the elevation (i.e. portions) of the building not exposed to the source of bushfire attack (i.e. if the building is BAL-19, BAL 12.5 would apply to portions of the building not exposed to the source of bushfire risk). Under AS 3959, an elevation is deemed to not be subject to the source of bushfire attack if all straight lines between the elevation and source of bushfire attack are obstructed by another part of the building. Examples of this are shown within **Plate A** below.

Where a BAL rating of 12.5 or higher applies, the minimum construction standard, regardless of shielding, will be BAL 12.5.

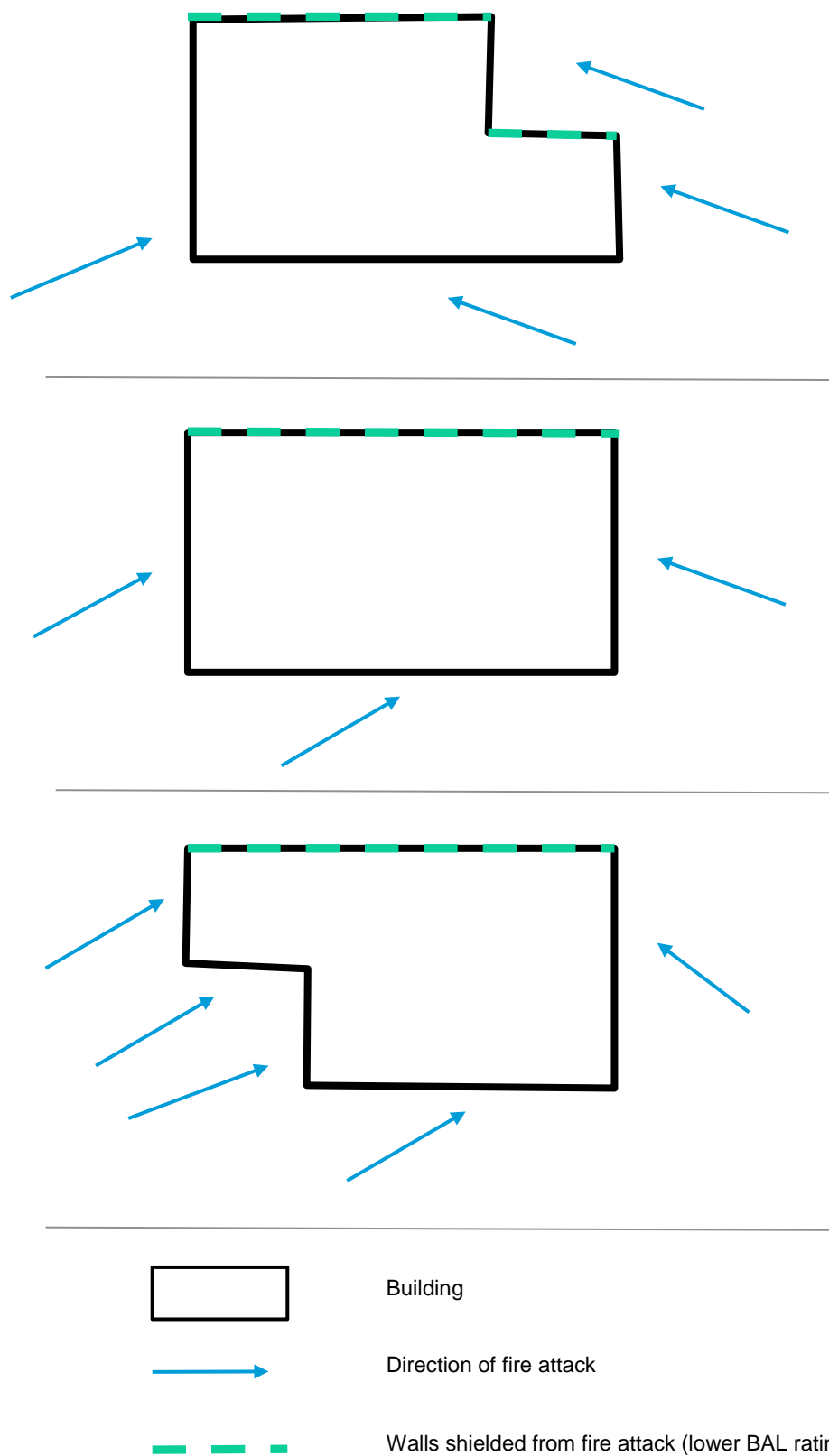
CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Plate A: Examples of walls subject to shielding (Source: AS 3959)

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 1

Asset Protection Zone

The provision of a perimeter Asset Protection Zone (APZ) where development is adjacent to an external bushfire hazard will ensure fuel loads in close proximity to the first row of buildings are managed to reduce the likelihood of ignition fuels adjacent to dwellings.

Managing vegetation in the APZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

All owners of lots subject to increased construction standards (i.e. BAL-12.5 or greater) will be required to maintain their property to a low threat standard, in order to avoid ignition sources in proximity to dwellings within bushfire prone areas (i.e. within 100 m of classified vegetation).

Areas managed to a low threat standard can act as APZ areas because of the landscaped nature and maintenance of these areas. Lots subject to BAL-12.5 or higher must be maintained to the following standards:

- Fine fuel load: reduced to and maintained at two tonnes per hectare
- Trees (crowns) are a minimum distance of ten metres apart. A small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species
- No tall shrubs or trees located within two metres of a building
- No tree crowns overhang the building
- Fences are constructed using non-combustible materials (e.g. iron, brick, limestone, metal post and wire, colorbond)
- Sheds (where present) should not contain flammable materials.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT

HAMMOND GROVE ESTATE - STAGE 2

Project Number EP15-063(03)

**Prepared for Qube Property Group
December 2016**

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Document Control

DOC NAME	CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT, HAMMOND GROVE ESTATE – STAGE 2				
DOC NO.	EP15-063(03)--010 DCM				
REVISION	DATE	AUTHOR		REVIEWER	
1	December 2016	Dylan Martini	DCM	Jen Longstaff	
				Rohan Carboon	
	Certified BAL ratings – Hammond Grove Stage 2				
A					
B					

Disclaimer:

This document has been prepared in good faith and is derived from sources believed to be reliable and accurate at the time of publication. Nevertheless, this publication is distributed on the terms and understanding that the author is not responsible for the results of any actions taken based on information in this publication or for any error in or omission from this publication.

The content of this document has been prepared primarily to consider the layout of the development or the appropriate building construction standard, where relevant. The measures outlined are considered to be prudent minimum standards only based on the relevant experience of the author and the standards prescribed by the relevant authorities. The level of implementation of the fire precautions achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a wide range of conditions. An element of risk, no matter how small always remains. The objective of the Australian Standard AS 3959-2009 is to “prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes” (Standards Australia 2009). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Certification of Specified BAL Ratings – Stage 2

This Bushfire Attack Level (BAL) certification for Stage 2 of Hammond Grove Estate has been prepared jointly by Emerge Associates and Bushfire Safety Consulting.

Bushfire Safety Consulting is owned and operated by Rohan Carboon, an experienced bushfire consultant to the urban planning industry. Rohan has obtained BPAD Level 1 BAL Assessor accreditation under the Fire Protection Association of Australia's new Western Australian accreditation scheme and is in the process of finalising his Level 2 and Level 3 accreditation. Rohan has provided all technical input and review for the bushfire risk assessment included within this BAL assessment. Bushfire Safety Consulting is a Corporate Bronze Member of the Fire Protection Association of Australia.

This purpose of this BAL Certification report is to review the BAL Assessment (document reference EP15-063(03)--006b) (Emerge Associates and Bushfire Safety Consulting 2016) completed for the Hammond Grove Estate, and to either confirm or reassess the BAL ratings for individual lots within Stage 2 based on the classified vegetation present. **Each lot has been considered individually in terms of proximity to classified vegetation, but has been documented within a single combined document.** The BAL ratings provided in this document are considered to be certified, based on the assumptions listed in **Table 1** below.

If required, this document can be used by future home owners, builders and the City of Cockburn to ensure future dwellings within Stage 2 are constructed to the appropriate BAL rating, in accordance with AS 3959. **Table 1** outlines the information relevant to the BAL assessment (Emerge Associates and Bushfire Safety Consulting 2016).

Future subdivision stages will have the lot specific BAL ratings certified separately to support the clearance of lot titles.

Table 1: Certification of BAL assessment

CERTIFICATION OF BAL ASSESSMENT (EMERGE ASSOCIATES AND BUSHFIRE SAFETY CONSULTING 2016)			
Summary of site details	Address	Hammond Grove Estate – Stage 2	
	Suburb	Hammond Park	
	Local Government Area	City of Cockburn	
	State	Western Australia	
Relevant Fire Danger Index (FDI)	FDI 80, Table 2.4.3 of AS 3959		
Has a Bushfire Management Plan or BAL Assessment report (or similar) been prepared?	A Fire Management Plan (Emerge Associates and Bushfire Safety Consulting 2014) was prepared to support the Local Structure Plan prepared for the Hammond Grove Estate. A BAL Assessment (Emerge Associates and Bushfire Safety Consulting 2016) was prepared to support the creation of lots and future construction of dwellings within the Hammond Grove Estate. The information in this document certifies the BAL ratings within the Stage 2 development area, as assessed as part of the BAL Assessment.		
Assessment method	Method 1, AS 3959		
Assessor details	Emerge Associates and Bushfire Safety Consulting (Rohan Carboon)		
Potential bushfire impacts	Plot 1	Vegetation classification	Forest (Class A)

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

CERTIFICATION OF BAL ASSESSMENT (EMERGE ASSOCIATES AND BUSHFIRE SAFETY CONSULTING 2016)			
within 100m of the site, based on AS 3959		Effective slope	Flat/Upslope
	Plot 2	Vegetation classification	Woodland (Class B)
		Effective slope	Flat/upslope and downslope 0-5°
	Plot 3	Vegetation classification	Grassland (Class G)
		Effective slope	Flat/upslope and downslope 0-5°
BAL ratings	A BAL Contour Map is provided in Figure 6 , with the relevant BAL ratings for each lot within Stage 2 detailed in Table 2 (below) and Figure 7 . These figures are attached separately to this Appendix.		
Assumptions	<ul style="list-style-type: none"> Existing firebreaks located within Bush Forever Site 392 will continue to be maintained in perpetuity by the relevant management authority. All future public open space and road reserves within the site will be landscaped and maintained to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959. All undeveloped areas within the Hammond Grove Estate will be maintained by Qube to a low threat standard until such a time as development progresses in these areas, to ensure no temporary fuels impact on each internal development stage/s. 		

Certified BAL ratings

The BAL ratings determined for individual lots within Stage 2 are shown in **Figure 7** (attached separately to this Appendix), and detailed in **Table 2** below which outlines the specific standard, in accordance with AS 3959, that a dwelling must be built to within an exposed lot.

BAL Ratings

	BAL-FZ
	BAL-40
	BAL-29
	BAL-19
	BAL-12.5
	BAL-LOW

Table 2: Certified BAL ratings for lots within Stage 2

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
411	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	54.9 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
412	Forest	>100 m	Flat/upslope	BAL-12.5

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
 HAMMOND GROVE ESTATE - STAGE 2

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
	Woodland (Class B)	55.3 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
413	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	55.4 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
414	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	55.6 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
415	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	55.7 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
416	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	55.7 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
417	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	90.9 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
418	None identified.	>100 m	N/A	BAL-LOW
419	None identified.	>100 m	N/A	BAL-LOW
420	None identified.	>100 m	N/A	BAL-LOW
421	None identified.	>100 m	N/A	BAL-LOW
422	None identified.	>100 m	N/A	BAL-LOW
423	None identified.	>100 m	N/A	BAL-LOW
424	None identified.	>100 m	N/A	BAL-LOW

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
 HAMMOND GROVE ESTATE - STAGE 2

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
425	None identified.	>100 m	N/A	BAL-LOW
426	None identified.	>100 m	N/A	BAL-LOW
427	None identified.	>100 m	N/A	BAL-LOW
428	None identified.	>100 m	N/A	BAL-LOW
429	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	91.5 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
430	Forest	>100 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	68.3 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
431	Forest	96.8 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	67.9 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
432	Forest	93.9 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	67.9 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
433	Forest	91.5 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	68.3 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
434	Forest	89.7 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	69.5 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
435	Forest	88.4 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	71.3 m	Flat/upslope Downslope 0-5°	

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
 HAMMOND GROVE ESTATE - STAGE 2

LOT NUMBER	CLASSIFIED VEGETATION	SETBACK OF LOT FROM CLASSIFIED VEGETATION	EFFECTIVE SLOPE	SPECIFIED BAL RATING
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
436	Forest	87.4 m	Flat/upslope	BAL-12.5
	Woodland (Class B)	73.1 m	Flat/upslope Downslope 0-5°	
	Grassland (Class G)	>50 m	Flat/upslope Downslope 0-5°	
437	None identified.	>100 m	N/A	BAL-LOW
438	None identified.	>100 m	N/A	BAL-LOW
439	None identified.	>100 m	N/A	BAL-LOW
440	None identified.	>100 m	N/A	BAL-LOW
441	None identified.	>100 m	N/A	BAL-LOW
442	None identified.	>100 m	N/A	BAL-LOW
443	None identified.	>100 m	N/A	BAL-LOW
444	None identified.	>100 m	N/A	BAL-LOW
445	None identified.	>100 m	N/A	BAL-LOW
446	None identified.	>100 m	N/A	BAL-LOW
447	None identified.	>100 m	N/A	BAL-LOW
448	None identified.	>100 m	N/A	BAL-LOW
449	None identified.	>100 m	N/A	BAL-LOW
450	None identified.	>100 m	N/A	BAL-LOW
451	None identified.	>100 m	N/A	BAL-LOW

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:



Rohan Carboon

Bushfire Safety Consulting

16 December 2016

Signature:



Jen Longstaff

Emerge Associates

16 December 2016

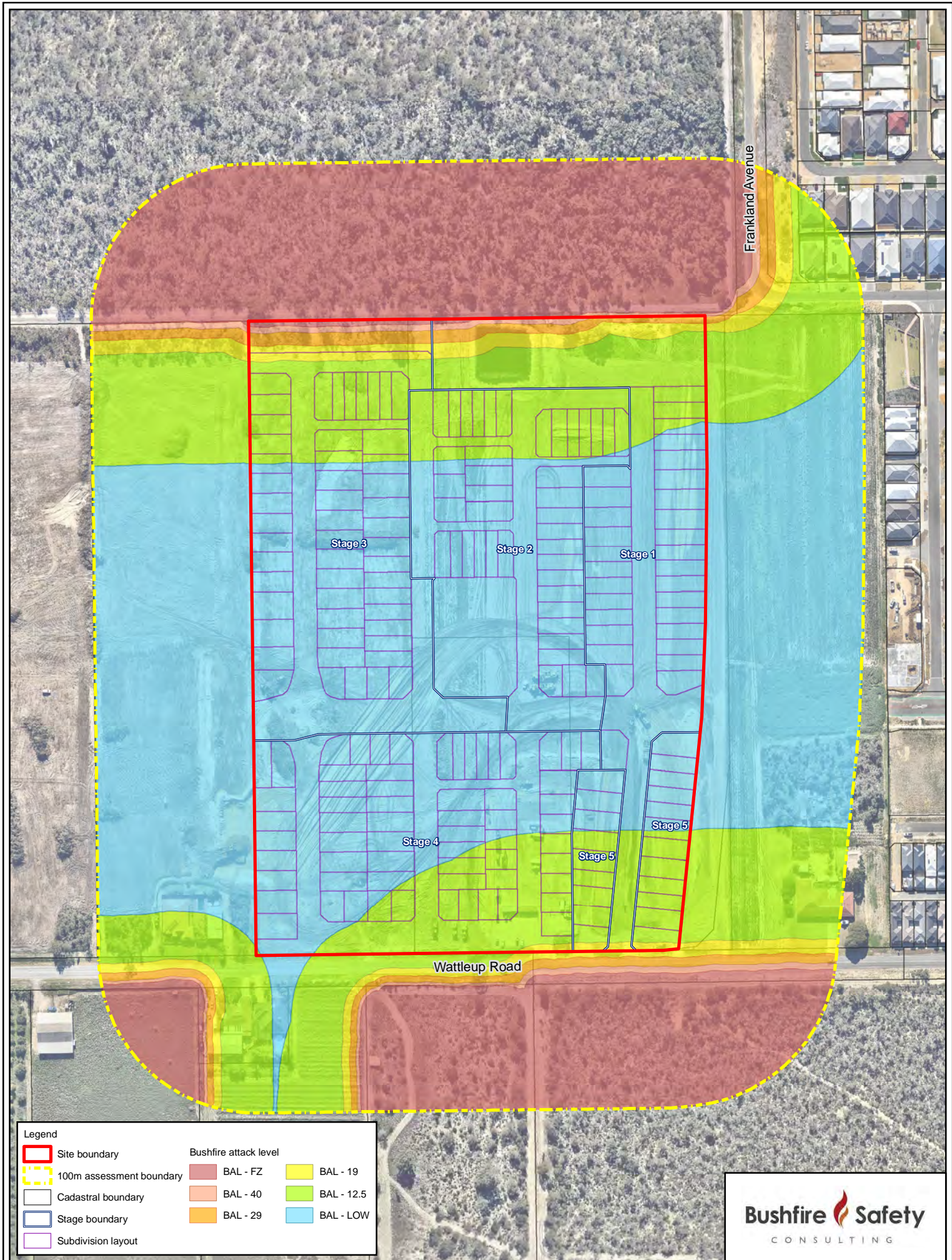


Figure 6: BAL Contour Plan

Project: Bushfire Attack Level Assessment
Hammond Grove Estate

Client: Qube Property Group

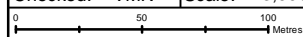


Plan Number: EP15-063(03)--F18

Drawn: KNM Date: 27/09/2016

Approved: KK Date: 11/10/2016

Checked: VMK Scale: 1:3,000@A4



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Figure 7: Specified BAL Ratings for Exposed Lots

Project: Bushfire Attack Level Assessment
Hammond Grove Estate

Client: Qube Property Group



Plan Number: EP15-063(03)--F19

Drawn: KNM Date: 27/09/2016

Approved: KK Date: 11/10/2016

Checked: VMK Scale: 1:3,000@A4

0 50 100 Metres

Bushfire Safety
CONSULTING

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Additional Information

A large, stylized graphic of flames in light gray lines, rising from the bottom and extending across the page. A solid orange horizontal band is positioned across the middle of the page, partially overlapping the flames.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Australian Standard 3959-2009 Construction of buildings in bushfire prone areas (AS 3959)

Australian Standard (AS) 3959 Construction of buildings in bushfire prone areas (AS 3959) (Standards Australia 2009) (AS 3959) specifies requirements for the construction of buildings in Bushfire Prone Areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

The Bushfire Attack Level (BAL) rating is determined through identification and assessment of the following parameters:

- Fire Danger Index (FDI) rating: assumed to be FDI 80 for Western Australia
- All classified vegetation within 100 m of the subject building
- Separation distance between the subject building and the classified vegetation source/s
- Slope of the land under the classified vegetation

The parameters applicable to the site are detailed within **Table 1** above.

AS 3959 provides six BAL ratings: BAL-LOW, BAL-12.5, BAL19, BAL-29, BAL-40 and BAL-FZ, which are based on heat flux exposure thresholds. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire-prone areas (as per AS 3959). A summary of each BAL rating, associated heat flux and applicable section of AS 3959 has been summarised in **Table A** below.

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Table A: Summary of BAL ratings, heat flux thresholds and associated construction standards, as outlined within AS 3959

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the subject building and heat flux exposure thresholds	Description of the predicted bushfire attack and levels of exposure	Construction section (within AS 3959)
BAL-LOW	See Clauses 2.2.3.2	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	$\leq 12.5 \text{ kW/m}^2$	Ember attack	3 & 5
BAL-19	$> 12.5 \text{ kW/m}^2$ to $\leq 19 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	$> 19 \text{ kW/m}^2$ to $\leq 29 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	$> 29 \text{ kW/m}^2$ to $\leq 40 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	$\leq 40 \text{ kW/m}^2$	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

Shielding Provisions

Under AS 3959 the construction requirements for the next lower BAL rating determined for a dwelling may be applied to the elevation (i.e. portions) of the building not exposed to the source of bushfire attack (i.e. if the building is BAL-19, BAL 12.5 would apply to portions of the building not exposed to the source of bushfire risk). Under AS 3959, an elevation is deemed to not be subject to the source of bushfire attack if all straight lines between the elevation and source of bushfire attack are obstructed by another part of the building. Examples of this are shown within **Plate A** below.

Where a BAL rating of 12.5 or higher applies, the minimum construction standard, regardless of shielding, will be BAL 12.5.

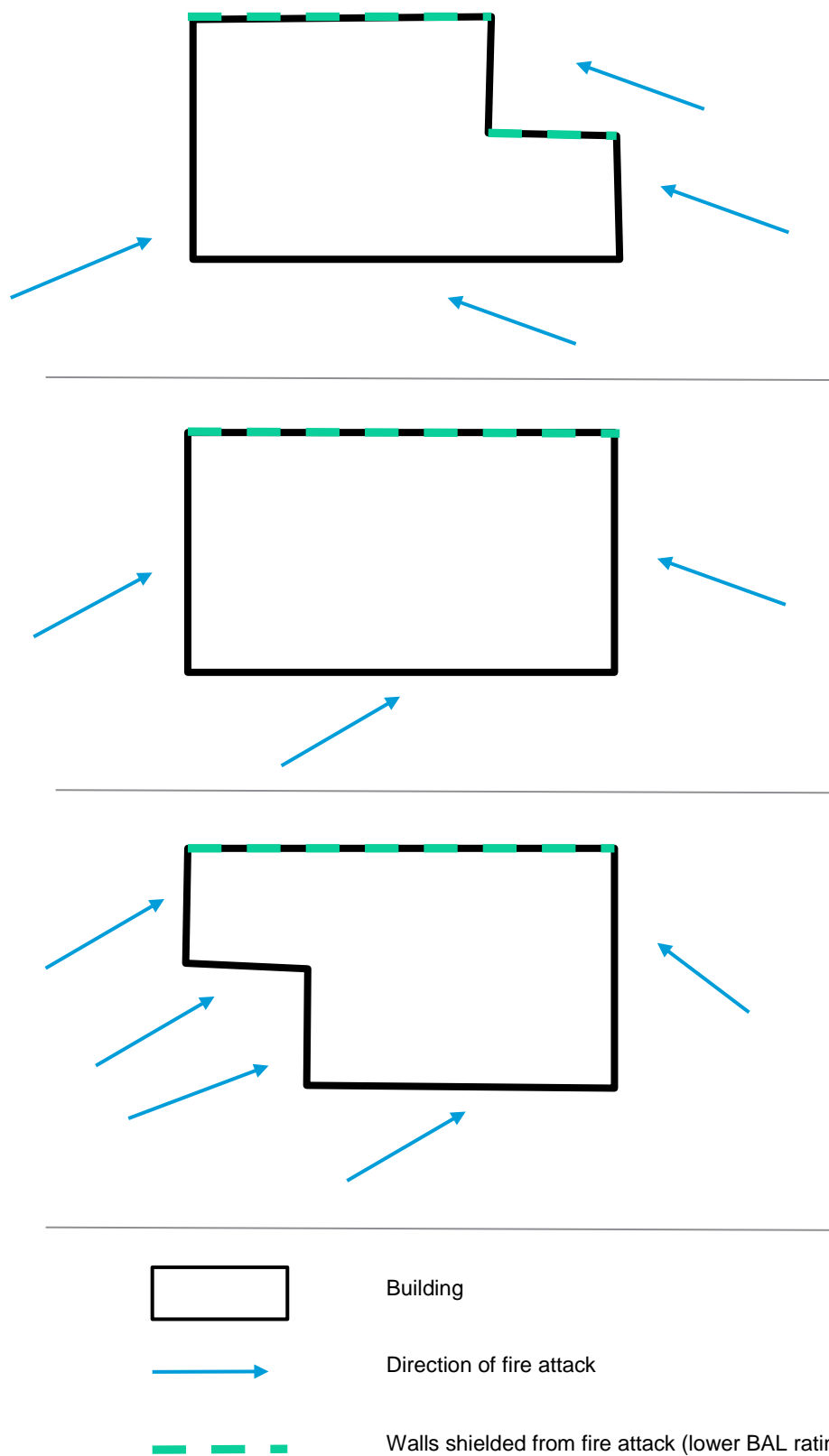
CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Plate A: Examples of walls subject to shielding (Source: AS 3959)

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT
HAMMOND GROVE ESTATE - STAGE 2

Asset Protection Zone

The provision of a perimeter Asset Protection Zone (APZ) where development is adjacent to an external bushfire hazard will ensure fuel loads in close proximity to the first row of buildings are managed to reduce the likelihood of ignition fuels adjacent to dwellings.

Managing vegetation in the APZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

All owners of lots subject to increased construction standards (i.e. BAL-12.5 or greater) will be required to maintain their property to a low threat standard, in order to avoid ignition sources in proximity to dwellings within bushfire prone areas (i.e. within 100 m of classified vegetation).

Areas managed to a low threat standard can act as APZ areas because of the landscaped nature and maintenance of these areas. Lots subject to BAL-12.5 or higher must be maintained to the following standards:

- Fine fuel load: reduced to and maintained at two tonnes per hectare
- Trees (crowns) are a minimum distance of ten metres apart. A small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species
- No tall shrubs or trees located within two metres of a building
- No tree crowns overhang the building
- Fences are constructed using non-combustible materials (e.g. iron, brick, limestone, metal post and wire, colorbond)
- Sheds (where present) should not contain flammable materials.



Government of Western Australia
Department of Fire & Emergency Services



THE HOMEOWNER'S BUSHFIRE SURVIVAL MANUAL

September 2014 | Sixth Edition

Don't let this happen to you ...



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Introduction

This manual has been prepared to help you be better informed about bushfires. It draws together the best advice available on preventing fires and preparing for them. Many of the lessons have been learnt at the devastating cost of loss of possessions and even life itself.

It is hoped that you will consider how best to apply this information to your own property and help reduce fire damage and the associated human trauma during Western Australia's hot, fire-prone summers or dry seasons.

You are in control

Whether you live in the city, town or rural property, the impact from bushfires is in your hands. How you prepare yourself, your family and your property (including your home) rests with you and will, in many instances, determine the outcome. This booklet sets out some useful hints on what to do on your property and how to better prepare it for bushfires.

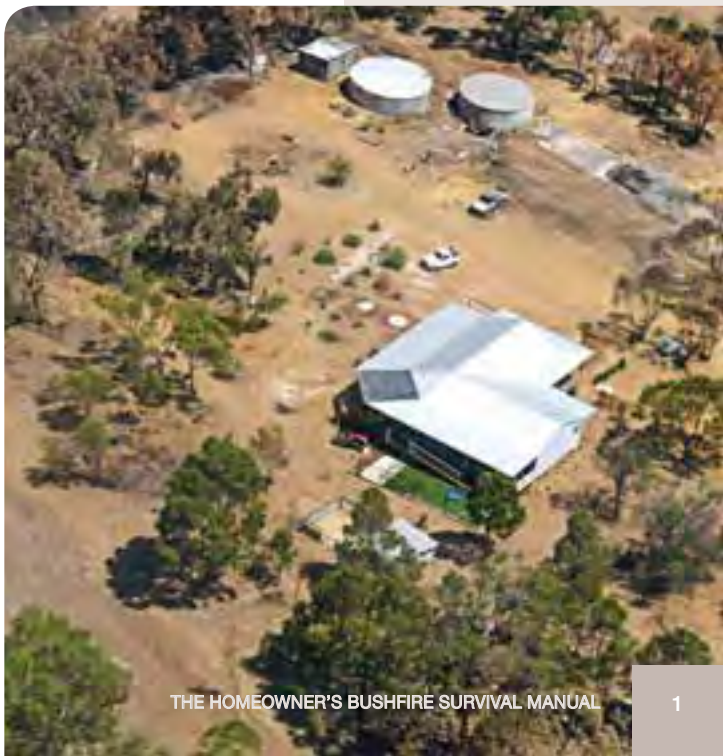
You should prepare your home to survive a bushfire, even if you plan to leave early.¹ A well prepared and constructed house is more likely to survive a bushfire and ember attack than an unprepared one.

- A well prepared home can be easier for you and firefighters to defend.
- A well prepared home is less likely to put your neighbours' homes at risk.
- A well prepared home will give you more protection if a fire threatens suddenly and you cannot leave and have to take shelter within the home.

Fire prevention is a family business. There's a job for even the youngest child—such as raking up dead leaves or watering the lawn near the house to keep it green and safe. For older children, there's a lot to learn about fire safety—the role of trees and scrub in a fire; safety features like building protection zones and hazard separation zones and the likely pattern of fires in the area.

Where the term summer is used it should be interpreted to include the dry season in the north of the State. Summer is used as a generic term to describe the bushfire season.

You must prepare your property to give yourself and your home the best chance of survival.



Bushfire behaviour and fuels

Any fire requires three elements to be present for it to ignite and continue to burn: oxygen, heat and fuel.

These three elements are described as the 'fire triangle'.

Remove one of these elements and the fire will stop.

OXYGEN

When a frying pan catches fire, the flames will go out if you put the lid on the pan. In the same way, a bushfire needs oxygen to keep going—the more there is, the faster the fire burns. Strong winds not only force the fire along, but also increase air circulation and provide more oxygen. Therefore, any measure that reduces wind speed will reduce the intensity of the fire. In many instances trees can effectively shelter your house from wind.

Fires usually move faster in grassland than in forests because winds are stronger and the fuels are less dense allowing easy movement of oxygen through the grass. Grass fires are generally less intense than bushfires.

The prevailing afternoon breeze in summer presents the **most common threat** as it fans bushfires when fire fuel is at its driest during the day. Unstable atmospheric conditions that create less common north-west winds in summer can lead to the **most destructive bushfires**.

HEAT

Bushfires generate unbelievable heat. Much of the heat goes up in the air, but a significant amount also radiates out at ground level. This 'radiant' heat spreads the fire by drying out vegetation so it will burn. Radiant heat can kill people, plants and animals. That's why during a fire you need to cover all bare skin with natural-fibre clothing—a shirt with long sleeves, long trousers and gloves. Keep a woollen blanket in the car so you can get under it, if trapped in a fire.

Although radiant heat can be fierce, it can easily be deflected by a non-combustible solid barrier, such as a wall or building. If you're caught in a bushfire, the safest place is inside a building, away from the radiant heat, particularly if the building is well prepared and has a minimum 20-metre Building Protection Zone.

Windbreaks and other barriers can slow the effects of radiant heat, which dries out unburnt vegetation, therefore helping to slow the blaze.



Oxygen, heat and fuel are described as the 'fire triangle'. If one of these components is removed the fire will stop.

Radiant heat can be deflected by a non-combustible solid barrier, such as a wall or building.

FUEL

In summer and during the northern dry season, Australia is covered with vegetation that is fuel for fires—long dry grass, parched native shrubs, leaves and twigs. Without fuel and an ignition source, there would be no bushfires.

Fire prevention measures are largely based on reducing these fuels—by creating firebreaks, low intensity burning of forests and woodlands and the low intensity burning, mowing and slashing of long grasses before the fire season. When a bushfire is raging, firefighters often create breaks around it or burn back towards it, to starve the fire of fuel. Likewise, it is essential to remove fuel from around the house in order to reduce fire intensity and flame length.



Most of the fire safety measures in this book are based on reducing fuel, oxygen and/or heat in and around the house and guiding you as to how to enhance the survivability of the home through modifications to the building.



Bushfire history — what we have learnt

WHAT HAVE WE LEARNT FROM BUSHFIRES THAT HAVE OCCURRED IN THE PAST?

- Dwellingup 1961
- Ash Wednesday 1983
- Sydney 1994
- Wooroloo WA 1997
- Brookton WA 1997
- Sydney 2001
- NSW 2002
- Canberra 2002–03
- Alpine Fires 2002–03
- Eyre Peninsula 2005–06
- Toodyay 2009
- Black Saturday 2009
- Roleystone/Kelmscott 2011
- Margaret River 2011
- Parkerville, Mt Helena 2014

We know that...

some houses are ill-prepared or built too close to a potential bushfire hazard and may not survive a bushfire. The construction standards, building protection zone and hazard separation zones need to match the potential bushfire threat for the predominant vegetation type and slope.

We know that...

too many people do not take even the most simple precautions to protect their homes, allowing grass, twigs and dead leaves and shrubs to build up around buildings and in gutters.

And we know that...

with sound planning and reasonable effort, houses in bushfire risk areas can be made safer from bushfires.



Roleystone/Kelmscott 2011.





Left: Margaret River 2011.

HOW HOUSES CATCH ALIGHT

There are three ways bushfire attacks property:

- **Direct flame contact** commonly occurs when houses are situated close to a fire hazard.
- **Radiant heat** is the energy emitted from the fire and attacks buildings by heating and igniting flammable objects. Windows are particularly vulnerable to radiant heat.
- **Ember attack** occurs before, during and after a fire front passes. Embers such as burning bark are carried by the wind and dropped away from the main fire front, creating spot fires. Nearly all structural damage caused by a bushfire is due to ember attack. Embers can land in areas of vegetation or in the garden, next to leaf litter, under or in the gutters of the house and on wooden decks which, if not extinguished, can completely engulf the house.



Bushfire Protection Zones are designed to reduce the threat of all three of these bushfire risks to property. A suitable **hazard separation zone** will support the reduction of ember attack.

Prepare your home

There are a number of measures that can be undertaken to increase the protection of your home in bushfire threat areas. Regardless of how old your home is, or to what standard your home is constructed, a Building Protection Zone is essential in increasing its chance of survival under bushfire attack.

Routine maintenance; constructing or retrofitting your home to meet the *Australian Standard 3959—Construction of buildings in bushfire-prone areas*; and addressing bushfire risks in accordance with the *Planning for Bushfire Risk Management Guidelines*² will ensure your house has the best bushfire protection.

Building Protection Zone

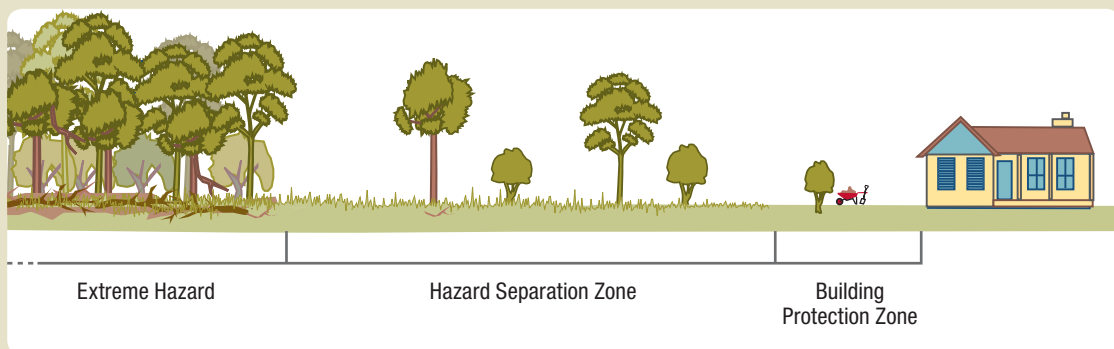
A Building Protection Zone (BPZ) is a buffer zone between a bushfire hazard and a building. In this zone fuel loads are minimised to reduce potential radiant heat levels, flame, ember and smoke attack.

An adequate BPZ will provide sufficient space and safety for firefighters and other emergency services to perform bushfire suppression activities. Managing and reducing fuel loads for a minimum of 20 metres around a building will increase its chances of survival from a bushfire. Create a BPZ, which has less than two tonne per hectare (t/ha) of fine fuel (<6 mm diameter for dead material and <3 mm diameter for live material) around your buildings and keep it maintained to this level.

Managing and reducing fuel loads for a minimum of 20 metres around a building will increase its chances of survival from a bushfire.

Within the BPZ, ensure:

- ✓ Tree crowns are a minimum of 10 metres apart.
- ✓ Trees are skirted or pruned up to a height of 2 metres.
- ✓ No tree is located within 2 metres of a building.
- ✓ Tree branches do not overhang the building.
- ✓ Ensure that there is a gap of at least 3 times the height (at maturity) of the shrub away from the building.
- ✓ Ensure shrubs aren't planted in clumps.
- ✓ Trees and shrubs do not have elevated dead material within the crowns.
- ✓ Lawns are kept short and green, where possible.
- ✓ Fences and sheds are constructed using non-combustible materials, but preferably not located in the BPZ.



An example of a good Building Protection Zone in bushfire area.

CONSIDER SLOPE

The steeper the slope, the more fuel you'll need to clear. To create a BPZ around houses on steep sloping country, greater areas need to be cleared of fuel. If you reduce the amount of ground fuel in forest areas, the fire intensity and the likelihood of crowning 'treetop' fires will be reduced.

When considering slope, a BPZ should be provided around all buildings in bush fire hazard areas in accordance with the following standards:

Slope	Building Protection Zone radius
0° – 5°	20m
5° – 10°	20m
10° – 15°	25m
15° – 20°	30m
Over 20°	40m

See more about improving your Building Protection Zone (BPZ) and Hazard Separation Zone (HSZ) by preparing your garden and property on page 21.

Understanding your risk

Understand the fire risk in your area by considering the following factors. The more high risk factors that apply to you, the more fire protection measures you're likely to need.

FIRE SEASON—HOW LONG?

High risk areas have a long fire season with heavy available fuel loads. Low risk areas have a shorter fire season with little available fuel.

SLOPE—HOW STEEP?

If you live on or near very steep slopes, it's a high risk area. The steeper the slope, the faster a fire will burn up it. A low risk area will have gentle slopes or be quite flat.

VEGETATION—HOW MUCH?

Fires need fuel to burn. If you have a heavy coverage of long grass, forest and woodland-floor litter and flammable scrub nearby, you're in a high risk area. A low risk area would have little or no such fuel.

VEGETATION—HOW DRY?

The drier the vegetation, the greater the fire hazard. The vegetation will naturally dry out through the summer, but it will also gain and lose moisture during the day. This is as a consequence of humidity and temperature changes—early mornings have the highest moisture content and mid-afternoon the lowest.

BUSHFIRES—HOW OFTEN?

Some places have a history of bushfires. The more often fires have occurred in the past, the higher the potential risk.

ROADS—HOW GOOD?

Low risk districts have many good roads providing easy movement through the area. High risk areas have a single, long dead end road, or roads that are easily blocked by falling trees.

Understand the fire risk in your area. If you live on or near very steep vegetated slopes, it's a high risk area.



Routine maintenance — small jobs can save lives

Simple measures such as clearing the leaves out of your gutter and keeping your lawns mown short can make all the difference in protecting your home in the event of a bushfire. Here are some simple pointers that are just as useful for older houses as they are for newly built homes. These tasks need to be undertaken before and during the bushfire season to ensure your home is well prepared.



This section focuses on simple routine maintenance of your house.

- For additional protection measures see page 12.
- For detailed garden landscape and property maintenance see page 21.

ROOFS AND GUTTERS

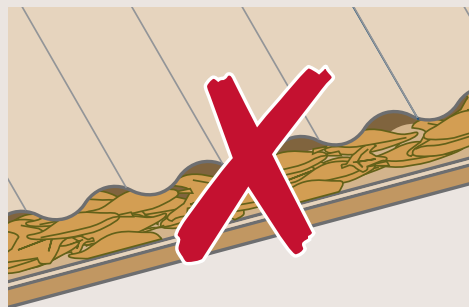
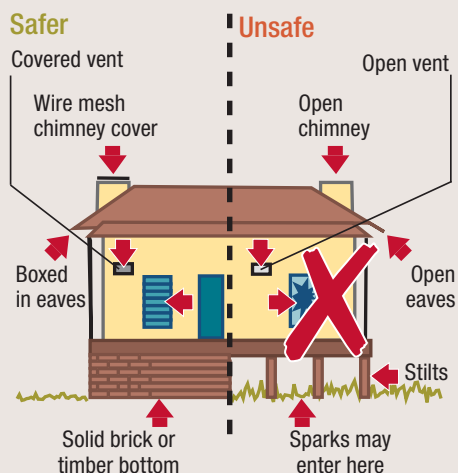
You should keep leaves clear of all gutters, roofing and downpipes both before and during the bushfire season to prevent fire entering through your roof. Consider installing metal leaf gutter guards to prevent litter build up. Check the roof for any broken tiles or dislodged roofing materials and ensure repairs are completed before the bushfire season. Don't have gaps that would allow embers into the roof space; if there are gaps seal them.

EXTERNAL WALLS AND WINDOWS

Do a full inspection of your external walls to check they are in good condition. Check for gaps in the walls and block them. If there are any broken bricks, decaying timber or damaged cement sheeting, repair the wall so that embers cannot lodge in the gaps.³

STEPS

Ensure that under steps, verandahs, patios and balconies there are no combustible materials. Clear out leaf litter and grass and don't store wood, rubbish, building materials or anything that might catch alight in a bushfire close to the building. Replace combustible welcome mats with non-combustible versions and move them back from the steps a short distance.



Keep gutters free of leaf litter.

WATER

Check taps, hoses and hose reels are in good condition and fittings are tight and in good working order. Check pumps are fuelled and oiled and will start easily—you don't want to wait until you need to use the pump to find out it is broken. If you have a bushfire water spray system, ensure that is constructed to *AS 5414 – Bushfire water spray system standards (external sprinkler system)*, and test regularly before the start and during the fire season. Ensure there is adequate water supply to meet the needs of the job.

For more information on water supply for bushfire protection, see page 33.

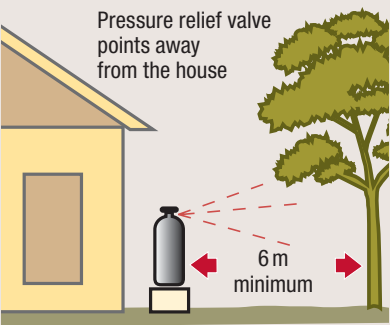
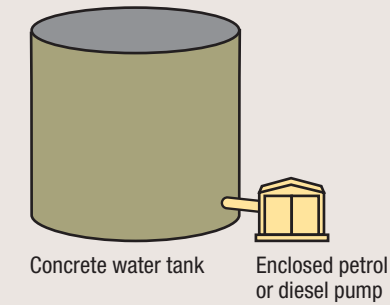
ACCESS

Check driveways and access tracks are clear of trees and are in good condition for use by fire appliances. Ideally fire service access needs to be 6 metres wide (trafficable surface) with a 4 metre vertical clearance. If you have gates ensure they are in good working order and check that locks can be easily locked or unlocked with a key. Consider leaving your gates unlocked if a bushfire is in the area so that emergency services can gain easy access to protect your property.

LP GAS CYLINDERS

Place LP gas cylinders on the side of the house furthest away from the likely direction of a bushfire. Do not place them under the verandah. Make sure the pressure relief valve is directed away from the house and that there is no flammable material in front of the valve for at least 6 metres. Set the cylinders on a concrete or brick base and fix them to a strong support. Turn the valve off as a fire approaches and if the cylinders are exposed to heat and it is safe to do so, hose them down with water to reduce the pressure.

Water supply



Below: LP gas cylinders stored under a house—Roleystone 2011.





PLASTIC PIPES HAVE MELTING MOMENTS

Exposed plastic water pipes and hoses may melt in the heat of a fire—just when you need them most. To avoid this:

- Bury plastic water pipes (PVC and poly pipes) at least 30 centimetres underground.
- Use metal hose fittings rather than plastic fittings.

FIX THE FIRE TRAPS

Walk around your property imagining a bushfire is approaching in the middle of summer. Are there any fire traps you've overlooked?

Typical fire traps are:

- The woodheap—don't pile it against or near the house. Keep it a minimum of 20 metres from the house.
- All fuel containers need to be in a shed away from the house. Unless the shed is constructed to the appropriate bushfire attack level, it should not be within the BPZ.
- Have a firebreak around the shed.
- Rubbish—remove any timber and old junk lying around.
- Overhanging trees—prune branches that overhang the roof or touch the walls. Create a two metre wide gap between the tree and the wall or roof.
- Prune out dead material such as leaves and limbs in the shrubs.

Fire traps



House protection

—upgrading of existing buildings

In a bushfire, most houses that are damaged or destroyed are from ember attack. Burning embers can travel long distances from the fire front—for example, in the Roleystone fire, a house 420 metres from the fire was destroyed.

Any gaps, cracks or areas where embers can lodge in or next to your home significantly reduce the building's ability to withstand bushfire attack.

Routine home and property maintenance is critical in preparing your home for the bushfire season each year however, even minimal building upgrades will significantly contribute to making more permanent improvements for bushfire protection.



DFES recommends that homes should be constructed to the appropriate potential bushfire attack level as described in the *Australian Standard 3959—Construction of buildings in bushfire-prone areas (AS3959)*. In many instances it is not possible to align the already constructed home to that required under the current *AS3959* unless there is retrofitting to achieve the appropriate level of protection.

GAPS AND VENTS

Minimal measures: Seal all gaps around the house that are more than 3 mm wide with joining strips or flexible silicon-based sealant; install mesh flywire on vents made from corrosion resistant steel, bronze or aluminium.

Additional measures: Engage a relevant industry expert to install a sprinkler system to the outside of your house to the *AS 5414 – Bushfire water spray system standards (external sprinkler system)*.⁴

WALLS

Minimal measures: Install sarking with a flammability index of not more than 5 behind weatherboards or other external cladding when they are being replaced for maintenance or other reasons.

Additional measures: Replace wall materials with non-combustible materials; install sarking with a flammability index of not more than 5 behind weatherboards or other external cladding for the entire house.⁴

SUBFLOOR

Minimal measures: Removal of combustible materials under floors and keeping areas clear and accessible.

Additional measures: Enclose subfloor with non-combustible materials.⁴

DOORS

Minimal measures: Install weather strips, draught excluders or draught seals at the base of side-hung doors.

Additional measures: Replace external doors with non-combustible or solid timber doors with minimum thickness of 35 mm and compliant with the requirements of *AS3959 Construction of buildings in bushfire-prone areas*; replace or over-clad parts of door frames less than 400 mm above the ground, decks and similar elements or fittings with non-combustible materials; install weather strips, draught excluders or draught seals at the base of side-hung doors.⁴



An example of a home damaged by embers entering through gaps in the roof.

ROOFS

Minimal measures: Close in spaces between eaves that lead to the roof space; seal around roofing and roof penetration with non-combustible materials; install sarking with flammability index of not more than 5 beneath existing roofing when it is being replaced for maintenance or other reasons; install gutter and valley leaf guards that are non-combustible; use wire mesh capping on chimneys.

Additional measures: Replace fascia and roof materials with non-combustible materials; install sarking with flammability index of not more than 5 beneath existing roofing.⁴

EVAPORATIVE AIR CONDITIONERS

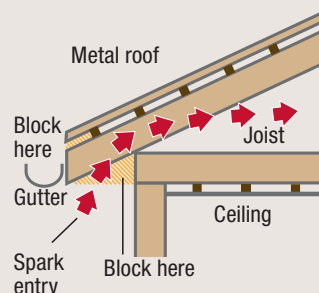
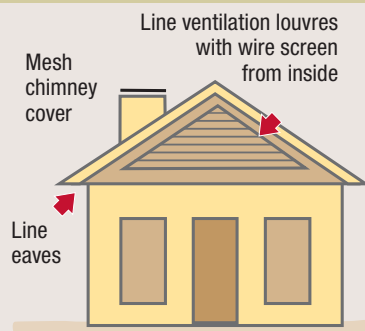
If you live near bushland (within 500 metres) and have a roof mounted evaporative air conditioning unit, your home may have an increased risk of ember attack.

The filter pads in evaporative air conditioners are made from cellulose material and are therefore a potential source of fuel for travelling embers. If air conditioners draw in embers and the filter pads ignite, the unit may collapse into the roof and the fire may spread throughout the house.

Install a non-combustible ember protection screen to your evaporative air conditioning unit using a unit cover, an external screen or an internal screen. DFES consider that external screens are the most effective option.

For more information, see the *DFES Info Note on Ember Protection Screens* available on the DFES website.

Protect house



SOLAR PANELS

Ensure that rooftop solar panels are fitted so that there is sufficient gap between the roof surface and solar panel such that burning embers cannot be caught underneath the panel.⁵

If you have a grid-connected solar system on your roof and you live in a bushfire threat area, there are some extra precautionary measures you can take. If you decide to leave early before the onset of bushfire (more than a day's notice) the following can be undertaken. In this situation you can follow the 'shutdown procedure' when leaving your house, which should be marked on your inverter or meter box:

1. Turn off the solar supply mains switch.
2. Turn off the normal supply mains switch.
3. Turn off the PV array isolator.

If you have a stand-alone solar system on your roof, you may have a battery storage that can also be disconnected prior to a bushfire threat. In this situation, you can take the following steps to shut down your stand-alone solar system and battery storage:

1. Turn off solar array.
2. Turn off inverter.
3. Follow battery shutdown procedures to isolate the battery bank.
4. Disable the generator from starting if it has auto start.

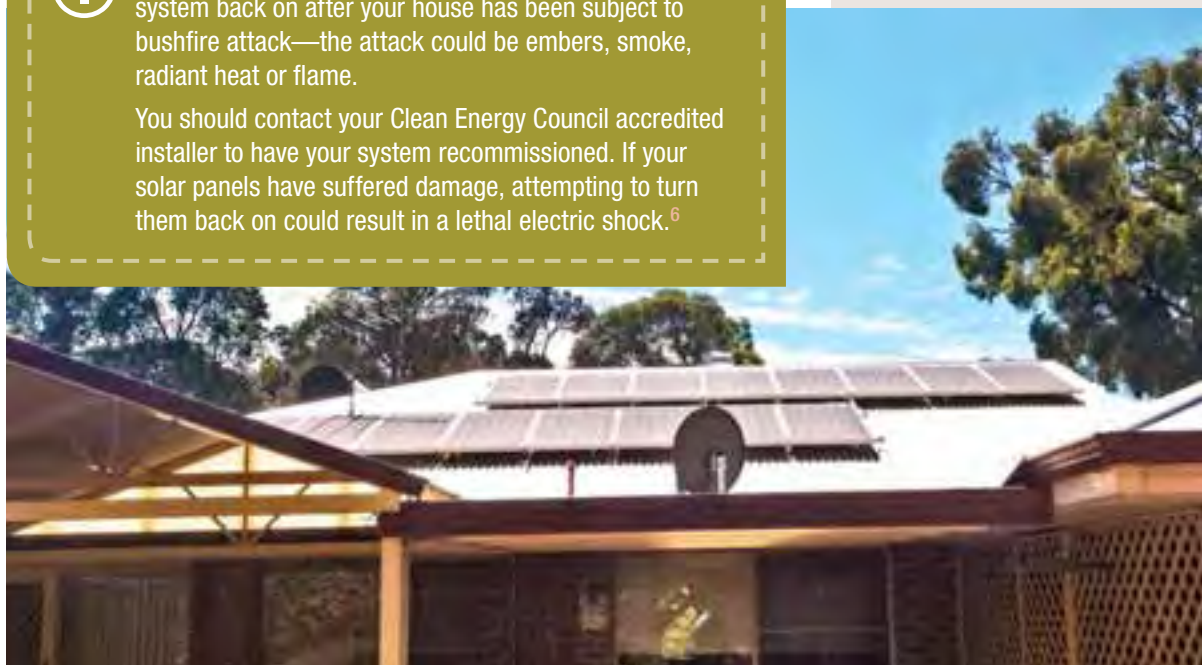
These above steps are only to be followed if you have a day or more advance warning that you will need to leave your house.

These steps are only to be followed if you have a day or more advance warning that you will need to leave your house.



Remember: Do not attempt to turn your solar power system back on after your house has been subject to bushfire attack—the attack could be embers, smoke, radiant heat or flame.

You should contact your Clean Energy Council accredited installer to have your system recommissioned. If your solar panels have suffered damage, attempting to turn them back on could result in a lethal electric shock.⁶



WINDOWS

Ordinary wire flyscreens, fitted on external windows reduce radiant heat (which can shatter glass and melt the seals) and keep out burning embers.

Minimal measures: Install mesh with a maximum aperture of 2 mm, made from corrosion resistant steel, bronze or aluminium to all external doors and windows.

Additional measures: Install appropriately tested shutters to external doors and windows; replace glass with toughened or laminated safety glass; replace overhead glazing with 'Grade A' safety glass as described in *AS 3959* for your bushfire attack level (BAL).⁴

EXTERNAL STRUCTURES

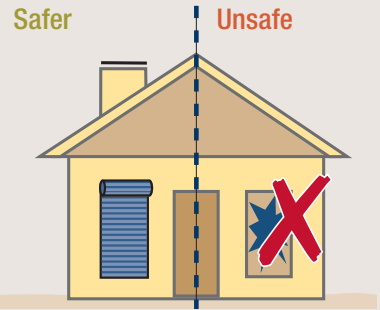
External structures such as sheds should be located outside the BPZ unless it is constructed to withstand the BAL and be more than 10 metres from the main dwelling.⁴

DECKING

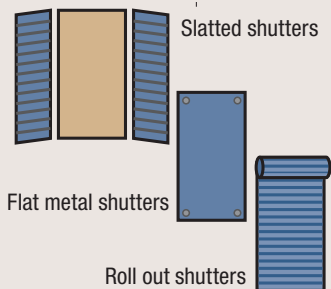
Decking should be compliant with *AS 3959* construction materials and standards for the potential BAL.⁴

For more information on protection measures and appropriate materials, refer the *Australian Standard 3959—Construction of buildings in bushfire-prone areas*.

Protect windows



Protect windows with shutters



Below: Deck damage as a consequence of being constructed from inappropriate materials for the potential BAL.



Building in bushfire threat areas

If you are going to build in an area that is a bushfire threat, then you are in the optimal position to assess your bushfire protection requirements prior to building and applying the appropriate measures to reduce your risk of bushfire attack on your home.

There may be existing features in the landscape that you can use to reduce the potential impact on your house in a bushfire, or there may be sites that have greater risks that will need to be carefully considered prior to purchasing.



From choosing your house site right through to house design and landscaping, DFES strongly recommends that the house be built to standards described in *Australian Standard 3959—Construction of buildings in bushfire-prone areas*, and bushfire risks are addressed in accordance with *Planning for Bushfire Risk Management Guidelines*.² The five key bushfire hazard management issues for new development are outlined below.

FIVE KEY BUSHFIRE HAZARD ISSUES TO CONSIDER

The *Planning for Bushfire Risk Management Guidelines*² outline five key bushfire management issues that need to be considered when you are planning to build in a bushfire threat area:

1. Location
2. Vehicular access
3. Water
4. Siting of development
5. Design of development.²

1. LOCATION

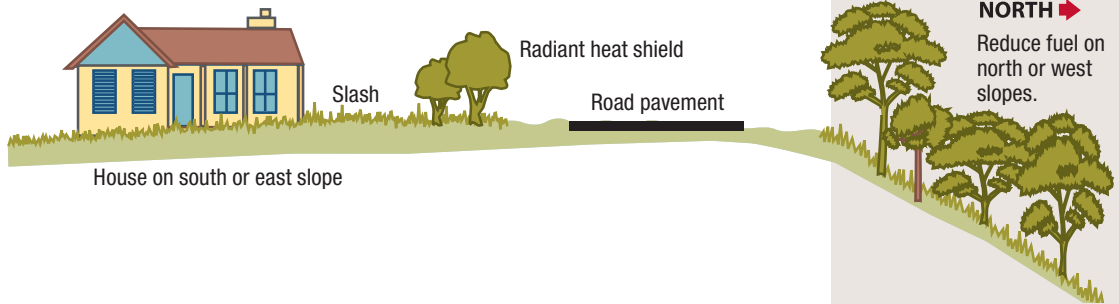
The location of a new development should be in areas where the bushfire hazard does not present an unreasonable level of risk to life and property. That is, the development is not located on land that is subject to extreme bushfire hazard by which appropriate bushfire attack level construction standards are hard to achieve or are excessively costly.

The lower the bushfire hazard, the less modifications are required to keep your home safe.

There may be existing features in the landscape that you can use to reduce the potential impact on your house in a bushfire, or there may be sites that have greater risks.

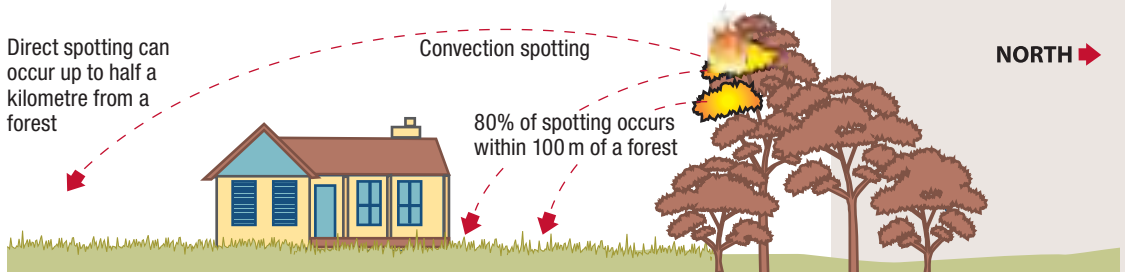
Beware of hilltops

The steeper the slope, the faster a fire will travel up it, so it is risky to build on the top of hills or ridges. The lower down the hill, the safer you are. Flat country is the safest.



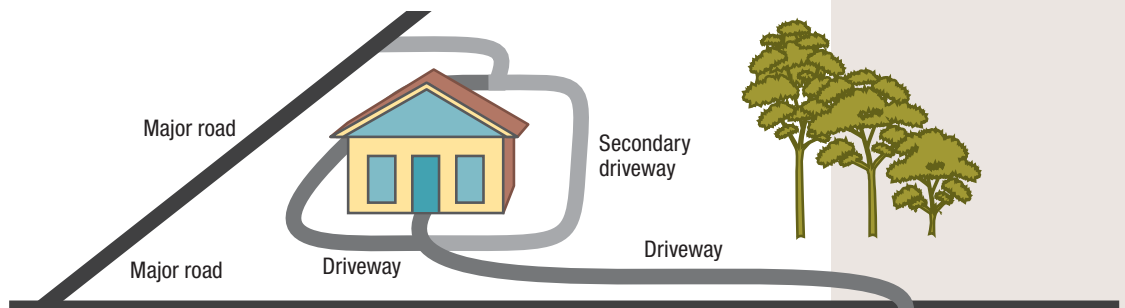
Keep clear of forests and woodlands

Forest and woodland fires can cause 'ember attack' or 'spotting' (spot fires from burning embers—for example, bark and leaves) for an extended distance down wind, possibly up to half a kilometre. The greatest risk of spotting is closest to forests and woodlands which have a high fuel load. Grassland does have short distance spotting characteristics.



2. VEHICULAR ACCESS

Roads can easily be blocked by fire, smoke and falling trees. It is important to ensure that vehicular access into and out of your new house site is safe and easy to navigate in the event of a bushfire. The first way to address this is to make sure there are at least two ways in and out of your property that connect to a public road. Fire trails and access tracks may be established to separate the bushfire hazard from the house site and provide access within and around the edge of the site. Consider installing a fire gate between your property and any neighbouring properties so that you and the fire services have alternative access routes.



3. WATER

Access to adequate water supplies will enable life and property to be defended in the event of a bushfire. Where mains water supply is not available, or for extra water security, a water tank should be installed, preferably with a fuel powered pump attached. As well as being an alternative permanent supply of water, swimming pools and dams located close to the house can act as buffers between the house and bushfire hazard.

More information about water supply can be found on page 33.



As well as being an alternative permanent supply of water, swimming pools and dams located close to the house can act as buffers between the house and bushfire hazard.

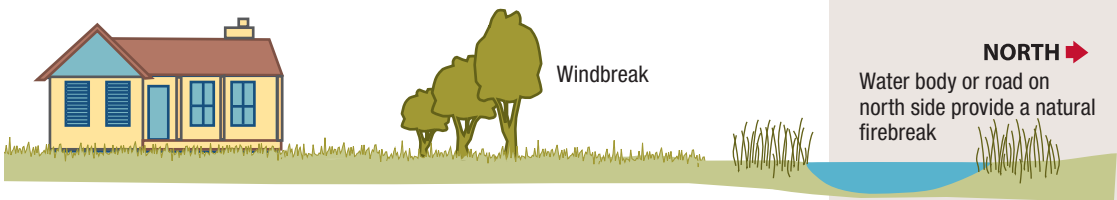
4. SITING OF DEVELOPMENT

The siting of your new house, including paths and landscaping, should be positioned such that it minimises the bushfire risk to life and property. Before you choose a site, weigh up its good and bad points. Is there a windbreak you can use to protect your house? Is there a nearby stream or dam? It may be preferable to build beside a body of permanent water so that the water is placed between the house and the likely direction of a bushfire. Be aware that if the water source dries out in summer it can provide extra fuel for the fire and increase the risk.

In steep, scrubby, fire-prone bushland you'll need extra fire protection. Remember, good siting is the key to protecting your new home from bushfires. Houses on ridges in bushland should be located on the opposite side to the likely direction of bushfires (see below). For this reason also reduce fuel regularly on the side of the ridge which faces the likely direction of bushfires.

The prevailing afternoon breeze in summer presents the **most common threat** as it fans bushfires when fuel is at its driest. Unstable atmospheric conditions that create less common north-west winds in summer can lead to the **most destructive bushfires**.

In a bushfire, most houses that are lost are from ember attack.



House is sited to take advantage of protection from the existing windbreak.

5. DESIGN OF DEVELOPMENT

Once you have chosen your house site, DFES strongly recommends that the house be built to standards described in *Australian Standard 3959—Construction of buildings in bushfire-prone areas*, and in accordance with *Planning for Bushfire Risk Management Guidelines*.²

In a bushfire, most houses are lost from ember attack. Apart from the direct flame and radiant heat of bushfires, buildings can be ignited by embers which catch on windowsills, in gaps and cracks, sheltered recesses and doorways or under loose roofing or verandahs. These embers start small fires that can go unnoticed and burn down a home from the inside out.

Simple shape, single storey

The safest houses have smooth outside walls with no gaps or spaces and a low-pitched roof with no level changes. Single-level houses are generally safer than split level.

Roofing materials

Metal sheeting is the best—it can withstand falling trees better than other roofing materials and it's easier to close off from embers. If you use tiles, they need to be well fitted (in accordance with *AS2050: Installation of roof tiles*), to minimise gaps and with fire-resistant sarking beneath them. Avoid roofing materials that catch fire easily like timber shingles, shakes and asphalt shingles. A low-profile roof reduces wind turbulence, so avoid or minimise level changes and valleys where leaves and debris can gather.

If your house is in dense bushland, it's worth taking extra measures to protect the rafters from burning. Ensure that you only use materials described in *AS3959* for the potential BAL on your home.

Skylights and air conditioners

Plastic skylights may melt and glass skylights may break, letting the fire in. If you must have a skylight, use the materials described in *AS 3959* for your BAL and circumstances.

Evaporative air conditioners should be turned off after the pads have been made wet when a bushfire approaches so smoke and sparks are not drawn into the unit. Air conditioners containing flammable materials should be covered with a suitable ember protection screen to prevent entry of burning embers.

See the *DFES Info Note on Ember Protection Screens*.



Single level houses are generally safer than split level.



A low-profile roof reduces wind turbulence



Under floor spaces

Houses on stilts can enable embers, radiant heat and flames into the spaces beneath the floor. These areas can be fire traps unless the area beneath the house is appropriately enclosed. Air turbulence and flammable material under the house can provide a fire with access to your flooring. The safest option is to build on a concrete slab. If stilts are a necessary part of your house design, keep the floor as close to the ground as possible. Enclose the under floor space and make sure no flammable materials build up under or in the subfloor.

Use fire safe building materials

Houses made of brick, mud brick, fibro and weatherboard are all acceptable (paint on the weatherboard has to be kept in good condition) in some situations. Vinyl weatherboards, rough timber and some other claddings however, may cause problems in a fire by warping or catching sparks. Only use the materials described in *AS 3959* for the BAL assessed for your site and ensure the materials are used appropriately.

If possible, use bricks or other fire-resistant material at ground level around the walls. If you use cladding that may cause problems in a fire—increase the building protection zone by two or three times if possible, paying particular attention close to the house.

Timber—rough is risky

If possible, steer clear of elevated timber decking, stairs or raised timber verandahs. If you do use them, remember that rough sawn timber catches dust, which is highly flammable.

Timber can be used safely if you:

- ✓ Use a dense hardwood timber like jarrah for exposed rafters and external timberwork.
- ✓ Give it a smooth or painted finish.
- ✓ Don't use flammable coatings or sealants like tar or resinous compounds, which may catch fire easily.
- ✓ Comply with the requirements of *AS 3959* for the BAL for your home.

For more information see the *Planning for Bushfire Risk Management Guidelines*² or contact your local government.



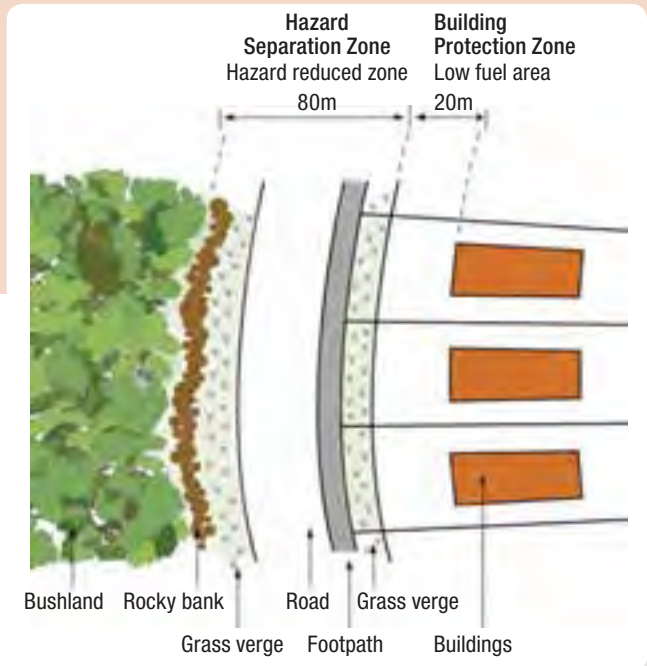
Prepare your property

Along with choosing the right site for your new home and building or retrofitting to the appropriate construction standards for your bushfire attack level (BAL); you need to consider the landscaping design of your garden and property. The best bushfire planning can be undone by poor design and maintenance of the gardening landscape.

Hazard Separation Zone

A Hazard Separation Zone (HSZ) is an area of reduced fuel adjacent to the Building Protection Zone (BPZ) of a house. Hazard Separation Zones assist in decreasing fire intensity and rate of spread and reducing the potential for crown or spot fires to develop close to the building.

The HSZ should be 80 m wide from the BPZ (particularly adjacent to forest or woodland) and kept to between 5 and 8 tonnes per hectare (t/ha) for jarrah/marri dominated forest and woodland, below 12–15 t/ha in mallee heath and below 15 t/ha in karri forest.



General garden design

Highly flammable vegetation located too close to the house may expose a house to higher levels of radiant heat and flame contact during a bushfire. A well designed garden can increase your home's survivability, even if you plan to leave early.

It is necessary to plan the layout of your garden so that it does not contribute to the spread of bushfires.

There are four main ways to design or modify your garden to create a safer zone for your property during the bushfire season:

- Remove fuels.
- Landscape for safety.
- Selection and placement of plants.
- Use your trees.



Remove fuels

The most important part of preparing your garden for the summer fire season is to remove fuels close to the house.



Fuel reduction activities include:

- Cutting all long grass and removing dead material from beneath and within shrubs and trees.
- Remove dead leaves and twigs from the gutters, under eaves and under the house.
- Move wood stacks, timber and rubbish away from the house.
- Do not store liquid fuels near the house (such as mower fuel).
- Mulched garden beds need to be kept damp so that the mulch itself does not become a fuel. It should be located away from vulnerable parts of the building (such as doors, windows and decks). Better alternatives to mulch include gravel, scoria, pebbles, shells or recycled crushed bricks.
- Use non-combustible pots and containers for plants that can be moved away from the house during the fire season.
- Other sources of fuel in a bushfire include objects such as caravans, sheds, barbeques and flammable outdoor furniture, which should be located away from the house.
- Shrubs should be placed 3 times their height at maturity away from the building.
- Shrubs should have the dead material pruned out of their crowns.



Heavy scrub fuels the fire.



Prune branches up to two metres off the ground to stop a ground fire spreading into tree tops.

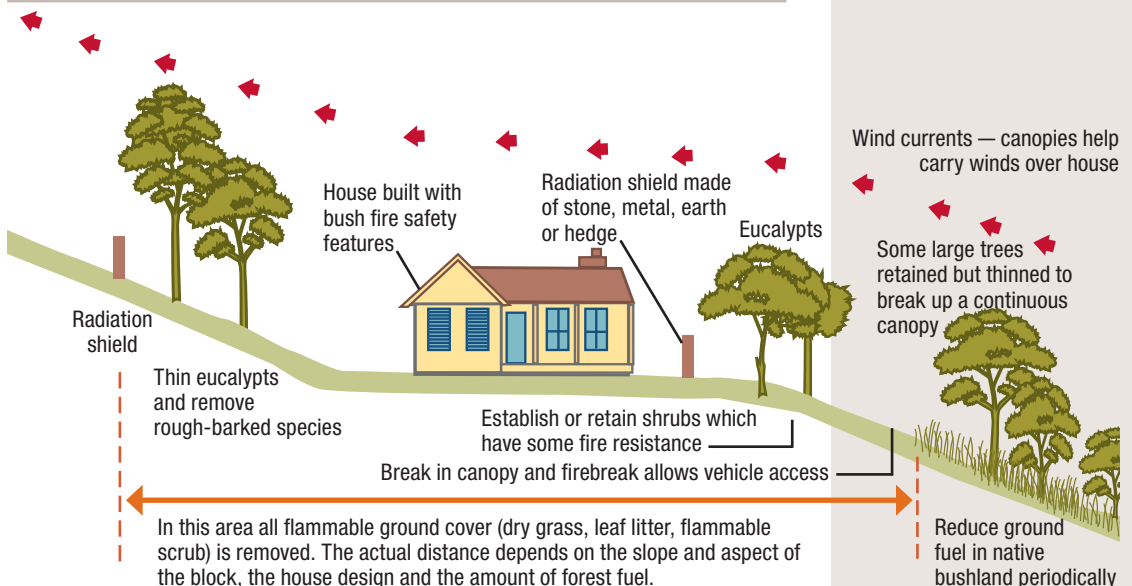
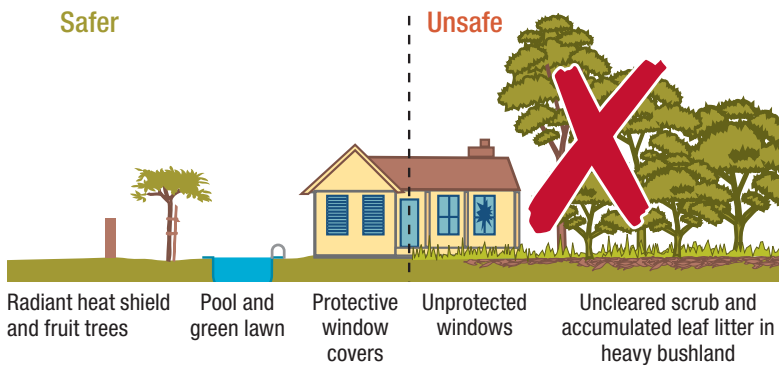
Landscape for safety

Plants and other flammable objects are potential fuels for bushfires and will compromise the protection of your house if placed inappropriately within the building protection zone.

You can build 'heat shields' and other features into the design of your garden to reduce fuel loads around your home.

- Use non-combustible materials such as stone, earth, concrete or galvanised iron for fences and retaining walls that can block radiant heat and embers.
- Use driveways or pathways made from materials such as concrete, gravel, clay or pebbles to provide separation between vegetation and your house.
- Green lawns can work as a low-risk ground cover close to the house, however it must be kept short and green as possible during the fire season.
- Design your garden so vegetable gardens, pools and patios are on the side of the house most at risk to bushfire.

See page 36 for more information about Firebreaks.



Build 'heat shields' and other features into the design of your garden to reduce bushfire fuel loads around your home.

Selection and placement of plants

Although all plants will burn under the right conditions, low flammability plants may actually help to protect your home by:

- Shielding your house from strong winds.
- Catching burning embers before they reach your house.
- Reducing radiant heat levels.
- Reducing the likelihood of direct flame contact.

PLANT SPACING

Fires spread easily when plants are placed close together because the radiant heat dries the surrounding vegetation enough for it to catch alight. A garden with continuous vegetation leading up to and surrounding the house will allow fire to spread from the garden to the house, placing the house at risk of catching alight.

Increasing separation between vegetation may include:

- Placing shrubs and other vegetation away from trees to reduce the likelihood of a 'fuel ladder' carrying fire from the ground into the canopy.
- Separating plantings so they do not form a continuous canopy and ensuring that these are separated by areas of low fuels (such as short, green lawns).
- Using paths, coarse mulch alternatives or short green lawns to separate garden beds and the house.
- Pruning branches, or 'skirting' trees to a minimum of 2 metres from the ground to increase vertical separation.
- Space at a distance three times the plant's height at maturity.

A garden with continuous vegetation leading up to and surrounding the house will allow fire to spread from the garden to the house.



PLANT SPECIES

Some plants will burn easily and quickly while others may provide better protection for your home. Plants that provide the best protection in a fire contain plenty of water or salt in their leaves. Avoid plants containing volatile oils and those that have too many dead leaves and twigs.

DFES strongly encourages homeowners to contact their local nursery for advice, and recommends plants that have the following characteristics:

- grow in a predicted structure, shape and height for your particular area;
- are open and loose branching with leaves that are thinly spread;
- have a coarse texture and low surface-area-to-volume ratio;
- are sparsely arranged;
- will not drop large amounts of leaves or limbs;
- have wide, flat and thick or succulent leaves;
- trees that have bark attached tightly to their trunk or have smooth bark;
- have low amounts of oils, waxes and resins (which will often have a strong scent when crushed);
- do not produce or hold large amounts of fine dead material in their crowns; and
- will not become a weed in the area.

CHOOSE APPROPRIATE PLANTS

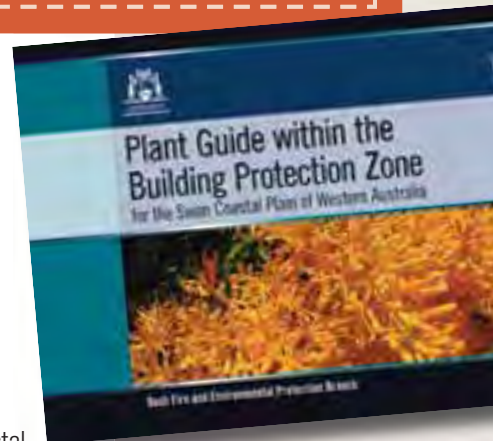
The DFES *Plant Guide within the Building Protection Zone for the Swan Coastal Plain of Western Australia* is a booklet designed as a planting guide for community members, gardeners, landscape designers and landscape managers throughout the Swan Coastal Plain, to protect houses from potential bushfires.

With this guide you will be able to choose and position plants at the appropriate distances from buildings to reduce the risk of bushfire damage. While specifically designed as a guide relevant to the Swan Coastal Plain, it may provide indicative species and separation planting options for the forest/urban interface zone to the east of the Swan Coastal Plain.

Plants in the garden may grow more vigorously than plants in their natural state due to increased moisture and nutrients.

FRUIT AND VEGETABLES ARE FINE

A vegetable patch makes a good green firebreak, so locate it, if you can, on the side of the house most at risk from bushfires (consider fuel levels as well as threats caused by wind direction). Fruit trees give excellent fire protection—plant them around the house but keep the crowns at a minimum 2 metre distance from the building. If you're starting an orchard, locate it on the side of the house that receives the prevailing afternoon summer wind so it can act as a windbreak.



Fruit trees make a good firebreak.



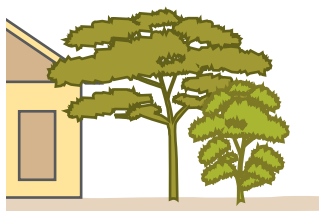
Use your trees

Trees can be useful in a bushfire provided they are; carefully selected, properly maintained, and located at a safe distance from the house. Using appropriately placed trees as a wind break can reduce wind speed, absorb radiant heat, and filter burning embers. The trees should carry the hot fire laden winds up and over your house, but not catch fire. If they catch alight, you do not want them to spread fire to other trees or the house.

TREE PLANTING AND MAINTENANCE GUIDELINES

- Maintain a minimum 2 metre gap between your house, other buildings, water supplies and trees.
- Do not allow branches to overhang the roof.
- Separate tree canopies by at least 10 metres.
- Avoid trees with loose, stringy or ribbon bark.
- Prune lower branches or 'skirt' trees to minimum of 2 metres above the ground to increase vertical fuel separation.
- Plant new trees at a safe distance from powerlines—the distance in metres should be 1.5 times the tree's mature height.
- Do not plant shrubs underneath trees.
- Periodically clean up in and under trees by removing dead leaves and litter—rake up leaves, remove hanging bark and dead branches.
- If your house is close to forest, make sure there's a good fuel reduced zone (up to 100 metres depending on the construction standard of your home) between the forest and your own trees.

Unsafe



Safer



For more information on using trees as windbreaks, see page 27.

Using appropriately placed trees as a windbreak can reduce wind speed, absorb radiant heat and filter burning embers.

Windbreaks

TREES AS WINDBREAKS

Windbreaks can be beautiful to look at and also useful for protecting houses, livestock and crops. Trees that are planted for windbreaks are most effective in a fire of low to moderate intensity and may:

- reduce wind speed;
- trap burning embers and flying debris; and
- absorb radiant heat.

Here's how they do it, and what you need to know to get the most from your windbreaks...

WIND SPEED

When the wind hits a row of trees, it is slowed down and the trees are able to trap anything the wind is carrying. The amount of protection a windbreak can offer depends on the density of the trees.

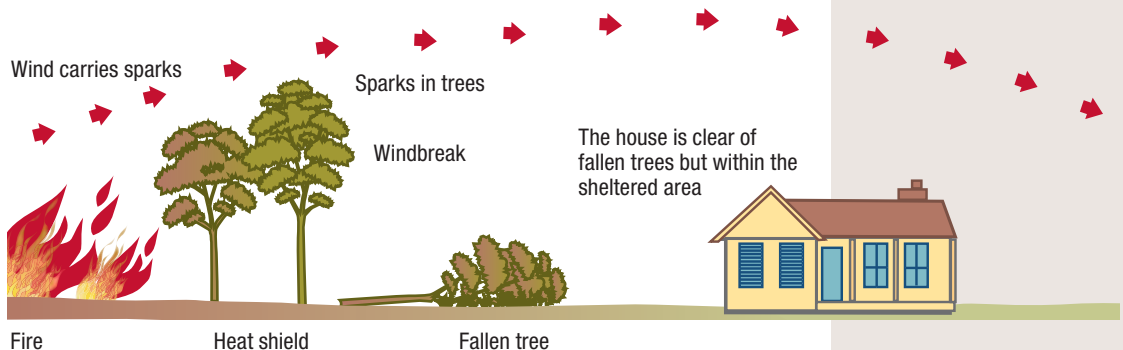
A dense windbreak will slow the wind speed initially but will leave a smaller area behind the break, causing turbulence and the movement of embers over the trees rather than trapping them. Greater wind speeds will move over a sparser wind break; however, it will divert the wind over a longer distance behind the break. If you're planting a windbreak around your home, 30–60% of the wind should be allowed to penetrate to achieve maximum effect of reducing speed whilst catching burning embers. You will need to manage the leaf litter from these trees, so they do not become a fire fuel.

BURNING EMBERS

In a bushfire, the greatest risk to your home could be burning embers carried by the strong winds. Trees can catch many of these sparks and burning twigs before they reach the house, so long as the plantings are not too dense.

In general, plants with green leaves contain a greater quantity of water, and therefore are usually safe from catching fire from flying embers, unless there is too much dead material (twigs, leaves and loose bark) on the tree.

Trees that are planted for windbreaks are most effective in a fire of low to moderate intensity.



RADIANT HEAT

A row of trees provides dense foliage that acts as a shield from radiant heat. Under trees where roots have suppressed the grass, there is usually a bare area that acts as a natural firebreak, helping to slow down the flames. Therefore it is important to keep trees free of loose bark and other dead material. The area beneath the trees also must be kept free of fine, dead and aerated vegetation. The trees must be sufficiently far away from the house so they will not affect the building with radiant heat.



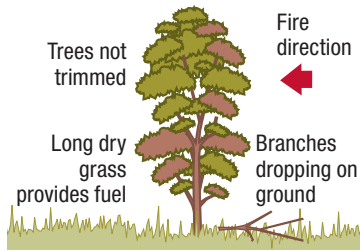
Remove dead leaves, loose bark and other litter.

GETTING THE MOST FROM TREES AS WINDBREAKS

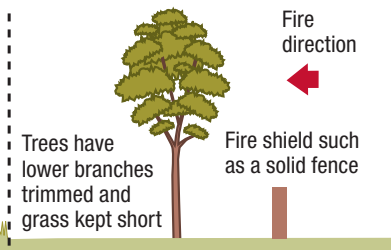
- ✓ Ensure adequate separation between a building and the windbreak—do not place a wind break in the Building Protection Zone.
- ✓ Tree species should be carefully selected (highly flammable trees will become a fire hazard).
- ✓ Trees should be pruned or skirted to at least 2 metres from the ground.
- ✓ Wind breaks should be planted at right angles (90°) to the prevailing winds.
- ✓ Solid windbreaks can cause turbulence—a windbreak that allows approximately 30–60% of the wind to pass through is recommended.
- ✓ The minimum length for a windbreak should be 100 metres, but ideally a 200 metre windbreak would give you a larger protected area from the winds.
- ✓ Make sure there are no gaps in the windbreak that are a sufficient size to allow wind to funnel through.
- ✓ Routine maintenance must be carried out to remove loose bark, leaf litter and other dead plant material from underneath the windbreak.
- ✓ A solid non-flammable fence along the windward side of the windbreak blocks low winds.



This windbreak is likely to burn



This windbreak is less likely to burn



FENCES AS WINDBREAKS OR CLOSE TO THE HOME

A solid non-flammable fence along the windward side of the wind break blocks low winds and helps to protect the trees from burning.⁷ CSIRO research into the performance of residential boundary fencing provided the following outputs:

- From a performance ranking, the Colorbond® steel fencing had an insignificant heat release, followed by new hardwood, old hardwood, old pine and new pine.
- Colorbond® steel fencing was the best performer due to non-combustible material; it maintained structural integrity as a heat barrier; and did not spread flames laterally or contribute to fire intensity.
- Closed-paling hardwood fencing maintained a radiant heat barrier during radiation-only exposures. Where flame contact of the fence occurred, flame emission from the fencing provided additional radiant heat on the structure.
- Open-paling hardwood fencing were effective in reducing radiation exposure, however they provided little barrier during direct flame contact.
- Treated pine has the lowest performance. The integrity of the fence was compromised under leaf litter attack with a potential increase in risk to the adjacent structure.⁷

Tree and powerline safety

Trees and powerlines are a dangerous combination. Fires can start in a number of ways from trees and powerlines coming together:

- Branches shorting out between wires.
- Branches causing the lines to clash together.
- Power leaking down a tree.
- Small branches bridging across insulators in high winds.
- Lines brought down by falling trees.



LEGAL RESPONSIBILITIES

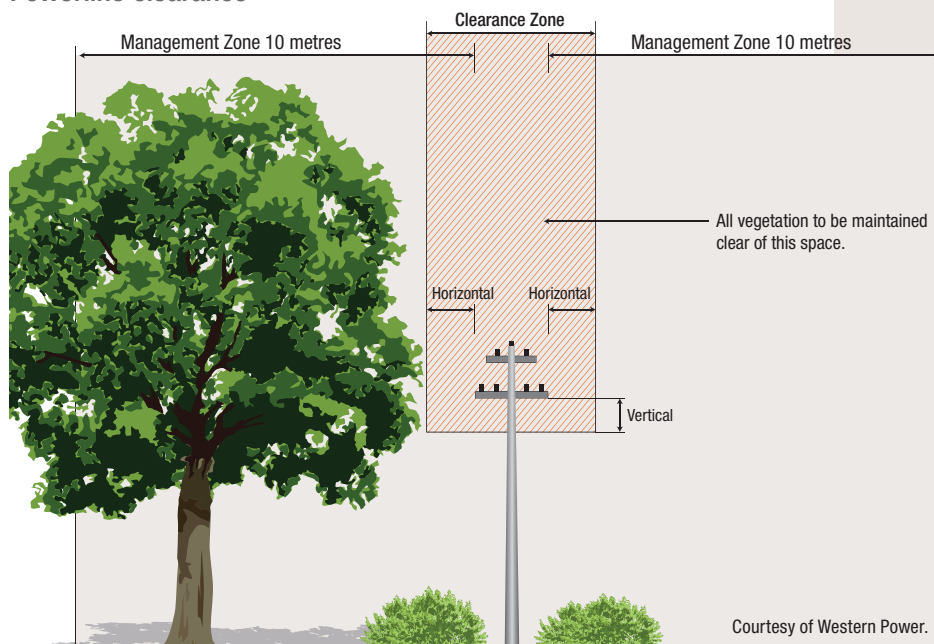
The owner/occupiers of land are responsible for keeping tree branches of any trees of their property at a safe distance from powerlines. If you are renting your home, you should contact your landlord to see if tree maintenance is covered in your rental agreement or if it is their responsibility. Local government and Western Power are responsible for the control of vegetation beyond the boundaries of private property, including street verges.

SAFE DISTANCES IN RESIDENTIAL AREAS

The minimum recommended safe distance between trees and powerlines is 5 metres, although this distance may vary according to your area and distance between power poles. The minimum distance has been chosen to prevent tree branches coming into contact with powerlines under strong winds.

Please refer to www.westernpower.com.au for specific clearances for your area.

Powerline clearance



In rural areas, distribution lines with a single pole support require greater distances between vegetation and powerlines. The clearance is recommended to be 10 metres to the side of the single pole line. This distance from single pole distribution lines for plantations of Blue Gums and Pine trees increases (see diagram).

The diagram illustrates a 40m wide road layout with the following components and dimensions:

- Top Section:** A 40m wide area labeled "Pine" at the top center, divided into two 20m sections.
- Blue Gum Zone:** Below the top section, a 30m wide area labeled "Blue Gum" at the top center, divided into two 15m sections.
- Clearance Zone:** A central 20m wide area labeled "Clearance Zone" at the top center, divided into two 10m sections.
- Planting Line (Pine):** A line on the left side of the diagram, labeled "Allows for 10m crown spread from planting line (pine)".
- Planting Line (Blue Gum):** A line on the right side of the diagram, labeled "Allows for 5m crown spread from planting line (Blue Gum)".
- Scrub Height:** A label on the right side of the diagram indicating "Scrub height maximum 1.5m".
- Tree Types:** The diagram shows "Pine trees" on the left and "Blue Gum" trees on the right.

Courtesy of Western Power

66/132 kV lines (double pole support)



TREE PLANTING NEAR POWERLINES

If you consider the species you choose to plant on your property carefully, and locate them well away from powerlines, you will reduce the need for pruning to keep them clear of powerlines. If you can't avoid growing trees near powerlines, they should be species that grow to a maximum of 3 metres tall.

Visit www.westernpower.com.au for more information on appropriate species to plant near powerlines.

VEGETATION INSPECTIONS

Western Power regularly inspects vegetation close to powerlines across its entire network. If they consider that trees on your property are growing too close to their powerlines, Western Power will issue you with a notice to have these trees pruned. It is highly recommended that you use a professional tree arborist to prune branches that are on large trees or within the clearance zone of a powerline.



IF YOU SEE A FALLEN POWERLINE

Contact Western Power immediately on 13 13 51 and notify nearby residents and passers-by of the danger.

It is highly recommended that you use a professional tree arborist to prune branches that are on large trees or within the clearance zone of a powerline.



Water supply—vital for home protection

If you've made the right preparations, the garden hose can save your house in a bushfire. But you may need an emergency water supply because in most bushfires the mains water supply (if you have it) can fail and electric power supplies can be cut off. If you are planning to actively defend your home, you will need to have an adequate independent water supply.

Additionally it is strongly encouraged that farmers and landholders have water supplies available and accessible to emergency services.



INDEPENDENT WATER SUPPLY

If your house is on reticulated mains water, you can run it through a storage tank, so that the tank is always full. If you use tanks for your domestic supply, make sure that a water supply for personal and home protection is always kept in reserve. A swimming pool or dam is fine if a diesel or petrol pump is available to use.

WATER STORAGE TANKS

Water storage tanks should be made of concrete or steel and supply pipes should be flame and heat resistant. Exposed PVC pipes and fittings will melt in the heat of a bushfire to the water line. According to research conducted by the Bushfire Cooperative Research Centre, steel construction tanks perform best when exposed to bushfire conditions.⁸

Where possible, fittings, couplings and adaptors for the tank should match specifications for fitting onto fire trucks.

More information can be found on the DFES website or by contacting your local government, Bushfire Brigade or Fire and Rescue for more information.



WATER PUMPS

If you lose mains power, you will need a generator or a petrol/diesel pump to power your water supply for actively defending your home. A generator will need to have more than a 1.5 kVA capacity to effectively power an electric pump, or you can use a small petrol or diesel pump to utilise your water supply and hoses effectively. Both pumps and generators will need to be shielded from the high radiant temperatures caused by bushfire. This can be done by enclosing them in a shed or inside another appropriate cover.

Remember to keep your pump and generator maintained throughout the year, particularly before and during bushfire season. Ensure everyone who is likely to stay and defend your property knows how to start and operate the pump and generator.

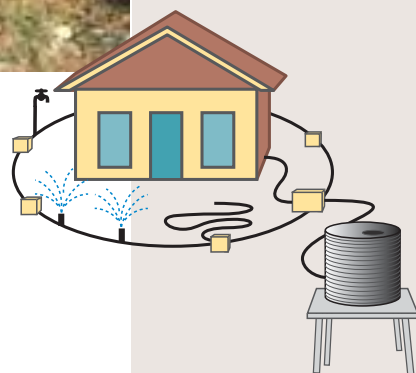
Remember to keep your pump and generator maintained throughout the year.



GARDEN SPRINKLERS AND HOSES

Hoses from pumps should be long enough to reach all corners of the home and should be fitted with a nozzle able to deliver 30 to 100 litres per minute. Fire hoses should be durable, flexible and able to withstand high temperatures and UV exposure. Make sure you have enough hoses to cover the entire house. If they are plastic, you'll need to take them inside while the fire front passes, to prevent them melting.

Run the reticulation system in a loop right around the house. Place gate valves and hose couplings at each corner, so you can deliver the full force of water wherever you need it. If you have a garden sprinkler system, direct the sprays on those parts of the house most at risk—the windows, eaves, LP gas cylinder and verandah. Remember that plastic water pipes are likely to melt—use metal pipes or bury plastic pipes at least 30 cm underground.



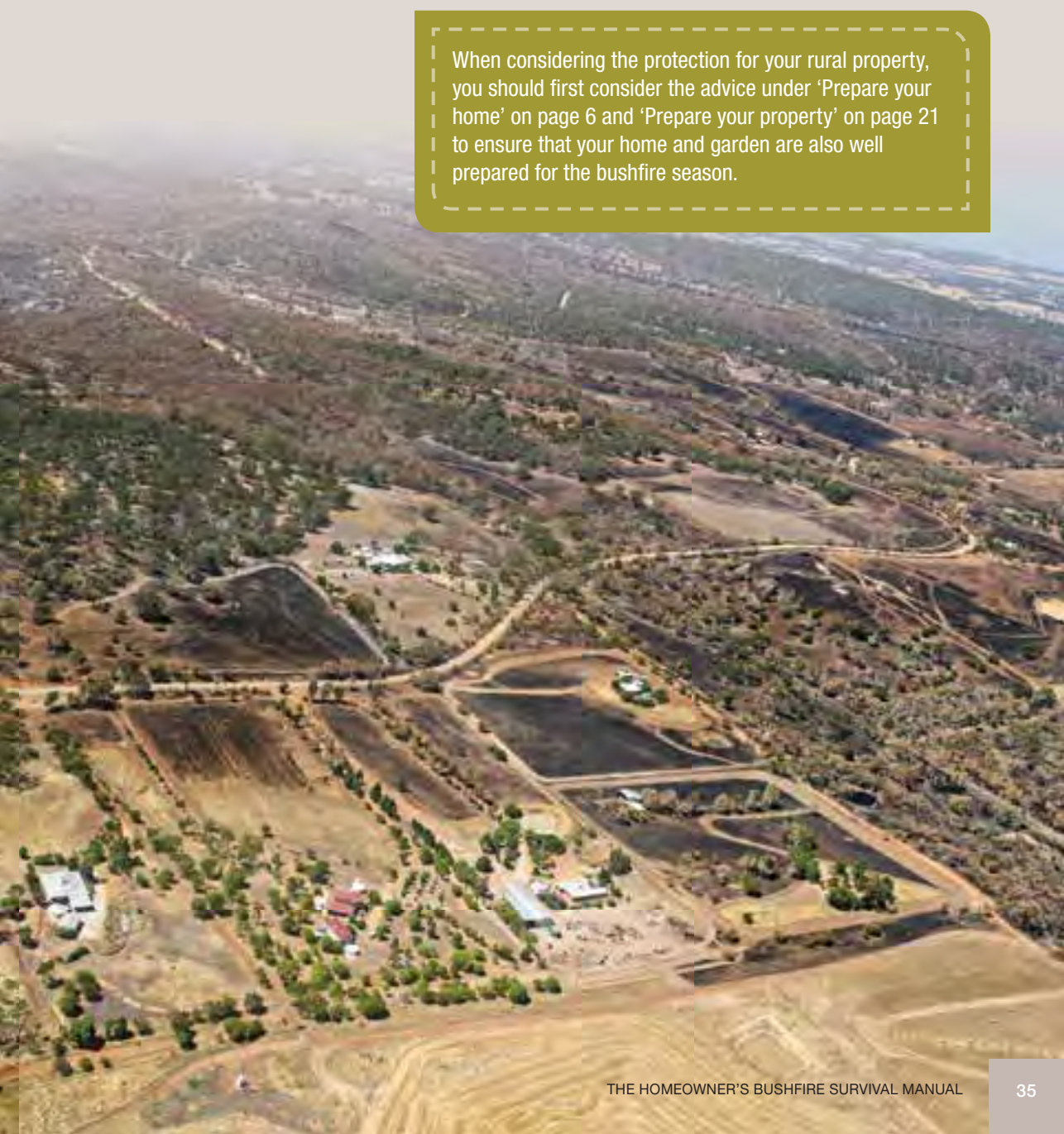
Use metal pipes or bury plastic pipes at least 30 cm underground.

Prepare your rural property

The layout of your rural property can be used to protect the homestead and other nearby buildings. The following advice for rural landholders focuses on specific bushfire considerations for rural properties such as maintaining machinery and equipment, and protecting livestock and crops.

It also provides advice on taking measures to protect your rural property from the threat of bushfire attack and ensuring additional care is taken to prevent a bush or grassfire from starting on your land.

When considering the protection for your rural property, you should first consider the advice under 'Prepare your home' on page 6 and 'Prepare your property' on page 21 to ensure that your home and garden are also well prepared for the bushfire season.



Reducing fuel loads around your assets

Ensure you have an adequate Building Protection Zone around your home (page 6) and equally consider the fuel loads around your farming assets such as sheds, fences, stables or pens. Increase the protection of these assets by removing vegetation in the immediate surrounds, raking up leaf litter and twigs and keeping grass cut or grazed short.

Options for reducing fuel loads may also include strategic grazing, slashing or herbicide use.

STRATEGIC GRAZING

Grazing may be the cheapest or easiest way of reducing dry paddock grass, which may become a fire hazard. Consider heavily grazing house paddocks in spring and summer.

MOWING OR SLASHING

Slashed grass must be removed to prevent it becoming a fire hazard. Slash any long grass near the house, along fence lines and access tracks or driveways.

HERBICIDES

Chemical firebreaks may be an option in areas that may be prone to soil erosion. Applying herbicide after the plants have grown to a short height and when the roots have developed can assist in producing a firebreak and hold the soil together. Choose a chemical that is non-residual and will not cause environmental harm.

Prescribed burning can also be useful in reducing fuels on your property, see page 39 for more information.

Create a low fuel zone by mowing or slashing



Firebreaks

Firebreaks usually have more than one purpose which may include:

- A mineral earth or reduced fuel break that helps prevent landscape fire entering your property.
- A mineral earth or reduced fuel break that helps prevent a fire starting on and leaving your property.
- Defined boundaries for prescribed burning.
- Access to critical areas so that fire suppression activities can be undertaken.

Firebreaks will not stop a major fire from spreading, but they can prevent small fires from escaping your property and landscape fires from entering. Most importantly, firebreaks provide safer access for yourself and firefighters to conduct fire suppression activities across your land.

Remember to allow for or manage the growth of trees, shrubs and grass when planning firebreaks.

Green summer crops can also provide a natural firebreak between the house and the most likely direction of bushfire.

Contact your local government for your specific firebreak requirements.

Property access

A number of measures need to be in place so that emergency services can locate and access your house and property in the event of a bushfire.

Make sure your property is identifiable at the entrance by having clear signs at the front gate.

The width of access tracks (which may also be firebreaks) and gateways should consider the dimensions of fire trucks and tankers.

Also make sure you have more than one access road into and out of your property in case one of them becomes obstructed.

Consider the dimensions of fire trucks and tankers when making access tracks, gateways and firebreaks.

Farm fire safety

HARVESTERS

The most common cause of harvester fire is crop material collecting on hot engine components such as the manifold, exhaust or turbocharger. Many of these fires can be prevented by conducting regular maintenance and cleaning checks and having fire suppression equipment readily available on the machines. You should also have a two-way radio and/or mobile phones (where there is a service) on all harvesting machinery and back at the homestead, along with emergency contact numbers.

Under the *WA Bush Fires Act Regulations 1954* harvesting machinery cannot be operated during prohibited or restricted burning times unless an approved fire extinguisher is carried on the machine. Check with your local government for specific fire suppression equipment requirements during harvesting.

On Total Fire Ban days, you can continue your farming activities provided that your local government has not imposed a Harvest and Vehicle Movement Ban. It is up to you to be aware of any bans that are in place in your local government area when you are harvesting or operating a vehicle.

For more information on fire-safe harvesting, see the *Stay Ahead of Crop Fires* brochure and the 'Safe Harvesting' checklist on the DFES website.

It is up to you to be aware of any bans that are in place in your local government area when you are harvesting or operating a vehicle.



ELECTRIC FENCING

If dry fuels are close to electric fences, a spark jumping from one wire to another can start a fire. Check that electric fences are clear of grass and other vegetation, and operate them according to the manufacturer's advice. Remember it's good fire safety practice to switch off electric fences during times of extreme fire danger.

Also refer to 'Tree and powerline safety' on page 30.

FUEL SUPPLIES

Keep fuel (e.g. petrol and diesel) away from haystacks and buildings. For large amounts of flammable fuels, use elevated storages or underground tanks supported by a bund to prevent spills leaking into the environment. Drums of fuel should be stored in a fully enclosed shed well away from the house.

Livestock

Where will you put your stock in a bushfire? Cattle, sheep and other agricultural stock need protection and refuge from bushfires.

Before the fire season, plan a refuge for your stock:

- ✔ Maintain a heavily grazed refuge area where stock can be moved to during a bushfire—this could be the centre of a ploughed paddock, a grazed or green paddock or laneway.
- ✔ Consider a central laneway that will assist in stock relocation.
- ✔ If appropriate, leave internal gates open so that stock may move about freely to safety from the effects of the fire.
- ✔ Ensure they have access to drinking water and if possible a dam or creek where they can seek relief from radiant heat.
- ✔ Identify a stock relocation area (if different from the refuge area) where they can be fed after the fire has passed.

It is good fire safety practice to switch off electric fences during times of extreme fire danger.

Maintain a heavily grazed refuge area where stock can be moved to during a bushfire—this could be the centre of a ploughed paddock, a grazed or green paddock or laneway.

Prescribed burning

Because Western Australia is so fire-prone, each summer there are restrictions or prohibitions on the lighting of fires in the open air. Prohibited burning times for a given area of the State are declared by the Minister and commonly operate within the bushfire season in the South of the State but vary in the North West, corresponding with the dry season during the Northern Winter. Restricted burning times for a given area of the State may be declared by the FES Commissioner whereby an appropriate permit will be required for burning to occur.

Check with your local government to ascertain the fire prohibition and restriction periods that apply to your district.

Restricted or prohibited periods



DURING THESE PERIODS WHERE RESTRICTIONS ARE IN FORCE, YOU MUST NOT:

- ⊘ Dispose of any burning tobacco, cigarette, cigar or match in circumstances that are likely to set fire to bush. Do not throw it from a vehicle under any circumstances.
- ⊘ Operate a tractor or self-propelled harvester unless its exhaust system is well maintained, fitted with a spark arrester and discharges exhaust emissions vertically upwards.
- ⊘ Light a campfire or cooking fire within three metres of a log or stump or unless there is a cleared area of at least three metres around the fire. Such fires are automatically prohibited on days when the fire danger forecast for the particular area is 'very high' or 'extreme'. Some local governments prohibit camp or cooking fires for part of the year.
- ⊘ Leave the fire unattended. Always extinguish the fire with water or earth before leaving.
- ⊘ Light a fire to burn bush, grass, stubble or undergrowth without a written permit.
- ⊘ Use welding apparatus of any kind, or power operated cutting discs of any kind unless there is at least one fire extinguisher situated at the site and all instructions issued by a local government fire control officer are complied with.



Your local governments may restrict or prohibit the above activity further.

Total Fire Bans

On days when the Minister has declared a total fire ban for a defined area of the State, a person shall not light, maintain or use a fire in the open or carry out an activity that causes or is likely to cause a fire. This ban includes fires for which a permit has already been issued, campfires, cooking fires (including pizza ovens), barbecue fires, incinerators and rubbish fires.

Controlled burning on your property

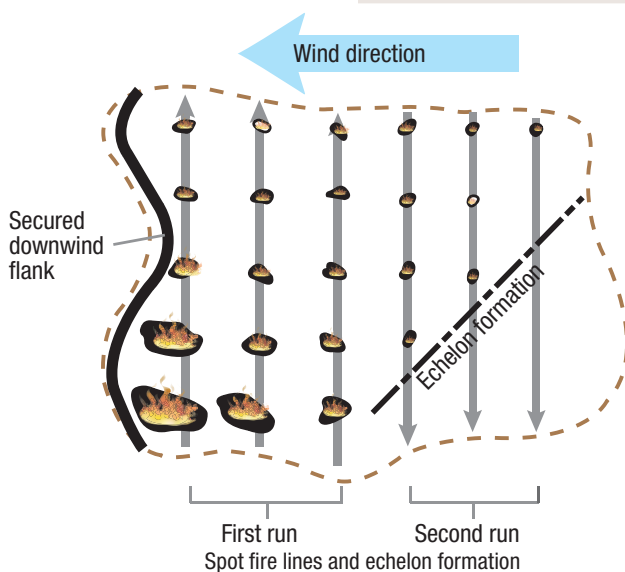
You will need a permit during the 'Restricted Burning Period,' so check who your local government representative is for your area. It's important to comply with the conditions of the permit.

Whether or not you have a permit, it's illegal to burn off on days of Very High, Severe, Extreme or Catastrophic fire danger.

Where you have the authority and expertise to burn on your own property, strip burning with spot ignition is best—but take great care by keeping the burn area small and always under control.

- Comply with permit conditions and seek advice from your local government.
- Plough or have a firebreak around the area to be burnt, have sufficient and appropriate firefighting equipment at hand (knapsack spray and hand tools and/or a firefighting unit), and burn back into the wind.
- Have a clear written plan of where you intend to burn and the results you are aiming to achieve. This will help you to determine the equipment you will need, the time of day to undertake the lighting and the ignition method (strip and spot distances) to carry out the burn safely.
- Advise your neighbours of any possible smoke hazards. Ensure that smoke from the burn does not produce a smoke nuisance for your neighbours and others.
- You'll need enough people with you to keep the fire under constant control.
- Mop-up standards must be adhered to—that is, ensuring that the fire is not left unattended until it is completely out.
- Consult with your local fire brigade—they may be able to help.

Whether or not you have a permit, it's illegal to burn off on days of Very High, Severe, Extreme or Catastrophic fire danger.



Example of best practice burning plan to follow for your property.

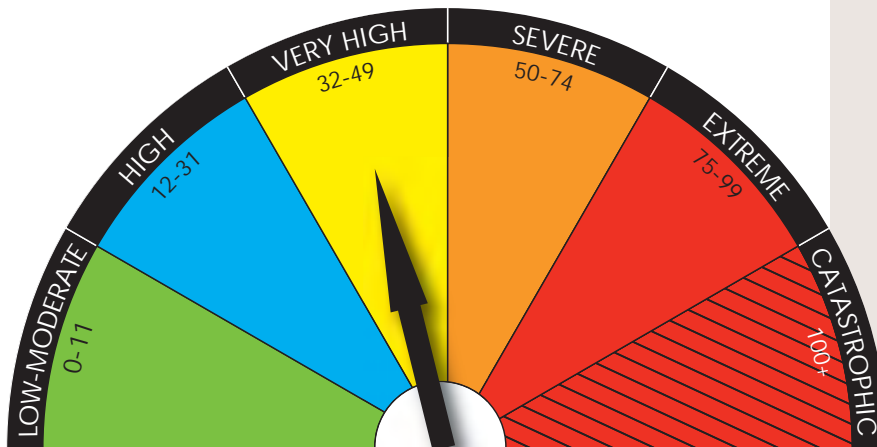
BURNING GARDEN REFUSE OR RUBBISH

Below are some general garden refuse burning guidelines.

Your local government area may further restrict or entirely prohibit the burning of garden refuse so you must check with your local council before proceeding.

You may not burn garden refuse during the limited burning times unless it is burned in an approved incinerator or on the ground according to the restrictions below.

- The incinerator must be designed and constructed so as to prevent the escape of sparks and burning material and is not situated closer than 2 metres from a fence or building unless your local government has given you written permission. There must be no other flammable material within 2 metres.
- If burning garden refuse on the ground, there must be no other flammable material within 5 metres of the fire. The fire must be lit between 6.00 pm and 11.00 pm and be completely extinguished before midnight on the same day.
- Whether you are burning in an incinerator or on the ground, at least one person must be present until the fire is completely extinguished.
- No fires may be lit on days when the fire danger forecast for the area is Very High, Severe, Extreme or Catastrophic or a Total Fire Ban has been declared.



No fires may be lit on days when the fire danger forecast for the area is Very High, Severe, Extreme or Catastrophic or a Total Fire Ban has been declared.

Leave early or stay and defend?



One of the key decisions you need to make when developing your Bushfire Survival Plan is the decision to stay and actively defend a well prepared home or leave early for a safer place.

Homeowners need appropriate information about their property, preparation and surrounding vegetation to prepare a Bushfire Survival Plan and make an informed decision about whether they will leave early or stay and defend.

Key factors to be taken into account include:

- How well the home is constructed, maintained, prepared and equipped to withstand a bushfire;
- Contingency plans in case the fire is more intense than expected or things don't go to plan; and
- The physical, mental and emotional fitness required by people to cope with the impact of a bushfire.

A home and surrounds that looks well prepared under normal conditions may suddenly look ill-prepared when a bushfire is approaching on a hot, windy summer's day. This must be considered when determining whether to stay and defend your property or whether to leave early.



In any case, it is important that you **know the triggers** that cause you to act even before a fire starts.

Finding out tomorrow's Fire Danger Rating (FDR) is the best trigger. It should be the first step in activating your Bushfire Survival Plan and choosing to leave early or stay and actively defend.



Know your triggers

It is important that you use triggers that cause you to act even before a fire starts.

It is likely that your actions will change depending on the Fire Danger Rating (FDR) so you should consider what FDR will trigger a change in action.

Your trigger may be different to your neighbour as it needs to work for you and your family's situation.

FIRE DANGER RATING

Fire Danger Ratings are used to advise people about the Bureau of Meteorology forecast weather conditions, providing advice on the level of bushfire threat for a particular area or day. Understanding the FDR categories and what they mean to you will help you to make decisions about what to do if a bushfire starts. When the rating is high, the threat of a bushfire increases.

When the FDR is Extreme or Catastrophic for your area it means any fires that start are likely to be so fierce that even a well prepared, well constructed and actively defended home may not survive a fire.

TOTAL FIRE BAN

The declaration of a **Total Fire Ban** (TFB) is another prevention measure that occurs when extreme fire weather conditions are expected or when widespread fires are seriously stretching firefighting resources. A TFB is declared by the Minister following consultation with DFES and local governments.

When a TFB is declared it prohibits the lighting of any fires in the open air and any other activities that may start a fire. The ban includes all open air fires for the purpose of cooking or camping. It also includes incinerators, welding, grinding, soldering or gas cutting and in some local government areas will restrict harvesting and vehicle movements.

When a Total Fire Ban is declared it prohibits the lighting of any fires in the open air and any other activities that may start a fire.

Bushfire Warning Systems

Once a fire has started, the Department of Fire and Emergency Services (DFES) may issue a range of warnings to inform the community during significant incidents threatening lives and property.

Warning information can be provided in the form of **community alerts**. Community alerts may use:

- **Bushfire Warning Levels** which are community alerts that reflect the increasing risk to life and property and the decreasing amount of time that you have to act before the fire arrives.
 - **Advice:** means that a fire has started but there is no immediate danger, this is general information to keep you informed and up to date with developments.
 - **Watch and Act:** means that a fire is approaching and conditions are changing, you need to leave or prepare to actively defend to protect you and your family.
 - **Emergency Warning:** means that you are in danger and you need to take immediate action to survive as you will be impacted by fire. An emergency warning may be supported with the SEWS siren.
 - **All Clear:** means that the danger has passed and the fire is under control, but you need to remain vigilant in case the situation changes. It may still not be safe to return home.
- **Standard Emergency Warning Signal (SEWS)** during emerging situations of extreme danger. It is an alert siren signal that can be played on public media such as radio, television, public address systems and mobile sirens which is followed by an urgent safety message.
- **Emergency Alert** when lives may be in danger in your neighbourhood, an alert may be sent as a voice message on your landline, based on your address, or via a text message to your mobile phone, based on the service address.

ALERT LEVEL
ADVICE Be aware and keep up to date Issued at 11am and 4pm unless the situation changes
WATCH AND ACT Put your preparations into action – do not wait and see Issued every two hours unless the situation changes
EMERGENCY WARNING Take immediate action to survive – you will be impacted by fire Issued every hour unless the situation changes
ALL CLEAR Take care to avoid any dangers and keep up to date Issued when the threat has passed

BUSHFIRE WARNINGS: WHAT SHOULD YOU DO?		
ALERT LEVEL	WHEN WILL IT BE ISSUED?	WHAT SHOULD YOU DO?
ADVICE Be aware and keep up to date Issued at 11am and 4pm unless the situation changes	<ul style="list-style-type: none">• When a fire has started but there is no immediate danger• There is no threat to lives and homes• The fire is likely to be small and may be causing smoke near homes• Firefighters will be able to control the fire	You need to be aware <ul style="list-style-type: none">• Stay alert and monitor your surroundings by watching for signs of a bushfire, especially smoke and flames• Check the Fire Danger Rating for your area• Close all doors and windows
WATCH AND ACT Put your preparations into action – do not wait and see Issued every two hours unless the situation changes	<ul style="list-style-type: none">• When a fire is approaching and conditions are changing• There is a possible threat to lives and homes• The fire will be out of control. There may be smoke and embers around your home and roads• Firefighters will be working with machines to put in containment lines to stop the fire spreading	You need to leave or get ready to defend <ul style="list-style-type: none">• Put your bushfire survival plan into action• If you have decided to leave for a safer place, leave now and take your survival kit with you• Leave well before roads are closed and full of smoke
EMERGENCY WARNING Take immediate action to survive – you will be impacted by fire Issued every hour unless the situation changes	<ul style="list-style-type: none">• When there is immediate danger and the fire will impact your home• There is a threat to lives and homes• The fire will be out of control and moving very fast. This is the highest level of warning• Firefighters will find it difficult to control the fire and it will take significant firefighting resources and a change in conditions to bring it under control• A siren sound called the Standard Emergency Warning Signal (SEWS) may be used to get your attention on radio and television	You need to act immediately to survive <ul style="list-style-type: none">• If you have not left yet and the way is clear leave immediately for your safer place and take your survival kit with you• If you have not prepared your home, it is too late to do it now. Your safest option is to leave for a safer place, if the way is clear• Do not relocate at the last minute in a vehicle or on foot as this is deadly, leave immediately if the way is clear
ALL CLEAR Take care to avoid any dangers and keep up to date Issued when the threat has passed	<ul style="list-style-type: none">• When the danger has passed and the fire is under control• Firefighters will be working to put the last bits of the fire out and make the area safe• It may still not be safe to return home. Emergency services will advise when you can go home	You need to be careful <ul style="list-style-type: none">• Remain vigilant in case the situation changes• When driving in the fire area you should take extreme caution and drive slowly• Dangers like smoke, fallen trees and downed power lines may be on roads and emergency services will still be working in the area

Leaving for a safer place

Many people plan to leave for a safer place but leave it too late. You need to identify and agree on a trigger with your family that will prompt you to leave early, and have a backup plan in case you cannot leave in time.

YOU MAY PREFER TO LEAVE FOR A SAFER PLACE IF:

- ✓ you are not confident about the fire safety of your house;
- ✓ you are worried about young children, elderly people or someone who is sick;
- ✓ you suspect you could not cope with the stress of fighting the fire;
- ✓ you know it is safe to leave and you have a firm destination; and
- ✓ you act the moment you know there is danger and know which access roads are open or affected by fire—do not wait and see.

If you have decided to leave for a safer place, you must do so early.

- Know the local bushfire warning system (such as your local ABC and 6PR radio station) and tune in when travelling.
- It is extremely dangerous to leave when roads are closed and full of smoke.
- Bushfires move quickly—make sure you and your family know where your safer place is, how you will get there and when you will go.
- Families with children or occupants who are sick, elderly or with a disability need to leave especially early.
- You need to act the moment you know there is danger—do not wait and see.
- Driving is very dangerous and stressful during a bushfire with smoke making it hard to see, fallen trees over the road and powerlines down.
- In the fire area, keep all the windows wound up, and don't get out of the car.
- The speed of the fire could also trap you and burn your vehicle. Cars do not protect you well from radiant heat.
- Put woollen blankets (wet if possible) and drinking water in the car and take pets and emergency kit with you.

If you are not able to leave early, staying and sheltering may be your safest option. You will need to actively defend your property regardless of what you planned to do. Preparing your property will give you and your home the best chance of survival.

You need to act the moment you know there is danger—do not wait and see.



Actively defending your home

Do not underestimate what is required to maintain your house as a place of safety during a bushfire. Your house is your best protection in a bushfire **only** if it is well constructed, maintained and prepared. Actively defending your property will take huge physical and mental effort for many hours before, during and after the fire and conditions will be unbearably hot.

YOU MAY PREFER TO ACTIVELY DEFEND IF:

- ✓ you are confident your home is well prepared and maintained;
- ✓ you have sufficient emergency water supplies and equipment;
- ✓ you think you and your family could deal with the stress and tension of the fire; and
- ✓ you and your family are in good health.



Research by the Bushfire CRC suggests that you will have a good chance of saving your home if you are fit and healthy, stay and actively defend and make sure the home is well prepared for the approaching bushfire.⁹

Most homes lost in bushfires ignite from burning embers that occur immediately before, during or up to several hours after the main fire front has passed. By extinguishing any spot fires caused by these embers, appropriately prepared people can save a building that would otherwise be lost in a fire.

Staying with a well prepared house could also be safer than trying to get away on roads blocked by smoke and fire. If you decide to **leave for a safer place you must go early**—you should never ‘wait and see what happens’. Evacuation at the last minute ahead of a bushfire is dangerous due to smoke, noise, heat, flames, emergency vehicles and panic on the road. It is much safer for people to stay in their homes than flee as the fire approaches.

Research suggests that you will have a good chance of saving your home if you are fit and healthy, and if you stay to actively defend, and the home has been well prepared for the approaching bushfire.

Staying with a well prepared house could be safer than trying to get away on roads blocked by smoke and fire. If you decide to leave for a safer place you must go early.



IF YOU DECIDE TO STAY AND ACTIVELY DEFEND:

- ✓ You need the right equipment, protective clothing for all household members and a property prepared to the highest level (see below).
- ✓ A defensible space around your home (BPZ) can provide protection from radiant heat but will not keep you safe from ember attack or spot fires.
- ✓ You will need to put out any spot fires that start long after the fire has passed, remain vigilant and keep checking for them.
- ✓ There may be many spot fires at once and you will need to prioritise these. Anyone who cannot help you to defend your home should relocate to a safer place well before the bushfire threatens.
- ✓ When the Fire Danger Rating (FDR) is catastrophic, extreme or severe it may not be possible to actively defend your home. On these days fires can be so bad that even homes prepared to the highest level and constructed to bushfire protection levels, that are actively defended, will not survive.
- ✓ Being involved in a bushfire can have a serious and long lasting psychological and emotional impact. Think about your long-term wellbeing.

PROTECTIVE CLOTHING

✓ WEAR

- Natural fibres.
- Long-sleeved shirts.
- Long trousers, jeans or overalls, sturdy leather shoes or boots (not elastic sides), wool or cotton socks.
- Hats and gloves.
- Eye protection.

✗ DO NOT WEAR

- Singlets.
- T-shirts.
- Short-sleeved shirts.
- Shorts.
- Dresses or skirts.
- Sandals or thongs.
- Stockings or synthetic socks.



✔ MATERIALS

Clothes should be made of:

- Pure wool.
- Heavy cotton drill or denim—not synthetics.

✔ OUTSIDE THE HOUSE

While outside the house, or fighting the fire, wear:

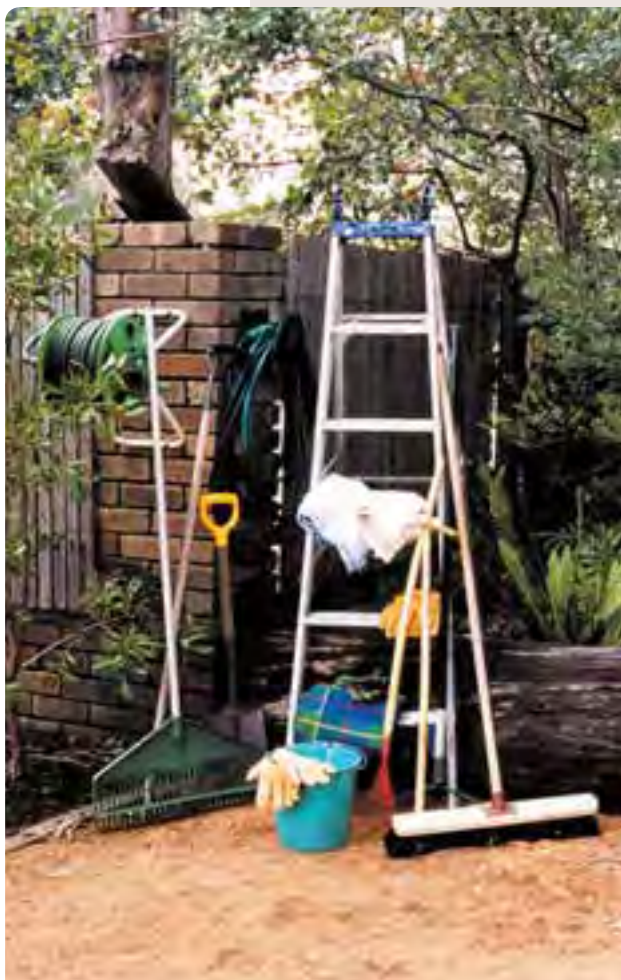
- A wide-brimmed or hard hat.
- Goggles or glasses.
- Gloves.
- A moistened mask to filter ash and other particles—and protect your face by wetting it with water.

THE RIGHT EQUIPMENT

Some of the equipment you'll need to protect your home will probably be on hand already. Other items may need to be bought but are not generally expensive, except for the water pump.

Here's what you need:

- **Torch**—make sure it works and that you have spare batteries.
- **Hoses**—one hose for each water outlet. You'll need enough hose to reach all corners of the house and out to the edge of the building protection zone.
- **Knapsack spray or mop**— used for small spot fires.
- **Buckets**—have plenty around the house. Don't use water on the roof if the power is on.
- **Ladder**—ideally, you'll need two (one for inside and one for outside) that are long enough to reach the roof.
- **Fuel-powered water pump** (preferably diesel fuel)—keep it in working order and in a safe place so it is not at risk from the fire. This is only required if you have your own water source.
- **Gloves**—sturdy, leather, garden variety, not rubber or synthetic.
- **Shovels, hoes and rakes**—at least one of each.
- **Blankets and towels**—woollen blankets and cotton towels, for blocking sparks under doors, and for heat protection. Keep them wet.
- **Drinking water**—make sure that you have plenty of clean drinking water available in a suitable container.



PROTECTING THE HOUSE: WHEN THE FIRE ARRIVES

- Close all doors, windows and shutters and bring outdoor furniture inside.
- Remove the highly flammable door mats and other flammable material near doors or crevices outside the building.
- Keep sprinklers on within the Building Protection Zone on high risk parts of the house e.g. windows, eaves, gas bottles.
- Fill outside gutters. If time permits, block up the mouth of downpipes and fill gutters with water.
- Soak towels and rugs in water and lay along the doorways to keep sparks and smoke out.
- Soak blankets and keep them ready for protection against radiant heat. Keep buckets of water and mops handy.
- As the fire approaches, turn off the mains electricity and gas supply to the house, and move people into the fire refuge area inside the house, if you have one.
- Keep checking for spot fires around the house, and put them out.
- Keep checking each room of the house as the fire passes outside.
- If possible, check for any embers that may have entered the roof space. Be mindful that the roof cavity may have live powerlines running through it.
- If a fire takes hold in the house, move people into another safe area, if you have one.



AFTER THE FIRE

- Once the fire front has passed, remain dressed in protective clothing and check the house thoroughly for spot fires both inside (check the roof space) and outside for several hours.
- Check for embers or signs of smoke inside the ceiling and from furniture, bedding and crevices in windows and walls.
- Check under the floor if possible.
- Hose trees and shrubs near the house.
- Check garage and sheds for small fires.

Most homes lost in bushfires ignite from burning embers that occur immediately before, during or up to several hours after the main fire front has passed.

Once the fire front has passed, remain dressed in protective clothing and check the house thoroughly for spot fires both inside (check the roof space) and outside for several hours.



Where to go as a last resort

During a bushfire the safest place to be is well away from the fire. However, your home may be a safer place, but only if you have prepared prior to the fire season and followed the advice in this book.

To remain with your well prepared home is safer than being out in the open and it's better than trying to make a dash by car through the fire front on roads blocked by emergency traffic, falling trees or covered in dense smoke.

SAFER PLACE

As a last resort, a safer place is a local open space or building where people may go to seek shelter from a bushfire. This may include an area already burnt, where the fire has passed through such as a paddock.

Use of a safer place may be your back-up plan when:

- Your bushfire survival plan has failed.
- You are unable to continue driving away from the fire.
- Your plan was to stay and actively defend but the scale of the fire means your home cannot withstand the fire.
- Your home is no longer a safe place to shelter.

Once you have arrived at your safer place you need to:

- Look and listen for fire information by whatever means of communication you have—on radio, your mobile phone and internet etc.
- Continually monitor the surrounding conditions.
- If you are sheltering in a building as the fire approaches make sure all doors and windows are sealed. When the fire has passed and if safe, check for spot fires and embers outside. Put these out if possible.
- If you are sheltering in an open space, as the fire approaches, seek protection from radiant heat and embers. Attempt to cover any exposed skin with blankets or clothing. You should lie flat on the ground as the fire front approaches.

A REFUGE IN THE HOUSE

Review your home's potential to be a 'fire safer' place. Have you filled in all the gaps (between the eaves, under the house and in any nooks and crannies) to keep out sparks? How good is the water supply? Have you put shutters or metal flywire on the windows? Do you have a suitable building protection zone?

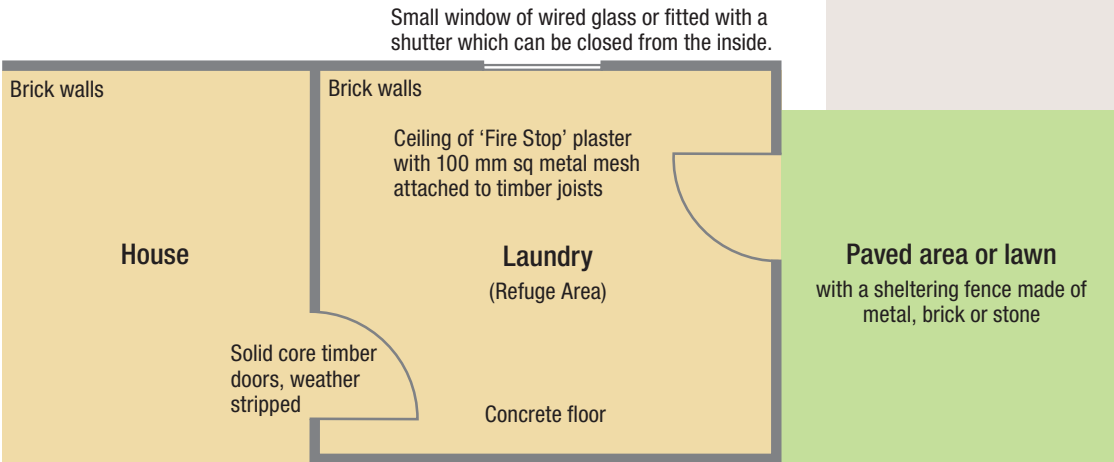
If you feel confident your house would be safe in a fire, you are fit and have considered the health and wellbeing of all family members, make plans to use it as your fire refuge. If you remain, after the fire front has passed—and this may only take 5–10 minutes—you'll be on hand to put out any little fires that have started around the house, before they have time to take hold. Spot fires have been found to be the primary way by which bushfires destroy homes.

If you are sheltering in an open space, as the fire approaches, seek protection from radiant heat and embers as best you can.

During the approach of a bushfire, you should patrol the interior of your house to put out any spot fires caused by embers entering broken windows or ceiling cavities. Attending immediately to any small fires inside the house can save your home and those within it.

If a fire becomes uncontrollable inside your house, sheltering inside it is courting disaster. Preparation, patrolling and quick action may prevent the house from burning uncontrollably, at least until the fire front has passed.

An example of a laundry used as a fire refuge.



Embers have been found to be the primary way by which bushfires destroy many homes.



Prepare your Home and Property Checklist

Don't leave it until summer to try to make your property safe from fire.
Many jobs can be done at cooler times of the year.

Here's a checklist of things to do. Details about most of them are given elsewhere in this book.

LONG-TERM PRECAUTIONS

- Prepare firebreaks. ☐
- Make the house safe—fit wire screens and shutters and fill gaps. ☐
- Develop and maintain a minimum 20-metre building protection zone. ☐
- Develop and maintain a suitable hazard separation zone. ☐
- Provide an emergency water supply. ☐
- Discuss fire prevention with your neighbours—is your locality safe? ☐
- Discuss your preparedness with your neighbours. ☐

AUTUMN AND WINTER (MAY–AUGUST)

- Tree pruning—remove lower branches, check that powerlines are clear. ☐
- Reduce fuel levels around the house—clear long grass, leaves, twigs and flammable shrubs. ☐
- Petrol and other fuels—store in a suitable shed away from the home. ☐
- Make sure your personal and home protection equipment is in good order. ☐
- Overhaul the emergency water pump. ☐
- Make sure everyone in the family knows what to do in a fire. ☐

SPRING (SEPTEMBER–NOVEMBER)

- Move woodpile and stacked timber away from the house. ☐
- Keep the grass short—on farms, keep grazing pressure high on areas near the house. ☐
- Prune the dead material from the shrubs in the building protection zone. ☐
- Clean out gutters, remove debris from roof. ☐
- Create firebreaks. ☐
- Prepare an emergency kit, including a plan. ☐
- Decide whether to stay and actively defend your property in the event of a fire or leave for a safer place. ☐

EARLY SUMMER (DECEMBER ONWARDS)

- Water lawns, trees and shrubs near the house to keep them green. ☐
- Re-check personal and home protection gear, screens, water supplies and gutters. ☐

Bushfire Management in WA

There are several government agencies with some responsibility for the prevention, preparedness, response and recovery of bushfires in Western Australia. The main agencies are Department of Fire and Emergency Services, Department of Parks and Wildlife and Local Governments, other emergency service agencies and also some private fire brigades and landholders.

Table 1. Bushfire Management arrangements as outlined in State Emergency Management Plan for Fire, WESTPLAN – FIRE, DFES (August 2013)¹⁰

	Department of Fire and Emergency Services (DFES)	Department of Parks and Wildlife (DPaW)	Local Government (LG)
Prevention	<ul style="list-style-type: none"> • Declaration of restricted and prohibited burning times, including Total Fire Bans. • Development and implementation of community engagement and education programs. • Contribute to the development of bushfire risk management planning. 	<ul style="list-style-type: none"> • Bushfire planning and mitigation on all DPaW managed land. • Contribute to the development of bushfire risk management planning. 	<ul style="list-style-type: none"> • Bushfire planning and mitigation on all LG managed land. • Prescription and enforcement of bushfire prevention measures on all private land within their LG. • Imposition of harvest and movement of vehicle bans. • Day to day administration, enforcement and firebreak notices under the <i>Bush Fires Act 1954</i>.
Preparedness	<ul style="list-style-type: none"> • Provide and maintain firefighting infrastructure, equipment, plans and programs, including training for firefighters and volunteers. 	<ul style="list-style-type: none"> • Provide and maintain DPaW firefighting equipment and procedures, including training for DPaW staff. 	<ul style="list-style-type: none"> • Training of bushfire brigades. • Ensure there are relocation centres available. • Participate in joint exercises with other emergency service authorities.
Response	<ul style="list-style-type: none"> • Response to all bushfires on lands within prescribed Fire Districts or where volunteer units are established. • Authorise bushfire liaison officers to coordinate DFES operational fire response. • Control of all level 3 fires—those which are complex and threatening life and property. • Manage standards and disseminations of public warnings and bushfire public information. 	<ul style="list-style-type: none"> • Respond to bushfires on all DPaW managed land. • Provide assistance to DFES and/or LG where capable. 	<ul style="list-style-type: none"> • Respond to bushfires on lands including unmanaged reserves and unmanaged crown land outside Gazetted Fire Districts and DPaW managed land. • Provide assistance to DFES and/or DPaW where capable.
Recovery	<ul style="list-style-type: none"> • Responsible responding agencies are expected to initiate recovery during response, however full recovery ultimately rests with the landowner. 		

Emergency Contact Numbers

POLICE, FIRE, AMBULANCE (life threatening emergencies):	000 (TTY 106)
Insurance Company:	
Policy Number:	
Local Council:	
Bank:	
Local GP/Doctor:	
School:	
Work:	
Vet:	
Water Supplier:	
Electricity Supplier:	
Gas Supplier:	
Neighbours/Family/Friends:	
Neighbours/Family/Friends:	
Neighbours/Family/Friends:	
Department of Fire and Emergency Services Info Line:	13 DFES (13 3337)
The frequency of our local ABC Radio:	
Our Fire Ban District:	
Local Fire Brigade:	
Local Police Station:	
Local Ambulance:	

REFERENCES

- ¹ New South Wales Rural Fire Service (2013) 'Bush Survival Plan.' (Government of New South Wales: Sydney).
- ² Department of Planning ('in press') 'Planning for Bushfire Risk Management Guidelines.' (Government of Western Australia: Perth).
- ³ Bowditch PA, Sargeant AJ, Leonard JE, Macindoe L (2006) 'Report on Window and Glazing Exposures to Laboratory-Simulated Bush Fires.' (Bushfire Cooperative Research Centre: Melbourne, Victoria).
- ⁴ New South Wales Rural Fire Service (2011) 'Best Practice Guide to Bush Fire Protection – Upgrading of existing Buildings.' (Government of New South Wales: Sydney).
- ⁵ Backstorm R (2012) 'Determination of the Efficacy of Screens to prevent Ignition of Debris Accumulation Under Rack Mounter PV Modules Installed on Roofs and Impact on Module Operating Temperatures.' (UL: Northbrook, Illinois).
- ⁶ Clean Energy Council (2014) Fire and flood emergency situations.
Available at <https://www.solaraccreditation.com.au/consumers/fires-and-floods.html>
- ⁷ Leonard JE, Blanchi R, White N, Bicknell A, Sargeant A, Reisin F, Cheng M (2006) 'Research and investigation into the performance of residential boundary fencing systems in bush fires.' (Bushfire Cooperative Research Centre: Melbourne, Victoria).
- ⁸ Leonard, JE (2010) 'Tanks on trial: performance of rainwater tanks in bushfire conditions.' (Bushfire Cooperative Research Centre: Melbourne, Victoria).
- ⁹ Bushfire Cooperative Research Centre (2006) 'Fire Note: The Stay and Defend your Property or Go Early Policy.' (Melbourne, Victoria).
- ¹⁰ Department of Fire and Emergency Services (2013) 'State Emergency Management Plan for Fire (WESTPLAN – FIRE).' (Government of Western Australia: Perth).

THE HOMEOWNER'S BUSHFIRE SURVIVAL MANUAL

On your property, fire safety starts with you. You are in control. It's in your hands to reduce fire risks around the home and create an environment that will help protect you in a fire. This book sets out some useful hints on what to do for those living in rural, semi-rural or bushland areas.

The Homeowner's Bushfire Survival Manual has been prepared to help you become better informed about bushfires. It draws together the best advice available on preventing and preparing for bushfires.



MORE INFORMATION

Alerts and Warnings, Fire Danger Ratings, Total Fire Bans
Department of Fire and Emergency Services (DFES) dfes.wa.gov.au
13 DFES (13 3337)
twitter.com/dfes_wa

Bushfires and prescribed burns in DPaW managed lands
(e.g. National Parks and State Forest)
Department of Parks and Wildlife (DPaW) dpaw.wa.gov.au
9219 8000

Fire Danger Ratings and Weather
Bureau of Meteorology bom.gov.au/weather/wa

Road Conditions and Closures
Main Roads mainroads.wa.gov.au
138 138

Suspicious or Criminal Activity
Crimestoppers wa.crimestoppers.gov.au
1800 333 000