



ENVIRONMENTAL

BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN

3-5 Panorama Outlook, Slacks Creek

Client:	Somerville Consultants
Reference:	S524105_BHAMP_v1.0
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Disclaimer

S5 Consulting Pty Ltd trading as S5 Environmental has developed this Bushfire Hazard and Bushfire Attack Level Assessment, taking into consideration the Australian Standard (AS3959-2018) - Construction of Buildings in Bushfire-prone Areas, the State Planning Policy and relevant local authority policies and guidelines. However, there can be no guarantee that following the recommendations made in this assessment can guarantee safety of property and human life.

Fire is an element of nature, and as such fire events (small or large) can have disastrous outcomes even with the best planning in place. The authors of this report and S5 Consulting Pty Ltd accept no responsibility for any harm to property or human life caused by fire or any other cause to persons utilising property or structures.

Abbreviations

AHD	Australian Height Datum
AS 3959-2018	<i>Australian Standard 3959-2018 Construction of Buildings in Bushfire-prone Areas</i>
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BMP	Bushfire Management Plan
BMZ	Bushfire Management Zone
BRC	Bushfire Resilient Communities (The State of Queensland 2017)
CFA	Country Fire Authority
DES	Department of Environment and Science
DNRME	Department of Natural Resources, Mines and Energy
DoR	Department of Resources
FFDI	Forest Fire Danger Index
ha	Hectares
LCC	Logan City Council
NCC	National Construction Code
RE	Regional Ecosystem
SEQ	South East Queensland
SPP	<i>State Planning Policy, 2017</i>
VHC	Vegetation Hazard Class

1.0 INTRODUCTION

S5 Environmental was commissioned by Somerville Consultants, on behalf of their client to undertake a Bushfire Hazard Assessment and Management Plan (BHAMP) as supporting documentation for a Development Application for a Material Change of Use (MCU) to locate two Building Location Envelopes (BLEs) with two lots located at 3-5 Panorama Outlook, Slacks Creek. Refer to **Table 1**.

The aim of this BHAMP is to undertake a site-specific bushfire hazard assessment, determine any set back required between the proposed development and hazardous vegetation and prepare a Bushfire Management Plan to ensure the proposed development is not exposed to an unacceptable bushfire risk and can comply with the relevant legislative bushfire requirements.

Table 1. Site Description

Address	3-5 Panorama Outlook, Slacks Creek	RPD	Lots 14 and 15 on RP112853
LGA	Logan City Council (LCC)	Site Area	7.8 ha
Coordinates	-27.7078° S, 153.0962° E	Tenure	Freehold
Zone	Low density residential and Environmental Management and Conservation		
Current State	Lots 14 and 15 on RP112853, herein referred to as the 'subject site', is a largely vegetated lot which decreases in evaluation from north to south. Residential dwellings are located on adjacent properties, fronting directly onto Panorama Outlook and Webb Street, with the rear three quarters containing retained vegetation. The southern extent of the site of the site borders with Slacks Creek, with the creek line meandering from the west to the east along the southern, eastern and western boundaries. The southern bank is located within the Meadowbrook Golf Club. The northern extent of the site has been mapped as Low density residential, with the balance of the site mapped as Environmental Management and conservation. Adjacent lots are similarly zoned, with lots to the north zoned solely as Low density residential. Refer to Figure 1, below.		
Proposed Development	The proposed development is a MCU for the location of one BLE within each of the existing lots. It is understood that the BLEs will again direct access onto Panorama Outlook to the north-east. An Asset Protection Zone (APZ) extending 25.8 m off the proposed BLEs will be required within both lots to ensure future dwellings will achieve an acceptable setback from hazardous vegetation. Refer to Figure 2 below.		
Potentially Hazardous Vegetation	Post development, the extent of potentially hazardous vegetation within the assessment area was determined to be located to the south of the development area. This potentially		

hazardous vegetation has been mapped as Regional Ecosystems (RE) 12.9-10.17d and 12.3.11a, and are described as follows:

RE 12.9-10.17d: *Eucalyptus racemosa* subsp. *racemosa* woodland on remnant Tertiary surfaces; and

RE 12.3.11a: Open forest of *Eucalyptus tereticornis* and/or *E. siderophloia*, *Lophostemon confertus* with vine forest understorey.

The potentially hazardous vegetation is further described in **Section 4.0**.



Figure 1. Subject Site (source: Nearmap, 03/06/2024)



Figure 2 Proposed Development (source: Sommerville Consultants, 29/08/24, issue 6)

2.0 STATUTORY REQUIREMENTS

2.1 Development Applications in Bushfire Prone Areas

Bushfire Prone Areas are identified at both the State and Local Government Level. The State Planning Policy (SPP) Bushfire Prone Area map was developed by CSIRO to map areas with Very High, High and Medium Potential Bushfire Intensity. The SPP also maps a 100 m Potential Impact Buffer. The Logan City Council (LCC) *Planning Scheme 2015* implements the Bushfire hazard overlay code which acts as a development constraint within the LCC locality. It is understood that the *Planning Scheme 2015* has integrated all aspects of the SPP: Safety and Resilience to Hazards, including Natural Hazards, Risk and Resilience – Bushfire Prone Areas. As such, the LCC Bushfire Hazard Overlay map was consulted to determine the preliminary bushfire hazard ratings of the site and locality (within 150 m), refer to **Figure 3**.

The LCC Bushfire Hazard Overlay has mapped the site as containing Very high potential bushfire hazard and High potential bushfire hazard. The balance of the site is mapped as Medium potential bushfire hazard. Adjacent lots are similarly mapped. To the north of the site is mapped as Potential impact buffer bushfire hazard.

Due to potentially hazardous vegetation being mapped within and around the proposed development site, further investigation into the site-specific bushfire hazard characteristics has been undertaken to determine the actual hazard of the proposed development.

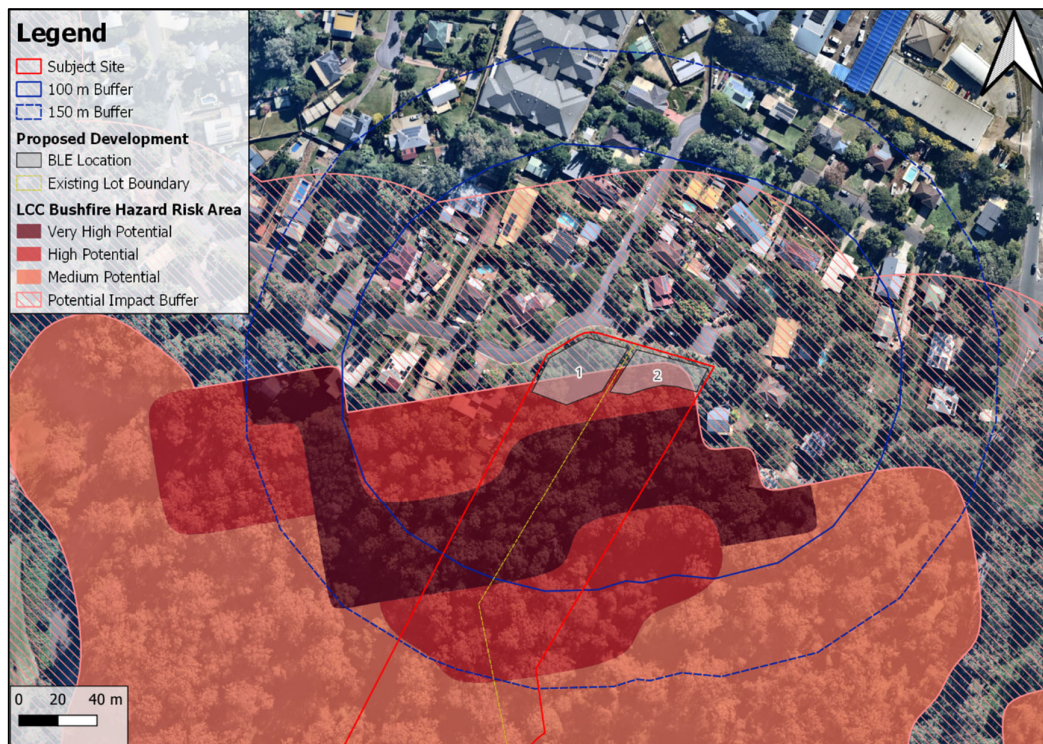


Figure 3. LCC Bushfire Hazard Mapping within and in Proximity to the Site

3.0 METHODOLOGY

3.1 Bushfire Hazard Assessment

The SPP Potential Bushfire Intensity classifications are based on the *New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland* (Leonard *et al.* 2014). This State-wide mapping methodology was developed to identify Bushfire Prone Areas in support of bushfire hazard provisions of Queensland's State Planning Policy. The new methodology scales bushfire hazard based on the Potential Fire-line Intensity (PFLI) of a severe bushfire and can be used to predict the radiation profile of areas located adjacent to potentially hazardous vegetation and an associated Potential Impact Buffer.

Accordingly, the classification of an area's PFLI is calculated as a combination of the following three metrics, using the below equation (Leonard *et al.* 2014):

- Total fuel load (W);
- The McArthur Forest Fire Danger Index (FFDI), and
- Maximum Landscape Slope (θ in $^{\circ}$).

$$FI = 0.62 W^2 FFDI \exp(0.069 \theta)$$

For the purposes of the bushfire hazard assessment, S5 Environmental have utilised data from the Queensland Fire and Emergency Services (QFES) published to the Queensland Government's Queensland Spatial Catalogue (QSpatial) for fuel load and FFDI. PFLI is delineated into a number of hazard categories shown in **Table 2**, and each patch of hazardous vegetation can be classed as Very High, High, Medium, Grassland or low hazard according to the PFLI determined for that specific patch. Any patch of hazardous vegetation classed as Very High, High or Medium is buffered by 100m called the Potential Impact Buffer.

The Potential Impact Buffer is also considered a Bushfire Prone Area, along with hazardous vegetation with a PFLI of Very High, High or Medium. Any development within a bushfire prone area requires further assessment of radiant heat exposure, assessment against the relevant local planning scheme bushfire code and/or an assessment against the SPP assessment benchmarks for Natural hazards, risk and resilience relevant to bushfire and the development of a site-specific bushfire management plan to ensure that the proposed development is exposed to an acceptable or tolerable bushfire risk.

Table 2. Potential Bushfire Intensity Classification

Potential Bushfire Intensity Class	Potential Fire-line Intensity (PFLI)
Very high	>40,000kW/m
High	20,000 – 40,000kW/m
Medium	4,000 – 20,000kW/m
Low	<4,000kW/m

3.2 Modification of Potential Intensity of Small Patches and Corridors

Using the Bushfire Resilient Communities (BRC) methodology in Section 4.2.6 (The State of Queensland 2019b), small patches of hazardous vegetation and narrow corridors were removed from the map of hazardous vegetation within 150 m of the proposed development. This is as small, isolated and/or narrow patches of hazardous vegetation are not large enough to support a fully developed fire. As stated in the BRC methodology (The State of Queensland 2019b), small, isolated or narrow patches are unlikely to reach a potential fire-line intensity greater than 4,000 kW/m and as such, are considered to be low hazard and not classed as a Bushfire Prone Area. The *SPP Technical Reference Guide - Bushfire Resilient Communities* (2019) summarises research by Leonard and Opie (2017) outlines four steps to filter out small patches and narrow corridors of continuous fuel (see **Table 3**, below).

Table 3. Steps to Downgrade Bushfire Intensity

Step	Description
1	Remove small, isolated patches of continuous fuel (< 1ha) surrounded completely by either discontinuous fuel or no fuel. These patches must be further than 100 m from other continuous fuel patches greater than 2 ha in area.
2	Downgrade intensity of small patches (0.5 to 3 ha) of continuous vegetation surrounded completely by either discontinuous or no fuel, which is more than 100 m from other continuous fuel patches greater than 2 ha in area.
3	Remove narrow corridors of continuous fuel (50 m, or less in width). The process erodes, then dilates by 25 m in width all continuous fuel patches in relation to discontinuous areas.
4	Remove small fragments (< 0.5 ha) of shrub-dominated or hazardous tree vegetation.

3.3 Radiant Heat Exposure Assessment

Radiant heat exposure for the proposed development was calculated using a Method 2 from the AS3959-2018. This Method 2 calculates the Bushfire Attack Level (BAL) for a proposed development by determining the minimum distance between hazardous vegetation and the development to achieve each BAL level. As BAL directly correlates to radiant heat exposure, this calculation reflects the level of bushfire risk for a proposed development (see **Table 4**).

To determine the radiant heat exposure for the proposed development, the online Flamesol Minimum Distance Calculator (FPA 2017) was used to determine the required setbacks to hazardous vegetation to achieve an acceptable radiant heat exposure for the proposed development.

Currently, S5 Environmental understand there is one set of inputs for a Method 2 calculation in accordance with AS3959-2018 or Bushfire Resilient Communities (BRC). Inputs to the BAL/radiant heat exposure assessment include the sets of parameters as summarised in **Table 5**, below.

Table 4. BAL and Radiant Heat Exposure

BAL Score	Radiant Heat Exposure
-	10 kW/m ²
12.5	12.5 kW/m ²
19	19 kW/m ²
29	29 kW/m ²
40	40 kW/m ²
Flame Zone (FZ)	> 40 kW/m ²

Table 5. Parameter inputs for Method 2 from AS3959-2018

Parameter	AS method 2
Surface fuel load (t/ha)	Surface fuel load for identified VHC (surface + near surface)
Overall fuel load (t/ha)	Total fuel load for identified VHC
Flame temperature	1200K
FDI/FFDI	From Catalyst/QSpatial
Standard inputs	Bushfire Resilient Communities (QG 2019)
Effective slope	Measured as the slope under the hazardous vegetation.
Site slope	Measured as the slope between the hazardous vegetation and the site.
Flame Width	Flame width is assumed to be 100 m (AS 3959-2018) unless a short-fire run.

3.4 Short Fire Run

Small or narrow patches of hazardous vegetation are unlikely to support a fully developed bushfire due to their limited size (see **Figure 4** for a schematic representation of how fire moves across a landscape, demonstrating this). As such, the flame width and height in these small patches will not reach the standard inputs for the Method 2 from AS3959-2018 as these standard inputs are based on a fully developed bushfire. In these cases, a short fire run calculation can be used. The short fire run methodology can only be applied when there is a maximum fire run of 150m as measured on the effective slope. In these cases where a short fire run can be justified, and thus a reduced flame width and height for a Method 2 calculation, the method from the *Short Fire Run: Methodology for Assessing Bush Fire Risk for Low Risk Vegetation* (NSW Rural Fire Service, 2019) is adopted.

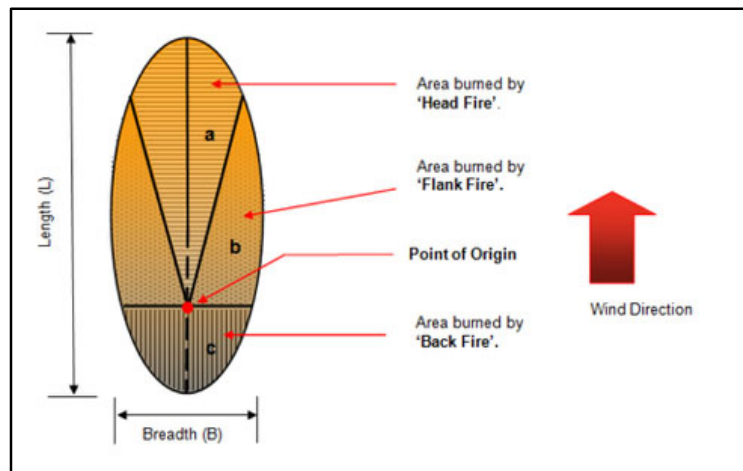


Figure 4. Schematic diagram of simple elliptical fire growth model (Van Wagner 1969) from NSW Rural Fire Surface (2019)

4.0 BUSHFIRE HAZARD ASSESSMENT

4.1 Potential Fire-line Intensity Assessment

In accordance with *A New Methodology for State-wide mapping of bushfire prone areas in Queensland* (Leonard *et al.* 2014), fuel loads derived from ground-truthed Vegetation Hazard Classes (VHCs), effective slope and FFDI were used to calculate the PFLI of hazardous vegetation within 150 m of the proposed development and hazardous into the relevant PFLI category. The following sections discuss how these parameters were determined to calculate PFLI for hazardous vegetation in proximity to the proposed development.

4.1.1 Vegetation Hazard Class Mapping

In accordance with the *New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland* (Leonard *et al.* 2014), potential fuel loads are assigned to vegetation categories (Vegetation Hazard Classes – VHC) formed by amalgamating land use and vegetation types with a moderately consistent fuel load and structure.

The potential fuel load assigned to each VHC is generally representative of the higher fuel load expected for the typical vegetation types, landscape and site conditions within each VHC and approximates the **80th percentile (%) fuel load of the “long unburnt condition”** for the class (generally greater than 10 years without burning).

Using QFES Catalyst Mapping, numerous VHCs were mapped within and adjacent to the subject site. An extract of the Catalyst Mapping is shown below in **Figure 5**.

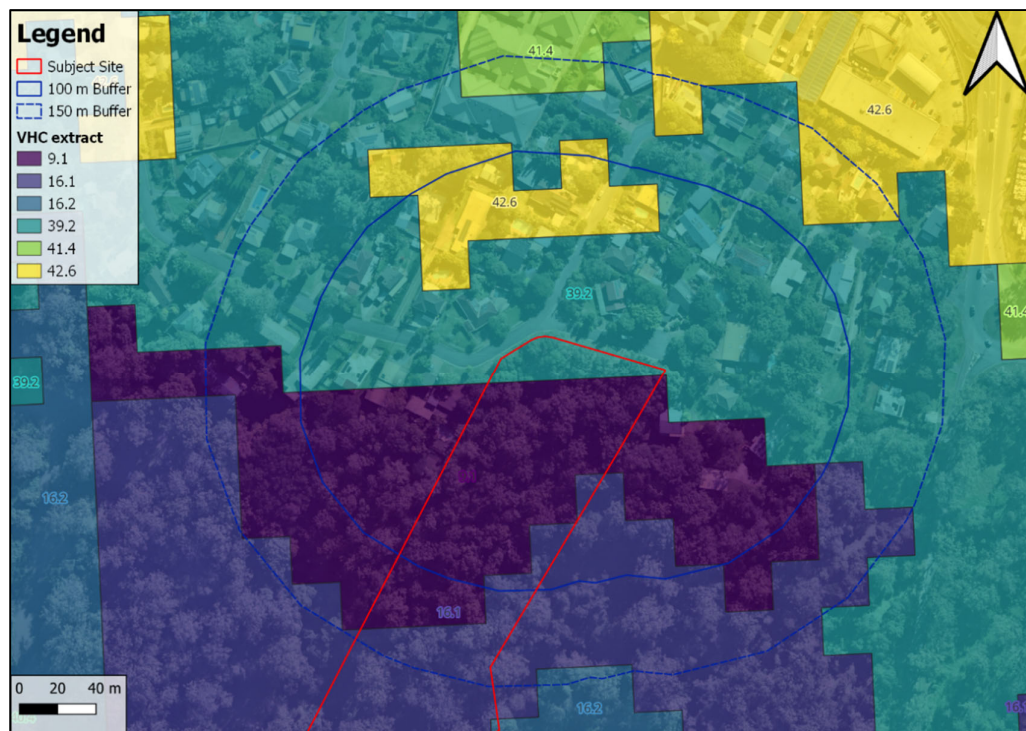


Figure 5. Extract of Vegetation Hazard Classes from Catalyst

4.1.2 Vegetation Hazard Class Verification

To ground-truth the State Government VHCs mapped within and adjacent to the subject site, S5 Environmental's Environmental Scientist undertook a desktop Reliability Assessment in accordance with BRC comparing available bushfire and vegetation mapping, with a comprehensive review of available aerial mapping of the site, including a 150 m buffered area, external to the proposed development.

The proposed development seeks to locate a single BLE within the northern extent of each lot. As such, the VHCs mapping within these areas have been amended to VHC 39.2 '*Low to moderate tree cover in built-up areas*' to reflect the future use of this area. Additionally, this VHC 39.2 mapping has been extended over all residential lots located to the north, east and west of the site. The proposed 25.8 m APZ has been amended to VHC 41.4 '*Discontinuous low grass or tree cover*', which will reflect the low-fuel nature of the area. Refer to **Section 6.3** for further information regarding vegetation management in this area.

VHC mapping within the balance of the assessment area has remained unchanged, with the State mapped RE 12.9-10.17d and 12.3.11a mapped as their respective VHCs; VHC 9.1 '*Moist to dry eucalypt open forest on coastal lowlands and ranges*' and VHC 16.1 '*Eucalyptus dominated forest on drainage lines and alluvial plains*'. Contours have been reviewed, which further confirm the extent of the REs in relation to the land zones.

The VHC mapping has, therefore, been modified to reflect the conditions more accurately, and to reflect the post-development state of the subject site and locality (see **Figure 6**). As spatially indicated in **Figure 6**, the modified VHCs have been restricted to a 150 m buffer from the subject site, as the more distant areas are not relevant for the purposes of this Bushfire Hazard Assessment.

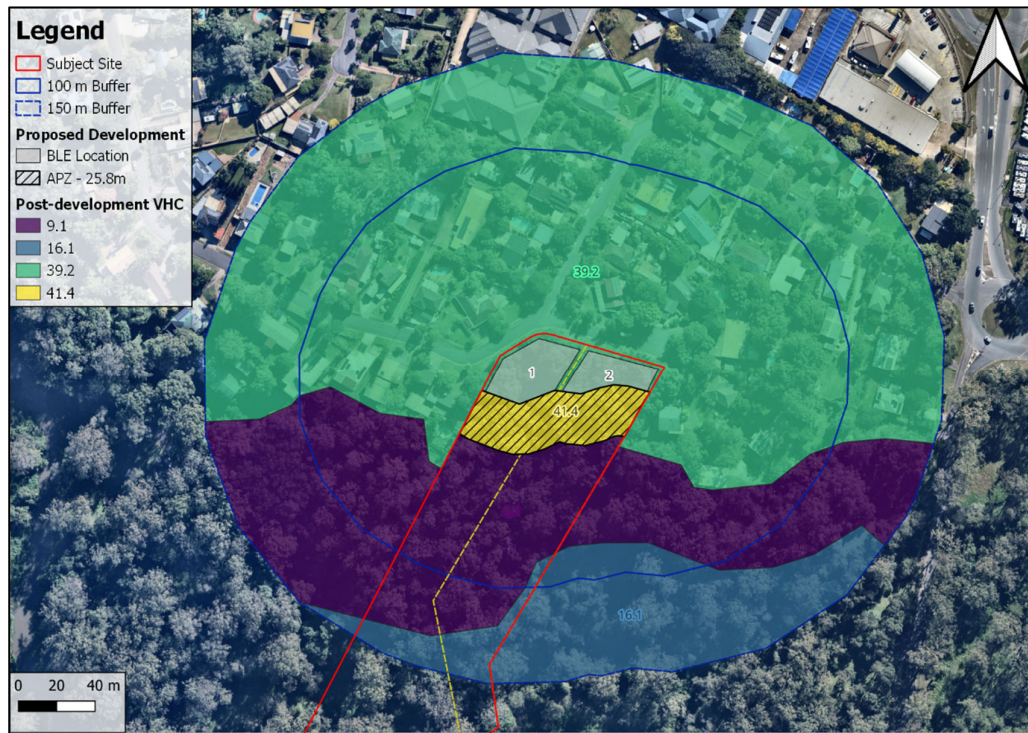


Figure 6. Ground-truthed and Post-development Vegetation Hazard Classes

4.1.3 Fuel Loads

Table 6 below, summarises the associated fuel-loads of the final VHCs in relation to the proposed development.

Table 6. Summary of VHCs and their Associated Fuel Continuity and Loads

VHC	VHC Description	Fuel Continuity	Potential Fuel Load * (t/ha)
			Total
9.1	Moist to dry eucalypt open forest on coastal lowlands and ranges	Continuous	24.2
16.1	Eucalyptus dominated forest on drainage lines and alluvial plains	Continuous	16
39.2	Low to moderate tree cover in built-up areas	Discontinuous	8
41.4	Discontinuous low grass or tree cover	Discontinuous	3

*CSIRO A Methodology for State-wide Mapping of Annual Fuel Load and Bushfire Hazard in Queensland. Glenn Newnham, Kimberley Opie, Justin Leonard CSIRO Land and Water, 2017.

4.1.4 Modification of Potential Intensity of Small Patches and Corridors

The fuel loads of Vegetation Hazard Classes which were determined to be continuous were rasterized to allow the processing stages to be carried out. S5 Environmental have investigated the application of the processing stages and have concluded that modification of small patches and corridors are not relevant in this instance. The potentially hazardous continuous vegetation is illustrated in **Figure 7**.

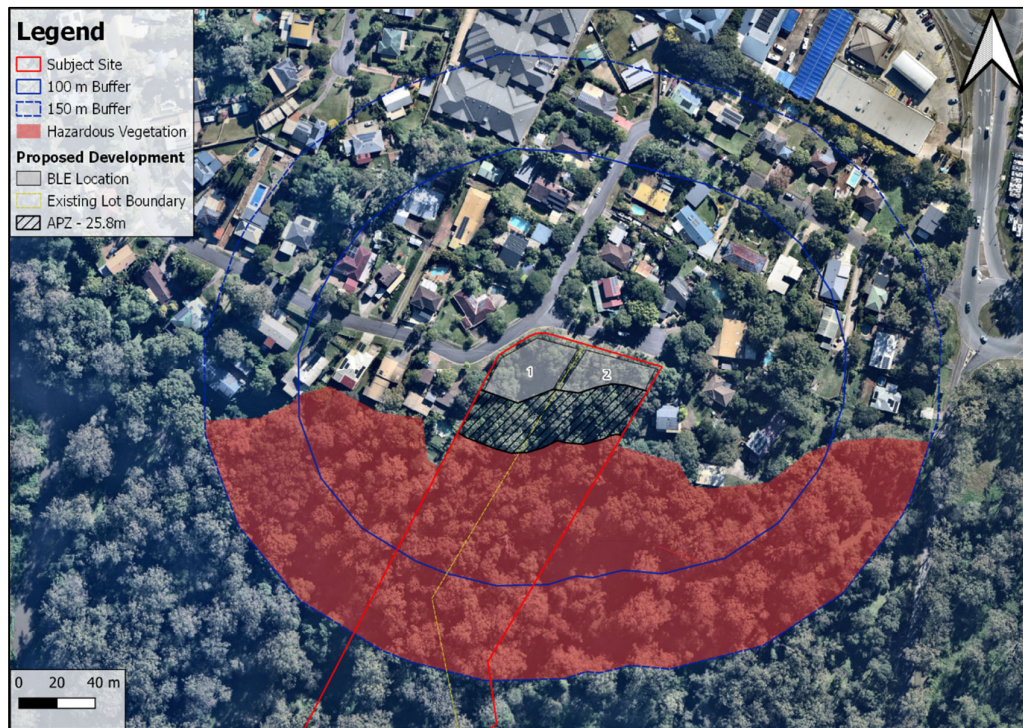


Figure 7. Potentially Hazardous Vegetation

4.1.5 Slope Assessment

The slope of vegetated land over which a bushfire passes has a strong influence on both the intensity and rate of spread of the bushfire. From a bushfire hazard assessment perspective, the relevant slopes to consider are the slopes beneath areas of potentially hazardous vegetation, defined as “effective slope” in AS 3959-2018, that would be retained within or adjacent to the proposed development site. Also relevant, is whether the vegetated land is situated upslope or downslope of the proposed development. As fire travels faster upslope, there is a significant reduction in risk and fire-line intensity for sites that sit below the vegetation. The potentially hazardous vegetation is located downslope of the proposed development. Refer **Figure 8**.

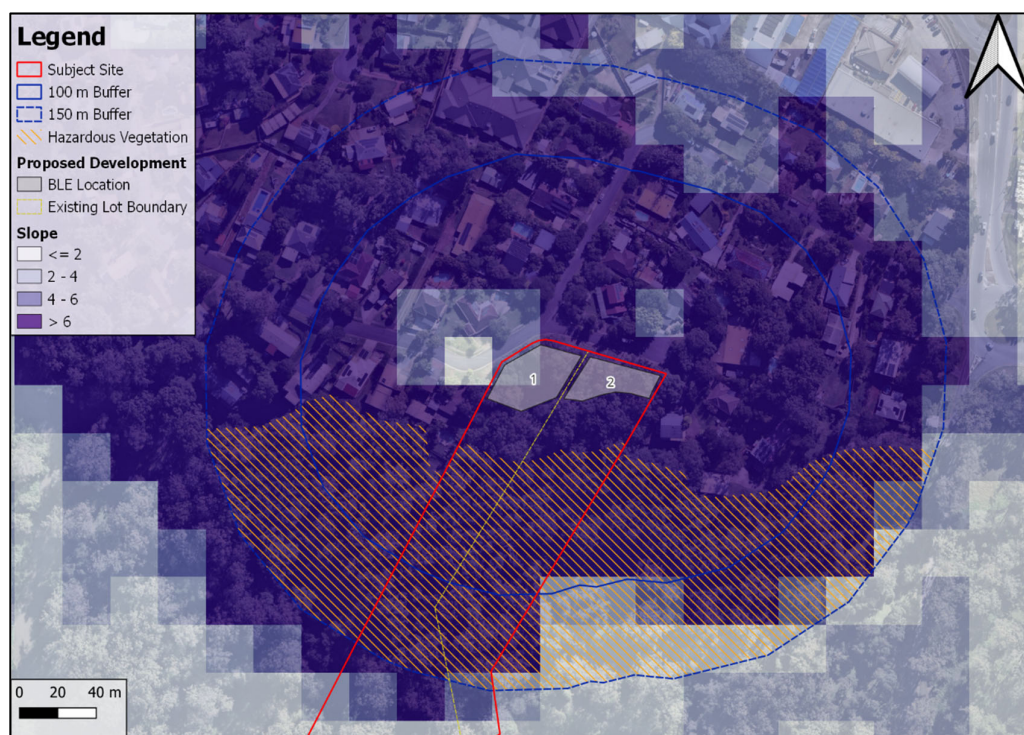


Figure 8. Slope in Proximity to the Proposed Development

4.1.6 Forest Fire Danger Index

In accordance with the Australian Standard (AS) 3959-2018, *Construction of Buildings in Bushfire Prone Areas*, the Fire Danger Index (FDI) indicates the chance of a fire starting, its intensity, rate of spread and the difficulty of its suppressions, according to several combinations of relative humidity, air temperature, wind speed as well as long- and short-term drought effects. The QFES Catalyst Mapping indicates that the site-specific Forest Fire Danger Index (FFDI) for the subject site is **54**.

4.1.7 Final PFLI

A final PFLI for patches of potentially hazardous vegetation (determined in **Section 4.1.4**) has been calculated using the PFLI equation in **Section 3.1**. Based on this PFLI calculation, the potentially hazardous vegetation to the south of the development area was mapped to contain areas of Medium PFLI (i.e., 4,000 – 20,000 kW/m), associated with VHC 16.1, and areas of High PFLI (i.e., 20,000 – 40,000 kW/m) and Very high PFLI (>40,000 kW/m), associated with VHC 9.1 vegetation. Refer to **Figure 9**.

4.2 Hazardous Vegetation

Vegetation mapped as VHC 9.1 and VHC 16.1 to the south of the proposed development were determined to be the hazardous vegetation within the assessment area. As this vegetation is within 100 m of the proposed development area, the proposed residential BLEs are therefore within a Bushfire Prone Area. As such, a radiant heat exposure assessment has been conducted to determine the radiant heat flux the residential subdivision may be exposed to, and what BAL score and subsequent building requirements the future dwellings will have to adhere to.

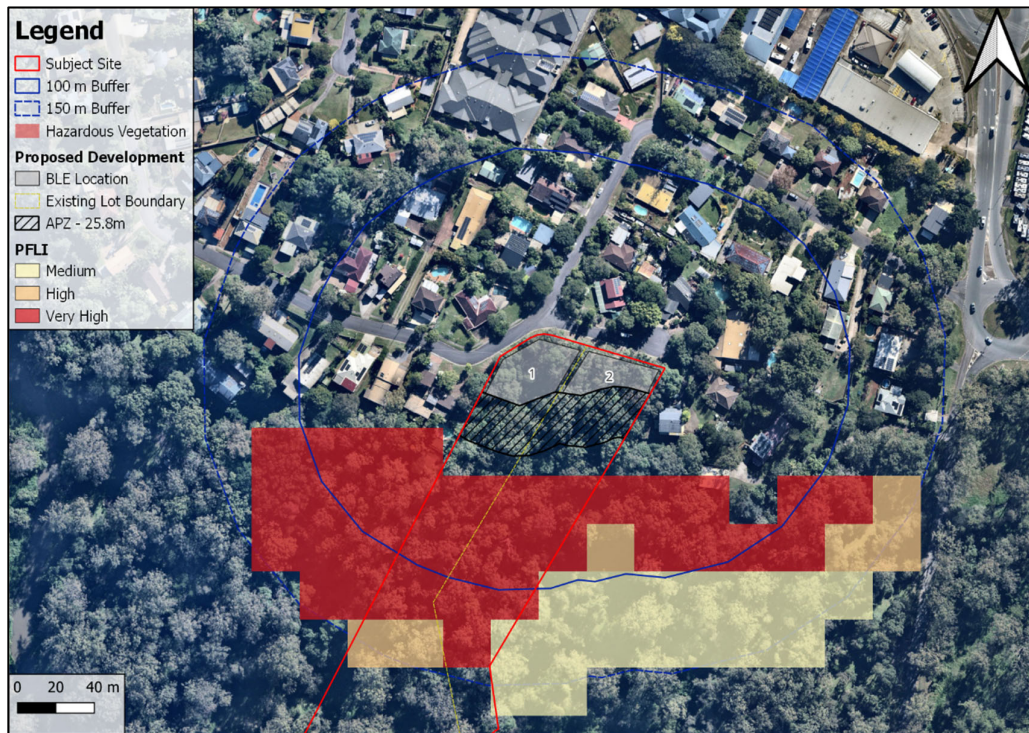


Figure 9. Potential Fire Line Intensity

5.0 RADIANT HEAT EXPOSURE ASSESSMENT

This radiant heat flux assessment has focused on the potential impact of a fire event in hazardous vegetation located within 100 m of the subject site. Hazardous vegetation in relation to the proposed development was determined to be the vegetation to the south of the proposed BLEs (refer to **Figure 9**). A Method 2 assessment in accordance with AS3959-2018 utilising the Flamesol Minimum Distance Calculator was undertaken to determine the required setbacks for the proposed development, from the hazardous vegetation (see **Table 7** and **Figure 10**). Refer to **Appendix B** for inputs and outputs from the Flamesol Minimum Distance Calculator, as well as the slope calculator.

Table 7. Summary of Setbacks and BAL Scores for the Proposed Development

Radiant Heat Exposure (kW/m ²)	BAL Score	Distance from hazardous vegetation to the South
-	Low	100 m
12.5	12.5	48.6 m
19	19	36.3 m
29	29	25.8 m
40	40	19 m
> 40	FZ	< 19 m

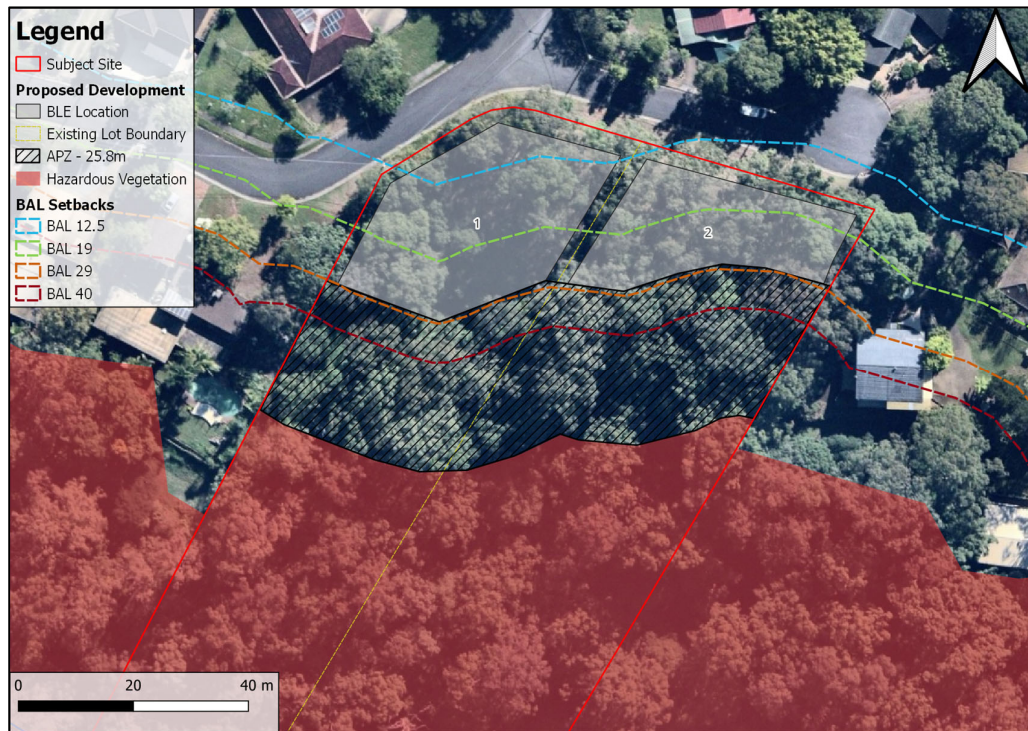


Figure 10. BAL Setbacks for the Proposed Development

Based on the results of the radiant heat flux assessment, future dwellings within the BLEs can achieve a BAL 29 score following the implementation of the proposed APZ. Further detail of this APZ is provided in **Section 6.3.5**. It should be noted that the final sitting of the dwelling within the BLE will determine final BAL score. Accordingly, a Bushfire Management Plan has been prepared and presented in **Section 6.0**.

6.0 BUSHFIRE MANAGEMENT PLAN

This Bushfire Management Plan (BMP) identifies management measures that must be implemented to ensure that the risk of bushfire attack is reduced to an acceptable level. It is first important to understand the processes that influence bushfire behaviour (**Section 6.1**), and the sources of damage that threaten people, infrastructure and property (**Section 6.2**).

6.1 Bushfire Behaviour

Understanding bushfire behaviour is imperative when planning new development. There are three main factors which influence fire behaviour as follows:

1) Topography

Slope influences the speed and intensity of a fire. Fire is known to burn faster uphill as flames and radiant heat preheat the vegetation ahead of the fire, drying it out and making it increasingly flammable. As a rule of thumb, for every 10 degrees slope, fire doubles in speed. Refer to **Figure 11**, below.

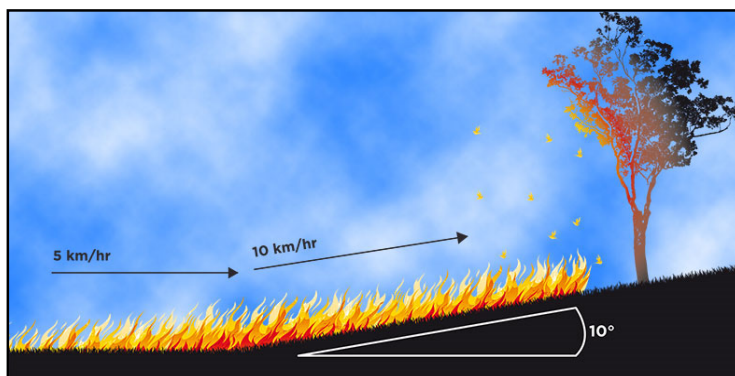


Figure 11. Effects of Topography on Bushfire (source: Country Fire Authority)

2) Weather Conditions

Bushfire weather conditions are fundamentally defined by temperature, humidity, wind, atmospheric conditions and past rainfall. For example, summer weather conditions increase the flammability of vegetation. Wind influences the speed and direction in which fire travels, fire intensity and possibility of spot fires from burning debris. A measure of weather conditions is the Forest Fire Danger Index (FFDI) and Grassland Fire Danger Index (GFDI). These measures are useful in determining the fire danger rating (refer to **Fire Danger Rating** in **Figure 12**).

3) Vegetation

Vegetation is the source of fuel for a bushfire. The amount of fuel surrounding a building can directly impact a building's survival. Vegetation management, landscaping for bushfire and breaking the continuity of vegetation can limit the spread of fire.

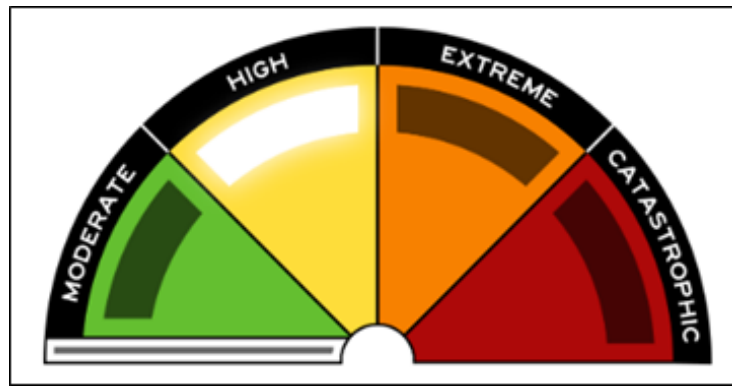


Figure 12. Fire Danger Rating (source: Queensland Government, Emergency Services and Safety)

6.2 Bushfire Damage Sources

The Country Fire Authority (2009) states, “*Bushfires can vary in intensity and scale across the landscape*”. As the past bushfire events throughout Australia have illustrated, bushfires can be devastating and lead to long-running fires which are difficult to suppress. Building survival is influenced by many interacting factors. The four main ways buildings are destroyed during a bushfire include:

- Ember attack;
- Radiant heat;
- Direct flame contact; and
- Fire-driven wind.

Ember Attack

Research indicates that the most common way buildings catch on fire is through ember attack (80% of house loss). Ember attack occurs when small burning twigs, bark, leaf are carried by wind and land in and around a building. Embers can ignite flammable plants, leaf litter, fences, outdoor furniture and sheds (refer to **Figure 13**, below). Ember attack is addressed within the AS 3959-2018 through Construction Standard requirements.

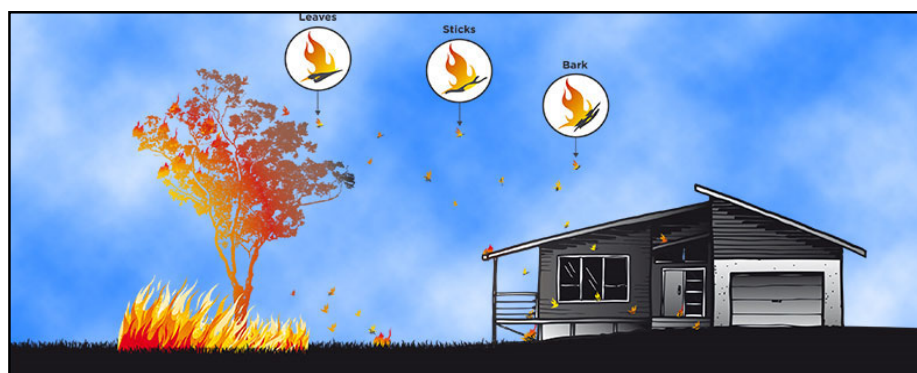


Figure 13. Ember Attack (source: Country Fire Authority)

Radiant Heat

Radiant heat is the heat created from burning fuel during a bushfire. Radiant heat can ignite surfaces without direct flame contact or ember attack, dry out vegetation ahead of the bushfire, crack glass (allowing embers to enter a building) and distort and melt materials (refer to **Figure 14**, below). The most common cause of loss of human life is via radiant heat (CFA, 2018).



Figure 14. Radiant Heat (source: Country Fire Authority)

Direct Flame Contact

Direct flame contact occurs when a fire front reaches a building, this is referred to as the 'Flame Zone'. Approximately 20% of house loss occurs when houses/buildings are directly adjacent to bushland.

Fire-driven Wind

Fire-driven wind can carry embers, cause trees to fall onto buildings, can break windows and destroy structures. The closer a building is to a fire front, the more severe the impact of fire-driven wind.

6.3 Management and Mitigation Measures – Permanent Buildings

Management and mitigation measures are generally outlined in relevant planning instruments at both the State and Local Government level.

Mitigation measures emphasize resilience to bushfire and are categorised into the following groups for the permanent structures within the site.

- Layout design;
- Building and construction requirements;
- Firefighting infrastructure;
- Bushfire emergency plan; and
- Vegetation management and landscaping

Layout Design

Access and Egress

Access to the future dwellings will be in the northern extent of the lots directly onto Panorama Outlook and Webb Street. The proposed driveways will provide egress away from hazardous vegetation to the south of the site in the case of a bushfire event. Panorama Outlook and Webb Street are considered suitable to carry emergency fire-fighting appliances, provide emergency evacuation and prevent entrapment during a bushfire.

Siting of Development

The proposed development is situated within 100 m of potentially hazardous vegetation to south of the development area. As mentioned above, with the implementation of a 25.8 m APZ, the future dwellings within the proposed BLEs can achieve a BAL 29 scores. This BAL score have been modelled utilising the Flamesol BAL Minimum Distance Calculator (refer to **Appendix B**). It should be noted that the final sitting of the dwelling within the BLE will determine final BAL score. The siting of the development is considered to ensure the proposed development is exposed to an acceptable level of bushfire risk.

Building and Construction Requirements

In accordance with the BCA, the AS 3959-2018 requirements for construction of buildings applies to any new Class 1, 2, 3 or 10a Building (when ancillary to a Class 1, 2, or 3 Building). Therefore, any future habitable Class 1, 2 and/or 3 buildings and their ancillary Class 10a building/s within the development must adhere to the relevant BAL construction Standards based on their location.

Early Warning Systems

Smoke alarms should be installed in accordance with the Building Code of Australia and the AS 3786-1993 - *Smoke Alarms*. The Queensland Fire and Emergency Services recommends photoelectric smoke alarms (not ionization alarms). Photoelectric smoke alarms are generally more effective than ionization types as they detect visible particles of combustion.

Firefighting Infrastructure

The site is expected to be connected to a reticulated water supply network. It is expected that the reticulated water supply network within the area complies with the provisions outlined in the SEQ Water Supply, Sewage Design and Construction Code.

Bushfire Emergency

In the event of a Bushfire Emergency, the local QFES should be contacted immediately. The Woodridge Fire Station is located approximately 9.6 km (by road) to the north-east of the subject site. The contact details for the Woodridge Fire Station are:

- Address: 95-105 Kingston Rd, Woodridge QLD 4114
- Phone: (07) 3297 9101

Please note that in fire emergencies the triple zero (000) emergency telephone number should be used.

Asset Protection Zone (APZ)

The QFES acknowledges the type, location and ongoing maintenance of landscaping as a necessary Bushfire Protection Measure. An Asset Protection Zone (APZ) has been proposed to the south of the development area. The BMZ will extend approximately 25.8 m from the southern extent of the BLEs. Refer to **Figure 15**.

Any grass within the APZ should be regularly mown and kept no more than 100 mm in height and further, any leaves and fallen woody debris must be regularly removed. Shrub layer and ground cover should be removed to reduce fuel load and mitigate risk. Scattered canopy trees may be retained within the APZ, however retained trees must achieve canopy separation. This APZ must be maintained in perpetuity to guarantee ongoing protection from bushfires in the locality. Maintenance of the APZ should be most strictly implemented prior to the bushfire season.

Vegetation Management and Landscaping

S5 Environmental recommend that future lot owners adhere to the following advice (outlined in the SPP Technical Reference Guide – Bushfire Resilient Communities) on low flammability landscaping.

Landscaping plays an important role in increasing a buildings' ability to endure bushfire attack. Landscaping for bushfire reduces the risk of ember attack which is the most common cause of building loss during bushfire. This includes utilisation of low flammability treatments such as rock mulches, concrete retaining blocks, and appropriate plantings.

Appropriate plant attributes to consider implementing in landscape design to reduce bushfire risk include:

- High leaf moisture content;
- Lower volatile oil content;
- Higher leaf mineral content;
- Broad-leaved species;
- Resilience to pruning;
- Low ignition likelihood;
- A low volume of persistent dead leaves/branches;
- Smooth or tightly held bark; and,
- Leaves and twigs that do not regularly fall,

Management of landscaped areas should ensure that there is no accumulation of litter and woody debris on garden beds and should ensure that there is horizontal and vertical separation of plants. Any grass within the proposed lots should never exceed 10 cm in height. Irrigation of garden and greenery areas could be considered to ensure a well-watered, low flammability landscape.

The Victorian Country Fire Authority (CFA) have produced an online Plant Selection Key which facilitates landscape designers and property owners to select fire wise garden plants. The CFA have also produced the publication 'Landscaping for Bushfire: Garden Design and Plant Selection' (CFA, 2011). The publication outlines planning, designing, choosing suitable plants, maintaining gardens and provides a Plant Selection Key, and can be obtained from their website.

In addition, trees should not overhang the roofline of the building, touch walls or other elements of a building and plants greater than 10 centimetres in height at maturity must not be placed directly in front of a window or other glass feature.

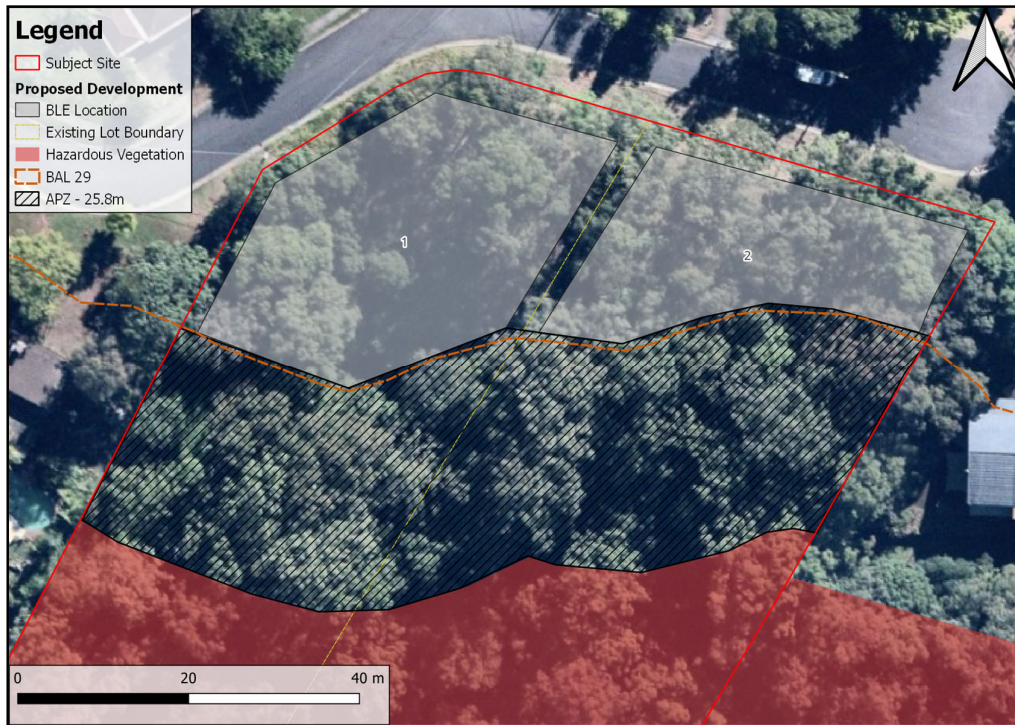


Figure 15. Proposed Asset Protection Zone

7.0 CONCLUSION

This Bushfire Hazard Assessment concluded that the proposed development is within 100m of potentially hazardous vegetation to the south. The AS3959-2018 Method 2 radiant heat flux exposure assessment for the proposed development determined future dwellings located within the BLEs will achieve a maximum BAL score of 29. Accordingly, all dwellings exposed to BAL 12.5 or greater, will have to adhere to the relevant construction requirements set out in AS 3959-2018.

S5 Environmental have prepared a site-specific Bushfire Management Plan has to support the proposed residential development, which recommends key mitigation measures to be implemented to ensure the risk to people, infrastructure and property is acceptable and minimised.

Overall, the proposed development complies with the relevant LCC bushfire related assessment benchmarks, refer to **Appendix A**.

8.0 REFERENCES

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APPENDIX A

LCC Bushfire Hazard Overlay Code Response

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
For accepted development (subject to requirements) and assessable development.			
Location, design and siting of development			
PO1 Development is designed to: a. minimise risk of bushfire hazard; b. provide safe premises; c. create efficient emergency access for fire-fighting and other emergency vehicles. Note - Planning scheme policy 6 - Management of bushfire hazard provides guidelines on how to achieve this outcome.	AO1 Development: a. does not increase the number of persons living in, or lots in, the Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or b. is on a site that a bushfire hazard assessment prepared in accordance with the methodology in Planning scheme policy 6 – Management of bushfire hazard determines is of low bushfire hazard	Complies S5 Environmental have prepared a site-specific Bushfire Hazard Assessment and Management Plan which has also included surrounding areas (within 150 m) in accordance with the <i>Logan Planning Scheme 2015</i> Bushfire Hazard Overlay Code and SC6.2.6 Management of Bushfire Hazard. Post development, the development area will be Low Potential Bushfire Intensity (< 4,000 kW/m²), with areas of Medium, High and Very high PFLI located to the south. Future dwellings within the proposed BLEs will achieve a maximum BAL score of 29. Final siting of the dwelling within the BLE will determine the final BAL score. The proposed BLEs will front directly onto public road, and provide access and egress away from hazardous vegetation in the south of the site.	

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
PO2 Development is sited and constructed to minimise the bushfire hazard and maximise the protection of life and property from bushfire. Editor's note - Planning scheme policy 6 - Management of bushfire hazard contains guidance on the preparation of bushfire management plans.	A02 Development is located and constructed: a. where there is no bushfire management plan approved by an existing development approval: i. such that the bushfire attack level is less than or equal to BAL-29; ii. away from the most likely direction of a fire front; iii. so that elements of the development least susceptible to fire are sited closest to the bushfire hazard; iv. such that asset protection zones are sited on land with a slope less than 18 degrees; v. such that asset protection zones are entirely within the boundaries of the private property of the development site; or b. where an approved bushfire management plan directs development to be located. Note - BAL = Bushfire attack level is the radiant heat flux a building will experience during a bushfire and is a measure of heat energy impacting on a surface expressed as kW/m2. BAL is calculated from the following factors; vegetation type, fuel loads, distance to vegetation, Forest Fire danger Index (FDI), flame length, fire behaviour/intensity and slope. BAL is used to determine the required construction level of a building and the size of asset protection zones (inner and outer radiation zones). Further information on calculating the BAL can be obtained from AS3959-2009. Editor's note - Asset protection zones are not located on slopes greater than 18 degrees to ensure maintenance is practical, soil stability is not compromised and the potential for crown/canopy fires is reduced.	Complies S5 Environmental understand that, following the application of the recommendations outlined within this report, the maximum radiant heat flux the proposed development will be exposed to is 29 kW/m ² , equivalent to BAL 29.	

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
PO3 Reconfiguring a lot ensures that lots are designed to minimise bushfire hazard and provide safe sites for people, property and buildings.	AO3 Lots: a. are suitable for people, property and buildings by: i. having a bushfire attack level less than or equal to BAL-29; or ii. containing a development envelope area that has a bushfire attack level less than or equal to BAL-29; b. provide asset protection zones that: i. are located on land with a slope less than 18 degrees; ii. are located on the same lot.	Complies The maximum radiant heat flux the proposed BLEs will be exposed to is 29 kW/m ² , equivalent to BAL 29.	
Vehicular access and fire maintenance trails			

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
PO4 Access for fire management and evacuation is provided by access that: - separates premises from adjoining vegetation; - is safely accessible by fire fighting vehicles; - has regular vehicular access points for bushfire management, response and evacuation; - has regular vehicle passing and turning areas for bushfire management, response and evacuation; - allows access at all times for fire fighting vehicles; - allows for maintenance, burning off and bushfire response; - has vehicular links to an alternative through road; - is readily maintained. Editor's note - Planning scheme policy 6 - Management of bushfire hazard provides details on alternative solutions for providing fire management access and evacuation	AO4 Access for fire management and evacuation is provided by vehicular access in the form of a perimeter road: - with a minimum reserve width of 20 metres; - located between the premises and adjoining vegetation; - with a maximum gradient of 12.5 percent; - constructed to otherwise comply with section 3.4 - Movement infrastructure standards of Planning scheme policy 5 - Infrastructure; - that has a layout that does not include a cul-de-sac.	Performance Solution As the development is for two residential BLEs within existing allotments, which front directly onto public roads, such access it not deemed necessary in this instance. Further, a managed APZ is proposed adjacent the hazardous vegetation. Refer to Section 6.3 .	
Water supply			
PO5 Development has access to adequate water supply for fire fighting purposes.	AO5 Development: is connected to a reticulated water supply scheme that has sufficient flow and pressure characteristics for fire fighting purposes at all times with a minimum pressure and flow of 10 litres per second at 200kPa; or	Complies S5 Environmental understand the subject site will be connected to a reticulated water supply which has sufficient flow and pressure characteristics to meet the Planning Scheme requirements.	

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
	b. has an on-site water storage in accordance with Table 8.2.3.3.2 - Water storage for fire fighting, dedicated or retained for fire fighting purposes that is made of fire resistant materials and is: i. a separate tank; or ii. a reserve section in the bottom part of the main water supply tank. Editor's note - The requirement in AO5 is: - in addition to the requirement for potable water supply/storage in AO2 in Table 9.4.3.3.1 - Infrastructure code: accepted development (subject to requirements) and assessable development; - reflected in AO5 in Table 9.4.3.3.1 - Infrastructure code: accepted development (subject to requirements) and assessable development.		
For assessable development			
Community infrastructure			
PO6 Community infrastructure is not located in a bushfire hazard area or is able to function effectively during and immediately after a bushfire event.	AO6 Community infrastructure is: a. not located in a Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or b. located to ensure that: i. the core services provided by the community infrastructure is able to function effectively during bushfire events; ii. access to the community infrastructure is not compromised by bushfire events; iii. the safe storage of valuable records, public records and items of cultural or historic significance is able to be maintained during a bushfire event.	Not applicable The proposed development does not involve community infrastructure.	

PERFORMANCE OUTCOMES	ACCEPTABLE OUTCOMES	COMMENTS	COUNCIL USE ONLY
		✓ Complies X Non-Compliance PS Performance Solution NA Not Applicable	
Hazardous materials			
PO7 Public safety and the environment are not adversely affected by the adverse impacts of bushfire on hazardous materials including fuels, explosives and flammable chemicals manufactured or stored in bulk on premises.	A07 Hazardous materials: a. storage is in compliance with AS1940 - The storage and handling of flammable and combustible liquids; b. manufacturing does not occur in a Bushfire hazard area on Bushfire hazard overlay map OM-03.00.	Not applicable The proposed development is for a residential BLEs, and S5 Environmental understand will not involve the storage and handling of flammable and combustible liquids.	

APPENDIX B

Flamesol Inputs and Outputs

Summary of Input Parameters of Hazardous Vegetation to the South

Parameter	Input	Note
FFDI	54	Source: QFES Catalyst Mapping.
Surface Fuel Load	17.5 t/ha	Mixed polygon: 0.52 % surface fuel load for VHC 9.1 (21t/ha) +0.48 % surface fuel load for VHC 16.1 (13.8t/ha).
Overall Fuel Load	20.26 t/ha	Mixed polygon: 0.052 % overall fuel load for VHC 9.1 (24.2t/ha) +0.48 % overall fuel load for VHC 16.1 (16t/ha).
Effective Slope	10.8 °	The slope under hazardous vegetation slopes up steeply to the proposed development.
Site Slope	20 °	The slope between the proposed development and hazardous vegetation slopes up steeply. A maximum input of 20 ° was utilised.
Flame Temperature	1,200 K	Standard input, in accordance with the BRC.
Flame Width	100 m	Standard input, in accordance with the BRC.



Calculated August 7, 2024, 1:08 am (MDc v.4.9)

Panorama Outlook

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	54	Rate of spread	2.38 km/h
Vegetation classification	Forest	Flame length	17.96 m
Understorey fuel load	17.5 t/ha	Flame angle	82 °, 88 °, 93 °, 96 °, 97 ° & 103 °
Total fuel load	20.26 t/ha	Elevation of receiver	1.97 m, 0 m, 0 m, 0 m, 0 m & 0 m
Vegetation height	n/a	Fire intensity	25,009 kW/m
Effective slope	10.8 °	Transmissivity	0.845, 0.824, 0.799, 0.778, 0.768 & 0.719
Site slope	20 °	Viewfactor	0.4215, 0.3136, 0.2125, 0.1436, 0.116 & 0.031
Flame width	100 m	Minimum distance to < 40 kW/m ²	19 m
Windspeed	n/a	Minimum distance to < 29 kW/m ²	25.8 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m ²	36.3 m
Flame temperature	1,200 K	Minimum distance to < 12.5 kW/m ²	48.6 m
		Minimum distance to < 10 kW/m ²	56.1 m

Flamesol Calculator Outputs for Required Setbacks from Hazardous Vegetation to the South

APPENDIX C

Slope Calculations

Summary of Slope Calculations for Hazardous Vegetation

Vegetation to the South							
Effective Slope				Site Slope			
Direction	Uphill			Direction	Uphill		
Top Elevation	21 m			Top Elevation	34 m		
Bottom Elevation	1 m	Slope %	18.87%	Bottom Elevation	21 m	Slope %	50.00%
Distance	106 m	Slope (°)	10.81	Distance	26 m	Slope (°)	28.65

