

PLANS AND DOCUMENTS
referred to in the PDA APPROVAL

- 5 MAR 2015

MEDQ



SURVEYORS | PLANNERS | DEVELOPMENT ADVISORS

BUSHFIRE HAZARD MANAGEMENT PLAN

Flagstone West (Context Plan Area 1)

NEW BEITH ROAD AND HOMESTEAD DRIVE, UNDULLAH



Prepared for:

PEET Flagstone City Pty Ltd

Issue: C (19.02.2015)

DOCUMENT CONTROL

Project Number: 00007763
Project Name: PEET Flagstone West – Context Plan Area 1
Document Reference: 141001 BHM Report

Prepared for

PEET Flagstone City Pty Ltd

Prepared by

Jensen Bowers Group Consultants Pty Ltd

PO Box 799
Spring Hill Qld 4004

T (07) 3852 1771
F (07) 3252 9818
E admin@jensenbowers.com.au
W www.jensenbowers.com.au

Document History

Version	Description	Date	Author	Approved by
Issue A	Original Issue	13-10-2014	LG	LG
Issue B	Final Report	19-11-2014	LG	LG
Issue C	Amended Report	19-02-2015	LG	LG

Laura Gannon BRTP (Hons) GCBP GCPM MPIA MFPA MAIES
Senior Town Planner | Bushfire Planning Specialist

E lauragannon@jensenbowers.com.au
T 07 3319 4909
M 0401 889 094

TABLE OF CONTENTS

1	Introduction	1
1.1	Impetus for Bushfire Hazard Assessment.....	2
1.2	Site Details.....	3
1.3	Site Locality.....	4
1.4	Understanding Fire Weather Characteristics.....	5
2	Proposed Development	6
2.1	Context Plan Area 1.....	6
2.2	Stage 1.....	6
3	Site Context and Locality	8
4	Statutory Bushfire Hazard Assessment	10
4.1	State Planning Policy.....	10
4.2	Local Government Provisions.....	13
4.2.1	Beaudesert Planning Scheme.....	13
4.2.2	Draft Logan City Plan 2014.....	14
5	Bushfire Site Assessment	16
5.1	Introduction.....	16
5.2	Assessment Methodology.....	16
5.3	Vegetation Classification and Fuel Structure Assessment.....	18
5.4	Effective Slope.....	19
5.5	Site-Based Assessment of Bushfire Hazard.....	20
5.5.1	Landscape Fire Risk.....	20
5.5.2	Localised Bushfire Risk.....	21
5.5.3	Influence and Frequency of Fire Weather.....	23
6	Bushfire Management and Mitigation Measures	25
6.1	Vegetation Management and Landscaping.....	25
6.1.1	Sandy Creek Corridor and Adjoining Parkland Buffer.....	26
6.1.2	Sandy Creek Corridor Parkland Buffer Clearing.....	26
6.1.3	Sandy Creek Corridor Parkland Buffer Landscaping.....	28
6.1.4	Remnant Gully Corridor Clearing.....	29
6.1.5	Remnant Gully Corridor Landscaping.....	31
6.1.6	Local Parkland Areas.....	32
6.1.7	Landscaping for Residential Allotments.....	32
6.1.8	Fire Management Approaches for Biodiversity Conservation.....	33
6.2	Fire Breaks and Fire Trails.....	33
6.3	Road Networks, Access, Egress and Evacuation.....	34
6.4	Fencing and Retaining.....	35
6.5	Water Supply and Firefighting Infrastructure.....	35
6.6	Bushfire Awareness.....	36
6.7	Building Construction Requirements.....	36
6.7.1	Limitations of AS3959-2009.....	38
6.7.2	Building Design to Reduce BAL-Compliance Costs.....	39
7	Management of Balance of Context Plan Area 1	40
8	Future Development Stages and Bushfire Risk	41

9	Summary of Recommendations	42
10	Conclusions	44
11	List of Reference Materials	46

ATTACHMENTS

Attachment A	Stage 1 Proposed Plan of Reconfiguration.....	A
Attachment B	Stage 1 Bushfire Management Plan.....	B
Attachment C	CFA'S Landscaping for Bushfire Guideline	C
Attachment D	RFSQ'S Bushfire Survival Plan.....	D

DISCLAIMER

This report is prepared on the basis the subject land is identified to be 'at risk' of bushfire. Any buildings or structures located on such land subsequently inherit this risk. This report does not seek to remove this risk, but provide detailed siting, layout, building and / or servicing information to assist the ability of the land-owner to manage the threat of this risk.

This assessment is prepared based upon local, State and Federal legislative provisions relating to bushfire protection, as relevant at the time of production. Jensen Bowers Group Consultants Pty Ltd maintains relevant knowledge with regard to planning and development in bushfire prone areas. However, it is important to note that whilst bushfires generally maintain certain scientific attributes, bushfire events vary in intensity, duration, location and 'typical' behavioural characteristics. Bushfires do not always conform to scientific and widely-understood predictabilities and remain subject to variation across fire seasons by virtue of changes in ground fuel loads and vegetation, prevailing weather and wind conditions and topography.

It remains the land owner's responsibility to understand and prepare for the event of bushfire, which requires year-round property maintenance, a proficient understanding of local bushfire knowledge and what do in the event of a bushfire. A personal bushfire safety plan is recommended, and decisions regarding what to do in an event should be made well in advance of any particular bushfire threat. Regular contact with your local fire authority is advised.

Whilst every care has been taken in the preparation of this report to advise upon the bushfire risk of the property, it forms no guarantee with respect to the safeguard of life and property.

Jensen Bowers Group Consultants Pty Ltd accepts no responsibility for any damage or loss of life or property as a result of bushfire or any other cause which may in any way be taken to be the subject of this report. This report and the information within it is provided on the understanding that reasonable care will be taken when using it. If there remains any uncertainty regarding the application of the information within the report in a specified circumstance, further professional advice should be sought. Jensen Bowers Group Consultants Pty Ltd does not accept responsibility for how the information within this report is applied or relied upon.

1

INTRODUCTION

Jensen Bowers Group Consultants Pty Ltd has been engaged on behalf of PEET Flagstone City Pty Ltd to undertake a site-based bushfire hazard management plan specifically relating to Context Plan Area 1 of the broader PEET Flagstone West Structure Plan Area. This report focuses specifically on this Context Plan Area and with particular regard to the Stage 1 Plan of Development (POD) and reconfiguration of lots (ROL) assessed by Economic Development Queensland (EDQ) incorporating approximately 714 residential allotments as well as a range of parkland, future commercial and balance allotments.

The focus of this assessment report remains two-fold, both with respect to the satisfaction of statutory requirements and also end-user consideration, being the purchasers and residents of the constructed allotments.

At the time this report was prepared, a development application had been lodged with EDQ for assessment of an ROL relating to Stage 1 of Context Plan Area 1, representing the first stage of development as part of the PEET Flagstone West Structure Plan Area and comprising approximately 80 hectares.

Flagstone West is located within the Greater Flagstone Priority Development Area (PDA) which overall is eventually sought to encompass a population of over 100,000 persons. The area is identified as subject to bushfire hazard under the PDA Development Scheme, the Beaudesert Planning Scheme which remains the applicable local planning instrument for this area following the 2008 Local Government amalgamations and the Draft Logan City Planning Scheme, due for final adoption in late 2014 or early 2015. The site is also identified on the State Planning Policy (SPP) bushfire hazard mapping recently released by the Queensland Government.

This assessment report aims to mitigate the risk to life and property from bushfire threat and the impact of bushfire attack which includes:

- direct flame contact
- ember and firebrand attack
- radiant heat
- fire-driven wind.

Building loss is typically associated with one or more forms of bushfire attack, the most common being the combined effects of radiant heat and ember attack. Danger to human life is also associated with these forms of bushfire attack in addition to smoke emission.

This assessment does not seek to remove the threat of bushfire risk, but provide relevant siting, layout, building and / or servicing information to assist the ability of land-owners to manage the threat of this risk. This assessment report is prepared in accordance with best practice industry standards as applicable in Queensland and pursuant to both State and local government bushfire hazard policies and guidelines.

1.1 Impetus for Bushfire Hazard Assessment

A development application has been submitted to EDQ seeking an ROL for the proposed development as outlined in Section 2 of this report.

This report has been prepared to address the relevant provisions of the Natural Environment Overall Site Strategy (OSS) Version 1.2 dated April 2014 and as endorsed by EDQ, specifically with regard to bushfire management and protection of biodiversity values across the site.

1.2 Site Details

Site address	New Beith Road and Homestead Drive, UNDULLAH
Local Government	Economic Development Queensland (Greater Flagstone PDA)
Real property description	Lot 2 on RP47120 Lot 910 on RP857850 Lot 911 on RP8587870 Lot 907 on RP819216 Lot 908 on RP819216 Lot 873 on SP166448
Area of Site	Context Plan Area 1: 340 hectares Stage 1: 80 hectares
Tenure	Freehold
Applicant's name	PEET Flagstone City Pty Ltd
Fire Authority	Rural Fire Service Queensland (RFSQ) RFSQ South Eastern Region (Jimboomba RFS Brigade)
Current Land Use	Vacant
Proposed Land Use	Urban residential subdivision (including park, commercial and balance lots)
Adjoining Properties	Freehold

1.3 Site Locality

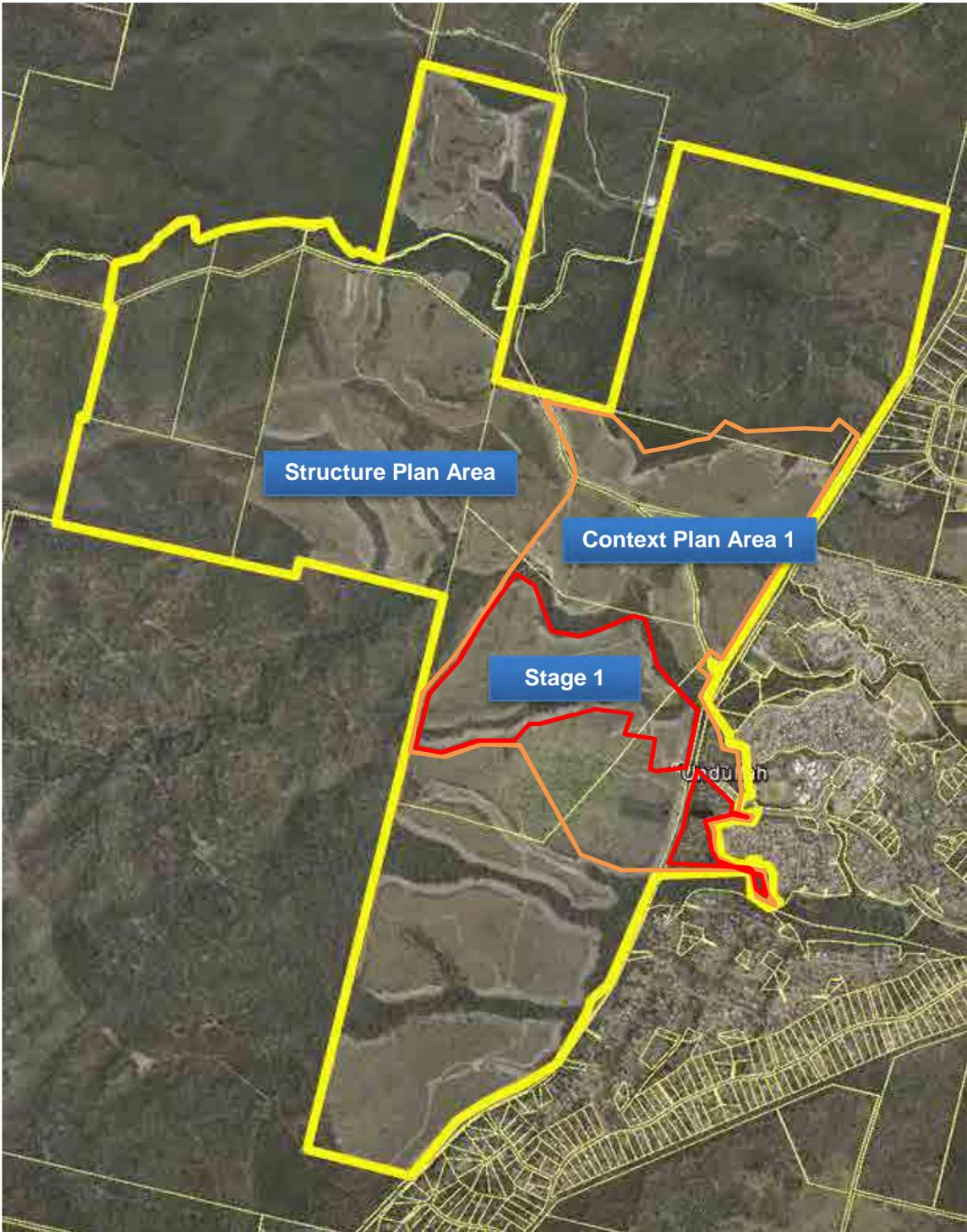


Figure 1: Flagstone West Structure Plan Area and Location of Context Plan Area 1 and Stage 1 (Source: Queensland Government, 2014)

1.4 Understanding Fire Weather Characteristics

It remains important to understand the influence of fire weather with regard to how it can affect bushfire risk levels on a daily, weekly or seasonal basis.

In South East Queensland, hot-air fire wind is typically generated by north-west and south-westerlies and cool-air fire wind is generated by south-westerlies which are prevalent during Southern Queensland's fire season which extends from August to March, annually. In some situations however, south-easterlies can also drive bushfire behaviour.

Notwithstanding the above, it is noted bushfires do not always conform to widely-accepted characteristics. Other fire weather conditions must also be contemplated such as preceding weather conditions (such as low rainfall or drought), air temperature and relative humidity. If the area has been subject to drought or low rainfall for a period of time, vegetation health tends to deteriorate with increased leaf drop, curing and drying. This contributes to increased ground fuel loads and general ignition susceptibility. Prolonged dry periods also reduce soil moisture content.

Air temperatures of above 30 degrees Celsius are typically conducive to increased fire weather, as are extended periods of higher than average air temperatures. In conjunction, low relative humidity (i.e low air moisture content) is also a contributing factor to increased fire weather.

In concert, all of the above factors can impact on the ability for fire to propagate, and alter behaviour and intensity characteristics and as such, fire weather is a significant component of bushfire hazard. Whilst an assessment of vegetation types, fuel loads, effective slope and other factors can be readily undertaken, fire weather can fluctuate across days, weeks and seasons and can have a significant impact on the potential for bushfire threat as well as influence bushfire behaviour and intensity.

The Fire Danger Index (FDI) is a commonly used method to readily advise the community of the likely ability of fire suppression based on fire weather, which is used to inform the Fire Danger Rating (FDR) System at Figure 2. It is important to maintain awareness as to the level of local fire danger during the fire season.

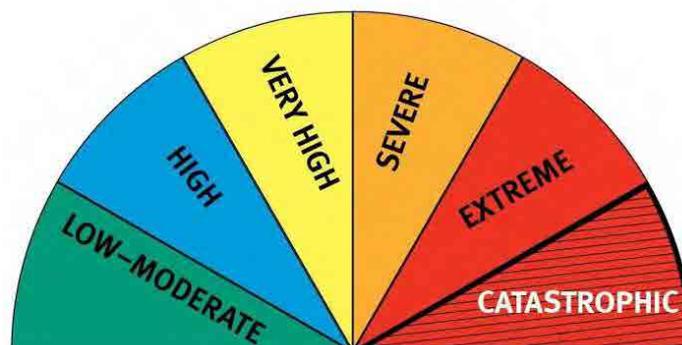


Figure 2: Fire Danger Ratings (Source: RFSQ, 2013)

2 PROPOSED DEVELOPMENT

2.1 Context Plan Area 1

Context Plan Area 1 encompasses the first of five Context Areas within the larger PEET Flagstone West Structure Plan Area. Context Plan Area 1 incorporates seven stages, which includes the local centre, refer to Figure 1 and Figure 3.

As identified by the Context Plan Area 1 Report prepared by RPS, Context Plan Area 1:

‘encompasses the first of four residential “villages” within the Flagstone master planned community and the adjoining Town Centre. Each of the villages within will be distinct areas within Flagstone and will be supported by the town centre which will provide services and employment opportunities to Flagstone and the wider regional area.’

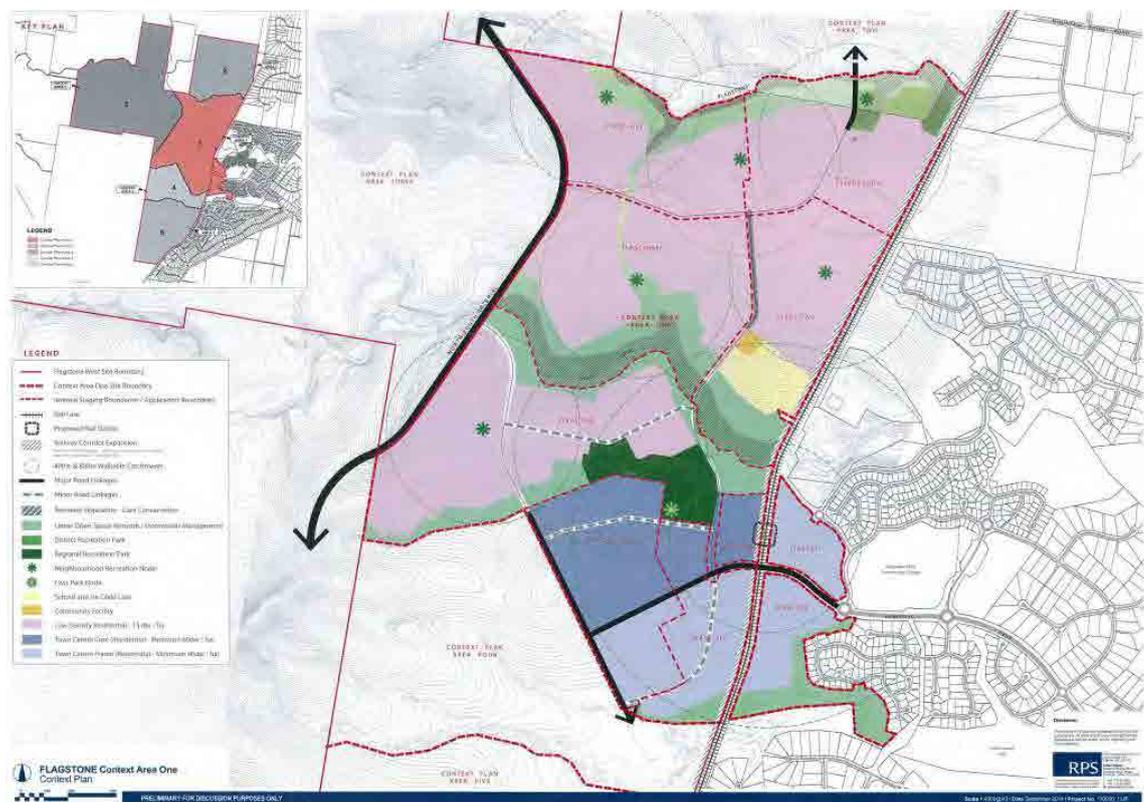


Figure 3: Proposed Context Plan Area 1 (Source: RPS, 2014)

2.2 Stage 1

Stage 1 of Context Plan Area 1 encompasses approximately 714 residential allotments as well as a range of parkland, future commercial and balance allotments. It is understood Stage 1 of Context Plan Area 1 will be the first initial stage of development of the Flagstone Estate to the west of the Brisbane – Sydney Railway Corridor at Undullah. This first stage of works will also include the construction of road access across the Railway Corridor and linking Homestead Drive on the eastern side to a new road network to the west.

Until development in the northern parts of the Structure Plan area occurs, road access will only be available to Stage 1 via Homestead Drive and a bridge across the Brisbane – Sydney Railway Corridor. The internal road network proposed by the remainder of Stage 1 will provide connection to future stages to the north and south, with Context Plan Area 3 to eventually provide a northern connection to and from the Estate via New Beith Road.

Stage 1 incorporates 25 Sub-Stages, some of which are broken down into further Sub-Stage precincts. It is further understood that stage sequencing will be largely in line with that outlined on the proposed reconfiguration plan and will be undertaken generally in an east to west arrangement, as access is constructed through the Stage. Proposed lot sizes are reflective of contemporary urban residential allotments between 200m² and 1,340m². Linear parkland corridors bound the site to the north, north-east and south and represent existing creek and gully corridors which will encompass regional recreation parkland, corridor parks and areas of retained vegetation.

Refer to **Attachment A** and Figure 4 for the proposed reconfiguration plan for Stage 1.

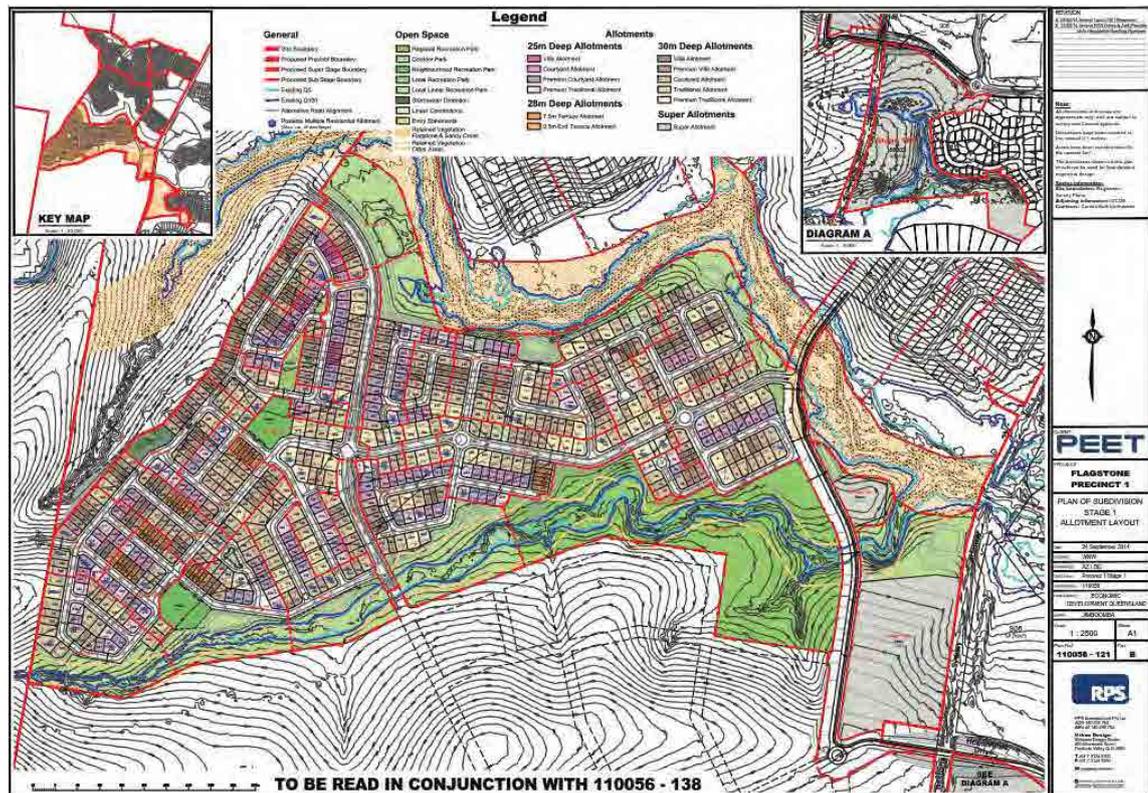


Figure 4: Stage 1 as proposed (Source: RPS, 2014)

3

SITE CONTEXT AND LOCALITY

The proposed Context Plan Area 1 and Stage 1 subdivision is located on the western side of the Brisbane – Sydney Railway Line which traverses the centre of the Greater Flagstone PDA, with land adjacent to Stage 1 to the west also intended to be developed for urban purposes at some future stage, as part of the Greater Flagstone PDA. It is noted this area is not within the same ownership as the subject site.

The majority of the area forming Context Plan Area 1 and Stage 1 has been historically cleared and now comprises an expansive grassland area incorporating emergent regrowth vegetation sporadically occurring as isolated specimens. At the outer periphery of the Stage and that of Context Plan Area 1, existing established vegetation has been retained along waterway corridors, identifiable at Figure 1 and Figure 4.

A similar clearing approach has been adopted for the remainder of Context Plan Area 1 as well as parts of Context Plan Areas 3, 4 and 5, refer to Figure 1. Context Plan Area 2 currently encompasses vegetation that is fully intact however, it is understood that incremental clearing of this area will occur in the future.

As previously noted, the western area of Greater Flagstone and indeed, the PEET Flagstone West Structure Plan Area, is currently inaccessible via constructed road. A bridge crossing over the Brisbane – Sydney Railway Corridor forms part of Stage 1 works to establish road connection to the area from Homestead Drive. The Brisbane – Sydney Railway Corridor bounds the PEET Flagstone West Structure Plan Area and Stage 1 to the east. Established and developing urban and rural residential development current exists within the Flagstone Rise Estate, further to the east of the railway line. Development within Context Plan Area 1 will continue to the immediate north of Stage 1, with a balance area which will eventually accommodate the town centre to the immediate south of Stage 1 to be developed in the future.

To the west and north-west of the Greater Flagstone PDA, the terrain steepens at the foothills of Flinders Peak and within the Flinders – Karawatha Bioregional Corridor. It is understood that land in this area is unlikely to be developed due to the ecological and scenic amenity values associated with the Corridor. Intervening land to the immediate west of the site and PEET Flagstone West Structure Plan Area, namely Lot 3 on RP45236, as previously mentioned is intended to be developed in the future for urban residential purposes.

The Greater Flagstone PDA adjoins the established area of Spring Mountain to the north and the Bromelton State Development Area to the south. To the immediate south of Stage 1 and on the southern side of the Sandy Creek tributary is a Council-managed sewerage effluent discharge area associated with an established sewerage treatment facility on the eastern side of the Brisbane – Sydney Railway Corridor, refer to Figure 5.

An established fire trail network throughout the Structure Plan area and surrounds also exists.



Figure 5: Stage 1 Context (Source: Queensland Government, 2014)

4

STATUTORY BUSHFIRE HAZARD ASSESSMENT

4.1 State Planning Policy

The single State Planning Policy (SPP) was released by the State Government in December 2013 and amended in July 2014 which comprises a range of State-interest requirements for planning scheme preparation and interim development assessment provisions.

The SPP mapping identifies areas of medium, high and very high hazard, along with an associated potential impact buffer area, with respect to the subject sites pursuant to the new bushfire hazard mapping methodology developed by the CSIRO in partnership with the Queensland Government. The new mapping methodology yields an estimated 85% level of accuracy based upon recent innovation in fire science and is considered a substantial advancement in bushfire hazard mapping in Queensland. The new mapping methodology is based upon potential fire line intensity using the MacArthur Mk 5 Forest Fire Danger Meter and inputs of total fuel load and effective slope to derive a potential rate of fire spread. A 100m 'buffer' area is also applied (see hatched areas at Figure 6) under the SPP (as it is under AS3959-2009 – Construction of Buildings in Bushfire Prone Areas) being the zone in which ember attack and radiant heat remain relevant adjacent to the actual hazard. It is important to note that the term 'buffer' as utilised by the SPP refers not to mandatory separation distances but to that area adjoining classifiable vegetation which may experience a level of bushfire attack, thereby ensuring assessment of surrounding areas is adequately captured. Patch and corridor filtering are also introduced on the premise that certain areas of vegetation are likely to prevent a running fire front from reaching its full potential.

This mapping supports the implementation of the SPP only and is not a trigger for AS3959-2009 – Construction of Buildings in Bushfire Prone Areas pursuant to the Building Code of Australia.

As identified by an excerpt of this mapping as relevant to the subject site at Figure 6, the site is identified as subject to a mix of medium and high level hazard areas, as well as the potential impact buffer area. It is noted that much of those areas both internal and external to Context Plan Area 1 are intended to be developed into the future as part of the Greater Flagstone PDA. Thus, the true bushfire hazard characteristics both internal and external to the site are dynamic and likely to fluctuate over time.

Figure 7 provides for a comparative analysis of bushfire hazard against recent aerial imagery identifying the key clearing areas of Context Plan Area 1. For the most part, the identified areas of hazard follow the retained areas of vegetation principally located along the waterways and gullies. However, there remain some locations across Context Plan Area 1 where the accuracy of the mapping is overtaken by recent clearing activity and the land management activities applying to the site as a whole.

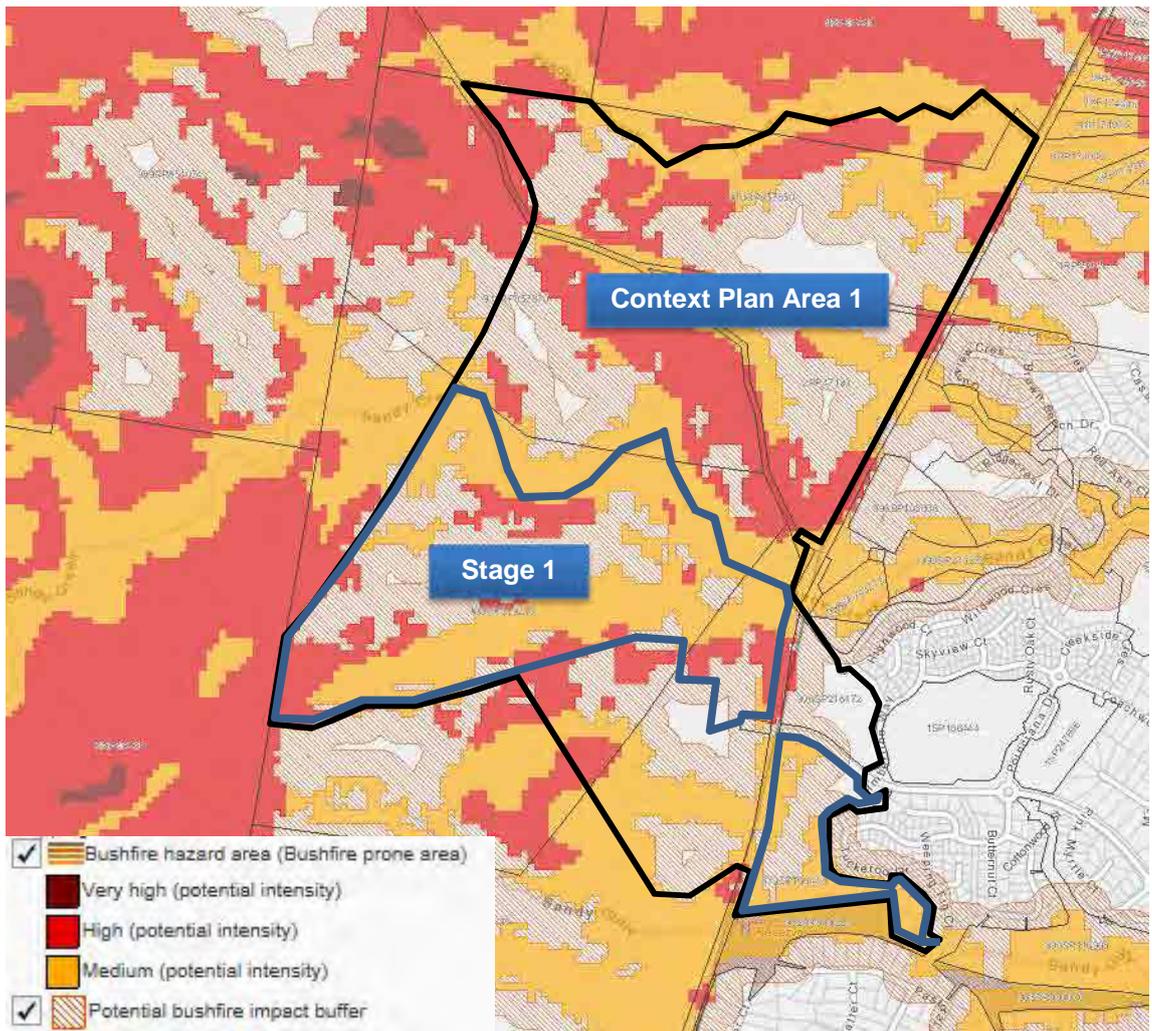


Figure 6: SPP Bushfire Hazard Development Assessment Mapping (Source: Queensland Government, 2014)

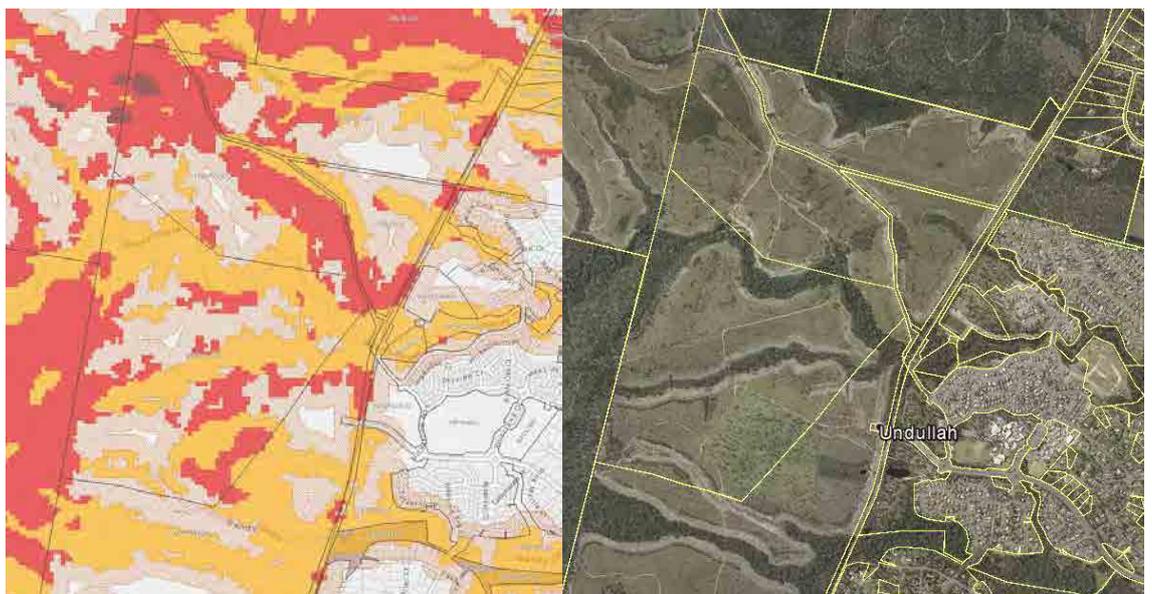


Figure 7: Comparative Analysis of SPP Bushfire Hazard Mapping and Aerial Imagery (Sources: Queensland Government, 2014)

Although the current development application to EDQ does not trigger assessment against the SPP, in this particular instance it is considered the SPP represents a more contemporary approach to natural hazard mitigation than that contemplated by the Greater Flagstone PDA given this instrument was not in place when the Greater Flagstone PDA Development Scheme was prepared and as such, is of relevant consideration.

As identified at Part E of the SPP, the following requirements relate to all types of development subject to natural hazards, assessed pursuant to the SPP:

Table 1: SPP Natural Hazards Interim Development Provisions

For all natural hazards, development:	Assessment
<p>1. Avoids natural hazard areas or mitigates the risks of the natural hazard to an acceptable or tolerable level; and</p>	<p>The provisions of this report seek to appropriately mitigate the risk of potential bushfire attack via a range of methodologies including:</p> <ul style="list-style-type: none"> - landscaping, rehabilitation and vegetation management approaches for fuel management - the use of firebreaks - accessibility and egress - fencing and retaining provisions - water supply and firefighting infrastructure - bushfire awareness and education - building construction requirements.
<p>2. Supports, and does not unduly burden, disaster management response or recovery capacity and capabilities; and</p>	<p>In this particular case, it is considered that matters with regard to disaster management response and recovery have been considered at the time the Greater Flagstone PDA was declared by the Minister and the Development Scheme was prepared, taking into consideration the extent of population growth proposed in this location.</p> <p>Irrespective of the above, the mitigation methodologies identified by this report seek to provide for increased community resilience and emergency response if required in addressing matters such as vegetation management, property maintenance, access and egress and built form.</p> <p>It is recommended a copy of this report is provided to the local Rural Fire Brigade for their information purposes.</p>

3. Directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties; and	A range of mitigation measures are recommended by this report to reduce the potential for damage caused by possible bushfire attack whilst maintaining a focus on end-user safety.
4. Avoids risks to public safety and the environment from the location of hazardous materials and the release of these materials as a result of the natural hazard; and	Not applicable.
5. Maintains or enhances natural processes and the protective function of landforms and vegetation that can mitigate risks associated with the natural hazard	The proposed development of Stage 1, the Context Plan Area 1 and wider PEET Flagstone West Structure Plan Area is subject to a range of land management, vegetation management, ecological assessment and landscape concept plans which combined, seek to effectively balance the natural features and processes associated with the subject land and hazard mitigation approaches. The measures and methodologies outlined in this report remain cognisant of this strategic balance.

4.2 Local Government Provisions

4.2.1 Beaudesert Planning Scheme

The Beaudesert Planning Scheme remains the applicable local planning instrument at the time this report was prepared. However, as the site remains within a declared PDA, the provisions of the local government planning scheme are not relevant.

Notwithstanding, the Bushfire Hazard Overlay mapping under the Beaudesert Planning Scheme remains relevant pursuant to the provisions of the Building Code of Australia (BCA). The BCA nominates local government planning scheme hazard overlay mapping as the relevant trigger for the applicability of AS3959-2009 – Construction of Buildings in Bushfire Prone Areas. On this basis, the overlay mapping is relevant in terms of dwelling construction.

Figure 8 provides an excerpt of the current Bushfire Hazard Overlay map under the Beaudesert Planning Scheme, identifying areas within Context Plan Area 1 as subject to medium level bushfire hazard.

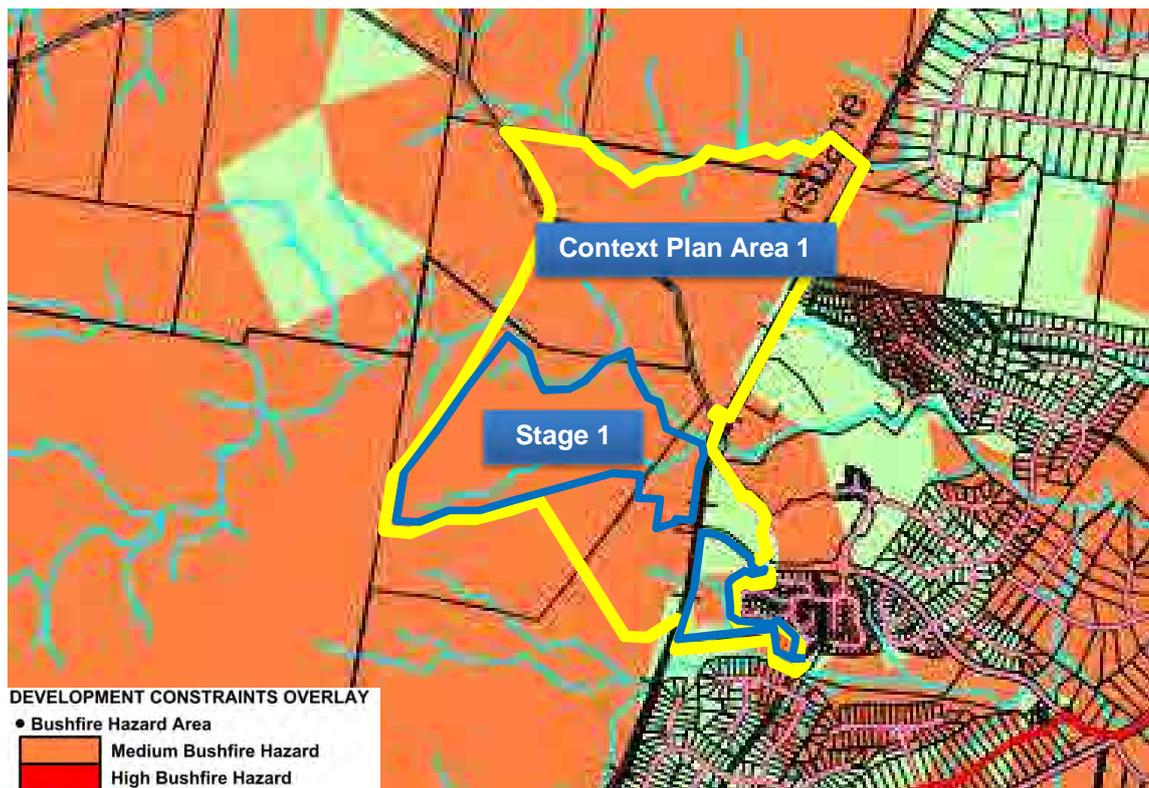


Figure 8: Excerpt from Beaudesert Planning Scheme Bushfire Hazard Overlay (Source: Scenic Rim Regional Council, 2014)

4.2.2 Draft Logan City Plan 2014

At the time this report was produced, the public display of the Draft Logan Planning Scheme had closed. It is understood that the Draft Planning Scheme Bushfire Hazard Overlay mapping was not based upon the new mapping methodology developed by the CSIRO and adopted by the State Government and to this end, the Draft Overlay mapping requires revision at a future stage in accordance with the new SPP mapping methodology requirements.

To this end, it is understood the Draft Bushfire Hazard Overlay mapping will be amended in accordance with the SPP mapping methodology. However, it is noted Local Government retains the ability to complete its own assessment in accordance with the mapping methodology which may derive different or additional hazard areas than identified by the State Government and as such, the current mapping may be adopted as per the Draft version.

It is likely the case the new Logan City Plan will be adopted prior to the construction of any dwellings on proposed allotments. Should this be the case, dwellings requiring building approval following the adoption of the new planning scheme will likely trigger assessment against AS3959-2009 pursuant to the new Bushfire Hazard Overlay mapping. Figure 9 below illustrates the Draft Bushfire Hazard Overlay mapping which was on public display however, it cannot be ascertained at this stage whether this mapping will change at the time of adoption or to what degree.

At present, it is considered that the Draft Bushfire Hazard Overlay mapping does not entirely reflect potential bushfire behaviour based upon the extent of clearing activity which has taken

place in recent years and continues to be maintained via a dedicated land and vegetation management program for the PEET Flagstone West Structure Plan Area.

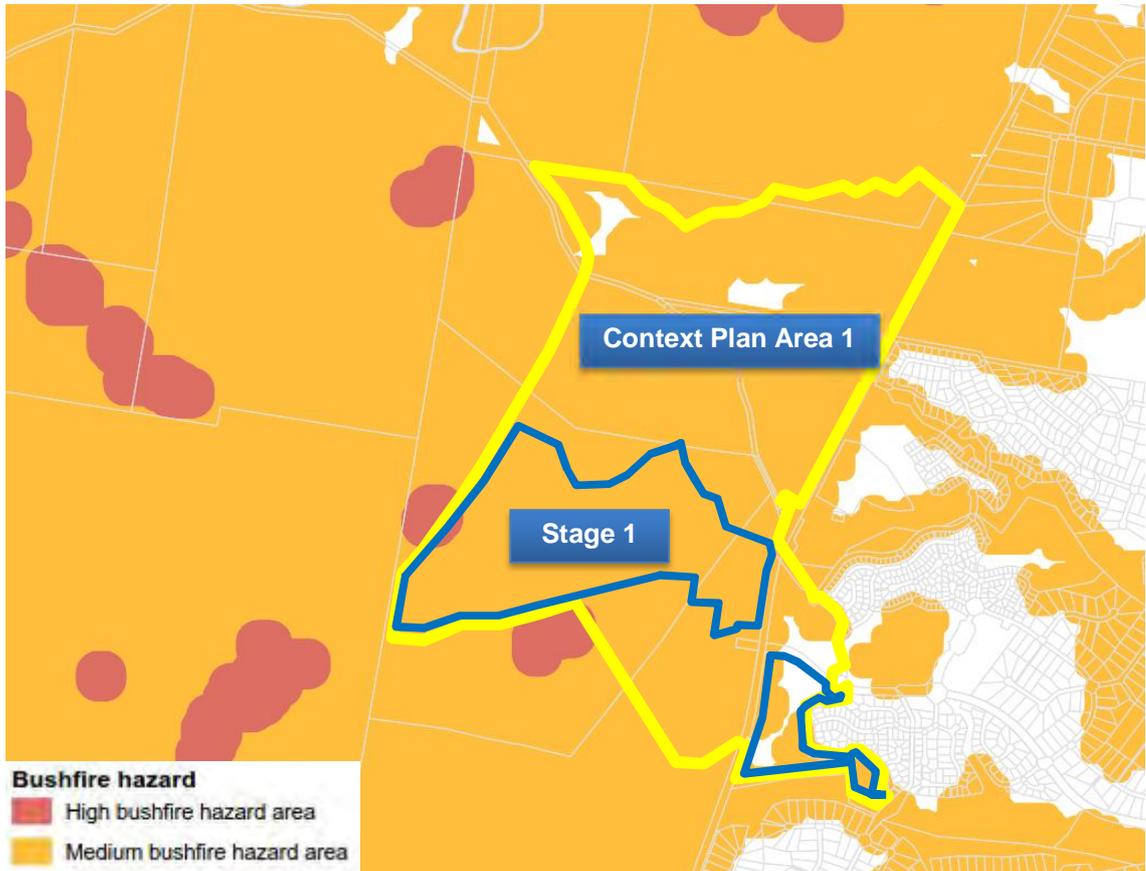


Figure 9: Excerpt from Draft Logan Planning Scheme Bushfire Hazard Overlay (Source: Logan City Council, 2014)

5

BUSHFIRE SITE ASSESSMENT

5.1 Introduction

The following assessment was carried out in accordance with the provisions of the State Planning Policy, Beaudesert Shire Planning Scheme and in a preliminary context with regard to the Draft Logan City Plan and AS3959-2009. It is noted this assessment is undertaken pursuant to proposed reconfiguration application currently being assessed by EDQ, refer to **Attachment A**, and for the purposes of end-users. To this end, Section 5 relates specifically to Stage 1 as opposed to the broader Context Plan Area 1.

In terms of assessment methodology, it is noted that the Fire Danger Index (FDI) is calculated at 40 with a flame temperature of 1,090k, as per the provisions of the Australian Standard as relevant to Queensland. On this basis and as required by both the SPP Bushfire Hazard mapping and AS3959-2009, the site assessment area encompasses that area within 100m of the identified hazard contained within and adjacent to the development sites.

5.2 Assessment Methodology

The site-based bushfire hazard assessment as set out in this report utilises a range of data, collected both on-site and via desktop analysis. A site inspection was carried out on Tuesday 30 September 2014 during fine Spring season conditions. The site inspection was undertaken in the early stages of the 2014 / 15 South East Queensland fire season. It is noted there had been an absence of substantial rainfall in the area in the period leading up to the site inspection, with a range of land management (including clearing) activity observed on the day. To this end, the vegetation as observed on-site is considered typical of fire season vegetation characteristics and fuel loads.

It is noted the site inspection took in a number of areas across the PEET Flagstone West Structure Plan Area as well as overall fuel hazard assessments undertaken specifically within the area of Stage 1, both within the Sandy Creek corridor to the north and the remnant gully area to the south. Figure 10 identifies the site inspection route taken through the Structure Plan area and locations of overall fuel hazard assessments.

In addition to the site inspection and overall fuel hazard assessment, a range of instruments have also been utilised to perform a desktop analysis to complement the data collected via the site inspection and inform the proposed development approach for Stage 1. These instruments include:

- local and State bushfire hazard mapping
- proposed Structure Plan and ROL plans
- Context Plan Area 1 Assessment Report, prepared by RPS
- aerial photography
- Natural Environment Assessment Report for Context Plan Area 1, prepared by Saunders Havill Group
- Natural Environment Site Strategy (land management strategy)

- Flagstone West Stage 1 Civil Engineering Report, prepared by Cardno
- Context Plan Area 1 Community Green Space Plan, prepared by RPS
- Stage 1 Landscape Master Plan, prepared by RPS
- AS3959-2009 – Construction of Buildings in Bushfire Prone Areas.

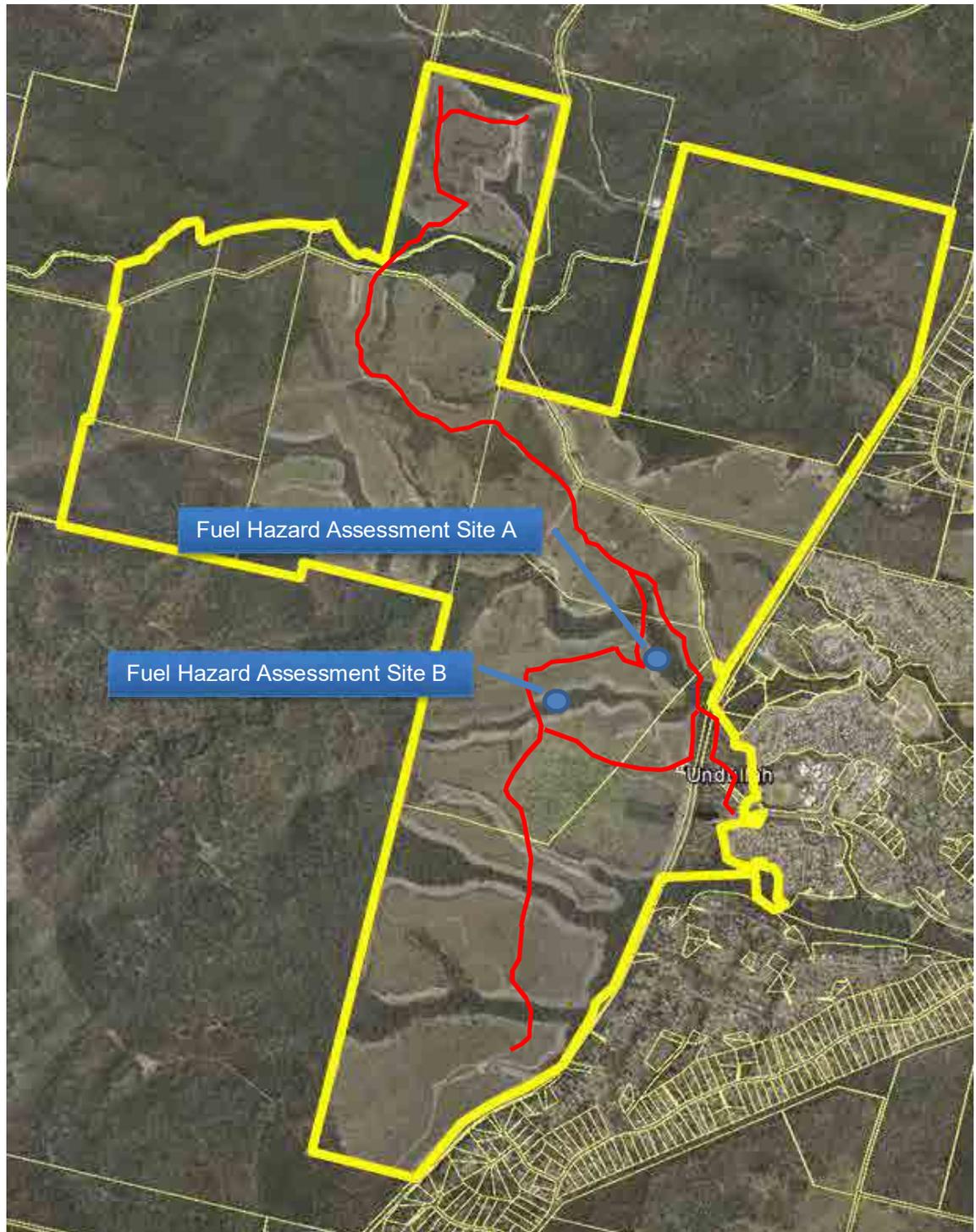


Figure 10: Site inspection route through PEET Flagstone West Structure Plan Area (Source: Adapted from Queensland Government, 2014)

5.3 Vegetation Classification and Fuel Structure Assessment

Vegetation classification is important for a number of reasons, namely it indicates the level of fire intensity and fire behaviour associated with specific stands of vegetation and it also indicates the fuel loads which may exist in certain locations.

It is noted the '*vast majority of areas encompassing Context Plan Area 1 were cleared in 2008 and 2009*' (Sanders Havill Group, 2012, p.35). The dominant remaining vegetation features of Stage 1 include Sandy Creek and the southern remnant gully / drainage corridor. Between these areas is a wide open and level to moderately grading expanse of grassland and juvenile eucalypt regrowth. The dominant trees remaining in these areas include:

- *Acacia disparrima* (Hickory Wattle)
- *Corymbia citriodora* (Spotted Gum)
- *Corymbia intermedia* (Pink Bloodwood)
- *Eucalyptus crebra* (Narrow Leaf Ironbark)
- *Corymbia tessellaris* (Moreton Bay Ash)
- *Angophora leiocarpa* (Smooth Bark Apple)
- *Eucalyptus tereticornis* (Forest Red Gum)
- *Lophostemon suaveolens* (Swamp Box) (Source: Saunders Havill Group, 2012)

The fuel composition within the Sandy Creek and remnant gully areas is generally continuous at present, with both horizontal and vertical connectivity. Both corridors link directly with a large expanse of bushland to the immediate west of Stage 1 and the PEET Flagstone West Structure Plan Area. This area to the west also forms part of the Greater Flagstone PDA and may be developed into the future however at this stage, must be considered in its current form. Further to the west and north-west, the PDA adjoins the Flinders Peak – Karawatha Bioregional Corridor and it is understood this area is unlikely to accommodate development.

The vegetation in these locations is dominated (in terms of fuel structure, but not necessarily species prevalence) by taller eucalypts, with a shrub understorey and ground cover fuel layer. Whilst there is certainly a difference in vegetation and fuel arrangement between overall fuel assessment area A (Sandy Creek) and overall fuel assessment area B (remnant gully) particularly in terms of vegetation density, in accordance with Table 2.3 of AS3959-2009, the vegetation in both locations is classified as **Open Forest**, refer to Figure 11.

With regard to Sub-Stage 1AC (proposed Lot 50002), this area currently accommodates a diversity of vegetation types with differing fuel structures as identified at Figure 11. However, it is noted the vast majority of this area will be cleared for development such that only a small corridor of remnant vegetation will be retained, as identified by the Stage 1 Landscape Master Plan prepared by RPS (2014). At Figure 11, the area of vegetation to be retained is that area which is identified as **Open Forest**, in accordance with Table 2.3 of AS3959-2009



Figure 11: Vegetation Classification for Stage 1 (areas are approximate only)
 (Source: As adapted from Queensland Government, 2014)

5.4 Effective Slope

Effective slope relates to the topography beneath classified vegetation, as this influences fire speed and fire spread - namely, that the speed of fire doubles for every 10 degrees incline. An on-site effective slope assessment has been conducted via site survey data. Figure 12 below illustrates the maximum effective slope relevant to this assessment.

The effective slope characteristics pertaining to Stage 1 are preferable with regard to the extensive area of vegetation to the west which is upslope from the subject site, correlating with a slowing in speed and rate of spread, and likewise fire intensity for any potential fire event approaching the site from the west. As identified previously, typical fire weather in South East Queensland is associated most commonly with hot, dry westerly winds.

The downslope areas illustrate the approximate location of Sandy Creek and the remnant gully which form part of Stage 1.

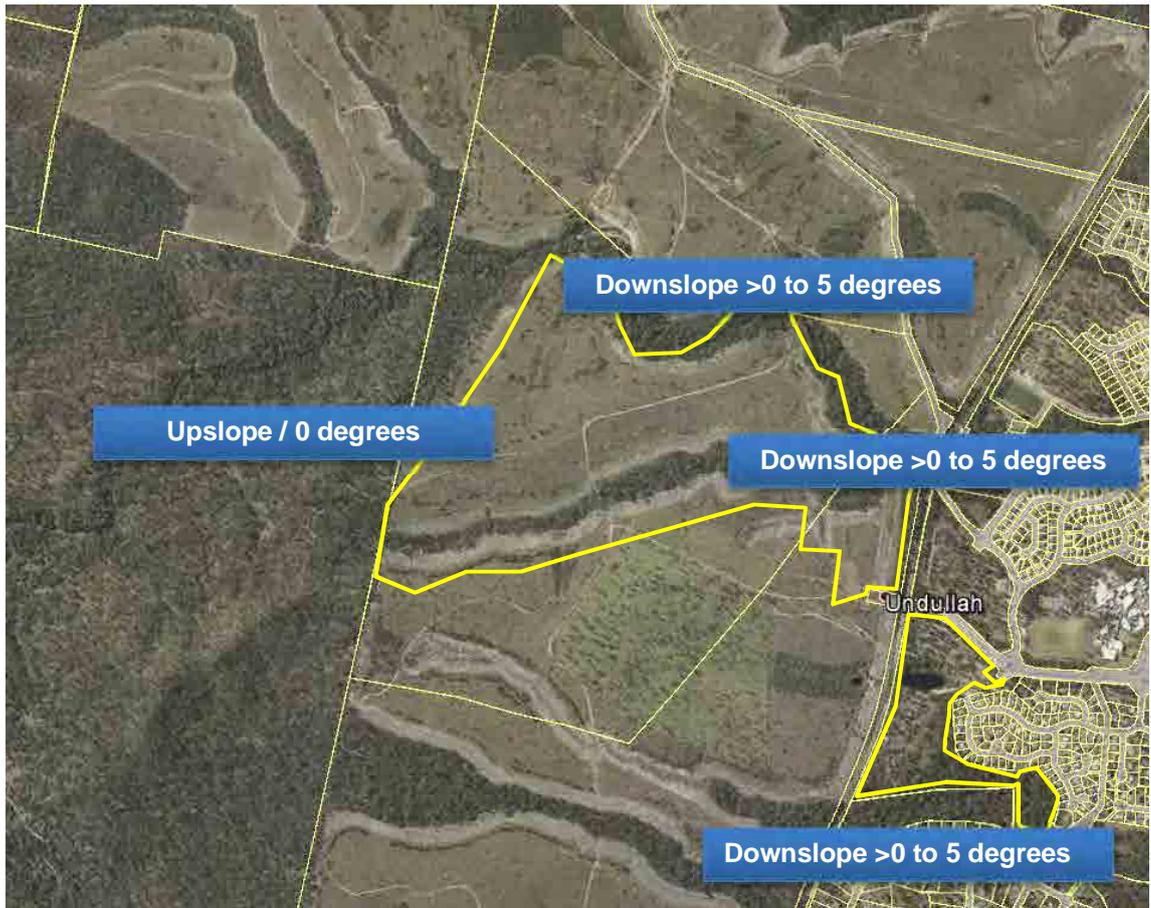


Figure 12: Effective slope relating to Stage 1 (Source: Queensland Government, 2014)

5.5 Site-Based Assessment of Bushfire Hazard

Two types of risk are relevant in terms of bushfire hazard including landscape risk where large expanses of bushland over tens to hundreds of hectares are located in immediate proximity to, and may traverse, urban periphery townships, and local bushfire hazard risk which is most commonly presented by fragmented areas of vegetation larger than 1 hectare in size.

Based on the characteristics of the locality, both landscape and localised bushfire risk is present.

5.5.1 Landscape Fire Risk

The more immediate and extensive risk is that of landscape bushfire by virtue of the site's proximity to vast areas of continuous bushland to the immediate west, north-west and south-west. Landscape fire events are typically a function of the following factors:

- higher fuel loads (particularly where unmanaged land and forests)
- steeper terrain
- higher fire weather conditions
- inaccessible areas with difficulties in early suppression
- long fire runs
- continuity of landscape with few fragmentations of fuel

- instability or increased mixing in the atmosphere above the fire.

These characteristics are typically associated more with south-eastern Australian States which experience periods of prolonged hot, low-humidity days during the spring and summer fire season and are experienced to a lesser degree in Queensland, largely by virtue of increased humidity. Notwithstanding, the potential for landscape fire remains present in this location.

It is noted the Greater Flagstone PDA continues to the north, west and south surrounding the PEET Flagstone West Structure Plan Area such that the exposure to landscape fire risk over time will likely reduce as intervening development sites are cleared. Whilst in the medium term this expectation may translate to a lower level of risk exposure, in the interim the context of landscape fire risk associated with vegetation to the west of the site requires consideration. The mitigation measures and methodology set out in Section 6 of this report seek to respond to the risk profile of the site taking into consideration the context of surrounding vegetation and other influential hazard characteristics such as fire weather, separation distance, orientation and effective slope.

In addition, a range of fire trails traverse the area to the west of the site which provide opportunities for the emergency construction of fire breaks for back burning and defensive firefighting tactics activities should they be required.

Specifically in terms of bushfire behaviour emanating from the west, this will largely be dictated by the weather conditions at the time of possible ignition. The landscape to the west allows for long fire runs with potential for wide fire fronts at a maximum rate of spread (over 100m in width), with speed largely dependant upon wind conditions. Spot fires ahead of the main fire front could be expected, along with considerable ember attack and radiant heat flux based upon fuel loads and fuel connectivity in the area. Opportunities for suppression will be dictated by the nature of the surrounding terrain and the degree to which it is accessible by fire appliances. A number of small dams are located in the wider area which may provide some level of water supply for draughting if required, the largest water storage area being the Coordinator-General's water store facility in Bromelton.

5.5.2 Localised Bushfire Risk

Localised bushfire risk to a lesser degree is also a relevant consideration, relating specifically to Sandy Creek, the remnant gully to the south and patches of bushland vegetation to the east of the site. Fire events in these locations are more likely associated with point ignition (i.e. via ember) rather than an intensive fire run by virtue of location, orientation with regard to the subject site and constrained size / width which, for the most part, would combine to limit any potential fire activity from reaching maximum rate of spread in these particular locations. In addition and upon development, a number of access opportunities traversing these areas will be available providing fire break functions as well as various attack points for fire suppression activities by fire services.

Of relevance in this context is the proposed landscape / rehabilitation / vegetation management activities which are proposed in combination by the Natural Environment Assessment Report for Context Plan Area 1, prepared by Saunders Havill Group; the Natural Environment Site

Strategy (land management strategy) prepared for the Structure Plan area; the Context Plan Area 1 Community Green Space Plan, prepared by RPS; and the Stage 1 Landscape Master Plan, prepared by RPS. The excerpt below from the Landscape Master Plan for State 1 demonstrates the intended landscape and vegetation outcome for both Sandy Creek and the remnant gully to the south.



Figure 13: Excerpt from Stage 1 Landscape Master Plan (Source: RPS, 2014)

As illustrated the remnant gully area to the south will be highly modified from its current form, to provide regional recreational open space and dividing Stage 1 from the future commercial centre to the south which also forms part of Context Plan Area 1. Walking, cycle and horse riding trails will permeate the corridor and provide access to a regional park at the eastern end of the site, doubling as a formal entry statement to the community. A number of stormwater detention basins will be located in this area, between the vegetated corridor and proposed residential allotments. It is also understood the understorey of the corridor will be removed, replaced only with ground covers and retaining only taller tree specimens

As the current vegetated form of the remnant gully area is intended to change substantially over time to align with the landscape intent for Stage 1 it is the case that pursuant to the landscape intent for the remnant gully, once the understorey clearing works are complete within each sub-stage (or unless otherwise identified in Section 6 of this report) the vegetation classification of the corridor, in accordance with Table 2.3 of AS3959-2009, will transition from **Open Forest** as it is categorised at present, to low threat vegetation as per section 2.2.3.2 which identifies 'maintained public reserves and parklands' as low threat vegetation. This is based upon the intended change to the fuel load and fuel structure arrangements which in this case will see only tress specimens retained, with only ground cover plantings and no shrub or elevated fuel layer and large expanses of manicured grass areas. Refer to Figure 13 and Figure 14.

The Sandy Creek corridor is intended to remain largely intact, with only weed management activities undertaken to rehabilitate the existing corridor and the establishment of a parkland buffer on the southern side which similar to the remnant gully area, will accommodate a number of stormwater detention basis and walking trails. To this end, the vegetation classification of

Sandy Creek will remain unchanged for the most part, but will exclude parkland areas illustrated at Figure 13.



Figure 14: Augmented Vegetation Classification for Stage 1 taking account of proposed landscaping changes when developed (areas are approximate only) (Source: As adapted from Queensland Government, 2014)

5.5.3 Influence and Frequency of Fire Weather

Irrespective of the above, it is important to note that bushfire behaviour can fluctuate on any given day, remaining a direct function of fire weather conditions which can change rapidly between hours.

In addition to the above, it is critical to note the FDI provisions pursuant to AS3959-2009 for Queensland provide design parameters which equate to Very High (FDI 25-49) in terms of the Fire Danger Rating (FDR). Thus, fire days in excess of this (Severe, Extreme and Catastrophic) are not accommodated by existing statutory instruments and are therefore beyond design parameters. As recommended by Queensland Fire and Emergency Services (QFES), the only safe option available on such days is to evacuate well ahead of any perceived fire threat.

It is essential that owners and residents maintain an awareness of the local FDR on a frequent basis across the fire season and prepare personal and household bushfire plans. Early evacuation is critical and as recent academic research has identified, waiting to make a decision to evacuate until a particular threat is perceived (i.e. waiting to see smoke) is not an appropriate

response. Owners and residents must mobilise to advance their understanding of what to do in the event of severe, extreme and catastrophic fire weather.

In considering the above, it is important to understand the frequency of these fire weather days in South East Queensland. **In terms of the number of days per decade (10 years) on which an FDI of 50 (Severe) is exceeded is 11.7 days, and an FDI of 75 (Extreme to Catastrophic) is exceeded only 0.9 days out of each decade** (Lucas, 2007). The influence of climate change may alter these statistics into the future however at present, this data accurately indicates the current risk profile posed by such fire weather conditions.

6

BUSHFIRE MANAGEMENT AND MITIGATION MEASURES

This report identifies a range of bushfire hazard mitigation measures which focus on increasing resilience to bushfire attack via a range of methodologies, as well as balancing the site's important natural functions and ecological values. Essentially, the mitigation methodologies are focused upon:

- vegetation management and landscaping approaches for fuel management and biodiversity conservation
- the use of firebreaks
- accessibility and egress
- fencing and retaining provisions
- water supply and firefighting infrastructure
- bushfire awareness and education
- building construction requirements.

The Bushfire Management Plan for Stage 1 which incorporates these approaches is included at **Attachment B**.

6.1 Vegetation Management and Landscaping

The proposed development comprises a number of parkland and retained vegetation areas. The bushland areas and corridors which adjoin the development site must be managed so as to reduce the build-up of unacceptable fuel loads. It is understood the majority of the Sandy Creek corridor will remain intact, subject to weed management activities, and will encompass a parkland buffer to the north and north-western areas of the proposed development. Regular inspections by the Council and local rural fire brigade are required to limit the opportunity for increased fire intensity by virtue of ground fuel load build-up and the propagation of weeds or swathes of long grass where in proximity to the site.

Management processes should ideally be undertaken prior to and during summer. Prescribed burning should only occur during winter months when the FFDI is low and weather conditions permit. The management of bushland surrounding the site should be included in Council's bushfire management plan and undertaken in accordance with Council policy.

It is understood the intent for the remnant gully corridor will undergo significant change from its current state and will transfer to parkland use upon its development. Based upon information contained within the Stage 1 Landscape Master Plan and Context Plan Area 1 Community Green Space Plan prepared for the proposed development, the landscape intent for this area is for understorey clearing with only taller tree specimens retained, allowing the space to accommodate a range of recreational facilities.

Based upon the above the vegetation management and clearing approaches for Sandy Creek and the remnant gully corridor are quite unique and thus contemplated separately in the sections below and subsequent to the following rationale:

- limiting potential for fuel accumulation on the site
- breaking opportunities for propagation of fire
- implementing fuel / fire breaks
- ensuring inner and outer defendable space zones are implemented and maintained in perpetuity
- landscape design which does not inadvertently increase bushfire attack risk.

6.1.1 Sandy Creek Corridor and Adjoining Parkland Buffer

It is noted the intent for the Sandy Creek corridor is for its retention, subject only to weed management activity and a break for a future arterial road which will transect the corridor to a width of approximately 33m (however until this break is cleared, the corridor remains linked to broader areas of vegetation to the west which for the time being, also remains intact). Taking into consideration the importance of such an approach from an ecology and natural systems perspective, clearing in this location could potentially lead to substantial erosion and scouring issues which may lead to water quality concerns. From a habitat perspective, retention of existing established vegetation is also of significance.

This being the case, this assessment accepts the retention of this corridor of vegetation and develops a range of mitigation measures in response. These measures principally relate to the landscape treatment of the parkland buffer between Sandy Creek and proposed residential allotments, as well as fencing, retaining and building construction requirements. The latter are dealt with in following sections of this report.

6.1.2 Sandy Creek Corridor Parkland Buffer Clearing

Based upon the retention of established vegetation along the Sandy Creek corridor, including the understorey and canopy, the landscape treatment of the intervening buffer area is critical in ensuring that potential bushfire risk is limited only to the vegetated corridor and is not inadvertently invited into the parkland buffer area.

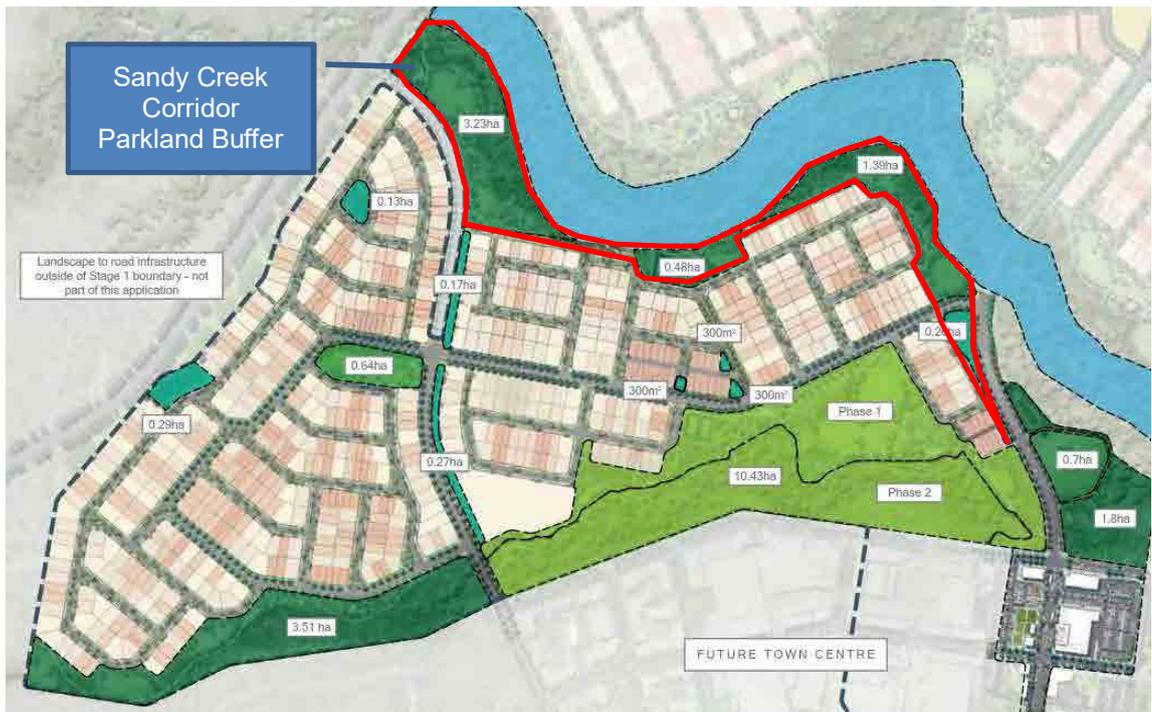


Figure 15: Proposed Landscape Structure with Parkland Buffer Highlighted in Red (Source: RPS, 2014)

Walking trails and stormwater detention basins are proposed within this area along with manicured landscaped areas.

The clearing requirements for this parkland buffer area are very specific. The parkland buffer is to be cleared of all relevant vegetation in accordance with the below guideline for a distance no less than 100m from the edge of each property boundary or Sub-Stage prior to the registration of any allotment title to the edge of the vegetated corridor (and not within):

- any established or emerging understorey (ground covers and shrubs) is to be completely cleared
- established trees may only be retained where canopy is isolated from that of other trees, retained only as scattered individuals and not in groups
- stringy barks, ribbon or candle barks, melaleuca species and any other tree species with fine-fibrous bark types are to be removed
- maintain a 10m separation distance between any parkland buffer tree canopies and tree canopy of the Sandy Creek corridor
- no tree species are retained within 10m of any proposed residential allotment
- grassed areas within the parkland buffer are maintained and regularly mowed, not exceeding a height of approximately 10cm, particular during annual fire seasons.

Vegetation clearing in accordance with this specific guideline will ensure the parkland buffer does not inadvertently contribute to bushfire hazard at the time purchasers seek building approval. It is critical these activities be undertaken for a minimum distance of 100m from the nearest property boundary / Sub-Stage boundary within the parkland buffer. To clarify, these provisions do not require any clearing within the Sandy Creek Corridor as outlined at **Attachment B**, but relate only to clearing within the identified buffer area. Should the buffer area not be cleared within 100m (excluding the vegetated corridor to be retained) of relevant

property boundaries, BAL construction requirements may be required in accordance with the plan in Attachment B.

This approach will ultimately lead to the staged clearing of the parkland buffer in a manner which limits fire risk within the parkland buffer on an interim basis.

In the longer term, the construction of the New Beith Arterial Road extension within Context Plan Area 3 and adjacent to the western boundary of Stage 1 and Context Plan Area 1 will provide a break across Sandy Creek Corridor of approximately 33m in width. This will provide for an effective fire break to that part of the corridor bounding Stage 1. When introduced, this break will ultimately alter the fire hazard of the corridor from potential line ignition (fire front) to point ignition (spotting), which is generally of lower intensity, slower moving and provides more opportunity for fire suppression. Notwithstanding, the future break this road reserve will provide does not alter the vegetation classification of Sandy Creek which will continue to be Open Forest, but will substantially alter the hazard profile associated with the spread of fire within the corridor.

6.1.3 Sandy Creek Corridor Parkland Buffer Landscaping

The landscaping intent of the parkland buffer, similarly to clearing, must not inadvertently allow for fire propagation. Landscaping of the parkland buffer is to be undertaken in accordance with the following:

- tree planting is to be undertaken as isolated specimens and not in groups
- any shrub planting within the parkland buffer are not located within the drip zone of any tree canopy and may only form small groupings where entirely isolated from tree species and not within 10m of the edge of the Sandy Creek corridor
- any ground cover plantings must not exceed 1m in height
- maintain a 10m low-fuel (mown grass cover) buffer between landscaped areas of the parkland buffer and that area of the buffer which has not yet been cleared (until landscaping is complete)
- shrub and tree planting is not undertaken within 10m of any residential property boundary
- avoid the use of garden mulch where possible and instead replace with alternatives such as stones, gravel, scoria, pebbles, shells or the like with a low level of flammability
- all plantings are selected in accordance with the CFA's 'Landscaping for Bushfire' Plant Selection Key which identifies essential characteristics for 'fire-wise' species – being those species which are less likely to propagate flame.

Collectively with the clearing guidelines above, the landscaping provisions identified here seek to ensure the parkland buffer provides an area of defensible space for adjoining residential areas which does not contribute to bushfire hazard.

As referenced above, the CFA has produced a 'Plant Selection Key' to assist in the identification of suitable 'fire-wise' plantings. The Country Fire Service of South Australia, New South Wales Fire Service and the Tasmania Fire Service have all prepared lists of less flammable species which are suitable for landscaping purposes relevant to their respective

jurisdictions. The CFA in particular has done much work focusing on the characteristics of 'fire-wise' plants as opposed to specific species, thus rendering it more relevant on a national level.

'Fire-wise' species maintain a number of characteristics which reduce their propensity for ignition. In detail:

- any trees or shrubs must comprise smoother bark or attached tightly on trunks as opposed to loose, fibrous, stringy or ribbon bark. Avoid species which shed bark on an annual basis
- select species with a high moisture content, with coarse and broad leaves which are thinly spread such as succulents
- select species with foliage which is less dense and open and loosely branching.

A copy of the CFA's 'Landscaping for Bushfire' Guideline and including its Plant Selection Key are provided at **Attachment C**.

Notwithstanding the above and irrespective of the characteristics of such species, certain weather conditions can impact upon the propensity for ignition and propagation of fire within any vegetation. It must be noted that no vegetation can be considered 'fire proof'.

It is noted the easiest and most effective way of managing bushfire threat is to monitor and reduce ground fuel loads and regrowth. Year-round maintenance is required to ensure excess or build-up of ground fuels (dead plant material) is removed prior to and during each annual fire season. The above requirements should ideally be managed in perpetuity by the Council in accordance with its bushfire management plans for the area.

6.1.4 Remnant Gully Corridor Clearing

It is noted the Regional Recreation Park (the eastern area of the corridor) will be entirely cleared of all understorey to make way for parkland. Only tree specimens will be retained.

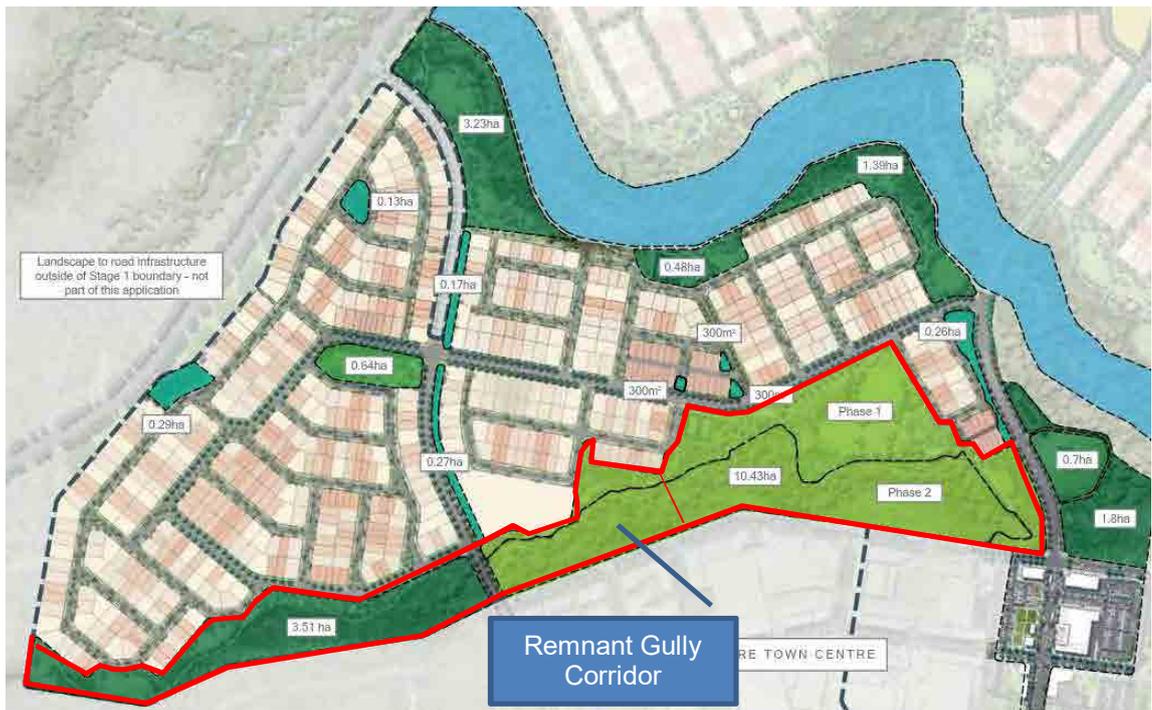


Figure 16: Proposed Landscape Structure with Corridor Highlighted in Red (Source: RPS, 2014)

Again, the clearing requirements for this corridor are very specific. The Regional Recreational Park component of the corridor is to be cleared of all understorey vegetation in accordance with the below guideline for a distance no less than 100m from the edge of each property boundary or Sub-Stage prior to the registration of any allotment title to the edge of the vegetated corridor (and not within):

- any established or emerging understorey (ground covers and shrubs) is to be completely cleared
- established trees may be retained however, thinning is recommended where possible, particularly the removal of thinner-trunked trees (up to 6cm diameter)
- stringy barks, ribbon or candle barks, melaleuca species and any other tree species with fine-fibrous bark types are to be removed
- no tree species are retained within 10m of any proposed residential allotment
- grassland is maintained and regularly mowed, not exceeding a maximum height of 10cm, particularly during annual fire seasons.

Vegetation clearing in accordance with this specific guideline will ensure the parkland area of the corridor does not inadvertently contribute to bushfire hazard at the time purchasers seek building approval. It is critical these activities be undertaken for a minimum distance of 100m from the nearest property boundary / Sub-Stage boundary to the corridor within the parkland buffer. To clarify, these provisions do not require any clearing within the Remnant Gully Corridor itself, but relate only to clearing within parkland buffer areas. Should the buffer area not be cleared within 100m (excluding the vegetated corridor to be retained) of relevant property boundaries, BAL construction requirements may be required and a further BAL assessment will be necessary.

This approach will ultimately lead to the staged clearing of the corridor in a manner which limits fire risk within the corridor on an interim basis.

With regard to the corridor park component of the corridor, being the western area of the corridor, the clearing extent of vegetation in this location in terms of accurate widths is unknown at this stage however, as per the Landscape Master Plan Report prepared by RPS, areas of managed and manicured parkland will adjoin forming a buffer between the vegetated corridor area and proposed allotments. A clear distinction between the vegetated corridor and adjoining parkland buffer areas must be made and implemented in accordance with those principals outlined in Section 6.1.2 of this report.

6.1.5 Remnant Gully Corridor Landscaping

The landscaping intent of the corridor, similarly to clearing, must not inadvertently allow for fire propagation. Landscaping of the corridor is to be undertaken in accordance with the following:

- any further tree planting is to be undertaken as isolated specimens and not in groups
- shrub planting within the corridor is avoided where possible and if required, are not located within the drip zone of any tree canopy and may only form small groupings where entirely isolated from tree species
- any ground cover plantings must not exceed 1m in height, or 500mm where within the drip zone of any tree specimen
- maintain a 10m low-fuel (mown grass cover) buffer between landscaped areas of the corridor and that area of the corridor which has not yet been cleared (until landscaping is complete)
- shrub and tree planting is not undertaken within 10m of any residential property boundary
- avoid the use of garden mulch where possible and instead replace with alternatives such as stones, gravel, scoria, pebbles, shells or the like with a low level of flammability
- all plantings are selected in accordance with the CFA's 'Landscaping for Bushfire' Plant Selection Key which identifies essential characteristics for 'fire-wise' species – being those species which are less likely to propagate flame (refer to **Attachment C**).

Collectively with the clearing guidelines above, the landscaping provisions identified here seek to ensure the corridor provides an area of defensible space for adjoining residential areas which does not contribute to bushfire hazard.

Notwithstanding the above and irrespective of the characteristics of such species, certain weather conditions can impact upon the propensity for ignition and propagation of fire within any vegetation. It must be noted that no vegetation can be considered 'fire proof'.

It is noted the easiest and most effective way of managing bushfire threat is to monitor and reduce ground fuel loads and regrowth. Year-round maintenance is required to ensure excess or build-up of ground fuels (dead plant material) is removed prior to and during each annual fire season.

6.1.6 Local Parkland Areas

A small number of local parks are identified throughout Stage 1. In terms of the clearing and landscaping rationale to mitigate bushfire hazard in these locations, local parkland areas must be designed and constructed in accordance with the following provisions:

- any established or emerging understorey (ground covers and shrubs) is to be removed where located in the drip line of any retained or planted tree and may only form small groupings where entirely isolated from tree species
- established trees may be retained where isolated from other tree canopies or in small groups but ensuring continuous canopy cover across the park does not ensue
- protected vegetation may be retained
- no tree species are retained within 10m of any proposed residential allotment
- grassland is maintained and regularly mowed, not exceeding a height of approximately 10cm, particularly during annual fire seasons
- any further tree planting is ideally undertaken as isolated specimens and not in groups
- any ground cover plantings must not exceed 1m in height, or 500mm where within the drip zone of any tree specimen
- shrub and tree planting is not undertaken within 10m of any residential property boundary
- all plantings are selected in accordance with the CFA's 'Landscaping for Bushfire' Plant Selection Key which identifies essential characteristics for 'fire-wise' species – being those species which are less likely to propagate flame.

Collectively, the retention, thinning and landscaping provisions identified here seek to ensure local parkland areas provide an area of defensible space for adjoining residential areas which does not contribute to bushfire hazard, namely via spotting from ember attack.

Notwithstanding the above and irrespective of the characteristics of such species, certain weather conditions can impact upon the propensity for ignition and propagation of fire within any vegetation. It must be noted that no vegetation can be considered 'fire proof'.

6.1.7 Landscaping for Residential Allotments

The landscaping rationale for private residential allotments plays a significant role in enhancing the ability of dwellings to withstand bushfire attack. Landscape design and plant selection is a critical element.

As identified above, the CFA's Plant Selection Key and 'Landscaping for Bushfire' Guideline provide a range of helpful tips for purchasers to consider when landscaping their properties. For example, it is recommended that purchasers:

- do not provide garden beds immediately adjoining a house or garage, but instead provide a gravel or concrete path at least 500mm in width
- select plants which accord with the characteristics outlined in the CFA's Plant Selection Key

- ensure vegetation layers avoid providing horizontal and / or vertical fuel continuity by separating out plant types by height and groupings
- consider the type of plants located near any windows or doors which may apply heat to glazing
- consider plantings which help to filter possible embers and wind but are of a nature which complies with the CFA's Plant Selection Key.

It is recommended a copy of the CFA's 'Landscaping for Bushfire' Guideline be provided to all property purchasers, a copy of this document is included at **Attachment C**.

6.1.8 Fire Management Approaches for Biodiversity Conservation

The context of this assessment aptly recognises the essential need for fire management approaches which address bushfire hazard in terms of life and property, but also with regard to the environment and the conservation of biodiversity values. With respect to Stage 1, this report most certainly reflects the ecological import of the Sandy Creek Corridor and the remnant gully corridor as well as lands adjoining Stage 1. Parkland buffer areas adjoining the Sandy Creek Corridor will be substantially altered by the presence of stormwater detention and public amenity facilities such as walking trails and grassed areas for general open space purposes. Certainly, the landscaping and vegetation management approaches adopted by this report are not inconsistent with the intent for these areas, but prescribe a range of specific measures to limit possible fire intrusion. A similar approach has been adopted with respect to the remnant gully corridor. To this end, it is not considered that this report seeks the removal of vegetation which maintains substantial biodiversity values, thus ensuring biodiversity and ecological values are retained.

Notwithstanding the above, it is critical to note that an appropriate fire regime is of significant importance to the retention of biodiversity. Whilst the ecological intent of this report focuses on the retention of vegetation, ecological and fire service advice with regard to prescription burning should be explored in terms of implementing a suitable fire threshold timeframe relevant to the particular species composition for the corridor areas which adjoin Stage 1.

6.2 Fire Breaks and Fire Trails

Stage 1 is of a design which largely negates the need for any specific fire trail or fire break network to be established above and beyond that required to manage the overall Structure Plan Area (refer to Master BHMP). However, there do remain two areas which attract specific requirements. In the first instance, an interim fire break is required immediately adjoining the western boundary of Stage 1 and in an area which forms part of Context Plan Area 3, refer to **Attachment B**. A future major road connection is identified in this location. It is required to clear this area between the rear property boundary of allotments in Stage 1 and the western alignment of this future road reserve. This fire break will assist in moderating any potential impact of landscape fire to the west of the site, on an interim basis.

It is also required to maintain a 5m fire break around property boundaries adjoining any proposed parkland areas. This area is to be maintained to the following standards:

- all vegetation from the fire break is removed
- fire break is to incorporate grass cover and be regularly mowed (no taller than 10cm)
- vehicle access to fire break must be available at all times (i.e. not via a locked gate)
- appropriate drainage and erosion controls are to be provided
- fire break is to be regularly inspected and maintained, particularly in the lead up to annual fire seasons. On-going vegetation management is required to mitigate opportunity for vegetation encroachment.

In addition, it is noted a pedestrian walking path is proposed across Sandy Creek, adjacent to Sub-Stage 1C. It is recommended this creek crossing be constructed to incorporate a pavement width of 4m and be of suitable construction to allow 4 wheel drive fire appliance access in emergency situations. In terms of when this connection is required to be constructed, it need not be constructed as part of Stage 1 but should be provided as part of landscaping works associated with the development of the stage to the immediate north of Sandy Creek.

6.3 Road Networks, Access, Egress and Evacuation

Road design is significant in terms of a range of aspects of bushfire prevention and ability for bushfire fighting. Road design must also cater for emergency access and egress in times of potential bushfire events.

The site's primary access to the established road network is provided via Homestead Drive which is the central road access point for the Flagstone Estate. Homestead Drive is a 4 lane, dual carriageway road with a 70km/hour speed limit. Established areas of the Flagstone Estate convey traffic onto Homestead Drive which provides connections to surrounding areas, including Jimboomba.

With the future development of the PEET Flagstone West Structure Plan, alternate road access to the north and south will also eventually be provided however, in the interim Homestead Drive will remain the primary source of access and egress for Stage 1.

The proposed Stage 1 road network incorporates a primary north / south collector and an east / west collector, with local streets emanating from these main traffic corridors. The proposed road network avoids cul-de-sacs in the western area of subdivision which allows for a multitude of route options for emergency access and egress.

At each stage of road construction, adjoining creek buffer areas will need to be cleared to the extent outlined in accordance with Section 6.1 of this report for a minimum distance of 100m (with the exception of corridor vegetation itself) to ensure these areas do not present an interim risk in terms of emergency access and evacuation. Specifically, the minor road network adjoining the Homestead Drive connection to the site (Sub-Stage 1A) must incorporate plastic bushfire-friendly bollards which are easily removed or collapsible to provide an informal access / egress opportunity should the need arise.

The proposed and existing road networks are of a design which allows for a high level of access and egress throughout Stage 1 and via Homestead Drive. Notwithstanding, network demand in the event of emergency can be considerable. Residents are encouraged to consider their

evacuation route and evacuation destination prior to any specific bushfire event and at what stage they will evacuate ensuring it is early enough to ensure safe evacuation. Residents are strongly discouraged from adopting a 'wait and see' approach and should prepare a personal / household bushfire survival plan and ideally, speak with officers of the local rural fire brigade for advice in advance of any particular bushfire event.

6.4 Fencing and Retaining

Fencing materials can have a considerable impact on the propagation of fire. Likewise, some fencing materials can alleviate exposure to radiant heat which can assist life and property survival. Timber fencing material is the most common form of fencing in urban residential areas. However, fire resistant and fire retardant materials are considered more appropriate than timber. For those dwelling units subject to BAL-12.5 or above and those allotments sharing a boundary with either the Sandy Creek or remnant gully corridors, it is recommended that open style metal (pool), Colorbond or masonry fencing is utilised in lieu of timber fencing to provide an additional level of protection against potential radiant heat exposure and also, potential sources of ember attack and radiant heat emanating from directly adjacent combustible materials (being the fence itself should it catch alight). Specific provisions for fencing in some locations are illustrated at **Attachment B**. Traditional timber paling fences (including side returns) are not recommended in these locations.

In addition, any retaining walls required in the area of dwelling units requiring BAL-12.5 or above should be constructed of fire resistant or fire retardant material such as concrete, stone, masonry or the like and not constructed from timber.

6.5 Water Supply and Firefighting Infrastructure

It is understood the site is connected to reticulated water. As per any new residential subdivision the reticulated water network must comply with Council's Subdivision Design and Construction Manual, which includes specific provisions for fire-fighting requirements. It is understood the site is serviced by a low pressure reticulated water supply with fire hydrants.

In some circumstances, reticulated water (pressure or supply) may not be guaranteed in the event of bushfire. This can be for a number of reasons including power outages to pump stations or damage to pump stations via bushfire or large amounts of water being drawn from the mains by fire services and the wider community. On this basis, the provision of 2,500 litre or 5,000 litre household water tanks or pool capable of draughting water for personal firefighting use in the event of ember attack may be a worthwhile consideration for property owners. Whilst this is not mandatory, it is considered a beneficial investment in terms of personal fire protection.

Should water tanks be provided, they are not to be constructed of any material which may fail when exposed to excessive heat and must be located on that side of the building which is furthest away from any nearby bushland vegetation. Access around the entire perimeter of each dwelling should be maintained and any hoses and equipment should likewise be capable of reaching all external areas of the dwelling, including roof valleys.

External hose connections both to reticulated water supplies and directly to the storage tank are recommended.

External fire-fighting systems for dwellings, such as 30m fire hoses and roof and gutter-mounted sprinkler systems, may be contemplated by prospective owners to enhance fire-fighting ability however, this is not specifically required. It is noted that such systems do have certain limitations which should be considered prior to installation, if so desired. Such systems cannot guarantee the preservation of life or property in the event of a bushfire.

Plastic gas fittings are not acceptable.

6.6 Bushfire Awareness

Landowners are responsible for developing their own knowledge and understanding of the level of bushfire risk specific to their respective property. A household bushfire plan is strongly recommended and must take account of matters such as where occupants are during the day (at home, work or school), if any occupants require special assistance (i.e infants, the elderly or the ill), evacuation routes available, evacuation destinations, property maintenance and preparation and arrangements for pets. Planning ahead of any perceived bushfire event is essential.

Understanding what to do in the event of bushfire emergency is critical, residents may not always receive an extended warning or warning to evacuate and fire appliances may not always be available to render assistance. Thus, prior knowledge as to the steps to take during the lead up to a fire event, during the passage of bushfire and what to do immediately after the fire front has passed is critical.

The RFSQ's 'Bushfire Survival Plan' provides detailed information on how to prepare for the bushfire season and how to take action to survive in the event of bushfire. A copy of this publication is enclosed at **Attachment D**.

Alternatively, residents are encouraged to volunteer with the local rural fire brigade to not only gain bushfire education which can be shared with family, friends and neighbours, but assist the local community in a variety of capacities. More information on rural fire brigade volunteering is available at <https://ruralfire.qld.gov.au/>.

6.7 Building Construction Requirements

Bushfire attack levels (BAL) are derived from AS3959-2009 to distinguish the level of attack buildings may experience based on a range of factors, being those addressed in Section 5.

A BAL is defined as '*a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire*' (Standards Australia, 2011).

Vegetation typologies, effective slope and separation distances maintain a significant bearing on the likely behaviour and intensity of a bushfire and how these factors may combine to impact upon nearby buildings.

The Australian Standard adopts six distinct BAL categories including a 'low' category for areas where bushfire risk is limited, these categories are outlined below. The categories themselves are based upon the level of radiant heat flux which may be experienced during a bushfire event and generally relates to how close or far a building is from classifiable vegetation. These BAL levels are translated to specific construction requirements to enhance the ability of buildings to withstand bushfire attack.

BUSHFIRE ATTACK LEVELS AND CORRESPONDING SECTIONS FOR SPECIFIC CONSTRUCTION REQUIREMENTS

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and heat flux exposure thresholds	Description of predicted bushfire attack and levels of exposure
BAL—LOW	See Clause 2.2.3.2	There is insufficient risk to warrant specific construction requirements
BAL—12.5	$\leq 12.5 \text{ kW/m}^2$	Ember attack
BAL—19	$> 12.5 \text{ kW/m}^2$ $\leq 19 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux
BAL—29	$> 19 \text{ kW/m}^2$ $\leq 29 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux
BAL—40	$> 29 \text{ kW/m}^2$ $\leq 40 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux with the increased likelihood of exposure to flames
BAL—FZ	$> 40 \text{ kW/m}^2$	Direct exposure to flames from fire front in addition to heat flux and ember attack

Figure 16: Excerpt from AS3959-2009 (Source: Standards Australia, 2011)

Attachment B includes the Bushfire Management Plan for the site which is to be read in conjunction with this report.

For the most part, the majority of the Stage 1 development does not require any specific, mandatory building construction requirements. Those allotments which are subject to construction standards are located to the west, north and north-west of the site. The majority of those allotments which require building construction standards in accordance with AS3959-2009 are subject to BAL-12.5 which is lowest bushfire mitigation construction category within the Standard. A small number of BAL-19 and BAL-29 allotments are identified.

It is recommended that those lots immediately adjoining the western boundary of Stage 1 to the south-west will be subject to BAL-40 and BAL-FZ until such a time as clearing and / or development of the adjoining property to the west is undertaken. To this end, a select number of these properties may only be registered on title and delivered to market when these allotments

can achieve a BAL classification of BAL-29 or less, refer to **Attachment B**. A bushfire inspection and assessment of this specific area will need to be undertaken prior to these lots being released to the market.

In the interim, these lots are to be cleared and formed and left vacant, providing a buffer area to adjacent BAL-12.5 allotments and other lots. These lots will need to be managed in a low-fuel condition (i.e. regularly mowed) until they are developed.

In addition, it is noted the vegetation and landscape intent of the corridor park component of the remnant gully corridor is not yet clear, specifically with regard to the extent of clearing and / or management within the corridor park areas of the corridor. It is noted the Regional Recreation Park which forms part of the corridor will be entirely managed with the understorey removed and maintained in a manicured parkland condition. That area of the remnant gully corridor which is not subject to understorey clearing will require a site-specific BAL assessment to be conducted at the time of building approval based on the conditions which exist at that time, given the current unknowns associated with the extent of vegetation which may not be entirely managed in this location. The allotments which are subject to these provisions are identified at **Attachment B**.

6.7.1 Limitations of AS3959-2009

The Australian Standard provides that although its provisions are:

'designed to improve the performance of buildings when subjected to bushfire attack in designated bushfire-prone areas there can be no guarantee that a building will survive a bushfire event on every occasion. This is substantially due to the unpredictable nature and behaviour of fire and extreme weather conditions.'

It is significant to also understand the objective of AS3959-2009, which is to *'prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:*

- a) potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and*
- b) intensity of the bushfire attack on the building.'*

Further and as set out previously in this report, the FFDI provisions pursuant to AS3959-2009 adopted for Queensland is 40 and as such the design parameters in this context are designed to a maximum of Very High (FDI 25-49). Thus, fire days in excess of this (Severe, Extreme and Catastrophic days) are not accommodated by existing statutory building instruments and is beyond design parameters. As advised by the RFSQ at **Attachment D**, early evacuation on fire danger days above Very High is recommended, even if properties are well-prepared and no immediate fire threat exists.

Importantly, the enhancement of survival of life and property relies upon a range of mitigation measures, including regular and on-going property and vegetation management as well as BAL construction requirements. Again, whilst all reasonable care and diligence has been applied throughout the preparation of this assessment and the identification of BAL provisions, these

provisions in no way form a guarantee against the loss of life or property as a result of bushfire and it remains the responsibility of property owners to investigate, self-educate and understand how best to protect their property and lives in the event of bushfire. A range of helpful resources are listed in Section 10 of this report.

6.7.2 Building Design to Reduce BAL-Compliance Costs

Certain building design approaches can effectively decrease construction costs associated with meeting the provisions of AS3959-2009. Some of these approaches include:

- consider on-site setbacks which may decrease BAL classes, the further a dwelling is from nearby vegetation the lower the building specifications
- slab on ground construction
- brick / masonry / concrete veneer as opposed to timber cladding
- consideration of the location of windows and window design, avoiding floor-to-ceiling glazing and raising windows at least 400mm off the ground and away from any adjoining timber structures such as decking
- consideration of more simple designs which avoid numerous roof valleys and avoiding re-entrant corners around the building
- consideration of door locations and door types, some types more affordably meet AS3959-2009 than others (i.e. consider avoiding bi-fold doors)
- stainless steel security screening to doors and windows and aluminium roller shutters (shutters may not be essential but may be more affordable than specified glazing requirements)
- avoid timber framing to windows and doors where applicable, which require selected timbers to a bushfire resistant density
- avoid entry sidelights
- avoid unnecessary skylights and certain roof ventilation systems (i.e. whirlybirds) to avoid additional need for ember guarding
- select non-combustible material for garage doors and frames as opposed to timber materials which must be of bushfire-resisting density
- consider the need for timber decking and / or other timber structures which may be located adjoining or affixed to the main dwelling and which would require bushfire resisting timber for construction.

Informed building design can substantially decrease costs associated with ember and radiant heat protection construction methodologies. Purchasers are strongly recommended to consult their builder and private certifier with respect to these opportunities in advance of dwelling design selection to maximise the opportunity for construction savings.

7

MANAGEMENT OF BALANCE OF CONTEXT PLAN AREA 1

Stage 1 is located toward the centre of Context Plan Area 1 (and adjacent to part of Context Plan Area 3) and upon development, will adjoin areas which have not yet been developed. The land management regime from this perspective is of significance to the ongoing safety of people and property in Stage 1.

It is noted a previous clearing and land management regime has been adopted by the developer with regard to the ongoing management of these areas, in accordance with the endorsed Natural Environment OSS which has been previously approved by EDQ.

As evidenced in Figure 1, these areas to the north and south of Stage 1 have been cleared and now comprise mostly grasslands with the isolated tree species or regrowth vegetation and creek and gully areas which continue to provide vegetated corridors.

Taking into account the development of Stage 1, the grassland areas to the north and south within Context Plan Area 1 must be managed to maintain a low-fuel environment to limit any potential grassland fire from spreading to adjoining vegetated corridors or vice versa. During the site inspection, grasslands in some locations were approximately 1m in height. More frequent grass management activity must occur across Context Plan Area 1 to limit the height of grasslands to no more than 500mm. It is acknowledged that more regular management over such a large area is significant. To this end, it is recommended that a 50m wide buffer between grasslands and all vegetated corridors forming part of Context Plan Area 1 be established and this buffer maintained in a low-fuel condition with grasses not exceeding approximately 10cm in height.

Regular inspections by the appointed land manager, Council and local rural fire brigade are required to limit the opportunity for increased fire intensity by virtue of ground fuel load build-up and the propagation of weeds or swathes of long grass where located in Context Plan Area 1.

More intensive management processes should ideally be undertaken prior to and during summer. Prescribed burning should only occur during winter months when the FFDI is low and weather conditions permit.

Other management and mitigation provisions as outlined in the accompanying Master Bushfire Hazard Management Plan will also apply.

8

FUTURE DEVELOPMENT STAGES AND BUSHFIRE RISK

It is noted that a Master Bushfire Hazard Management Plan (BHMP) is concurrently being prepared for the PEET Flagstone West Structure Plan Area, of which this report must remain entirely consistent. Notwithstanding the intent of the Master BHMP, bushfire hazard assessment reports will be required for each individual Stage of development in order to critically assess subdivision design with a view to bushfire hazard mitigation measures.

These future reports must be prepared in accordance with the Master BHMP which will seek to manage bushfire risk on an interim basis as development of the Structure Plan Area occurs over time.

9

SUMMARY OF RECOMMENDATIONS

This report contains a number of recommendations relating to specific bushfire mitigation measures. These recommendations are summarised below and must be implemented by the developer, purchasers and / or Logan City Council.

1. Provide a copy of this report to EDQ for approval
2. Provide a copy of this report to Logan City Council, the local rural fire brigade and all current and potential purchasers for review and information purposes
3. Carry out proposed development in accordance with the measures identified in this report and as per the Bushfire Management Plan at **Attachment B**
4. Ensure registration of properties specifically identified at **Attachment B** is not undertaken until these identified allotments can achieve a BAL classification of BAL-29 or less. Interim clearing provisions apply to these allotments
5. Ensure each property identified at **Attachment B** requiring a future BAL assessment (where adjacent to the corridor park component of the remnant gully corridor) is assessed against the provisions of AS3959-2009 prior to building approval
6. Undertake site clearing requirements as outlined at Section 6
7. Undertake all landscaping activity in accordance with the provisions set out in Section 6
8. Ensure clearing as identified at Section 6 is carried out within a minimum distance of 100m (excluding the vegetated corridors to be retained) of the nearest residential property boundary and / or Sub-Stage boundary within the parkland buffer areas prior to registration of residential allotment titling to ensure parkland buffers areas do not inadvertently influence bushfire risk. Should this parkland buffer clearing not occur prior to allotment title registration, a further BAL assessment for each allotment within 100m of vegetation is required prior to building approval as per AS3959-2009
9. Establish a 5m wide firebreak (as per provisions set out in Section 6) around all residential allotments which share a boundary with either the Sandy Creek parkland buffer or the remnant gully corridor, with an additional 5m outer zone which includes ground cover plantings only. No tree or shrub specimens are provided within 10m of these shared boundaries
10. Provide fencing and retaining as per provisions set out at Section 6 and as noted on the Bushfire Management Plan at **Attachment B**
11. Provide a firebreak within Context Plan Area 3, immediately adjoining Stage 1 to the west as dimensioned on the Bushfire Management Plan at **Attachment B** and as provided by the Master Bushfire Hazard Management Plan for the PEET Flagstone West Structure Plan Area
12. Ensure property setbacks and BAL provisions comply as per the requirements set out at **Attachment B**, or unless otherwise assessed by a qualified specialist or building certifier where a property-specific assessment is undertaken pursuant to AS3959-2009

13. Potential purchasers seek advice from a qualified and registered builder, suitably qualified bushfire specialist and / or building certifier with regard to the construction requirements identified for respective properties set out in **Attachment B**
14. Ensure the collective range of bushfire mitigation measures as identified within this report and illustrated at **Attachment B** are implemented to ensure the bushfire attack levels identified can be achieved
15. Regular inspections and maintenance of all vegetated corridors adjoining the subject site is required (at least once quarterly). Removal of ground fuel matter and management of vegetation (mowing, pruning, thinning, etc) is required prior to every fire season
16. Manage vegetation in the balance area of Context Plan Area 1 in accordance with measures identified at Section 7 of the report and in accordance with the Master Bushfire Hazard Management Plan
17. The CFA's 'Landscaping for Bushfire' guide is utilised in garden design and plant selection process for all parkland areas and residential properties. Purchasers should be aware of how to create and maintain a 'fire-wise' garden so as to limit fuels surrounding dwellings
18. Plastic gas fittings for individual dwellings are not acceptable and should not to be used
19. Purchasers should consider additional fire preparedness at the dwelling design stage. This may be in the form of:
 - a. limiting the number of roof valleys and wall articulations (forming re-entrant corners) so as to reduce the number of points around the dwelling where embers may lodge and accumulate
 - b. include window and door sills of 18 degrees or higher to allow embers to easily roll off or blow away
 - c. consider glass type and protection such that, to reduce the possibility of fracturing from radiant heat
 - d. provide gutter guards to keep leaf litter and vegetation debris out of gutters and roof valleys, which may catch alight via ember attack
 - e. consider roof tie-down to protect against fire-driven wind
 - f. consider the use of mounted sprinklers and / or hoses for additional fire-fighting protection external to the house
 - g. design dwellings to accommodate higher BAL construction requirements than required under the Australian Standard
 - h. consider provision of a 2,500 litre or 5,000 litre water tank for personal fire protection purposes
20. Land-owners seek to educate and inform themselves and their family members on how to appropriately manage bushfire risk, how to prepare themselves and their properties for a bushfire event and what to do in the event of a bushfire.

10 CONCLUSIONS

This report considers the bushfire mitigation measures required for Stage 1 of Context Plan Area 1 as part of the PEET Flagstone West Structure Plan Area. Based upon on-site inspections and analysis, a range of mitigation measures are identified to aid in the defence against bushfire with respect to areas of classifiable vegetation which surround the development site.

Based on this assessment, a range of recommendations has been derived. In addition, it is significant to note that bushfire remains a natural process which is endemic to the Australian bush and is subject to a range of contributing factors which are variable almost on a daily basis. As such, it is extremely difficult to predict the behaviour and intensity of a fire event at any given time. On this basis it remains of the upmost importance that residents within identified bushfire prone areas obtain knowledge and remain aware of their options in the event of a bushfire to ensure the preservation of both life and property.



Laura Gannon BRTP (Hons) GCBP GCPM MPIA MFPA MAIES
Senior Town Planner | Bushfire Planning Specialist

E lauragannon@jensenbowers.com.au
T 07 3319 4909
M 0401 889 094

AUTHOR'S PROFILE

Laura Gannon is a Senior Town Planner and qualified specialist in the area of bushfire planning and management with Jensen Bowers Group. With almost 10 years of industry experience, Laura's expertise focuses on bushfire hazard planning policy, bushfire responsive strategic planning and planning for development in bushfire hazard areas. Laura's experience spans the private and public sectors, including both local and state government.

QUALIFICATIONS

Laura holds a diversity of tertiary level qualifications, including:

- Bachelor of Regional and Town Planning (Hons), University of Queensland
- Graduate Diploma in Bushfire Protection, University of Western Sydney (Q1, 2015)
- Building and Development in Bushfire Prone Areas, University of Technology Sydney
- Practice in Risk Based Land Use Planning (National Qualification Code: 10020NAT), Australian Emergency Management Institute
- Graduate Certificate in Project Management, University of South Australia.

Specific areas Laura is qualified and experienced in include:

- bushfire behaviour
- bush firefighting
- planning and development control for bushfire prone areas
- building and development in bushfire prone areas
- risk-based land use planning (natural hazard planning)
- bushfire risk assessment and management.

AFFILIATIONS

- Corporate Member of the Planning Institute of Australia
- Member of the Fire Protection Association of Australia
- Member of the Australian Institute of Emergency Services.

PROFESSIONAL REPRESENTATION

- Convener of the PIA Queensland Environmental Planning Chapter
- Committee Member, PIA Queensland Division Committee
- Committee Member, PIA National Climate Change Group
- Member, Queensland Government Climate Adaptation Strategy Partnership Group
- Member, Australian Sustainable Built Environment Council (ASBEC)'s Resilience Strategy Task Group
- Member, Queensland Government Bushfire Risk Advisory Group.

AWARDS

2011 PIA Australian Young Planner of the Year

2010 Robert Swider Memorial Award for PIA Queensland Young Planner of the Year

11

LIST OF REFERENCE MATERIALS

Beaudesert Shire Council, 2007, 'Beaudesert Planning Scheme', Available online at:

<http://www.logan.qld.gov.au/planning-and-building/planning/current-planning-schemes/beaudesert-planning-schemes/beaudesert-planning-scheme-2007>

Country Fire Authority, 2012, 'Planning for Bushfire Victoria: Guidelines for Meeting Victoria's Bushfire Planning Requirements', Available online at:

http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/planning-for-bushfire-web-complete.pdf

Country Fire Authority, 2011, 'Landscaping for Bushfire: Garden Design and Plant Selection', Available online at:

http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/landscaping/landscaping_for_bushfire.pdf

Country Fire Authority, 2011, 'Fire Safety Guide Land Use Planning 0003 – Assessing Vegetation in a Bushfire Management Overlay'; Available online at:

http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/fsg_0003_assessing_vegetation_in_bmo.pdf

Country Fire Service, 2000, 'Fire Retardant Plants'; Available online at:

www.cfs.sa.gov.au/public/download.jsp?id=1949

CSIRO, 2014, 'A New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland', Queensland Government, Brisbane, Queensland

DSDIP, 2013, 'State Planning Policy', Available online at:

<http://www.dsdip.qld.gov.au/resources/policy/state-planning/state-planning-policy.pdf>

DSDIP, 2013, 'Draft State Planning Policy Guideline: State Interest – Natural Hazards',

Available online at: <http://www.dsdip.qld.gov.au/resources/guideline/spp/spp-guideline-natural-hazards-flood-bushfire-landslide.pdf>

Logan City Council; 2014, 'Draft Local Planning Scheme', Available online at:

<http://www.logan.qld.gov.au/planning-and-building/planning/draft-planning-scheme/draft-logan-planning-scheme-2014>

Lucas. C, Hennessy. K, Mills. G, Bathols. J, 2007, 'Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts, Consultancy Report prepared for The Climate Institute of Australia', Bushfire CRC, Melbourne, VIC

NSW Rural Fire Service, 2006, 'Planning for Bushfire Protection', Available online at:

http://www.rfs.nsw.gov.au/dsp_content.cfm?cat_id=900

NSW Rural Fire Service and Gosford City Council, 2013, 'Plant Selection in Bushfire Prone Areas', Available online at: http://www.gosford.nsw.gov.au/recreation/natural_areas/bushfire-management/images/Fire%20Resistant%20Plants%20for%20BFP%20Areas%206-9-05.pdf

Tasmania Fire Service, 2010, 'Fire Resisting Garden Plants', Available online at: <http://www.fire.tas.gov.au/userfiles/stuartp/file/FireResistingPlants2010.pdf>

Queensland Museum, 2003, 'Wild Plants of Greater Brisbane', Queensland Museum, QLD

Ramsay. C, Rudolph. L, 2003, 'Landscape and Building Design for Bushfire Prone Areas', CSIRO Publishing, Melbourne, Victoria

Rural Fire Service of Queensland, 2014, 'Bushfire Planning'; Available online at: https://ruralfire.qld.gov.au/Bushfire_Planning/

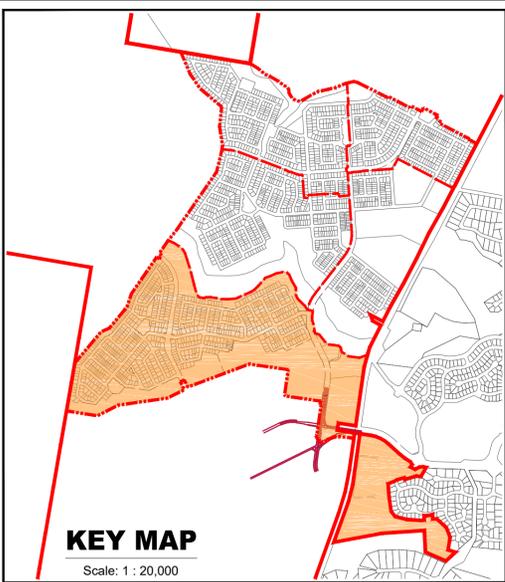
Rural Fire Service of Queensland, 2014, 'Bushfire Survival Plan', Available online at: https://ruralfire.qld.gov.au/Fire_Safety_and_You/Bushfire_Survival_Plan/PAS_BushfireSurvivalPlan_0913.pdf

Standards Australia, 2011, 'Australian Standard 3959-2009 Construction of Buildings in Bushfire Prone Areas', Council of Standards Australia, NSW

Webster. J, 2012, 'Essential Bushfire Safety Tips', 3rd Ed. CSIRO Publishing, VIC

Attachment A

STAGE 1 PROPOSED PLAN OF RECONFIGURATION



Legend

General

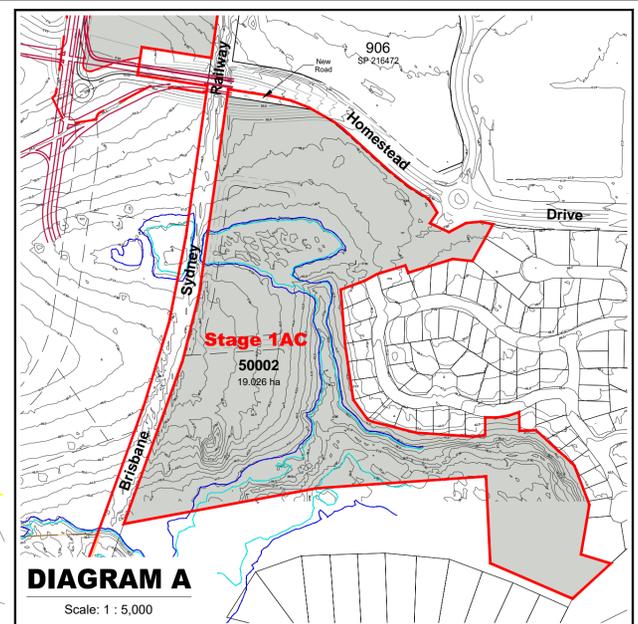
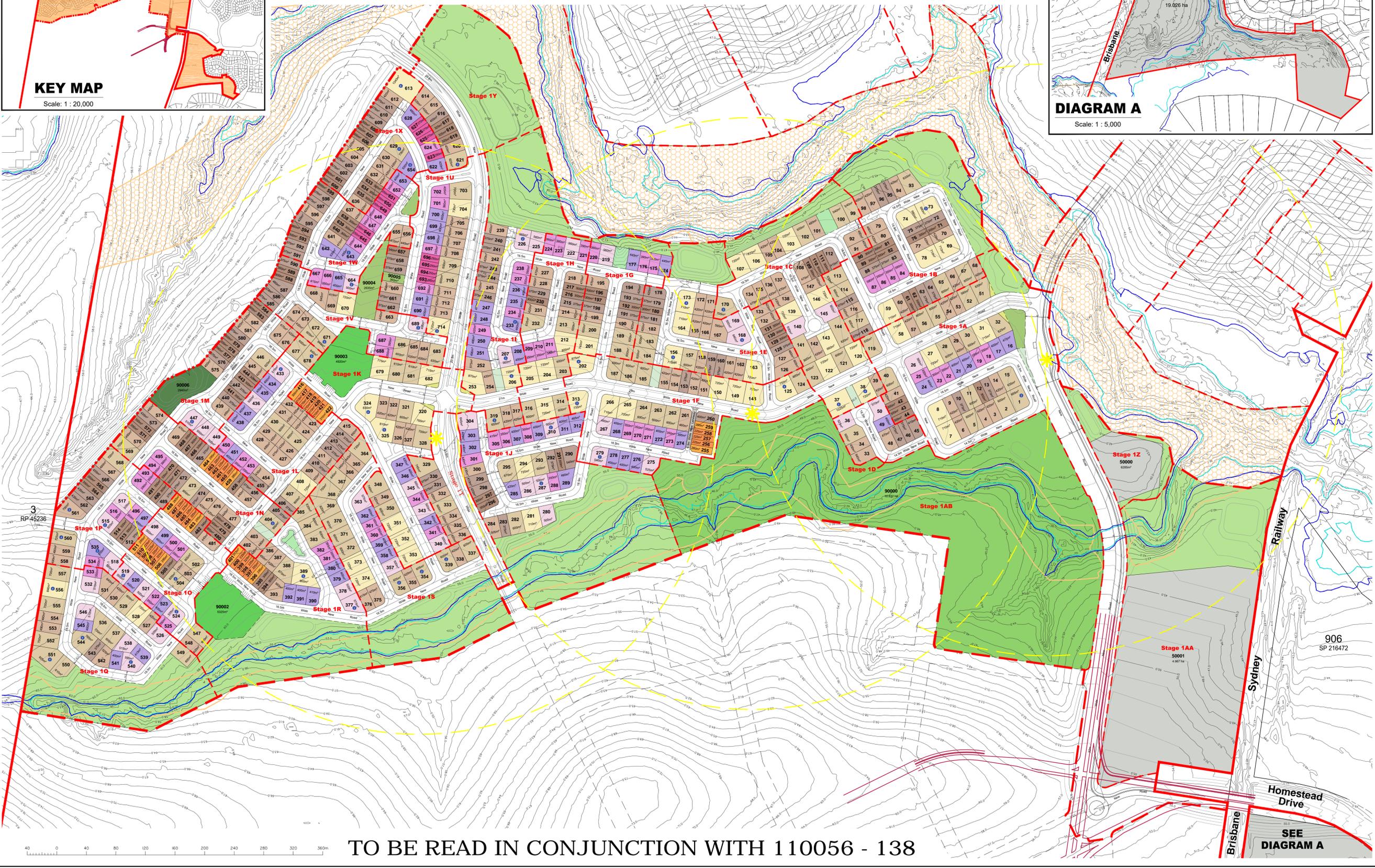
- Site Boundary
- Proposed Precinct Boundary
- Proposed Super Stage Boundary
- Proposed Sub Stage Boundary
- Existing Q5
- Existing Q100
- Alternative Road Alignment
- 400m Catchment Area
- Possible Multiple Residential Allotment (Max. no. of dwellings)

Open Space

- Regional Recreation Park
- Corridor Park
- Neighbourhood Recreation Park
- Local Recreation Park
- Local Linear Recreation Park
- Stormwater Detention
- Linear Connections
- Entry Statements
- Retained Vegetation - Flagstone & Sandy Creek (updated as per Saunders Havill email 10/11/14)
- Retained Vegetation - Other Areas (updated as per Saunders Havill email 10/11/14)

Allotments

- ##### 25m Deep Allotments
- Villa Allotment
 - Courtyard Allotment
 - Premium Courtyard Allotment
 - Premium Traditional Allotment
- ##### 28m Deep Allotments
- 7.5m Terrace Allotment
 - 9.5m End Terrace Allotment
- ##### 30m Deep Allotments
- Villa Allotment
 - Premium Villa Allotment
 - Courtyard Allotment
 - Premium Traditional Allotment
- ##### Super Allotments
- Super Allotment



REVISION

A: 08/09/14 Amend Layout RFI Response
 B: 24/09/14 Amend POD Notes & Add Possible Multi Residential Dwelling Numbers
 C: 11/11/14 Add Maximum Clearing Outcome
 D: 17/11/14 Remove Roundabouts

Note:
 All dimensions and areas are approximate only, and are subject to survey and Council approval. Dimensions have been rounded to the nearest 0.1 metres. Areas have been rounded down to the nearest 5m². The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
 Site boundaries: Registered Survey Plans.
 Adjoining information: DCDB.
 Contours: Cardno Bulk Earthworks



CLIENT
PEET

PROJECT
FLAGSTONE PRECINCT 1

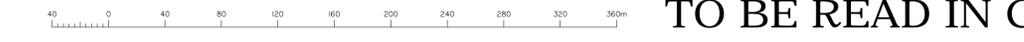
PLAN OF SUBDIVISION STAGE 1 ALLOTMENT LAYOUT

Date	17 November 2014
Comp. By:	WNW
Checked By:	AZ / DG
DWG Name:	Precinct 1 Stage 1
Job Reference:	110056
Local Authority:	ECONOMIC DEVELOPMENT QUEENSLAND
Locality:	JIMBOOMBA
Scale	Sheet
1 : 2500	A1
Plan Ref	Rev
110056 - 121	D



RPS Australia East Pty Ltd
 ACN 140 292 762
 ABN 44 140 292 762
 Urban Design
 Brisbane Design Studio
 455 Brunswick Street
 Fortitude Valley QLD 4006
 T +61 7 3124 9300
 F +61 7 3124 9399
 W rpsgroup.com.au

TO BE READ IN CONJUNCTION WITH 110056 - 138





LANDSCAPING FOR BUSHFIRE

**GARDEN DESIGN
AND PLANT SELECTION**



FOREWORD

The type, quantity and condition of fuel has a very important effect on bushfire behaviour. The survivability of buildings, and of those who occupy and shelter in them, can be significantly enhanced or endangered by the type of plants around the building.

Landscaping for Bushfire has been developed by CFA in response to Recommendation 44 from the Victorian Bushfires Royal Commission. It forms just one part of our approach to help Victorian communities prepare for the fire season.

Residents in high bushfire risk areas need to be aware of their environment and the risks they face during the fire season. Planning ahead is essential for surviving the coming fire season. The most effective way to reduce risk in the garden is to focus on the location and arrangement of fuel on your property.

Even though all plants burn, measures can be taken to reduce fire intensity from garden plants. This guide identifies what you can do within defensible space to minimise the risk of losing your house or threatening the lives of occupants in a bushfire.

Landscaping for Bushfire is a valuable resource for home gardeners, landscape architects and nursery staff as well as CFA Fire Safety Officers, Vegetation Management Officers and Home Bushfire Advice Service consultants.

Landscaping for Bushfire bridges the gap between vegetation management and the Bushfire Management Overlay (BMO), providing advice on how to plan and maintain a garden while meeting planning permit conditions within the BMO.



Euan Ferguson AFSM
Chief Officer

The views and final content of this document remain the responsibility of CFA.

CFA makes this information available on the understanding that you take reasonable care when using it. If you have any uncertainty about the application of the information to your particular circumstance, you should obtain further professional advice.

CFA does not accept responsibility for how you apply or rely on the information in this publication.

Cover image

Brachyscome, photo courtesy of Owen Gooding.

LFB 11/2011

SECTION 01 ABOUT THIS PUBLICATION	WHAT INFORMATION IS COVERED? WHAT IS LANDSCAPING FOR BUSHFIRE? WHY IS LANDSCAPING FOR BUSHFIRE IMPORTANT?	02
SECTION 02 BUSHFIRE BEHAVIOUR	HOW BUSHFIRE DESTROYS HOUSES	04
SECTION 03 PLANNING A GARDEN	NEW HOUSES EXISTING HOUSES	06
SECTION 04 DESIGNING A GARDEN	DESIGN PRINCIPLES TYPES OF GARDENS	10
SECTION 05 CHOOSING SUITABLE PLANTS	PLANT FLAMMABILITY PLANT MOISTURE CONTENT ENVIRONMENTAL WEEDS	34
SECTION 06 MAINTAINING THE GARDEN		42
SECTION 07 PLANT SELECTION KEY		44
SECTION 08 RESOURCES		63

ABOUT THIS PUBLICATION

CFA has developed *Landscaping for Bushfire: Garden Design and Plant Selection* for new and established homes in high-risk areas. This includes properties in the Bushfire Management Overlay (see below). The focus is on residential gardens, but the design principles can be applied to larger developments and subdivisions.

WHAT INFORMATION IS COVERED?

This publication provides information on landscaping to minimise the effects of direct flame contact and radiant heat on a house during a bushfire.

Sections 2-5 are a guide to the planning and design process. There are four example gardens with landscape plans, design notes and suitable plant options. These gardens illustrate the design principles of landscaping for bushfire for gardens in coastal, hilly, rural and suburban environments.

Section 6 draws attention to the importance of garden maintenance.

Section 7 includes a Plant Selection Key. This tool can be used to help choose suitable plants with low flammability. The key is also available as an online tool at cfa.vic.gov.au/plants

Section 8 provides information on further resources and references.

WHAT IS LANDSCAPING FOR BUSHFIRE?

Landscaping for bushfire involves planning, designing, planting and managing the area around a house.

The aim is to keep the area around a house and other structures (such as carports and sheds) free of plants that can easily catch fire and then ignite the buildings.

Landscaping for bushfire can be used to create new – or modify existing – gardens. It takes into account a number of factors that include:

- understanding how fire behaves
- creating defensible space
- the location of plants within the garden
- the flammability of individual plants
- the need for ongoing maintenance.

BUSHFIRE MANAGEMENT OVERLAY

The Bushfire Management Overlay is a planning control that applies to high bushfire risk areas in Victoria. It identifies areas where the bushfire hazard requires specified bushfire protection measures to be implemented.

The Bushfire Management Overlay is identified by planning schemes and can be found at Clause 44.06. It sets out:

- the types of development that require a planning permit
- the information that must be submitted with a planning permit application
- the objectives, standards, mandatory standards and decision guidelines that must be considered in a planning permit application.

Visit dpcd.vic.gov.au for further details.

WHY IS LANDSCAPING FOR BUSHFIRE IMPORTANT?

Victoria is one of the most bushfire-prone areas in the world. The combination of vegetation, climate and topography creates ideal conditions for bushfire. Population growth in high-risk locations means that these communities need to be well prepared for bushfires.

Landscaping using appropriate design principles and plant selection can increase the likelihood of a house surviving a bushfire – even if the plan is to leave early.

Poorly located vegetation that burns readily may expose a house to increased levels of radiant heat and flame contact.

Well-placed vegetation with low flammability may actually help protect houses by:

- reducing the amount of radiant heat received by a house
- reducing the chance of direct flame contact on a house
- reducing wind speed around a house
- deflecting and filtering embers
- reducing flammable landscaping materials within the defensible space.

A holistic approach is the best way to ensure proper preparation. It involves a combination of bushfire protection measures. These include:

- house construction and maintenance
- preparing a Bushfire Survival Plan (see the *Fire Ready Kit* – available at cfa.vic.gov.au)
- having an adequate water supply and road access
- garden design and plant selection.

FIRE RESISTANT, FIRE RETARDANT OR FIREWISE?

These terms are often used when talking about flammability characteristics of a plant. They have very specific and quite different meanings and should not be confused.

Fire resistant is a term that describes plant species that survive being burnt and will regrow after a bushfire. They are resistant to being killed by a bushfire, but not to being burnt. Therefore, they may be highly flammable and inappropriate for a garden in a high bushfire risk area.

Fire retardant can also be misleading when referring to plants. It implies that a plant will not burn readily or may slow the passage of a fire. It cannot be emphasised enough that all plants will burn under the right conditions.

Firewise, in this document, refers to the flammability ranking system applied to a plant by the Plant Selection Key (see Section 7). The term is linked with advice about maintenance and where that plant should be located within a garden.



IMPORTANT



While a well-planned garden is important, it is only one aspect of preparing for bushfire. It should not be relied upon in isolation. In high-risk areas on **Severe, Extreme** and **Code Red** days, leaving early is always the safest option.

BUSHFIRE BEHAVIOUR

Understanding how bushfire behaves and destroys houses is important when planning, designing and selecting suitable plants for a garden. There are three major factors that influence bushfire behaviour: topography, weather conditions and vegetation.

TOPOGRAPHY (OR SLOPE)

Fire burns faster uphill. As the slope increases so does the speed of the fire and its intensity.

Flames and radiant heat preheat the vegetation ahead of the fire. This dries it out, making it easier to burn.

WEATHER

Hot, dry and windy days provide ideal conditions for a bushfire. In summer, these are common weather conditions that increase the flammability of vegetation.

Low humidity and high temperatures, which are fuelled by hot winds, dry out vegetation, allowing it to readily ignite.

VEGETATION (FUEL)

Plants are the primary source of fuel for a bushfire.

The amount of fuel available to a bushfire and where the fuel is located can directly impact on house survival. Understanding how vegetation influences fire behaviour is important when planning a garden.

Within a property, vegetation management and the placement of other flammable objects around the house can determine the amount of fuel available to a bushfire.

The amount, type (flammability) and arrangement of vegetation affects how easily a bushfire will spread throughout a garden.

Fine fuels such as leaf litter readily dry out, ignite and can be carried as embers. Shrubs, vines and other elevated fuel can act as ladder fuels, allowing fire to climb into the canopies of trees, significantly increasing bushfire intensity.

Breaking up the continuity of the vegetation can limit the spread of fire within the garden.

Remember there are no 'fire proof' plants. All plants can burn under the right conditions – typically in extreme fire weather following extended drought.

See Section 4 for more information about how to minimise bushfire risk through garden design.



Leaf litter and dead plant material on and around houses and gardens can be cleared to reduce the risk of them catching fire or becoming burning embers.

HOW BUSHFIRE DESTROYS HOUSES

House survival is influenced by many interacting factors. The four main ways houses are destroyed during a bushfire are:

- ember attack
- radiant heat
- direct flame contact
- wind.

Ember attack is the most common way houses catch fire during a bushfire. Ember attack occurs when small burning twigs, leaves and bark are carried by the wind, landing in and around houses and their gardens.

If they land on or near flammable materials, such as leaf litter and dead plant matter, they can develop into spot fires. Embers can also ignite a house if they land on or near vulnerable parts of the building.

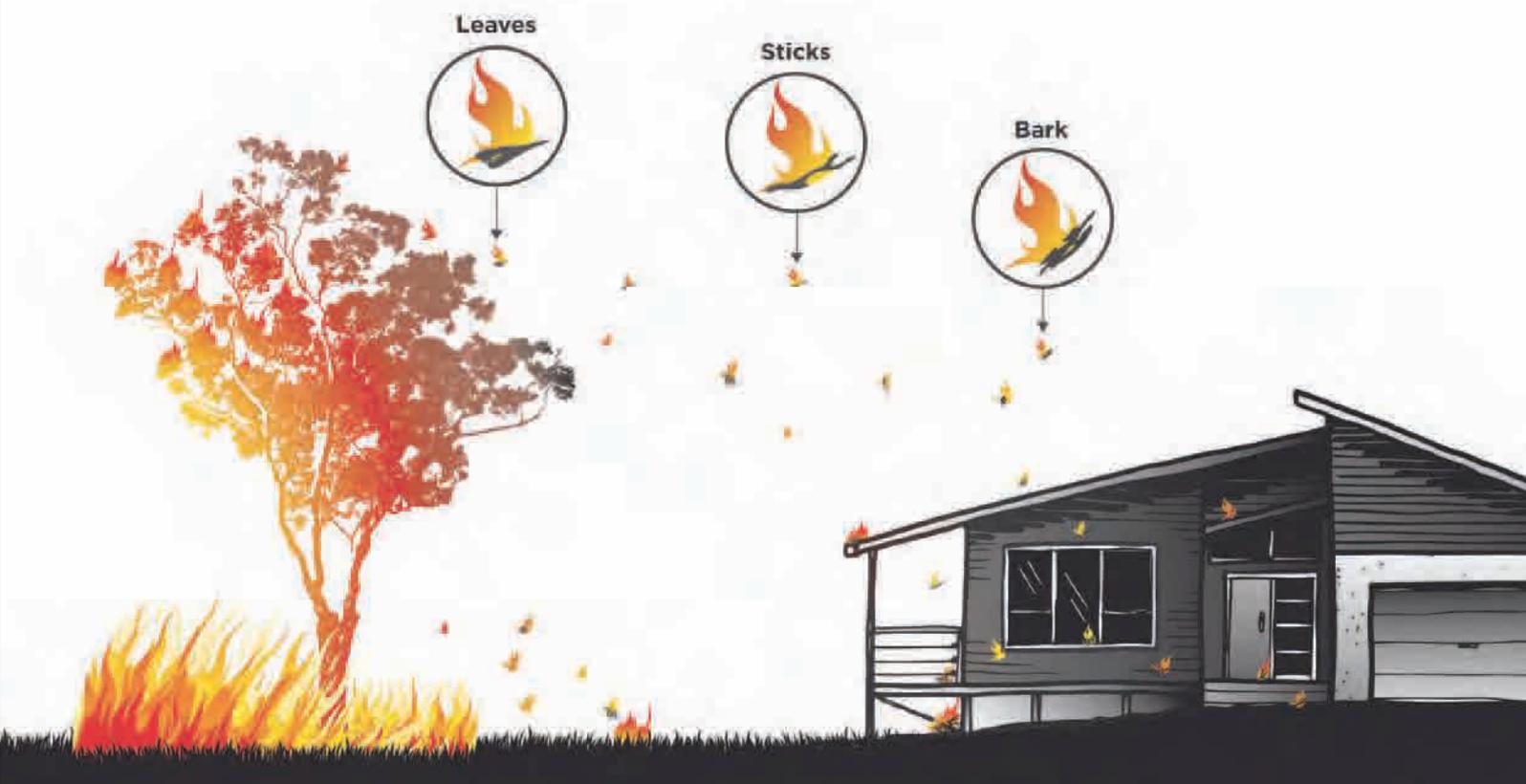
Radiant heat is the heat created from combustion during a bushfire. It can:

- ignite surfaces without direct flame contact or ember attack. This is due to the heat being received from the fire
- dry out vegetation ahead of the bushfire so that it burns more readily
- crack and break windows, allowing embers to enter a building
- distort and melt materials such as plastic.

Flame contact occurs when flames touch a house. Any burning vegetation can directly ignite a house if it is planted too close.

Wind can be very destructive to houses in a bushfire because it:

- carries embers
- can cause trees to fall onto buildings
- can break windows
- can loosen roof tiles
- can blow roofs off houses under severe conditions.



Ember attack

PLANNING A GARDEN

Before designing a garden, there are a number of factors to consider. Reducing bushfire risk to any house is most effective when considered early in the planning process.

NEW HOUSES

Property layout

Think strategically about where the house is located and how the garden around it is designed. That way, it is possible to achieve multiple outcomes – bushfire safety considerations are incorporated but are not the only function of the garden.

Find out what building and planning regulations apply to the property. Visit land.vic.gov.au or talk to the local council. Depending on the bushfire risk, these regulations may influence:

- where the house can be built
- the construction level required
- how to manage the vegetation within the property.

Information in this section is based on the bushfire protection requirements for building in high bushfire risk areas.

The requirements are fully set out in Planning Schemes at Clause 52.47 Bushfire Protection: Planning Requirements (see Further Resources) but are summarised below.

Understanding how these factors influence bushfire can avoid unnecessarily increasing the risk within properties.

Bushfire protection requirements

SITING AND DESIGN

One of the most effective ways to reduce bushfire risk is the appropriate location of a house within a property. Features of the topography can be used to help minimise bushfire spreading into and within the property. Houses should be located away from unmanaged vegetation, steep slopes, saddles or narrow ridge tops. They should ideally be located close to public roads and accessways.

Look at the landscape in and around the property:

- What is the bushfire risk from the surrounding area?
- Is there existing vegetation within or close to the property that will pose a significant bushfire hazard?

Anywhere that embers can lodge or enter a house can start a fire.

There are areas of a house that contribute more to overall bushfire risk than others. These include decks, windows, doors and roof areas. Complex designs that may create nooks and crannies allow dead plant material and embers to drop and accumulate.

DEFENDABLE SPACE

Defendable space is an area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire. It breaks up continuity and reduces the amount of fuel available to a bushfire.

It is one of the most important aspects of preparing properties for bushfire. This is because defendable space separates the bushfire hazard and the house. The greater the separation from the bushfire hazard, the lower the risk.

Defendable space can prevent direct flame contact and minimise the effects of radiant heat on the house. This reduces the risk of house loss during a bushfire, regardless of active defence.

Defendable space:

- comprises an inner and outer zone with different vegetation management requirements
- needs careful garden design that considers the location of all flammable objects
- requires regular maintenance that should be included as part of every Bushfire Survival Plan.

Requirements for defendable space will vary depending on the type of development and the level of bushfire risk to a property. Section 4 provides further detail about defendable space requirements.



Complex house designs allow dead plant material and embers to accumulate.

CONSTRUCTION

The way a building is constructed can help reduce the risk of house loss via radiant heat and ember attack.

Construction standards are linked to defensible space. The greater the area of defensible space, the lower the construction requirement under Australian Standard AS3959-2009: Construction of Buildings in Bushfire-prone Areas.

A bushfire site assessment is required to determine the construction standard that will apply to any house. Details for undertaking a bushfire site assessment in the Bushfire Management Overlay can be found in Department of Planning and Community Development (DPCD) *Practice Note 65: Bushfire Management Overlay and Bushfire Protection: Planning Requirements* (see Further Resources).

PROVISION OF SERVICES

Water is essential for firefighting.

The amount and reliability of water is critical for all properties and must be considered in relation to the bushfire risk.

In all areas the water supply must have appropriate pressure, access and fittings. In the Bushfire Management Overlay, a water supply must be provided.

Access is just as important as it provides a way for residents to get out and the fire services to get in. Roads must be capable of accommodating fire trucks and will require specific construction standards, as well as width and clearance, depending on the property.

For minimum water supply and access requirements that apply to a property in the Bushfire Management Overlay, refer to *CFA Fire Service Guideline: Land Use Planning 0002: Requirements for Water Supply and access in a Bushfire Management Overlay* (see Further Resources).

HOME BUSHFIRE ADVICE SERVICE

Book a free Home Bushfire Advice visit for help assessing bushfire risk at a particular property.

To book an appointment, complete the online form on the CFA website. One of CFA's trained Fire Safety Officers will provide tailored advice, delivered on the property.

Self assessment of bushfire risk can be undertaken by using the Online Household Bushfire Self-Assessment Tool at cfa.vic.gov.au



Paths provide separation between garden beds.



Water feature



Non-flammable outdoor furniture



Water feature

LANDSCAPING

Once the layout of the property is decided there are some decisions to make about what type of garden will be planted.

Gardening is a personal activity and when planning any garden there are many considerations apart from bushfire.

While this publication focuses on gardening to reduce bushfire risk, any garden must meet the needs of those that are using and maintaining it. If a garden suits the needs of residents it is more likely to be maintained from year to year.

There are many different styles of gardening. Some focus on native vegetation, productive or water-sensitive design.

Whatever style is chosen the garden must be appropriate to the local area. Seek advice from the local council (see Further Resources) about species that are suited to a particular location. This will help to avoid planting environmental weeds or invasive plants.

Consider bushfire risk early in the garden planning process. By incorporating the design principles in Section 4, costs can be minimised and bushfire mitigation will complement other functions of the garden.

When planning a garden some things to consider include:

- budget
- the local growing conditions that may affect plant selection
- ongoing maintenance requirements
- function and style of the garden.

Think about how the features below are incorporated into the overall garden design as they may reduce the spread of fire by providing separation between the house and bushfire hazards. For example:

- paths
- pools or water features
- tennis courts
- vegetable gardens.

EXISTING HOUSES

The information outlined on page 6 about defensible space and landscaping is relevant to planning a garden for existing houses.

However, there are also some specific points that need consideration.

CONSTRUCTION

The resilience of existing houses can be improved by retrofitting some building elements.

More advice can be obtained from *A guide to retrofit your home for better protection from a bushfire* (see Further Resources).

PROVISION OF SERVICES

In high bushfire risk areas, it is recommended that a dedicated water supply is installed for firefighting purposes. Where possible, access should meet the requirements as outlined for new houses.

RULES FOR VEGETATION CLEARANCE AROUND EXISTING HOUSES

Throughout Victoria there are restrictions for vegetation clearance on private property. These are contained in the planning scheme of each municipality. In many cases, a planning permit is required to remove vegetation.

In areas where bushfire is a risk, there are particular circumstances where a permit is not required for vegetation removal around existing houses.

For example, the Victoria Planning Provisions Clause 52.17 Native Vegetation outline exemptions that apply for removing, destroying or lopping native vegetation for fire protection. Clause 52.48 Bushfire Protection: Exemptions refers to the 10/30 and 10/50 rules.

To find out if these exemptions apply to a particular council, refer to the relevant planning scheme (see Further Resources).

The 10/30 rule

The 10/30 rule applies to a building used for accommodation that was:

- constructed before 10 September 2009 or approved by a planning or building permit issued before 10 September 2009.

It allows landowners to:

- Remove, destroy or lop any vegetation within 10 metres of an existing building used for accommodation.
- Remove, destroy or lop any vegetation, except for trees within 30 metres of an existing building used for accommodation.
- Remove, destroy or lop any vegetation for a combined maximum width of 4 metres either side of an existing fence on a boundary. The fence must be between properties of different ownership and have been constructed before 10 September 2009.

The 10/50 rule

The 10/50 rule applies only to land in the Bushfire Management Overlay. It applies to a building used for accommodation that was:

- constructed before 10 September 2009 or lawfully erected before 18 November 2011 without the need for a planning permit
- approved by a planning or building permit before 10 September 2009 and erected before 18 November 2011
- approved by a building permit before 10 September 2009 and erected before 18 November 2011.

The 10/50 rule allows landowners to:

- Remove, destroy or lop any vegetation within 10 metres of an existing building used for accommodation.
- Remove, destroy or lop any vegetation, except trees, within 50 metres of an existing building used for accommodation.
- Remove, destroy or lop any vegetation for a combined maximum width of 4 metres either side of an existing fence on a boundary between properties. The fence must be between properties of different ownership and have been constructed before 10 September 2009.

IMPORTANT

In high bushfire risk areas properties may need a greater amount of defensible space. Clearance over the distances stipulated in the 10/30 and 10/50 rules require a planning permit.

DESIGNING A GARDEN

Effective defensible space, house construction, water and access in new and existing gardens can all be compromised by inappropriate landscaping.

The location, type and ongoing maintenance of vegetation within a property have a significant impact on the bushfire risk to any house. These factors can prevent the accumulation of debris and prevent the spread of fire towards a building.

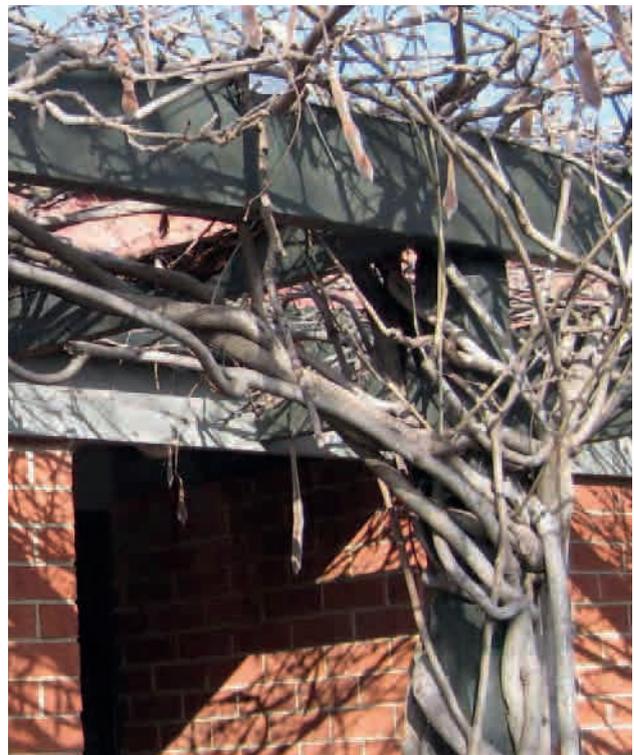
When designing a new or modifying an existing garden, carefully consider the placement of garden beds, trees and other vegetation to reduce the bushfire risk to the house.

When selected and located correctly, plants can filter embers, absorb radiant heat and break up fuel in the path of a bushfire.

However, plants can also contribute to house loss by:

- providing a continual fuel path to the house, allowing direct flame contact
- dropping leaf litter on the ground, which readily ignites and can become embers
- dropping limbs or tree branches onto the house
- adding to fuel loads on or near the house, such as creepers over pergolas, fences or verandahs
- if located too close, producing radiant heat that may ignite the house or cause windows to break, allowing embers into the house
- acting as ladder fuel from the ground into tree canopies, increasing the intensity of the fire.

Vegetation should always be kept clear of access to and from the house and property.



Vines and creepers act as ladder fuels.



Vegetation located too close to a house poses a threat during bushfire.



Garden bed framed by non-flammable landscape materials.
Australian Garden, Royal Botanic Gardens Cranbourne.

The following design principles outline how defensible space can be used to reduce radiant heat, prevent flame contact and minimise ember attack on the building.

These design principles are based on the bushfire protection requirements within the Bushfire Management Overlay.

These principles should be followed in all types of gardens.

**DESIGN PRINCIPLE 1
CREATE DEFENDABLE SPACE**

**DESIGN PRINCIPLE 2
REMOVE FLAMMABLE OBJECTS
FROM AROUND THE HOUSE**

**DESIGN PRINCIPLE 3
BREAK UP FUEL CONTINUITY**

**DESIGN PRINCIPLE 4
CAREFULLY SELECT,
LOCATE AND MAINTAIN TREES**

DESIGN PRINCIPLE 1

CREATE DEFENDABLE SPACE

What is it?

Defendable space is an area of land around a building where vegetation is modified and managed to reduce the effects of direct flame contact and radiant heat associated with bushfire. It breaks up continuity and reduces the amount of fuel available to a bushfire.



Managing vegetation within the defendable space does not mean clearing all plants and trees. There may be opportunities to retain existing vegetation depending on its flammability, location and management.

Whether starting from scratch or making changes to an existing garden, there are ways to design an effective defendable space.

Defendable space needs careful garden design and regular maintenance. It consists of an inner and an outer zone:

- The **inner zone** is the area immediately around the house. It provides separation from fuel sources, reduces radiant heat, eliminates direct flame contact and reduces ember attack. Vegetation needs significant and intensive management. Fuel is managed to a minimum level in this zone.
- The **outer zone** sits between the inner zone and unmanaged vegetation (beyond the defendable space). Vegetation is managed to a more moderate level to substantially decrease the ground fuel and restrict the fuels available to an approaching bushfire.

How to calculate it

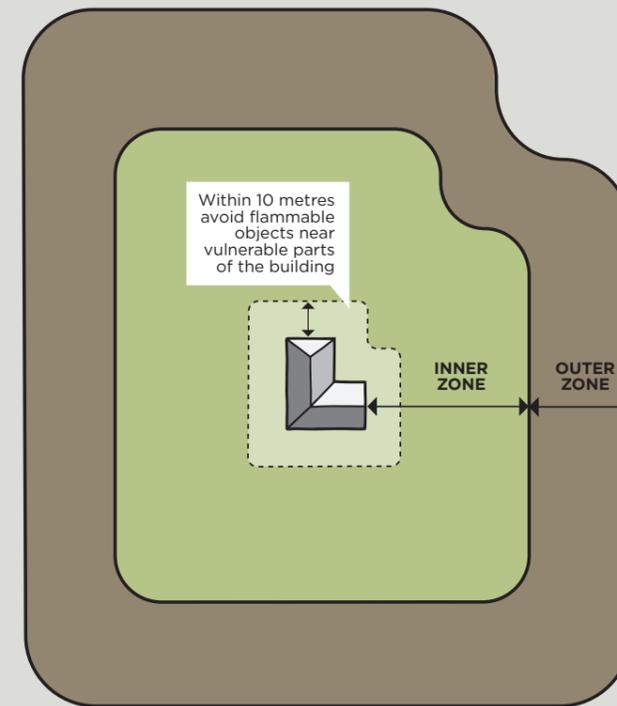
Requirements for defendable space will vary. They depend on the type of development and the level of bushfire risk to the property.

New houses in a Bushfire Management Overlay

As part of the planning permit process, defendable space requirements are determined by a bushfire site assessment. Permit conditions will prescribe the inner and outer zone distances for vegetation management. The site assessment process is outlined in DPCD *Practice Note: 65: Bushfire Management Overlay and Bushfire Protection: Planning Requirements* (see Further Resources).

In the **inner zone** fuel should be managed to the following condition:

- Within 10 metres of a building, flammable objects such as plants, mulches and fences must not be located close to vulnerable parts of the building such as windows, decks and eaves.
- Trees must not overhang the roofline of the building, touch walls or other elements of a building.
- Grass should be no more than 5 centimetres in height. All leaves and vegetation debris are to be removed at regular intervals.
- Shrubs should not be planted under trees.
- Plants greater than 10 centimetres in height at maturity must not be placed directly in front of a window or other glass feature.
- Tree canopy separation of 2 metres and overall canopy cover no more than 15 per cent at maturity.



The **outer zone** fuel should be managed in the following condition:

- Grass must be no more than 10 centimetres in height and leaf and other debris mowed, slashed or mulched.
- Shrubs and trees should not form a continuous canopy.
- Tree branches below 2 metres from ground level should be removed.
- Trees may touch each other with an overall canopy cover of no more than 30 per cent at maturity, with few shrubs in the understorey.
- Shrubs should be in clumps no greater than 10 square metres, which are separated from each other by at least 10 metres.

For both the **inner zone** and **outer zone**:

- Non-flammable features such as tennis courts, swimming pools, dams, patios, driveways or paths should be incorporated into the proposal, especially on the northern and western sides of the proposed building.
- Features with high flammability, such as doormats and firewood stacks, should not be located near the structure.

Existing houses and houses outside the Bushfire Management Overlay

Defendable space can be calculated using CFA's online Household Bushfire Self Assessment Tool available at cfa.vic.gov.au. Ideal defendable space requirements can be worked out using this tool.

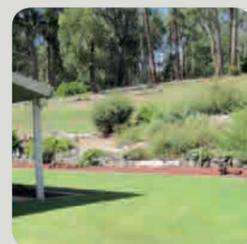
What to include

Plants and other flammable objects provide fuel for bushfires and defendable space requires ongoing maintenance.

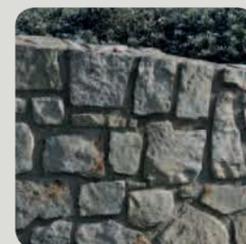
When modifying an established garden, it is critical to consider existing vegetation and other flammable objects within the defendable space.

If planting new vegetation, ensure that it is not compromising the effectiveness of the defendable space by significantly increasing the amount of fuel or adding to its continuity.

Landscaping for bushfire should:



- Locate areas of low fuel between the house and the bushfire hazard (for example, maintained lawn, ponds, pools and tennis courts).
- Locate farm machinery, sheds and poison well away from the house (as they too may become fuel in a bushfire).



- Use landscaping features to provide barriers to wind, radiant heat and embers (such as stone walls and non-combustible fences).
- Use materials such as brick, earth, stone, concrete and galvanised iron. These can act as radiant heat barriers.



- Use driveways and paths to create separation between vegetation and the house. Suitable materials include clay, concrete, gravel and pebbles.
- Locate non-combustible water tanks to act as radiant heat barriers.

DESIGN PRINCIPLE 2

REMOVE FLAMMABLE OBJECTS FROM AROUND THE HOUSE

The area immediately surrounding a house should be clear of flammable objects that can catch fire during a bushfire.

Within 10 metres of a building, flammable garden materials (such as plants, mulches and fences) must not be located close to vulnerable parts of the building (such as windows, doors, decks, pergolas and eaves). The intention is to prevent flame contact on the house.

There are a number of things that can be done to support this design principle:

- Locate non-flammable surfaces (such as paths, driveways and paved areas) against the house.



- Ensure trees are planted away from the house so they do not cause damage if they fall. They must not overhang the house and should be located 1.5 times their mature height from the house.

For example, if a mature tree height is 8 metres, it should be planted at a minimum of 8 metres x 1.5 = 12 metres away.

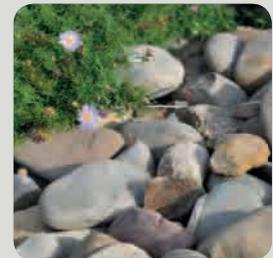
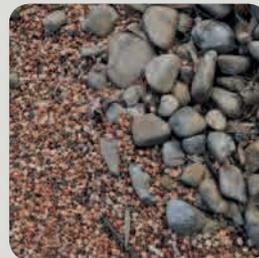
- Maintain grass to no more than 5 centimetres in height in the inner zone and 10 centimetres in the outer zone.



- Use non-combustible, moveable containers and pots that can be relocated in the summer.

- Avoid flammable mulches within the defendable space. Mulch is used to improve the quality of soil, improve water efficiency and keep plants cool and moist in the summer. Most mulch used in gardens can also be a bushfire hazard as it will dry out and burn.

Alternatives include gravel, scoria, pebbles, shells or recycled crushed bricks. These materials provide the same role and come in a variety of shapes and colours.



- Remove other flammable objects from around the house. These include sheds, caravans, outdoor furniture, barbeques, gas bottles, wood piles and organic mulch.

These should not be placed within 10 metres of the house and must have adequate separation from other flammable objects, including plants.

DESIGN PRINCIPLE 3

BREAK UP FUEL CONTINUITY

One of the most effective ways to reduce the spread of fire within a garden is to create separation between plants, garden beds and tree canopies.

Fire spreads easily when plants are located close together.

When a plant catches fire it can preheat and ignite the vegetation around it through radiant heat or direct flame contact.

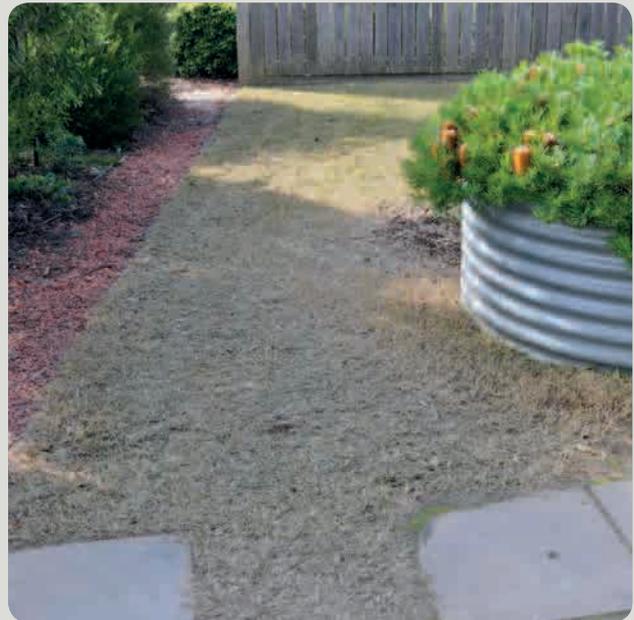
If there is continuous vegetation leading up to and surrounding a house, fire is likely to spread throughout the garden to the house. Grouping plants and garden beds with areas of low fuel between them can help avoid this by breaking up fuel continuity.

Ways to reduce fuel continuity include:

- Locating shrubs or other flammable objects away from trees. If planted under trees, vegetation can act as a ladder fuel and carry fire into canopies.
- Clumping shrubs and trees so they do not form a continuous canopy and are separated by areas of low fuel.
- Using gravel paths, non-flammable mulch and mown grass to provide separation and areas of low fuel between plant groupings and garden beds.
- Pruning branches to a minimum of 2 metres above the ground. This increases the vertical separation between fuel at ground level and the canopy.



Paths can be used to break up fuel continuity.
Australian Garden, Royal Botanic Gardens Cranbourne.



Mown grass provides separation between garden beds.
Australian Garden, Royal Botanic Gardens Cranbourne.

DESIGN PRINCIPLE 4

CAREFULLY SELECT, LOCATE AND MAINTAIN TREES

Trees can be useful during a bushfire, provided they are:

- selected carefully
- properly maintained
- located at a safe distance from the house.

Bushfires are often accompanied by strong winds, which may cause branches to break or whole trees to blow over. Trees can also catch fire, burn through and fall over.

Correctly selected and located trees can:

- reduce wind speed
- absorb radiant heat
- filter embers.

Fire is rarely sustained in the tree canopy, unless there is a fire burning in the plants or leaf litter under the tree.

When implementing this design principle:



- Avoid trees with loose, stringy or ribbon bark.
- Separate tree canopies by at least 2 metres.
- Canopies should cover less than 15 per cent of the inner zone and 30 per cent of the outer zone.

- Prune branches to a minimum of 2 metres above the ground increasing the vertical separation between fuel at ground level and the canopy.
- Locate trees at a safe distance from all other buildings, driveways, water supplies and powerlines. They should be at least 1.5 times their mature height away.
- Do not plant trees near shrubs, as shrubs can carry fire into tree canopies.



- Periodically remove dead leaves, bark and branches as well as leaf litter from underneath trees around the house.

Windbreaks

Trees can also be planted for windbreaks but are most effective in a fire of low to moderate intensity.

However, windbreaks are only one of many factors that affect the speed and progression of a bushfire.

Windbreaks are not a stand alone solution because:

- it takes time for trees to grow and they may not provide protection for some years
- wind direction can change and spot fires occur, allowing bushfires to approach from any direction.

Other things to remember are that:

- there needs to be adequate separation between a building and the windbreak
- a windbreak should not be planted within the defensible space
- trees should be carefully selected and will require ongoing maintenance
- highly flammable trees will become a fire hazard
- the windbreak should be planted at right angles to prevailing winds
- the windbreak should allow some wind to pass through
- the windbreak should have a continuous length of at least 100 metres if possible
- slashed, well-watered grass should be planted underneath the windbreak
- routine maintenance must be carried out to remove leaf litter and other dead plant material from underneath the windbreak.

TYPES OF GARDENS

The following four gardens provide practical examples of landscaping for bushfire, using the design principles outlined earlier in this section.

Plants have been selected for each location for their characteristics of low flammability (see the Plant Selection Key in Section 7).

The example gardens also highlight the importance of proper maintenance.

LEAVING EARLY

In high-risk areas, bushfire behaviour will be driven by the heavily vegetated landscape. While garden design and maintenance can improve the chances of a house surviving a bushfire, do not rely on these in isolation. A garden will not provide protection in a bushfire.

A holistic approach to bushfire preparation is critical. Appropriate water supply, access, house construction and general property maintenance are all important.

On **Severe, Extreme** and **Code Red** days leaving early will always be the safest option.

MODEL 1 COASTAL GARDEN

Establishing and maintaining a garden in a coastal location can be particularly challenging. Strong, seasonal winds, sometimes coupled with high levels of airborne salt, provide difficult growing conditions. These can reduce the height and modify the shape of many garden plants and limit overall growth potential.

Coastal landscapes are also typically exposed to high light conditions and elevated temperatures. These factors, often coupled with sandy, shallow soils with poor water retention, mean that horticultural practices to retain soil moisture, such as addition of organic matter and mulches, become critical for garden success.

Creating microclimates through shelter and screening can minimise these problems and enable a larger range of plants to be grown successfully.

When planning a coastal garden, consider the local site's topography, aspect and neighbouring vegetation.

Gardens located on slopes are more likely to experience the effects of strong winds than those in protected locations.

North-facing gardens are more likely to rapidly dry out during hot summer days. Those in a southerly aspect are more protected.

Natural vegetation growing near the coast is often highly flammable and in some places will be in close proximity to a home garden.

In any of these situations the application of the design principles, such as incorporation of a defensible space and location and arrangement of plants, is particularly important.

EXAMPLE: COASTAL MODEL GARDEN

The numbers here refer to the illustration below and those on pages 20-21.

The paved sitting area **1**, lawn **2** and low-sitting wall **3** provide separation between the house and the direction of the most likely fire hazard.

A small tree **4** is located well away from the house. It provides shade and may also catch embers during a fire. Planting beneath the tree has been kept very low and short. The lower branches of the tree are pruned up to 2 metres from ground level to prevent a fire from moving into the canopy. Behind the tree, a fleshy-leaved hedge **5** is managed as a long, barrier planting. This will also help catch embers.

The area within the property that is most likely to be impacted first by fire has been planted out as a vegetable garden **6** and orchard **7**. Good separation is provided between all trees and garden beds to help slow fire spread. The entire area is irrigated to keep plants lush over hot summer days. The service area **8**, with a shed and washing line, is kept well away from the house in the garden's south-west corner.

Large steel pots with upright succulent plants **9** soften the paved area and can be moved away from the house during summer. The low stone wall acts as a radiant heat barrier and forms an attractive garden feature.

The area north of the house **10** includes smaller growing succulents that minimise the amount of flammable material near the carport **11**. Both the carport and the pergola against the house **12** are constructed of steel. Using this material avoids adding fuel close to the house. The driveway and carport **13** have 4 metres vertical and horizontal clearance for vehicle access.

Small deciduous trees **14** have been planted well away from the house and carport. This ensures there are no overhanging branches and they do not obstruct the driveway. Good separation between the canopies has been provided. Other characteristics such as smooth bark and an open habit contribute to the low flammability rating of these trees.

The gravel driveway **15** and portions of the front garden include bands of decorative stone as a design feature. The front garden also includes strips of lawn **16** between the beds of low shrubs and groundcovers. This provides good separation between plantings and reduces potential fire movement across the garden.

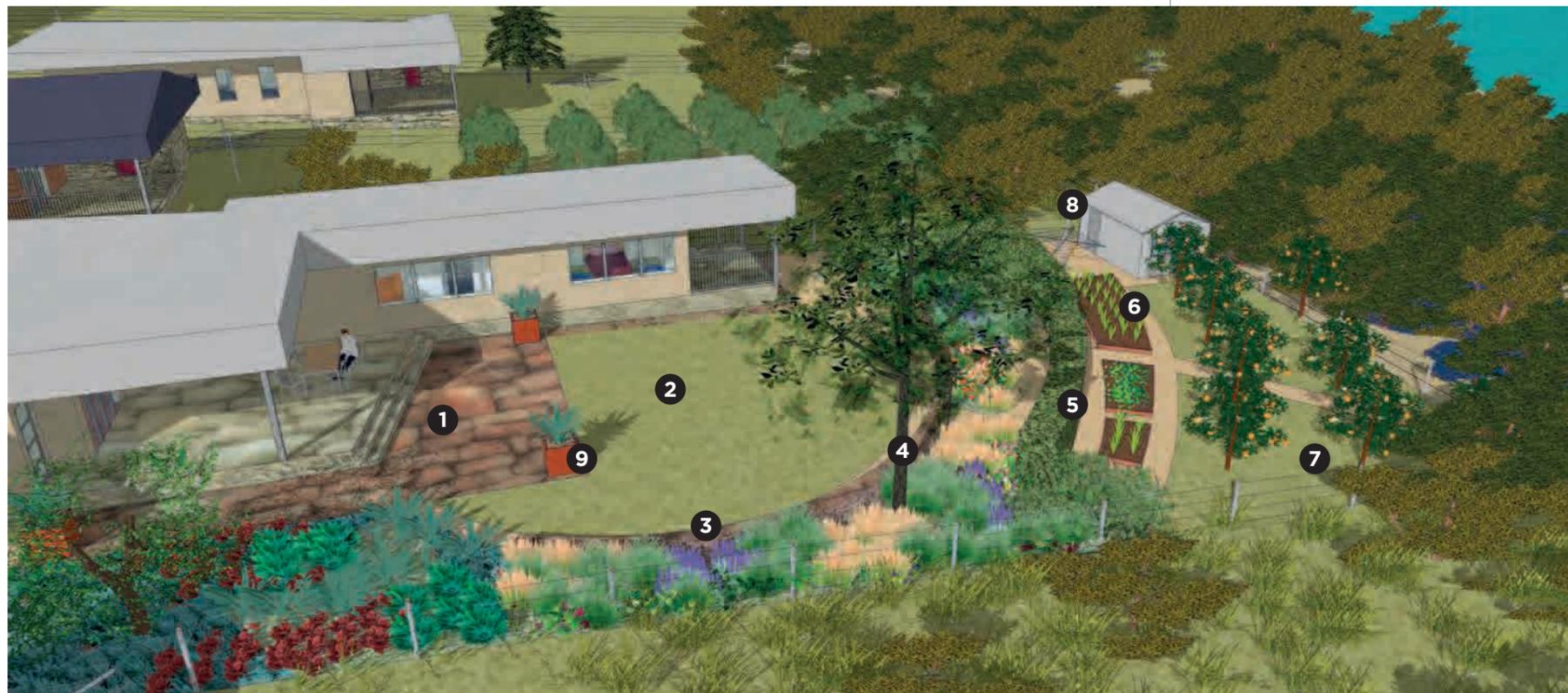
Plants chosen for the model garden have been selected for their firewise properties.

SMALL ORCHARD AND VEGETABLE GARDEN

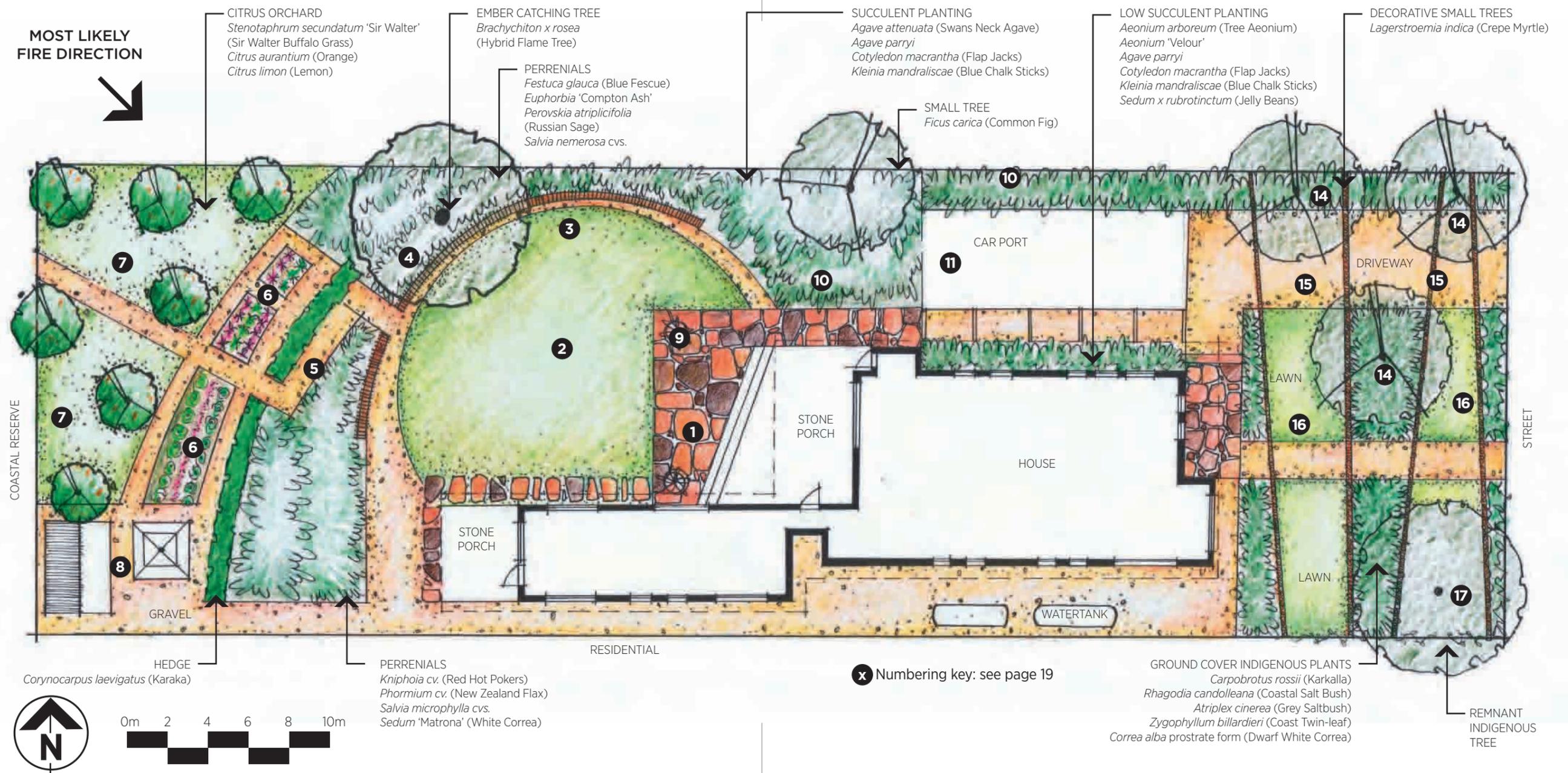
Located on the coastal side of the property, this area adjoins the remnant indigenous vegetation. The orchard includes widely spaced *Citrus* trees (Lemon, Orange) and a lawn of *Stenotaphrum secundatum* 'Sir Walter' (Sir Walter Buffalo Grass). The vegetable garden includes small soil-raised beds edged by rock and is drip irrigated from tank water on site.

HEDGE

The plant used for the medium-sized hedge (2m x 1m) is *Corynocarpus laevigatus* (Karaka). It is a fleshy, evergreen shrub from New Zealand. While maintenance of the hedge is important to reduce plant litter build-up, it is a good example of a firewise plant. This species retains very little dead foliage and has low levels of oils, waxes and resins in the plant tissues.



See also next page.



PERENNIALS

A decorative mix of evergreen and herbaceous perennials and short grasses are planned for this part of the garden to provide colour and textural qualities for most of the year. Where located near the tree, they will be maintained to a low height to ensure good separation.

Plants selected include *Festuca glauca* (Blue Fescue), *Euphorbia* (Compton Ash), *Kniphofia* cv. (Red Hot Pokers), *Perovskia atriplicifolia* (Russian Sage), *Phormium* cv. (New Zealand Flax), *Salvia nemerosa* (Woodland Sage), *Salvia microphylla* (Baby Sage) and *Sedum* (Matrona).

SMALL TREES

The trees are planted across the garden with low, herbaceous vegetation planted beneath them. This planting arrangement will maximise separation between the vegetation and their canopies. The canopies will also be maintained 2 metres apart to reduce fire spread.

Brachychiton x rosea (Hybrid Flame Tree) has been placed more than 10 metres from the house. It has an open, branching habit, fleshy stems and plays a role in ember catching.

Ficus carica (Common Fig) is a small, deciduous, productive tree with an open habit, smooth bark, large leaves stems and plays a role in ember catching.

Lagerstroemia indica (Crepe Myrtle) is also a deciduous tree with smooth bark and open habit. In this garden it will be managed as a pollarded tree (a tree whose

top branches have been cut back to the trunk so that it produces a dense growth of new shoots). This treatment reduces its overall height, as well as keeping lower branches and canopy clear from the ground.

LOW SUCCULENT PLANTINGS

A small linear bed planting of succulents is planted near the house and carport. In the example above, the succulent plants are low in height, have very low flammability and are set well below the house windows. This provides good separation between succulent plantings and vulnerable areas of the house.

Species used here include: *Agave attenuate* (Swans Neck Agave), *Agave parryi*, *Aeonium arboreum* (Tree Aeonium), *Cotyledon macrantha* (Flap Jacks), *Klenia madraliscae* (Blue Chalk Sticks), *Aeonium* 'Velour' and *Sedum x rubrotinctum* (Jelly Beans).

GROUND COVER INDIGENOUS PLANTS

These consist of low-growing, indigenous ground cover plants. They have low flammability features, such as leaf and stem succulence and low litter carrying.

They include *Carpobrotus rossi* (Karkalla), *Rhagodia candolleana* (Coastal Salt Bush), *Atriplex cinerea* (Grey Saltbush), *Zygophyllum billardieri* (Coast Twin-leaf) and *Correa alba* prostrate form (Dwarf White Correa).

TURF AREAS

The turf species used here is *Stenotaphrum secundatum* 'Sir Walter' (Sir Walter Buffalo Grass), a soft, low-growing and drought-tolerant grass.

MODEL 2 HILLS GARDEN

The foothills and mountains of Victoria generally provide exceptional conditions for growing gardens. They typically have higher rainfall, cooler temperatures, deeper soils and well-drained sites. This environment enables a wide range of plants to be grown successfully.

As a result, hills gardens often display great diversity and layers of vegetation, from large trees and shrubs through to ground covers and herbaceous perennials.

The design of a hills garden should carefully consider the local site and context. Many gardens will be located in areas adjoining native forests or tall trees that are highly flammable. In these high-risk sites bushfire can move readily across the landscape (see page 17). Leaving early is the safest option.

Dual-access driveways and multiple entry points should be considered in the design of a garden. This will improve access into and from the site. Using stone or masonry retaining walls is preferable to timber structures. Terracing should be considered on very steep sites to support level areas.

Good garden maintenance is essential in a hills garden. These gardens can produce large amounts of plant growth, including litter, bark and dead leaves.

To reduce fuel load build-up, removal of litter through tree and shrub canopies, such as dry bark hanging from trees and on the ground, is an important garden maintenance task. Pruning trees to raise the canopy 2 metres from the ground and placing trees to ensure canopies are at least 2 metres apart reduces potential fire spread into and between the canopies.

The most suitable vegetation to plant around the house is irrigated, green lawns. Any trees should be placed at least 1.5 times their mature height from the house. Choose low flammable and lush vegetation, particularly in high-risk areas. Locate plants in clumps, away from the house and other flammable structures.

Remember fire can spread from any direction, regardless of slope and aspect.

EXAMPLE: HILLS MODEL GARDEN

The numbers here refer to the illustration below and those on pages 24 and 25.

This hills garden is located within steeply sloping, dense *Eucalyptus regnans* (Mountain Ash) forest. It is typical of many areas including the Dandenongs and the Macedon and Kinglake Ranges.

Some indigenous eucalypts have been retained within the property **1** but only those that are located more than 10 metres from the house. They have been retained in clumps and do not overhang the house. Any hanging bark and litter from these trees will be removed from surrounding garden plants during the summer months to help prevent fire ladders into the high canopies **2**.

The vegetation chosen beneath these trees **3** includes herbaceous ground covers. They ensure maximum separation between vegetation and the canopy. These have been carefully chosen for their low flammability and dense, lush summer growth.

The orchard trees **7** are planted with 2 metres between the mature canopies to reduce potential fire spread. The extensive lawn areas slope downwards to the house **5** and those at the property's southern end **12** provide areas of low fuel within the defendable space. They will be irrigated and mown low over summer.

Stone terracing **4** reduces the steepness of the slope and makes necessary maintenance easier. The house has been located along the eastern side of the property to provide maximum separation between the house and the main fire hazard to the west.

A vegetable garden **8** and orchard **7** sit in a series of terraces between the unmanaged vegetation and the house. They have been included in the defendable space because of their low flammability. They will be kept well-watered over summer using the adjacent steel water tanks **9**.

The retaining walls on the slope **6** are all constructed of stone. Stone paving **10** and a lawn area **11** located between the house and potential fire hazard maximise separation opportunities. The eastern side of the house **14** is maintained with gravel as a vehicle storage area and includes steel retaining walls **15**.

The caravan in this space would be moved off the property during summer and the clothes line and wood shed **13** have both been located well away from the house.

Plants chosen for the model garden have been selected for their firewise properties.

FEATURE TREE

The small feature tree in the main lawn, *Parrotia persica* (Persian Ironwood), has been chosen for its attractive autumn foliage and summer shade. It also has a deciduous lifecycle, smooth bark, open, diffuse habit and low leaf-litter production over summer – all low flammability characteristics.

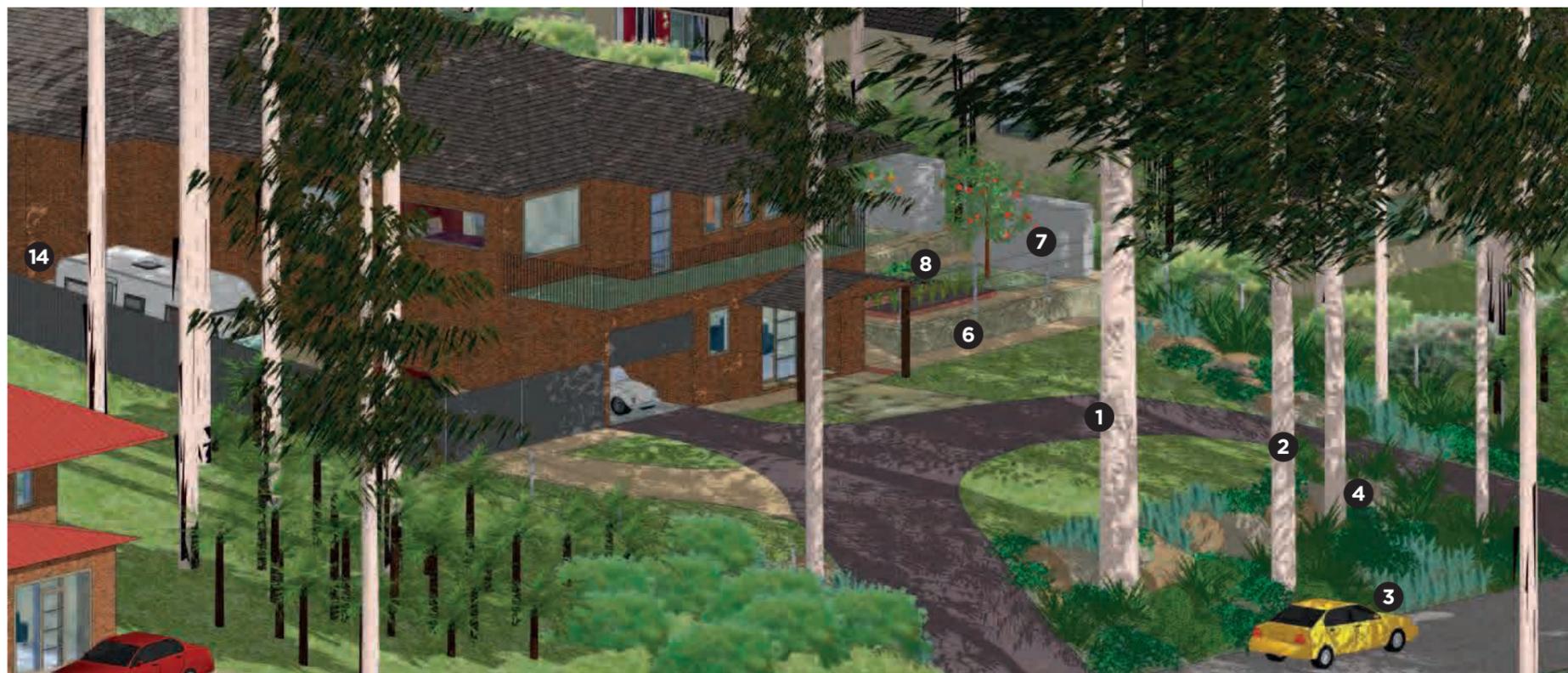
GROUND COVERS

Herbaceous plants are used in the front garden to provide ground cover throughout the year and seasonal colour over winter, spring and summer. All are shade-tolerant perennials with a low-growing habit (to 30 centimetres in height) and have leaves that maintain a high moisture content.

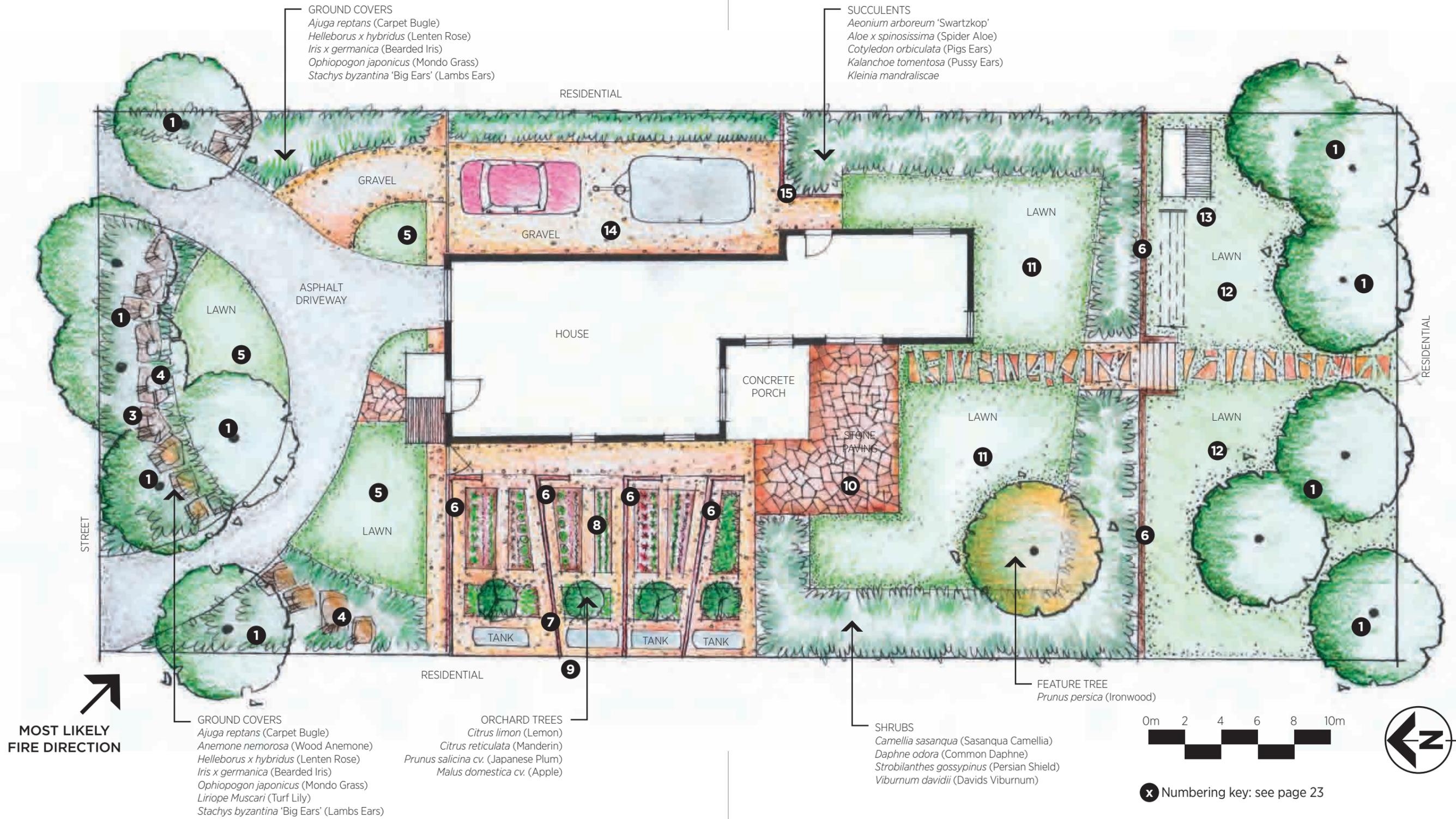
They include: *Ajuga reptans* (Carpet Bugle), *Anemone nemorosa* (Wood Anemone), *Helleborus x hybridus* (Lenten Rose), *Iris x germanica* (Bearded Iris), *Liriope muscari* (Turf Lily), *Ophiopogon japonicus* (Mondo Grass) and *Stachys byzantina* 'Big Ears' (Lambs Ears).

TURF

The lawn areas are planted with *Stenotaphrum secundatum* 'Sir Walter' (Sir Walter Buffalo Grass), a soft-leaf, hard-wearing turf species. It can be managed to a low height and will be irrigated over summer. This maintenance helps create a defendable space.



See also next page.



x Numbering key: see page 23

ORCHARD AND VEGETABLE GARDEN

This includes raised beds of vegetables and a collection of small productive fruit trees. They include a *Citrus limon* (Lemon), *Citrus reticulata* (Mandarin), two *Prunus salicina* (Japanese Plum cultivars) and two *Malus domestica* (Apple cultivars). The vegetables and trees are all irrigated using water supplied from the adjacent steel water tanks.

SHRUBS

Groupings of shade-tolerant evergreen shrubs are planted on the boundary of the garden's middle terrace. They include *Camellia sasanqua* (Sasanqua Camellia), *Daphne odora* (Common Daphne), *Strobilanthes gossypinus* (Persian Shield) and *Viburnum davidii* (Davids Viburnum).

Their broad and fleshy leaves, open habit and coarse texture are low flammability characteristics. All shrubs will be pruned regularly to maintain their height to below 2 metres.

SUCCULENTS

Close to the eastern side of the house are garden beds containing low-growing succulent plants. They include *Aeonium arboresum* (Swartzkop), *Aloe x spinosissima* (Spider Aloe), *Cotyledon orbiculata* (Pigs Ears), *Kalanchoe tomentosa* (Pussy Ears), and *Kleinia mandraliscae* (Blue Chalk Sticks).

MODEL 3 RURAL GARDEN

When planning a rural garden, consider house and garden location, the placement of other structures, elements and services, and good planting design strategies.

Many rural gardens are on larger farming properties surrounded by pasture paddocks and grasses. These can dry rapidly over summer, causing fire to spread from the paddock to the garden.

Other rural gardens are located just outside cities and larger towns. They generally form part of a small 'farmlet', with larger productive and/or ornamental gardens.

One of the most effective ways to reduce fire risk in rural sites is to have defensible space around the house.

Placing farm dams in the direction of the most likely path of a fire provides a fuel-free area and further separation between the bushfire hazard and the house. Dams also form a useful irrigation source for the garden. Keeping plants well hydrated will help reduce heat stress over summer when they often become more flammable.

Sheds and outbuildings should always be located well away from the house, particularly those used for storage of chemicals, fertilisers or hay.

Planting design solutions in the rural garden include the use of lawns, gravel surfaces and kitchen gardens.

These features ensure there are areas of low fuel directly around the house.

Careful placement of all vegetation in the garden is important. In particular, break up the continuity of fuel available to any fire and provide adequate separation between vegetation and the house. This includes locating trees at least 1.5 times their mature height from the house and locating other plants away from vulnerable areas (such as windows, decks and eaves).

The strategic placement of windbreak trees or hedges outside the defensible space of the house block can reduce wind speed and catch embers produced by the fire. Tree selection should consider low flammability characteristics and good maintenance practices need to be applied.

Effective ways to minimise the spread of fire within the garden is by using irrigated, well-spaced orchard trees and good separation of plantings throughout the garden. This can also be achieved with vertical and horizontal separation of garden plantings. In particular, separation between shrubs and trees will remove ladder fuels and break up direct fuel corridors to the house.

EXAMPLE: RURAL MODEL GARDEN

The numbers here refer to the illustration below and those on pages 28 and 29.

The garden and home paddock design aims to reduce spread of a grassfire to the house from surrounding paddocks and properties. It also aims to limit the spread of fire within the garden to the house.

In this garden example, the most likely direction of fire is from the north-west. However, fire can spread from any of the paddocks surrounding the house. Therefore, landscaping for bushfire design principles should be applied throughout.

The farm dam **1** is placed in the most likely direction of the fire. The front lawn **4**, tennis court **9**, front driveway **5**, turning circle **6**, and kitchen garden **8** all provide further separation and areas of low fuel between the fire hazard and the house.

A mass planting of irrigated ornamental orchard trees **2** acts as a windbreak and helps provide protection from ember attack in the home paddock. Shrub masses **3** between the house and these trees are ornamental and are kept away from the tree canopies to prevent them acting as ladder fuels. There is also good separation provided between the shrub beds to break up the spread of fire.

Planting has been kept away from the house with lawn and gravel paths. Planting near the driveway **7** softens the view from the house with low succulent plants. These are also planted away from vulnerable areas of the house. Decks around the house are replaced with non-flammable materials, such as concrete and steel.

Densely planted windbreaks are provided on the southern and western boundaries **14** outside the defensible space. While these are common features on rural properties, choosing low flammable species in this example reduces the fire risk.

The shed with chemical stores **11**, clothes line **10** and fire wood **15** are all located well away from the house. Non-combustible water tanks (concrete or corrugated iron) are fed off the roof of the shed **12** and may provide an additional water source during a fire. Grapes and berry plants **15** are located at the rear of the property near the shed and are kept well-watered over the summer months to reduce their flammability.

Plants chosen for the model garden have been selected for their firewise properties.

TREES

In the orchard, a mixed collection of small fruiting trees have irrigated lawn beneath.

They include *Prunus avium* (Sweet Cherry), *Prunus salicina* (Japanese Plums) and *Prunus domestica* (European Plums). All are trained to an open form and maintained with their lower branches pruned to provide separation.

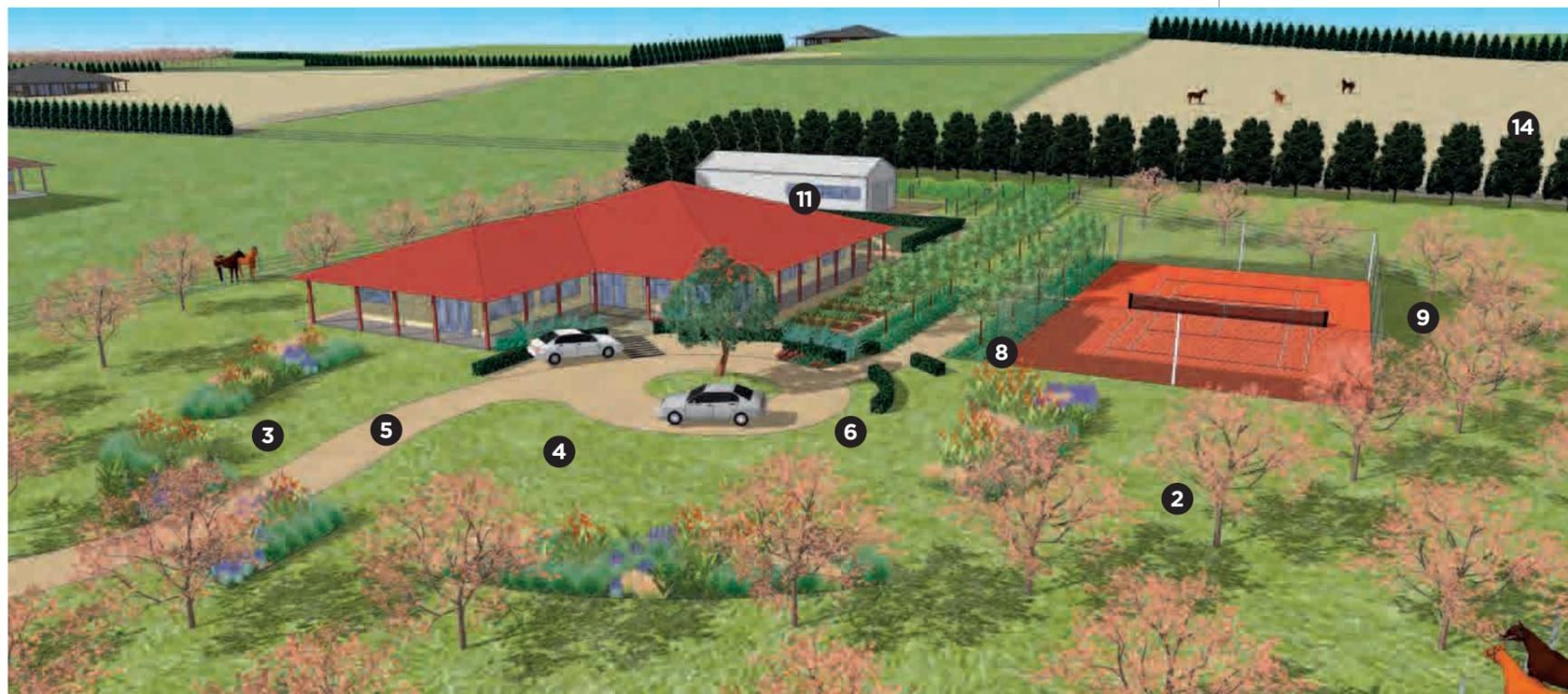
A small, decorative tree *Arbutus x andrachnoides* (Hybrid Strawberry Tree) is located in the lawn turning circle. With smooth bark, an open habit, attractive flowers and form, this display specimen is easily viewed from the house.

BOUNDARY WINDBREAKS

At the outer perimeter of the home paddock on two sides are windbreak plantings.

The species selected includes *Acmena smithii* (Lily Pilly) on the southern boundary and *Casuarina cunninghamiana* (River Oak) on the western boundary of the home paddock.

These trees have a moderately dense habit and retain little dead leaves or twigs. The grass beneath these trees is mowed low and is well-watered during summer.



See also next page.



WINDBREAK
Casuarina cunninghamiana
(River Oak)

**MOST LIKELY
FIRE DIRECTION**



HEDGE
Buxus sempervirens 'Suffruticosa'
(Dutch Box)

HERBACEOUS PLANTINGS
Festuca glauca (Blue Fescue)
Dianella caerulea (Paroo Lily)
Lomandra longifolia
(Spiny-headed Mat Rush)
Phormium 'Apple Green'
(New Zealand Flax)
Strelitzia reginae (Bird of Paradise)

ORCHARD
Prunus avium (Sweet Cherry)

WINDBREAK
Acmena smithii
(Lily Pilly)

PERENNIAL DISPLAY
Achillea millefolium cv. (Yarrow)
Anthemis montana
Beschorneria yuccoides (Mexican Lily)
Festuca glauca (Blue Fescue)
Dahlia 'Le Coco'
Euphorbia 'Compton Ash'
Salvia nemorosa
Tulbaghia violacea (Society Garlic)

HEDGE
Escallonia
'Pink Pixie'

ORCHARD
Prunus salicina
(Japanese Plum)

SUCCULENTS
Aeonium arboresum (Tree Aeonium)
Agave attenuata (Swans Neck Agave)
Cotyledon orbiculata (Pigs Ears)
Echeveria cvs. (Hen and Chickens)
Tradescantia pallida (Purple Heart)
Kleinia mandralascae (Blue Chalk Sticks)
Sedum pachyphyllum (Jelly Beans)
Sedum 'Matrona'



x Numbering key: see page 27

PLANTING AT FRONT DOOR

Closer to the house, flanking the front door are beds of drought-tolerant succulent plants. These have been chosen for their colourful foliage, low-growing habit, fleshy leaves and ease of cultivation.

They include *Aeonium arboresum* (Tree Aeonium), *Agave attenuata* (Swans Neck Agave), *Cotyledon orbiculata* (Pigs Ears), *Echeveria* cvs. (Hens and Chickens), *Tradescantia pallida* (Purple Heart), *Kleinia mandralascae* (Blue Chalk Sticks), *Sedum pachyphyllum* (Jelly Beans) and *Sedum* (Matrona).

HEDGES

Two hedges are used in the garden. These were selected for their low flammability characteristics. In particular, the absence of oils, waxes and resins in the leaves and stems, and their low retention of dead foliage after pruning.

At the front of the house a low hedge (to 50 centimetres in height) of *Buxus sempervirens* 'Suffruticosa' (Dutch Box) is planted either side of the pathway. This is a low-growing form of the Common Box with a medium texture and a moderately dense habit.

At the rear of the house a low hedge to 1 metre high is planted to frame the house garden. This hedge uses *Escallonia* (Pink Pixie). This is a low-growing hybrid form of this compact species that has fleshy leaves year-round. Like all hedging plants both these species require regular maintenance.

PERENNIAL DISPLAY PLANTING AT REAR OF HOUSE

Within the house garden towards the rear are mixed plantings. These contain drought-tolerant, flowering herbaceous perennials, which range from 30 centimetres to 1 metre in height. Plants include *Achillea* cultivars, *Anthemis montana*, *Beschorneria yuccoides* (Mexican Lily), *Festuca glauca* (Blue Fescue) 'Purple Emperor', *Dahlia* 'Licoco', *Euphorbia* (Compton Ash), *Penstemon* cultivars, *Salvia nemorosa*, *Sedum* cultivars, and *Tulbaghia violacea* (Society garlic). These will be irrigated to ensure a lush habit over summer, and mulched with pea gravel – a type of non-flammable mulch.

LAWN

The lawn species is *Pennisetum clandestinum* (Kikuyu Grass). It is tough, hard wearing and able to be managed at a low height. These lawns will be irrigated over summer to assist in maintaining a green, defensible space.

HERBACEOUS PLANTINGS

Around the perimeter of the lawn area are four rectangular clumps of herbaceous plants growing up to 1 metre in height.

These include *Festuca glauca* (Blue Fescue), *Dianella caerulea* (Paroo Lily), *Lomandra longifolia* (Spiny-headed Mat Rush), *Phormium* 'Apple Green' (New Zealand Flax), *Salvia nemorosa* (Woodland Sage) and *Strelitzia reginae* (Bird of Paradise).

All are drought-tolerant plants with strappy or vertical foliage and interesting flowers. They readily maintain a green and lush habit over summer.

MODEL 4 SUBURBAN GARDEN

In recent years, severe fires have moved beyond the rural fringe and into metropolitan suburbs of Canberra and Melbourne.

Planning a garden using the principles in Section 4 can help reduce the bushfire risk in suburban areas. However, a garden only forms one component of preparing for bushfire. There are many other things to consider (see Section 1).

The hard landscaping in a garden involves making changes to material selection. Use brick, stone, steel or concrete materials for retaining walls and garden edging. Gravel products are suitable for pathways and mulches. These design selections can reduce fire risk from within the garden.

In most areas timber should be avoided as this can provide a way of directly moving a fire further into the property. In a garden in a high bushfire risk area, timber fences should be replaced with non-combustible options.

Swimming pools or ponds can help when creating a defensible space if placed between the most likely direction of a fire and the house.

Removing other potential fuel sources from directly around the house is important. This includes sheds, garden tools and machinery areas, woodpiles, outdoor furniture, clothes lines and shade screens. These should all be positioned at least 10 metres away from the house.

Planting design should focus on plants that have low flammable characteristics that are placed away from the house. Plants in containers can be an effective way to create seasonal interest and bring productivity into the suburban garden. They can also be readily moved away from the house.

EXAMPLE: SUBURBAN MODEL GARDEN

The numbers here refer to the illustration below and those on pages 32 and 33.

Existing indigenous trees of *Eucalyptus polyanthemos* (Red Box) have been retained in the suburban garden ① but those within 10 metres of the house have been removed. Vegetation beneath the trees is confined to shortly-mown lawn, very low shrub and fleshy ground cover plantings. These plantings avoid ladder fuels that can carry fire into the canopy. Any low hanging branches have also been removed up to 2 metres as part of the regular garden maintenance.

A dual access driveway ② at the front of the property has been provided. The pool ⑪ has been placed between the house and a possible fire front. It includes a small area of adjoining timber decking ⑩ that is well separated from the house. Stone paving ⑨ and gravel pathways ④ are used in the area directly surrounding the house. The pathways have been designed to provide separation between garden beds and areas of low fuel around the house.

The slope of the site has been partially terraced using large rocks ③. Both the rear portion of the garden ⑫ and the lawn area to the east of the house ⑤ are maintained as open lawns. This design element reduces fuel loads within the defensible space.

Garden beds are separated by areas of maintained lawn that break up fuel continuity. The lawn also allows easy access for maintenance throughout the garden.

The clothes line and shed ⑥, which includes swimming pool chemicals and fire wood, are located in this area well away from the house. The eastern boundary of the garden has three large non-combustible water tanks ⑦ adjoining the fence. These help shelter the house from radiant heat and provide water for the adjacent vegetable garden ⑧. The vegetation is low around the tanks so that they can be accessed if there is a fire.

Plants chosen for the model garden have been selected for their firewise properties.

POOL AREA

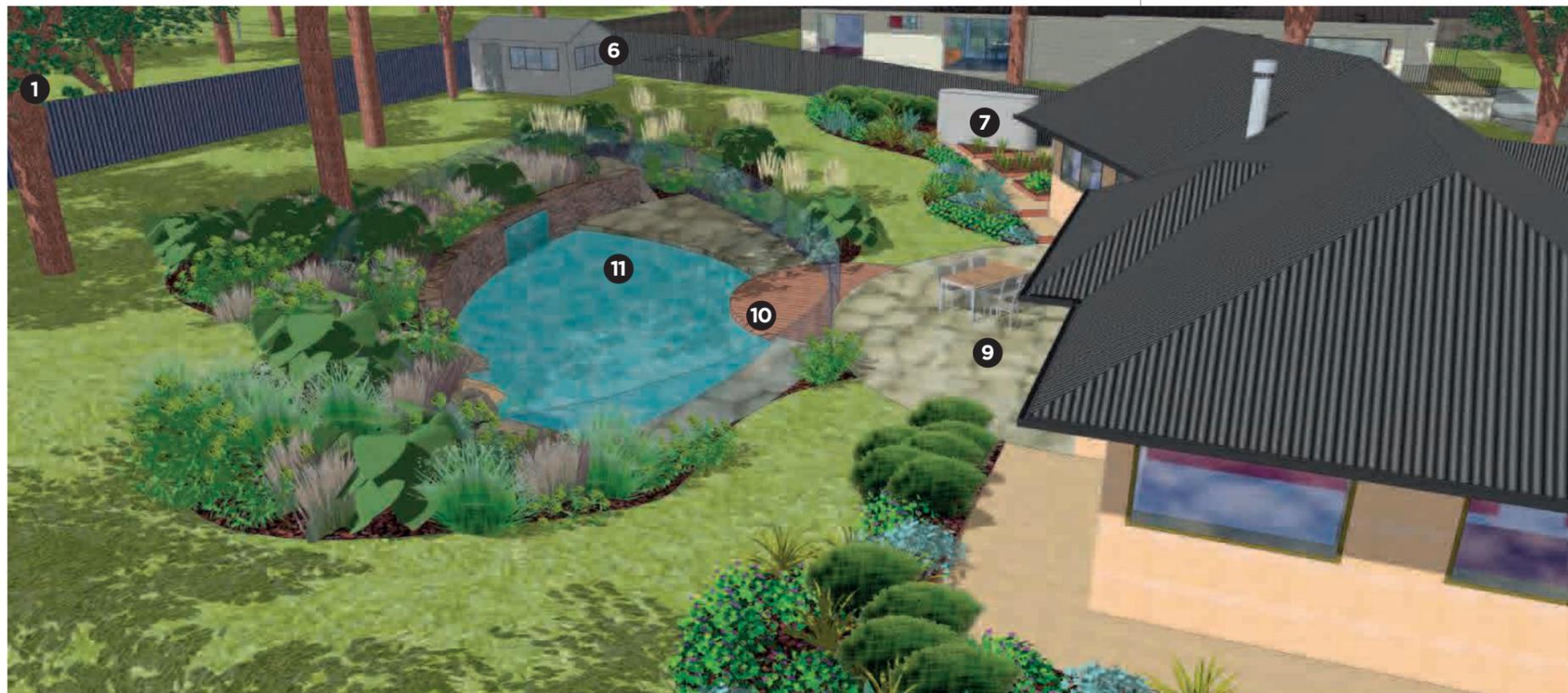
At the back of the pool area is a mixed display planting of short grasses and ornamental shrubs. These include *Festuca glauca* (Blue Fescue), *Cotinus 'Grace'* (Smoke bush); *Echium candicans* (Pride of Madeira), *Euphorbia characias* subsp. *wulfenii* (Wulfen Spurge) and *Senecio vira-vira*.

Adjoining the paving area (between the house and the pool) are low-growing (to 30 centimetres in height), drought-tolerant herbaceous plants. These include *Aloe x spinosissimum* (Spider aloe), *Chrysocephalum apiculatum* (Common Everlasting), *Coreopsis 'Moonbeam'*, *Dianthus caryophyllus* (Pinks) and *Nepeta fassenii* (Catmint).

SIDE PLANTING IN THE FRONT YARD

A mix of grouped shrub plantings (0.5-2 metres in height) is located away from the house. These shrubs are pruned after flowering to maintain an open form, reduce plant litter and encourage repeat flowering.

These Australian native plants include *Alyogyne huegii* (Native Hibiscus), *Banksia blechnifolia* (Creeping Banksia), *Correa pulchella* (Salmon Correa), *Crocea exalata*, *Eremophila maculata* (Emu Bush) and *Philotheca* (Bounda Beauty).



See also next page.



CHOOSING SUITABLE PLANTS

After planning and designing, the next task is to choose suitable plants for the garden. Some plants have intrinsic characteristics that reduce the likelihood of ignition. Choosing these plants and locating them correctly will help reduce bushfire risk within a garden.

There are a number of characteristics that influence how flammable a plant is. It is important to know which factors contribute to plant flammability. This will assist in making informed decisions when selecting plants for a garden.

A consistent approach for determining the flammability rating of a plant is provided by the Plant Selection Key (see Section 7).

The key takes the user through a series of questions about the characteristics of the plant and provides:

- an overall flammability rating
- firewise rating
- maintenance requirements
- advice on where to locate that plant within a garden.

Before working through the key, there are elements of plant flammability that should be further explained.

PLANT FLAMMABILITY

Determining the flammability of plants is not straightforward. Although it can be tested under controlled circumstances in a laboratory, the flammability of a plant may vary in a bushfire, where the conditions are often unpredictable. Some plants are more flammable than others but all plants in a garden – living and dead – can provide fuel for a bushfire.

Plant flammability is described as a combination of:

- the time taken for a plant to ignite
- how readily it burns when the ignition source is removed
- how much material there is to burn
- how long it takes for all available fuel to be consumed.

Flammability will vary depending on:

- a plant's age, health, physical structure and chemical content

- the daily and seasonal climatic variations
- location of the plant in relation to other vegetation and flammable objects
- the specific part of a plant – some parts of plants are also more flammable than others.

PLANT MOISTURE CONTENT

Foliage moisture content is the most critical factor that determines plant flammability. It influences how readily a plant will ignite.

Plants with high foliage moisture content will not burn until sufficient moisture in its foliage has been removed.

Plants with low moisture content will ignite more rapidly and continue to burn when the ignition source is removed.

Plants in the path of an oncoming bushfire will dry out as a result of the radiant heat and wind generated by the fire. Even fully hydrated plants will eventually dry out and burn if they are exposed to bushfire heat for long enough.



This succulent ground cover has a high moisture content.

REMEMBER

The arrangement of vegetation within a garden, rather than the flammability of individual plants, has a greater impact on how a bushfire will spread.



Thick, succulent leaves



Soft, fleshy leaves

Moisture content depends on a number of interacting factors:

The time of day

- Before sunrise, plants will typically have their maximum moisture content (influenced by the moisture content of the soil and humidity).
- As they transpire during the day their foliage moisture content decreases until the plant stops transpiring after sunset.
- Generally plants are most flammable in the mid- to late-afternoon when their foliage moisture content is at its lowest.

The season

- During summer as the soil dries out, the moisture content of the plant will decrease and the flammability of the plant will increase.

The part of the plant

- The leaves and new growth on a plant will generally have a higher moisture content than the stems or branches.
- Dead leaves and twigs have a very low moisture content that is driven by the relative humidity. On hot, dry days they become highly flammable as fine fuels.

Where it is planted

- The amount of sun or shade, the availability of water, drainage and soil type will affect plant moisture content.

Environmental conditions

- High temperatures, low humidity and periods of drought will increase the flammability of plants.

The age of the plant and its growth stage

- Many plants start as moisture-rich shoots but become woody as they age. As plants approach the end of their life they tend to dry out.
 - New growth on a plant will usually be soft and fleshy and become woody after the growing season.
-

ENVIRONMENTAL WEEDS

In most high bushfire risk areas, houses are located in close proximity to unmanaged vegetation. Some popular garden plants have become environmental weeds by escaping to the bush and displacing native species. Environmental weeds often contribute to high fuel loads, which increases bushfire risk. Priority should be given to removing environmental weeds within the property.

Avoid planting environmental weeds. Contact local council to find out which weed species are a problem in the area. The Department of Primary Industries also has information about weed species at dpi.vic.gov.au

When selecting plants, consider using local native species with low flammability. These are well suited to local conditions and will add to the habitat value of the bushland.

CHARACTERISTICS

The following plant characteristics are used throughout the Plant Selection Key. They all contribute to plant flammability to varying degrees and should not be considered in isolation.

BRANCHING PATTERN

This influences the distribution and density of foliage within the plant.



- Choose plants with open and loose branching as well as leaves that are thinly spread.



- Plants with closely packed leaves and branches have more fuel available within the plant and are usually more flammable.



- Plants with branches at least 2 metres above the ground are better than those with continuous foliage from the ground to the canopy. Under-pruning increases separation.



- Separation between ground fuel and foliage on the rest of the plant prevents lower branches acting as ladder fuels.

TEXTURE

This describes the overall appearance of the plant.

In coarse textured plants, it is easy to distinguish each branch or leaf from a distance of 3 metres.

Plants with a coarse texture have a lower surface-area-to-volume ratio making them less flammable than plants with a fine texture.



➤ Coarse textured plants



➤ Medium textured plants



➤ Fine textured plants

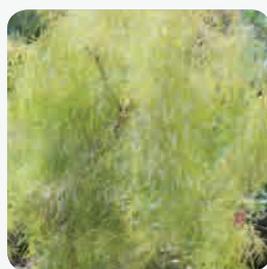


DENSITY

This describes the amount and arrangement of fuel within the plant.

A dense plant is difficult to place a hand into and is not easy to see through.

Plants that are very dense are often more flammable as there is a higher fuel load readily available to burn.



➤ Very dense



➤ Moderately dense



➤ Sparsely dense

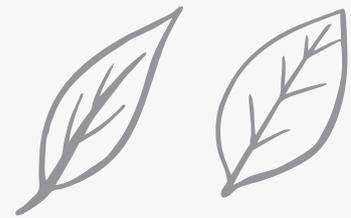


LEAVES

The fineness, size and shape of leaves affect their flammability.



- Wide, flat and thicker leaves (such as those on maples, camellias and oaks) and those that are soft and fleshy have more plant tissue in their leaves. This usually means a higher moisture content relative to their surface area.



- Leaves with a high moisture content take longer to dry out and therefore longer to catch fire.



- Small, thin and narrow leaves have a high surface-area-to-volume ratio, which tends to make them more susceptible to drying out.

- Generally, the higher the surface-area-to-volume ratio, the more flammable a leaf will be. Some plants with high surface-area-to-volume have leaves with high levels of oils (such as paperbark, tea trees, eucalypts) or resins (conifers such as pine trees). These combined properties increase flammability.



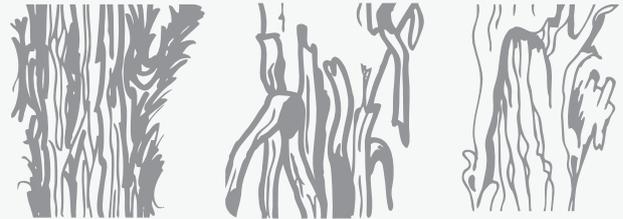
- The shape of leaves influences how easily they are caught in vegetation when they fall off the plant. If leaves are caught within plants it will increase that plant's flammability as leaf litter dries out and ignites readily. Dead pine needles are a good example of leaves that readily catch in other plants.

BARK TYPE

Some bark types ignite more readily than others.



- Bark that is loose, stringy or fibrous will ignite easily and can break off to create burning embers that are carried ahead of a bushfire.
- These types of bark can also act as ladder fuels that carry fire into the canopy of a tree, increasing the intensity of the fire. Examples of such plants include stringybark eucalypts and some paperbarks.



- Bark that is attached tightly to the trunk or is smooth is usually less flammable because it is more difficult to ignite and will not be easily carried as an ember, for example Box Barks.



- However, some smooth-barked trees shed their bark annually and trap large ribbons of bark in their branches or on the ground below. These ribbons of bark are highly flammable, can be carried as embers and can also act as a ladder fuel, for example Manna Gums.

OILS, WAXES AND RESINS

Some chemicals that are found naturally in plants will increase their flammability.

The leaves of plants containing significant amounts of oils, waxes and resins will often have a strong scent when crushed. For example rosemary, lavender and eucalyptus have oil in their foliage and pines can have high resin content.



- Waxes and resins have a similar effect of increasing flammability of plants although there are a number of characteristics that contribute to the overall flammability of a plant.
- Plants with high amounts of resins or oils should be limited and placed carefully within a garden.

RETENTION OF DEAD MATERIAL



- Dead leaves, twigs, bark and branches that are retained on the plant or accumulate on the ground or in shrubs can increase the flammability of an otherwise firewise plant.
- Regular pruning and maintenance of all trees and shrubs to remove these fine fuels is necessary.

MAINTAINING THE GARDEN

Remember that establishing a garden takes time. Buildings may not change but the plants in a garden will. To ensure a garden is effective over many years it will require ongoing maintenance of the defendable space around the house.

Replacement planting will need to be considered, as well as the periodic assessment of the suitability of the plants within the garden. Use the Plant Selection Key in Section 7 to assess plant flammability.

Diseased, stressed or dead plants are more flammable and moisture content will be lower in summer when bushfires are most prevalent.

Regular maintenance of the garden must be carried out and should be included as part of overall preparation for bushfire.

Incorporate maintenance into a Bushfire Survival Plan to ensure the garden is ready for the upcoming bushfire season.



Branches should be pruned up to 2 metres above ground level to increase separation from ground fuels.

Regular maintenance actions:

- Clear ground fuel from underneath plants, on and around the house.
- Prune plants with low-hanging branches, providing separation of at least 2 metres above the ground.
- Replace plants that die or become diseased.
- Keep plants well hydrated through watering and mulch. Watering less frequently but for longer encourages the plants to develop deep roots reducing moisture loss during dry periods.
- Replace or cover organic mulch such as woodchips, straw or dead plant matter with non-flammable mulches.
- Remove other flammable objects from your defendable space.
- Remove any fine, dead material that might accumulate in plants.
- Remove weeds from defendable space as these often contribute to high fuel loads.



Use non-flammable mulch.



Remove fine, dead material.

PLANT SELECTION KEY

About the key

The Plant Selection Key is a practical tool developed to guide you in choosing plants suitable for use in a garden in a high bushfire risk area.

The key comprises a series of questions and information about plant characteristics and their relative flammability. The key provides:

- › an overall flammability rating
- › a firewise rating
- › advice about maintenance
- › advice about whether the plant is appropriate for a garden.

An interactive version of this key is available online at cfa.vic.gov.au/plants

This Plant Selection Key is based on Behm AL, Long AJ, Monroe MC, Randall CK, Zipperer WC, Hermansen-Baez LA (2004) *Fire in the Wildland-Urban Interface: Preparing a Firewise Plant List for WUI Residents*. Circular 1453, School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Address: Southern Center for Wildland-Urban Interface Research and Information,
408 W. University Ave., Suite 306, USDA Forest Service, Gainesville, FL 32601.
Email (ahermansen@fs.fed.us) or fax (1-352-376-4536).

The Plant Selection Key has been customised to better suit Australian conditions and is intended to provide an indication of plant flammability. The flammability of plants is highly variable and in periods of drought or in the path of an oncoming bushfire, plants will dry out and become highly flammable. If there is uncertainty about the results this key produces, seek professional advice from a plant specialist.

PLANT SELECTION KEY

USING THE KEY: A THREE STEP PROCESS

1. Make a list of plants to be used in the garden

As a starting point, make an initial list of plants you want to plant in a garden. In doing this, it is important to:

- Choose plants that are suited to the local growing conditions.
- Check with your local council about legislative controls that may apply to your property. These may influence what and where you can plant.
- Check for characteristics that influence flammability. These are outlined in Section 5.
- Identify the plant species, including both the common name and the scientific name. This is important as even closely related plants in the same genus can vary greatly in their flammability.
- Take note of the size and form of the plant at maturity. Plant labels often focus on plant size within five to ten years of planting and may not be reliable for this assessment.
- Note how the plant will look in summer and whether it is susceptible to disease, insects or pests. This information can be obtained from plant websites, books, the local nursery or council.

2. Work through the key

- Begin at 1. *What type of plant is it?* and follow the prompts to the next number.
- Record how many 'Less Firewise' or 'Not Firewise' results the plant receives in the record sheet on page 62 at the end of the key.
- Collate the results in the record sheet.

3. Rate each plant for its suitability in the garden

The table on page 45 outlines four firewise ratings – Not Firewise, At-Risk Firewise, Moderately Firewise and Firewise – and a corresponding flammability rating. The flammability rating of individual plants depends on the number of 'Less' or 'Not Firewise' results you record.

Once you have established the firewise and flammability rating for each plant, you can determine the plant's suitability for use within a garden, where it should be planted (presuming it is suitable) as well as maintenance requirements.

FIREWISE AND FLAMMABILITY RATINGS

NOT FIREWISE

If you record any **NOT FIREWISE** results, regardless of any **LESS FIREWISE** results, then that plant is **NOT FIREWISE**.

- **Flammability = Extreme**
- **Where to plant:** These plants should not be planted in a garden or used when landscaping for bushfire.

AT-RISK FIREWISE

If you recorded three or more **LESS FIREWISE** results, then that plant is **AT-RISK FIREWISE**.

- **Flammability = High**
- **Where to plant:** Avoid using these plants in a garden. If you are on a large property, they may be planted outside the defensible space.

MODERATELY FIREWISE

If you recorded one or two **LESS FIREWISE** results, then that plant is **MODERATELY FIREWISE**.

- **Flammability = Moderate**
- **Where to plant:** These plants can be used in a garden but they need regular maintenance to keep them in a less flammable condition.

FIREWISE

If after finishing the key you had no **LESS FIREWISE** results, then that plant is **FIREWISE**.

- **Flammability = Low**
- **Where to plant:** These plants can be used in a garden as they are not known to be particularly flammable.

**BEGIN
PLANT
SELECTION KEY**



PLANT SELECTION KEY

1. What type of plant is it?



Tree

- Has single or multiple woody trunks and grows from 5-30 metres or over at maturity.
- Single-stem trees typically branch well above the ground, while multiple-stemmed trees typically branch close to the ground.
- Foliage is concentrated in the canopy allowing other vegetation to grow underneath.
- Has highly variable leaf and bark types.

Go to 2



Palm or palm-like

- Vary greatly in height.
- Generally have a single woody trunk topped by fronds.
- Many species retain dead fronds which can be flammable.
- Australian palm-like plants include tree-ferns, screw-palms, cycads and grass-trees. They can grow several metres tall and also have a 'skirt' of dead fronds or leaves close to the ground. This is an important flammability characteristic as it can act as a ladder fuel.

Go to 9



Shrubs

- Are shorter and generally more compact than trees, typically 3-4 metres in height with branching close to the ground.
- Have dense, bushy foliage and woody stems.
- Because of this structure, shrubs can carry fire from the ground to the tree canopy.

Go to 13



Vines and climbers

- Have soft or woody stems and are climbing or scrambling plants. Are often grown over fences, pergolas or trellises and can grow over other plants.
- Can be deciduous or evergreen. Some accumulate large amounts of dead leaves.
- Can act as ladder fuel and carry flames up into shrubs, trees or supporting structures.
- Examples include grapes, Virginia Creeper, Coral pea, Running Postman or Happy Wanderer.

Go to 17



Herbaceous plants

- Have soft and fleshy leaves with non-woody stems.
- Are low-growing, often less than 50 centimetres tall.
- Include most smaller flowering plants grown in gardens. Can look 'shrubby', form clumps or grow as groundcovers.
- Moisture content is usually higher than most woody shrubs. Often droop when dry.
- Examples include violets and pansies.

Groundcovers

- Are woody or herbaceous. Woody groundcovers spread without climbing.
- Are generally less than 50 centimetres tall.

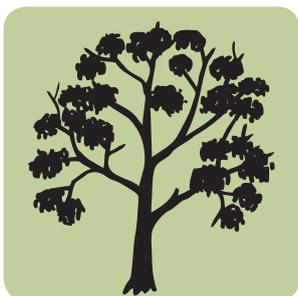
Grasses or grass-like

- Leaves are usually long, fine or strappy.
- Vary from a few centimetres to over 2 metres tall. Clump size can be up to 1 metre in diameter.
- Most grasses grown in gardens are perennial rather than annual. Many of these form clumps called tussocks. Examples include Wallaby Grass and Canary Grass.
- Perennial tussock grasses accumulate dead material mixed with the living leaves and are quite flammable, although they usually only burn for a short time.
- Other grasses grow as a continuous mat, such as lawn grasses.
- Leaves of grass-like plants are often coarse and thick and may accumulate dead leaves in the living clump. Examples include Mat rush, New Zealand Flax, Iris and Gladioli.

Go to 18



2. What type of tree is it?



Eucalypts

- Can have woolly fibrous bark (stringy bark), deeply corrugated and dense bark (iron bark), 'chippy' or platy bark (box bark) or smooth (gum bark).
- All flower and have leaves that hang vertically.
- Their bark can be extremely flammable.
- Examples include trees from the genera *Eucalyptus*, *Corymbia* (includes Flowering Gums) and *Angophora* (includes Smooth Barked Apple and Dwarf Apple that are similar in appearance to smooth barked gums).

Go to 3



Conifer or conifer-like

- Develop woody cones and have needle-like or scale-like leaves.
- Examples include pines, hemlocks, spruces, junipers, cedars and cypress.
- Native Australian examples include Cypress Pine, Cherry Ballart and she-oaks.

Go to 7



Other tree types

- This category contains all trees that are not eucalypts, conifers or conifer-like.
- Leaf type can vary greatly. For example:
 - the small leaves and phyllodes (lea-like structures) of wattles such as Blackwood and Silver Wattle
 - the medium-sized leaves of Lilly Pilly and Southern Sassafras
 - the deeply lobed leaves of Silky Oak
 - the wider, broad leaves of Kurrajong and non-native species such as maples, oaks and elms.

Go to 11

3. What type of bark does the tree have?



Stringybark eucalypt with coarse, loose fibrous bark

- Examples include Messmate and Red Stringybark.

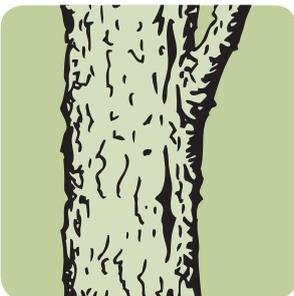
Go to 4



Sheds large ribbons or sheets of bark annually

- Strips or ribbons of bark are caught and held in the tree.
- Examples include many smooth or gum-barked eucalypts such as Manna Gum and Mountain Grey Gum.

Go to 8



Does not have stringy bark or ribbons of bark

- Examples include iron bark, some gum-bark species, box bark and peppermint bark eucalypts.

Go to 5

4. NOT FIREWISE



- Trees with this type of bark are extremely flammable.
- This type of bark acts as a ladder carrying fire into the canopy of the tree and produces masses of embers.

For more information, see *Section 3: Rules for vegetation clearance around existing houses* or *Section 5: Choosing suitable plants*.

Go to 29 (END)

5. What is the height of the lowest branch?



Low Branches are less than 2 metres above the ground.

Go to 6



Good separation At least 2 metres between ground and branches.

Go to 20

6. LESS FIREWISE



- Trees must be under-pruned up to 2 metres if possible and dead branches and fronds removed to ensure a more firewise characteristic.

Go to 11

7. Does it shed large amounts of leaves or needles?



Yes The conifer sheds large amounts of leaves or needles. For example, Monterey Pine.

Go to 8



No The conifer or conifer-like tree does not shed large quantities of leaves or needles. Examples may include native Cypress Pine, she-oak and Cherry Ballart.

Go to 9

8. LESS FIREWISE



- Pine needles need to be periodically removed from roofs, other plants and the ground near structures.
- Eucalypt bark and foliage should also be routinely removed from the tree and the ground.

Go to 9

9. What is the height of the lowest branch or frond?



Low Branches or fronds are less than 2 metres above the ground.

Go to 10



Good separation At least 2 metres between ground and branches.

Go to 11

10. LESS FIREWISE



- Trees must be under-pruned to a height of 2 metres if possible and dead branches and fronds removed to ensure a more firewise characteristic.

Go to 11

11. Does it have papery or loose bark?



Yes Trunk has papery bark or loose fibrous bark.
For example tea-trees and most paper barks.

Go to 12



No Trunk does not have papery bark or loose fibrous bark.

Go to 20

12. LESS FIREWISE



- Papery bark and fibres may act as ladder fuels.
- Requires appropriate placement in your garden.

Go to 20

13. What is the plant's texture?



Fine texture

- Texture is used to describe the overall appearance of the plant from a distance.
- From a distance of about 3 metres it is not easy to distinguish individual leaves or branches on plants with a fine texture.
- Examples include diosma and some paper barks with thin, narrow leaves. The fineness of foliage (the surface area-to-volume-ratio) is a very important determinant of flammability.

Go to 14



Medium texture

- This category includes many azalea and holly species as well as the natives Sarsaparilla and Hairpin Banksia.

Go to 15



Coarse texture

- It is easy to distinguish each individual leaf or branch from a distance of about 3 metres.
- Examples include hydrangea, cotoneaster, hazel pomaderris and blanket leaf.

Go to 15

14. LESS FIREWISE



- Plants with a fine texture have a higher surface-area-to-volume ratio and tend to dry out more readily than medium- and coarse-textured plants. This makes them generally more flammable.
- Require appropriate placement and routine pruning.

Go to 15

15. How dense is the plant?



Very dense

- So dense that it is very difficult to place a hand in the plant and touch the main stem. These plants have dense branches.
- Examples include shrubby grevilleas and junipers.

Go to 16



Moderately dense

- Sufficiently dense to not be able to see through the plant, but reasonably easy to place a hand into the plant and touch the main stem.
- Examples include some lavenders, rosemary and some correas.

Go to 20



Sparsely dense

- May have open branching patterns, making it easy to see through the plant.
- Examples include many wattles, rhododendrons and some hydrangeas.

Go to 20

16. LESS FIREWISE



- Dense plants have a larger amount of fuel packed closely together, which encourages the spread of flames within the plant.
- Require appropriate placement and routine pruning.

Go to 20

17. NOT FIREWISE

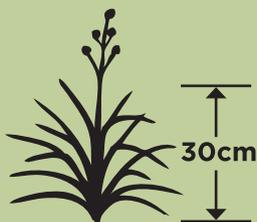


- Vines are extremely flammable as they typically add fuel directly to a structure. As such, they act as ladder fuels bridging gaps between surface fuels and canopy fuels.

For more information, see *Section 3: Rules for vegetation clearance around existing houses* or *Section 5: Choosing suitable plants*.

Go to 29 (END)

18. Is it a grass greater than 30 centimetres tall?



Yes Grass is greater than 30 centimetres tall (for example grass in the Family Poaceae or Gramineae).

Go to 19

No Short grasses and all other herbaceous plants or grass-like plants.

Go to 20



19. NOT FIREWISE



- Regardless of how many **LESS FIREWISE** results you may get, tall grasses are extremely flammable because they readily dry out and rapidly carry fire.

For more information, see *Section 3: Rules for vegetation clearance around existing houses* or *Section 5: Choosing suitable plants*.

Go to 29 (END)

20. Does the plant retain dead leaves or twigs?



Yes Plant retains dead leaves or twigs mixed with the living leaves.

- Retention of dead leaves or twigs increases the flammability of a plant. Fine fuels readily dry out and increase the fuel available within the plant for fire.

Go to 21



No Plant does not usually retain dead leaves or twigs, except when shedding leaves.

Go to 22

21. NOT FIREWISE



- Regardless of how many **LESS FIREWISE** results you receive for this plant, plants that retain dead foliage throughout the year are extremely flammable.
- Dead foliage has very low leaf moisture content and is therefore highly susceptible to ignition.

For more information: see *Section 3: Rules for vegetation clearance around existing houses* or *Section 5: Choosing suitable plants*.

Go to 29 (END)

22. Are the leaves waxy or oily?



Yes Leaves have a waxy coating or numerous oil glands dotted on the leaves.

- The leaves of plants containing significant amounts of oils and waxes will often have a strong scent when crushed. The presence of these chemicals often contributes to plant flammability.
- Plants with waxy leaves are often grey, silver or whitish and the waxy 'bloom' can be scraped off the leaf with a fingernail. For example, Wax Myrtle and gallberry.
- Plants in the families Myrtaceae, Rutaceae, Lamiaceae and Pinaceae are examples of plants with numerous oil glands. [Go to 23](#)



No Leaves do not have a waxy coating or numerous oil glands.

[Go to 24](#)

23. LESS FIREWISE



- Plants with large amounts of oils and waxes are more flammable than those without these chemicals.
- Require appropriate placement and routine pruning.

[Go to 24](#)

24. Is the species seriously susceptible to disease, insects or pests?



Yes Species is known to be seriously susceptible to disease or insect pests.

- Plants seriously susceptible to disease are likely to become stressed and have less vigorous growth.
- When this happens, there is a lower foliage moisture content and a greater number of dead leaves are retained. This in turn makes the plant more flammable. For example, elm trees.

Go to 25



No Species is not known to be particularly susceptible to disease or insect pests.

Go to 26

25. LESS FIREWISE



- Routine monitoring and appropriate treatment for the disease or pest is recommended.

Go to 26

26. Is the plant deciduous or evergreen?



Deciduous Plants drop all leaves once a year and the new leaves usually have higher moisture content than evergreen plants.

Go to 29



Evergreen Plants retain leaves for several years.

Go to 27

27. Are the leaves soft, thick or fleshy?



Yes Plant leaves are soft, thick, succulent or fleshy.

- These types of leaves often have a higher moisture content than hard, thin and needle-like leaves, making them less flammable.
- Moisture can often be seen on the exposed edge of torn leaves. Examples include cactus, agave, some myoporums such as Creeping Myoporum, many Lilies, some saltbush species and geraniums.

Go to 29



No Plant leaves are not obviously succulent; they may have various shapes and vary in thickness.

Go to 28

28. LESS FIREWISE



- Require appropriate placement and routine pruning.

Go to 29

29. END

How many LESS FIREWISE ratings did your plant score?	Then your plant is:	What does this mean?
None	FIREWISE	<ul style="list-style-type: none"> ➤ Flammability = Low ➤ Where to plant: These plants can be used in a garden as they are not known to be particularly flammable.
 or 	MODERATELY FIREWISE	<ul style="list-style-type: none"> ➤ Flammability = Moderate ➤ Where to plant: These plants can be used in a garden but they need regular maintenance to keep them in a less flammable condition.
 or more	AT-RISK FIREWISE	<ul style="list-style-type: none"> ➤ Flammability = High ➤ Where to plant: Avoid using these plants in a garden. If you are on a large property, they may be planted outside the defensible space.
Was your plant NOT FIREWISE?	NOT FIREWISE	<ul style="list-style-type: none"> ➤ Flammability = Extreme ➤ Where to plant: These plants should not be planted in a garden or used when landscaping for bushfire.

WHAT TO DO NEXT

- It is important to consider the role that plant selection plays in enhancing defensible space.
- If the plant is 'Firewise' or 'Moderately Firewise', locate it according to the design principles as outlined in Section 4. Remember, the location and arrangement of plants has a significant effect on reducing the bushfire risk within your garden, but during summer as soil dries out, the moisture content of plants will decrease and their flammability will increase.
- If the plant is 'At Risk' or 'Not Firewise' it should not be planted within the defensible space. For further information, see *Section 3: Rules for vegetation clearance around existing homes* or *Section 5: Choosing suitable plants*.
- You can also book a free Home Bushfire Advice Service visit where a member of CFA will assess your property and provide a range of options to assist you to develop your Bushfire Survival Plan. Go to cfa.vic.gov.au/hbas for information and bookings.

RECORD SHEET

➤ Use this sheet to record the plant name and how many 'Less Firewise' or 'Not Firewise' results the plant receives as you work through the Plant Selection Key.

Plant name	NOT FIREWISE Circle the questions that had a Not Firewise outcome	LESS FIREWISE Circle the questions that had a Less Firewise outcome	Firewise Rating	Flammability
			NOT FIREWISE (any Not Firewise results)	Extreme
			AT-RISK FIREWISE (3 or more Less Firewise results)	High
			MODERATELY FIREWISE (1 or 2 Less Firewise results)	Moderate
			FIREWISE (no Less Firewise results)	Low
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		
	4. 17. 19. 21.	6. 8. 10. 12. 14. 16. 23. 25. 28.		

FURTHER RESOURCES

CFA

cfa.vic.gov.au

Fire Ready Kit

On the Land: Agricultural Fire Management Guidelines

A guide to retrofit your home for better protection from a bushfire

Fire Service Guidelines:

- *Land Use Planning 0002: Requirements for Water Supply and Access in a Bushfire Management Overlay*
- *Land Use Planning 0003: Assessing Vegetation in a Bushfire Management Overlay*

OTHER

dpcd.vic.gov.au/planning/bushfire

Fact Sheet: Planning and Building for Bushfire Protection

Advisory Note 39: Amendment VC83 Bushfire Protection Vegetation Exemptions

Advisory Note 40: Amendment VC83 Bushfire Protection Bushfire Planning Provisions

Practice Note 64: Local Planning for Bushfire Protection

Practice Note 65: Bushfire Management Overlay and Bushfire Protection: Planning Requirements

planningschemes.dpcd.vic.gov.au

Clause 13.05 Bushfire

Clause 44.06 Bushfire Management Overlay

Clause 52.17 Native vegetation

Clause 52.43 Interim Measures for Bushfire Protection

Clause 52.47 Bushfire Protection: Planning Requirements

Clause 52.48 Bushfire Protection: Exemptions

Planning for Bushfire in Victoria (CFA and DPCD, forthcoming)

Department of Sustainability and Environment

dse.vic.gov.au

land.vic.gov.au

Department of Primary Industries

dpi.vic.gov.au

Municipal Association of Victoria

Council details can be found at mav.asn.au/about-local-government/council-details

Ramsay, C and Rudolph, L, 2003 *Landscape and Building Design for Bushfire Areas*, CSIRO, Melbourne.

Standards Australia AS 3959-2009: Construction of Buildings in Bushfire-prone Areas

REFERENCES

- | | |
|--|---|
| ACT Planning and Land Authority, 2005 | <i>Fire Wise Home Gardens</i> , Australian Capital Territory Government, ACT Planning and Land Authority, Canberra. |
| Behm, A, Long, A, Monroe, M, Randall, C, Zipper, W and Hermansen-Baez, L, 2004 | <i>Fire in the Wildland-Urban Interface: Preparing a Firewise Plant List for WUI Residents</i> , University of Florida and USDA Forest Service Centre for Wildland-Urban Interface Research and Information, Florida. |
| Chladil, M and Sheridan, J, 2006 | <i>Fire Retardant Garden Plants for the Urban Fringe and Rural Areas</i> , brochure, Royal Tasmanian Botanical Gardens, Forestry Tasmania, Tasmania Fire Service, Parks and Wildlife Service Tasmania, Tasmania. |
| Country Fire Authority Headquarters, 2010 | <i>Fire Ready Kit</i> , CFA, Melbourne. |
| Doran, J, Randall, C and Long, A, 2004 | <i>Fire in the Wildland-Urban Interface: Selecting and Maintaining Firewise Plants for Landscaping</i> , University of Florida and USDA Forest Service Southern Centre for Wildland-Urban Interface Research and Information, Florida. |
| Gill, A and Moore, P, 1996 | <i>Ignitability of leaves of Australian Plants</i> , Australian Flora Foundation, Centre for Plant Biodiversity Research CSIRO Plant Industry, Canberra. |
| NSW Rural Fire Service, date unknown | <i>Garden Design and Plant Selection in a Bush Fire Prone Area</i> , brochure, NSW Rural Fire Service. |
| NSW Rural Fire Service, 2006 | <i>Planning for Bush Fire Protection</i> , NSW Rural Fire Service. |
| Randall, C, Hermansen-Baez, L and Acomb, G, 2004 | <i>Fire in the Wildland-Urban Interface: Reducing Wildfire Risk while Achieving other Landscaping Goals</i> , University of Florida and USDA Forest Service Southern Centre for Wildland-Urban Interface Research and Information, Florida. |
| Ramsay, C and Rudolph, L, 2003 | <i>Landscape and Building Design for Bushfire Areas</i> , CSIRO, Melbourne. |
| Rural Solutions SA, 2005 | <i>Landscaping for Fire Protection</i> , Government of South Australia Eyre Peninsula Natural Resources Management Board, Adelaide. |
| South Australia Country Fire Service, 2000 | <i>Community Fire Safe Fire Retardant Plants</i> , brochure, Country Fire Service, Adelaide. |
| White, R and Zipper, W, 2010 | <i>Testing and Classification of Individual Plants for Fire Behaviour: Plant Selection for the Wildland-Urban Interface</i> , International Journal of Wildland Fire, CSIRO publishing. |

Bushfire Survival Plan

PREPARE. ACT. SURVIVE.

Tomorrow's Queensland: strong, green, smart, healthy and fair



You must **PREPARE**. **ACT**. **SURVIVE**.

Your main priority is to ensure that you and your family are safe. During a bushfire you and your family's survival and safety depend on your preparations, and the decisions you make.

The lives of you and your family are more important than any building.

Whether your plan is to leave early or stay, you must prepare your home and property to increase their level of resilience and your chances of survival.

Bushfires in Queensland

The fire season in Queensland normally commences in the far north of the state in July and progresses through to southern areas as spring approaches. The fire season can extend through to February in southern and far south-western Queensland. These time frames can vary significantly from year to year, depending on the fuel loads, long-term climate and short-term weather conditions in each area.

There are four key considerations for dealing with bushfire:

- The safety of you and your family.
- The resilience of your property.
- The protection of irreplaceable valuables and important documents.
- The maintenance of adequate levels of insurance.

This document will provide you with information about the things you need to consider to prepare yourself and your home for the bushfire season, and how to make your own personal Bushfire Survival Plan.

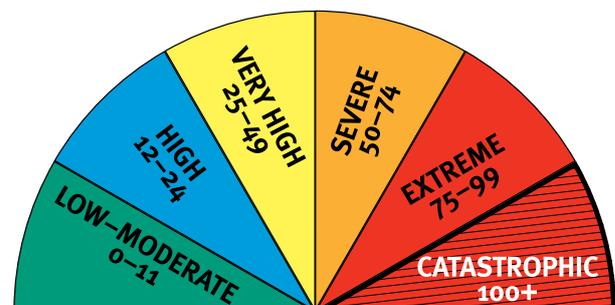
It is your responsibility
to prepare yourself, your
family and your
home for the threat
of bushfire.

Understand your risk

The first step in planning to survive a bushfire is to understand your own level of risk. By understanding your own level of risk you will be able to make informed decisions that are right for you and your family. Included with this Bushfire Survival Plan is a self-assessment tool that will enable you to assess the risk level associated with your property. If you are still unsure of your level of risk or require assistance contact your local fire station for more information. To book a Bushfire Safety presentation call 1300 369 003.

Fire danger ratings

The increased frequency of extreme bushfires in Australia in the last 10 years and the recent experience of the Black Saturday fires in Victoria have encouraged fire services throughout Australia to introduce new levels of Fire Danger Rating (FDR). A lift-out chart of the FDR system is contained within this document. Display it in a prominent place in your home or keep it with your Bushfire Survival Plan.



Catastrophic fire danger rating

The highest level is catastrophic. On a day of catastrophic FDR leaving early is the only option to ensure your survival. You must relocate early to a safer location, hours or the day before a fire occurs. Under no circumstances will it be safe to stay with your property.

Extreme fire danger rating

The second highest level is extreme. Should a fire occur in your area on a day of extreme FDR leaving early will always be the only option. Staying can only be considered for homes that:

- Have been designed and constructed specifically to address the threat of bushfire.
- Have been maintained to those levels and are currently well prepared.
- Can be actively defended by people with the skills, knowledge and confidence to implement a well-rehearsed Bushfire Survival Plan.

On days of catastrophic or extreme FDR:

- Fires are likely to be uncontrollable, unpredictable and very fast moving with highly aggressive flames extending high above tree tops and buildings.
- Thousands of embers may be violently blown into and around homes causing other fires to start rapidly and spread quickly up to 20 kilometres ahead of the main fire.
- Fire can threaten suddenly, without warning, and the heat and wind will make it difficult to see, hear and breathe as the fire approaches.
- People in the path of such fires will almost certainly be injured or die and a significant number of homes and businesses will be destroyed or damaged.
- Even well-prepared and constructed homes will not be safe.
- Expect power, water and phone networks to fail as severe winds bring down trees, power lines and blow roofs off buildings well ahead of the fire.

It is vital that you understand on these days that your survival will depend solely on how well you have prepared and how decisively you act.

Leaving late can be
a deadly option.
If you are in any doubt,
make the decision to
LEAVE EARLY.

What will you do?

At all times you need to **PREPARE.ACT.SURVIVE.**

When the fire danger rating is '**catastrophic**' leaving early is the safest option.

When the fire danger rating is lower than '**catastrophic**', one of the most important decisions you need to make is whether you will leave early or stay with a well prepared property. This decision is the basis of your Bushfire Survival Plan.

The following questions may help you make the right decision for whether you will leave early or stay:

- Do you need to consider family members who are young, elderly or infirm?
- Are you physically and emotionally prepared to stay with your property?
- Do you have the knowledge, skills, and confidence to stay with your property?
- Is your home adequately constructed, maintained and prepared to withstand the impact of a fire? In other words, is your home prepared to withstand the impact of a bushfire?
- Do you have well-maintained resources and equipment to fight fire, and do you know how to use them?
- Do you have appropriate protective clothing to fight a fire?
- What will you do if a rapid onset fire leaves you with no time to leave? Where will you shelter?



Leave early

If you plan to leave early then you must leave your home well before a bushfire threatens and travelling by road becomes hazardous. Your leave early preparations include:

Step 1: Preparation – your property should be well prepared for bushfire even if you intend to leave early.

Step 2: What you will do – make your Bushfire Survival Plan in accordance with your decision to leave early.

Step 3: Make a contingency plan – the FDR, the preparedness of your home, a change in household circumstances, a change in your physical preparedness or unexpected visitors are some things that may require you to reconsider your Bushfire Survival Plan.

Planning to stay

Planning is critical to successfully staying with your home may involve the risk of psychological trauma, injury or death.

Step 1: Preparation – your property must be able to withstand the impact of bushfire and well prepared to shelter you and your family.

Step 2: What you will do – make your Bushfire Survival Plan in accordance with your decision to stay.

Step 3: Make a contingency plan – the FDR, the preparedness of your home, a change in household circumstances, a change in your physical preparedness or unexpected visitors are some things that may require you to reconsider your Bushfire Survival Plan.

In making your decision to stay, here are a few things you need to consider.

- Is your property able to withstand the impact of a bushfire?
- Are you physically and emotionally prepared to stay with your property?
- Do you have well-maintained resources and equipment and do you know how to use them?
- Do you have appropriate protective clothing?
- Will your bushfire survival plan need to be different for weekdays, weekends or if someone is sick at home?
- Do you have a contingency plan?

Preparing your Bushfire Survival Plan

Preparation is the key to survival. Being involved in a fire will be one of the most traumatic experiences of your life.

- Prepare yourself – you need to be both mentally and physically prepared to carry out your Bushfire Survival Plan.
- Prepare your Bushfire Survival Plan.
- Prepare your Bushfire Survival Kit.
- Prepare your Bushfire Relocation Kit.
- Prepare your property.

When writing your plan you need to consider:

- Have you made the right choice: to leave early or stay?
- Have you discussed your choice with your family, friends and neighbours?
- Who will take charge and lead other family members by carefully communicating the various tasks set out in the plan?
- If you have chosen to stay what will you do to protect your property when the fire arrives?
- What will you put in your Bushfire Survival Kit and where will you store it?
- Do your friends, family and neighbours know the details of your plan?

- What will you do if your Bushfire Survival Plan fails?
- Do you have an alternative option or contingency plan if your plan fails?
- Do you have a Neighbourhood Safer Place (NSP) you can go to as a last resort? For more information on NSPs see www.ruralfire.qld.gov.au.
- Is it safe to travel there?

If your decision is to leave early, you must include the following information or action items in your Bushfire Survival Plan:

- Monitor media outlets – radio, TV, mobile phone and internet for bushfire alerts.
- When will you leave?
- What will be your trigger for action?
- Will your plan be different for weekdays, weekends, or if someone is at home sick or injured?
- What will you take with you (Relocation Kit)?
- Where will you and your family go when you leave early?
- What route will you take to get there?
- What will you do with your pets?
- What will you do if there are consecutive or multiple **'catastrophic'** or extreme fire danger days?
- Will you go into work on days when the FDR is in the upper levels?
- Will you send your children to school when the FDR is in the upper levels?
- Will all members of your household leave early?
- What will you do to prepare your property?
- What is your contingency plan in the event that it is unsafe to leave?

If your decision is to stay you must include the following information or actions items in your Bushfire Survival Plan:

- Monitor media outlets – Radio, TV, mobile phone and internet.
- Locate your Bushfire Survival Kit.
- Put on protective clothing.
- Remain hydrated by drinking lots of water.

- Move any stock to fully grazed paddocks.
- Move cars to a safe location.
- Remove garden furniture, doormats and other items.
- Close windows and doors and shut blinds.
- Take down curtains and move furniture away from windows.
- Seal gaps under doors and window screens with wet towels.
- Place pets inside, restrain them, and provide water.
- Block downpipes and fill gutters with water.
- Wet down the sides of buildings facing the approaching fire front.
- Wet down decks and verandas.
- Wet down fine fuels close to buildings.
- Turn on sprinklers in garden before bushfire arrives.
- Fill containers with water; bath, sinks, buckets, wheelie bins, etc.
- Have ladders ready for roof space access (inside) and against roof (outside).
- Have generator or petrol pump ready.
- Start checking and patrolling for embers outside.

When the fire front arrives:

- Take all fire fighting equipment inside such as hoses and pumps as they may melt during the fire.
- Go inside and shelter away from the fire front.
- Patrol the inside of your home, including the ceiling space, for embers or small fires that may start.
- Drink lots of water.
- Check family and pets.

After the fire front has passed:

- Wear protective equipment.
- Go outside once it is safe.
- Check for small spot fires and burning embers:
 - inside roof space
 - under floor boards
 - under house space
 - on veranda and decks

- on window ledges and door sills
- in roof lines and gutters
- garden beds and mulch
- wood heaps
- outdoor furniture
- sheds and carports
- Continue to drink lots of water.
- Stay at your property until the surrounding area is clear of fire.
- Monitor media outlets – radio, TV, mobile phone and internet.

You need to be both mentally and physically prepared to carry out your Bushfire Survival Plan

There may be other actions to include, depending on your individual property and the level of bushfire risk you are exposed to.

Include the whole family in creating your Bushfire Survival Plan. You and your family should be aware of the actions you will take at the various FDR levels and it is important to ensure this is incorporated into your Bushfire Survival Plan. The FDR for your area can be found on roadside signs and by visiting www.ruralfire.qld.gov.au and following the FDR link.

It is important that your Bushfire Survival Plan does not rely solely on receiving an alert.

Once you have completed your Bushfire Survival Plan, practise it regularly to ensure everyone involved knows exactly what to do in the event of a fire.

Preparing your Bushfire Survival Kit

It is essential that you have a Bushfire Survival Kit if your choice is to stay with your property. This kit will ensure you and your family have the important equipment you need to stay. For a comprehensive list of equipment needed in a Bushfire Survival Kit see page 14.

Preparing your Bushfire Relocation Kit

It is equally important to have a relocation kit if your choice is to leave early. This kit will ensure you and your family have important items and equipment required to relocate for the time needed. For a comprehensive list of items and equipment needed in a Bushfire Relocation Kit see page 15.

Making a contingency plan

No matter whether your decision is to leave early, well before a bush fire threatens or to stay you should still have a contingency plan as part of your Bushfire Survival Plan. There are many scenarios to consider, such as what you will do if a rapid onset fire starts in your local area making roads impassable or travel particularly dangerous. You should have other options if road travel is not safe.

- Is your house well prepared?
- Can it provide you with protection from radiant heat?
- Have you identified a safer location such as an NSP?

Sheltering in a well-prepared property is far safer than being out in the open or in a vehicle

Preparing your property

An unprepared property is not only at risk itself, but may also present an increased danger for your neighbours and their homes.

Planning is absolutely critical to safely staying with your home. Staying home involves the risk of psychological trauma, injury and death.

There are a number of measures you can take to prepare your home and property for bushfire. These include several preparations you must take annually prior to the bushfire season.

Your pre-season property preparations should include:

- Displaying a prominent house number.
- Ensuring there is adequate access for fire trucks to your property – 4 metres wide by 4 metres high with a turn-around area. Reduce vegetation loads along the access path.
- Mowing your grass regularly.
- Removing excess ground fuels and combustible material (long dry grass, dead leaves and branches).
- Clearing of leaves, twigs, bark and other debris from the roof and gutters.
- Purchasing and testing the effectiveness of gutter plugs.
- Trimming low-lying branches 2 metres from the ground surrounding your home.
- Enclosing open areas under your decks and floors.
- Installing fine steel wire mesh screens on all windows, doors, vents and weep holes.
- Pointing LPG cylinder relief valves away from the house.
- Conducting maintenance checks on pumps, generators and water systems.
- Checking that you have sufficient personal protective clothing and equipment.
- Relocating flammable items away from your home including woodpiles, paper, boxes, crates, hanging baskets and garden furniture.
- Sealing all gaps in external roof and wall cladding.
- Checking that the first aid kit is fully stocked.

Bushfire Alerts

If you receive an emergency warning about a bushfire or other emergency, take notice as it could save your life.

There are three types of alert messages to help you make the right safety choices:

Bushfire Advice Message – a fire has started – general information to keep you up to date.

Bushfire Watch and Act Message – represents a heightened level of threat. Conditions are changing, a fire is approaching; lives may come under threat. Take appropriate action.

Bushfire Emergency Warning – is the highest level message advising of impending danger. It may be preceded with the Standard Emergency Warning Signal (SEWS).

An Emergency Warning
means there is a threat
to lives and protective
action is required
immediately.

When a bushfire strikes

You have made your decision to **PREPARE.ACT.SURVIVE**. You have prepared your property before the fire season. You have made your Bushfire Survival Plan. You have practised your Bushfire Survival Plan.

A bushfire is threatening? What do you do?

- Know the FDR for any given day.
- Regularly check the FDR on the Rural Fire Services website at www.ruralfire.qld.gov.au.
- Monitor your media outlets for warnings on bushfire activity.
- Seek out information if you have to, and do not assume that you will receive a warning.
- Leave early or stay according to your Bushfire Survival Plan.
- Act decisively in accordance with your Bushfire Survival Plan.
- Do not adopt the 'wait and see' option.

Travelling in your vehicle near a bushfire

Sheltering inside a vehicle is a high-risk strategy that can result in death. Whilst sheltering inside a vehicle offers you a slightly higher chance of survival than being caught in the open, having a leave early or stay strategy is a much safer option.

You should never take a journey into areas where the fire danger is catastrophic or extreme. You should consider postponing or finding alternative routes if necessary. If you can smell or see smoke in the distance it is best to u-turn and drive away from the danger.

If you are caught in smoke or flames while on the road:

- Turn on the vehicle's headlights and hazard warning lights.
- If you need to shelter in your vehicle drive your car into a bare, clear area well away from surrounding trees, leaving lights on. Position vehicle to prevent side impact from advancing fire front.
- Close all windows and vents.
- Leave the engine running and turn off the air conditioning system.
- Cover your entire body with woollen or cotton blankets to protect from radiant heat.
- Take shelter below the window level.
- Drink water frequently and stay in the vehicle until the fire front has passed.
- Once the fire front has passed exit the vehicle to inspect the damage and ensure other passengers are safe.

Neighbourhood Safer Places

A Neighbourhood Safer Place (NSP) is a place of last resort for people during a bushfire. An NSP may form part of a back-up plan when:

- Your Bushfire Survival Plan has failed.
- Your plan was to stay but the extent of the fire means that your home cannot withstand the impact of the fire and therefore your home is not a safe place to shelter.
- The fire has escalated to an extreme or catastrophic level and relocation is the safest option.

An NSP is an identified building or open space within the community that can provide a level of protection from the immediate life-threatening effects of a bushfire. NSPs still entail some risk, both in moving to them and while sheltering in them and cannot be considered completely safe.

They are a place of *last resort* in bushfire emergencies only. The following limitations of NSPs need to be considered within your Bushfire Survival Plan:

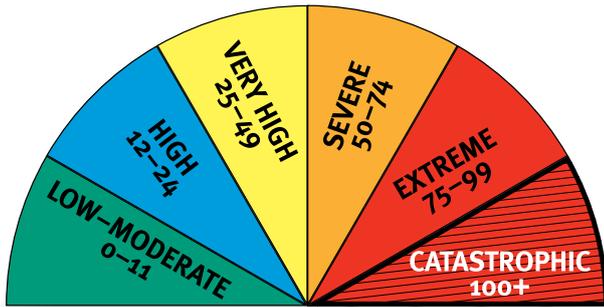
- NSPs do not cater for pets.
- Firefighters may not be present as they will be fighting the main fire front elsewhere.
- NSPs do not provide meals or amenities.
- They may not provide shelter from the elements, particularly flying embers.

If you are a person with special needs you should give consideration to what assistance you may require at an NSP.

Although QFRS cannot guarantee an immediate presence during a bushfire, every effort will be made to provide support as soon as resources are available.

If an NSP is part of your contingency plan it should not require extended travel through fire-affected areas to get there.

FIRE DANGER RATING



The Fire Danger Rating (FDR) is an early indicator of potential danger and should act as your first trigger for action. The higher the rating the greater the need for you to act.

The FDR is an assessment of the potential fire behaviour, the difficulty of suppressing a fire, and the potential impact on the community should a bushfire occur on a given day.

A Fire Danger Index (FDI) of 'low-moderate' means that fire will burn slowly and that it will be easily controlled, whereas a FDI in excess of 'catastrophic 100+' means that fire will burn so fast and so hot that it will be uncontrollable.

CATASTROPHIC 100+

A fire with a rating of 'catastrophic' may be uncontrollable, unpredictable and fast moving. The flames will be higher than roof tops. Many people will be injured and many homes and businesses will be destroyed.

During a 'catastrophic' fire, well-prepared and constructed homes will not be safe. Leaving is the only option for your survival.

EXTREME 75-99

A fire with an 'extreme' rating may be uncontrollable, unpredictable and fast moving. The flames will be higher than roof tops. During an 'extreme' fire, people will be injured and homes and businesses will be destroyed.

During an 'extreme' fire, well-prepared and well-constructed homes may not be safe. Leaving is the only option for your survival.

SEVERE 50-74

A fire with a 'severe' rating may be uncontrollable and move quickly, with flames that may be higher than roof tops. A 'severe' fire may cause injuries and some homes or businesses will be destroyed.

During a fire with a 'severe' rating, leaving is the safest option for your survival. Use your home as a place of safety only if it is well-prepared and well-constructed.

VERY HIGH 25-49

A fire with a 'very high' danger rating is a fire that can be difficult to control with flames that may burn into the tree tops. During a fire of this type some homes and businesses may be damaged or destroyed.

During a fire with a 'very high' danger rating, you should use your home as a place of safety only if it is well prepared and well-constructed.

HIGH 12-24

A fire with a 'high' danger rating is a fire that can be controlled where loss of life is unlikely and damage to property will be limited.

During a fire with a 'high' danger rating, you should know where to get more information and monitor the situation for any changes.

LOW-MODERATE 0-11

A fire with a 'low to moderate' rating can be easily controlled and pose little/or no risk to life or property.

During a fire with a 'low to moderate' rating, you should know where to get more information and monitor the situation for any changes.

BUSHFIRE SURVIVAL PLAN

Complete your personalised Bushfire Survival Plan lift-out.

Personal details:

Important phone numbers: **000** (Fire, Police and Ambulance)

Family: _____ Family: _____ Family: _____

Work: _____ Friends: _____ Friends: _____

School: _____

Important contact details – name and phone number:

Insurer: _____ Policy Number: _____ Phone: _____

Electricity: _____ Phone: _____

Water: _____ Phone: _____

Gas: _____ Phone: _____

Phone Company: _____ Phone: _____

Council: _____ Phone: _____

Leave early:

List all names and contact phone numbers of household members who have decided to leave early then complete Section 1.

Names: _____

Phone: _____

Stay:

List all names and contact phone numbers of household members who have decided to stay, then complete Section 2.

Names: _____

Phone: _____

Leave early – Section 1

Pull this Bushfire Survival Plan lift-out from this document and keep in a safe place.

Leaving early will always be the safest option for you and your family. It is extremely important for you to prepare a detailed leave early plan to ensure everyone understands what to do and when. Use the boxes below to list tasks to do.

When to go – Think of different triggers that will cause you and your family to leave early. Think about what you will do if you have sent the children to school that day. Think about whether or not you will have to travel from work into the fire zone.

Where to go – Identify one or more safer locations. Consider putting on personal protective clothing before you leave home.

How to get there – What roads will you take to your destination? Have an alternative route if your first choice is impassable.

What to take – Make a list of your most valuable items (e.g. insurance papers, electronic records, photo albums, passports, birth certificates and other important documents).

Stay – Section 2

Anyone who is not going to leave early must be involved in completing this stay and defend plan to ensure they know what to do. Every stay plan will be different depending on your circumstances. Use the boxes below to list tasks to do.

Before the fire approaches – Start getting yourself and your property ready for a bushfire.

As the fire approaches – Prepare for ember attack on or near your home.
Remember to put on personal protective clothing.

As the fire front arrives – Stay safe by monitoring the fire from inside your home.

After the fire has passed – Patrol your property and extinguish any spot fires or burning embers.
You may need to keep this up for several hours.

Everyone must have a contingency plan

Have a contingency plan – what will you do if you can't activate your Bushfire Survival Plan? Remember that leaving late can lead to loss of lives.

Know where your nearest NSP is and how to get there.

ACTIVATING YOUR BUSHFIRE SURVIVAL PLAN

Once you have prepared your Bushfire Survival Plan and completed your preparations, it is absolutely essential that you regularly practise and review your plan. This will make sure you and your family are well organised in the event of a bushfire. If a bushfire threatens the health and safety of you, your family, home or property, you should follow these steps:

Step 1 – Activate your Bushfire Survival Plan

Someone must take charge and lead other family members through this emotional experience by carefully communicating the various tasks set out in the plan. Know who is going to leave early and who is going to stay.

Step 2 – Put on your personal protective clothing

Every member of the family must change into their personal protective clothing, including long pants, long-sleeve-shirt and closed-in shoes.

Step 3A – Pack your vehicle and leave early

If your plan is to leave early, pack all valuables in your vehicle (see Relocation Kit) and relocate to your designated safer location. Give yourself enough time to get you and your family to safety. Don't return home until it is safe to do so.

OR

Step 3B – Implement your strategy to stay and defend

If your plan is to stay ensure you have all the items in the Bushfire Survival Kit ready to go. This can be a dangerous option and you should be physically and mentally prepared.

Step 4 – Keep informed of bushfire activity

Listen to the radio, television, internet, firefighters and/or police for information on the fire in your local area. Bushfire is dynamic and unpredictable so you need to be prepared for the unexpected. Warnings are not guaranteed so do whatever is necessary to ensure you remain safe.

BUSHFIRE SURVIVAL KIT

You need to have a Bushfire Survival Kit stored in an area of the house that is safe and easy to access. It should contain:

- protective clothing
- mop
- gloves
- torch
- hoses
- shovel
- towels
- buckets
- safety goggles
- ladder
- medications
- bottled drinking water
- fire extinguishers
- battery operated radio
- spare batteries
- smoke mask
- woollen blankets
- first aid kit
- knapsack sprayer
- protective clothing for the whole family.



RELOCATION KIT

Write a list of all items your family will need before, during and after your relocation. The list below shows items that you might like to put in your relocation kit.

- protective clothing for the whole family
- battery operated radio and spare batteries
- safety goggles
- mobile phone and battery charger
- medications
- wallet or purse and money
- clothing (two sets of clothes for each family member)
- identity information (passports, birth certificates)
- bottled water (enough for each relocated family member)
- family and friends' phone numbers
- items of high importance (e.g. family photos, valuables, important documents)
- blankets (natural fibres)
- children's toys



BUSHFIRE RISK SELF-ASSESSMENT CHECKLIST



This basic self-assessment checklist is designed to give you a greater understanding of the bushfire risk level relevant to your property. Information provided in this assessment will assist you when completing your Bushfire Survival Plan.

Address:

Postcode:

Property Owner/Property Name:

ACCESS/EGRESS

Road/Street/Driveway PLEASE ✓ APPROPRIATE BOX

Clear of overhanging vegetation	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Unrestricted gate access	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Clear of overhead power lines	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Able to reverse in	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Turning/passing areas	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Heavy vehicle access on cattle grid/bridge	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Alternative way out	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Two wheel drive access	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

STRUCTURE/S

Exterior walls – non-combustible	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Roof ridge capping sealed	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Eaves enclosed	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Roofing gutters and valleys clear of leaf litter and fine fuels	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Underfloor enclosed	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Vents screened	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Windows – non-combustible finishing	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Deck/veranda non-combustible	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

WATER SUPPLY

Reticulated water supply	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Tank supply with QFRS access – 50mm male camlock fitting so fire fighters can use water if needed	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
QFRS accessible external open water supply (dam/pool)	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Firefighting pump and hose connected to water supply	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

Other considerations

There are a range of other things to be considered regardless of your decision to leave early or stay:

- Firefighting equipment such as pumps, hoses and sprinkler systems should be tested regularly and maintained in maximum operational working condition.
- Firefighters may need access to your property during a bushfire so it is in your best interests to allow enough space for fire trucks (4 metres wide by 4 metres high).
- Your pets, livestock and other animals require proper care and attention during fires. Consider food, medication, transportation and sleeping arrangements for your animals.

Myths versus Reality

Myths	Reality
There will always be a fire truck available to fight a bushfire threatening my home.	Firefighters may be required to fight many fronts of a large fire. Fire trucks and firefighters are finite resources so it is important they are deployed in an appropriate manner to best manage the fire.
I know the back streets in town like the back of my hand so it is OK for me to leave at the last minute.	If your decision in your Bushfire Survival Plan is to leave early, then you should leave well before the fire front reaches your property. Irrespective of your local area knowledge you must stick to your plan and leave early. Leaving late can be fatal.
Someone from an emergency service will knock on my door when it is time to leave.	Emergency services personnel may not be available to alert the community by door-knocking and encouraging you to leave. You need to monitor the bushfire alerts by listening to the radio, watching TV or checking the rural fire website. You need to be ready to leave early if your life or the people in your care are at risk.
My house will not burn down because there is more than 50 metres between my home and nearby bushland.	Most houses which burn down during bushfires have been attacked by flying embers. Under certain conditions embers can cause ignitions up to 20kms in front of the main fire. A combination of your level of preparation and your home's construction will determine the survivability of your home.
I only have to clean my gutters and mow my lawns to prepare my property for bushfire.	Fire requires fuel, heat and oxygen to occur. This means that flames or embers do not necessarily rely solely on your gutters and lawns for fuel. They might utilise overhanging trees, woodpiles, old building materials under the deck or chemicals in the garden shed to sustain them. Take the time to properly prepare your whole property, which includes yourself, your house and your land.

ADDENDUM - DETAILED ASSESSMENT OF THE SOUTHERN SANDY CREEK TRIBUTARY CORRIDOR FOR FLAGSTONE CITY STAGE 1

Prepared for PEET Limited

February 2017



DISCLAIMER

This document has been prepared for the benefit of PEET Limited. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This report is prepared for the benefit of the named client only. No third party may rely upon any advice or work done by MWH in relation to the services, including this report, except to the extent expressly agreed in writing by MWH.

It is acknowledged and agreed that the site may be subject to a degree of bushfire hazard. The Client acknowledges and agrees that MWH has not created or contributed to the creation or existence of this hazard and the Client indemnifies MWH for claims arising out of or resulting from a bushfire event except to the extent attributable to the negligence of MWH.

The Client agrees that the Consultant shall have no liability in respect of any damage or loss incurred as a result of bushfire. Compliance with this report shall be the responsibility of the Client and/or land owners.

This disclaimer shall apply notwithstanding that the report may be made available to Economic Development Queensland and/or Logan City Council and other persons for an application for permission or approval to fulfil a legal requirement.

QUALITY STATEMENT

PROJECT MANAGER

Laura Gannon/Joanne Seach

PROJECT TECHNICAL LEAD

Laura Gannon

PREPARED BY

Laura Gannon

22/02/2017

CHECKED BY

.....

...../...../.....

REVIEWED BY

.....

...../...../.....

APPROVED FOR ISSUE BY

Laura Gannon

22/02/2017

BRISBANE

Level 3 SW1 52 Merivale Street, PO Box 3602, South Brisbane, QLD 4101
 TEL +61 7 3029 5000, FAX +61 7 3029 5050

REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
A	22/02/17	Final	LG			LG

PEET Limited

ADDENDUM - Detailed Assessment of the Southern Sandy Creek Tributary Corridor for Flagstone City Stage 1

CONTENTS

1	Introduction	1
2	Background	1
3	Site Investigations	2
4	Hazard Assessment	2
4.1	Fireline Intensity	3
5	Conclusions.....	5

1 Introduction

This brief report is prepared in addendum to the existing Bushfire Management Plan dated 19 February 2015 and Bushfire Management Plan Drawing 01 (amended in red) dated 5 July 2016, approved by Economic Development Queensland (EDQ) as part of Stage 1 of the Flagstone City development.

This addendum report specifically relates to the detailed assessment of the southern Sandy Creek tributary which represents a vegetated corridor (the southern corridor) which bounds Stage 1 of the development. Since July 2016, an extensive range of detail regarding the treatment of this southern corridor has become available which relates to the hazard context of the overall corridor. This brief addendum report highlights the works undertaken across the southern corridor since July 2016 until present, and having regard to future works which are yet to be completed.

Taking into account the observations and assessments made in this addendum report, the fire risk presented by the southern corridor is identified as 'low hazard' in accordance with the provisions of the guidance material supporting the implementation of the State Planning Policy. The existing approved Bushfire Management Plan currently in place across Stage 1 will continue to apply, noting recommendations in place to ensure the corridor remains low hazard in perpetuity. Notwithstanding this, the low hazard context achieved via the treatment of the corridor, as specified in this addendum report, does not trigger bushfire attack levels for building construction and this is reflected by the existing Bushfire Management Plan approved by EDQ in July 2016.

2 Background

At the time this report was prepared, the construction of various sub-stages of Stage 1 were underway with several compliance statements issued to EDQ relating to subdivision construction compliance¹ in accordance with the approved Bushfire Management Plan. None of these however, have related to the southern corridor, pending the issue of this addendum report.

In 2016, the issue of dispersive soils associated with a number of sections of the southern corridor became evident. Following various geotechnical and ecological assessments commissioned by PEET Limited, a number of clearing zones across the corridor were identified where earthworks is required to treat dispersive soils. These waterway stability works remain in addition to the required extent of subdivisional earthworks, biobasin works and recreation trails to be established within the southern corridor. Figure 1 below identifies the extent of works currently marked across the southern corridor, noting clearing zones 1, 2 and 3 have been cleared prior to the preparation of this addendum report. Refer to photographs included at **Appendix A**.

¹ It is noted that additional future/ongoing management and mitigation requirements under the approved Bushfire Management Plan, such as building construction, ongoing vegetation management and landscaping, did not form part of this assessment. Compliance with these elements of the Bushfire Management Plan remain the responsibility of the developer and/or Council, relevant building certification professionals and future property owners. To this end, compliance assessments does not seek to endorse compliance with the entirety of the approved Bushfire Management Plan, and remain limited only to the completed bushfire management works associated with the subdivision layout undertaken as at the date the statements were issued.



Figure 1: Plan demonstrating the multiple disruptions to vegetation across the southern corridor (Source: MWH, 2017)

3 Site Investigations

A number of site inspections were conducted across parts of the southern corridor, which occurred on 30 January 2017, 3 February 2017 and 21 February 2017. The site inspection assessment process involved the use of GIS data and technology provided and administered by Veris.

The surveying process located the approved 'line' of remnant vegetation representing the northern 'boundary' or extent of the southern corridor using survey equipment, with the extent of the corridor already pegged at the time of the inspection which took place on 21 February 2017.

During these inspections, the fuel load and topography of the southern corridor were examined in detail. At the time of these inspections, clearing zones 1, 2 and 3 of the waterway stability works had been cleared, with further clearing work yet to be undertaken. This outstanding clearing work remains associated with the balance of waterway stability works throughout the corridor, the extent of subdivisional earthworks, biobasin construction and recreation trails/crossings. Photographs are included at **Appendix A**.

4 Hazard Assessment

Based on the above works which have been undertaken and the balance of clearing works yet to be completed, the hazard context of the southern corridor is varied greatly. The approved Bushfire Management Plan identifies part of the waterway stability works required, relating to a 200m-300m area adjacent to the western boundary of the site. Since the Bushfire Management Plan was prepared in July 2016, further areas of clearing to support waterway stability works have been identified. Two of these zones have since been cleared to facilitate those works, with other areas of clearing throughout the southern corridor yet to be cleared.

The waterway stability works are primarily required to ensure the southern corridor does not continue to erode at a current rapid pace. The observed rate of erosion across the southern corridor identified clearing zones 1, 2 and 3 as the highest priority. However, these works and those yet to be undertaken throughout the southern corridor, also serve a hazard reduction purpose in terms of significant fragmenting the connectivity of the corridor and areas within the corridor both in terms of vertical and horizontal fuel arrangement. The 250m clearing area adjacent to the western boundary completely severs the southern corridor from the wider body of bushland to the west². A separate clearing area measuring 65m in width currently occurs towards the centre of the southern corridor, further fragmenting fuel connectivity and fuel arrangement. Taking just these two significant firebreaks into account, the vegetation context of the southern corridor is substantially disturbed to a point where any continued propagation of a fire front moving toward Stage 1 would not penetrate the southern corridor.

In addition to these existing fuel load disruptions, it is important to also consider the following:

- The average width of the southern corridor is less than 75m;
- The corridor is pinched in some locations at a width of approximately 40m;
- Further waterway stability works are proposed throughout the corridor, which will involve clearing of vegetation and re-vegetation with fire-wise species (such as rock figs);
- Further subdivisional earthworks adjoining the corridor which will augment the width of the corridor in some locations;
- Further recreation trail construction which will allow pedestrian and cyclist crossings at various points across the corridor;
- Construction of the regional recreation park which forms part of the eastern extent of the corridor is expected to commence momentarily and be completed around May 2017. Waterway stability, recreational trails and further clearing at the edges of the corridor (already pegged) as part of the regional recreation park construction, and ongoing management, will occur over coming months;
- Existing haul road and fire trail access which is established across the corridor effectively breaking fuel connectivity and arrangement in a consistent fashion throughout the corridor; and
- Continued management of the land to the south of the corridor, external to Stage 1.

Based on all of the elements identified above, it is clear the treatment of the southern corridor is of a nature that has and will continue to mitigate the potential impact of bushfire in this location. The clearing zones which have been established prior to the preparation of this addendum report provide a satisfactory level of mitigation whilst the balance of Stage 1 works are completed. It is understood that the additional works dot pointed above will be undertaken on a stage-by-stage basis. To this end, the southern corridor is an area which is already significantly altered so as to mitigate any moderate extent of bushfire hazard presented by the corridor itself, and which is to continue to be subject to a variety of treatments and management activities which substantially vary and interrupt it from its natural state such that the threat of bushfire risk is considerably decreased or removed.

4.1 Fireline Intensity

Despite the qualitative assessment conducted above, it is necessary to test the hazard profile of the southern corridor. For this, a fireline intensity analysis (as identified by the State's current mapping methodology and set out in the SPP Technical Guideline – A Fit-for-Purpose Approach to Undertaking Natural Hazard Studies and Risk Assessments) has been undertaken. Fireline intensity is a standardised measure of the rate that an advancing head fire would consume fuel energy per unit time per unit length of fire front introduced by Byram (1959), refer to Figure 2 below.

² It is noted a development application for development of the site to the immediate west has been lodged with EDQ but is yet to be decided. Irrespective, the Greater Flagstone PDA envisages development of land to the west of the subject site, such that over time the extent of bushfire hazard exposure to Stage 1 will be reduced.



Figure 2: Fireline intensity analysis process (Source: DILGP, 2016)

Pursuant to the process of establishing fireline intensity, as prescribed by the technical guideline, the fact that the vegetation to which this calculation relates is a corridor (rather than a patch) and of an average width of less than 75m is not taken into account, nor are the existing and proposed disruptions to fuel connectivity. In this sense, this assessment is highly conservative and can assume to over-estimate the actual level of fireline intensity.

The process involves two steps, the first to calculate the relevant rate of fire spread and the second which utilises rate of spread to establish fireline intensity. These processes are set out at Tables 1 and 2 below. With regard to fuel load, the pre-clearing Regional Ecosystem of RE 12.3.3 is utilised, which converts to a vegetation hazard class (VHC) of 16.2 which carried an estimated fuel load of 11.5t/ha as per the SPP technical guidance material.

Table 1: Rate of Spread Analysis

Fuel Load	FFDI	Effective Slope	Rate of Spread ³
11.5t/ha	56 (as per SPP est. FFDI at 2050)	8 degrees (maximum effective slope observed)	RoS = $0.0012 \times 55 \times 7.5 \times \exp(-0.0069 \times 8)$ 0.444km/hr

Table 2: Fireline Intensity Analysis

Heat Release	Fuel Load	Rate of Spread	Fireline Intensity ⁴
18,600kJ/kg	1.15kg/m ²	0.123m/sec	2,630.97kW/m (Low)

The fireline intensity analysis in this case verifies the hazard context is low as prescribed by Table 2 of the SPP technical manual, excerpt below. The modelling demonstrates a relatively slow moving and low intensity fire as relevant to the southern corridor and as previously noted, this does not account for the fragmentation of fuel load and fuel connectivity which has and will continue to occur.

³ Noble et al. 1980

⁴ Byram, 1959

Table 2: Potential bushfire hazards classes

<i>Hazard Class</i>	<i>Potential Fireline intensity</i>
1. Very High	40,000+kW/m
2. High	20,000 – 40,000kW/m
3. Medium	4,000 – 20,000kW/m
4. Grass Fire Hazard	Generally less than 4,000 kW/m
5. Low Hazard	0-4,000 kW/m

Figure 3: Excerpt of potential bushfire hazard classes (Source: DILGP, 2016)

5 Conclusions

This brief addendum report addresses the hazard context relating to the southern Sandy Creek tributary corridor as part of the Flagstone City development. Recent information with regard to the treatment of the southern corridor demonstrates a significant fragmentation of fuel load and fuel connectivity which translates to a low level of potential bushfire hazard. This being the case, the southern corridor does not in itself constitute a level of hazard that requires specific building construction treatment (i.e. construction in accordance with AS3959-2009). Notwithstanding, mitigation measures which mitigate the residual low hazard (nuisance ignitions from spotting via ember attack, accidental and unlawful ignitions may still occur), noting the modelled fireline intensity indicates a lower level of radiant heat exposure is likely. To this end, the approved bushfire management plan remains in place and its provisions relating to the southern corridor continue to remain relevant.

Appendices

Appendix A Photographs



Southern corridor as viewed to the west from Stage 1A



Existing fire trail through the southern corridor, adjacent to Stage 1A



Waterway stability clearing zone completed adjacent to central haul route through the southern corridor



Waterway stability clearing zone completed adjacent to the western boundary

Appendix B Stamped Approved Bushfire Management Plan (July 2016)

Appendix C Author's Qualifications



Laura Gannon

MANAGING CONSULTANT – PLANNING, RISK & RESILIENCE

Laura.Gannon@mwhglobal.com, Ph: +61 400 264 041

Laura is a senior risk and resilience professional in Australia with over 11 years of diversified industry experience across both the public and private sectors.

Laura specialises in the integration of natural hazard risk management into land use planning policy, with a particular emphasis on bushfire risk and resilience and climate adaptation.

Laura maintains extensive experience in the areas of planning policy, strategic and statutory planning accumulated via a number of senior and leadership positions. Most recently, Laura has been engaged in the area of bushfire risk and resilience, including bushfire hazard management planning and risk assessment. Laura's approach seeks to 'think differently' in reconciling the unique challenges associated with integrating land use planning, emergency management and hazard mitigation processes. Laura's extensive knowledge and experience in the areas of bushfire behaviour and risk assessment compliments her considerable land use planning capabilities developed over many years of practice in Queensland, New South Wales, Victoria and Tasmania. Laura recently completed the preparation of the *National Land Use Planning Guidelines for Disaster Resilient Communities* for the Attorney-General's Department, Commonwealth Government.

Laura also retains comprehensive expertise and practical experience in the areas of emergency management, bushfire building provisions, hazard responsive urban design and radiant heat flux analysis.

Laura is a recognised leader in the land use planning profession and was awarded **Queensland** and **Australian Young Planner of the Year** in 2010 and 2011.

SPECIALISATIONS

- Natural Hazard & Resilience Planning
- Risk Assessment & Management in Planning
- Formulation of Planning Policy
- Strategic Land Use Planning
- Bushfire Behaviour & Land Use Planning Policy
- Project Management
- Integration of Hazard Mitigation, Land Use Planning & Emergency Management

CAREER SUMMARY

- Managing Consultant – Asia Pacific, MWH Global (August 2015 – present)
- Associate Research Student, Bushfire & Natural Hazards CRC (2015 – present)
- Deputy Chair, Australian Sustainable Built Environment Council Resilience Strategy Taskgroup (2015 – present)
- Convenor – PIA Queensland Environmental Planning Chapter (2014 – present)
- Representative, Queensland Government Climate Adaptation Strategy Partnership (2014 – present)
- Committee Member, PIA National Climate Change Advocacy Group (2014 – present)
- Bushfire Planning Specialist, Jensen Bowers Group (2012 – 2015)
- Senior Planner – Regional Planning, Department of State Development, Infrastructure and Planning (2011 – 2012)
- Senior Project Officer – State Development Areas, Office of the Coordinator General (2010 – 2011)
- Planner, Craven Ovenden Town Planning Consultants (2005 – 2010)

QUALIFICATIONS AND MEMBERSHIPS

- Graduate Diploma of Bushfire Protection (with Distinction), Western Sydney University
- Bachelor Regional & Town Planning (Hons) University of Queensland
- Building & Development in Bushfire Prone Areas University of Technology Sydney
- Practice in Risk Based Land Use Planning Australian Emergency Management Institute
- Graduate Certificate in Project Management University of South Australia
- Member, Planning Institute of Australia
- Member, International Association of Wildland Fire
- Member, Australian Institute of Emergency Services
- Member, Fire Protection Association of Australia – BPAD Accredited Practitioner

Brisbane

Level 3 SW1 52 Merivale Street, PO Box 3602
South Brisbane, QLD 4101
Tel +61 7 3029 5000
Fax +61 7 3029 5050
www.mwhglobal.com

