BUSHFIRE MANAGEMENT PLAN

Lots 3, 5 and 6 on RP180932

160 Daleys Road, Ripley

Client Reference: 010.07.19

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DOCUMENT CONTROL **Bushfire Management Plan**

Client: **Orchard (Daleys) Developments Pty Ltd**

Client Reference: **011.07.19**

Project: **RoL and MCU**

Site Location: **160 Daleys Road, Ripley**

Version	Date	Status	Changes	Author	Approver
Rev 0	29.07.2019	First Draft		AH	AH
Rev 1	19.08.2019	Final Report		AH	AH
Rev 2	17.09.2019	Final Report	Typo corrections	AH	AH
Rev 3	23.04.2020	Final Report	Layout changes and IR response	AH	AH

Contents

1.0 Introduction

This report has been commissioned by the Orchard (Daleys) Developments Pty Ltd in order to support aa amendment Application for the subdivision of Lots 3, 5 and 6 on RP180932 (the "Subject Lots") into 439 Lots, an Open Space Area, two Stormwater Management Areas and a Local Park; and also in compliance with the Building Code of Australia (BCA), in respect of future buildings on each of the residential Lots.

Ipswich City Council (ICC) bushfire hazard overlay mapping classifies the entire area of the Subject Lots and adjacent Lots as "bushfire prone area" (BPA). The hazard mapping is created from data that is collected remotely to combine vegetation data with slope and aspect data, and arrive at a hazard rating based on a model specified in State Planning Policy (SPP) 01/03 (*Mitigating the adverse impacts of flood, bushfire and landslide*).

SPP 01/03 was replaced by State Planning Policy– Natural Hazards, Risk & Resilience (2013, latest version July 2017) accompanied by *A new methodology for State-wide mapping of bushfire prone areas in Queensland* (CSIRO 2014) with bushfire hazard mapping which also designates the Subject Lots as BPA.

The designation by Council of land being BPA has two main implications:

1. It requires the production of a Bushfire Management Plan which complies with the Ipswich Planning Scheme (in this case Part 11, Division 4 (Bushfire Overlay Code).
2. It invokes the Building Code of Australia (BCA), requiring compliance with its bushfire related function performance objectives and with AS3959-2018 *Construction of buildings in bushfire prone areas*.

This Bushfire Management Plan objectively determines the nature and severity of potential worst case wildfire in the area, and develops risk mitigation measures to be used in combination with established construction needs in accordance with AS3959-2018. It is the implementation of all these protection measures in combination, that will demonstrate the viability and conformance of the proposed development in the development application process.

2.0 Site and Development Description

2.1 Property Description

Site ID:	Lots 3, 5 and 6 on RP180932 Parish of Ipswich, County of Stanley.
Current address of property:	160 Daleys Road, Ripley, QLD 4306.
Local Government Area:	Ipswich City Council.
Total Area:	34.156ha
Zoning:	Future Urban

2.2 Proposed Development

The proposed development is planned to create 439 Lots, an Open Space Area, two Stormwater Management Areas and a Local Park.

2.3 Site Location and Layout

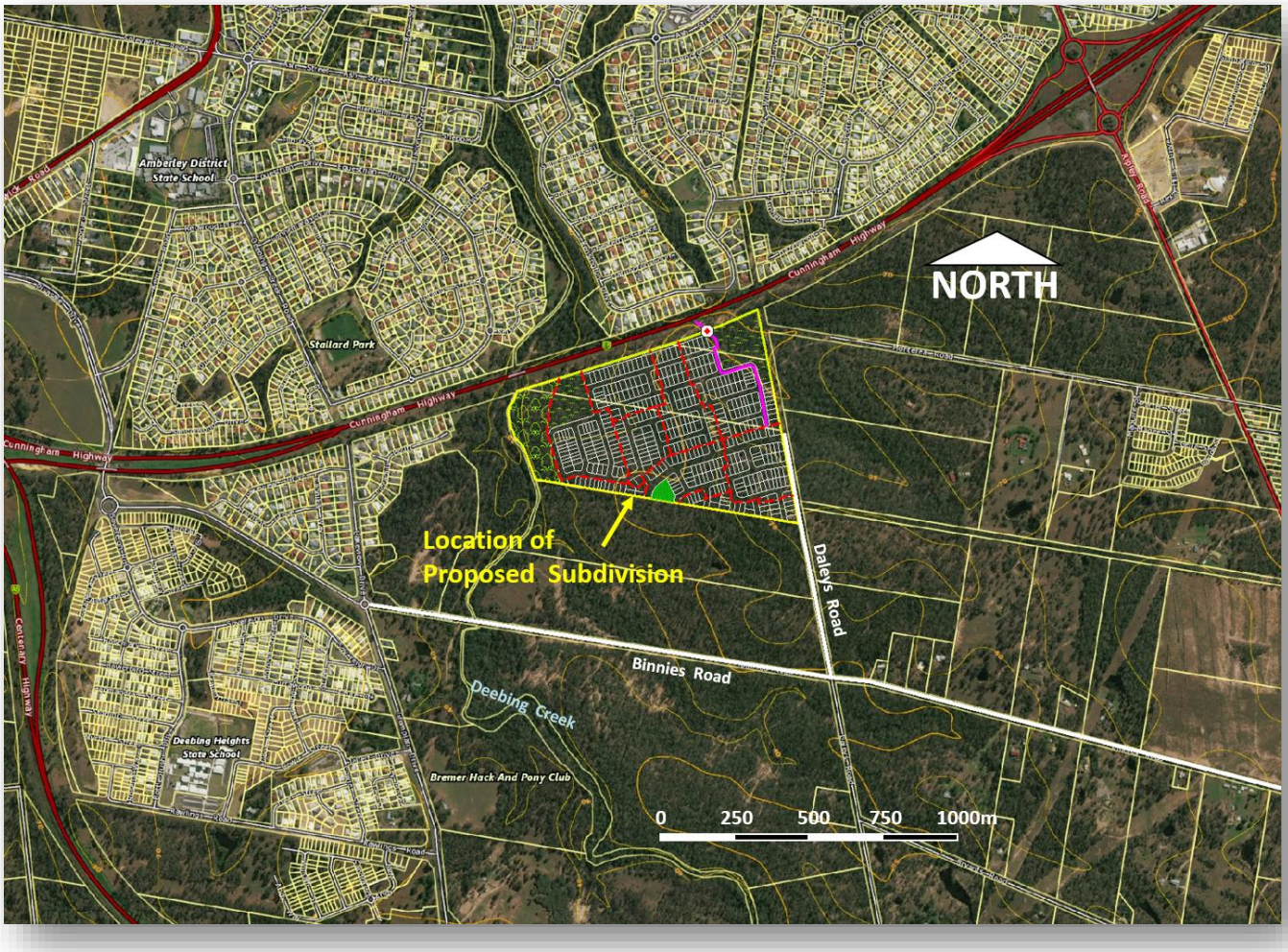

Figure 1. Broader area showing the location of the proposed development.

Located on the southern side of the Cunningham Highway, between Deebing Creek and Daleys Road, the site abuts extensive areas of open forest to the west, south and east. Relatively poor soil fertility and water holding capacity limits biomass production, and light grazing pressure (cattle) combines with additional grazing by macropods and hares, so that available fuel loads are well below the default values attributed by State Government to the mapped Regional Ecosystem present.

The Daleys Road reserve will be cleared for the construction of the main access, and in the northern section a water main and bike path, providing a 20m setback for Lots at the eastern interface. Perimeter roads help to protect new lots closest to the Open Space area to the west. Stormwater Management Areas will be revegetated.

The development will occur in eight Stages, with clearing proposed on a sequential Stage by Stage basis, including a 30m bushfire buffer beyond the Stage boundary. This is to ensure that the construction of new dwellings at the stage boundary does not need to exceed BAL 19 when taking into account finished level contours. In addition to this clearing there may be times throughout the development where minor clearing may be required to accommodate fill/stockpiling materials. Stage 8 will be deferred until the adjacent Lot to the south is developed.

The justification of the 30m bushfire buffer is provided in Section 6.3 of this Plan. At the completion of each Stage, a Bushfire Attack Level Assessment will be provided for the most exposed Lots, and whilst the 30m bushfire buffer means that none will exceed BAL 19, the assessment provided before Plan sealing will be more accurate than if an attempt is made at this DA Stage to provide an accurate BAL Assessment for all Lots at each Stage.

This Plan is however able to demonstrate with relative accuracy, the BAL contours for the development at completion, including the most exposed Lots 501, 778 and 701.

Access and egress will be via Daleys Road and Binnies Road (to the west and/or to the east). Until such time as Lots to the adjacent south are developed, this access/egress route is potentially threatened by thick smoke. The emergency management arrangements for the site will recognise this hazard and require residents to either remain in place, or in the event of individual (eg. Medical) emergency if the main access is compromised, use the route provided via Stage 7 and the Cunningham Highway (shown in purple in Figures 1 and 2).

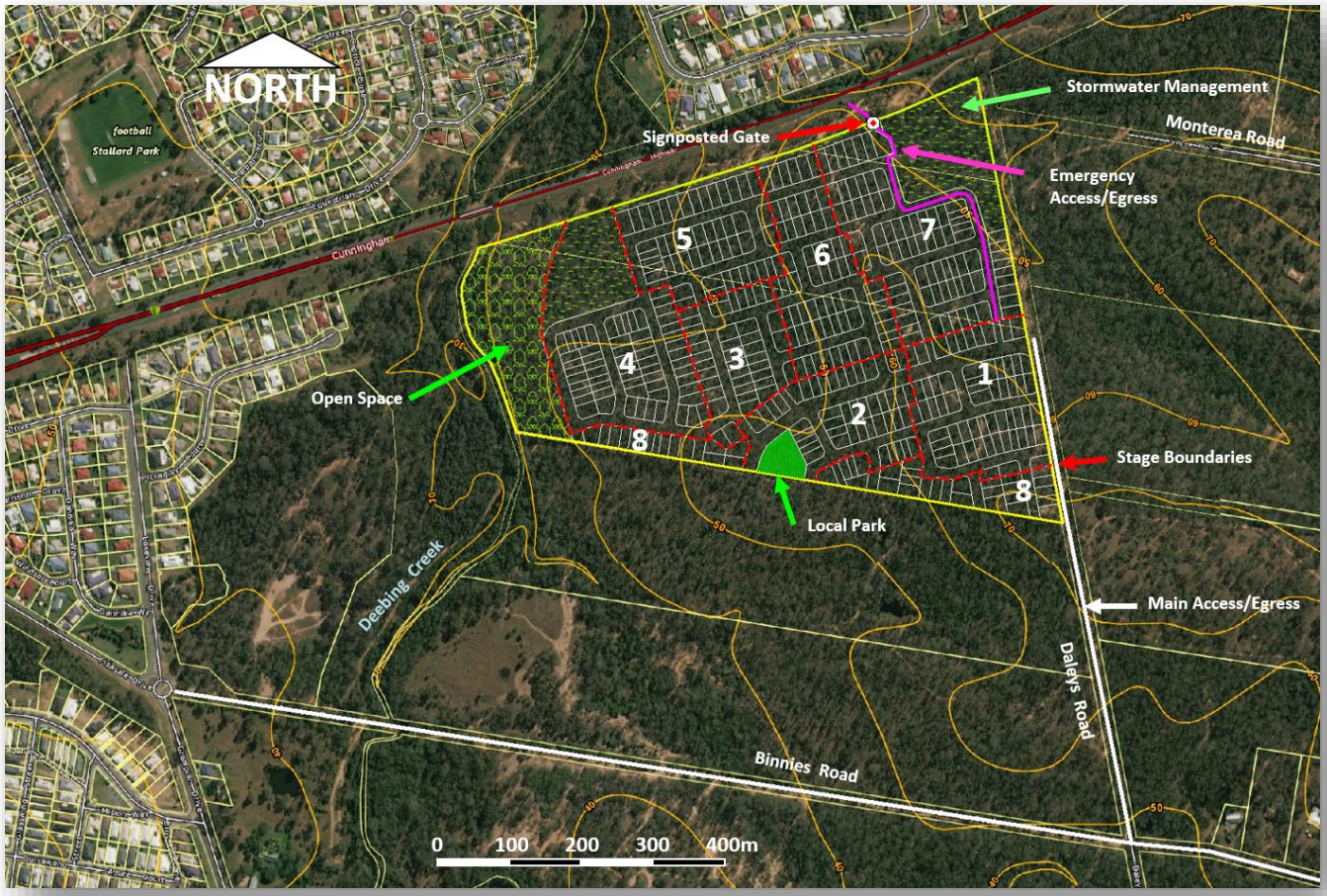

Figure 2. Proposed Subdivision

The site is within approximately 3km by road of the nearest Queensland Fire and Emergency Services (Ripley Rural Fire Station).

3.0 Bushfire Hazard Assessment

3.1 Bushfire hazard classification

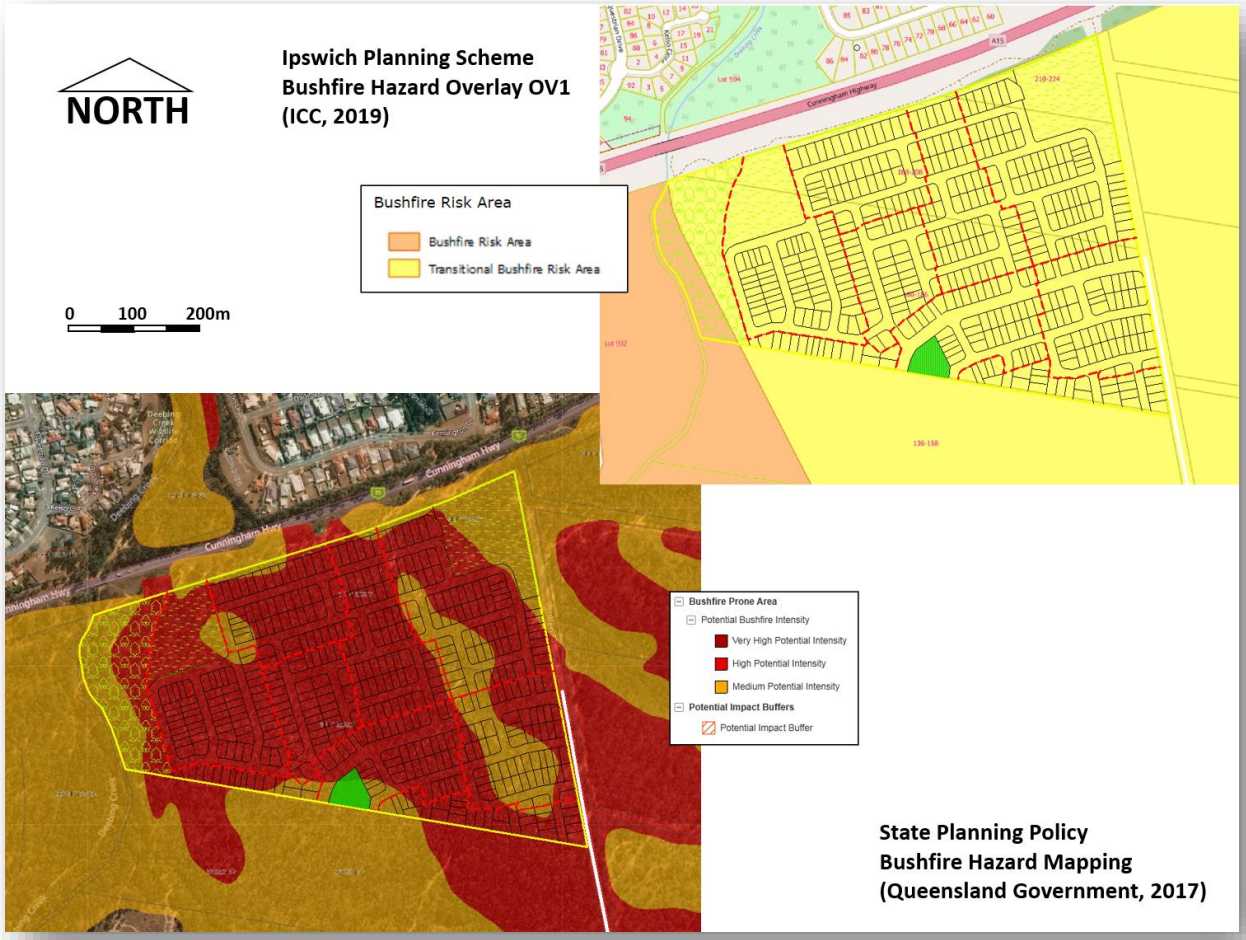

Figure 3. Council and latest State bushfire hazard mapping

"Bushfire Prone Land" is defined under the BCA and SPP01/03 as an area **identified as such by Local Government** (using the methodology specified in Appendix 3 of SPP01/03); and using "medium and high hazard" as indicators of bushfire prone land. Table 1 validates the forested areas closest to site as "medium" hazard (and hence BPA) according to this methodology. Note that the forested area to the west has been omitted from classification in error. Neither State nor Council hazard overlay claim to be perfect, and both are subject to ground validation.

Bushfire hazard assessment SPP01/03 Methodology		
Date: 25th June 2019		
Characteristic	**Description**	**Hazard score**
Vegetation	Eucalypt forest with dry shrub ladder fuels	6
Slope	Undulating > 5 – 10%	2
Aspect	Various, generally northerly to westerly	3
Total hazard score	**Medium**	**11**

Table 1. SPP01/03 Methodology applied to forested areas closest to the site

AS3959-2018 specifies building implications within 100m of designated bushfire prone land, or more strictly speaking, within 100m of intact, classified vegetation (50m in the case of grassland). This BMP establishes Bushfire Attack Levels (BALs) for affected Lots, using a combination of Methods 1 and 2 approach under AS3959-2018.

SPP 01/03 was replaced by State Planning Policy – Natural hazards, risk and resilience (December 2013, latest version July 2017) accompanied by *A new methodology for State-wide mapping of bushfire prone areas in Queensland* (CSIRO 2014) with bushfire hazard mapping shown in Figure 3 which also designates the site a "bushfire prone area" (BPA).

3.2 Vegetation Assessment, Slope and Separation Distances from Proposed Development

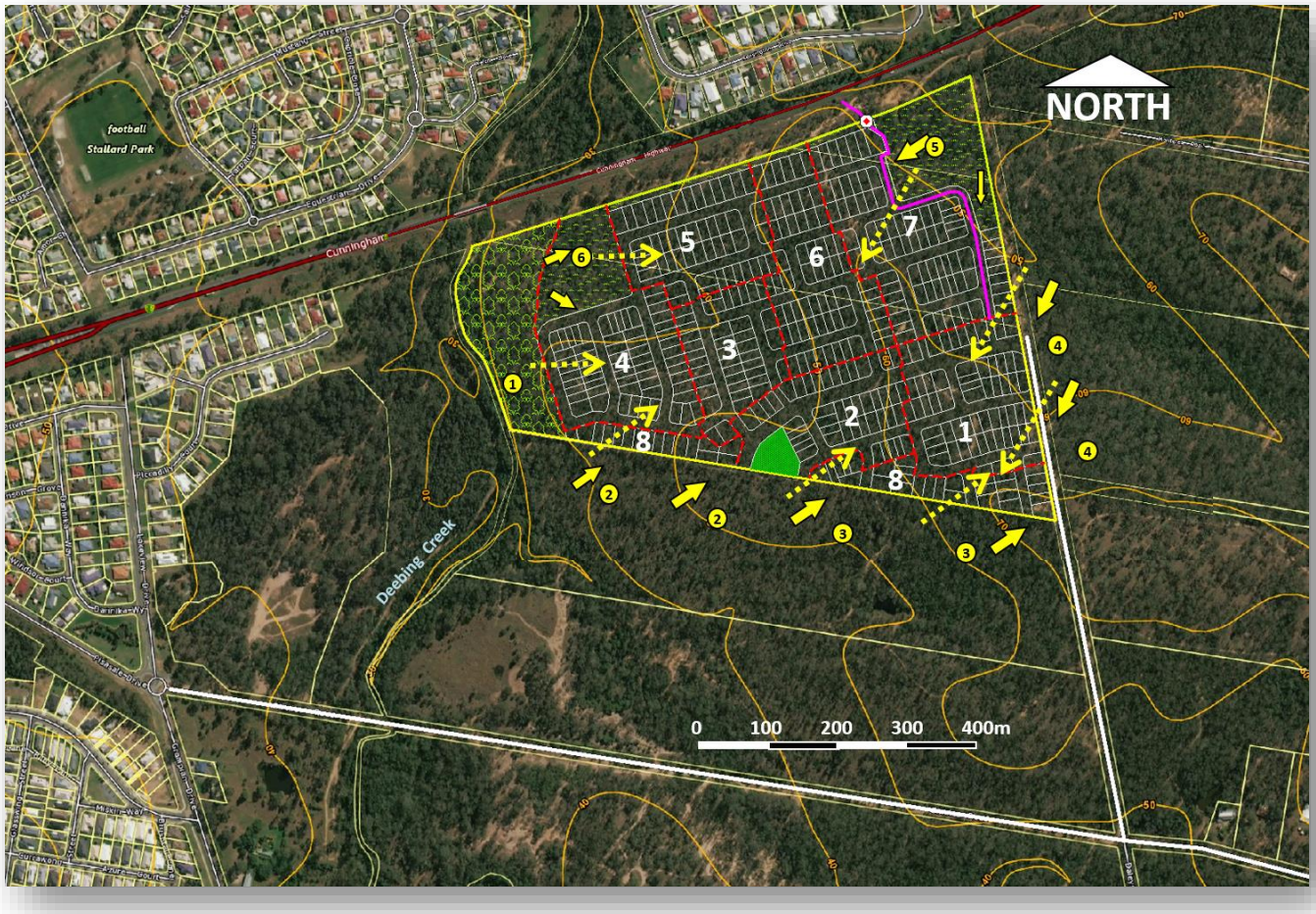

Figure 4. Fuel Zones Assessed Solid yellow arrows indicate most likely direction of bushfire attack, dotted arrows in the form of embers. Contours shown are 10m.

Figure 4 shows the seven main fuel zones assessed, and which are relevant at the completion of the development. The average slope is taken as 8° Down slope for Area 1, 6° Down slope for Area 2 and 3 and 4° Down slope for Area 4.

This assessment enables minimum "bushfire buffer" to be determined, to be cleared ahead of each Stage, to ensure that new dwellings do not require construction above BAL 19.

Section 6 objectively calculates and determines the potential nature and severity of bushfire attack more thoroughly. This serves as a basis for determining the construction and other bushfire protection measures outlined in this BAL Assessment.

Fuel assessments were determined using the Overall Fuel Hazard Assessment Guide - DSE Victoria (Oct 2010).

3.3 Fuel Accumulation Assessment – Fuel Area 1

Figure 5. Fuel Accumulation Assessment – Fuel Area 1

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Themeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Low	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to walk in any direction without needing to choose a path through.	1
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.tessellaris, E.crebra, A.subvelutina).*	1
Overall rating	**Moderate**		**Potential 10t/ha**

Table 2. Fuel Assessment Fuel Area 1.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.3.3, for which State Government attributes a default Total Available Fuel Load of 11.5t/ha (Vegetation Hazard Class 16.2). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 11.5t/ha (11.1t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

3.4 Fuel Accumulation Assessment – Fuel Area 2

Figure 6. Fuel Accumulation Assessment – Fuel Area 2

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Tehmeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Moderate	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to choose a path through but brush against vegetation occasionally.	2
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.citriodora, E.crebra, A.leiocarpa, C.tessellaris, C.intermedia).*	1
Overall rating	**Moderate**		**Potential 11t/ha**

Table 3. Fuel Assessment Fuel Area 2.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.9 – 10.2, for which State Government attributes a default Total Available Fuel Load of 20.8t/ha (Vegetation Hazard Class 10.1). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 20.8t/ha (19.3t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

3.5 Fuel Accumulation Assessment – Area 3

Figure 7. Fuel Accumulation Assessment – Area 3

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Themeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Moderate	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to choose a path through but brush against vegetation occasionally.	2
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.citriodora, E.crebra, Allocasuarina sp).*	1
Overall rating	**Moderate**		**Potential 11t/ha**

Table 4. Fuel Assessment Fuel Area 3.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.9 – 10.2, for which State Government attributes a default Total Available Fuel Load of 20.8t/ha (Vegetation Hazard Class 10.1). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 20.8t/ha (19.3t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

3.6 Fuel Accumulation Assessment – Area 4

Figure 8. Fuel Accumulation Assessment – Area 4

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Themeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Low	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to walk in any direction without needing to choose a path through.	1
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.citriodora, E.crebra, Allocasuarina sp).*	1
Overall rating	**Moderate**		**Potential 10t/ha**

Table 5. Fuel Assessment Fuel Area 4.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.9 – 10.2, for which State Government attributes a default Total Available Fuel Load of 20.8t/ha (Vegetation Hazard Class 10.1). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 20.8t/ha (19.3t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

3.7 Fuel Accumulation Assessment – Area 5

Figure 9. Fuel Accumulation Assessment – Area 5

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Themeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Low	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to walk in any direction without needing to choose a path through.	1
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.citriodora, E.crebra, Allocasuarina sp).*	1
Overall rating	**Moderate**		**Potential 10t/ha**

Table 6. Fuel Assessment Fuel Area 5.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.9 – 10.2, for which State Government attributes a default Total Available Fuel Load of 20.8t/ha (Vegetation Hazard Class 10.1). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 20.8t/ha (19.3t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

3.8 Fuel Accumulation Assessment – Area 6

Figure 10. Fuel Accumulation Assessment – Area 6

Fuel hazard estimate	**Assessment according to Hines et al 2010**		
Date: 25th June 2019			
Layer	**Rating**	**Description / Comments**	**Equivalent fuel load t/ha**
Surface and near surface	Moderate	Moderate litter bed 10 mm with Moderate NS fuels, *Cymbopogon sp, Themeda sp, Aristida sp,* and fine native grasses partly grazed by macropods, with *Lantana montevidensis sp.*	5 – 6 Potential 8
Elevated	Low	Canopy recruiters, with *Acacia spp, Lantana sp.* Easy to walk in any direction without needing to choose a path through.	1
Bark	Moderate	Few ribbon barks *(E.tereticornis*), papery barks (*L.suavolens*) with predominance of low bark hazard - *C.citriodora, E.crebra, Allocasuarina sp).*	1
Overall rating	**Moderate**		**Potential 10t/ha**

Table 7. Fuel Assessment Fuel Area 6.

Mapped as remnant, site assessment identified the developing vegetation community most closely resembling RE12.9 – 10.2, for which State Government attributes a default Total Available Fuel Load of 20.8t/ha (Vegetation Hazard Class 10.1). Applying this default value (as required under AS3959-2018) clearly provides considerable redundancy in planning.

Giving consideration to both State and observed available fuel values, more than 15 years post fire; and recognising the limitations in soil water holding capacity, a total of 20.8t/ha (19.3t/ha of which is Surface and Near Surface fuel) is considered reasonable to use in fire modelling in accordance with Method 2 of AS3959-2018, as presented in Section 6.

4.0 Site constraints and environmental values which may limit mitigation options

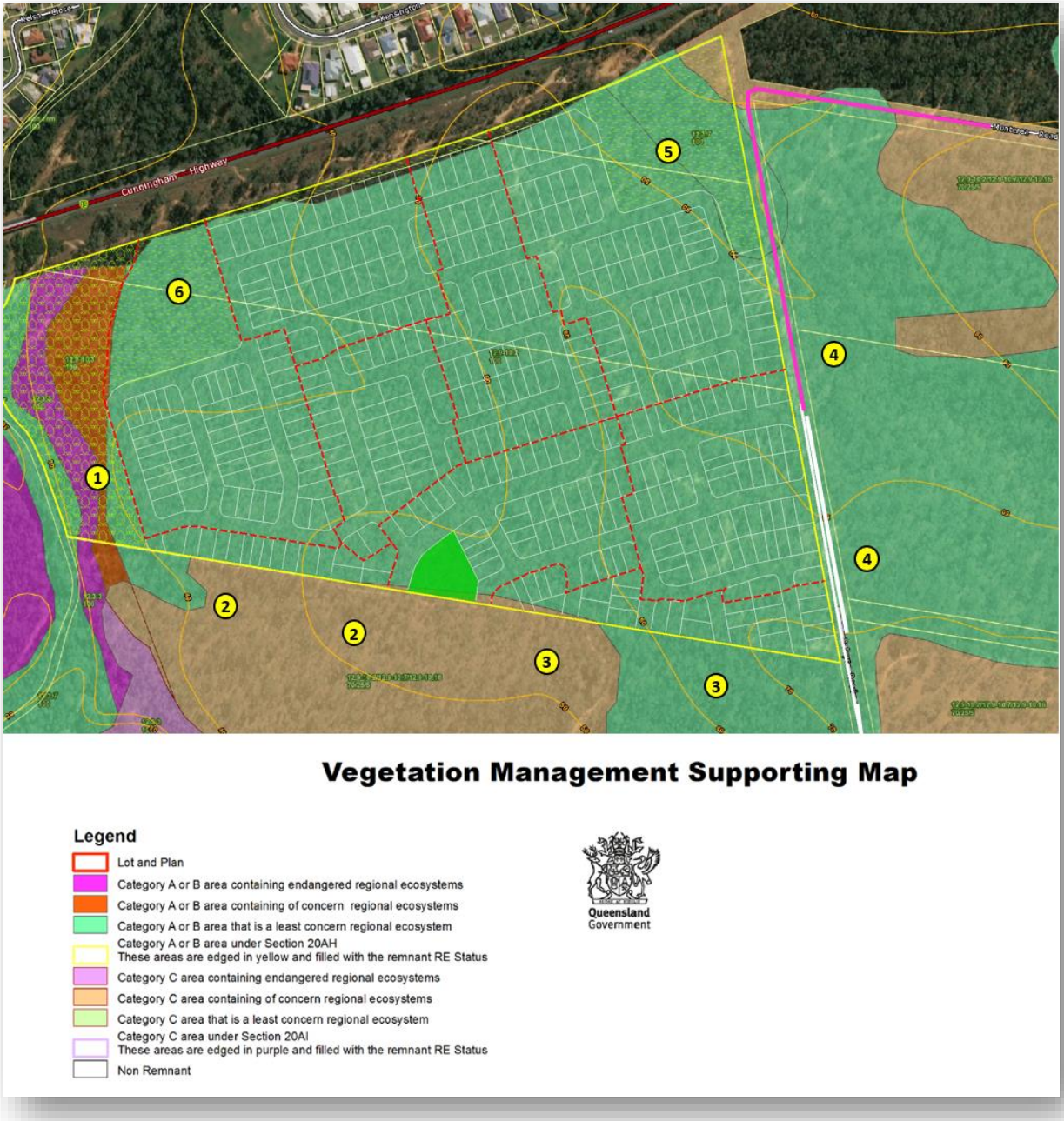

Figure 11. Regional Ecosystem (RE) Mapping

Figure 11 shows the proposed development location in relation to vegetation mapped by the Queensland Department of Natural Resources, Mines and Energy as predominantly remnant "Of Concern" RE 12.9-10.2, across the area generally. Site assessment indicates that adjacent open forest is consistent with the same Regional Ecosystem.

DNRME provides the following Description and recommended fire guidelines for the vegetation communities mapped.

Regional Ecosystem	Description	Fire Guidelines
RE 12.9-10.2 Of Least Concern	Open-forest or woodland of *Corymbia citriodora*, usually with *Eucalyptus crebra*. Other species such as *Eucalyptus tereticornis* and *Corymbia* intermedia may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 10b) Vegetation Hazard Class (VHC) 10.1 20.8t/ha Total Available Fuel Load (State Default Value)	OPTIMAL SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.
RE 12.3.7 Of Least Concern	Narrow fringing community of *Eucalyptus tereticornis, Melaleuca viminalis, Casuarina cunninghamiana +/- Waterhousea floribunda*. Other species associated with this RE include *Melaleuca bracteata, M. trichostachya, M. linariifolia and M. fluviatilis* in north of bioregion. *Lomandra hystrix* often present in stream beds. Occurs on fringing levees and banks of rivers and drainage lines of alluvial plains throughout the region. (BVG1M: 16a) Vegetation Hazard Class (VHC) 16.2 11.5t/ha Total Available Fuel Load (State Default Value)	STRATEGY: Avoid intentionally burning this fringe vegetation. Burn surrounding ecosystems in conditions that would minimise fire incursion. ISSUES: Protection relies on broad-scale management of surrounding country. However, fire exclusion is not necessary. Casuarina cunninghamiana is sensitive to fire and germination after fire is typically low. Triggers unrelated to fire appear to maintain a healthy ecosystem. Issues with lantana and other weeds may result from fire and other disturbance.
RE 12.3.3 Endangered	*Eucalyptus tereticornis* open-forest to woodland. *Eucalyptus crebra* and *E. moluccana* are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include *Angophora subvelutina or A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens and E. melanophloia*. Occurs on broad Quaternary alluvial plains where rainfall is usually less than 1000mm/y. (BVG1M: 16a) Vegetation Hazard Class (VHC) 16.2 11.5t/ha Total Available Fuel Load (State Default Value)	SEASON: Summer to late-autumn. INTENSITY: Low. INTERVAL: 3-6 years. STRATEGY: Aim to burn 40-60% of any given area. Spot ignition in cooler or moister periods encourages mosaics. ISSUES: Control of weeds is a major focus of planned burning in most areas. Maintain ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas.

Table 8. Regional Ecosystems Descriptions and Fire Guidelines

The adjacent areas of open forest vegetation are unlikely to be provided with managed fire, along with the temporary hazard reduction benefits this brings; and current grazing pressures are assumed to continue.

Planning is not based on any assumptions regarding hazard reduction; and has to be based on fuel levels reaching a long term maximum stable state, coinciding with ignition under worst case foreseeable fire weather conditions.

4.1 Fire History and Frequency

This study found several indicators of prior fire, dating back more than 15 years. Recurrence of fire at some time has to be regarded as possible, potentially coinciding with maximum fuel accumulation and worst case fire weather conditions.

5.0 Specific risk factors associated with the development proposal

5.1 Nature of activities anticipated on site

Normal residential activities are anticipated to occur in the area, which includes the potential inclination of juveniles and others to make temporary "camps" in bushland, and others to undertake illegal dumping or torching of vehicles. The number of fire incidents expected by QFES varies in direct proportion to the numbers of people present. The proposed development adds significantly to the number of people living in the area or likely to cause ignition. However only a limited number of new Lots are directly exposed.

5.2 Numbers of people likely to be present

2 - 4 residents could be expected to be present on each of the 440 Lots/Units. The proposed development adds significantly to the number of people living in the area or potentially exposed to the possibility of unplanned fire, however the design of the development and road layout serves to protect life and property, and facilitate access and egress.

6.0 Nature and Severity of Potential Bushfire Attack

6.1 Bushfire season and Fire Weather

The "typical fire season" in this area peaks between September and November. The predominant winds in the area are south easterly, however during the fire season, hot gusty westerlies of over 30 kph can be expected, with Relative Humidity falling to 10% and less. Temperatures on these days can climb over 35°C , and for two or three days a year, fire weather conditions equivalent to FDI levels of around 60 can be anticipated. (Note that this is in contrast to the value of 40 which Queensland is currently using in the recently revised AS3959 - 2009).

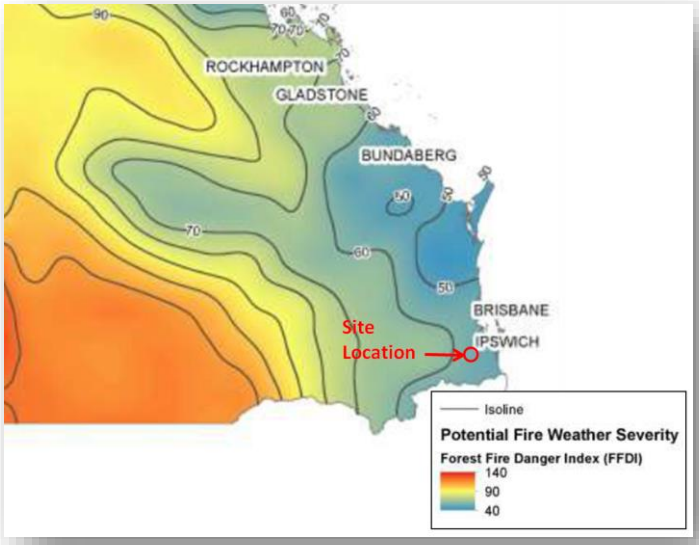

Figure 12. State Government revised FDI values to FDI 60 for the area involved. (CSIRO, 2014).

6.2 Anticipated direction of bushfire attack

The probability of unplanned "wildfire" attack is currently regarded as possible, or even likely. The potential directions of attack are from the west, south or east, as indicated in Figure 4. The direction of worst case fire weather is generally westerly to north westerly.

Bushfire attack comes in a number of forms: direct flame, radiant heat, embers, smoke and wind. Research shows that over 80% of houses lost to bushfire in Australia can be attributed to ember attack, within 100m of bushland.

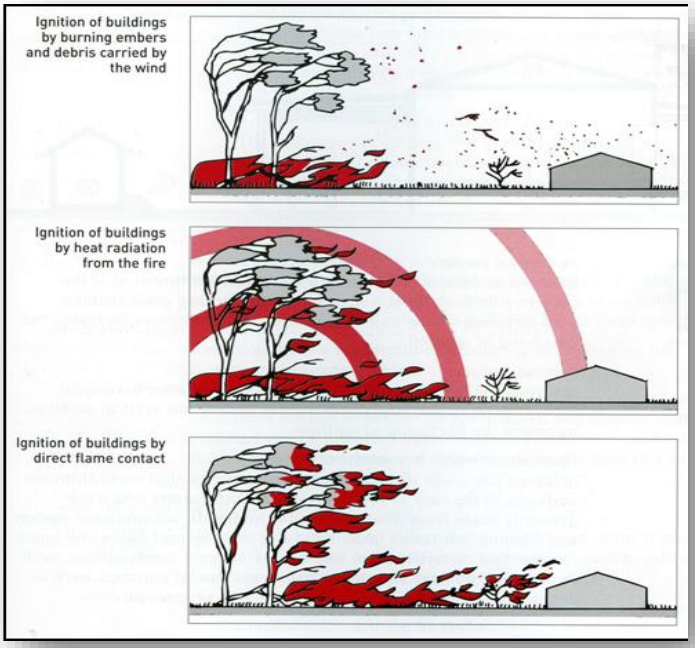

Figure 13. Main Bushfire Attack mechanisms (Image courtesy of Ramsay & Rudolf, 2003)

6.3 Anticipated severity of bushfire attack

Values for vegetation type, fuel load and slope are carried forward to Table 14, to predict the key fire parameters for the potential worst case fire scenarios.

Fire Scenario – Area 1 Method 2 AS3959-2018 FDI 60 Forest @ 11.1/11.5t/ha. Ave Slope under vegetation 8° Down	Fire Scenario – Area 2 and 3 Method 2 AS3959-2018 FDI 60 Forest @ 19.3/20.8t/ha. Ave Slope under vegetation 6° Down	Fire Scenario – Area 1, 2 and 3 Method 1 AS3959 – 2018 FDI 40 Forest Ave Slope under vegetation 5 - 10° Down	Fire Scenario – Area 4, 5 and 6 Method 2 AS3959-2018 FDI 60 Forest @ 19.3/20.8t/ha. Ave Slope under vegetation 4° Down	Fire Scenario – Area 4, 5 and 6 Method 1 AS3959 – 2018 FDI 40 Forest Ave Slope under vegetation 0 - 5° Down
Fire Intensity (Byram, 1959) 8 247W/m ("MEDIUM")	Fire Intensity (Byram, 1959) 22 592W/m ("HIGH")		Fire Intensity (Byram, 1959) 19 680W/m ("MEDIUM")	
Rate of Spread (Noble et al, 1980) 1.39kph	Rate of Spread (Noble et al, 1980) 2.1kph		Rate of Spread (Noble et al, 1980) 1.83kph	
Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 10.4m	Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 16.16m		Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 14.4m	
Flame Width 100m	Flame Width 100m		Flame Width 100m	
Elevation of Receiver 2.4m	Elevation of Receiver 2.4m		Elevation of Receiver 2.4m	
BAL FZ within <9m of intact unmanaged vegetation BAL 40 from 9 - <12m BAL 29 from 12 - <18m BAL 19 from 18 - <25m BAL 12.5 from 25 – 100m	BAL FZ within <14m of intact unmanaged vegetation BAL 40 from 14 - <18m BAL 29 from 18 - <26m BAL 19 from 26 - <36m BAL 12.5 from 36 – 100m	BAL FZ within <15m of intact unmanaged vegetation BAL 40 from 15 - <20m BAL 29 from 20 - <29m BAL 19 from 29 - <41m BAL 12.5 from 41 – 100m	BAL FZ within <12m of intact unmanaged vegetation BAL 40 from 12 - <17m BAL 29 from 17 - <24m BAL 19 from 24 - <33m BAL 12.5 from 33 – 100m	BAL FZ within <12m of intact unmanaged vegetation BAL 40 from 12 - <16m BAL 29 from 16 - <24m BAL 19 from 24 - <34m BAL 12.5 from 34 – 100m

Table 14. Calculated values for potential bushfire characteristics, and methods used.

The radiant heat flux values for Methods 1 and 2 are compared as Bushfire Attack Levels (BALs) in Table 14 and Figure 14. The predicted fireline intensity for unmanaged vegetation interfaces is in the "Medium" and "High" range, validating classification as BPA. Application of Method 2 under AS3959-2018 has derived lower BAL ratings, particularly for Area 1.

In determining the width of a "bushfire buffer" to apply to clearing ahead of each Stage (so as not to exceed BAL 19 construction for dwellings) the above table has been used. Based on the "worst" combinations of fuel load and slope, a 30m setback is seen to be adequate to avoid BAL ratings above BAL 19. The 30m buffer is also of a size which is manageable, without creating erosionm and sediment control issues.

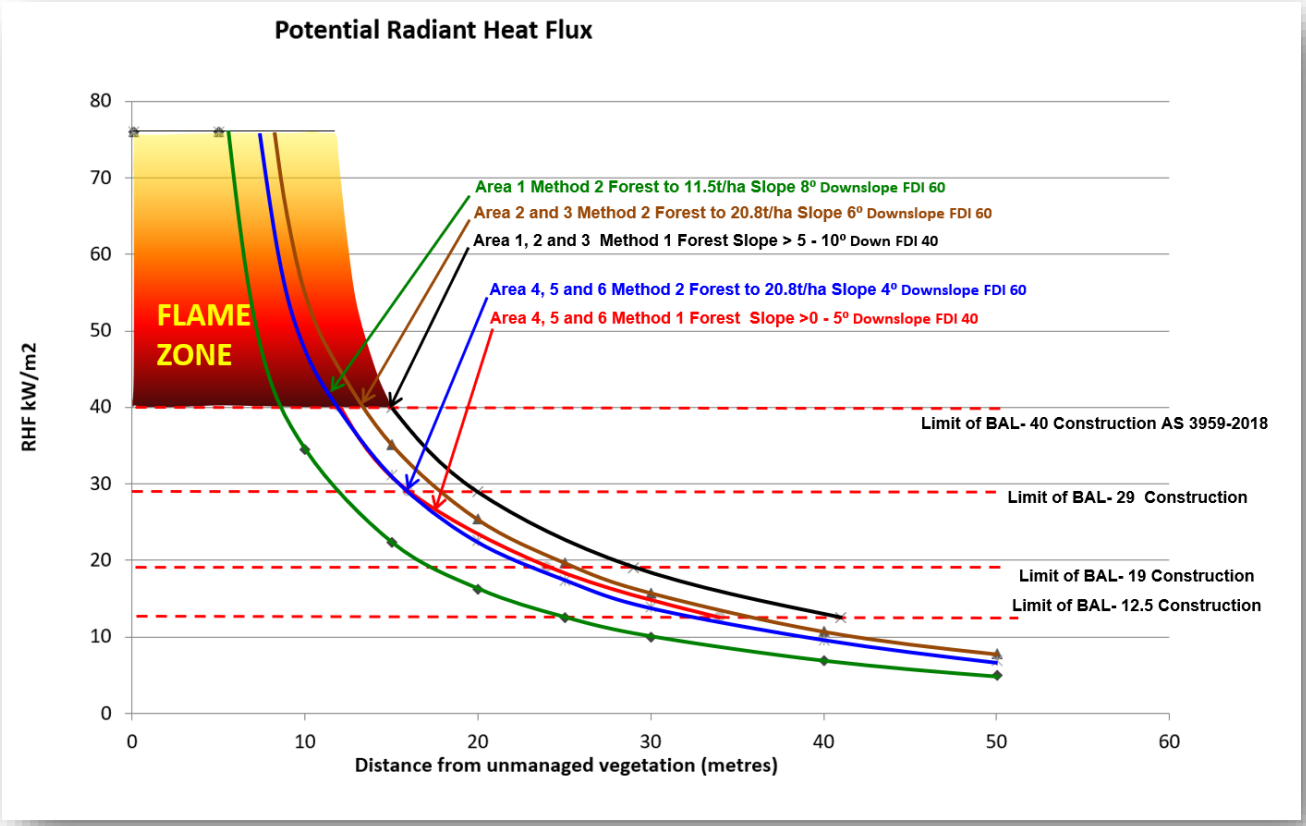

Figure 14. Radiant Heat Flux Predicted by Methods 1 and 2.

The radiant heat flux values are represented as BAL contours in Figure 14.

The significance of the radiant heat flux levels discussed is shown below in Table 15.

Radiant Heat Flux (kW/m²)	Likely Effects
> 40 - 110	Flame Zone. Even the strongest toughened glass fails.
29 - 40	Latest technology in toughened glass may survive. Most will not. Timber ignites without pilot flame. Limit of BAL-40 Construction AS3959 - 2009.
29	Ignition of timbers without piloted ignition (3 minutes exposure) during the passage of a bushfire. Most types of toughened glass could fail. Limit of BAL-29 Construction AS3959 - 2009.
19	Screened float glass could fail during the passage of a bushfire.Limit of BAL-19 Construction AS3959 - 2009.
12.5	Standard float glass could fail during the passage of a bushfire. Limit of BAL-12.5 Construction AS3959 - 2009. Some timbers can ignite with prolonged exposure and with pilot ignition sources (eg embers)
10	Critical conditions. Firefighters not expected to operate in these conditions. Considered life threatening in under a minute in protective equipment. Fabrics inside a building could ignite spontaneously with long exposures.
7	Likely fatal to unprotected persons after exposure of several minutes.
4.7	Extreme conditions. Firefighter in protective clothing will feel pain after 60 seconds exposure.
3	Hazardous conditions. Firefighters expected to operate for a short period (10 minutes).
2.1	Unprotected person will feel pain after 1 minute exposure - non fatal.

Table 15. Significance of various RHF levels (Source: NSW RFS, 2006)

6.4 Specific BAL Assessment for Lots 501, 778 and 701

Lots 501, 778 and 701 are the lots which will be most exposed, with revegetation anticipated in the stormwater management areas.

In providing a BAL Assessment for these three Lots, the following arguments are made in support of applying Vegetation Hazard Class (VHC) 16.2 fuel loads (11.5t/ha) rather than the higher values attributed to VHC 10.1 of 20.8t/ha:

1. The open vegetation structure that is present across the site is more akin to eucalypt dominated woodland (VHC 16.2) than forest.
2. The default value of 11.5t/ha for total available fuel load is supported by actual fuel values assessed, which also reflect poor fertility soils with low water holding capacity, which in turn limits biomass accumulation potential (fuel).
3. In each case there is considerable redundancy provided for the three Lots in the form of radiant heat barriers which at this point have not been factored into fire calculations as it is unknown whether future dwellings will be single or double storey, an important question when evaluating shielding. Lot 501 is shielded to 2.5m in height by the fibre cement clad acoustic barrier, which also shields Lot 778 to a height of 3m. A 1.8m high non combustible radiant heat barrier is recommended for the northern boundary of Lot 701, which also faces a reduced flame width.

None of these factors apply to other Lots, and so Section 6.3 conservatively applies the higher default available forest fuel loads for Areas 2, 3 and 4, despite actual fuel loads being considerably less.

Fire Scenario – Lot 501 **Method 2 AS3959-2018 Woodland @ 11.1/11.5t/ha.** **Ave Slope under vegetation 3° Down slope** **FDI 60**	**Fire Scenario – Lot 778** **Method 2 AS3959-2018 Woodland @ 11.1/11.5t/ha.** **Ave Slope under vegetation 5° Down slope** **FDI 60**	**Fire Scenario – Lot 701** **Method 2 AS3959-2018 Woodland @ 11.1/11.5t/ha.** **Ave Slope under vegetation 3° Down slope** **Flame width 30m** **FDI 60**	**Fire Scenario – Lots 501, 778 and 701** **Method 1 AS3959 – 2018 Woodland** **Ave Slope under vegetation >0 - 5° Down slope** **FDI 40**
Fire Intensity (Byram, 1959) 5 841kW/m "MEDIUM"	Fire Intensity (Byram, 1959) 6 705kW/m "MEDIUM"	Fire Intensity (Byram, 1959) 5 841kW/m "MEDIUM"	
Rate of Spread (Noble et al, 1980) 0.98kph	Rate of Spread (Noble et al, 1980) 1.13kph	Rate of Spread (Noble et al, 1980) 0.98kph	
Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 7.77m	Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 8.72m	Flame Height (modified Mc Arthur V equation, NSW RFS 2001) 7.77m	
Flame Width 100m	Flame Width 100m	Flame Width 30m	
Elevation of Receiver 2.4m	Elevation of Receiver 2.4m	Elevation of Receiver 2.4m	
BAL FZ within <7m of intact unmanaged vegetation BAL 40 from 7 - <9m BAL 29 from 9 - <14m BAL 19 from 14 - <20m BAL 12.5 from 20 – 100m	BAL FZ within <8m of intact unmanaged vegetation BAL 40 from 8 - <10m BAL 29 from 10 - <15m BAL 19 from 15 - <22m BAL 12.5 from 22 – 100m	BAL FZ within <7m of intact unmanaged vegetation BAL 40 from 7 - <9m BAL 29 from 9 - <13m BAL 19 from 13 - <17m BAL 12.5 from 17 – 100m	BAL FZ within <15m of intact unmanaged vegetation BAL 40 from 15 - <20m BAL 29 from 20 - <29m BAL 19 from 29 - <41m BAL 12.5 from 41 – 100m

Table 16. Calculated fire values for Lots 501, 778 and 701.

The data from Table 16 is shown as radiant heat flux curves in Figure 15 and as BAL contours in Figure 17.

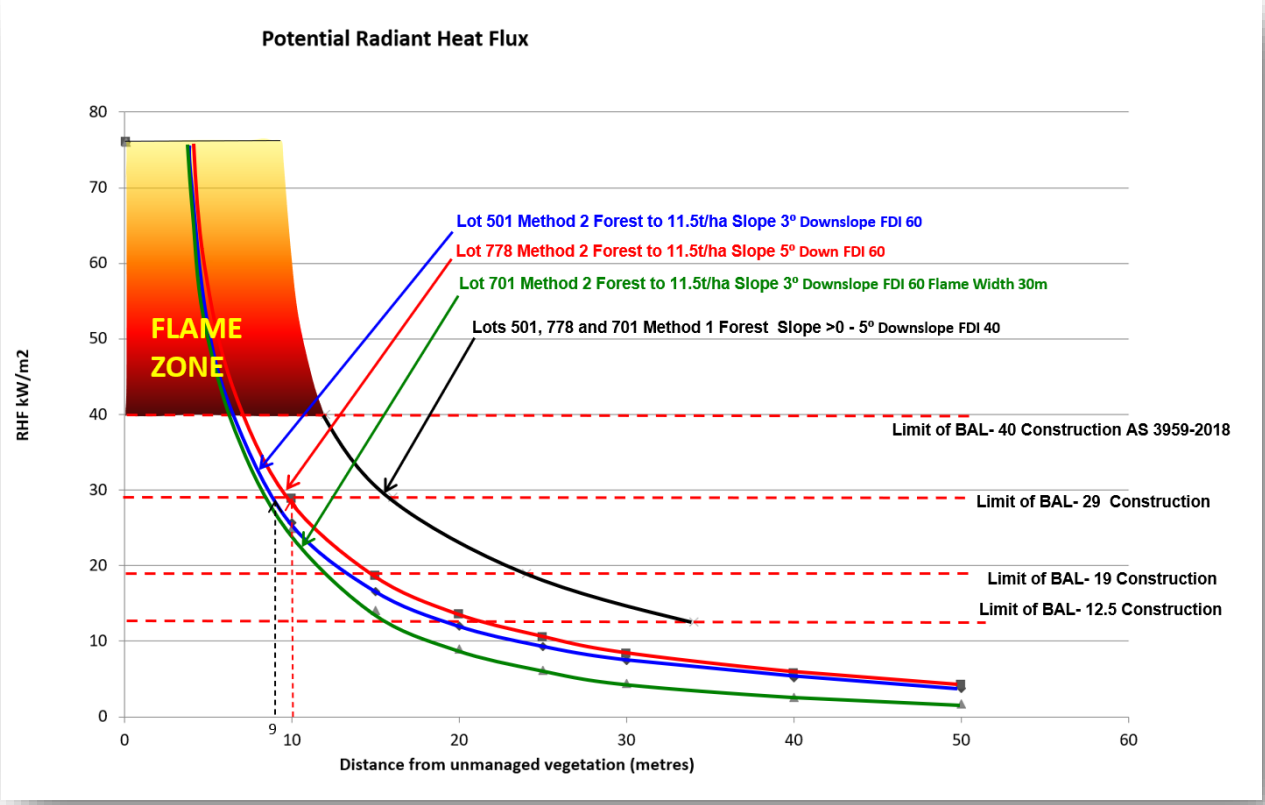

Figure 15. Radiant heat flux curves for Lots 501, 778 and 701.

7.0 Bushfire Protection Measures in Combination

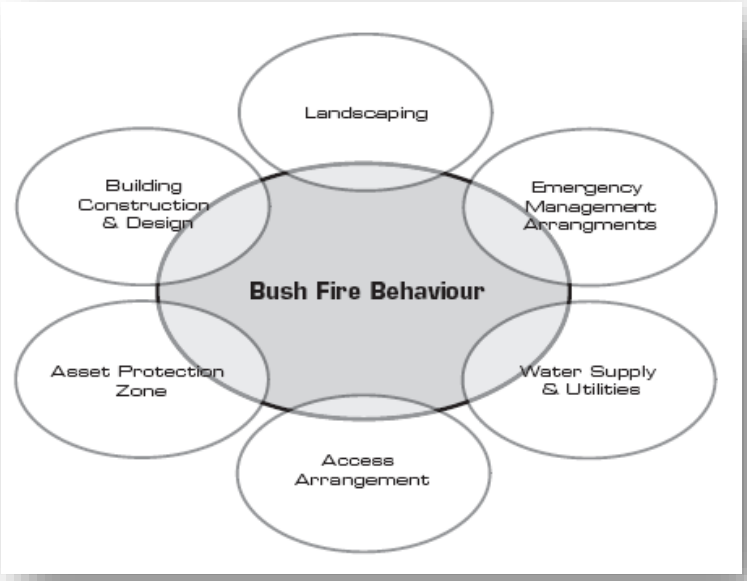

Figure 16. Bushfire Planning Measures in Combination (Source: NSW RFS, 2006)

Figure 16, taken from *Planning for Bushfire Protection* (NSW Rural Fire Service, 2006) illustrates that there are other factors and measures which need to be integrated to mutually support one another to provide protection against bushfire.

Simply removing the hazard (bushland) is one possible way of removing risk to life and property, but this approach is not desirable. The safety of life and property can be achieved whilst retaining the natural amenity and value of bushland areas, provided these integrated bushfire protection measures are applied.

7.1 Building Construction and Design

The proposed design serves to avoid construction to greater than BAL 19 under AS3959-2018, apart for Lots 501, 778 and 701, where construction to BAL 29 will be required. Across the south of the site, this will be achieved by delaying Stage 8 until the adjacent lot to the south is developed. At that point the BAL contours shown between “A” and “B” in Figure 17 fall away. In other words the BAL contours across the south of the site only exist until the adjacent land develops.

The same can be said for the BAL contours across the east of the site. When the land east of Daleys Road is cleared for development, the adjacent BAL contours shown in Figure 17 fall away.

Within the reach of BAL 12.5, any structure built within 6m of any dwelling will also need to be constructed in accordance with AS3959-2018.

The acoustic barrier will be of non combustible material, or clad in non combustible material.

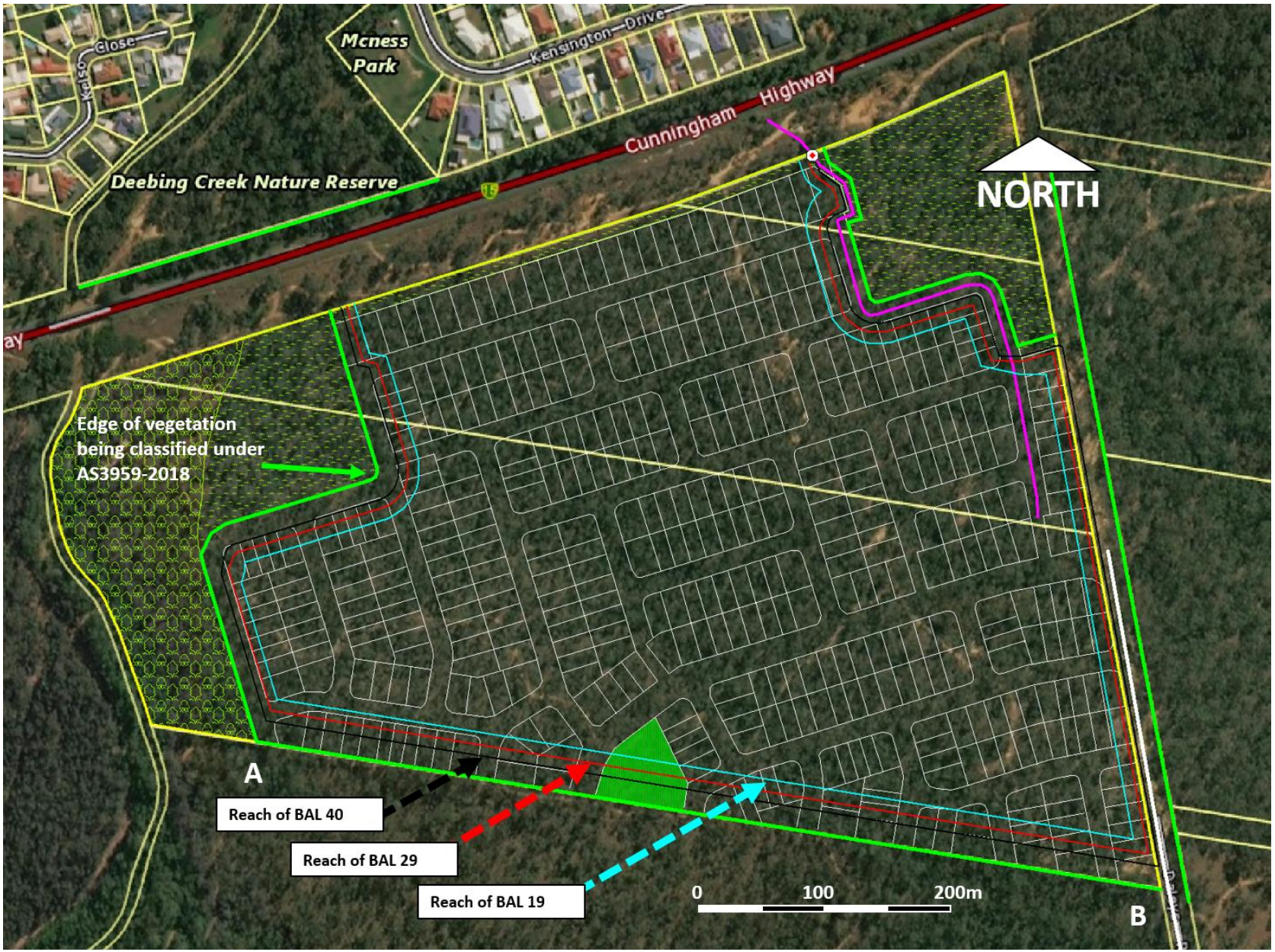

Figure 17. BAL contours at completion of development. (Contours between A and B likely fallen away). Radiant heat barriers not shown.

7.2 Asset Protection Zones and Landscaping

Asset protection zones are the most strategically valuable defence against radiant heat and flame, and to a lesser extent embers.

The landscaping plan shall maintain an "Inner Protection Area" (IPA) for the entire unbuilt area of all Lots within the reach of BAL 12.5, effectively free of available fuel.

- Plants retained in or introduced into the IPA should be selected based on low combustibility, by virtue of high moisture content, low volatile oil content, high leaf mineral levels, large fleshy leaves, absence of shedding bark.
- Plant arrangement is just as important as low combustibility. Plants should be placed so as to minimize either vertical or horizontal connectedness of plant material. Appendix 1 provides examples of less hazardous native plant species.
- Combustible vegetation shall not be allowed to come into contact with combustible parts of buildings.
- Trees should not be allowed to directly overhang roof lines.
- Regular yard maintenance should be undertaken to remove available fine fuels and debris, particularly throughout the fire season.

An Outer Protection Area involves removal of the understorey so as to deprive an advancing fire front of its fuel continuity, and thereby collapsing the fire front. In this case the APZ recommended for the new lots shall be constructed and maintained as IPA.

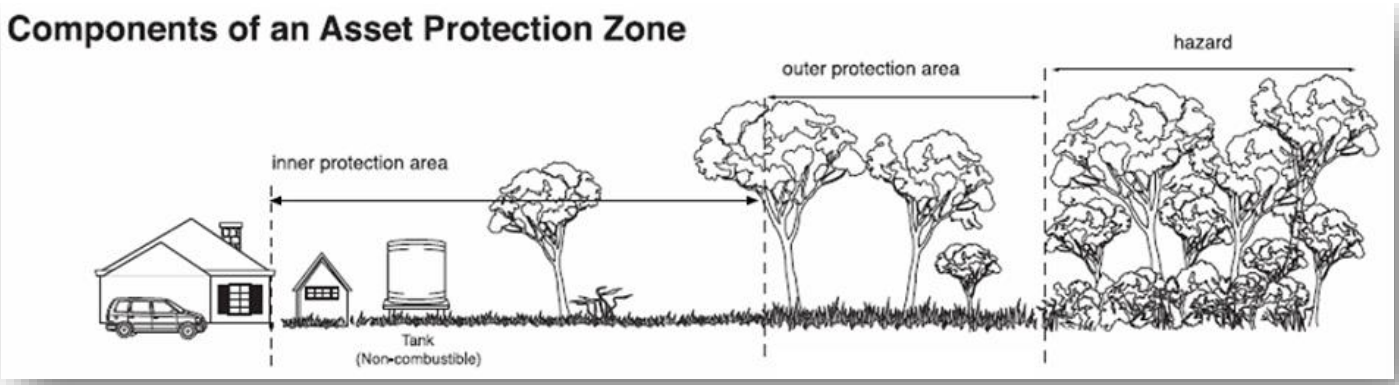

Figure 18. Components of an Asset Protection Zone (APZ)

The 30m bushfire buffer at the interface of each Stage will be maintained in a grassed and slashed (low hazard) state.

The closest 9m of stormwater management area beside lot 701 will be planted out to low combustibility groundcovers, with a non combustible fence across the northern boundary of Lot 701 providing redundancy in the event that such groundcovers become desiccated.

7.3 Access and Egress Management

The site is within approximately 3km by road of the nearest Queensland Fire and Emergency Services (Ripley Rural Fire Station).

Two access/egress options exist, via Daleys Road and Binnies Road to the south; and in emergencies via Stage 7 and the Cunningham Highway to the north. The access should be gated and signposted "Medical Emergency Access Only". The entire site will be fenced to deter nuisance traffic. With future development to the east and south, further connections become available, and at that point, much of the hazard present will have been removed.

Access and egress for fire fighters will be provided in accordance with the Queensland Fire and Emergency Services Guideline (*Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots, 2015).* The guideline is attached as Appendix 2.

The proposed internal road system provides for continuous traffic flow and for through roads. Ample turning opportunities are also available for large urban fire fighting appliances (a minimum inside radius of 6m and minimum outside radius of 12m).

7.4 Water Supplies and Utilities

Water supply for the development will be connected to Council mains reticulated supply, with hydrants installed in accordance with AS2419.1-2005 and with volumes and pressure under the control of Council water utilities provider. Fire fighting water supply and fire hydrants will be provided in accordance with the Queensland Fire and Emergency Services Guideline (*Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots, 2015).*

Electricity supply to the site will be supplied underground.

Any reticulated or bottled gas shall be installed and maintained in accordance with AS1596 – 2002. Metal piping is to be used. Any fixed LPG tanks shall be kept clear of flammable materials, and located on the non hazard side of the building. Any gas cylinders which need to be kept close to a building shall have release valves directed away from the building. Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.

7.5 Fire Fighting and Emergency Management Arrangements

Until such time as Lots to the adjacent south are developed, this access/egress route is potentially threatened by thick smoke. The emergency management arrangements for the site will recognise this hazard and require residents to either remain in place, or in the event of individual emergency, use the route provided via Stage 7 and the Cunningham Highway to the north (shown in purple in Figures 1 and 2).

The development is serviced by the proposed road and driveways for Emergency Services use. The maintenance of a mown or slashed grass surface of all Lots provides safe defendable space around key assets in the unlikely event of bush fire.

Obstructions to access onto individual Lots and the rear of buildings should be avoided.

Residents shall be made aware of the existence of this Plan, and their need to comply with the relevant provisions, in particular building construction, APZ maintenance, optimizing access around buildings and emergency response preparations.

Residents shall decide on their Stay and Defend / or Go Early strategy before each fire season so as to ensure this decision is not made too late, when smoke and emergency vehicles prevent an orderly evacuation. Staying to defend is a viable and preferable option for the proposed development.

Residents staying to defend should ensure that they have adequate protective clothing , including full length cotton or denim garments, sturdy boots, gloves, smoke mask (minimum P2 with valves) and smoke goggles.

Appendix 2 provides guidance for Residents' Emergency Management Planning in relation to bushfire.

8.0 Assessment of proposal against Ipswich Planning Scheme 2006 Part 11, Division 4 – Bushfire Hazard Areas Overlay Code

Specific Outcomes	Probable Solutions
8.1 (SO1) Design, Siting and Construction (1) Uses and works in bushfire risk areas are designed, sited, and constructed to— (a) minimise the number of people and properties subject to bushfire risk; (b) improve the survivability of buildings and the protection of life during the passage of a firefront; (c) minimise costs and threats to emergency services; and (d) facilitate evacuation in the event of a bushfire	**PS1** is applied in that: (1) (a) Uses and works are sited— (i) in existing cleared areas able to accommodate the use within an adequate fire protection buffer generally as identified in (iii) below, except for Lots 501, 778 and 701, although this Plan demonstrates the setbacks available to be adequate to avoid exceeding BAL 29; and (ii) where possible, on land and parts of a site which are least prone to bushfire risk with regard to aspect, slope, elevation and vegetation type— (A) away from the tops of ridgelines and with the flatter portion of the lot being used as building sites; and (B) on land with a slope gradient less than 15%, and generally on level ground; and (iii) with a minimum 20 metre wide area (measured from the horizontal from the building) serving as a fire protection buffer around the building of which at least the first 10 metres from the building is a cleared area (fuel free inner zone), while the outer 10 metres (fuel reduced outer zone) may be planted with fire retardant vegetation species or grassed; and (iv) to ensure that any outbuilding (such as garages and carports) is built as part of the main building or located at least 5 metres from the main building. (b) If trees are planted they— (i) are of a species that grow to over 2 metres in height to maintain separation between lower canopy and the ground; (ii) have vertical and horizontal separation between each plant to ensure the canopy is not continuous; and (iii) do not grow closer to the building than a distance equivalent to the tree's expected mature height so that branches do not overhang the eaves of the building.

	(c) Buildings— (i) have a continuous roof line avoiding roof valleys, multiple hips and a combination of pitched and flat roofs on the same building – as these provide catchment areas for debris; and (ii) have low pitched roofs between 12 and 21 degrees to reduce radiation pick up; and (iii) are of slab-on-ground construction where this is responsive to the site; or (iv) "pole based structures" with floors elevated off the ground with all external openings (between the floor and the ground) sealed to prevent the entry of burning debris; and (v) minimise large expansive walls as these expose a greater surface area to a bushfire; and (vi) shall be constructed in accordance with AS3959-2018.
8.2 (SO2) Uses and works avoid a high concentration of people living or congregating in a high bushfire risk area.	**PS2** is applied in that: The proposed development does not involve uses where people are likely to congregate, including a caravan park, camping ground, or other high concentration uses.
8.3 (SO3) Water Storage and Supply Uses and works provide sufficient and accessible water storage and supply for firefighting purposes by— (a) connection to a reticulated water supply, if available to the site, having sufficient pressure and flow for firefighting purposes; or (b) where reticulated water supply is not available to the site, a dam, lake, water tank or swimming pool are provided with sufficient capacity for water pumping in times of bushfire.	**PS3** is applied in that: Where reticulated water supply is available— Water supply outlet pipes are located within 40m of dwellings.
8.4 (SO4) Vehicular Access and Fire Trails Fire trails or perimeter roads are provided to mitigate against bushfire risk by— (a) separating uses and works from surrounding vegetated areas; and (b) being of sufficient width to serve as an effective fire trail which allows continuous access for firefighting vehicles; and (c) being in secure tenure and maintained. **8.5 (SO5)** Residential uses and works (including reconfiguring a lot) are designed to mitigate potential bushfire risk and provide safe sites for dwellings.	**PS5** is applied in that: Uses and works (including where reconfiguring a lot) incorporate— (a) a perimeter road— (i) located between the majority of proposed Lots and adjacent vegetated lands; and (ii) with a minimum cleared width of more than 10 metres; and (iii) with a constructed road width of 6 metres; and (iv) constructed to an all weather standard. **PS6** is applied in that: Wherever possible the road layout provides through roads and avoids the use of culs de-sac and dead end roads.

	PS1 is applied utilising the areas of lowest risk on the site; and the use will adhere to the requirements specified by this Plan.
8.6 (SO6) Where the use involves the reconfiguring a Lot and the opening of a new road, the road layout provides vehicular access which is designed to— (a) mitigate against bushfire risk by ensuring adequate access for firefighting and other emergency vehicles; and (b) allow for evacuation in the event of a bushfire; and (c) provide for the safe and effective operation of water supply and equipment for fire fighting vehicles	**PS5** is applied to the extent outlined above. **PS6** is applied in that: Wherever possible the road layout provides through roads and avoids the use of culs de-sac and dead end roads. **PS7** is applied in that: Road gradients are generally no more than 12.5%, or are from 12.5% to not more than 20% over a maximum distance of 50 metres.
8.7 (SO7) The size and shape of residential Lots and the design and location of access paths facilitate emergency access to buildings and firefighting infrastructure, and the incorporation of suitable on-site bushfire mitigation measures.	PS 1, 5, 6 and 7 are applied.
8.8 (SO8) New residents are informed about the nature of the bushfire hazard and mitigation measures.	Lot Buyers shall be made aware of this Plan at the point of purchase, including a property note attached to land title.

9.0 Assessment of proposal against State Planning Policy 2017

State Planning Policy – Natural hazards, risk and resilience (SPP, December 2013, latest version July 2017) replaces State Planning Policy 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide.* The SPP Guideline – Natural hazards, risk and resilience provides a methodology for determining Bushfire Hazard based on Potential Fireline Intensity. The methodology and hazard mapping has been included in Section 3.1 of this Plan in establishing the adjacent area as potentially hazardous and as a bushfire prone area.

Part E of the SPP provides interim development assessment requirements to ensure that State interests are appropriately considered in relation to natural hazards, including bushfire hazard areas. These provisions serve as general guidelines to either avoid or otherwise adequately mitigate bushfire risk. Specific guidelines for bushfire hazard overlay codes are yet to be provided, and this detail is addressed by this Plan in terms of meeting the current requirements of Local Government in Section 8 above.

Interim Development Assessment Requirements – SPP Part E	**Solutions Provided**
(3) Development avoids natural hazard areas or where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level, and	This Plan establishes the nature and potential severity of the adjacent hazard and provides a combination of bushfire protection measures to mitigate risk including park management, building construction, asset protection zones, access, water supplies and utilities, and emergency management arrangements.
(4) Development supports, and does not unduly burden, disaster management response or recovery capacity and capabilities, and	The combined effect of the bushfire protection measures specified by this Plan serves to reduce risk to a low level and ensure resilience and preparedness for unplanned fire so that the response or recovery capacity and capability of emergency services is not unduly burdened or impeded. This Plan serves to protect life and property from bushfire without depending on emergency services for protection.
(5) Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties, and	The development does not increase the nature of the existing hazard, and site layout and landscaping on the site is designed to moderate the exposure of buildings. The potential for damage to other properties is not increased as a consequence of the proposed development.
(6) Risks to public safety and the environment from the location of hazardous materials and the release of these materials is avoided, and	Hazardous materials are not stored in quantities or locations on the site which would pose a risk to the public or the environment.
(7) The natural processes and the protective function of landforms and the vegetation that can mitigate risks associated with the natural hazard are maintained or enhanced.	The development maintains the natural processes and protective function of vegetation that previously existed for the site.

10.0 Recommendations

1. That future dwellings shall be constructed in accordance with AS3959-2018, as summarised in Tables 14 and 16 and Figures 14 and 15 of this Plan. Upon clearing for the development of adjacent land to the south and east the BAL contours for those parts of this site will fall away.

   Any other structure built within 6m of each residence shall be constructed in accordance with this Standard.

   Builders should warrant that they have a copy of this Standard, and that it shall be used consistently throughout the design and construction of dwellings and other structures located within 6m of them.

   The acoustic barrier will be of non combustible material, or clad in non combustible material. A non Combustible radiant heat barrier should be constructed across the northern boundary of Lot 701.

2. Asset Protection Zones as described in Section 7.2 of this Plan shall be maintained as IPA separating buildings from retained vegetation on adjacent Lots. This includes the clearing of the northern section of the Daleys Road reserve. Stage 8 shall be deferred until the clearing for development of the adjacent lot to the south. The 30m bushfire buffer at the interface of each Stage will be maintained in a grassed and slashed (low hazard) state.
   The closest 9m of stormwater management area beside lot 701 will be planted out to low combustibility groundcovers, with a non combustible fence across the northern boundary of Lot 701 providing redundancy in the event that such groundcovers become desiccated.

3. An emergency access/egress route will be provided from the outset via Stage 7 and the Cunningham Highway, maintained in a condition trafficable by two wheel drive vehicles. The access should be gated and signposted "Emergency Access Only".

4. Fire fighting water supply and fire hydrants will be provided in accordance with the Queensland Fire and Emergency Services Guideline (*Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots, 2015).*

5. Lot buyers shall be made aware of the existence of this Plan and their responsibilities outlined within it, in particular construction, asset protection zone and emergency management.

11.0 Summary

The soils and vegetation of the area are such that fuel accumulation potential is limited, and this assessment can be seen as applying considerable redundancy to design. The area of "hazard" faced by the proposed development is significant, and the likelihood of wildfire at some time is regarded as likely, warranting protection measures to be taken, as outlined in this Plan. This Plan demonstrates compliance with legislative requirements of State and Local Government, and the BCA.

Along with adequate water supply and emergency management arrangements, compliant construction under AS3959-2018 and APZs to reduce the exposure of life and property to bushfire, these combined measures assist to prepare residents for the possibility of fire in the area.

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Appendix 1

Less combustible native plants list

Source: Bowden, J (1999)