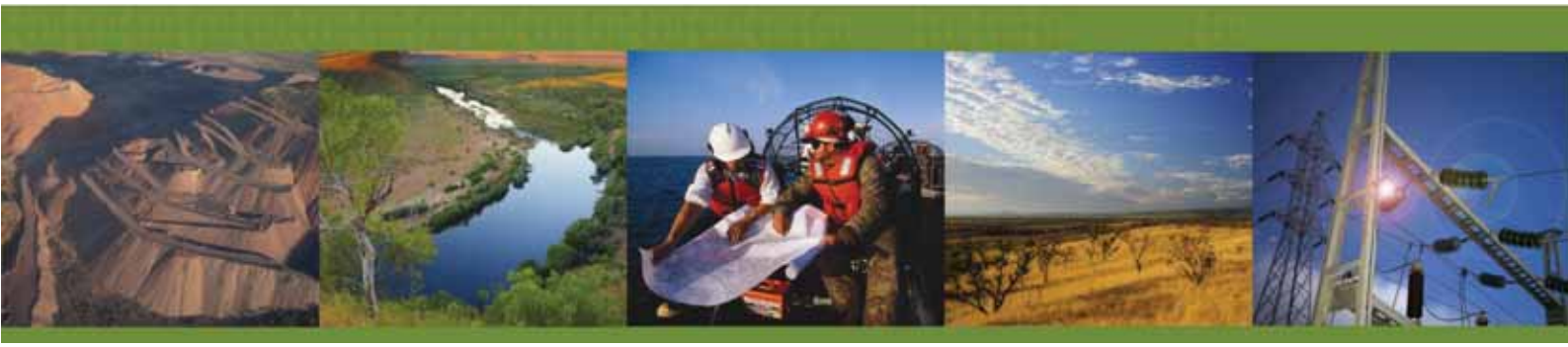

Fire Management Plan

Equis Lake Stage 1B & Stages 2 and 3

Prepared for
Roberts Day Planning
by Strategen

May 2014

STRATEGEN
environmental consultants

Fire Management Plan

Equis Lake Stage 1B & Stages 2 and 3

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May 2014

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Client: Roberts Day Planning

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For review by client	Z Cockerill / R Banks	Electronic (email)	5/09/2013
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Revised Final Report (inclusive of Stages 2 and 3 FMP)	Rev 3	Issued for use: for endorsement by CoS	Z Cockerill, K Oliver	Electronic (email)	30/05/2014

Filename: RDP13151_01 R001 Rev 3 - 30 May 2014

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1. Introduction

1.1 Background

This Fire Management Plan (FMP) pertains to the development by Roberts Day (on behalf of LWP Property Group) of Equis Lake Stage 1B and Stages 2 and 3 as part of the subdivision of Lot 4 Railway Parade, Upper Swan, in the City of Swan. The FMP has been prepared in accordance with *Planning for Bush Fire Protection Guidelines (Edition 2)* (PFBFP Guidelines; WAPC et al. 2010), with consideration of the *Draft State Planning Policy 3.7 Planning for Bushfire Risk Management* (SPP 3.7; DoP & WAPC 2014a) and accompanying *Draft Planning for Bushfire Risk Management Guidelines* (revised guidelines; DoP & WAPC 2014b) for endorsement by Department of Fire and Emergency Services (DFES) and City of Swan (CoS). A completed FMP compliance checklist is contained in Appendix 1

1.1.1 Stage 1B

Stage 1B will result in a total of 38 residential lots and two Public Open Space (POS) lots and is the second stage of the overall Equis Lake development. The preceding stage (Stage 1A) is currently being constructed.

Stage 1B was granted conditional subdivision approval from Western Australian Planning Commission (WAPC) on 23 April 2010, in accordance with the approved subdivision plan presented in Figure 1. Condition 5 of subdivision approval requires the following, due to the proximity of Stage 1B to bush fire hazards along the adjacent wetland:

> *A Fire Management Plan being prepared and implemented to the specifications of the local government and the Fire and Emergency Services Authority.*

Roberts Day has commissioned Strategen to prepare a Fire Management Plan (FMP) for Stage 1B to satisfy Condition 5 of subdivision approval.

1.1.2 Stages 2 and 3

Stages 2 and 3 (the current undeveloped portion of Lot 4) are the final stages of the overall Equis Lake development. The proposed development will result in a total of 151 residential lots and three Public Open Space (POS) lots. The preceding approved stages of Equis Lake include Stage 1A (constructed) and Stage 1B (currently being constructed).

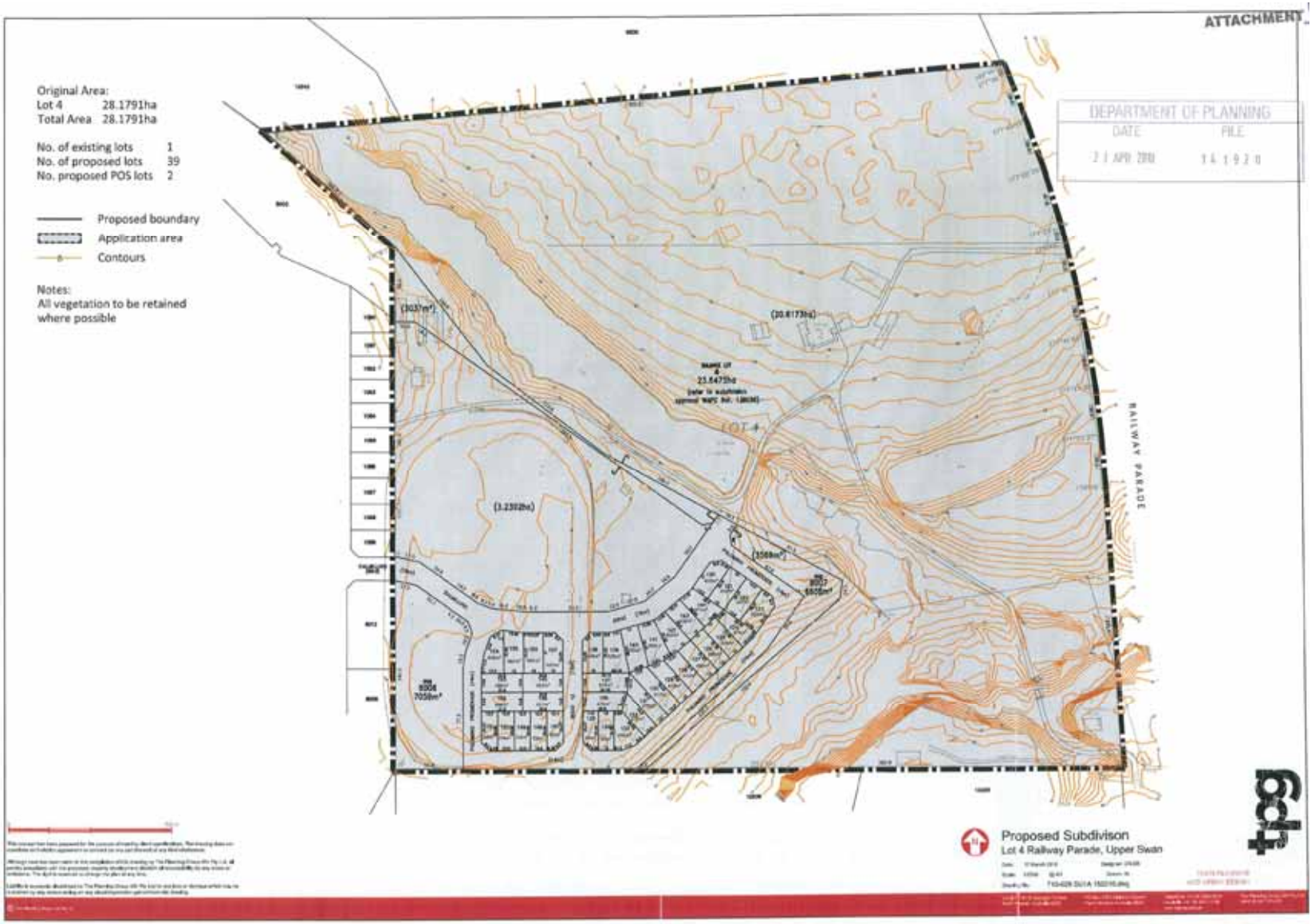
Equis Lake is subject to an approved Outline Development Plan (ODP); however, Stages 2 and 3 have undergone a redesign in accordance with Figure 2. Fire Management Plans (FMPs) have been required to support each preceding stage of development at Equis Lake due to the bush fire risk from adjacent bushland areas. Strategen expects the Stages 2 and 3 will also require fire management planning and guidance in the form of an FMP due to the bush fire risk to proposed life and property assets from adjacent bushland areas, particularly within surrounding areas of wetland vegetation.

LWP Property Group has commissioned Strategen to prepare an FMP for Stages 2 and 3 to guide bush fire protection of the proposed residential development and ensure a suitable and effective bush fire management outcome is achieved for the site.

1.2 Development context and fire management planning

LWP Property Group has recently purchased the Equis Lake residential development project, which is subject to an approved Outline Development Plan (ODP) comprising the following stages of development:

- Stage 1A, which is currently being constructed and is supported by an approved FMP prepared by FirePlan (2009)
- Stage 1B (the subject of this FMP), which is yet to be fully constructed but has existing subdivision approval in accordance with an ODP amendment (approved in April 2010)
- Stages 2 and 3 (the subject of this FMP), which covers the remaining undeveloped portion of Lot 4 in line with the ODP redesign.



Source: TPG 2010

STRATEGEN	Fire Management Plan: Stage 1B Equis Lake Approved Stage 1B subdivision plan	Figure 1

Source: Roberts Day 2013

2. Aim and objectives

2.1 Aim

The FMP aims to achieve a reduction in the occurrence of uncontrolled bush fires and minimise potential impacts on life and property of the proposed development through the following:

- quantifying the bush fire hazard and assessing the bush fire risk
- documenting bush fire prevention requirements to provide ongoing protection to future residents, visitors and built assets of the subject lands
- identifying bush fire protection issues, appropriate strategies and those persons and/or organisations who have a responsibility to implement the FMP
- complying with PFBFP Guidelines (and proposed SPP 3.7/revised guidelines) and maintaining compatibility with bush fire management on neighbouring subdivisions
- providing guidance for the developer, CoS and prospective landowners to protect the subject land and on-site assets in the event that fire appliances may not be available to offer an adequate bush fire suppression response.

2.2 Objectives

Key objectives of the FMP and the relevant section/s of this document in which they are addressed are outlined in Table 1.

Table 1 Key objectives of the FMP

Objective	Section
Define areas where values are located	Section 3.6
Define and rank fire hazard areas	Section 4.2.1 & 5.2.1
Nominate individuals and organisations responsible for fire management and associated works	Section 6.7 & 7.7
Propose bush fire risk treatment and mitigation measures with due regard for life, property and the environment	Section 6 & 7
Define an assessment procedure that will evaluate the effectiveness and impact of proposed fire prevention work and strategies	Section 8.2
Provide performance criteria and acceptable solutions for all fire management works (e.g. development location, vehicular access, water supply, siting of development and design of development)	Section 4.2.2 & 5.2.2

3. Description of the area

3.1 General overview

Stage 1B (Figure 3) and Stages 2 and 3 (Figure 4) form part of the proposed Equis Lake subdivision located at Lot 4 Railway Parade, Upper Swan, in the City of Swan (Lot 4). Lot 4 is approximately 28 ha and is situated north of Swan Valley, approximately 10 km north of Midland and 30 km northeast of Perth. Lot 4 is bound by The Vines residential golf estate to the west, the proposed Ellenbrook Village 7 development area to the north, Railway Parade and the Perth–Geraldton railway to the east and rural properties to the south.

Lot 4 contains a proposed conservation area, which the client and environment regulators are looking to preserve in order to retain environmental values. Sawpit Gully and Ellen Brook wetlands run through Lot 4, both of which are classified geomorphic wetlands and contain vegetation that forms part of Bush Forever Site 300. Since Stage 1B and Stages 2 and 3 are predominantly cleared, the areas of surrounding wetland vegetation form the majority of the bush fire risk to the site and proposed life and property assets.

3.1.1 Stage 1B

At a site level, Stage 1B is bound by the approved Equis Lake Stage 1A development to the north (which is currently under construction), Ellen Brook wetland to the south, CoS-managed Public Open Space (POS) to the west and Sawpit Gully wetland to the northeast (Figure 5). The remaining undeveloped portion of Lot 4, located opposite Sawpit Gully to the east, will form future Stages 2 and 3 of the Equis Lake development. This land is predominantly cleared, apart from a few, degraded areas of remnant vegetation.

3.1.2 Stages 2 and 3

At a site level, Stages 2 and 3 is predominantly cleared apart from a few degraded areas of remnant vegetation. The project area is bound by Sawpit Gully wetland to the west, the Stage 1A and 1B Equis Lake developments to the southwest, Ellen Brook wetland to the south, Railway Parade and the Perth–Geraldton railway to the east and the proposed Ellenbrook Stage 7B development to the north (Figure 6).

3.1.3 Overview of bush fire hazards

At a strategic level, the adjacent wetland vegetation is a small, previously grazed, linear bushland remnant surrounded by a significantly cleared, developed urban and agricultural footprint including irrigated viticulture. The bushland has been degraded due to previous grazing by livestock, current grazing by kangaroos and weed invasion by Watsonia and Kikuyu. This disturbance has resulted in a distinct lack of understorey and midstorey species, as well as a reduced leaf litter layer. Consequently, the vegetation is not dense and the fuel ladder is incomplete due to the lack of ground level and mid level fuels (i.e. lack of litter, trash and scrub).

Tree crowns from individual *Eucalyptus rudis* (Flooded gum) and *Melaleuca rhaphiophylla* (Swamp paperbark) trees may provide a source of ember attack for a brief period of time under adverse fire weather conditions. However, given the narrow and isolated nature of the vegetation and relatively low available fuel loads (i.e. less than 8 tonnes/ha), Strategen is of the view that the wetland vegetation would not support intense bush fire occurrence, such as a sustained intense crown fire. In addition, the vegetation is unlikely to support a severe bush fire for 10 months of the year due to the abundance of green, weed infested vegetation. The widespread infestation of weed species is unlikely to change the fuel profile in the short term unless there is a concerted effort to restore the full suite of native vegetation species post development, which in Strategen's experience is unlikely to occur.

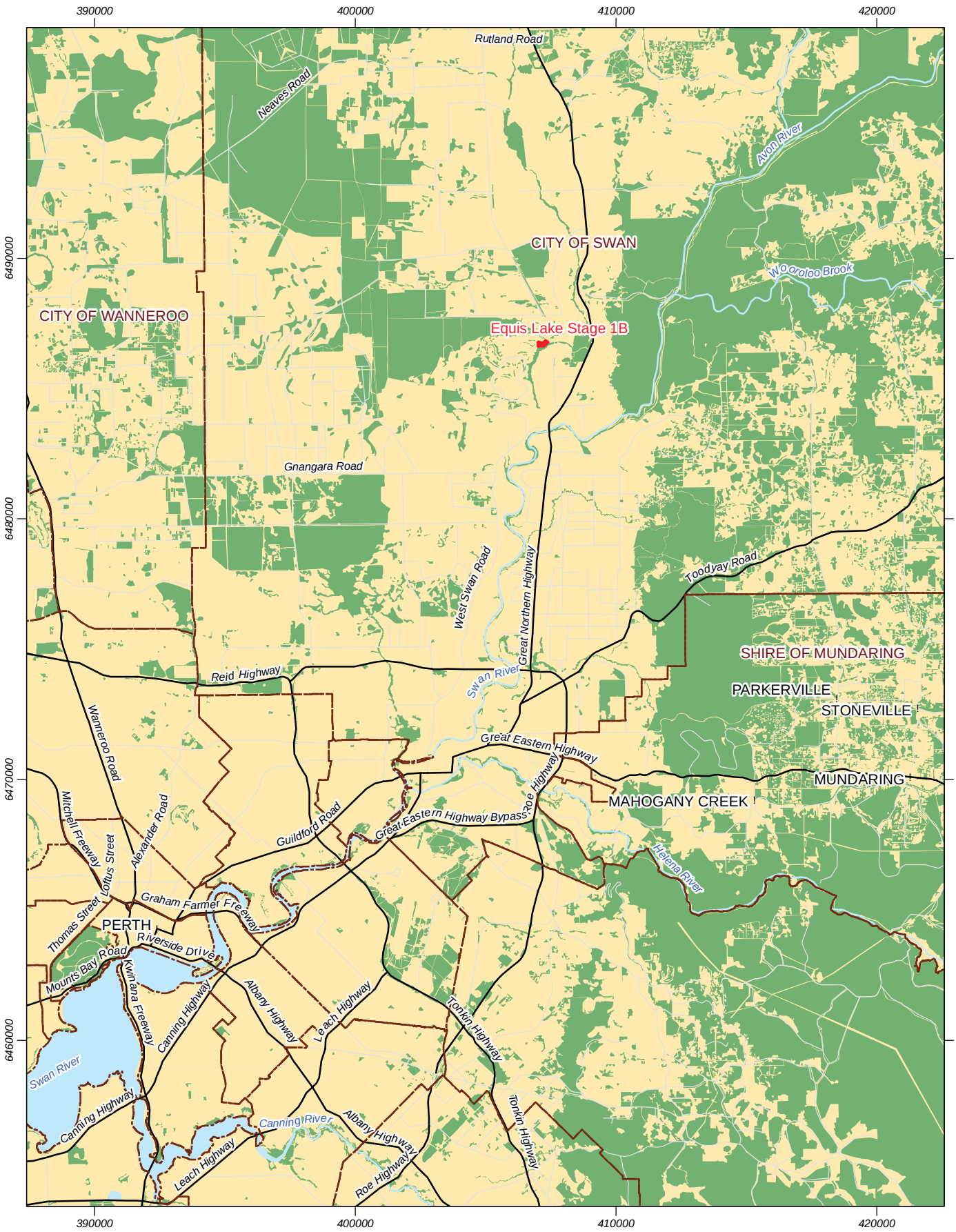


Figure 3 Stage 1B Regional location

Scale 1:200,000 at A4

0 1 2 3 4 5 km

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 30/05/2014
Author: JCrute
Source: Topography: Geoscience Australia 2011.

Legend

- Town
- Major road
- Minor road
- Major river
- Lakes
- Stage 1B boundary
- Local government boundary
- Native vegetation

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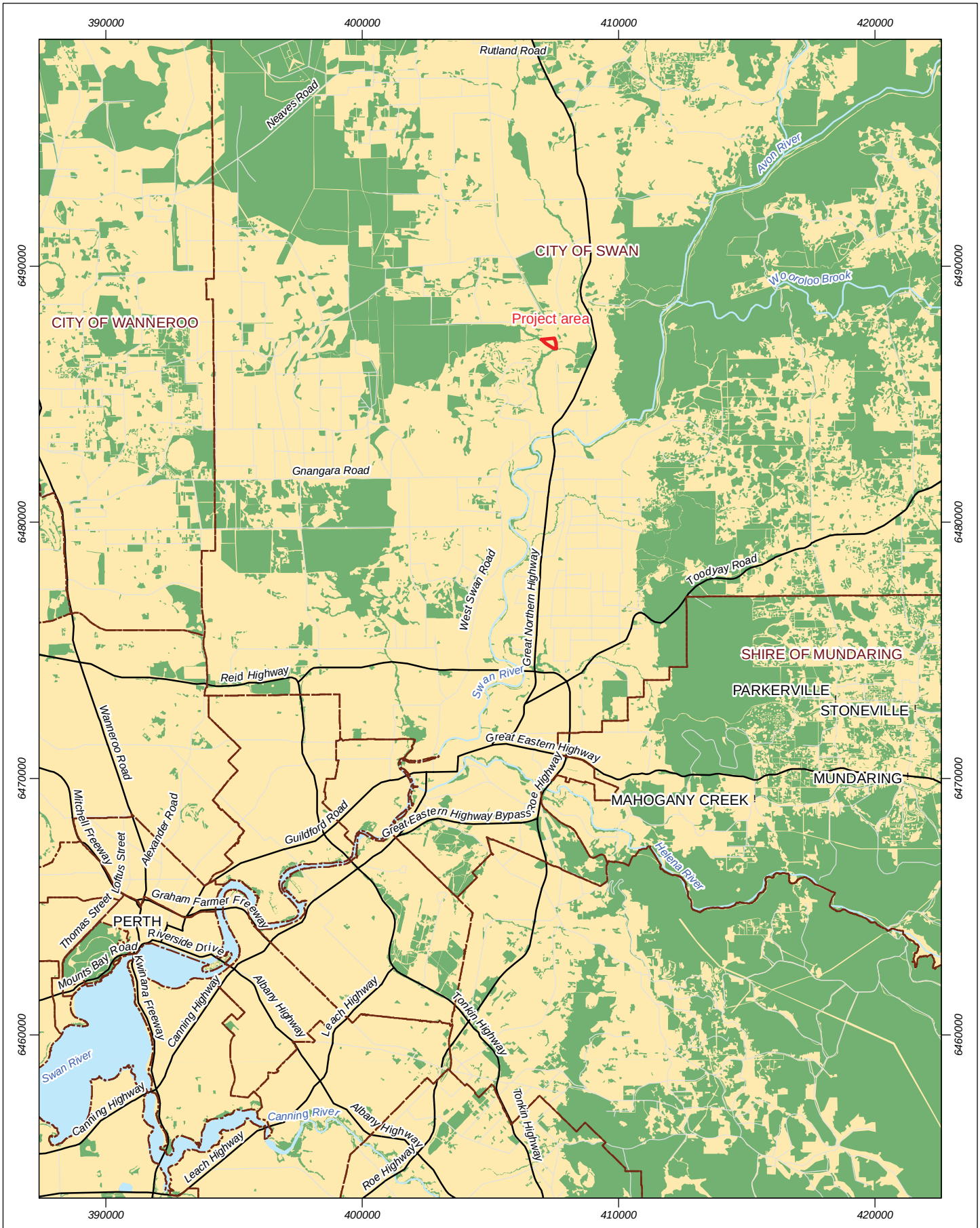

Figure 4 Stages 2 and 3 Regional location

Scale 1:200,000 at A4

0 1 2 3 4 5 km

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 30/05/2014
Author: JCrute
Source: Topography: Geoscience Australia 2011.

Legend

- Town
- Major road
- Minor road
- Major river
- Lakes
- Project area
- Local government boundary
- Native vegetation

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Figure 5 Stage 1B Site overview

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Abutting cadastral boundaries
- Stage 1B boundary
- Proposed Equis Lake Development boundary
- Residential R25 lots
- Proposed conservation area
- Proposed group housing
- POS
- Parks & Recreation
- Proposed retirement village
- Rural

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Figure 6 Stages 2 and 3 Site overview

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Conservation area boundary
- Residential R25 lots
- Roads
- Project area boundary
- Lot 4 boundary
- POS
- Parks & Recreation
- Rural

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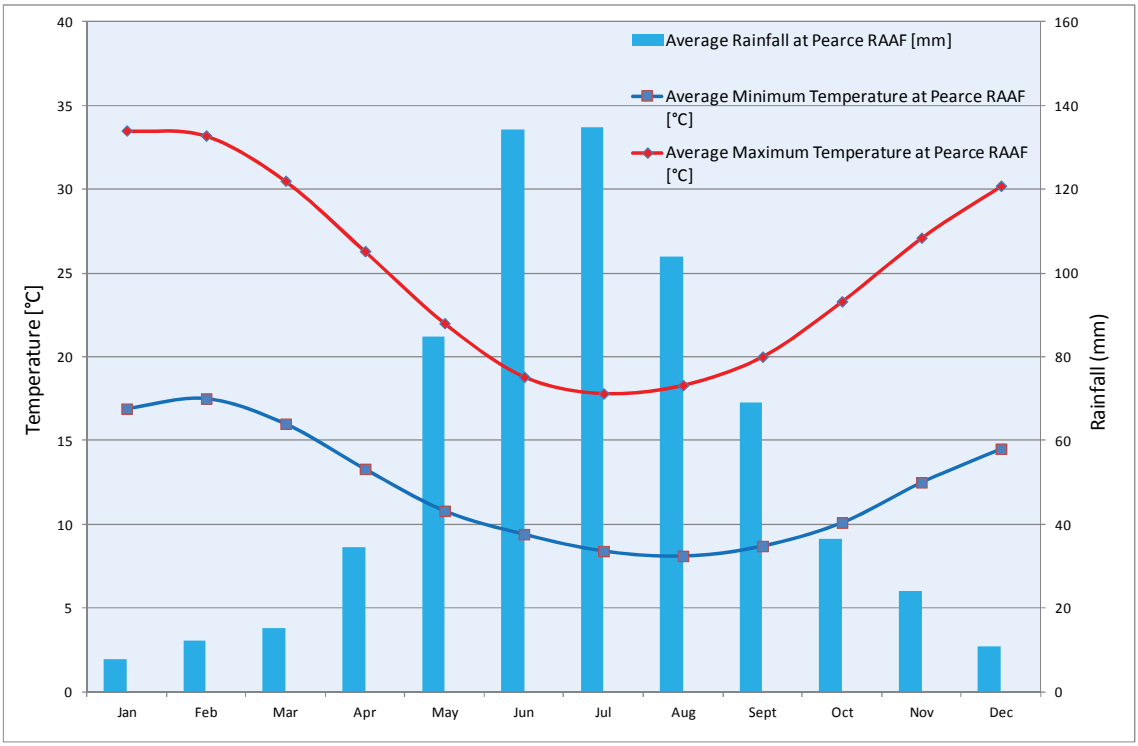
3.2 Local climate

Upper Swan experiences a Mediterranean-type climate characterised by mild, wet winters and warm to hot, dry summers. The Bureau of Meteorology (BoM) weather station at Pearce RAAF base (Station No. 9053), located approximately 10 km north of the project area, provides average monthly climate statistics for the locality, as illustrated in Figure 7.

Average annual rainfall recorded at Pearce RAAF since 1940 is 680.9 mm (BoM 2013). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur from December to March, with average monthly maximums ranging from 30.2°C in December to 33.5°C in January (BoM 2013). Lowest temperatures occur from June to September, with average monthly minimums ranging from 8.1°C in August to 9.4°C in June (BoM 2013).



Source: BoM 2013

Figure 7 Average monthly climate statistics for Pearce RAAF (Station No. 9053)

3.2.1 Fire weather

Southwest Western Australia generally experiences a cool to mild growing season in the months of August through to November of each year, followed by four months of summer drought conditions, which is when the potential for wildfire occurrence is at its peak. The worst fire weather conditions occur during this dry period when a low pressure trough forms off the west coast and strong winds develop from the north or northeast. These conditions are sometimes associated with 'Extreme' or 'Catastrophic' fire danger indices, which are consistent with very high temperatures, low relative humidity and strong winds. Based on the predominant summer climatic conditions of the local area, these high fire risk conditions are considered to occur less than 5% of the time during the designated bush fire season, which equates to around 9 days between December and March.

Average 9:00 am and 3:00 pm January wind profiles for Pearce RAAF are contained in Appendix 2, which illustrate that the predominant winds during this high risk period are from the east in the morning averaging around 18 km/h; and from the southwest in the afternoon averaging around 20 km/h (BoM 2013). These dominant wind patterns are considered to occur 95% of the time during the designated bush fire season. It should also be noted that the mean 9:00 am and 3:00 pm relative humidity in January for Pearce RAAF is 48% and 30% respectively. These predominant fire weather conditions correlate with a fire danger index of 'High', as determined using the Commonwealth Science and Industrial Research Organisation (CSIRO) Fire Danger and Fire Spread Calculator (CSIRO 1999).

3.3 Landform and topography

Lot 4 is located on the Swan Coastal Plain between the Darling Scarp and the aeolian sands of the Bassendean Dunes (TPG 2006). The Swan Coastal Plain is characterised by a low-lying coastal plain, mainly covered with woodlands of eucalyptus, banksia, paperbark and sheoak (McKenzie et al. 2003).

Stage 1B consists of predominantly flat land; however, the southern and eastern edges of the site slope downwards towards Ellen Brook and the confluence of Ellen Brook and Sawpit Gully respectively. These slopes are up to 5 degrees, with site elevation ranging from approximately 15 mAHD (Australian Height Datum) on areas of flat land located up-slope, to approximately 12 mAHD at the foot of the slopes (Figure 8). There is no vegetation under slope, but proposed dwellings will be located up-slope at up to 5 degrees from wetland vegetation within Ellen Brook.

Stages 2 and 3 consists of predominantly flat land that slopes gently downwards towards Sawpit Gully and Ellen Brook to the west and south respectively (Figure 9). Maximum slopes occur at 5 degrees with elevation ranging from 12–18 mAHD (Australian Height Datum) along the banks of both watercourses. The remainder of the site to the north experiences very minor variations in slope and elevation, ranging from 18–22 mAHD. Based on the topography of the site, all proposed residential lots are located up-slope at a maximum of 5 degrees from wetland vegetation to the west and south

3.4 Vegetation and flora

3.4.1 Surveyed vegetation complexes

Vegetation mapping of the Swan Coastal Plain undertaken by Heddle et al. (1980) indicates the occurrence of two predominant vegetation complexes over Lot 4 and adjacent properties: the Yanga complex and the Guildford complex. Refer to Figure 10 for Stage 1B and Figure 11 for Stages 2 and 3.

However, site-specific examination suggests that the original vegetation for the central and northern parts of Lot 4 would have been more characteristic of the Bassendean (North) complex, with the Swan complex occurring along Ellen Brook and the Guildford complex occurring on the alluvial plain (TPG 2006). These vegetation complexes are characterised by the following:

1. The Bassendean (North) complex ranges from low open forest to woodland of banksia-prickly bark to low woodland of *Melaleuca* species with sedgelands occupying the moister sites.
2. The Guildford complex is an open forest of Marri-Wandoo-Jarrah, with minor components including fringing woodlands of Flooded gum and Swamp paperbark along streams.
3. The Swan complex is dominated by Flooded gum and Swamp paperbark woodlands, with localised occurrences of low open forest of Swamp sheoak and Saltwater paperbark.

Figure 8 Stage 1B Site topography

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Surface elevation (mAHD)
- Proposed Equis Lake Development boundary
- Stage 1B boundary

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Figure 9 Stages 2 and 3 Site topography

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Surface elevation (mAHD)
- Project area boundary
- Lot 4 boundary

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Figure 10 Stage 1B Vegetation complexes

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Vegetation: DEC 2004. All other data: Client 2013.

Legend

- Stage 1B boundary
- Proposed Equis Lake Development boundary

Vegetation complex

- Guildford complex
- Yanga complex

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Figure 11 Stages 2 and 3 Vegetation complexes

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Vegetation: DEC 2004. All other data: Client 2013.

Legend

- Project area boundary
- Lot 4 boundary

Vegetation complexes

- Guildford complex
- Yanga complex

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3.4.2 On-site vegetation extent

Stage 1B is fully cleared of native vegetation, except for a few individual Flooded gum trees scattered to the west of the site. Cleared areas of the site are dominated by managed grasses and pasture weeds.

Stages 2 and 3 is predominantly cleared of native vegetation, except for:

1 Scattered remnants of *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) open woodland located in the central and eastern parts of the site, which have been significantly degraded by ongoing rural land uses, clearing and recent bush fire occurrence. Central remnants will be subject to further clearing to allow for the proposed development.

2. A narrow strip of wetland vegetation along the banks of Sawpit Gully to the west, dominated by a woodland of *Melaleuca raphiophylla* (Swamp paperbark) and fringing *Eucalyptus rudis* (Flooded gum) with a relatively sparse understorey.

Cleared areas Stages 2 and 3 are dominated by managed grasslands.

3.4.3 Adjacent vegetation extent

Stage 1B and Stages 2 and 3 are located to the north of Ellen Brook which is dominated by woodland of Swamp paperbark and fringing Flooded gum. The vegetation has been degraded due to previous grazing by livestock, current grazing by kangaroos and weed invasion by Watsonia and Kikuyu. This disturbance has resulted in a distinct lack of understorey and midstorey species, as well as a reduced leaf litter layer. Consequently, the vegetation is not dense and the fuel ladder is incomplete due to the lack of ground level and mid level fuels (i.e. lack of litter, trash and scrub). Similar wetland vegetation occurs along Sawpit Gully which is located to the northeast of Stage 1B and to the southwest of Stages 2 and 3.

Both wetlands form part of Bush Forever Site 300 and are considered to pose the predominant bush fire risk to the project area.

The remainder of Lot 4 is predominantly cleared, with scattered remnants of Jarrah and Marri open woodland, which have been significantly degraded by ongoing rural land uses, weed invasion and recent bush fire occurrence.

Stage 1B is bound to the west by open woodland of *Corymbia calophylla* (Marri) trees over a managed grassland understorey. This area is CoS-managed POS and contains a boardwalk along the fringe of Ellen Brook and associated Bush Forever Site 300.

Additional areas of degraded open woodland dominated by Jarrah and Marri are located within the Railway Parade road reserve to the east of the site, some of which is proposed to be cleared to facilitate road construction along Railway Parade.

At a strategic level, the native vegetation extent is generally sparse throughout the locality due to the current or proposed urban development extent and ongoing rural land uses.

3.5 Land use and zoning

3.5.1 Current land use and zoning

Lot 4 is subject to the provisions of the City of Swan Local Planning Scheme No 17 (LPS No. 17, DoP 2013), which establishes detailed statutory planning controls for the local government area, consistent with the broader controls under the Metropolitan Region Scheme (MRS).

Stage 1B is cleared and currently being prepared for urban development. The majority of the site is zoned 'Residential Development' under LPS No. 17 and 'Urban' under the MRS.

The majority of Stages 2 and 3 is zoned 'Residential Development' under LPS No. 17 and 'Urban' under the MRS. The site was previously used for equestrian and residential purposes.

Land zoned 'Residential Development' requires the preparation and adoption of an ODP under Clause 6.2 of the scheme provisions.

3.5.2 Proposed land use

Stage 1B is the second stage of the Equis Lake development and is proposed to be developed for residential purposes in line with the existing Stage 1B subdivision approval. This will result in development of 38 residential lots and two POS lots, along with provision of road, water, sewerage, power, gas and communications infrastructure (Figure 5). The two POS lots will be located at the western and eastern ends of the site. These will be subject to landscape design and will be managed on an ongoing basis by CoS.

Stages 2 and 3 are the final stages of the Equis Lake residential development. The land is proposed to be developed for residential purposes in accordance with Figure 2. This will result in development of 151 residential lots and three POS lots, along with the provision of road, water, sewerage, power, gas and communication infrastructure. On-site POS will comprise the Sawpit Gully and Ellen Brook foreshore reserves, as well as the proposed conservation reserve to the east, all of which will retain existing vegetation but be subject to landscape design and ongoing management. Long term management of POS areas will be the responsibility of CoS.

3.5.3 Surrounding land use

Land surrounding Lot 4 is zoned a combination of 'Parks and Recreation' and 'Rural' under the MRS. Ellen Brook and Sawpit Gully are both designated geomorphic wetlands. These wetlands and associated vegetation form part of Bush Forever Site 300, which is under conservation as part of the State Bush Forever Policy.

3.6 Site assets

Stage 1B and Stages 2 and 3 are cleared and undeveloped, so do not currently maintain any critical life or property assets, or significant environmental assets. Proposed development of Stage 1B and Stages 2 and 3 will significantly increase the critical life and property assets of the site, with a total of 38 dwellings proposed for Stage 1B (Figure 5) and 151 dwellings proposed for Stages 2 and 3 (Figure 2). This will intensify the number residents, visitors and built assets across the development areas.

3.7 Water and power supply

Existing Stage 1A services will be extended across the Stage 1B and Stages 2 and 3 sites, which will result in provision of a reticulated water supply and underground power supply for the proposed developments.

3.8 Site access

Stage 1B comprises an internal road network that provides three links to the surrounding public road network in Dalmilling Drive. Proposed Courbette Way will provide an access point sufficient for emergency service vehicles, as well as a buffer to the south between predominant vegetation of Ellen Brook and proposed residences.

The proposed vehicular access network for Stages 2 and 3 will provide up to six links to the surrounding public road network (Figure 2). The proposed vehicular access network will also provide buffers and access for emergency service vehicles between proposed residences and the surrounding bushland extent.

4. Fire problem (Stage 1B)

4.1 Bush fire history

The Stage 1B site does not contain any evidence of recent bush fire occurrence; however, eastern and northern areas of Lot 4 were burnt recently. The observed fire scarring is suspected to be caused by a bush fire that occurred in early 2013, resulting in burning within the eastern boundary of Lot 4 and adjacent railway reserve. Unconfirmed reports indicate the fire was directed to the northwest by prevailing winds and burnt open woodland areas of Lot 4, as well as areas of Sawpit Gully to the north.

Based on the bush fire history of the locality, bush fires are considered to be a relatively common occurrence. Predominant sources of ignition are expected to be:

- intentional causes (e.g. suspected arson)
- accidental causes (e.g. vehicle accidents, pole top fires, train sparks along railway reserve).

There are numerous emergency service resources located in City of Swan that could provide a suppression response to Equis Lake within 30 minutes, including local and career bush fire brigades stationed at East and West Gidgegannup, East Swan and Bullsbrook.

4.2 Bush fire hazards

A bush fire hazard assessment aims to classify the bush fire hazard at both the strategic and local level, which leads to an assessment of the Bushfire Attack Level (BAL). A bush fire hazard assessment has been undertaken across the Stage 1B area and adjacent land in accordance with procedures outlined in PFBFP Guidelines and proposed SPP 3.7/revised guidelines. In addition, an assessment of bush fire prone areas has been undertaken at the strategic level and incorporated into local government planning. Portions of the site and surrounding land were mapped as bush fire prone areas as part of this assessment.

4.2.1 Classifying the bush fire hazard

Fuel hazard assessment

A comprehensive fuel hazard assessment of the Stage 1B site and adjacent land was undertaken by Strategen during two separate site visits, the first on 7 August 2013 and the second on 16 April 2014. The assessments were undertaken on the basis of a visual inspection of the following factors, cross-referenced with the Swan Coastal Plain Visual Fuel Load Guide (FESA 2012):

- vegetation type and structure
- vegetation condition and density
- fuel age
- scrub extent
- litter and trash accumulation.

On-site fuel hazards

On-site fuel hazards comprise managed grasses and pasture weeds, with a few scattered Flooded gum trees in the western portion of the site (Plate 1). Available fuel loads were assessed to be less than 2 t/ha (tonnes per hectare); however, these fuels will be removed on development of the site, which will create a permanent built and landscaped footprint over the land.

Plate 1 On-site managed grasses with pasture weeds (less than 2 t/ha, not a classified vegetation type)

Adjacent fuel hazards

Much of the land surrounding Stage 1B is devoid of vegetation. However, the following three fuel types were identified throughout the surrounding landscape:

1. Woodland of Flooded gum and Swamp paperbark over grazed Kikuyu and Watsonia (Plate 2 through to Plate 4): this fuel type occurs to the south and northeast of Stage 1B within wetland vegetation of Ellen Brook and Sawpit Gully respectively. The vegetation has been degraded due to previous grazing by livestock, current grazing by kangaroos and weed invasion by Watsonia and Kikuyu. This disturbance has resulted in a distinct lack of understorey and midstorey species, as well as a reduced leaf litter layer. Consequently, the vegetation is not dense and the fuel ladder is incomplete due to the lack of ground level and mid level fuels (i.e. lack of litter, trash and scrub). As a result, available fuels loads were assessed to be less than 8 t/ha.
2. Open woodland of Marri (Plate 5): this fuel type occurs adjacent west of the Stage 1B site within CoS-managed POS. Available fuel loads were assessed to be less than 2 t/ha due to the managed grass understorey and Marri regrowth.
3. Open woodland of Jarrah and Marri (Plate 6): this fuel type occurs in small, degraded remnants throughout the remaining portion of Lot 4 and some adjacent properties. Available fuel loads were assessed to be less than 2 t/ha due to the sparse mid and understoreys and recent occurrence of bush fire.

Plate 2 Fringing Flooded gum along Ellen Brook (less than 8 t/ha, woodland vegetation type)

Plate 3 Swamp paperbark and weed species understory throughout Ellen Brook (less than 8 t/ha, woodland vegetation type)

Plate 4 Fringing Flooded gum along Sawpit Gully (less than 8 t/ha, woodland vegetation type)

Plate 5 Marri regrowth with managed grass understorey in adjacent west POS (less than 2 t/ha, open woodland vegetation type)

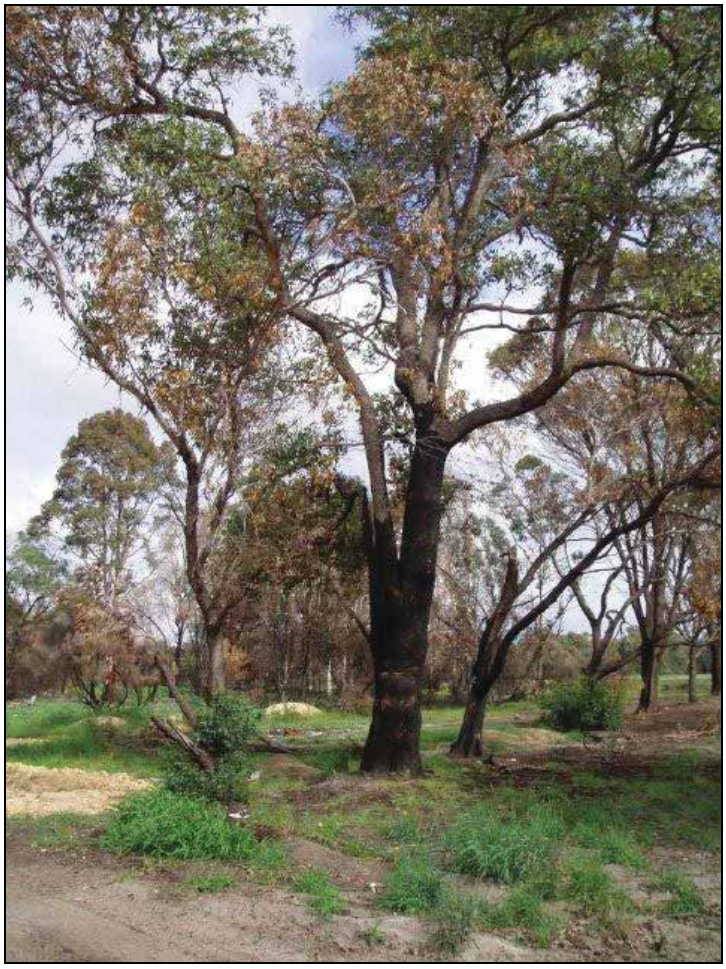
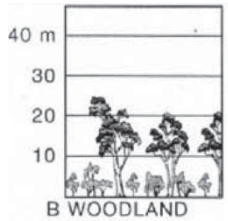
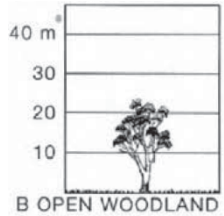


Plate 6 Recent burn through open woodland areas of Jarrah and Marri (less than 2 t/ha, open woodland vegetation type) (note low scorch height which reflects low fuels)

Vegetation class and type

An assessment of vegetation class and type within and adjacent to the Stage 1B site has been undertaken in accordance with procedures outlined in PFBFP Guidelines (Table 2).

Table 2 Stage 1B Predominant vegetation class and type

Predominant vegetation and fuel load	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Description (as per PFBFP Guidelines)
Woodland of Flooded gum and Swamp paperbark to the south, east and northeast (within 8 t/ha)	(B) Woodland	Woodland	 B WOODLAND FIGURE 2.2-05	Trees 10–30 m high; 10-30% foliage cover dominated by eucalypts; understorey low trees to tall shrubs typically dominated by acacia, callitris or casuarina.
Open woodland of Marri to the west (within 2 t/ha)		Open woodland	 B OPEN WOODLAND FIGURE 2.2-06	
Open woodland of Jarrah and Marri in scattered remnants surrounding Stage 1B (within 2 t/ha)				

Location of bush fire hazards

The location of existing bush fire hazard areas is outlined in the vegetation class map (Figure 12). This map has been created using the abovementioned vegetation class and type descriptions and assessed available fuel loads.

Bush fire hazard levels

Bush fire hazard levels of the predominant vegetation surrounding Stage 1B are displayed in the bush fire hazard assessment map (Figure 13). Classifying the bush fire hazard by assessing the predominant vegetation is a key to the initial determination of site suitability for development. This also leads to determination of the potential level of construction standard by the application of AS 3959–2009 *Construction of buildings in bushfire prone areas* (SA 2009) for any adjacent proposed development.

The on-site bush fire hazard level is 'Low' since the land is fully cleared and consists of managed grass and pasture weeds.

The adjacent bush fire hazard level varies from 'Moderate' to 'Extreme'. 'Extreme' bush fire hazard levels were identified within the woodland vegetation along Ellen Brook and Sawpit Gully wetlands located to the south and northeast of Stage 1B respectively. The 'Extreme' rating reflects the potential (worst case) level of bush fire hazard in this area, given the overall woodland vegetation type; however, the current hazard is more representative of a 'Low' to 'Moderate' rating, due to the lack of understorey and midstorey fuels from ongoing grazing by kangaroos and weed invasion from Watsonia and Kikuyu.

'Moderate' bush fire hazard levels were identified within open woodland areas surrounding Stage 1B and scattered remnants throughout the locality. All other areas in the general vicinity do not contain a bush fire hazard rating due to the extent of vegetation clearance from rural land uses and surrounding urban development.

According to PFBFP Guidelines, land with an assessed 'Moderate' to 'Extreme' bush fire hazard level is classified as bush fire prone land, which may trigger implementation of AS 3959–2009 for adjacent proposed development.

Figure 12 Stage 1B Vegetation class map

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Abutting cadastral boundaries
- Stage 1B boundary
- Proposed Equis Lake Development boundary
- Residential R25 lots

Vegetation class

- Open woodland of Jarrah and Marri (within 2 t/ha)
- Open woodland of Marri (within 2 t/ha)
- Woodland of Flooded gum and Paperbark (8 t/ha)

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Figure 13 Stage 1B Bush fire hazard assessment map

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Abutting cadastral boundaries
- Stage 1B boundary
- Proposed Equis Lake Development boundary

FireHazard

- Moderate bush fire hazard level
- Extreme bush fire hazard level
- Residential R25 lots

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4.2.2 Bush fire hazard performance criteria

The relationship between various bush fire hazard levels and development performance criteria is set out in Table 3. Although Stage 1B and areas of adjacent land do not maintain a bush fire hazard rating, portions of the site are situated within 100 m of 'Extreme' bush fire hazard areas. Consequently, a comprehensive suite of bush fire risk treatment and mitigation measures, including implementation of AS 3959-2009, will need to be implemented to protect future assets from existing hazard areas.

Compliance with performance criteria for a 'Moderate' bush fire hazard level will be achieved for the proposed development, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development. Performance criteria will be achieved through adoption of recommended acceptable solutions outlined in PFBFP Guidelines.

Table 3 Stage 1B Bush fire hazard levels and performance criteria

Bush fire hazard level	Bush fire protection performance criteria required
Low hazard	Development does not require special bush fire planning controls. Despite this, DFES strongly recommends that ember protection features be incorporated in design where practicable.
Moderate hazard	Performance criteria for: • location (Element 1) • vehicular access (Element 2) • water (Element 3) • siting of development (Element 4) • design of development (Element 5).
Extreme hazard	Development is to be avoided in areas with these hazard levels.

Source: WAPC et al. 2010

4.2.3 Classifying the Bushfire Attack Level

This procedure, as outlined in AS 3959–2009, uses a combination of the state-adopted Fire Danger Index rating of FDI 80, vegetation class, slope under classified vegetation and the distance maintained between proposed development areas and predominant vegetation to specify the Bushfire Attack Level (BAL). Based on the specified BAL, construction requirements for proposed buildings can then be assigned.

BAL 12.5 is required for all proposed lots of Stage 1B located east of Jutland Way. A 20 m wide Building Protection Zone (BPZ) and 20 m wide Hazard Separation Zone (HSZ) is also required adjacent to the first row of lots along the southern boundary. This is to protect these lots from bush fire hazards located to the south. A 3 m average height retaining wall has also been constructed as an additional measure to provide protection to the outer lots from radiant heat.

All other lots of Stage 1B (i.e. to the west of Jutland Way) do not require BAL ratings, BPZs or HSZs given the hazard separation provided by existing cleared areas is sufficient. This approach has been endorsed by DFES and is illustrated in Figure 16.

5. Fire problem (Stages 2 and 3)

5.1 Bush fire history and predominant sources of ignition

The project area has been subject to recent bush fire occurrence. The observed fire scarring is suspected to be attributed to an uncontrolled bush fire that occurred in early 2013, which burnt areas along the eastern boundary, adjacent east railway reserve and scattered woodland trees throughout the centre of the site. Unconfirmed reports indicate the fire was directed to the northwest by prevailing winds, which burnt open woodland areas of Lot 4, as well continuing areas of wetland vegetation along Sawpit Gully to the northwest.

Based on the bush fire history of the locality, ignition and occurrence of uncontrolled bush fires is considered to be relatively common, which increases the overall bush fire risk to the subject land. Predominant sources of ignition are:

- intentional causes (e.g. suspected arson)
- accidental causes (e.g. vehicle accidents, pole top fires, train sparks along railway reserve, sparks from vehicle exhausts and/or surrounding agricultural activities).

There are numerous emergency service resources located in City of Swan that could provide a suppression response to Equis Lake within 30 minutes, including local and career bush fire brigades stationed at East and West Gidgegannup, East Swan and Bullsbrook.

5.2 Bush fire hazards

A bush fire hazard assessment aims to classify the bush fire hazard at both the strategic and local level, which leads to an assessment of the Bushfire Attack Level (BAL). A bush fire hazard assessment has been undertaken across the Stages 2 and 3 area and adjacent land in accordance with procedures outlined in PFBFP Guidelines and proposed SPP 3.7/revised guidelines. In addition, an assessment of bush fire prone areas has been undertaken at the strategic level and incorporated into local government planning. Portions of the site and surrounding land were mapped as bush fire prone areas as part of this assessment.

5.2.1 Classifying the bush fire hazard

Fuel hazard assessment

A comprehensive fuel hazard assessment of Stages 2 and 3 and adjacent land was undertaken by Strategen during a site visit on 7 August 2013. The assessment was undertaken on the basis of a visual inspection of the following factors, cross-referenced with the Swan Coastal Plain Visual Fuel Load Guide (FESA 2012):

- vegetation type and structure
- vegetation condition and density
- fuel age
- scrub extent
- litter and trash accumulation.

Managed grasslands, woodland and open woodland were the predominant vegetation types identified during the fuel hazard assessment, as described in the following subsections.

Managed grasslands

Stages 2 and 3 is predominantly clear of native vegetation and consists primarily of managed grasslands (Plate 7). Managed grasslands across the site contain available fuel loads within 2 t/ha (tonnes per hectare) and are subject to livestock grazing. Future development of Stages 2 and 3 will occupy the majority of cleared, managed grasslands across the site.

Most of the land surrounding the project area is cleared for rural use (east of Railway Parade and south of Ellen Brook, Plate 8) or proposed for residential development (north and southwest of the project area, Plate 9). These areas currently consist of managed grasslands and pastures with available fuel loads maintained within 2 t/ha.

Plate 7 On-site managed grasslands within 2 t/ha

Plate 8 Off-site managed pastures east of Railway Parade (rural land within 2 t/ha)

Plate 9 Off-site managed grasses/weeds to the southwest (Stage 1A and 1B development sites within 2 t/ha)

Woodland

The predominant fuel hazard within the Stages 2 and 3 site consists of a narrow strip of woodland vegetation along the banks of Sawpit Gully (western site boundary) (Plate 10). This wetland vegetation comprises Swamp paperbark and fringing Flooded gum with a relatively sparse understorey. Available fuel loads were estimated to be approximately 8 t/ha.

This woodland vegetation continues off site to the northwest at further locations along Sawpit Gully at similar fuel types and available fuel loads (Plate 11). Similar wetland vegetation also occurs to the south of the project area along the banks of Ellen Brook (Plate 12).

The above woodland areas are considered to pose the predominant bush fire risk to proposed life and property assets of the development.

Plate 10 On-site woodland vegetation along Sawpit Gully to the west (Swamp paperbark and Flooded gum at 8 t/ha)

Plate 11 Off-site woodland vegetation to the northwest (Sawpit Gully wetland vegetation at 8 t/ha)

Plate 12 Off-site woodland vegetation to the south (Ellen Brook wetland vegetation at 8 t/ha)

Open woodland

The project area also contains discrete patches of open woodland in the form of two degraded remnants dominated by Jarrah and Marri located in the central and eastern parts of the site (Plate 13). These areas contain available fuel loads within 2 t/ha due to being subject to ongoing rural land uses, clearing and recent bush fire occurrence. These areas, particularly the central remnant, will be subject to clearing as part of the proposed development and are not considered to pose a significant long term bush fire risk to the site.

Additional areas of degraded open woodland vegetation dominated by Jarrah and Marri are located within the Railway Parade road reserve to the east of the site (Plate 14). Available fuel loads were estimated to be within 2 t/ha; however, some of this remnant is proposed to be cleared to facilitate road construction along Railway Parade. This vegetation is not considered to pose a significant long term bush fire risk to the site.

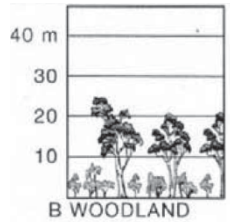
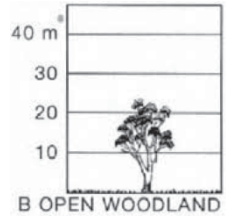
Plate 13 On-site scattered open woodland of Jarrah and Marri (recently burnt within 2 t/ha)

Plate 14 Off-site open woodland to the east within the Railway Parade road reserve (recently burnt within 2 t/ha)

Vegetation class and type

An assessment of vegetation class and type within and adjacent to the project area has been undertaken in accordance with procedures outlined in PFBFP Guidelines (Table 4).

Table 4 Stages 2 and 3 Predominant vegetation class and type

Predominant vegetation and fuel load	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Description (as per PFBFP Guidelines)
Woodland of Swamp paperbark and Flooded gum associated with Sawpit Gully and Ellen Brook wetlands (up to 8 t/ha)	(B) Woodland	Woodland	 B WOODLAND FIGURE 2.2-05	Trees 10–30 m high; 10-30% foliage cover dominated by eucalypts; understorey low trees to tall shrubs typically dominated by acacia, callitris or casuarina.
Open woodland of Jarrah and Marri in scattered, degraded remnants (within 2 t/ha)		Open woodland	 B OPEN WOODLAND FIGURE 2.2-06	

Location of bush fire hazards

The location of existing bush fire hazard areas is outlined in the vegetation class map (Figure 14). This map has been created using the abovementioned vegetation class and type descriptions and estimated available fuel loads.

Bush fire hazard levels

Bush fire hazard levels of the predominant vegetation are displayed in the bush fire hazard assessment map (Figure 15). Classifying the bush fire hazard by assessing the predominant vegetation is a key to the initial determination of site suitability for development. This also leads to determination of the potential level of construction standard by the application of AS 3959–2009 *Construction of buildings in bushfire prone areas* (SA 2009) for any proposed development.

The pre-development, on-site bush fire hazard level is predominantly 'Low' due to the extent of cleared, managed grasslands throughout the site. However, the project area also contains small areas of 'Moderate' and 'Extreme' bush fire hazards in association with degraded open woodland areas and woodland vegetation along Sawpit Gully.

The bush fire hazard level of adjacent land is predominantly 'Low' due to the extent of cleared, managed grassland and pastures, particularly to the north and east. However, surrounding land also contains areas of 'Moderate' and 'Extreme' bush fire hazards in association with open woodland vegetation along Railway Parade, as well as woodland vegetation associated with Sawpit Gully and Ellen Brook wetlands.

According to PFBFP Guidelines, land with an assessed 'Moderate' to 'Extreme' bush fire hazard level is classified as bush fire prone land, which triggers implementation of AS 3959–2009 for any adjacent proposed development. Proposed separation distances between proposed residential lots and 'Moderate' and 'Extreme' bush fire hazard areas are outlined in Figure 15, as well as a 100 m buffer to 'Extreme' bush fire hazard areas to inform the BAL assessment.

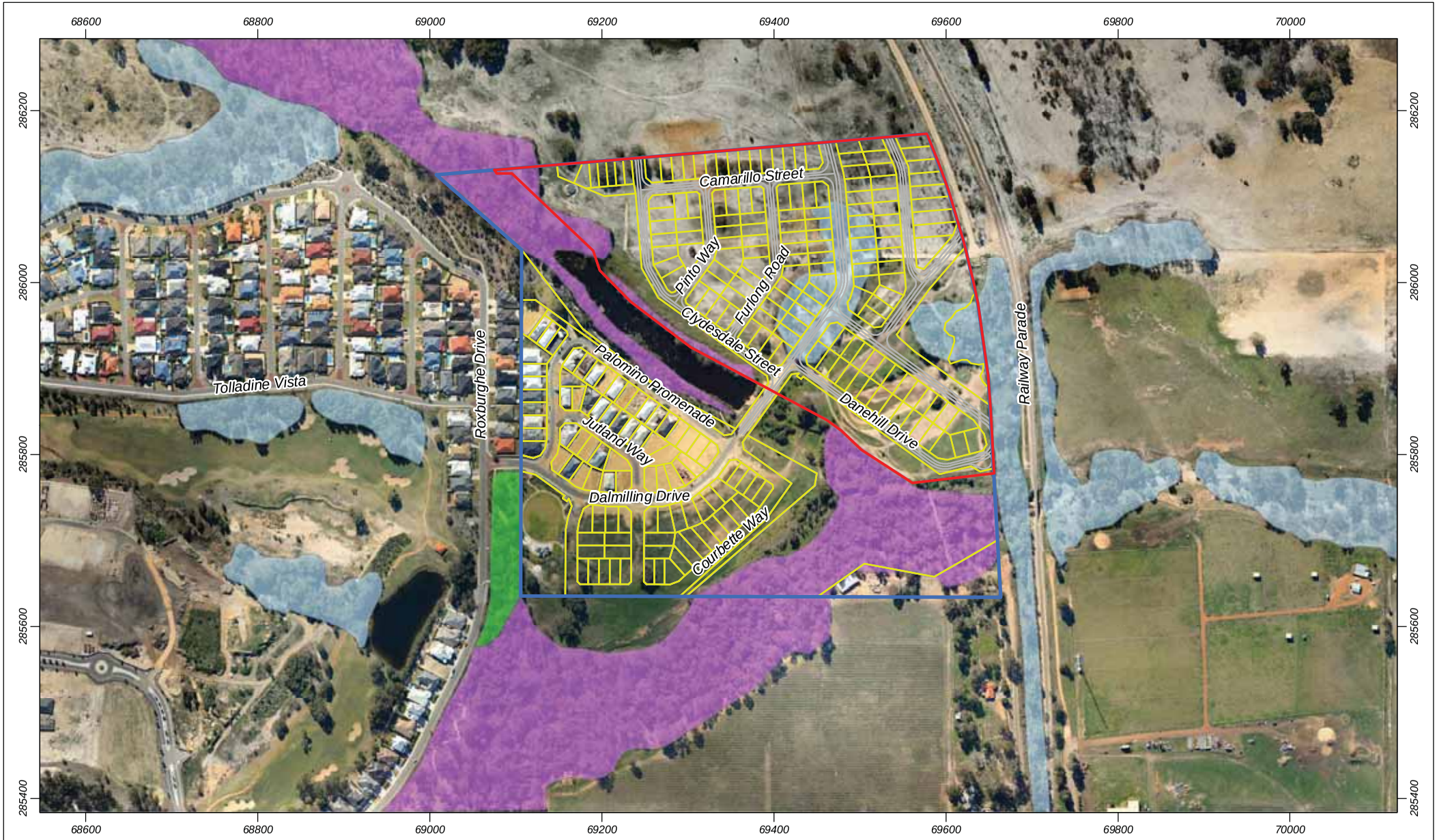


Figure 14 Stages 2 and 3 Vegetation class map

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Roads
- Residential lots
- Project area boundary
- Lot 4 boundary

Vegetation class

- Open woodland of Jarrah and Marri (within 2 t/ha)
- Open woodland of Marri (within 2 t/ha)
- Woodland of Flooded gum and Paperbark (8 t/ha)

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Figure 15 Stages 2 and 3 Bush fire hazard assessment map

Scale 1:6,000 at A4

0 25 50 75 100 125 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Residential lots
- Roads
- Project area boundary
- Lot 4 boundary
- 100m buffer

Fire hazard level

- Low bush fire hazard level
- Moderate bush fire hazard level
- Extreme bush fire hazard level

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5.2.2 Bush fire hazard performance criteria

The relationship between various bush fire hazard levels and development performance criteria is set out in Table 5. Some residential lots of Stages 2 and 3 are proposed to be located within 100 m of 'Moderate' and 'Extreme' bush fire hazard areas, as displayed in Figure 15. Consequently, a comprehensive suite of bush fire risk treatment and mitigation measures, including implementation of AS 3959-2009, will need to be implemented to protect these assets from existing hazard areas.

Compliance with performance criteria for a 'Moderate' bush fire hazard level will be achieved for the proposed development, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development. Performance criteria will be achieved through adoption of recommended acceptable solutions outlined in PFBFP Guidelines.

Table 5 Stages 2 and 3 Bush fire hazard levels and performance criteria

Bush fire hazard level	Bush fire protection performance criteria required
Low hazard	Development does not require special bush fire planning controls. Despite this, DFES strongly recommends that ember protection features be incorporated in design where practicable.
Moderate hazard	Performance criteria for: • location (Element 1) • vehicular access (Element 2) • water (Element 3) • siting of development (Element 4) • design of development (Element 5).
Extreme hazard	Development is to be avoided in areas with these hazard levels.

Source: WAPC et al. 2010

Compliance of the proposed development with bush fire protection performance criteria and associated acceptable solutions is documented in a completed compliance checklist (Appendix 1).

5.2.3 Classifying the bush fire attack level

This procedure, as outlined in AS 3959–2009, uses a combination of the state-adopted Fire Danger Index rating of FDI 80, vegetation class, slope under classified vegetation and the distance maintained between proposed development areas and predominant vegetation to specify the Bushfire Attack Level (BAL). Based on the specified BAL, construction requirements for proposed buildings can then be assigned.

Proposed residential lots will be situated at varying distances to 'Moderate' and 'Extreme' bush fire hazard areas, some within 100 m (Figure 15). Proposed residences will be located up-slope from the predominant woodland vegetation types at up to 5 degrees. Given the variations in vegetation type and separation distance between proposed lots and bush fire hazard areas, a range of BALs will apply to proposed residential lots, as indicated in Table 6. In addition, a 1.5–4.5 m high masonry wall will be constructed around selected areas of the development perimeter, which will provide a reduction in BAL to numerous lots due to shielding.

Table 6 Stages 2 and 3 Determination of bush fire attack level (BAL)

Vegetation class	Bush fire attack level (BAL)				
	BAL FZ	BAL 40	BAL 29	BAL 19	BAL 12.5
	Distance (m) of the site from the predominant vegetation class				
	Vegetation is down-slope (building is up-slope) >0 to 5 degrees				
(B) Woodland	<13 (not appropriate)	13–<17 (not appropriate)	17–<25	25–<35	35–<100

Source: WAPC et al. 2010

BAL 12.5 and corresponding construction standards will apply to all buildings within specified lots in accordance with Figure 17. BAL 12.5 has been applied based on the separation distances to 'Extreme' and 'Moderate' bush fire hazard areas, up-slope nature of proposed residential lots and shielding properties of the proposed masonry wall. Hazard separation to these lots will be in the form of building setbacks, road reserves and low fuel POS areas, which will achieve 20 m wide Building Protection Zones (BPZs) at a minimum, plus additional low fuel Hazard Separation Zones (HSZs) throughout managed POS areas.

BAL 19 and corresponding construction standards will apply to all buildings within the north-western-most lot of the proposed development, due to the reduced separation distance to 'Extreme' bush fire hazards and lack of shielding (Figure 17). Hazard separation to this lot will be in the form of building setbacks and a low fuel POS area, which will achieve a 20 m wide BPZ at a minimum.

All other lots of the proposed development are considered to be BAL-Low, where there is insufficient risk to warrant specific construction requirements. The risk to these lots is diminished due to an increase in the low fuel separation distance to bush fire hazard areas.

Strategen considers that a potential bush fire occurring within wetland vegetation associated with Sawpit Gully, Ellen Brook and the proposed conservation reserve will have significantly reduced fire intensity and ember attack characteristics compared to a potential bush fire in a traditional forest or woodland area with long fire runs and high available fuel loads. The wetland vegetation adjacent to proposed lots, while certainly posing a bush fire risk to future life and property assets of the development, occurs in discrete, manageable patches, has relatively low fuel loads and small potential fire runs. Therefore, Strategen considers the abovementioned BAL recommendations are justified and will provide suitable protection and defendable space for proposed buildings from the potential effects of ember attack and radiant heat. In addition, the abovementioned BAL ratings are consistent with BAL ratings applied to lots within surrounding development areas, including preceding stages of Equis Lake and the adjacent north Stage 7B Ellenbrook development.

Relevant sections of AS 3959–2009 that outline construction standards for buildings in areas specified as BAL 12.5 and BAL 19 are provided in Table 7. Construction standards for BAL 12.5 and BAL 19 are fully explained in Appendix 3.

Table 7 Stages 2 and 3 Construction standards

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and heat flux exposure thresholds	Description of predicted bush fire attack and levels of exposure	Relevant section of AS 3959–2009
BAL 12.5	≤12.5 kW/m^2	Ember attack	3 and 5
BAL 19	>12.5 kW/m^2 ≤19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux	3 and 6

Source: WAPC et al. 2010

6. Bush fire risk treatment and mitigation (Stage 1B)

The following subsections outline how the proposed Stage 1B development will mitigate the bush fire risk to future life and property and achieve a suitable and effective bush fire management outcome for the site. This will be achieved by meeting performance criteria and associated acceptable solutions in accordance with PFBFP Guidelines, with consideration of SPP 3.7 and revised guidelines. Where applicable, these measures are illustrated on an aerial image of Stage 1B to assist with implementation of the FMP (refer to Figure 16).

6.1 Development location

Strategic location, layout and management of future development at the planning stage can reduce future fire threat and risk to critical life and property assets.

Stage 1B is contained within a 'Low' bush fire hazard area and is proposed to be developed as a significant built and landscaped footprint. The two areas of POS will be subject to landscape design and will be managed on an ongoing basis by CoS to less than 2 t/ha. This can be achieved through mechanical slashing (i.e. mowing) or chemical spraying of understorey grasses, trash and litter fuels throughout POS areas prior to the onset of the designated bush fire season.

The above measures will ensure the development is not located on land subject to either an extreme bush fire hazard level or requires construction standards applicable to BAL 40 or BAL FZ. This meets performance criteria for development location (Element 1) by adopting acceptable solution A1.1.

6.2 Vehicular access

Stage 1B will provide an internal road network with three links to the surrounding public road network in Dalmilling Drive, which provides access to the east, west and north, away from the predominant fuel hazards and potential fire front. This measure adopts acceptable solution A2.1 by ensuring all residents and visitors of the development are provided with at least two vehicular access routes connecting to the surrounding public road network at all times.

All public roads and private driveways will be constructed to specifications in accordance with Main Roads WA and DFES requirements (which align with acceptable solutions A2.2 and A2.5).

Emergency access ways, fire service access routes, gates, firebreaks and signs are not considered necessary as part of the current development. However, should CoS construct a fence around the eastern, southern and western site boundaries, then gates that provide emergency and operational access to surrounding areas of Crown Land are recommended to be constructed at the northeast and southwest boundaries of the site.

Proposed Courbette Way will provide suitable emergency service access to the higher risk areas of the site (i.e. to the south), as well as providing an additional buffer between proposed southern-based dwellings and adjacent south vegetation extent.

The above measures will ensure the development meets performance criteria for vehicular access (Element 2).

6.3 Water supply

A reticulated water supply will be provided for the proposed Stage 1B development through extension of the existing reticulated water supply from Stage 1A, which is currently being constructed.

A network of hydrants will also be provided along the internal road network at locations that meet relevant water supply authority and DFES requirements.

The above measures will ensure the development meets performance criteria for water supply (Element 3) by adopting acceptable solution A3.1.

6.4 Siting of development

When considering the overall bush fire management of Stage 1B, protection should be provided to critical life and property assets (residents, visitors and built assets) as a minimum requirement. Low fuel buffers between fire hazard areas and critical assets, as well as application of AS 3959–2009, can be implemented to achieve this.

BAL 12.5 is required for all proposed lots of Stage 1B located east of Jutland Way. A 20 m wide Building Protection Zone (BPZ) and 20 m wide Hazard Separation Zone (HSZ) is also required adjacent to the first row of lots along the southern boundary. This is to protect these lots from bush fire hazards located to the south. A 3 m average height retaining wall has also been constructed as an additional measure to provide protection to the outer lots from radiant heat.

All other lots of Stage 1B (i.e. to the west of Jutland Way) do not require BAL ratings, BPZs or HSZs given the hazard separation provided by existing cleared areas is sufficient. This approach has been endorsed by DFES and is illustrated in Figure 16.

The above measures will ensure the development meets performance criteria for siting of development (Element 4).

6.5 Design of development

The bush fire management concept, as indicated in Figure 16, is expected to reduce the vulnerability of life and property assets from the effects of bush fire and greatly assist bush fire prevention and suppression operations. Given the proposed development is considered to comply with Element 4 Siting of development, there are no special design requirements.

6.6 Additional bush fire risk mitigation

The following measures will be implemented in addition to those outlined previously to provide a more effective level of bush fire protection to the Stage 1B development:

1. Avoid installation of evaporative air conditioners: rooftop evaporative air-conditioners are not recommended to be installed throughout the proposed Stage 1B development as these items can result in a higher risk and vulnerability to ember attack in the event of bush fire.
2. Section 70 Notification on Title: prospective landowners should be made aware that an FMP exists over the site through a Section 70 Notification on Title and provision of this FMP on purchase of the lot.
3. Annual fuel inspections: these may be undertaken by CoS staff and failure to comply with this FMP and the specified requirements of the current CoS firebreak order may result in the issuing of fines (refer to Appendix 5 for the current CoS firebreak order).
4. Landowner education and awareness: prospective landowners should obtain a copy of local government and DFES bush fire information booklets that are currently available, as well as this FMP. In addition, attendance by landowners at annual DFES bush fire awareness briefings would be advantageous.

6.7 Summary of bush fire risk mitigation and works program

6.7.1 Responsibilities for developer, City of Swan and prospective landowners

A summary of the bush fire risk treatment and mitigation measures described in Section 6, as well as a works program, is provided in Table 8. These measures will be implemented to ensure the ongoing protection of proposed life and property assets is achieved. Additional optional measures are also provided and can be adopted by residents to further mitigate their risk to life and property from uncontrolled bush fires. Timing and responsibilities are also defined to assist with implementation of each management measure.

Table 8 Stage 1B Summary of bush fire risk treatment and mitigation measures and works program

Bush fire risk mitigation	Required works	Mandatory	Optional	Timing	Responsibility
Development location	Undertake development in accordance with the Stage 1B approved subdivision plan to ensure the site maintains a low bush fire hazard and is not subject to BAL 40 or BAL FZ. Refer to FMP Section 6.1.	Yes	No	On implementation of the Stage 1B development	Developer
	Manage all POS understoreys within 2 t/ha through landscape design and mechanical slashing/chemical spraying where required. Refer to FMP Section 6.1.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer during development, CoS thereafter
Vehicular access	Provide an internal road network to ensure all residents and visitors of the development are provided with at least two vehicular access routes connecting to the surrounding public road network at all times. Refer to FMP Section 6.2.	Yes	No	On implementation of the Stage 1B development	Developer
	Construct all public roads and private driveways in accordance with Main Roads WA and DFES requirements. Refer to FMP Section 6.2.	Yes	No	On implementation of the Stage 1B development	Developer
	Construct gates at the northeast and southwest site boundaries sufficient for emergency and operational access. Refer to FMP Section 6.2.	Yes	No	Should CoS construct a fence around the eastern, southern and western site boundaries	CoS
Water supply	Provide a reticulated water supply to Stage 1B through extension of the existing reticulated water supply from Stage 1A. Refer to FMP Section 6.3.	Yes	No	On implementation of the Stage 1B development	Developer
	Provide a network of hydrants along the internal road network at locations which meet relevant water supply authority and DFES requirements. Refer to FMP Section 6.3.	Yes	No	On implementation of the Stage 1B development	Developer
Siting of development	Apply BAL 12.5 construction standards for all proposed lots of Stage 1B located east of Jutland Way, as depicted in Figure 16. Refer to FMP Section 6.4.	Yes	No	During building construction	Builder, prospective landowner
	For the above lots designated as BAL 12.5, create and manage an outer 20 m wide BPZ and 20 m wide HSZ to the south, as outlined in Figure 16. Refer to FMP Section 6.4.	Yes	No	On implementation of the Stage 1B development	Developer during development, prospective landowner and CoS thereafter on the relevant owned lands
Design of development	Comply with acceptable solutions under Element 4 Siting of development to prevent any special building design requirements. Refer to FMP Section 6.5.	Yes	No	On implementation of the Stage 1B development	Developer
Additional bush fire risk mitigation	Avoid installation of rooftop evaporative air-conditioners within all future buildings of the proposed development. Refer to FMP Section 6.6.	No	Yes	On development of individual lots	Builder, prospective landowner
	Advise all prospective landowners that an FMP exists over the site through Section 70 Notification on Title and provision of the FMP on purchase of the lots. Refer to FMP Section 6.6.	Yes	No	On creation of title and sale of lots	Developer
	Undertake annual fuel inspections across Stage 1B and adjacent land to assess compliance with the FMP and CoS firebreak order. Issue work orders or fines where compliance with the *Bush Fires Act 1954* or the FMP has been compromised. Refer to FMP Section 6.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoS
	Obtain bush fire information booklets and attend annual DFES bush fire awareness briefings. Refer to FMP Section 6.6.	No	Yes	Annually	Prospective landowners

Bush fire risk mitigation	Required works	Mandatory	Optional	Timing	Responsibility
Restricted and prohibited burning times	Comply with the annual CoS firebreak order and DFES/CoS-determined burning periods. Refer to Appendix 5.	Yes	No	As specified by DFES/CoS	Developer and prospective landowners

7. Bush fire risk treatment and mitigation (Stages 2 and 3)

The following subsections outline how the proposed Stages 2 and 3 Equis Lake residential development will mitigate the bush fire risk to future life and property and achieve a suitable and effective bush fire management outcome for the site. This will be achieved by meeting performance criteria and associated acceptable solutions in accordance with PFBFP Guidelines with consideration of the proposed SPP 3.7 and revised guidelines. Where applicable, these measures are illustrated on an aerial image of the project area in Figure 17 to assist with implementation of the FMP.

7.1 Development location

Strategic location, layout and management of future development at the planning stage can reduce future fire threat and risk to critical life and property assets.

7.1.1 Residential lots

The proposed built footprint currently intersects areas of 'Low' and 'Moderate' bush fire hazard (Figure 15). However, the central woodland area ('Moderate' bush fire hazard level) is proposed to be cleared, which will result in the full development extent, including all proposed residential lots, being located entirely within a 'Low' bush fire hazard area.

7.1.2 Public Open Space

Three POS areas are proposed as part of the development, including Sawpit Gully and Ellen Brook foreshore reserves, as well as the proposed conservation reserve to the east. All three POS areas will be subject to landscape design and ongoing management, as outlined in Appendix 4. The landscape concept for POS areas includes:

- retention and enhancement of existing wetland vegetation and environmental values
- planting of individual endemic native trees and shrubs throughout low fuel rehabilitated areas, managed on an ongoing basis within 2 t/ha
- low fuel drainage basins planted with endemic, damp-land species, tolerant of winter wet and summer dry conditions, managed on an ongoing basis within 2 t/ha
- dual use paths for public access
- seating nodes
- provision of 1.5–4.5 m high masonry walls around selected areas of the development perimeter
- regional walk trails linking with adjacent development areas, suitable for access by emergency service vehicles.

Aside from the discrete pockets of existing wetland vegetation along the Sawpit Gully and Ellen Brook foreshores and proposed conservation reserve (proposed for retention and enhancement), available fuel loads within all POS areas will be managed on an ongoing basis within 2 t/ha. This can be achieved through mechanical slashing or manual removal of understorey grasses, trash and litter fuels prior to the onset of the designated bush fire season. This will create significant low fuel areas between proposed residential lots and retained wetland vegetation, which has been achieved for the preceding stages of Equis Lake, as indicated in Plate 15.

The above measures will ensure the development is not located on land subject to either an extreme bush fire hazard level or construction standards applicable to BAL 40 or BAL FZ. This meets performance criteria for development location (Element 1) by adopting acceptable solution A1.1.

Plate 15 Example of low fuel landscaped POS adjacent to built assets of Stage 1A Equis Lake

7.2 Vehicular access

7.2.1 Public access routes

The proposed development will provide a vehicular access network with potentially six links to the surrounding public road network (Figure 17). Three of these will provide access to the proposed Stage 7B Ellenbrook development to the north; one will provide access to Stages 1A and 1B Equis Lake via Dalmilling Drive to the southwest; and one will link with Railway Parade to the southeast subject to construction of a bridge over Ellen Brook. An additional link will be provided connecting to the northern section of Railway Parade if the bridge over Ellen Brook is constructed. Notwithstanding, a fire service access route will be constructed within this reserve as outlined in Section 7.2.2.

A small amount of vegetation clearance will be required to facilitate construction of Railway Parade to the southeast of the site if a bridge over Ellen Brook is constructed. This will provide additional hazard separation between proposed residential lots and open woodland vegetation within the road reserve (Figure 17).

These measures adopt acceptable solution A2.1 by ensuring all residents and visitors of the development are provided with at least two vehicular access routes connecting to the surrounding public road network at all times.

All public roads, cul-de-sacs and private driveways will be constructed to specifications in accordance with Main Roads WA and DFES requirements, which align with acceptable solutions A2.2, A2.3 and A2.5.

7.2.2 Fire service access routes

A fire service access route will be provided within the proposed road reserve linking with the eastern site boundary (Figure 17). This route will provide emergency services with additional site access from the north via Railway Parade (unsealed) and importantly, will provide an accessible buffer and defendable space between residential lots to the north of the proposed conservation reserve. The access route will be constructed in accordance with acceptable solution A2.7, with gates and signage implemented at each end of the route in accordance with acceptable solution A2.8 and A2.10 respectively.

Additional access routes suitable for emergency service vehicles will be implemented via the regional walk trails, which will link Stages 2 and 3 with adjacent development areas in accordance with the ODP.

Firebreaks are not considered necessary as part of the development, given the lack of on-site standing vegetation and significant level of hazard separation provided by perimeter roads and surrounding low fuel POS areas.

The proposed vehicular access network is considered adequate for the purposes of bush fire protection and will ensure the development meets performance criteria for vehicular access (Element 2).

7.3 Water supply

A reticulated water supply will be provided for Stages 2 and 3 through extension of the existing reticulated water supply from Stage 7B Ellenbrook to the north and/or Stages 1A and 1B Equis Lake to the southwest.

A network of hydrants will also be provided along the internal road network at locations which meet relevant water supply authority and DFES requirements.

The above measures will ensure the development meets performance criteria for water supply (Element 3) by adopting acceptable solution A3.1.

7.4 Siting of development

When considering the overall bush fire management of the project area, protection should be provided to critical life and property assets (residents, visitors and built assets) as a minimum requirement. Low fuel buffers between fire hazard areas and critical assets, as well as application of AS 3959–2009, can be implemented to achieve this.

The following bush fire hazard areas are considered to be the predominant, long term bush fire risks to the proposed development. In the absence of ongoing vegetation management, these areas will increase in vegetation density and available fuel load:

- wetland vegetation associated with Ellen Brook to the south and Sawpit Gully to the west (Paperbark/Flooded gum woodland vegetation at up to 8 t/ha, ‘Extreme’ bush fire hazard)
- wetland vegetation within the proposed conservation reserve to the east (degraded Jarrah/Marri open woodland within 2 t/ha, ‘Moderate’ bush fire hazard).

As such, critical assets located in proximity to the abovementioned hazards should be prioritised for bush fire protection measures through provision of low fuel defendable space (BPZs and HSZs), heightened levels of construction standard and shielding mechanisms. The BAL assessment undertaken in Section 5.2.3 achieves this through the following recommendations:

1. BAL 12.5 and corresponding construction standards will apply to all buildings within specified lots in accordance with Figure 17. BAL 12.5 has been applied based on the separation distances to ‘Extreme’ and ‘Moderate’ bush fire hazard areas, up-slope nature of proposed residential lots and shielding properties of the proposed masonry wall. Hazard separation to these lots will be in the form of building setbacks, road reserves and low fuel POS areas, which will achieve 20 m wide BPZs at a minimum, plus additional low fuel HSZs throughout managed POS areas.

2. BAL 19 and corresponding construction standards will apply to all buildings within the north-western-most lot of the proposed development, due to the reduced separation distance to 'Extreme' bush fire hazards and lack of shielding (Figure 17). Hazard separation to this lot will be in the form of building setbacks and a low fuel POS area, which will achieve a 20 m wide BPZ at a minimum.
3. All other lots of the proposed development are considered to be BAL-Low, where there is insufficient risk to warrant specific construction requirements. The risk to these lots is diminished due to an increase in the low fuel separation distance to bush fire hazard areas and shielding properties provided by external lots.

The abovementioned recommendations are supported by sound justification and rationale based on potential fire behaviour characteristics of the surrounding vegetation and subsequent risk to proposed life and property assets (refer to 5.2.3).

The above measures will ensure the development meets performance criteria for siting of development (Element 4) by adopting acceptable solutions A4.1, A4.2, A4.3, A4.4 and A4.5.

7.5 Design of development

Development design, as indicated in Figure 2, is expected to reduce the vulnerability of life and property assets from the effects of bush fire and greatly assist bush fire prevention and suppression operations. Given the proposed development is considered to comply with acceptable solutions A4.1, A4.2, A4.3, A4.4 and A4.5, there are no special design requirements.

7.6 Additional bush fire risk mitigation

The following measures will be implemented in addition to those outlined previously to provide a more thorough level of bush fire protection to residents, visitors and built assets of the subject land:

1. Avoid installation of evaporative air conditioners: rooftop evaporative air-conditioners are not recommended to be installed throughout the proposed Stages 2 and 3 development as these items can result in a higher risk and vulnerability to ember attack in the event of bush fire.
2. Section 70 Notification on Title: these will be provided for those lots with a BAL rating to ensure prospective landowners are aware that an FMP exists over the site and that landowner and building construction requirements may apply.
3. Annual fuel inspections: these may be undertaken by CoS staff and failure to comply with this FMP and the specified requirements of the current CoS firebreak order may result in the issuing of fines (refer to Appendix 5 for the current CoS firebreak order).
4. Landowner education and awareness: prospective landowners should obtain a copy of local government and DFES bush fire information booklets that are currently available, as well as this FMP. In addition, attendance by landowners at annual DFES bush fire awareness briefings would be advantageous.

7.7 Summary of bush fire risk mitigation and works program

7.7.1 Responsibilities for developer, City of Swan and prospective landowners

A summary of the bush fire risk treatment and mitigation measures described in Section 7, as well as a works program, is provided in Table 9. These measures will be implemented to ensure the ongoing protection of proposed life and property assets is achieved. Additional optional measures are also provided and can be adopted by residents to further mitigate their risk to life and property from uncontrolled bush fires. Timing and responsibilities are also defined to assist with implementation of each management measure.

Table 9 Stages 2 and 3 Summary of bush fire risk mitigation measures and works program

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
Development location	Undertake development in accordance with the Stages 2 and 3 ODP to ensure the development occurs within a low bush fire hazard area. Refer to FMP Section 7.1.1.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Manage available fuel loads within 2 t/ha throughout all POS areas (aside from the discrete pockets of existing wetland vegetation along the Sawpit Gully and Ellen Brook foreshores and proposed conservation reserve, which are proposed to be retained and enhanced). This can be achieved through mechanical slashing or manual removal of understorey grasses, trash and litter fuels. Refer to FMP Section 7.1.2.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer during development, CoS thereafter
Vehicular access	Implement an internal road network providing all residents and visitors of the development with potentially six vehicular access routes connecting to the surrounding public road network. Refer to FMP Section 7.2.1.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Construct all public roads, cul-de-sacs and private driveways in accordance with Main Roads WA and DFES requirements. Refer to FMP Section 7.2.1.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Construct a fire service access route along the existing road reserve linking with the eastern site boundary with signage and gates implemented at each end. Refer to FMP Section 7.2.2.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Provide a network of regional walk trails to adjacent development areas, suitable to accommodate access by emergency service vehicles. Refer to FMP Section 7.2.2.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
Water supply	Provide a reticulated water supply through extension of the existing reticulated water supply from adjacent development areas. Refer to FMP Section 7.3.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Provide a network of hydrants along the internal road network at locations which meet relevant water supply authority and DFES requirements. Refer to FMP Section 7.3.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
Siting of development	Apply BAL 12.5 and corresponding construction standards to all buildings within specified lots in accordance with Figure 9. Refer to FMP Section 7.4.	Yes	No	During building construction	Developer, builder
	Apply BAL 19 and corresponding construction standards to all buildings within the north-western-most lot in accordance with Figure 9. Refer to FMP Section 7.4.	Yes	No	During building construction	Developer, builder
	Provide minimum 20 m wide BPZs for specified lots in accordance with Figure 9. Additional low fuel HSZs will be created following implementation of landscape design for adjacent POS areas. Refer to FMP Section 7.4.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
	Construct a 1.5–4.5 m high masonry wall around selected areas of the development perimeter in accordance with Figure 9. Refer to FMP Section 7.4.	Yes	No	During implementation of the Stages 2 and 3 development	Developer
Design of development	Comply with acceptable solutions A4.1, A4.2, A4.3, A4.4 and A4.5 to prevent special design requirements. Refer to FMP Section 7.5.	Yes	No	During implementation of the Stages 2 and 3 development	Developer

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
Annual fuel hazard inspections	Comply with the current CoS firebreak order. Refer to Appendix 5.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer and prospective landowners
	Undertake an inspection of fuel hazards across the Stages 2 and 3 development area to assess compliance with the FMP and CoS firebreak order. Refer to FMP Section 7.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoS
	Issue work orders or fines where compliance with the *Bush Fires Act 1954*, FMP or CoS firebreak order has been compromised. Refer to FMP Section 7.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoS
Section 70 notification on title	To provided on the Title of those lots with a BAL rating to ensure prospective landowners are aware that an FMP exists over the site and that landowner and building construction requirements may apply. Refer to FMP Section 7.6.	Yes	No	On creation of Title	Developer
Landowner education and awareness	Obtain bush fire information booklets and attend annual DFES bush fire awareness briefings. Refer to FMP Section 7.6.	No	Yes	Annually	Prospective landowners
Optional building requirements	Restrict the installation of roof-top evaporative air-conditioners, mesh screens or shutters. Refer to FMP Section 7.6.	No	Yes	During implementation of the Stages 2 and 3 development	Developer, builder, prospective landowners
Restricted and prohibited burning times	Comply with the annual CoS firebreak order and DFES/CoS-determined burning periods. Refer to Appendix 5.	Yes	No	As specified by DFES/CoS	Developer and prospective landowners

8. Implementation of the Fire Management Plan

8.1 Implementation of bush fire risk mitigation measures

Works programs for Stage 1B and Stages 2 and 3 are detailed in Table 8 and Table 9 respectively, which provide clear direction for the implementation of all works associated with this FMP, including appropriate timing and responsibilities. In addition, the full range of bush fire risk treatment and mitigation measures, as well as location of implementation as specified in this FMP, is provided in Figure 16 for Stage 1B and Figure 17 for Stages 2 and 3. The plans have been overlain on an aerial image of each site to assist with implementation.

8.2 Assessment of bush fire management measures

Implementation of the bush fire risk treatment and mitigation measures outlined in this FMP will ensure that should a bush fire occur within or adjacent to Stage 1B or Stages 2 and 3, fire intensity on-site will be minimised and life and property assets are expected to be protected. In addition, a fire occurring on either site is highly likely to be readily contained within 30 minutes, which is the approximate emergency response time provided by local bush fire brigades.

The cost of undertaking the various tasks and initiatives outlined in the FMP will provide significant cost benefit to the developer and prospective landowners when compared with the possible loss of life or infrastructure values of the site.

8.3 Legislative requirements, specifications and standards

The legislative requirements, specifications and standards applicable to implementation of this FMP are referenced in Section 9 and Appendix 6 and pertain to the following:

- *Bush Fires Act 1954*
- *Planning and Development Act 2005*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Protection Act 1986*
- *Wildlife Conservation Act 1950*
- Building Code of Australia
- Planning for Bush Fire Protection Guidelines (Edition 2)
- Australian Standard AS 3959–2009 Construction of Buildings in Bushfire Prone Areas
- City of Swan annual firebreak order.

Figure 16 Fire Management Plan: Stage 1B Equis Lake

Scale 1:2,000 at A4

0 10 20 30 40 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Stage 1B boundary
- 3m average height retaining wall
- Future road centreline
- HSZ 20m
- BPZ 20m
- BAL 12.5
- POS
- Residential R25 lots

STRATEGEN

info@strategen.com.au www.strategen.com.au

Path: Q:\Consult\2013\RDP\RDP13151.01\ArcMap_documents\R001\Rev3\RDP13151_01_R001_Rev3_F016.mxd

Figure 17 Stages 2 and 3 Fire Management Plan: Stages 2 and 3 Equis Lake

Scale 1:3,500 at A4

0 20 40 60 80 100 m

Coordinate System: GDA 1994 Perth Coastal Grid 1994

Note that positional errors may occur in some areas

Date: 30/05/2014

Author: JCrute

Source: Client 2013.

Legend

- Public access routes
- Signage and access gates
- Masonry wall
- Conservation area boundary
- Residential lots
- Roads
- Proposed road reserve
- Parks & Recreation
- POS
- Project area boundary
- Lot 4 boundary
- BAL12.5
- BAL 19
- 20 m wide BPZ

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Path: Q:\Consult\2013\RDP\RDP13151.01\ArcMap_documents\R001\Rev3\RDP13151_01_R001_Rev3_F017.mxd

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Appendix 1
Fire Management Plan compliance checklist

Stage 1B and Stages 2 and 3 Compliance checklist for performance criteria and acceptable solutions

Element	Acceptable solution	Compliance	Yes/No	Explanation (if no)
1. Location	A1.1 Development location	Does the proposal comply with performance criteria P1 by applying acceptable solution A1.1?	Yes	
2. Vehicular access	A2.1 Two access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.1?	Yes	
	A2.2 Public roads	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.2?	Yes	
	A2.3 Cul-de-sacs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.3?	N/A	
	A2.4 Battle axes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.4?	N/A	
	A2.5 Private driveways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.5?	Yes	
	A2.6 Emergency access ways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.6?	N/A	
	A2.7 Fire service access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.7?	N/A	
	A2.8 Gates	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.8?	N/A	
	A2.9 Firebreak widths	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.9?	N/A	
	A2.10 Signs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.10?	N/A	
3. Water	A3.1 Reticulated areas	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.1?	Yes	
	A3.2 Non-reticulated areas (a)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.2?	N/A	
	A3.3 Non-reticulated areas (b)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.3?	N/A	
4. Siting of development	A4.1 Hazard separation – moderate to extreme bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.1?	Yes	
	A4.2 Hazard separation – low bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.2?	Yes	
	A4.3 Building protection zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.3?	Yes	
	A4.4 Hazard separation zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.4?	Yes	
	A4.5 Reduction in bush fire attack level due to shielding	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.5?	Yes	
5. Design of development	A5.1 Compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.1?	Yes	
	A5.2 Non-compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.2?	N/A	

Note: Performance criteria and acceptable solutions are in accordance with *Planning for Bush Fire Protection Guidelines (Edition 2)* (WAPC et al. 2010).

Applicant Declaration

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

Full name: Roger Banks

Applicant signature: 

Date: 30/05/2014

Appendix 2

January wind profiles for Pearce RAAF

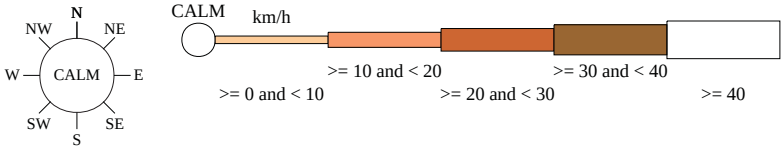
Rose of Wind direction versus Wind speed in km/h (02 Nov 1940 to 31 Oct 2011)

Custom times selected, refer to attached note for details

PEARCE RAAF

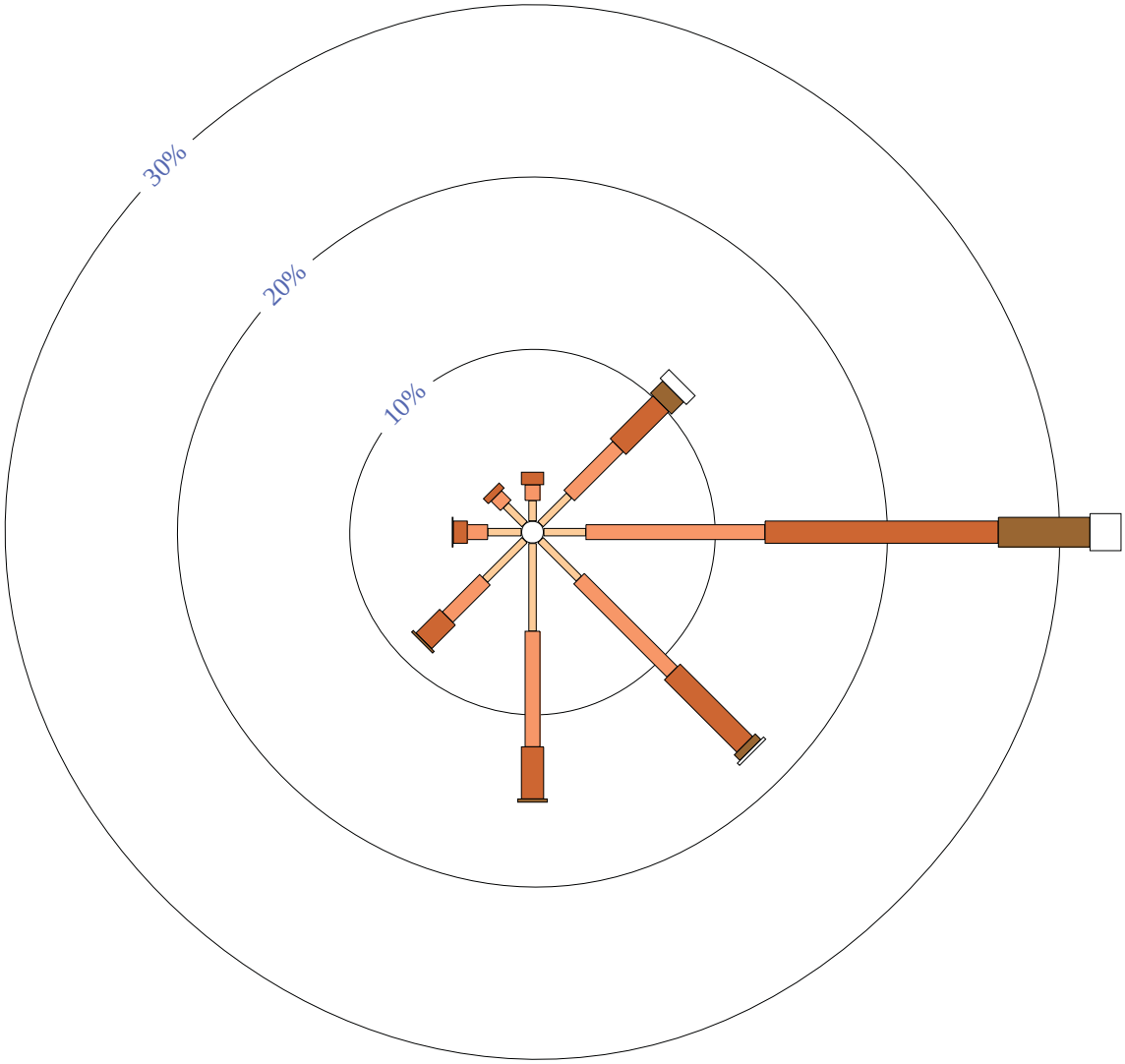
Site No: 009053 • Opened Jan 1937 • Still Open • Latitude: -31.6669° • Longitude: 116.0189° • Elevation 40m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am Jan
1093 Total Observations

Calm 3%



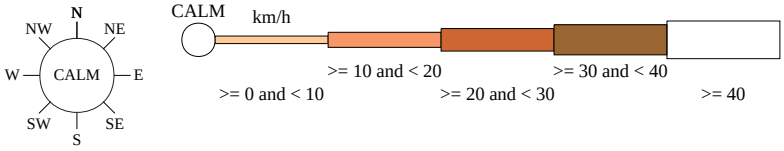
Rose of Wind direction versus Wind speed in km/h (02 Nov 1940 to 31 Oct 2011)

Custom times selected, refer to attached note for details

PEARCE RAAF

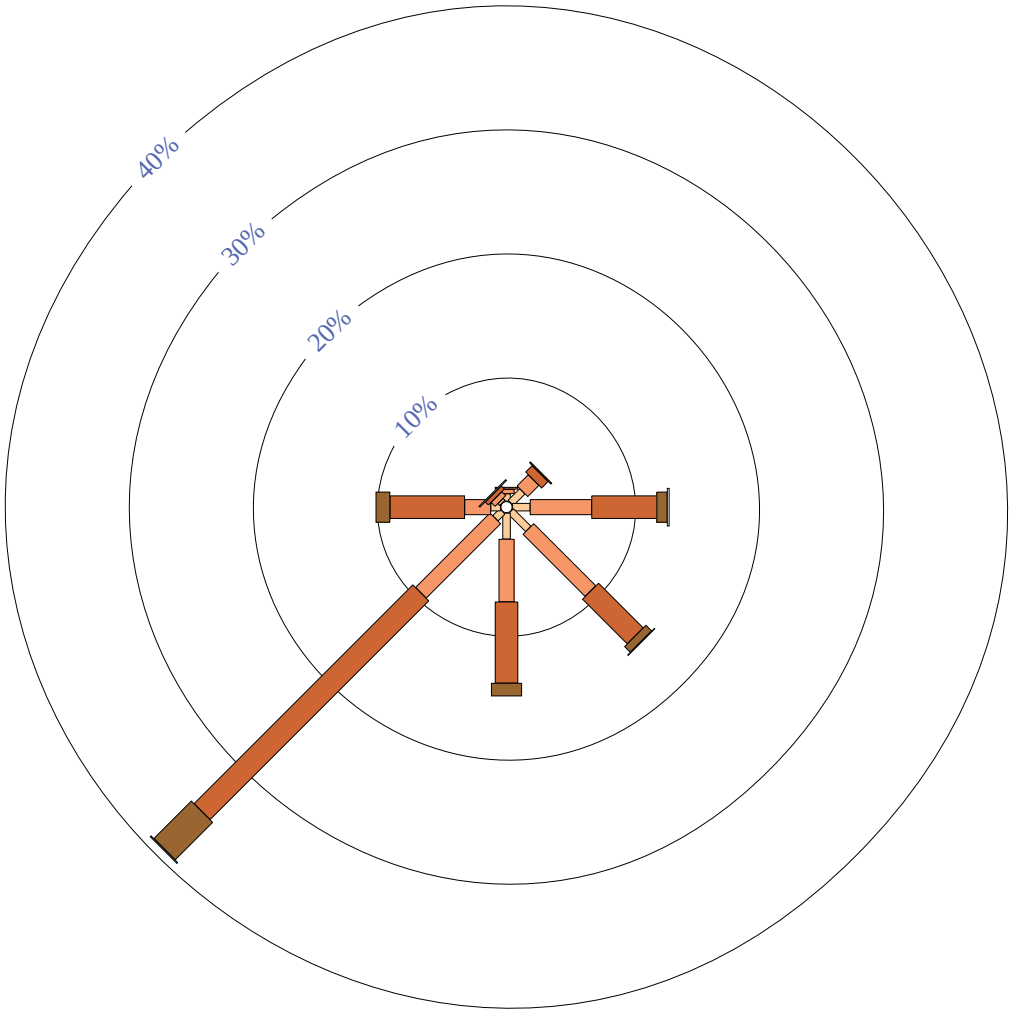
Site No: 009053 • Opened Jan 1937 • Still Open • Latitude: -31.6669° • Longitude: 116.0189° • Elevation 40m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm Jan
1015 Total Observations

Calm 2%



Appendix 3
Stages 2 and 3 Construction standards for BAL 12.5 and BAL 19 as per AS 3959–2009

SECTION 5 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 12.5 (BAL — 12.5)

5.1 GENERAL

A building assessed in Section 2 as being BAL—12.5 shall comply with Section 3 and Clauses 5.2 to 5.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 5.2 to 5.8 (see Clause 3.8).

NOTE: BAL—12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m^2 where the site is less than 100 m from the source of bushfire attack.

5.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 5.7).

C5.2 *Ideally, storage of combustible materials beneath a floor at this BAL would not occur and on this assumption, there is no requirement to enclose the subfloor space or to protect flooring materials from bushfire attack. However, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.*

5.3 FLOORS

5.3.1 Concrete slabs on ground

This Standard does not provide construction requirements for concrete slabs on the ground.

5.3.2 Elevated floors

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

5.4 EXTERNAL WALLS

5.4.1 Walls

That part of an external wall surface that is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less

than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be of—

(a) non-combustible material; or

(b) fibre-cement external cladding, a minimum of 6 mm in thickness; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

There are no requirements for external wall surfaces 400 mm or more from the ground or for external wall surfaces 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

5.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material may be applied over the outer face of the frame prior to fixing any external cladding.

5.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where the vents and weepholes are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

5.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

5.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

(a) non-combustible material; or

(b) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a combination of any of Items (a), (b) or (c) above.

5.5.2 Windows

Window assemblies shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

Or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be Grade A safety glass minimum 4 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double glazed units are used the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used.

(v) The openable portions of windows shall be screened with mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

5.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; or

(D) a fully framed glazed door, where the framing is made from materials required for bushfire shutters (see Clause 5.5.1), or from a timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

(ii) Where doors incorporate glazing, the glazing shall comply with the glazing requirements for windows.

(iii) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(iv) Where any part of the door assembly is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D), that part of the door assembly shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

5.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be Grade A safety glass complying with AS 1288.

(ii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall be a mesh or perforated sheet made of corrosion-resistant steel, bronze or aluminium.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present or during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iii) Sliding doors shall be tight-fitting in the frames.

5.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a timber species specified in Paragraph E1 and listed in Table E1, Appendix E; or

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

5.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

5.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

5.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) have a flammability index of not more than 5;

(b) be located directly below the roof battens;

(c) cover the entire roof area including the ridge; and

(d) be installed so that there are no gaps that would allow the entry of embers where the sarking meets fascias, gutters, valleys and the like.

5.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 5.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

(b) have any gaps greater than 3 mm, under corrugations or ribs of sheet roofing and between roof components, sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(ii) mineral wool; or

(iii) other non-combustible material; or

(iv) a combination of any of Items (i), (ii) or (iii) above.

5.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 5.6.1, 5.6.2, 5.6.3, 5.6.5 and 5.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 5.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separated from the main roof space.

5.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors, shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass, minimum 4 mm, shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level or, the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(g) Vent pipes made from PVC are permitted.

5.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 5.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 5.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

5.6.7 Gutters and downpipes

This Standard does not provide material requirements for—

(a) gutters, with the exception of box gutters; and

(b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

5.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

5.7.1 General

Decking shall be either spaced or continuous (i.e., without spacing).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C5.7.1 *Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other 'permissible gaps') in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.*

5.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.2.1 *Materials to enclose a subfloor space*

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 5.4.

5.7.2.2 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

5.7.2.4 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1 of Appendix E;

(d) PVC-U; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

5.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.3.1 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.3.2 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

5.7.3.3 *Decking*

This Standard does not provide construction requirements for decking unless it is less than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b) or (c) above.

5.7.4 Balustrades, handrails or other barriers

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

5.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

SECTION 6 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 19 (BAL — 19)

6.1 GENERAL

A building assessed in Section 2 as being BAL—19 shall comply with Section 3 and Clauses 6.2 to 6.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 6.2 to 6.8 (see Clause 3.8).

NOTE: BAL—19 is primarily concerned with protection from ember attack and radiant heat greater than 12.5 kW/m2 up to and including 19 kW/m2.

6.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 6.7).

C6.2 Ideally, storage of combustible materials beneath a floor at this BAL would not occur and on this assumption, there is no requirement to enclose the subfloor space or to protect flooring materials from bushfire attack. However, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.

6.3 FLOORS

6.3.1 Concrete slabs on the ground

This Standard does not provide construction requirements for concrete slabs on ground.

6.3.2 Elevated floors

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

6.4 EXTERNAL WALLS

6.4.1 Walls

That part of an external wall surface that is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18

degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be made from—

(a) non-combustible material; or

(b) fibre-cement external cladding, a minimum of 6 mm in thickness; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(e) a combination of any of Items (a), (b), (c) or (d) above.

This Standard does not provide construction requirements for external wall surfaces 400 mm or more from the ground or for external wall surfaces 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

6.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material may be applied over the outer face of the frame prior to fixing any external cladding.

6.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where they are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

6.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

6.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

(a) non-combustible material; or

(b) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(c) bushfire-resisting timber (see Appendix F); or

(d) a combination of any of Items (a), (b), or (c) above.

6.5.2 Windows

Window assemblies shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings, having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery, shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species, as specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and the sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing, shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings, having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be toughened glass, minimum 5 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double-glazed units are used, the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used. Where annealed glass is used, the fixed and openable portions of windows shall be screened externally with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(v) Where toughened glass is used, the openable portions of windows shall be screened internally or externally with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(vi) Glazed elements that are designed to take internal screens shall use toughened glass and the openable portion shall be screened in such a way to have no gaps greater than 3 mm in diameter. Screening material shall be a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; or

(D) a fully-framed glazed door, where the framing is made from materials specified for bushfire shutters (see Clause 6.5.1).

(ii) Where doors incorporate glazing, the glazing shall be toughened glass minimum 5 mm.

(iii) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(iv) Where the doorframe is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D) the doorframe shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species, as specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

6.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 6.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be toughened glass, minimum 5 mm.

(ii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall be mesh or perforated sheet made of corrosion-resistant steel, bronze or aluminium.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present or during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iii) Sliding doors shall be tight-fitting in the frames.

6.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

6.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

6.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) have a flammability index of not more than 5, when tested to AS 1530.2;

(b) be located directly below the roof battens;

(c) cover the entire roof area including the ridge; and

(d) be installed so that there are no gaps that would allow the entry of embers where the sarking meets fascias, gutters, valleys and the like.

6.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 6.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

(b) have any gaps greater than 3 mm under corrugations or ribs of sheet roofing and between roof components sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or

(ii) mineral wool; or

(iii) other non-combustible material; or

(iv) a combination of any of Items (i), (ii), or (iii) above.

6.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 6.6.1, 6.6.2, 6.6.3, 6.6.5 and 6.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 6.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separate from the main roof space.

6.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass of minimum 4 mm shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level, or the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

6.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 6.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 6.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

6.6.7 Gutters and downpipes

This Standard does not provide material requirements for—

(a) gutters, with the exception of box gutters; and

(b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

6.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

6.7.1 General

Decking shall be either spaced or continuous (i.e., without spacings).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C6.7.1 Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other ‘permissible gaps’) in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.

6.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

6.7.2.1 *Materials to enclose a subfloor space*

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 6.4.

6.7.2.2 *Subfloor supports*

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, stringers, piers and poles.

6.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

6.7.2.4 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b), or (c) above.

6.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

6.7.3.1 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

6.7.3.2 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

6.7.3.3 *Decking*

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; or

(b) bushfire-resisting timber (see Appendix F); or

(c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or

(d) a combination of any of Items (a), (b), or (c) above.

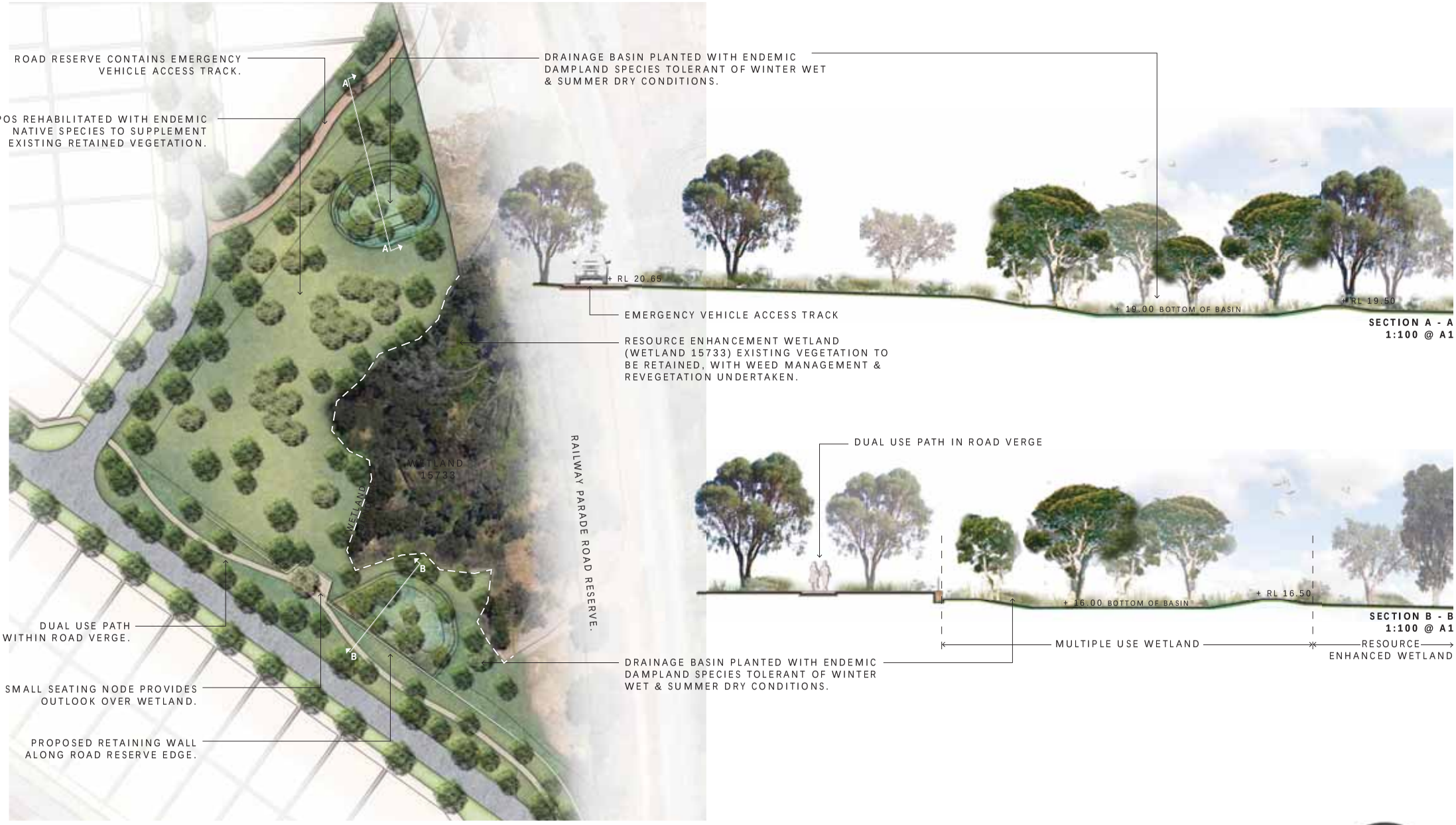
6.7.4 Balustrades, handrails or other barriers

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

6.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

Appendix 4
Stages 2 and 3 POS landscape concept plans



EQUIS LAKE UWMP - STAGE 2 RESOURCE ENHANCEMENT & MULTIPLE USE WETLANDS

PREPARED FOR THE VINES (STAGE 5) JOINT VENTURE - EQUIS LAKE

LANDSCAPE CONCEPT PLAN

JOB NO. 13077-05 C1.101 REV B DEC 2013

1:500 @ A1

0 5 10 20 30 50m

LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au
LANDSPACE PTY LTD ACN 056 538 679

PLAN E

SECTION A - A
1:100 @ A1

EQUIS LAKE UWMP - STAGE 3 CCW & MULTIPLE USE WETLANDS
PREPARED FOR THE VINES (STAGE 5) JOINT VENTURE - EQUIS LAKE

LANDSCAPE CONCEPT PLAN

JOB NO. 13077-05 C1.102 REV B DEC 2013
1:500 @ A1

0 5 10 20 30 50m

LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au
LANDSPACE PTY LTD ACN 056 538 679

PLAN E

EQUIS LAKE UWMP - STAGE 1 & 2 MULTIPLE USE WETLAND

PREPARED FOR THE VINES (STAGE 5) JOINT VENTURE - EQUIS LAKE

LANDSCAPE CONCEPT PLAN

JOB NO. 13077-05 | C1.103 | REV B | DEC 2013

1:500 @ A1

0 5 10 20 30 50m

LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au
LANDSPACE PTY LTD ACN 056 538 679

PLAN E

Appendix 5
City of Swan firebreak order 2013–2014

BUSHFIRES ACT 1954

City of Swan

FIREBREAK NOTICE

Notice to Owners and/or Occupiers of land situated within the City of Swan.
As a measure to assist in the control of bush fires, and pursuant to Section 33 of the Bush Fires Act 1954, all owners and occupiers of land within the City of Swan are required on or before **2 November 2013**, or within 14 days of becoming an owner or occupier of land if after that date, to clear firebreaks or take measures in accordance with this notice and maintain those firebreaks and measures to the required condition up to and including the **30th day of April, 2014**.

1. All Land with an area under 5,001m2 (land under 1/2 Hectare)

1) Maintain grass to a height of no greater than 5cm.
2) Install and maintain a Building Protection Zone, in accordance with the requirements specified in clause 12 of this notice.
3) Any parcel of land having an area less than 5,001m2 that is substantially developed that may include land that:
    a) Predominantly consists of non-flammable managed vegetation, reticulated lawns and gardens and other non-flammable features; or
    b) Areas that are sufficiently Parkland Cleared

   may maintain grass to a height of no greater than 5cm, or remove all flammable materials in lieu of clearing firebreaks.
4) Areas of natural vegetation to be maintained at or below 8 tonnes per hectare.

2. All land with an area of 5,001m2 or greater (land over ½ Hectare)

1) Install a 3 metre firebreak immediately inside and adjacent to all external property boundaries.
2) Properties over 100 hectares require additional firebreaks to divide the land into areas not exceeding 100 hectares.
3) Slash or mow unmanaged grass (grass that is 50cm or higher) to a height no greater than 10cm immediately adjacent firebreaks to a minimum width of 3 metres.
4) Install and maintain a Building Protection Zone, in accordance with the requirements specified in clause 12 of this notice.
5) Hazard Separation Zones - Properties that are affected by a Fire Management Plan approved in writing by the City, that outlines the requirement and dimensions of a Hazard Separation Zone area in addition to and extending from a Building Protection Zone, must install and maintain this area to the standard specified within the Fire Management Plan. Fuel loads within Hazard Separation Zones must not exceed 6 tonnes per hectare.
6) Areas of natural vegetation to be maintained at or below 8 tonnes per hectare.

3. Plantations

1) Install and maintain external and internal firebreaks, firebreaks that form compartments (cells), firebreaks and hazard reduction measures that protect neighbouring communities and essential infrastructure in accordance with the requirements of a Fire Management Plan approved in writing by the City; or
2) Where no such approved Fire Management Plan exists,
    a) Unless the City approves an alternative plan in writing in accordance with clause 3(2)(b), install and maintain external and internal firebreaks and firebreaks that form compartments (cells), and carry out all other firebreaks and hazard reduction measures which are required in accordance with the requirements and specifications within the

Department of Fire & Emergency Services 'Guidelines for Plantation Fire Protection' 2011 publication; or

b) If it is considered impractical for any reason to carry out the plantation requirements outlined above in clause 3(2)(a), plantation owners and managers may apply in writing to the City to implement an alternative plan or measures in accordance with clause 4 of this notice. A Fire Management Plan may be required to be developed and submitted as part of the application.

4. Application to Vary Firebreak and Hazard Reduction Requirements

1) If it is considered impractical for any reason to clear firebreaks in a manner or location required by this notice, or to carry out on the land any fire hazard reduction work or measures required by this notice, you may apply in writing on or before the **15th day of October, 2013** for approval to provide firebreaks in alternative positions or to take alternative measures to abate fire hazards on the land.
2) If permission is not granted in writing by the City prior to the **2nd day of November, 2013** you shall comply with the requirements of this notice.
3) When permission to provide alternative firebreaks or fire hazard reduction measures has been granted, you shall comply with all conditions on the endorsed permit and maintain the land to the required standard throughout the period specified by this notice.
4) Where the City has in writing approved a Fire Management Plan as a condition of subdivision and the Fire Management Plan depicts an array of alternative firebreak positions and alignments, a property owner may, as an alternative to general boundary firebreaks, elect to provide an alternative firebreak(s) depicted on the Fire Management Plan. However, if the alternative firebreak is not constructed by the date required by this notice, then general firebreak requirements shall apply.

5. Fuel Dumps and Depots

Remove all inflammable material within 10 metres of fuel dumps, fuel ramps or where fuel drums, whether containing fuel or not, are stored.

6. Hay Stacks

Clear and maintain a firebreak completely surrounding any haystack on the land, within 60 metres of the haystack.

7. Strategic Firebreaks

1) Where under a written agreement with the City, or where depicted on an approved Fire Management Plan strategic firebreaks are required on the land, you are required to clear and maintain strategic firebreaks a minimum of 6 metres wide along the agreed alignment to provide restricted vehicular access to emergency and authorised vehicles, unimpeded by obstructions including boundary fences unless fitted with gates and signage approved in writing by the City.
2) Gates may only be secured with City of Swan Fire Service padlocks.
3) Strategic firebreaks shall be graded to provide a continuous 4 wheel drive trafficable surface a minimum of 4 metres wide.
4) All branches must be pruned and obstacles removed to maintain a 4 metre vertical height clearance above the full 6 metre width of the firebreak.

8. Emergency Access Ways

1) Where under a written agreement with the City, or where depicted on a Fire Management Plan Emergency Access Ways are required on private land, you are required to clear and maintain a vehicular access way a minimum of 6 metres wide along the agreed alignment.
2) Emergency access ways must be unimpeded by obstructions including boundary fences unless fitted with gates and signage approved in writing by the City.
3) Gates on Emergency Access Ways must remain unlocked at all times.
4) Emergency Access Ways shall be graded and have suitable drainage to provide a minimum 6 metre wide continuous trafficable surface suitable for all types of 2 wheel drive vehicles.
5) All branches must be pruned and obstacles removed to maintain a 4 metre vertical height clearance above the full 6 metre width of the trafficable surface.

9. Firebreak Construction

1) Firebreaks are to be developed and maintained clear of all obstacles and flammable materials to create a minimum of 3 metre wide trafficable surface suitable for 4 wheel drive vehicles.
2) Overhanging branches must be pruned to provide a 4 metre vertical clearance above the full width of the firebreak surface.
3) Boundary Firebreaks must be aligned immediately inside and adjacent to the external property boundaries.
4) Alternative Firebreaks that are approved in writing by the City, or as depicted within a Fire Management Plan approved in writing by the City, are to be constructed to the same standard as general firebreaks and must be constructed along the specified alignment.
5) Firebreaks must not terminate in a dead end.
6) Firebreaks may be constructed by ploughing, grading, raking, burning, chemical spraying or any other approved method that achieves the required standard.

10. Fuel Reduction - Unmanaged Grasses

1) All grass within Building Protection Zones, and on all land less than 5,001m2 in area, is required to be mowed and maintained under 5cm in height over the entire area.
2) On land 5,001m2 or greater, and not including Building Protection Zones,
    a) Maintain grass under 10cm within Hazard Separation Zones.
    b) Slash or mow unmanaged grass (grass that is 50cm or higher) to a height no greater than 10cm immediately adjacent firebreaks to a minimum width of 3 metres.
    c) If the land described above in 10(2)(b) is stocked, the grass must be reduced to a height of no greater than 10cm high by the **1st day of December 2013.**

Subject to clause c), all grassed areas required by this notice to be maintained at or below a required height must be maintained in that condition between **2 November until the 30 April the following year.**

11. Fuel Reduction - Natural Vegetation

1) Available bushfire fuels must be maintained at or below:
    a) Building Protection Zones - 2 tonnes per hectare
    b) Hazard Separation Zones - 6 tonnes per hectare **This requirement only applies where HSZs are depicted within a Fire Management Plan approved in writing by the City.*
    c) Natural Vegetation - 8 tonnes per hectare
2) Fuel Reduction within natural vegetation may be achieved by burning, raking, pruning, weed management, removal of dead materials and any other approved method.
3) Permanent removal or partial clearing of natural vegetation may only be carried out in accordance with the minimum requirements of this notice.
4) Permanent clearing of natural vegetation structures including individual plants, shrubs or trees, that exceeds the requirements of this notice or the specifications outlined within an

fire management plan approved in writing by the City, is only permitted in accordance with the provisions and exemptions outlined within the Environmental Protection Act 1986, or with the approval of the Department of Environment Regulation and the City of Swan.

Note: Advice and resources on how to measure and manage native vegetation fuel loads are available from the Department of Fire and Emergency Services or the City of Swan.

12. Building Protection Zones Specification

The Building Protection Zone for habitable buildings and related structures must meet the following requirements:

1) Building Protection Zones for habitable buildings must extend a minimum of 20 metres out from any external walls of the building, attached structures, or adjacent structures within 6 metres of the habitable building, unless varied under an approved Bushfire Management Plan.
2) On sloping ground the Building Protection Zone distance shall increase at least 1 metre for every degree in slope on the sides of the building/structure that are exposed to down slope natural vegetation.
3) Building Protection Zones predominantly consist of non-flammable managed vegetation, reticulated lawns and gardens and other non-flammable features.
4) All grass is maintained to or under 5cm.
5) Fuel loads must be reduced and maintained at 2 tonnes per hectare or lower.
6) The crowns of trees are to be separated where possible to create a clear separation distance between adjoining or nearby tree crowns, the separation distance between tree crowns is not required to exceed 10 metres.
7) A small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species.
8) Trees are to be low pruned (or under pruned) to at least a height of 2 metres from ground.
9) No tree, or shrub over 2 metres high is planted within 2 metres of a building, especially adjacent to windows.
10) There are no tree crowns or branches hanging over buildings.
11) Tall shrubs over 2 metres high are not planted in groups close to the building and ensure there is a gap of at least 3 times the height (at maturity) of the shrub away from the building.
12) Clear and prune scrub to reduce to a sparse density (able to walk through vegetation with relative ease with minimal deviation around trees and shrubs).
13) Install paths and non-flammable features immediately adjacent to the building.
14) Wood piles and flammable materials stored a safe distance from buildings.

13. Burning

If the requirements of this notice are carried out by burning, such burning must be carried out in accordance with the relevant provisions of the Bush Fires Act 1954.

14. Compliance

1) In addition to the requirements of this notice, further works which are considered necessary by an Authorised Officer of the City may be required as specified in writing in a subsequent notice addressed to the land owner.
2) Where the owner or occupier of the land fails or neglects to comply with the requirements of this notice or a subsequent notice addressed to the land owner, the City of Swan may enter onto the land with workmen, contractors, vehicles and machinery to carry out the requisitions of the notice at the expense of the land owner.

3) Failure to comply with this notice and subsequent written notices may result in a penalty not exceeding $5,000, or the issue of a $250 infringement notice and liability for any costs incurred by the City in relation to works undertaken on behalf of the land owner.
4) Adherence to measures outlined within an approved Fire Management Plan developed as a condition of subdivision does not provide land owners and occupiers with any exemptions to the requirements of this notice unless this notice specifically states otherwise.

15. Definitions

'Alternative Firebreak' is a firebreak that is in an alternative position or alignment to the external boundaries of a property.

'Alternative Firebreak Application' is an application that may be made by a land owner to install firebreaks in an alternative position, or to carry out an alternative measures in lieu of general firebreaks.

'Available Fuel' is the fuel that will actually burn under prevailing conditions. Fuel available for burning depends on temperature, moisture in the air and within the vegetation and curing of vegetation. In summer there is a significant rise in available fuel.

'City' means the City of Swan

'Buildings, Attached and Adjacent Structures' means habitable buildings that are used as a dwelling, workplace, place of gathering or assembly, a building that is a car park, or a building used for the storage or display of goods or produce for sale by whole sale in accordance with classes 1-9 of the Building Code of Australia. The term building includes attached and adjacent structures like garages, carports verandas or similar roofed structure(s) that are attached to, or within 6 metres of the dwelling or primary building.

'Building Protection Zone (BPZ)' is a low fuel area that is reduced of flammable vegetation and materials surrounding buildings and essential infrastructure to minimise the likelihood and impact that direct flame contact, radiant heat or ember attack may have on buildings and assets in the event of a bushfire. This area must extend out from the external walls of a building or asset a minimum of 20 metres.

'Emergency Access Way' is a two wheel drive trafficable, 6 metre wide access route to provide local residents, general public and emergency services alternative links to road networks at the end of cul-de-sacs or areas where access is limited during an emergency incident.

'Essential Infrastructure' or Critical Infrastructure means assets, infrastructure, systems and networks that provide essential services necessary for social and economic wellbeing and is typically public infrastructure. Assets and infrastructure, usually of a public nature, that generate or distribute electricity, water supply, telecommunications, gas and dams are typical assets that are essential to society and are often located in, or traverse areas that are prone to bushfires.

'Firebreak' is an area of land cleared of flammable material to minimise the spread or extension of a bushfire. For the purpose of this notice the term firebreak is a strip of land 3 metres wide that also provides a trafficable surface and 4 metres vertical clearance for emergency and authorised vehicle access. Boundary firebreaks are installed immediately adjacent the external boundaries of a property.

'Fire Hazard or Bushfire Hazard' means accumulated fuel (living or dead) such as leaf litter, twigs, trash, bush, dead trees and scrub capable of carrying a running fire, but excludes standing living trees and isolated shrubs.

'Fire Management Plan' is a comprehensive plan that may be placed on the certificate of title(s) of land, that has been developed as a condition of development or subdivision primarily for the purpose of determining the land suitability, design features and infrastructure that will increase bushfire safety within the location. Fire Management Plans may become outdated with regards to property owner fire safety advice and responsibilities due seasonal changes and evolving fire safety strategies. Up to date advice and strategies are administered within local government areas as a legal requirement through the annual firebreak notice regulation. Fire Management Plans are not a

legal requirement unless specifically referenced as a requirement within this notice, or a written notice addressed directly to a land owner.

'Hazard Separation Zone (HSZ)' if required by this notice and in accordance with a Fire Management Plan, means an area extending out from a Building Protection Zone a distance of 80 metres unless otherwise specified, to create a graduated fuel reduction and separation from natural vegetation that is unmodified in structure and density.

'Natural Vegetation' means natural areas of forest, woodland, shrubland, scrub, mallee and mulga.

'Parkland Clearing' means areas of natural vegetation that has been significantly cleared of understory and tree density reduced to create a grassland or low vegetation area that can be walked through unimpeded with isolated, grouped or well spaced trees.

'Plantation' is any area of native or exotic planted trees that exceeds three hectares in a gazetted town site, or elsewhere a stand of trees of 10 hectares or larger that has been planted and managed intensively for their commercial and environmental value. A plantation includes roads, firebreaks and small areas of native vegetation.

'Strategic Firebreak' is a firebreak that is 6 metres wide established to provide strategic access and links to road networks whilst providing a wider control/containment line to protect town sites, estates and similar exposures during bushfire operations.

'Unmanaged Grasses' is undisturbed or very lightly grazed grasses with a height of 50cm or greater.

By order of the Council,

MJ Foley
CHIEF EXECUTIVE OFFICER
CITY OF SWAN

Appendix 6
AFAC bush fire glossary

afac
Australasian Fire and Emergency Service Authorities Council

BUSHFIRE GLOSSARY

Prepared by Rural and Land Management Group for AFAC Agencies

January 2012

January 2012

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East Melbourne Victoria 3002
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http://knowledgeweb.afac.com.au/

Preface

The AFAC Bushfire Glossary has been developed to promote an exchange of information between member agencies on terminology used specifically in bushfires.

The Glossary has been developed based on a set of agreed business rules. It includes the bushfire technical terms, their definition or description as adopted and applied by the AFAC member agencies. It does include some fire terms that are of a general industry wide nature for completeness. It excludes terms for which an agreed definition could not be reached by the member agencies.

This document is not designed to be a text book or to provide a discussion of a term beyond the definition/description of that term. Nor is it an attempt to modify or redefine terms defined in codes, standards or legislation. Terms that have been adopted for use by the fire management industry from another discipline will maintain the meaning ascribed to them in their originating discipline.

It is proposed that this Glossary will be reviewed regularly to ensure that it continues to be relevant and meets the needs of AFAC member agencies. This is the fifth review. It is the current 2012 version.

AFAC acknowledges the significant contribution of the Rural and Land Management Glossary Working Group lead by Greg Esnouf and Country Fire Authority staff, Matthew Fraser and Jo Richards, who contributed generously of their time and expertise in the establishment of this document and the work of the Genesis Institute to provide a framework for refining the glossary.

Previous versions of the Glossary were titled Wildfire Glossary. The term wildfire has been replaced with the term bushfire in line with a trend towards using language more accepted by the general public.

The terms appear in alphabetical order excluding spaces. In this way it is possible to find a compound word without knowing if it is one or two words.

Aim

The purpose of this Glossary is to seek to facilitate a greater understanding by using common language between bushfire and land management agencies and support organisations during the prevention of, preparedness for, response to and recovery from bushfires.

Index

Term	Definition
Accelerant	Any substance (such as oil, gasoline, etc) that is applied to a fuel-bed to expedite the burning process.
Adaptor	A fitting used to couple different sized hoses, hoses of the same size with different threads, or different types of couplings, or to connect the male to male, or female to female parts of the same type of coupling.
Adsorption	The taking in of water vapour from the air by dead plant material.
Advance burn	A prescribed fire that reduces fuel through a forest area before felling operations. It is intended to improve the safety of timber harvesting operations and as a silvicultural tool to protect lignotubers and standing trees.
Advancing fire	That portion of the fire with rapid fire spread and higher intensity which is normally burning with the wind and/or up slope.
Aerial detection	The discovering, locating and reporting of fires from aircraft.
Aerial fuel	See: Elevated fuel
Aerial ignition	Ignition of fuels by dropping incendiary devices or materials from aircraft.
Aerial ignition device (AID)	Inclusive term applied to equipment designed to ignite wildland fuels from an aircraft.
Aerial Observer	See: Air Observer
Aerial reconnaissance	Use of aircraft for detection of fires and observing fire behaviour, values-at-risk, suppression activity, and other critical factors to facilitate command decisions on strategy and tactics needed for fire suppression.
Aerosol	Airborne solid or liquid particles dispersed or suspended in a gas stream.
After action review (AAR)	A discussion, focused on performance standards, of an event that enables those involved to discover what happened, why it happened, and how to sustain strengths and improve on weaknesses. An After action review is a tool incident command personnel and units can use to get maximum benefit from every incident. It provides a review of the incident upon its completion to identify and discuss effective and non-effective performance and lessons learned and how to apply them in the future. (adapted from NWCG)
AIIMS structure	The combination of facilities, equipment, personnel, procedures, and communications operating within a common organisational structure with responsibility for the management of allocated resources to effectively accomplish stated objectives relating to an incident (AIIMS).
Air attack	The direct use of aircraft in the suppression of bushfires.
Air attack Supervisor	Primarily responsible for the safety and efficient tactical coordination of aircraft operations when fixed and/or rotary firebombing aircraft are operating at a fire (Air Attack Supervisor Training Manual).
Air base Manager	An experienced, trained person who is appointed to manage all the functions and personnel on an air base or helicopter base.
Air mass	A meteorological term referring to an extensive body of air within which the conditions of temperature and moisture in a horizontal plane are essentially uniform.
Air Observer	The primary role of the air observer is to aerially obtain intelligence to assist the planning of fire suppression operations (NSWRFS).
Air operations	The use of aircraft in support of an incident for the purposes of suppression, transportation of personnel, equipment or supplies, or for aerial reconnaissance.

Term	Definition
Air operations Manager	The air operations manager position is responsible for overall coordination of air operations and air support activities in support of an incident.
Aircraft Officer	The aircraft officer is responsible for ground operations and overall provision of support, enabling a safe and efficient air operation to be conducted.
Airside	The parts of an airport not normally open to unauthorised people. It comprises the apron, taxiways, runways and the areas containing them.
Allocated resources	Resources working at an incident (AIIMS).
Anchor point	An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed (NWCG).
Aqueous film forming-foam (AFFF)	A synthetic amber coloured liquid concentrate mixed with water to form an agent that is capable of forming water-solution films on the surface of flammable liquids that prevent the escape of fuel vapours, excludes oxygen and maintain the surface when disturbed (self healing).
Area ignition	Ignition of several individual fires throughout an area, either simultaneously or in rapid succession, and so spaced that they add to and influence the main body of the fire to produce a hot, fast-spreading fire condition. Also called simultaneous ignition.
Area of origin	General location where the fire started.
Arson	The deliberate setting of a fire where the intent of the person responsible was to cause harm or destruction to life or property.
Aspect	The direction towards which a slope faces.
Asphyxiants	Substances which interfere with the respiratory process.
Assembly area	See Staging area.
Assessment	The process of determining if an individual has the prescribed skills, knowledge and experience needed to acquire a specific capability.
Assets	Anything valued by people which includes houses, crops, forests and, in many cases, the environment.
Assisting agency	An agency directly contributing suppression, support or service resources to another agency.
Atmospheric stability	The degree to which the atmosphere resists turbulence and vertical motion.
Attack time	See Elapsed time
Australasian Inter-service Incident Management System (AIIMS)	A nationally adopted structure to formalise a coordinated approach to emergency incident management.
Automatic dispatch	See Pre-planned dispatch.
Automatic weather station (AWS)	The Bureau's standard AWSs use sensors to monitor temperature, humidity, wind speed and direction, pressure and rainfall. Various advanced sensors are available for specialised applications. These sensors can monitor cloud height (ceilometer), visibility, present weather, thunderstorms, soil temperature (at a range of depths) and terrestrial temperature. (Developed from the BOM)
Available fuel	The portion of the total fuel that would actually burn under various environmental conditions.
Available resources	The resources at an incident and available for allocation at short notice. (AIIMS)

Term	Definition
Backburn	1. A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire (Australia). 2. A counterfire commenced from within continuous fuel for the purpose of fighting a fire (New Zealand).
Back fire	See: Backburn (Preferred term).
Backing fire	The part of a fire which is burning back against the wind or down slope, where the flame height and rate of spread are reduced.
Bark fuel	The flammable bark on tree trunks and upper branches.
Bark heaps	Accumulations of bark and branch material resulting from timber harvesting operations. Soil may be mixed with bark heaps, but generally the heap is formed by a machine dropping fresh bark on the top of the heap.
Basal accumulation	Bark fallen from a tree and forming a relatively high and localized accumulation of fine fuel.
Base camp	A location where personnel are accommodated and fed for a period of time. A base camp usually contains catering, ablution and accommodation facilities, a water supply and a lighting system, and may include other facilities such as car parking maintenance and servicing. (AIIMS)
Bay(s)	A marked indentation (s) in the fire perimeter usually located between two fingers.
Beaufort wind scale	A system for estimating wind speeds based on observation of visible wind effects. A series of descriptions of visible wind effects upon land objects or sea surfaces is matched with a corresponding series of wind speed ranges, each being allocated a *Beaufort number.*
Blacking out	The process of extinguishing or removing burning material along or near the fire control line, felling stags, trenching logs to prevent rolling and the like, in order to make the fire safe.
Blackspot	An area where two-way radio coverage does not exist.
Blank cap	The metal cap used on delivery outlets and on the suction inlet of the pump to prevent discharge of water.
Blow down	See: Wind throw.
Blow up	Sudden increase in fireline intensity or rate of spread of a fire sufficient to preclude direct control or to upset existing suppression plans. Often accompanied by violent convection and may have other characteristics of a fire storm. (NWCG)
Bole	The trunk of a tree.
Bole damage	The damage to the trunk of a living tree by fire, mechanical equipment or disease.
Bracken	Bracken fern varies significantly in height and density. If Bracken is generally upright (either alive or dead) with the majority of its biomass in the top half of the plant and only the stems in touch with the ground, then it is considered to be part of the elevated fuel. If however, it has collapsed and most of its biomass is in touch with the ground, then it is considered to be Near-surface fuel.
Branch	A tapered pipe, fitted to the end of a hose line, which increases the velocity (converting pressure energy to kinetic energy) of the water or foam solution travelling through the hose, and forms an effective firefighting jet or spray.
Breakaway	The points at which a fire, after it has been contained, escapes into unburnt areas across a fireline or fire edge.

Term	Definition
Breeching	A device to divide one hose line into two or collect two hose lines into one.
Briefing	A general overview of an operation.
Broad area hazard reduction	Large scale removal of selected fuel before the onset of a bushfire danger period.
Broadcast burning	See: Prescribed burning (Preferred term)
Buffer	A strip or block of land on which the fuels are reduced to provide protection to surrounding lands.
Bulk water carrier	A large tanker used for replenishing water to firefighting tankers.
Burn back	See: Reburn (Preferred term).
Burning brands	Lofted burning material such as bark, usually flaming.
Burning conditions	The state of the combined components of the fire environment that influence fire behaviour and fire impact in a given fuel type. Usually specified in terms of such factors as fire weather elements, fire danger indices, fuel load and slope.
Burning off	Generally setting fire - with more or less regard to areas carrying unwanted vegetation such as rough grass, slash and other fuels.
Burning out	To intentionally light fires to consume islands of unburned fuel inside the fire perimeter.
Burning program	A program of prescribed burns scheduled these for a designated area over a nominated time, normally looking ahead over one fire season (for the coming spring to the following autumn), but can also look ahead five years or more.
Burning rotation	The period between burning of a prescribed area for management purposes.
Burning unit	A specified land area for which prescribed burning is planned.
Burn out	1. A fire set to consume islands of unburnt fuel inside the fire perimeter and between the fire edge and fireline (Australia). 2. A counterfire commenced from a natural or previously constructed firebreak for the purpose of fighting a fire (New Zealand).
Burn over	A section of fire that overruns personnel and/or equipment.
Burn plan	The plan which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
Bushfire	Un planned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective.
Bushfire danger period	A period of the year either established by legislation or declared by the relevant agency, when restrictions are placed on the use of fire due to dry vegetation and the existence of conditions conducive to the spread of fire.
Bushfire management	All those activities directed to prevention, detection, damage mitigation, and suppression of bushfires. Includes bushfire legislation, policy, administration, law enforcement, community education, training of fire fighters, planning, communications systems, equipment, research, and the multitude of field operations undertaken by land managers and emergency services personnel relating to bushfire control.
Byram-Keetch Drought index (BKDI)	See: Keetch-Byram Drought Index
Cache	A predetermined complement of supplies stored in a designated location. (CIMS).
Campaign fire	A fire normally of a size and/or complexity that requires substantial firefighting resources, and possibly several days or weeks to suppress.

Term	Definition
Candle (Candling)	A tree (or small clump of trees) is said to candle when its foliage ignites and flares up, usually from the bottom to top.
Candlebark	Long streamers of bark that have peeled from some eucalypt species that form fire brands conducive to very long distance spotting.
Canopy	The crowns of the tallest plants in a forest – the overstorey cover.
Canopy cover	Canopy cover refers to 2 dimensions (ie plan view, area coverage)
Canopy density	Canopy density refers to 3 dimensions (ie mass/volume)
Catastrophic fire danger	The highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index greater than 100 or a Grassland fire danger index greater than 150.
Central ignition	A method of prescribed burning in which fires are set in the centre of an area to create a strong convective column. Additional fires are then set progressively closer to the outer control lines causing indraft winds to build up. This has the effect of drawing the fires towards the centre.
Chaining	The process of flattening vegetation (usually mallee or scrub) by dragging a heavy chain or cable between two large tractors or bulldozers.
Charged line	A line of fire hose filled with water under pressure and ready to use.
CIMS	Coordinated Incident Management System used in New Zealand.
Class A foam	See: Foam
Class labels	Class labels identify the type of hazardous material being stored or transported. These are grouped under broad classifications according to the predominant type of risk involved.
Climate	The atmospheric conditions of a place over an extended period of time.
Clinometer	An instrument used to measure the angle of a slope.
Cloud cover	The amount of sky covered or obscured by cloud, expressed in eighths. Eight eighths is complete cloud cover.
Coarse fuels	Dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches). Some researchers categorise forest fuels as: fine <6 mm diameter; twigs 6-25 mm diameter; coarse >25 mm diameter.
Code of Practice	Document giving methods developed to assist compliance with acts and regulations in the performance of work.
Cold front	A cold front is the delineation between cold polar air moving towards the equator and undercutting warm tropical air moving poleward. The temperature differences across a cold front can be extreme and associated with strong winds. The warm tropical air is forced to rise and become unstable with the development of large cumuliform clouds. Severe weather such as thunderstorms, squall lines and severe turbulence may accompany these cold fronts. (BOM)
Cold trailing	A method of determining whether or not a fire is still burning, involving careful inspection and feeling with the hand, or by use of a hand-held infrared scanner, to detect any heat source.
Collecting head	A collecting head is used to collect (usually from two to four) lines into the suction inlet of a pump.
Combat agency/authority	See: Control authority
Combustion	Rapid oxidation of fuels producing heat, and often light.

Term	Definition
Command	The direction of members and resources of an agency in the performance of the agency's role and tasks. Authority to command is established in legislation or by agreement within an agency. Command relates to agencies and operates vertically within an agency.
Communications plan	Details the methods and systems for people to communicate with each other, the incident management structure, including the actual radio channels/mobile phone numbers. (AIIMS)
Compartment	(1) Forestry Definition – A basic administrative unit of a managed forest. (2) Building Definition - An enclosed space with floor, walls and ceiling.
Competency	Skills and knowledge and their application within an occupation to the standard of performance required in the workplace. (Vic report)
Conduction	The transfer of thermal energy between regions of matter due to temperature gradient.
Contained	The status of a wildfire suppression action signifying that a control line has been completed around the fire, and any associated spot fires, which can reasonably be expected to stop the fire's spread. (NWCG)
Contour lines	Contour lines connect points of equal elevation on a topographical map.
Control	The overall direction of response activities in an emergency situation. Authority for control is established in legislation or in an emergency response plan, and carries with it the responsibility for tasking and coordinating other agencies in accordance with the needs of the situation. Control relates to situations and operates horizontally across agencies.
Control authority	The agency, service, organization or authority with legislative responsibility for control of the incident. (Also referred to as the responsible authority or agency.) (AFAC)
Controlled	The stage during fire suppression activities at which the complete perimeter of a fire is secured and no breakaway is expected.
Controlled burning	See: Prescribed burning.
Control line	See: Fireline
Convection	1. As applied in meteorology, atmospheric motions that are predominantly vertical, resulting in vertical transport and mixing of atmospheric properties; distinguished from advection. 2. As applied in thermodynamics is a mechanism of heat transfer occurring because of the bulk movement of fluids.
Convection burn	See: Central ignition
Convection column	The rising column of smoke, ash, burning embers and other particle matter generated by a fire.
Convective activity	General term for manifestations of convection in the atmosphere, alluding particularly to the development of convective clouds and resulting weather phenomena, such as showers, thunderstorms, squalls, hail, and tornadoes. (NWCG)
Convergence zone	1. See: Junction zone. 2. In fire weather, that area where two winds come together from opposite directions and are forced upwards often creating clouds and precipitation. (NWCG)
Convoy	Two or more vehicles driving together under the control of a single Convoy Leader.

Term	Definition
Coordination	The bringing together of agencies and elements to ensure effective response to an incident or emergency. It is primarily concerned with the systematic acquisition and application of resources in accordance with the requirements imposed by the emergency or emergencies. Coordination relates primarily to resources and operates: • vertically, within an agency, as a function of the authority to command; • horizontally, across agencies, as a function of the authority to control.
Cordon	A cordon is the means to maintain an area and is used to restrict movement into and out of an area.
Coupe	A defined forest area in which timber harvesting takes place.
Crew	See: Fire crew.
Crew leader	Person responsible for the supervision and management of crews
Critical burnout time	Total time a fuel can burn and continue to feed energy to the base of a forward-travelling convection column.
Critical incident stress	Unusually strong emotional reactions which have the potential to interfere with the ability of personnel to function, either at the incident scene or later, arising from any situation faced during operations.
Critical incident stress debriefing	The process in which teams of professional and peer counsellors provide emotional and psychological support to incident personnel who are or have been involved in a critical (highly stressful) incident.
Cross bearings	Intersecting lines of sight from two or more points on the same object; used to determine the location of bushfire from lookouts.
Crown fire	A fire that advances from top to top of trees or shrubs.
Crown scorch	Browning of the needles or leaves in the crown of a tree or shrub caused by heat from a fire.
Crowning	A fire ascending into the crowns of trees and spreading from crown to crown.
Crowning potential	A probability that a crown fire may start, calculated from inputs of foliage moisture content and height of the lowest part of the tree crowns above the surface. (NWCG)
Curing	Drying and browning of herbaceous vegetation due to mortality or senescence.
Dead fuel	Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation). (NWCG)
Debrief	To gather information from the participants in an action so as to gauge the success or otherwise of the action at the end of the task, shift, tour or incident.
Deep-seated fire	A fire burning far below the surface in duff, mulch, peat, or other combustibles as contrasted with a surface fire.
Defensive strategy	A firefighting strategy used where the protection of life and assets is a priority when a fire is: (i) located in inaccessible or remote location OR (ii) too intense to be safely or effectively attacked directly.
Dehydration	Excessive loss of water from the body's tissues. Dehydration may follow any condition in which there is a rapid depletion of body fluids.
Delayed aerial ignition devices (DAID)	An incendiary device that will ignite after a predetermined time.

Term	Definition
Deliberate fire	A fire resulting from a person placing burning material to cause ignition. The intent of the person may have been to cause harm or destruction to life or property (arson-criminal offence) or to modify fuels and/or vegetation for land management purposes (summary offence). See also Arson.
Delivery hose	Hose used to transport water under pressure.
Delivery valve	On a pump, the valved outlet through which water is discharged.
Demobilisation	The orderly release of resources no longer required at an incident.
Depth of burn	The reduction in forest floor litter thickness (cm) due to consumption by fire. Most commonly used in connection with prescribed burning.
Desiccant	A chemical that, when applied to a living plant causes or accelerates the drying out of its aerial parts.
Desorption	The loss of moisture to the atmosphere from dead plant material.
Detection	The discovery of a fire. Individuals, fire towers, reconnaissance aircraft and automatic devices may be used, either alone or in combination.
Dew	The moisture which collects in small droplets on the surface of substances and vegetation by atmospheric condensation, chiefly at night.
Dew point temperature	This is a measure of the moisture content of the air and is the temperature to which air must be cooled in order for dew to form. The dew-point is generally derived theoretically from dry and wet-bulb temperatures, with a correction for the site's elevation. (BOM)
Dieback	The progressive dying, from the top downward, of twigs, branches or tree crowns.
Diffused pattern	A spray pattern (as opposed to straight stream) of water or foam.
Direct attack	A method of fire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge which then becomes the fireline.
Dispatch	The act of ordering attack crews and/or support units to respond to a fire, or from one place to another.
Division	A portion of the incident comprising of two or more sectors. The number of sectors grouped in a Division should be such as to ensure effective direction and control of operations. Divisions are generally identified by a local geographic name.
Dominant height	Mean height of the largest trees in a stand. A specified number per unit area are generally selected.
Downwind	Away from the wind direction. In the direction opposite to the direction from which the wind is blowing. The direction that smoke will travel.
Dozer	A crawler tractor fitted with a blade which can be transported to a fire on a tray truck or trailer. Dozer is a shortened form of "Bulldozer"
Dozer line	Fireline constructed by the front blade of a dozer.
Drain time	The time (minutes) it takes for foam solution to drop out from the foam mass; for a specified percent of the total solution contained in the foam to revert to liquid and drain out of the bubble structure.
Drift	The effect of wind on smoke or on a water drop.
Drip torch	A canister of flammable fuel fitted with a wand, a burner head and a fuel flow control device. It is used for lighting fires for prescribed burning, backburning and burning out.

Term	Definition
Drop pass	Indicates that the firefighting aircraft has the target in sight and will make a drop of fire control agent on this run over the target.
Drop pattern	The distribution of an aerially delivered fire control agent drop on the target area in terms of its length, width, and momentum (velocity x mass) as it approaches the ground. The latter determines the relative coverage level of the fire control agent on fuels within the pattern.
Drop zone (DZ)	Target area for firefighting aircraft, or cargo dropping.
Drought	Prolonged absence or marked deficiency of precipitation (rain). (BOM)
Drought index	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation.
Dry bulb temperature	Technically, the temperature registered by the dry-bulb thermometer of a psychrometer. However, it is identical to the temperature of the air. (Degrees Celsius). (NZ)
Dry firefighting	The suppression of a fire without the use of water. This is normally achieved by removing the fuel by the use of hand tools, burning or machinery.
Duff	The layer of decomposing vegetative matter on the forest floor below the litter layer, the original structure still being recognisable.
Ecological burning	A form of prescribed burning. Treatment with fire of vegetation in nominated areas to achieve specified ecological objectives.
Edge burning	A term used to describe perimeter burning of an area in mild conditions prior to large scale prescribed burning. This practice is used to strengthen buffers and to reduce mop-up operations.
Elevated fuel	The standing and supported combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, bark and creepers.
Embers	Glowing particles cast from the fire (as 'showers' or 'storms'). (Vic report)
Emergency centre	A facility where the coordination of the response and support to the incident is provided.
En route resources	Resources despatched to an incident that have not yet checked in. (AIIMS)
Entrapment	A situation in which individuals are exposed to life threatening or potentially life threatening conditions from which they cannot safely remove themselves.
Equilibrium moisture content (EMC)	The moisture content that a fuel element would attain if exposed for an infinite period in an environment of specified constant dry-bulb temperature and relative humidity. When a fuel element has reached its EMC, it neither gains nor loses moisture as long as conditions remain constant.
Equipment	All material supplied to an incident excluding personnel and vehicles.
Escape route	A planned route away from danger areas at a fire.
Evacuation	The temporary relocation of persons from dangerous or potentially dangerous areas to safe areas.

Term	Definition
Exposures	Parts of the same structure or other structures or property not directly involved in the fire but at risk of being burnt or damaged if the fire is not controlled. In the bushfire context: 1. Property that may be endangered by a fire burning in another structure or by a bushfire. In general, property within 12 metres of a fire may be considered to involve an exposure hazard, although in very large fires the danger may exist at much greater distances. 2. Direction in which a slope faces, usually with respect to cardinal directions (N, S, E, W). 3. The general surroundings of a site, with special reference to its openness to winds and sunshine.
Extinguishing agent	A substance used to put out a fire by cooling the burning material or blocking the supply of oxygen, or chemically inhibiting combustion or combinations of these mechanisms.
Extreme fire behaviour	A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved: • high rates of spread • prolific crowning and/or spotting • presence of fire whirls • a strong convective column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.
Extreme fire danger	The second highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 75 and 99 or a Grassland fire danger index greater between 100 and 149.
Facilities	Permanent and temporary facilities where personnel sleep, cook, maintain and repair equipment. (AIIMS)
Fall back fire control line	Any fire control line which is at a distance from the fire perimeter, and is the second control line at which the fire perimeter may be stopped should it cross the first fire control line. Also known as 'fallback line'.
Fine fuel	Fuel such as grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry.
Fingers	Long and narrow slivers of fire which extend beyond the head or flanks. (AFAC)
Fire	The chemical reaction between fuel, oxygen and heat. Heat is necessary to start the reaction and once ignited, fire produces its own heat and becomes self-supporting.
Fire access track	A track constructed and/or maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Fire Behaviour Analyst	Person responsible for developing fire behaviour predictions based on fire history, fuel, weather, and topography. (NWCG)amended
Fire behaviour model	A set of mathematical equations that can be used to predict certain aspects of fire behaviour.
Fire behaviour prediction	Prediction of probable fire behaviour usually prepared by a fire behaviour analyst in support of fire suppression or prescribed burning operations. (NWCG)
Fire behaviour prediction system	A system that uses a set of mathematical equations to predict certain aspects of fire behaviour in wildland fuels when provided with data on fuel and environmental conditions.

Term	Definition
Fire bombing	A technique of suppressing a bushfire by dropping water, foam or retardants on it from an aircraft.
Fire brand	A piece of flaming or smouldering material capable of acting as an ignition source. eg eucalypt bark.
Fire climate	The composite pattern or integration over time of the fire weather elements that affect fire occurrence and fire behaviour in a given area.
Fire control	See Fire suppression.
Fire control agent	A substance that acts as an Extinguishing agent, and or a Fire retardant and or a Fire suppressant.
Fire control line	See: Fireline.
Fire crew	A general term for two or more firefighters organised to work as a unit. (NWCG)
Fire danger	Sum of constant danger and variable danger factors affecting the inception, spread, and resistance to control, and subsequent fire damage; often expressed as an index. (NWCG)
Fire danger class	A segment of a fire danger index scale identified by a descriptive term and or a colour code. The classification system may be based on more than one fire danger index and an assessment of risk exposure.
Fire danger index (FDI)	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
Fire danger rating	A relative class denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed, indicating the relative evaluation of fire danger.
Fire ecology	The study of the relationships between fire, the physical environment and living organisms.
Fire edge	Any part of the boundary of a going fire at a given time. *NOTE*: The entire boundary is termed the 'fire perimeter'.
Fire effects	The physical, biological and ecological impact of fire on the environment. (NWCG)
Fire environment	The surrounding conditions, influences, and modifying forces of topography, fuel, and weather that determine fire behaviour. (NWCG)
Firefighter	Any employee, volunteer or agent of any fire agency who occupies, or is designated, to undertake a role for the purpose of fire suppression.
Firefighting operations	Any work or activity directly associated with control of fire.
Fire frequency	A general term referring to the recurrence of fire in a given area over time (NWCG). Also see: Fire regime
Fire front	The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smouldering combustion. (NWCG)
Fireground	The area in the vicinity of a fire suppression operations, and the area immediately threatened by the fire. It includes burning and burnt areas; constructed and proposed fire lines; the area where firefighters, vehicles, machinery and equipment are located when deployed; roads and access points under traffic management control; tracks and facilities in the area surrounding the actual fire; and may extend to adjoining area directly threatened by the fire.

Term	Definition
Fire hazard	A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.
Fire intensity	See: Fireline intensity.
Fireline	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
Fireline intensity	The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (Kw/m). The rate of energy release per unit length of fire front, defined by the equation I=Hwr, where I = fireline intensity (kW/m) H = heat yield of fuel (kJ/kg)-16,000 kJ/kg w = dry weight of fuel consumed (kg/m2) (mean total less mean unburnt) r = forward rate of spread (m/s) The equation can be simplified to I = w r/2 where I = fireline intensity (kW/m) w = dry weight of fuel consumed (tonnes/ha) r = forward rate of spread (m/hr)
Fire lookout	A structure strategically located and manned to detect the occurrence and the location of fires. It may be a tower or a structure on a high point
Fire management	All activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives.
Fire potential	The chance of a fire or number of fires occurring of such size, complexity or impact that requires resources (both a pre-emptive management and suppression capability) from beyond the area of the fire origin. (BCRC)
Fire preparedness	All activities undertaken in advance of bushfire occurrence to decrease its extent and severity and to ensure more effective fire suppression.
Fire prevention	All activities concerned with minimising the incidence of bushfire particularly those of human origin.
Fire regime	The history of fire in a particular vegetation type or area including the frequency, intensity and season of burning. It may also include proposals for the use of fire in a given area. (AFAC)
Fire report	An official record of a fire, generally including information on cause, location, action taken, damage, costs, etc., from start of the fire until completion of suppression action. These reports vary in form and detail from agency to agency (NWCG). Also see Report of Fire
Fire retardant	A chemical generally mixed with water, designed to retard combustion by a chemical reaction. It is applied as slurry from the ground or air to fuels ahead of the fire.
Fire risk	Processes, occurrences or actions that increase the likelihood of fires occurring.
Fire run	A rapid advance of a fire front. It is characterised by a marked transition in intensity and rate of spread.
Fire scar	1) A healing or healed-over injury caused or aggravated by fire on a woody plant. 2) A mark left on a landscape by fire.
Fire season	The period during which bushfires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire simulator	A device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of informing fire suppression personnel of potential fire situations either for an actual fire or hypothetical fire(s).
Fire spread	Development and travel of fire across surfaces.

Term	Definition
Fire storm	Violent convection caused by a large continuous area of intense bushfire often characterised by destructively violent surface indrafts, a towering convection column, long distance spotting, and sometimes by tornado-like whirlwinds. (AFAC)
Fire suppressant	An additive designed to reduce the surface tension of water and/or to hold water in suspension thus increasing water's efficiency as a fire extinguishing agent. Suppressants are applied directly to the burning fuels.
Fire suppression	The activities connected with restricting the spread of a fire following its detection and before making it safe.
Fire suppression organisation	1. The personnel and equipment collectively assigned to the suppression of a specific fire or group of fires. 2. The personnel responsible for fire suppression within a specified area. 3. The management structure, usually shown in the form of an organization chart of the persons and groups having specific responsibilities in fire suppression. (NWCG)
Fire suppression plan	See Incident action plan (IAP).
Fire tetrahedron	An instructional aid in which the sides of the tetrahedron (comprising 4 triangular shaped figures) are used to represent the 4 components of combustion and flame production process-fuel, heat, oxygen and the chemical chain reaction.
Fire threat	The impact a fire will have on a community.
Fire tower	Tower strategically located and manned to detect and report the occurrence and location of fires. A type of Fire lookout
Fire training simulator	A training device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of instructing fire suppression personnel in fire situations and fire suppression techniques.
Fire triangle	Diagrammatic expression of the three elements that are necessary for a fire to occur. FUEL – HEAT – OXYGEN. The removal of any one of these will extinguish a fire.
Fire weather	Weather conditions which influence fire ignition, behaviour, and suppression. (NWCG)
Fire weather forecast	A weather prediction specially prepared for use in wildland fire operations and prescribed fire. (NWCG)
Fire whirl	Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado. (NWCG)
Fire wind	The inflow of air close to a fire caused by the action of convection. It is not to be confused with a prevailing wind.
First attack	See: Initial attack
Fixed wing aircraft	A heavier than air aircraft which obtains lift for flight by forward motion of wings through the air.
Flame angle	The angle of the flame in relation to the ground, caused by wind direction or the effect of a slope.
Flame depth	The depth of the zone within which continuous flaming occurs behind the fire edge.

Term	Definition
Flame height	The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope. (NWCG)
Flame length	The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity. (NWCG)
Flame Zone	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to heat flux and ember attack. (AS 3959 - 2009)
Flame zone	The area around fuels where the combustion of gases occurs to form flames.
Flaming zone	See: Flame zone.
Flammability	The ease with which a substance is set on fire.
Flammable	Capable of being ignited and of burning with a flame.
Flank attack	Obtaining control of a fire by attacking its side/s (flank).
Flanks of a fire	Those parts of a fire's perimeter that are roughly parallel to the main direction of spread. (NWCG)
Flare up	Any sudden acceleration of fire spread, or intensification of fire, or a part of the fire. A flare up is of relatively short duration and does not radically change existing control plans. (NWCG)
Flash fire	A fast moving fire consuming most of the fine fuels available.
Foam	Foam is a mass of bubbles formed by mixing air with water and a foam concentrate in specific proportions. It is used as a firefighting agent to form a smothering, cooling and/or ignition preventing layer of the surface over a fuel.
Foam blanket	A layer of foam which forms an insulating and reflective barrier to heat and is used for fuel protection, suppression, and mop-up. (NWCG)
Foam Class A	A mixture of foam concentrate & water specifically formulated for extinguishing bushfires. The foam is biodegradable, non toxic and is used at very low concentrates. It may be delivered aspirated or non-aspirated. (See also Foam solution).
Foam Class B	A foam formulated for application on Class B fires
Foam concentrate	The concentrated foaming agent as received from the manufacturer which, when added to water, creates a foam solution.
Foam inductor	Equipment consisting of an inlet connection, ejector pump and a discharge assembly, for the induction of foam concentrate.
Foam solution	The mixture of water and foam concentrate.
Forest	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent. This definition includes Australia's diverse native forests, woodlands and plantations, regardless of age.
Forest fire	A fire burning mainly in forest and/or woodland.
Forest type	A category for describing a forest commonly based on the predominant tree species, tree form and structure.

Term	Definition
Forward looking infrared (FLIR)	Hand held or aircraft mounted device designed to detect heat differentials and display them. FLIRs have thermal resolution similar to IR line scanners, but their spatial resolution is substantially less; commonly used to detect hot spots and flare ups obscured by smoke, evaluate the effectiveness of firing operations, or detect areas needing mop-up. (NWCG)
Forward rate of spread (FROS)	The speed with which a head fire moves in a horizontal direction across the landscape.
Frontal fire intensity	See: Fireline Intensity
Front end loader	Earthmoving equipment designed to move loose earth and/or loads into vehicles. A multi-purpose bucket is fitted to articulated arms at the front of the vehicle. May be either wheeled or tracked.
Fuel	Any material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare. Related Terms: Available fuel, Coarse fuel, Dead fuel, Elevated dead fuel, Fine fuel Ladder fuels, Surface fuels, and Total fine fuel.
Fuel age	The period of time lapsed since the fuel was last burnt.
Fuel arrangement	A general term referring to the spatial distribution and orientation of fuel particles or pieces. (NWCG)
Fuel array	The totality of fuels displayed in a location: fine and coarse, live and dead. (Vic report)
Fuel assessment	The estimation or calculation of total and available fuel present in a given area.
Fuel bed depth	Average height of surface fuels contained in the combustion zone of a spreading fire front. (NWCG)
Fuelbreak	A natural or manmade change in fuel characteristics which affects fire behaviour so that fires burning into them can be more readily controlled.
Fuelbreak system	A series of modified strips or blocks tied together to form continuous strategically located fuel breaks around land units.
Fuel continuity	The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.
Fuel depth	The average distance from the bottom of the litter layer to the top of the layer of fuel, usually the surface fuel.
Fuel load	The oven dry weight of fuel per unit area. Commonly expressed as tonnes per hectare. (AFAC). (Also known as fuel loading)
Fuel management	Modification of fuels by prescribed burning, or other means. (AFAC)
Fuel map	A map showing areas of varying fuel quantities and types and usually indicates past fire history.
Fuel model	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified. (NWCG)
Fuel modification	Manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).(NWCG)
Fuel moisture content	The water content of a fuel expressed as a percent of the oven dry weight of the fuel particle. (%ODW)

Term	Definition
Fuel moisture differential	A term used to describe the situation where the difference in the moisture content between fuels on adjacent areas results in noticeably different fire behaviour on each area.
Fuel profile	The vertical cross section of a fuel bed down to mineral earth.
Fuel quantity	See: Fuel load.
Fuel reduction	Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.
Fuel reduction burning	The planned application of fire to reduce hazardous fuel quantities; undertaken in prescribed environmental conditions within defined boundaries.
Fuel separation	The action of separating fuel for the purpose of providing a mineral earth firebreak. Also means the actual gap between fuel layers or particles eg gap between individual hummock grasses or gap between surface and canopy fuels
Fuel type	An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause predictable rate of spread or difficulty of control under specified weather conditions. (AFAC)
Fuel weight	See Fuel load.
General origin area	The larger area where the fire started that is readily identifiable based on macro scale indicators and witness statements. (NWCG)
Going fire	Any bushfire which is expanding and suppression actions have not yet contained the fire.
Grass fire	Any fire in which the predominant fuel is grass or grass like. (NWCG)
Grassland curing	The proportion of dead material in grasslands – usually increases over summer as tillers die off and dry out, increasing the risk of grassland fire.
Grid ignition	A method of lighting prescribed fires where ignition points are set individually at a predetermined spacing through an area.
Ground crew	See: Hand crew.
Ground fire	Fire that consumes the organic material beneath the surface litter ground, such as a peat fire. (NWCG)
Ground fuel	All combustible materials below the surface litter, including duff, roots, peat and saw dust dumps that normally support a glowing or smouldering combustion without flame.
Habitat	The local environment of conditions in which an animal or plant lives.
Hand crew	A fire suppression crew trained and equipped to fight fire with hand tools.
Hand line	A fireline constructed with hand tools. (NWCG) (Wildfire context)
Hand trail	See Hand line.
Hang up	A situation in which a tree is lodged in another and prevents it from falling to the ground.
Hazard	A source of potential harm or a situation with potential to cause loss.
Hazard reduction	See: Fuel Management
Head	See: Head Fire
Head attack	Directly knocking down the head of a fire. Recommended only for low intensity fires where firefighters can be sure that the fire will not flare up unexpectedly.
Head fire	The part of a fire where the rate of spread, flame height and intensity are greatest, usually when burning downwind or upslope.

Term	Definition
Heat exhaustion	A form of shock, due to depletion of body fluids resulting from overexposure to a hot environment.
Heat stress	Illness caused by the body overheating.
Heat stroke	A life-threatening condition that develops when the body's temperature-regulating and cooling mechanisms are overwhelmed and body systems begin to fail.
Heat transfer	The transfer of thermal energy from one physical system to another by conduction, convection or thermal radiation.
Heavy fuels	See: Coarse fuels.
Heel	See: Rear (Preferred term).
Heel fire	See: Backing Fire.
Helibase (HB)	A location for parking, refuelling and maintenance of helicopters operating in support of an incident.
Helicopter	A form of heavier-than-air, rotor-wing aircraft whose lift is produced by engine-driven rotors which behave as if they were both propellers and wings.
Helipad (HP)	A designated location which meets specific requirements for a helicopter to take off and land.
Helitack crew	An initial attack crew specially trained in the tactical and logistical use of helicopters for fire suppression.
Heli-torch	An aerial ignition device hung from or mounted on a helicopter to disperse ignited lumps of gelled gasoline. Used for backburns, burnouts, or prescribed burns. (NWCG)
High fire danger	The second lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 25 and 49 or a Grassland fire danger index between 25 and 49.
High intensity fire	Fires with an average intensity greater than 3000 $kW.m^{-1}$ and flame heights greater than 3 m, causing complete crown scorch or possibly crown fires in forests. Uncontrollable by direct attack. The term is also applied to stationary fires burning in very high fuel loads (such as logging slash).
Hold over fire	See: Sleeper
Hop over	See: Breakaway.
Hose bandage	A means of affecting a temporary repair to a canvas or synthetic hose.
Hose strangler	A crimping device for stopping the flow of water in a hose.
Hot Refueller	A trained person responsible for the operation of the equipment for the 'hot' refuelling of helicopters.
Hot spot	1. A particularly active part of a fire. 2. An area of smouldering fuels requiring to be extinguished during patrol operations.
Humus	Layer of decomposed organic matter on the forest floor beneath the fermentation layer and directly above the soil. It is that part of the duff in which decomposition has rendered vegetation unrecognizable and mixing of soil and organic matter is underway. See Also: Duff & Litter
Hygrometer	An Instrument which measures the humidity in the air.
Ignition	The beginning of flame production or smouldering combustion; the starting of a fire.

Term	Definition
Ignition pattern	The manner in which a prescribed burn, backburn, or burnout is set, determined by weather, fuel, ignition system, topographic and other factors having an influence on fire behaviour and the objective of the burn.
Ignition source	A source of energy sufficient to initiate combustion.
Incendiary	A burning compound or metal used to produce intense heat or flame, like a bomb.
Incendiary device	Device designed and used to start a fire.
Incident	Any unplanned event requiring emergency intervention. (AIIMS)
Incident Action Plan (IAP)	The plan used to describe the incident objectives, strategies, resources and other information relevant to the control of an incident. (AIIMS)
Incident control	See: Incident management
Incident Control Centre (ICC)	The location where the Incident Controller and various members of the Incident Management Team provide overall direction of response activities. (See also Incident Control Point)
Incident Controller	The individual responsible for the management of all incident control activities across a whole incident (AIIMS)
Incident Control Point (ICP)	The location where the Incident Controller and, where established, members of the Incident Management Team provide overall direction of response activities in an emergency situation. (See also Incident Control Centre)
Incident control system (ICS)	A command structure to systematically and logically manage suppression of emergency incidents including bushfires, from small, simple incidents to large, difficult or multiple situations. It is designed to develop in modular fashion from the top (Incident Controller) downwards. Refer NIMS, AIIMS, CIMS
Incident management	The process of controlling the incident and coordinating resources. (EMA)
Incident Management Team (IMT)	The group of incident management personnel comprising the Incident Controller, and the personnel he or she appoints to be responsible for the functions of Operations, Planning and Logistics. (AIIMS)
Incident objective	An incident objective is a goal statement indicating the desired outcome of the incident. Incident objectives guide the development of the Incident Action Plan and must reflect the policies and needs of the control authority and supporting agencies. All factors affecting the incident and its potential impact must be considered before determining the objective. (AIIMS)
Incident strategies	The incident strategies will be developed from the incident objectives and will describe how the Incident Management Team plans to resolve the incident. There is a requirement for strategies to be developed throughout the incident and they should be reviewed for each operational period. (AIIMS)
Indirect attack	A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favourable breaks in the topography. The intervening fuel is usually backburnt; but occasionally the main fire is allowed to burn to the line, depending on conditions.(NWCG)
Induced wind	See: Fire wind.
Infrared scanning	Use of an optical-electronic system for identifying or obtaining imagery of thermal infrared radiation to detect non-smoking fires or fire perimeters through smoke.
Initial attack	The first suppression work on a fire.

Term	Definition
Instability	The tendency for air parcels to accelerate when they are displaced from their original position; especially, the tendency to accelerate upward after being lifted. Instability is a prerequisite for severe weather - the greater the instability, the greater the potential for severe thunderstorms. (Weather Zone)
Interface	See: Urban Rural interface.
Inversion	A layer of the atmosphere in which temperature increases with increasing elevation. A condition of strong atmospheric stability.
Island	An unburnt area within a fire perimeter.
Isobar	Lines on weather maps joining places which have the same air pressure.(BOM)
I zone	See: Urban Rural interface.
Jump fire	See: Spot fire
Jump over	See: Breakaway
Junction zone	An area of greatly increased fire intensity caused by two fire fronts (or flanks) burning towards one another.
Keetch-Byram Drought Index (KBDI)	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation, and expressed as a scale from 0 - 200 where the number represents the amounts of rainfall (mm) to return the soil to saturation.
Knock down	To reduce the flame or heat on the more vigorously burning parts of a fire edge. (NWCG)
Ladder fuels	Fuels that provide vertical continuity between strata. Fire is able to carry surface fuels into the crowns of trees with relative ease.
Lag time	The time delay in fuel moisture content responding to changing environmental conditions (for example, relative humidity). Technically, it is the time necessary for a fuel particle to lose approximately 63% of the difference between its initial moisture content and its equilibrium moisture content.
Lead agency	The organisation with the legislative or agreed authority for control of an incident.
Lee (leeward)	Away from the wind, on the sheltered side of something that the wind is blowing on.
Legislation	A set of rules made by a State, Territory or Federal Government; includes acts and regulation.
Light fuel	An assessment of fuel quantity indicating a low weight.
Lighting pattern	See: Ignition pattern.
Lightning	The flash of light accompanying a sudden electrical discharge which takes place from or inside a cloud, or less often from high structures or the ground or from mountains. A large electrical spark. Caused when the negative charge in the lower part of the cloud and the positive charge in the upper part of the cloud become so great that they can overcome the natural resistance of the air and discharge between negative and positive takes place. (BOM)
Lightning fire	A fire caused by lightning.
Lightning formation	See: Lightning.
Light patrol unit	See: Tanker.
Line ignition	See: Strip burning.

Term	Definition
Litter	The top layer of the forest floor composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves and needles, little altered in structure by decomposition. (The litter layer of the forest floor). (NWCG)
Litter bed fuel	Dead fine fuel, including surface fuel and fuel lower in the fuel profile.
Litter fall	The addition of litter that falls from vegetation to the forest floor.
Living fuels	Fuels made up of living vegetation.
Living shrub fuel	Living understorey fine fuel less than 2 metres above ground level.
Local winds	Winds which are generated over a comparatively small area by local terrain and weather. They differ from those which would be appropriate to the general pressure pattern. (NWCG)
Log	Documentation of information and actions arising during an incident
Logistics	The provision of facilities, services and materials in support of an incident.
Lookout	1. A person designated to detect and report fires from a fixed vantage point. 2. A member of a fire crew designated to observe the fire and warn the crew when there is danger. 3. For structure see: Fire lookout
Lookout tower	See: Fire tower.
Low intensity fire	A fire which travels slowly and only burns lower storey vegetation, like grass and lower tree branches, with an average intensity of less than 500 $kW.m^{-1}$ and flame height less than 1.5m. Usually causes little or no crown scorch and is easily controlled.
Low-moderate fire danger	The lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index less than 12 or a Grassland fire danger index less than 12.
Medium fuels	See Course fuels.
Mineral earth	When used in the context of fire control refers to a non-flammable surface (either natural or prepared) which provides a break in understorey, litter and humus fuels and hence a barrier (of varied effectiveness depending, amongst other things, on its width and the intensity of the approaching fire) to fire travelling on or near the ground surface.
Mobilisation	The processes and procedures for organisations to activate, assemble, and transport the requested resources to an incident.
Moisture content	See Fuel moisture content.
Mopping up	See Blacking out
Mosaic	Used in reference to the spatial arrangement of burnt and unburnt fuels at either a local or a landscape scale.
Move up method	See: Step-up method
Multi-agency response	The response to an incident where one or more agencies assist the jurisdictional control agency or agencies.
Multiple fire situation	A circumstance of high fire incidence over short periods of time in any administrative unit, usually overtaxing the normal initial attack capability of the unit.
Natural barrier	Any area where lack of flammable material obstructs the spread of vegetation fires.

Term	Definition
Near surface fuel	Live and dead fuel, including suspended leaves, bark or twigs, effectively in touch with the ground but not lying on it, with a mixture of vertical and horizontal orientation.
Needle bed	A fuel bed consisting mainly of pine needles.
Nozzle	A fitting that is used with a branch to control the size, pattern and/or velocity of water or extinguishing medium being discharged.
One lick method	A progressive system of building a fireline on a wildfire without changing relative positions in the line. Each worker does one to several "licks", or strokes removing a set proportion of the fuel on the line, with a given tool and then moves forward a specified distance to make room for the worker behind. (NWCG)
Operations	The direction, supervision and implementation of tactics in accordance with the Incident Action Plan.
Operations point	The location from which the overall field operations are commanded by the Operations Officer. (AIIMS)
Parallel attack	Method of fire suppression in which fireline is constructed approximately parallel to, and just far enough from the fire edge to enable workers and equipment to work effectively, though the fireline may be shortened by cutting across unburned bays. The intervening strip of unburned fuel is normally burned out as the control line proceeds but may be allowed to burn out unassisted where this occurs without undue delay or threat to the fireline. (NWCG)
Parallel fire suppression	See: Parallel attack.
Parallel method	See: Parallel attack.
Parts of a Fire	See: Bay(s), Fingers, Flanks of a fire, Head.
Patch burning	Burning in patches to prepare sites for group planting or sowing or to form a barrier to subsequent fires. (NWCG)
Patrol	1. To travel over a given route to prevent, detect, and suppress fires. Includes interaction with the public for wildland fire prevention and educational purposes. 2. To go back and forth vigilantly over a length of control line during and/or after construction to prevent breakaways, suppress spot fires, and extinguish overlooked hot spots. 3. A person or group of persons who carry out patrol actions. (NWCG)
Peat	An amorphous organic material formed by anaerobic decomposition which usually means that the area is seasonally or permanently inundated with water. Peat fires burn by smouldering combustion and generate very high amounts of energy per unit area.
Perimeter	See: Fire perimeter.
Peri urban interface	See: Urban rural interface.
Permit burn	A burn carried out under permit from a Fire Authority.
Personal protection equipment (PPE)	The equipment and clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
Personal protective clothing (PPC)	The clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
Plan of attack	See: Incident Action Plan (Preferred term)
Planned burning	See: Prescribed burning.
Pocket	See: Island.

Term	Definition
Point of attack	The part of the fire on which work is started when suppression forces arrive.
Point of origin	The specific location where the fire started.
Portable dam	A temporary water storage used in conjunction with power pumps and hose lines.
Predicted rate of spread	The rate of spread predicted by the application of fire spread models utilising appropriate inputs of fuel conditions, topography and weather. Also see Rate of Spread.
Pre-incident plan	Advanced planning and preparation for an emergency situation.
Pre-suppression plan	See Pre-Incident Plan
Prepared community	A community that has developed effective emergency management arrangements at the local level, resulting in: • An alert, informed and active community that supports its voluntary organizations • An active and involved local government • Agreed and coordinated arrangements from prevention, preparedness, response and recovery.
Preparedness	All activities undertaken in advance of the occurrence of an incident to decrease the impact, extent and severity of the incident and to ensure more effective response activities.
Pre-planned dispatch	The pre-planned dispatch of designated suppression forces to fires in predetermined zones. It is usually dependent on the location of the fire, and the forecast fire danger.
Prescribed burn	A fire utilised for Prescribed burning.
Prescribed burn plan	See: Burn plan.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Prescribed fire	Any fire ignited by management actions to meet specific objectives. A written, approved burn plan must exist, and approving agency requirements (where applicable) must be met, prior to ignition.
Prescription	A written statement defining the objectives to be attained during prescribed burning.
Prevention	All activities concerned with minimising the occurrence of incidents, particularly those of human origin.
Profile litter moisture content	The moisture content, expressed as a percentage of oven-dry weight, of the entire leaf litter bed above the mineral soil surface.
Profile moisture content	See Fuel moisture content.
Psychrometer	The general name for instruments designed for determining the relative humidity of the air. A psychrometer consists of wet and dry bulb thermometers, generally with the aid of psychrometric tables or a psychrometric slide rule. (BOM)
Pulaski tool	A combination chopping and trenching tool widely used in fireline construction, which combines a single-bitted axe blade with a narrow adze-like trenching blade fitted to a straight handle. (NWCG)
Pumper	A firefighting vehicle equipped with a large capacity pump, water tank and hose. Generally intended to be operated when stationary, from reticulated or static water supplies.

Term	Definition
Quick-fill pump	A high volume water pump used for filling tankers.
Rain gauge	The general name for instruments designed to measure the amount of rain that has fallen.
Rakehoe (McLeod tool)	A hand tool used for bushfire fighting, consisting of a combination of a heavy rake and hoe.
Rate of spread (ROS)	The speed with which a fire moves in a horizontal direction across the landscape at a specified part of the fire perimeter. See also Forward rate of spread.
Reaction time	The time taken between the report of a fire or incident, and the departure of the crew. See also Response time.
Rear	1. That portion of a fire spreading directly into the wind or down slope. 2. That portion of a fire edge opposite the head. 3. Slowest spreading portion of a fire edge. Also called heel of a fire. (NWCG)
Reburn	Repeat burning of an area over which a fire has previously passed, but left fuel that later ignites when burning conditions are more favourable. (NWCG)
Reconnaissance	To examine a fire area to obtain information about current and probable fire behaviour and other related fire suppression information. (NWCG)
Recovery	The coordinated process of supporting emergency affected communities in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical wellbeing.
Red Flag Warning	A process for passing critical safety information to incident suppression resources and support resources on which they can base decisions regarding strategy, tactics and deployment.
Regeneration burn	A burn lit under prescribed conditions for the purpose of achieving regeneration of a particular vegetation type.
Re-ignition	The action of a material that ignites again after it has been extinguished.
Relative humidity (RH)	The amount of water vapour in a given volume of air, expressed as a percentage of the maximum amount of water vapour the air can hold at that temperature.
Relay pumping	Using a series of pumps positioned at intervals along a line or lines of hose to share the workload of pumping water over a long distance.
Relief	The replacement of personnel whose period of time at the incident has concluded.
Report of fire	The notification of the detection of a fire to the fire service. (AFAC)
Residence time	The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.
Resources	All personnel and equipment available, or potentially available, for incident tasks.
Response	Actions taken in anticipation of, during, and immediately after an incident to ensure that its effects are minimised, and that people affected are given immediate relief and support.
Response time	The time taken between the report of a fire or incident, and arrival at the scene. It includes both reaction time and travel time.
Responsible authority	See: Control authority.
Retardant	See: Fire retardant.

Term	Definition
Risk	The exposure to the possibility of such things as economic or financial loss or gain, physical damage, injury or delay, as a consequence of pursuing a particular course of action. The concept of risk has two elements, i.e. the likelihood of something happening and the consequences if it happens. (AS4360)
Risk analysis	A systematic use of available information to determine how often specific events may occur and the magnitude of their likely consequences.
Road Management Point	A strategic position from which traffic can be observed and controlled. (See also Traffic Management Point and Vehicle Control Point)
Rural	Any area wherein residences and other developments are scattered and intermingled with forest, range, or farm land and native vegetation or cultivated crops.
Rural urban interface (RUI)	See Urban rural interface
Safe	The stage of bushfire suppression or prescribed burning when it is considered that no further suppression action or patrols are necessary.
Safety zone	An area cleared of flammable materials used for escape if the line is outflanked or in case a spot fire outside the control line renders the line unsafe. In fire operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks. They are greatly enlarged areas which can be used with relative safety by fire fighters and their equipment in the event of a blow up in the vicinity. (Vic report)
Scorch height	1. The height above ground level up to which foliage has been browned by a fire. 2. A measurement for determining the acceptable height of flame during prescribed burning.
Scout	A person who checks and reports on conditions in the fire area.
Scrub	Refers to vegetation such as heath, wiregrass and shrubs, which grows either as an understorey or by itself in the absence of a tree canopy.
Scrub fire	Fires burning in scrub.
Secondary fire control line	See: Fall back fire control line.
Sector	A specific area of an incident which is under the control of a Sector Commander who is supervising a number of crews.
Seen area	The ground, or vegetation, that is directly visible from an established or proposed lookout point, or aerial detection flight route.
Severe fire danger	The third highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 50 and 74 or a Grassland fire danger index between 50 and 74.
Shift	The period resources are allocated during an operation at the incident or on the fireground.
Shift change	Replacement of allocated crews and or equipment during operations.
Situation report **(Sitrep)**	A report on the progress of the fire and the efforts to control it. It confirms the location of the fire, its status and potential and the number, nature and effectiveness of resources deployed. Situation reports are normally provided at regular times until the fire is declared safe.
Size up	The evaluation of a fire to determine a course of action for suppression.
Slash	Accumulated fuel resulting from such natural events as wind, fire, snow breakage, or from such human activities as logging, cutting or road construction.

Term	Definition
Slash burn	A prescribed burn conducted to consume slash for fire hazard reduction or silvicultural purposes.
Sleeper	1. A fire that starts up again after appearing to have been extinguished. 2. A fire that is detected some time after an ignition opportunity (usually from lightning or hop over events).
Slip-on unit	A tank, a live hose reel or tray, a small capacity pump, and an engine combined into a single one-piece assembly that can be slipped onto a truck bed or trailer and used for spraying water and/or foam on bushfires.
Slop over	See: Breakaway
Smoke management	Used by land managers and meteorologists planning a prescribed burn, to ensure that smoke does not cause problems downwind of the burn.
Smoke Plume	The column of smoke that rises from a fire. (See also Convection Column)
Smoker	An isolated small burning item such as a log, stump or tree, in an area of fire otherwise mopped up.
Softwood	A conventional term used to describe a tree, and the timber of trees, belonging to the group of plants with cones, such as pine and cypress.
Soil Dryness Index (SDI)	A form of Drought Index, usually with slightly more detailed inputs than the Keetch-Byram Drought Index. May be on a scale of 0-200 like the KBDI, but some versions have different scales (for example, Western Australia: 0-2000).
Southern Oscillation Index (SOI)	The comparison of surface air pressure differences between Tahiti and Darwin that shows a strong correlation with rainfall.
Spark arrestor	A device fitted to the exhaust system of machinery for trapping carbon sparks.
Spot fire	1. Isolated fire started ahead of the main fire by sparks, embers or other ignited material, sometimes to a distance of several kilometres. 2. A very small fire that requires little time or effort to extinguish.
Spot ignition	An ignition pattern using a series of spaced points of ignition.
Spot over	See: Breakaway
Spotting	Behaviour of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire. (NWCG)
Staging area	An area where resources are mustered and prepared for allocation to an incident. It may include the provision of welfare and equipment maintenance facilities. (AIIMS)
Stand by	The period during which personnel are to be immediately available at home or other location for fire suppression purposes.
Static water supply	A supply of water in a reservoir or pond, of limited capacity.
Step-up method	A method used by a team of firefighters to construct a firebreak in which each firefighter completely constructs a section of the firebreak after which the entire team ‘steps up’ to the next section.
Strike teams	A set number of resources of the same type that have an established minimum number of personnel. Strike Teams always have a leader (usually in a separate vehicle), and have a common communications system. Strike Teams are usually made up of five resources of the same type such as: vehicles, crews, earth moving machinery, etc (AIIMS).

Term	Definition
Strip burning	1. An ignition pattern using lines of continuous fire. 2. In hazard reduction, burning narrow strips of fuel and leaving the rest of the area untreated by fire. (NWCG)
Strip ignition	See: Strip burning.
Stripping	See: Strip burning.
Structure	A constructed object, usually a free-standing building above ground.
Sub surface fire	See: Ground fire
Sub surface fuel	See: Ground fuel
Suction hose	Hose used to draught from static/open water. It has a hard, usually reinforced, exterior to prevent it collapsing when a partial vacuum exists within the hose.
Supply hose	Hose feeding from a water supply to a pump.
Support agency	An organisation contributing services or resources directly to a lead agency.
Surface fire	Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation. (NWCG)
Surface fuel	Litter fuels made up of leaves, twigs, bark and other fine fuel lying on the ground, predominately horizontal in orientation.
Surface moisture content	The moisture content expressed as a percentage of oven dry weight of the top 5-10 mm of leaf litter.
Tactics	These are the tasking of personnel and resources to implement the incident strategies. Incident control tactics are accomplished in accordance with appropriate agency procedures and safety directives. (AIIMS)
Tail fire	See: Backing fire.
Tanker	A mobile firefighting vehicle equipped with a water tank, pump, and the necessary equipment for spraying water and/or foam on bushfires.
Task force	A combination of resources assembled for a specific purpose. Task Force always have a leader (usually in a separate vehicle), and have a common communications system. Task Forces are established to meet tactical needs and may incorporate a mixture of different resources types. (AIIMS)
Task group	A large or complex combination of resources assembled for a specific purpose including intrastate, interstate and international deployments made up of multiple strike teams or task forces and or other response or support resources in any combination.
Technical advisors	Are advisors with special skills needed to support incident activities/functions.(AIIMS)
Temperature (dry bulb)	The ambient air temperature recorded by an exposed thermometer.
Temperature (wet bulb)	Wet bulb temperature is measured by placing a moist, single-layer, muslin sleeve over the bulb of a dry bulb thermometer. The difference between dry and wet bulb readings is used to determine relative humidity and dewpoint values.
Test fire	A controlled fire ignited to evaluate fire behaviour.
Thermal imagery	A display or print out from an infra-red scanning device.
Thermal radiation	The process by which the surface of an object radiates its thermal energy in the form of electromagnetic radiation.

Term	Definition
Thermohygrograph	An instrument that simultaneously and continuously measures and records temperature and relative humidity, normally by tracing each onto a revolving chart. Charts can be either for one day or one week of continuous recording.
Time lag	See: Lag time
Tongues	See: Fingers
Topography	The surface features of a particular area or region. It may include mountains, rivers, populated areas, roads and railways and fuel types.
Torch	See: Candle
Torching	See: Candle
Traffic Management Point	Point along movement routes that are staffed by emergency personnel to direct and control traffic flow. (See also Road Management Point and Vehicle Control Point)
Travel time	The time taken between the departure of a crew, and arrival at the incident. See also Response time.
Under storey	The lowest stratum of a multi-storeyed forest.
Upwind	Towards the wind direction. In the same direction as the direction from which the wind is blowing. The opposite direction to that smoke will travel.
Urban	Area in which residences and other human developments form an essentially contiguous covering of the landscape, includes most area within cities & towns, subdivisions, commercial and industrial parks, and similar development whether inside city limits or not.
Urban interface	See Urban rural interface
Urban rural interface (URI)	The line, area, or zone where structures and other human development adjoin or overlap with undeveloped bushland.
Values at risk	The natural resources or improvements that may be jeopardised if a fire occurs.
Vehicle Control Point	A point on a vehicle access route controlled by a barrier, or similar means, at which a vehicle is required to stop. (See also Road Management Point and Traffic Management Point)
Very high fire danger	The forth highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 25 and 49 or a Grassland fire danger index between 25 and 49.
Warning device	Audible devise fitted to fire bombing aircraft to alert ground crews of pending drop.
Water bombing	See: Fire bombing.
Water point	Any natural or constructed supply of water that is readily available for fire control operations.
Water tank	A container capable of storing a large volume of water.
Wetting agent	A chemical added in low concentration to water. It is used in firefighting to break down the surface tension of the water and to improve its penetration into fuels.
Widow maker	See: Hang up
Wilderness Area	Places where wilderness quality defined using thresholds of remoteness, naturalness and total area is recognised and valued by society.
Wildfire	See: Bushfire.
Wildfire control plan	See: Incident Action Plan

Term	Definition
Wildland urban interface (WUI)	See: Urban rural interface
Wind direction	The direction from which the wind blows.
Windfall	See: Wind throw
Wind throw	An area of previously standing timber which has been blown over by strong winds or storms.
Wind speed	The rate of horizontal motion of the air past a given point expressed in terms of distance per unit of time. In the NZ Fire Danger Rating System, wind speed is measured at the standard height of 10 metres in the open, averaged over a 10-minute interval and in kilometres per hour.
Wind strength	Generally measured as wind speed. May be measured by the Beaufort wind scale.
Windrow	A long line of piled slash or debris resulting from forest or scrub clearing.
Windrow burning	The burning of windrows.
Windward	Towards the wind. You are windward if the wind is blowing on your face.
Woodland	A subset of forest plant communities in which the trees form only an open canopy (between 20% and 50% crown cover), the intervening area being occupied by lower vegetation, usually grass or scrub.