



**CARDINIA CREEK SOUTH PART 2 PSP
BUSHFIRE ASSESSMENT
ADDENDUM REPORT**

Prepared for
Casey City Council
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Cover image: Looking north from a proposed local park site near the centre of the Part 2 PSP area.

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Spatial Data

Most spatial data were supplied from the State Government of Victoria. Care was taken with the creation of maps used in this report, however the accuracy cannot be guaranteed. Users of the maps should make appropriate enquiries to ascertain the accuracy of the information presented before relying on it.

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GLOSSARY & ACRONYMS

BAL	<i>Bushfire Attack Level</i> - A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire e.g. a building constructed to a BAL-12.5 standard is designed to be exposed to radiant heat not exceeding 12.5 kW/m ² .
BMO	<i>Bushfire Management Overlay</i> - A planning scheme provision used to guide the development of land in areas of high bushfire hazard. The BMO applies to areas where there is potential for extreme bushfire behaviour, such as a crown fire and extreme ember attack and radiant heat.
BPA	<i>Bushfire Prone Area</i> - An area that is subject to, or likely to be subject to, bushfire attack as determined by the Minister for Planning.
Bushfire	An unplanned fire burning in vegetation; sometimes referred to as wildfire. A generic term which <i>includes grass fires</i> , forest fires and scrub fires.
Bushfire attack	Attack by wind, burning embers, radiant heat or flame generated by a bushfire.
Bushfire hazard	A source of potential damage or harm, typically one or more of three key elements; vegetation, weather and topography.
Bushfire risk	The chance or probability of damage or harm if exposed to a bushfire hazard and the severity of the impact i.e. consideration of the likelihood and consequences of impacts from bushfire.
CCC	<i>Casey City Council</i>
Classified vegetation	Vegetation deemed to be a bushfire hazard in accordance with the Bushfire Management Overlay (BMO) and/or AS 3959:2018 <i>Construction of buildings in bushfire prone areas</i> .
CFA	<i>Country Fire Authority</i>
Defendable space	An area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire.
DEECA	<i>Department of Environment, Energy and Climate Action</i>
DTP	<i>Department of Transport and Planning</i>
Effective slope	The slope of the land (gradient, measured in degrees) under the classified vegetation which most influences the bushfire attack. The slope is determined on the basis of the fire moving towards the building and the rate of spread of the fire and not solely on the basis of the relative elevation of the vegetation.

Ember attack	Attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.
EMV	<i>Emergency Management Victoria</i>
EVC	<i>Ecological Vegetation Class</i> - The standard unit for classifying vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range and, although differing in species, have similar habitat and ecological processes operating.
FBI	<i>Fire Behaviour Index</i> – A mathematically calculated scale of potential fire behaviour that ranges from 0 to 100+, based on fire behaviour models. Fire agencies use the FBI to inform decisions about the Fire Danger Rating (FDR) for a district.
FDR	<i>Fire Danger Rating</i> – The FDR is set by fire agencies based on FBIs and indicates how difficult it will be to control or suppress a fire and communicate the level of bushfire risk. There are four FDRs; Moderate, High, Extreme and Catastrophic. 'No rating' may be shown when there is low risk.
FFDI	<i>Forest Fire Danger Index</i> – A numerical index representing the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression, according to various combinations of air temperature, relative humidity, wind speed and both the long- and short-term drought effects.
FFMvic	<i>Forest Fire Management Victoria</i>
FRV	<i>Fire Rescue Victoria</i>
LGA	<i>Local Government Area</i>
RHF	<i>Radiant heat flux</i> - The heat transfer rate per unit area from thermal (electromagnetic) radiation, expressed as kilowatts per metre squared (kW/m ²). Calculated or measured for a specific surface to determine the radiant heat received by that surface from flames associated with a bushfire.

1 Introduction

The Department of Transport and Planning (DTP) and Casey City Council (Council) are preparing an amendment to the Casey Planning Scheme to facilitate the development of the Cardinia Creek South Part 2 (CCSP2) Precinct Structure Plan (PSP) area.

For the development of the parent PSP (formerly McPherson PSP, now the Cardinia Creek South PSP), Terramatrix prepared a Bushfire Development Report (BDR) in September 2017 (Terramatrix, 2017) as expert evidence for the panel hearing for Planning Scheme Amendment C221.

Given the passage of time and subsequent changes to development assumptions within the Part 2 precinct, Council and DTP requested Terramatrix prepare an Addendum Report as a review of the 2017 BDR to inform the finalisation of the Cardinia Creek South Part 2 PSP (CCC, 2025).

An update to the previous assessment is also required as the CCSP2 area, originally planned as part of the broader Cardinia Creek South precinct, was subsequently excised pending a decision on the location of a regional park. With an alternative site for the regional park now confirmed, future development of the Part 2 precinct is anticipated to provide for a mix of residential, open space and drainage uses.

Council directed that the study should comprise a ‘high-level strategic refresh’ informed by the most recent applicable bushfire planning controls and aligned with existing concept plans, rather than a comprehensive redevelopment of the 2017 BDR (CCC, 2025). Specific tasks were to:

- *Review the Bushfire Development Report Prepared as expert evidence for the McPherson Precinct Structure Plan Planning Panel as part of Casey Planning Scheme Amendment C221 (September 2017) as it relates to the Part 2 area and identify any changes since its completion.*
- *Undertake a strategic review and update of the bushfire risk assessment and the 2017 report to ensure alignment with:*
 - *Current Victorian Planning Provisions for bushfire risk management, including the Planning Policy Framework (PPF) and Clause 13.02-1S Bushfire Planning.*
 - *The Indicative Future Urban Structure for Cardinia Creek South Part 2, as shown in Appendix G of the 2018 gazetted Cardinia Creek South Precinct Structure Plan.*
- *Provide recommendations on dwelling setbacks that provide acceptable safety and mapping to support the finalisation of the Part 2 PSP. Also recommending BAL construction standards and required vegetation setbacks – drawing from topography and the ‘effective slope’ of Cardinia Creek and Melbourne Water DSS footprint (including Mirvac’s drainage works permit).*
- *Provide recommendations on proposed strategies for how the Place Based Plan holistically responds to bushfire risk, including the requirements of Clause 13.02-1S, published guidance, and building regulations applicable to construction in a BPA.*
- *Review Mirvac/JetWise Bushfire Assessment and Development Report (if available) to verify consistency in assumptions and risk assessment approach (CCC, 2025).*

Accordingly, this addendum report comprises a high level review of the 2017 BDR, that assesses the bushfire hazard in and around the CCSP2 precinct and summarises the suitability for growth and

development (from a bushfire perspective only¹) of the precinct, in accordance with the Victorian planning and building controls that relate to bushfire, in particular the objective and strategies of Clause 13.02-1S *Bushfire Planning* in the Casey Planning Scheme.

The assessment incorporates as appropriate, applicable guidance for the assessment of and response to bushfire risk provided in:

- *Design Guidelines Settlement Planning at the Bushfire Interface* (DELWP, 2020a).
- *Local planning for bushfire protection*, Planning Practice Note 64 (DELWP, 2015).
- *AS 3959:2018 Construction of buildings in bushfire prone areas* (Standards Australia, 2020).

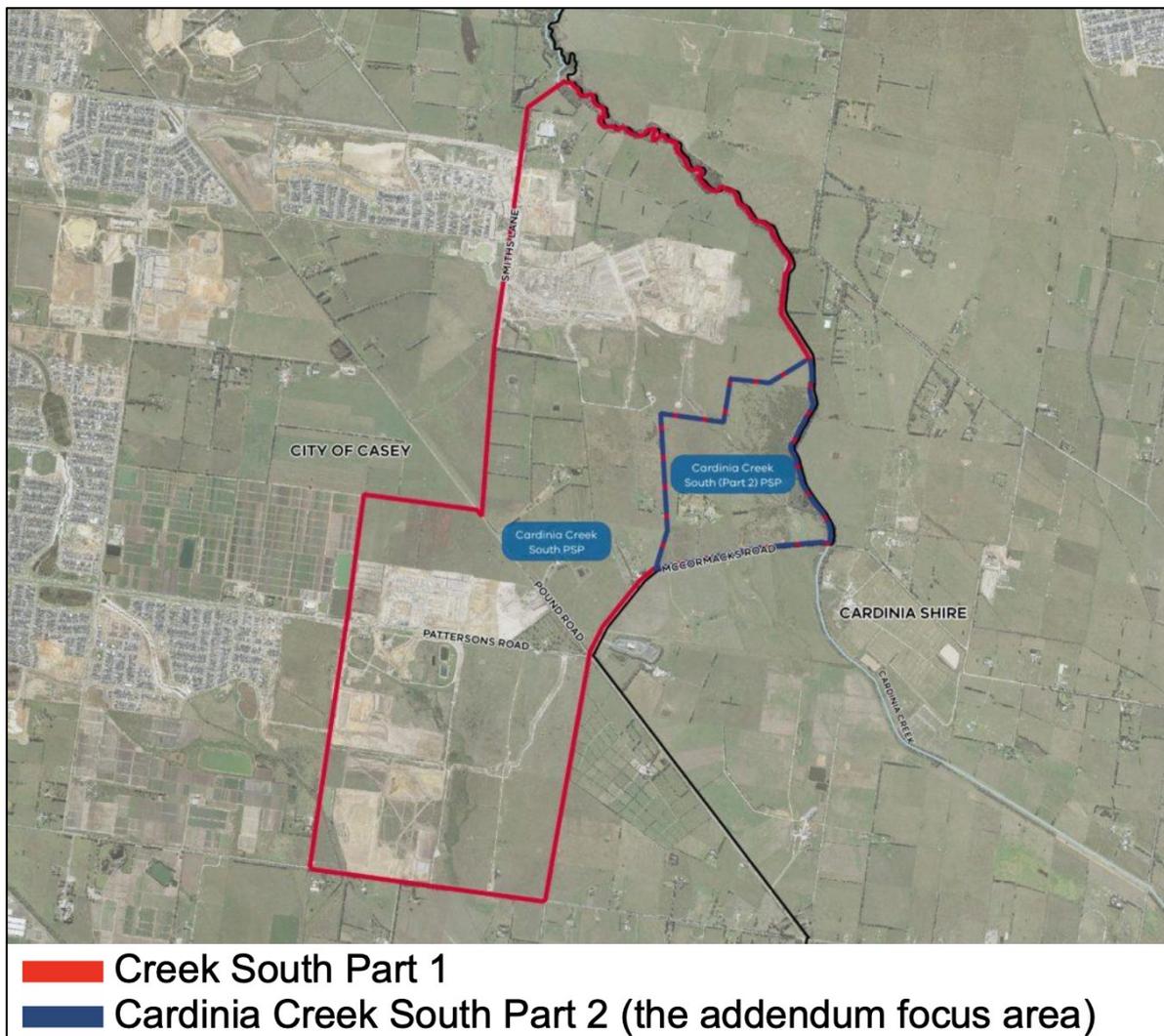


Figure 1 – Cardinia Creek South Part 1 and 2 areas (Figure 1 in CCC, 2025).

¹ i.e. the study does not consider other potential constraints to growth and development such as flood risk or biodiversity values.

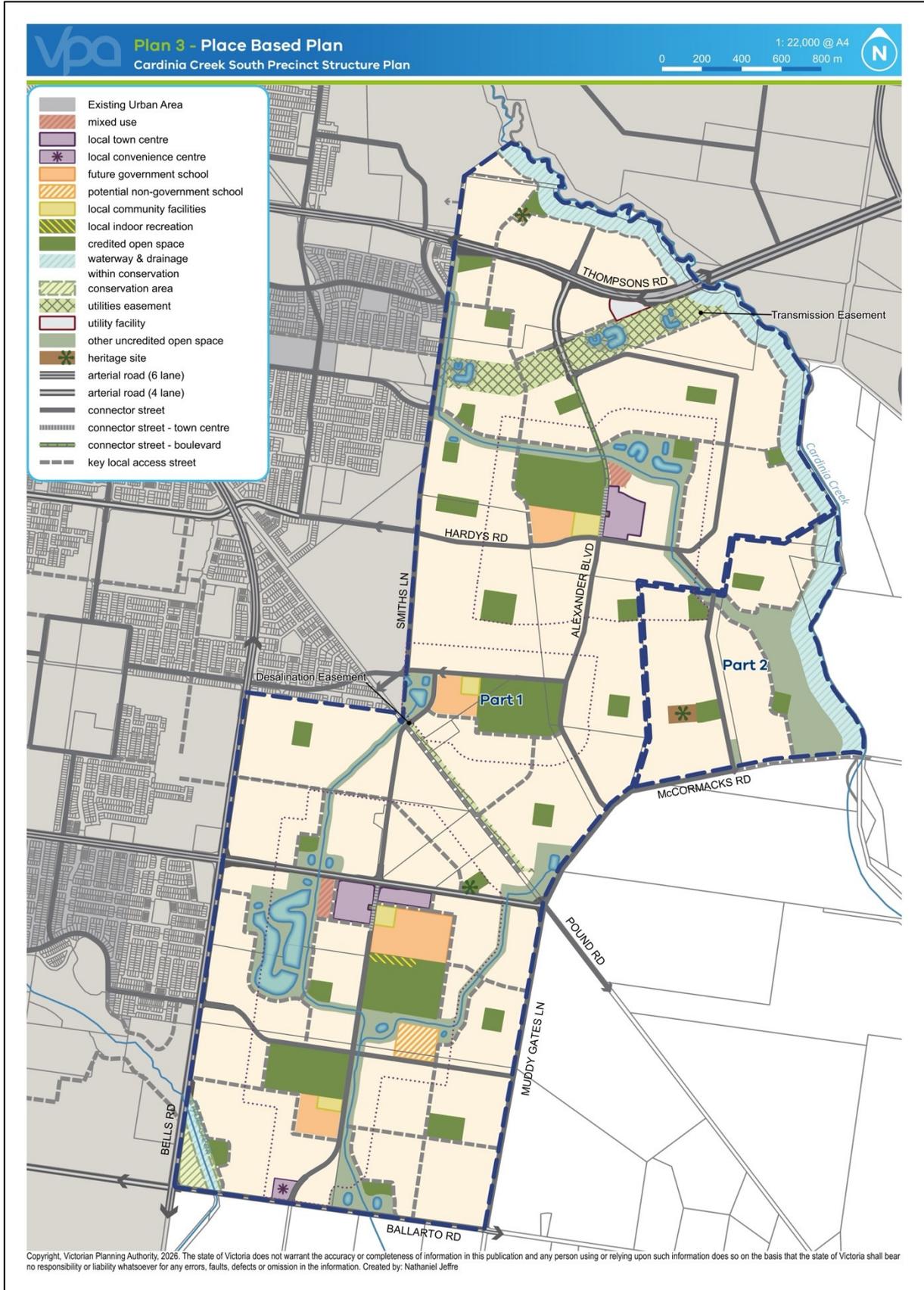


Figure 2 – Cardinia Creek South Proposed Future Urban Structure (VPA, 2026).

2 Bushfire planning and building context

This section summarises the applicable planning and building strategies and controls that relate to bushfire.

2.1 Casey Planning Scheme

2.1.1 Clause 02 Municipal Planning Strategy

The Municipal Planning Strategy (MPS) in the Casey Planning Scheme, identifies the increasing incidence of bushfire as a result of climate change is one of the environmental risks for the municipality. A strategic direction is to *‘Ensure strategic and settlement planning and development decisions prioritise the protection of human life and minimise the risk to property from bushfire’* (Casey Planning Scheme, Cl. 02.03-3).

The MPS identifies the CCSP2 precinct as a residential growth location and Future Medium Neighbourhood Activity Centre (Casey Planning Scheme, Cl. 02.04-7) (see CCSP2 area in red outline in Figure 3).

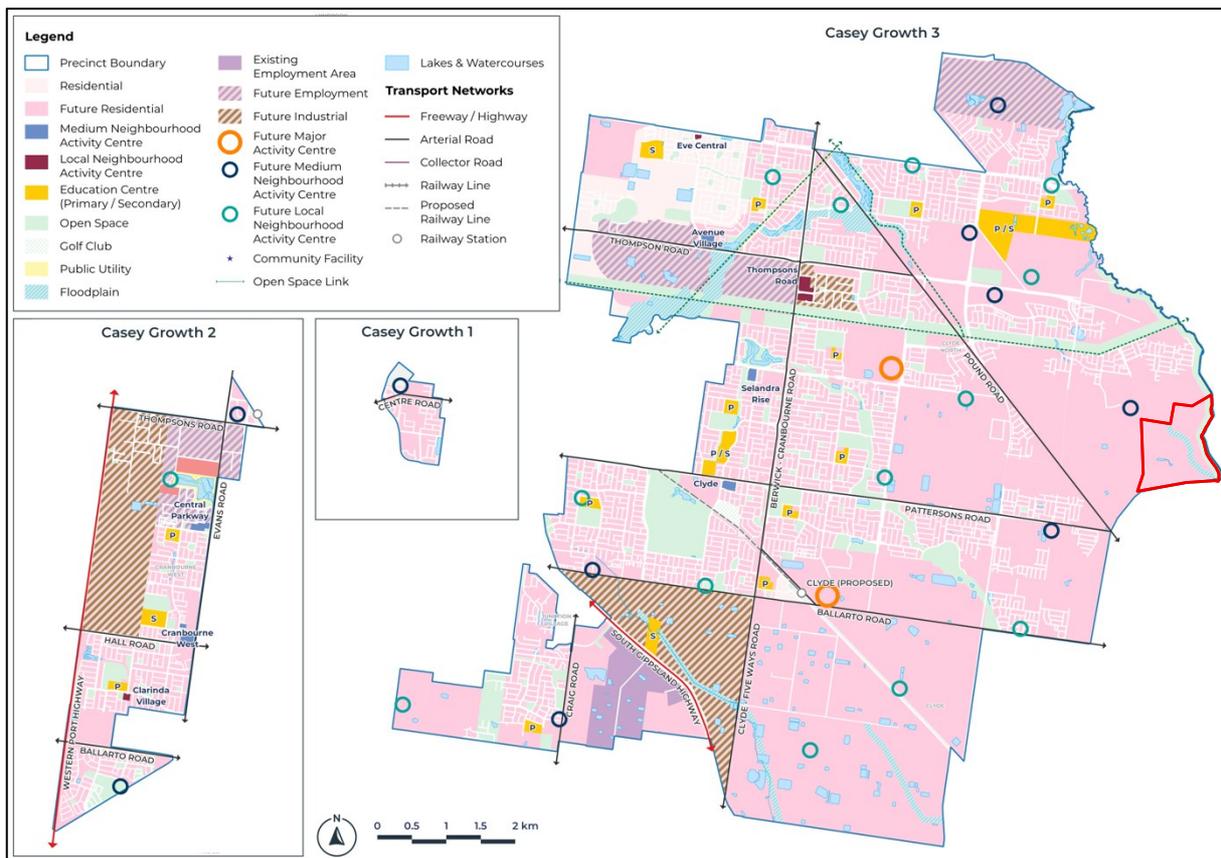


Figure 3 - Growth Areas Strategic Framework Plan (Casey Planning Scheme, Cl. 02.04-7).

In the broader regional context, the precinct is also identified as an urban growth area in the Melbourne Settlement Framework Plan, where investment and growth will be focussed (Casey Planning Scheme, Cl. 11.01-1R).

In managing growth, structure and precinct plans are to, amongst other things, *‘Address the strategic and physical context of the location, including increased physical risks associated with climate change’* and *‘Address environmental risk and amenity’* (Casey Planning Scheme, Cl. 11.02-2S).

The PSP must be consistent with the *Precinct Structure Planning Guidelines: New Communities in Victoria* (Victorian Planning Authority, 2021), including to *‘Respond to climate change and increase environmental sustainability’* and, as a growth location, meet a dwelling density target of at least 20 dwellings per net developable hectare (Casey Planning Scheme, Cl. 11.02-2S).

2.1.2 Clause 13.01-1S Natural hazards and climate change

The objective of this Clause in the Planning Policy Framework (PPF) is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning.

Specified strategies to achieve the objective are:

- *‘Respond to the risks associated with climate change in planning and management decision making processes.*
- *Identify at risk areas using the best available data and climate change science.*
- *Integrate strategic land use planning with emergency management decision making.*
- *Direct population growth and development to low risk locations.*
- *Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.*
- *Ensure planning controls allow for risk mitigation and climate change adaptation strategies to be implemented.*
- *Site and design development to minimise risk to life, health, property, the natural environment and community infrastructure from natural hazards’* (Casey Planning Scheme, Cl. 13.01-1S).

The Australian and New Zealand Council for Fire and Emergency Services (AFAC) identifies that climate change has already influenced the frequency and severity of dangerous bushfires. More dangerous bushfire weather conditions are being experienced, including a longer and more severe fire season, especially in southern and southeastern Australia (AFAC, 2020). Further, a failure of building codes and land use planning to adequately adapt to climate change is identified as a risk (AFAC, 2018).

The precinct is in the Southern Slopes (Victoria West) natural resource management sub-cluster of Australia. Average temperatures in this region are projected to substantially increase in all seasons (with very high confidence) and more hot days and warm spells are projected with very high confidence (CSIRO/BOM, 2026). Generally, less rainfall is anticipated in winter and spring, but summer and autumn rainfall changes are less clear.

There is high confidence that climate change will result in a harsher fire-weather climate in the future, but a low confidence in the magnitude of the expected change, which depends on the rainfall projection and its seasonal variation (CSIRO/BOM, 2026).

Victoria's latest Climate Science report identifies that changes in fire regimes, activity and drivers in Victoria have already been observed, including:

- more frequent and severe large fires
- a longer fire season
- a greater frequency of days of significant fire danger
- that these changes are likely to escalate with increasing temperatures (DEECA, 2024).

Continued trends will change the quantity, composition and moisture content of flammable vegetation but there is uncertainty about the magnitude of change. Fuel loads across forested and grassy landscapes may increase by the end of the century, however these effects may be counteracted by nutrient limitations and drought. There is confidence that climate change is causing increasing fire weather and fuel dryness, but some uncertainty about the effects on fuel load and ignition risk (DEECA, 2024).

In the absence of specific direction or policy from fire authorities or other agencies (e.g. to adopt a higher projected FFDI threshold for strategic planning), climate change trends support the adoption of a precautionary and conservative approach in identifying and responding to bushfire risk, especially by avoiding growth and development in high risk locations and directing it to lower risk locations in accordance with the State planning policy for bushfire at Clause 13.02-1S.

2.1.3 Clause 13.02-1S Bushfire planning

Clause 13.02-1S has the objective '*To strengthen the resilience of settlements and communities to bushfire through risk based planning that prioritises the protection of human life*' (Casey Planning Scheme, Cl. 13.02-1S). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a BPA;
- Subject to a BMO; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Priority must be given to the protection of human life by:

- '*Prioritising the protection of human life over all other policy considerations.*
- '*Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.*
- '*Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process*' (Casey Planning Scheme, Cl. 13.02-1S).

Key strategies are stipulated that require strategic planning documents, planning scheme amendments and development plan approvals to properly assess bushfire risk and include appropriate bushfire protection measures.

In a BPA this also applies to planning applications for uses and developments that are:

- Subdivisions of more than 10 lots
- Accommodation
- Child care centre
- Education centre
- Emergency services facility
- Hospital
- Indoor recreation facility
- Major sports and recreation facility
- Place of assembly
- Any application for development that will result in people congregating in large numbers.

Development should not be approved where ‘...a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented’ (Casey Planning Scheme, Cl. 13.02-1S).

This study assesses the hazard in accordance with the hazard identification strategies of Clause 13.02-1S. It analyses likely bushfire behaviour at the landscape, settlement, local, neighbourhood and site scales, including applying the best available science to identify hazard attributes and the potential for neighbourhood-scale destruction.

Areas are identified that can meet key settlement planning strategies for directing growth such that development will not be exposed to radiant heat flux (RHF) above 12.5 kW/m² i.e. commensurate with a Bushfire Attack Level (BAL)-12.5 construction standard. These locations are assessed as BAL-12.5 and BAL-LOW under AS 3959:2018 *Construction of buildings in bushfire-prone areas* (Standards Australia, 2020) (see Map 2 in Section 4.2) and the ability for access to safer locations is considered in Section 4.3.

The maximum 12.5 kW/m² safety threshold is required for settlement planning as the upper limit for acceptable risk. Responsible authorities must ‘*Not approve any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2018 Construction of buildings in a bushfire prone area*’ (Casey Planning Scheme, Cl. 13.02-1S).

2.1.4 Clause 71.02-3 Integrated decision making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate planning policies relevant to the issues to be determined and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas this clause states the protection of human life must be prioritised over all other policy considerations (Casey Planning Scheme, Cl. 71.02-3).

2.1.5 Zones and Overlays

Most of the precinct is Urban Growth Zone (UGZ), other than the proposed Conservation/Waterway reserve along the eastern precinct boundary, which is Rural Conservation Zone (RCZ), and most of the more central linear drainage reserve and retarding basin area, which is Urban Floodway Zone (UFZ). Land beyond the urban growth boundary bordering the precinct to the south and east is Green Wedge Zone (GWZ1).

The zones within the precinct have no intrinsic implications for bushfire safety. However, the UGZ designation facilitates intensive development in a BPA, which could result in an increase in risk if people or assets are exposed to a bushfire hazard without appropriate mitigation measures commensurate with the level of hazard exposure.

The Land Subject to Inundation Overlay (LSIO) applies to much of the precinct and a small central area has the Heritage Overlay but these controls do not have any bushfire risk implications.

The Environmental Significance Overlay (ESO6) applies to land in the proposed conservation/waterway reserve along the eastern precinct boundary. It aims to protect and enhance significant biodiversity and other environmental values associated with urban conservation areas, and one of the objectives is *'To encourage ecological restoration, regeneration and revegetation with indigenous species within the site'* (Casey Planning Scheme, Cl. 42.01-s6). The potential hazard associated with future vegetation along the ESO6 riparian corridor is considered in the hazard assessment in Section 3.2.

2.2 Bushfire Prone Area (BPA)

BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning. Those areas of highest bushfire risk within a BPA are designated as BMO areas. Note that there is no BMO coverage of the precinct, and the nearest area of BMO is over 6 km to the north in Officer and Beaconsfield.

All the CCSP2 precinct is currently designated as a BPA. Land just to the north of the precinct, in the Part 1 area has been excised from the BPA as non-bushfire prone land (see Map 1). Development of the Part 2 area will similarly result in the creation of large, reliably low threat or non-vegetated land that will also become eligible for excision from the BPA, especially as development occurs in the Part 1 area to the west of Part 2 (see Map 2).

The DTP reviews and excises eligible areas from the BPA approximately every 6 months, particularly in growth areas where the hazard is removed as urban development occurs. Land becomes eligible for excision from the BPA if it satisfies statewide hazard mapping criteria, including that the land typically needs to be:

- At least 150 m and up to 300 m from areas of classified vegetation, except grassland, more than 2 ha in size; and
- At least 60 m from areas of classified grassland more than 2 ha in size (DELWP, 2019).

For areas of vegetation less than 2 ha, the shape of the area and connectivity to any other hazardous vegetation is a further consideration (DELWP, 2019).

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code 2022 (NCC), require specific design and construction standards for Class 1, 2 and 3² buildings, certain Class 9 and 4 buildings³, and Class 10A buildings⁴ or decks adjacent to, or connected with, these classes of buildings.

For Class 1 buildings (dwellings) and associated Class 10A buildings or decks, the applicable performance requirement in the NCC is:

- ‘A Class 1 building or a Class 10a building or deck associated with a Class 1 building that is constructed in a designated bushfire prone area must be designed and constructed to—*
- (a) reduce the risk of ignition from a design bushfire with an annual exceedance probability not more than 1:50 years; and*
 - (b) take account of the assessed duration and intensity of the fire actions of the design bushfire; and*
 - (c) be designed to prevent internal ignition of the building and its contents; and*
 - (d) maintain the structural integrity of the building for the duration of the design bushfire*
- (ABCB, 2023).

The performance requirement for Class 1, 2 and 3 buildings and associated Class 10a buildings and decks, is deemed to be satisfied by design and construction in accordance with AS 3959:2018 *Construction of buildings in bushfire prone areas*. For Class 1 buildings and associated decks, the NASH Standard – *Steel Framed Construction in Bushfire Areas* (NASH, 2021) is also deemed to satisfy the performance requirement.

More onerous performance measures apply to certain Class 9 buildings.

In Victoria, buildings in a BPA must be constructed to a minimum BAL-12.5, or higher as determined by a site assessment, planning scheme requirement or other NCC requirement⁵.

A BAL is a means of measuring the severity of a building’s potential exposure to ember attack, radiant heat and direct flame contact. There are six BALs defined in AS 3959, which range from BAL-LOW, which has no bushfire construction requirements, to BAL-FZ (Flame Zone) where flame contact with a building is expected (see Figure 4).

² Class 1, 2 and 3 buildings are defined in the NCC and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

³ Applicable Class 9 buildings are Class 9a health-care buildings, Class 9b early childhood centres, primary and secondary schools, Class 9c residential care buildings, and any Class 4 parts of a building associated with these Class 9 buildings.

⁴ Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.

⁵ Class 9 buildings are typically required to meet an enhanced BAL-19 construction standard, as well as comply with other bushfire protection specifications.

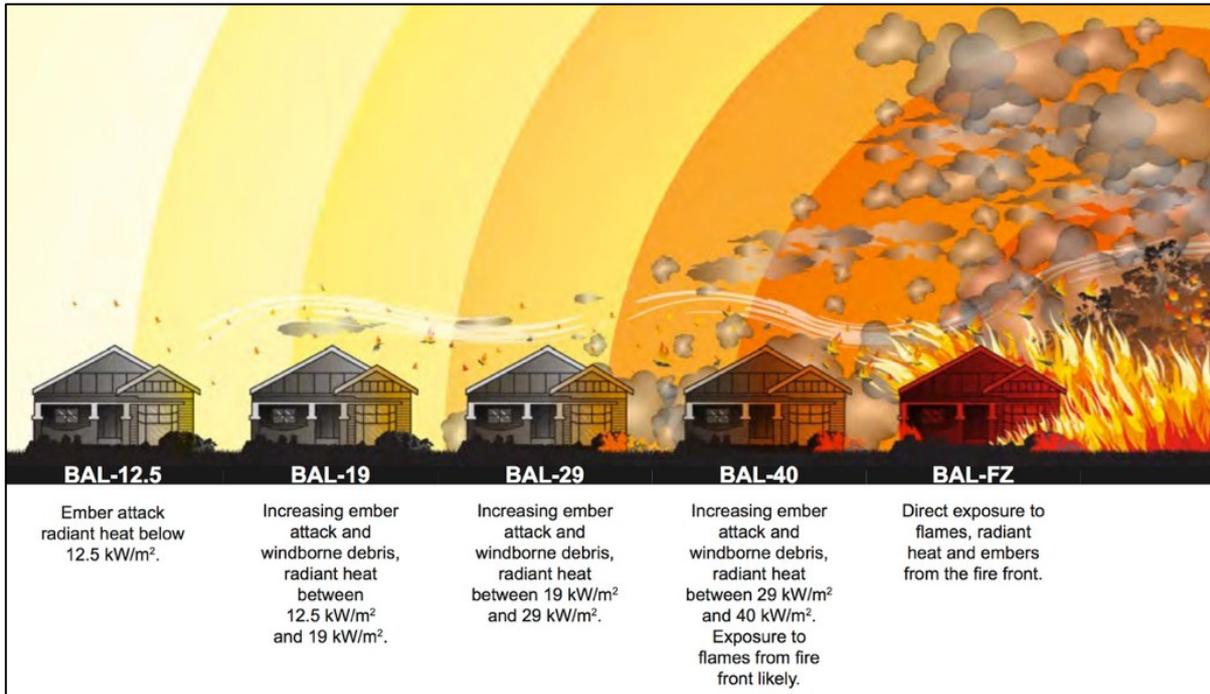


Figure 4 - Bushfire Attack Levels (CFA, 2012).

3 Hazard assessment

One of the bushfire hazard identification and assessment strategies in Clause 13.02-1S, is to use the best available science to identify the hazard posed by vegetation, topographic and climatic conditions (Casey Planning Scheme, Cl. 13.02-1S). The basis for the hazard assessment should be:

- *‘Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;*
- *Local conditions - meaning conditions within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions within 400 metres of a site; and*
- *The site for the development’* (Casey Planning Scheme, Cl. 13.02-1S).

Planning Practice Note 64 *Local Planning for Bushfire Protection* recommends an assessment of the landscape for 20 km, 10 km and 1 km around a study area (DELWP, 2015). Development applications responding to the state planning policy for bushfire at Clause 13.02-1S (and BMO applications) also typically require an assessment of the broader risk arising beyond the site scale.

3.1 Broad and local landscape conditions

Figure 5 shows the broader landscape for at least 75 km around the precinct. It shows extensive areas of land that are not designated as bushfire prone areas, including the waters of Port Phillip Bay. The non-BPA land occurs to the west and north, which are directions typically associated with high bushfire threat on day of elevated fire danger. To the south, large areas of predominately flat grassland extend for just over 10 km to Westernport Bay.

The nearest large area of high hazard vegetation, other than the flat grasslands to the south and east, is the Beaconsfield Nature Conservation Reserve over 8 km to the north, and Lysterfield Lake Park and Cardinia Reservoir, which are both approximately 15 km or more to the north-northeast and north-northwest respectively. Large areas of low threat developed land, including non-BPA land, occur between the precinct and these landscape hazards.

The lack of BMO coverage in surrounding landscape for over 5 km, reflects the relatively low risk for development on the site from bushfire. The nearest publicly recorded fire history is a grass fire that occurred approximately 2.5 km to the north, just south of the Princes Freeway in 2013.

The relatively low bushfire risk in the area is supported by the findings of the *Regional Bushfire Planning Assessment – Melbourne Metropolitan Region* (DPCD, 2012). As part of the State Government’s response to the 2009 Victorian Bushfires Royal Commission, Regional Bushfire Planning Assessments (RBPAs) were undertaken across six regions that covered the whole of Victoria. The RBPAs provide information about ‘identified areas’ where a range of land use planning matters intersect with a bushfire hazard to influence the level of risk to life and property from bushfire. The RBPAs state that *‘This information should be addressed as part of strategic land use and settlement planning at the regional, municipal and local levels’* (DPCD, 2012).

In the RPBA covering the municipalities of Casey and Cardinia, no bushfire matters or hazards needing consideration, are identified in or around the Cardinia Creek South precinct.

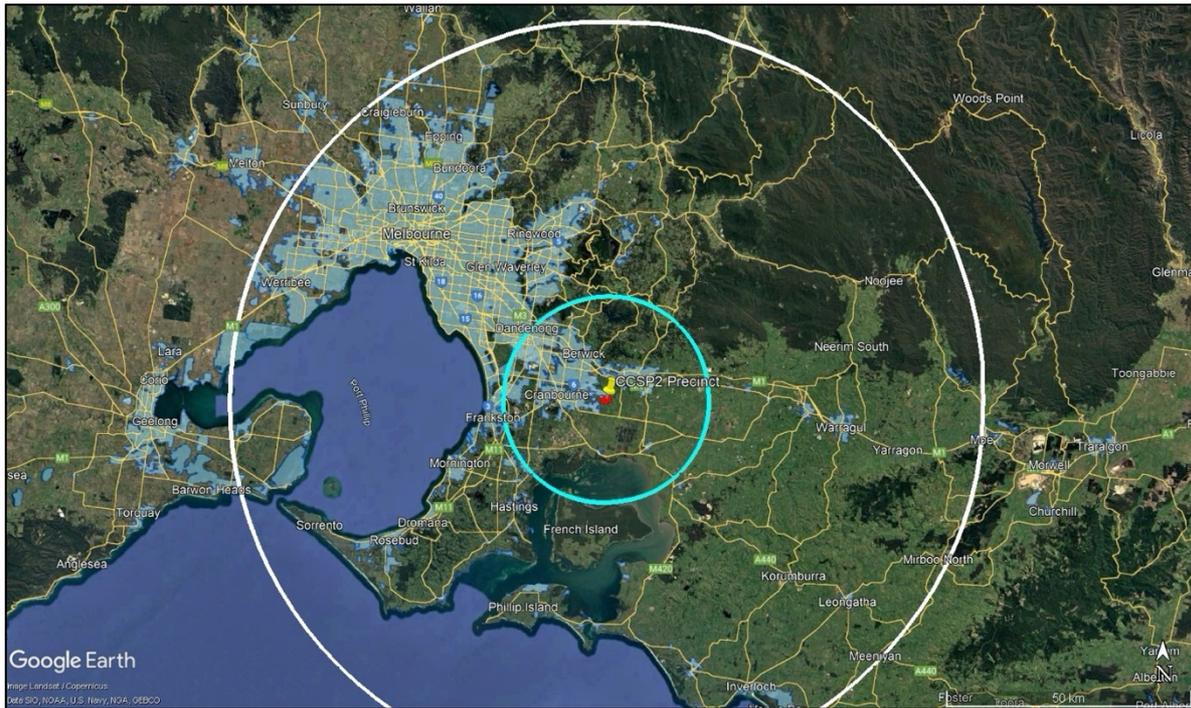
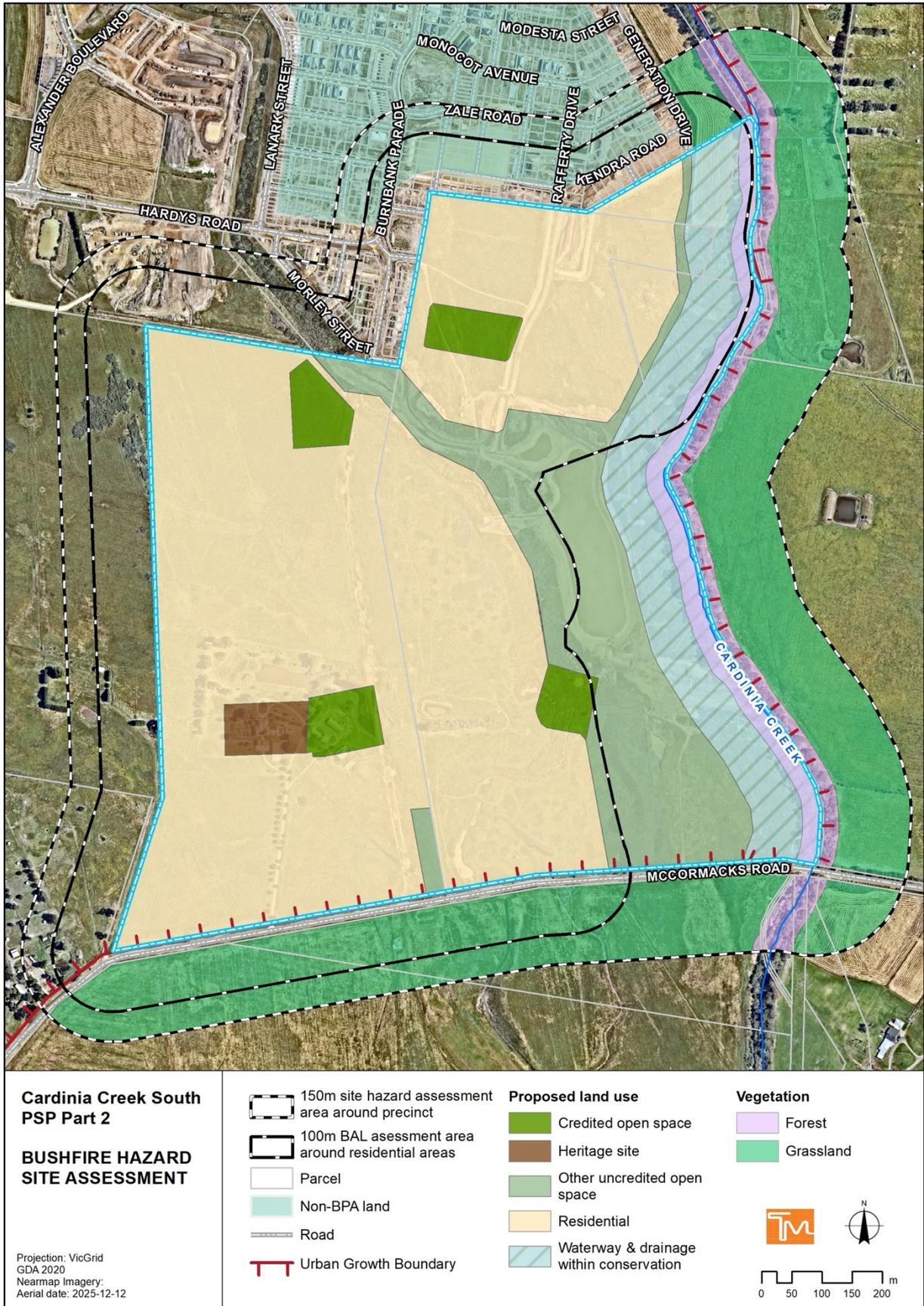


Figure 5 – Broad landscape context of the precinct (in red with yellow pin) showing 20 km and 75 km extents around the area (in teal and white respectively). Non-BPA land is shown in semi-transparent blue fill.



Figure 6 – Local landscape around the precinct, with 5 km area around it in blue outline, and 1 km local area in orange outline. Non-BPA land is shown in semi-transparent blue fill with BMO coverage (in view to the west) in semi-transparent orange fill.



Map 1 - Bushfire hazard site assessment (note as Grassland to the west will be removed by future development it has not been classified).

3.2 Neighbourhood and site scale conditions

The AS 3959 model, upon which BALs and vegetation setbacks are based, presumes a large, fully developed fire (a fire moving at a quasi-steady state rate of forward spread) with a head fire width of 100 m. The only credible bushfire scenario for a fire of this scale to impact the site is a grassfire. A grassfire could ignite and develop in the pastures on or around the site but it could approach only from the west, south or east. As the precinct to the west is developed in accordance with the Part 1 PSP and the grassland hazard is permanently removed in that direction, a fire could only threaten the southern and eastern urban growth boundary interfaces.

Whilst grassfires can grow and spread rapidly, based largely on wind direction and speed, they are generally of lesser intensity than scrub or forest fires and typically do not generate significant ember attack. It should be noted though, that if a large grassfire threatened, fire behaviour including flame length, radiant heat flux and ember attack, would likely increase if it burnt into or along tree and shrub vegetation in the riparian corridor along the Cardinia Creek.

However, if appropriate development setbacks and BAL construction standards are provided in accordance with AS 3959, it is considered that acceptable safety will be achieved through the applicable building controls that require a construction standard for buildings, water and access as required by the planning scheme for subdivisions, along with perimeter roads along permanent hazard interfaces as a 'best practice' design feature. Additional protective features such as increased setbacks beyond the AS 3959 default distances for BAL-12.5 are not considered necessary.

3.2.1 Forest/Woodland

Vegetation along the Cardinia Creek corridor and in and around the precinct, has been classified in accordance with the AS 3959 methodology (see Map 1). Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is based on the likely fire behaviour the vegetation will generate.

The classification has been undertaken based on interpretation of aerial imagery, publicly available vegetation mapping by DEECA, and site assessment.

EVC mapping and site assessment identifies treed vegetation along the Cardinia Creek currently comprises Open Forest and/or Woodland (see Figures 7-10).



Figure 7 - Looking north at Forest along Cardinia Creek from the southwest corner of the precinct.



Figure 8 - Looking southwest at Forest along Cardinia Creek from the southwest corner of the precinct.

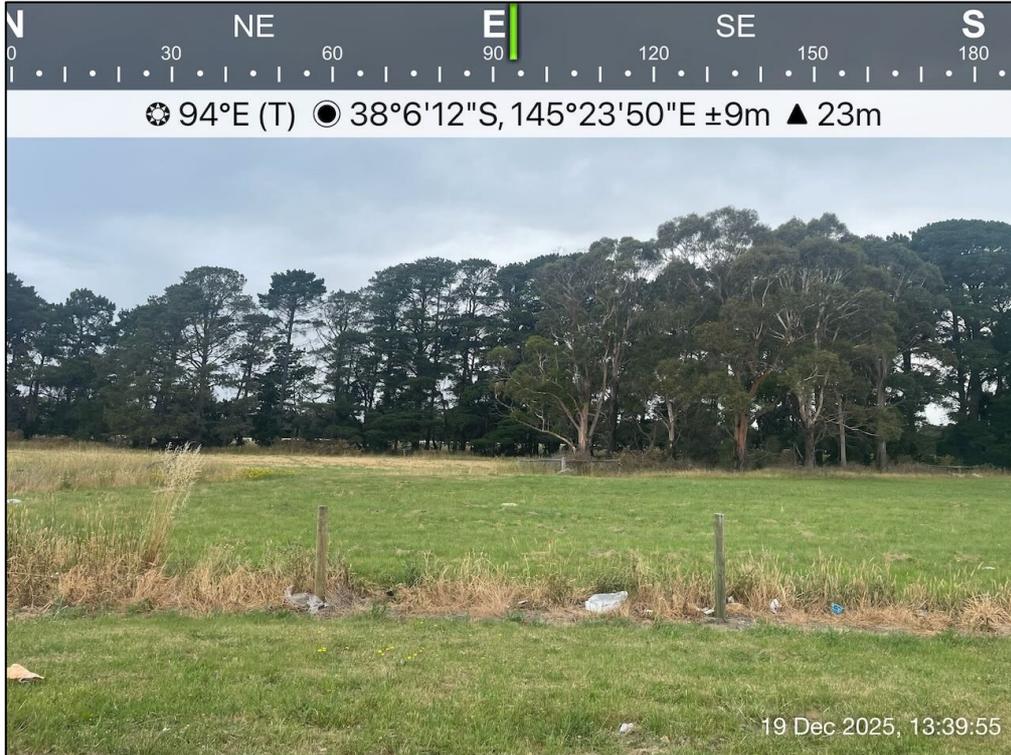


Figure 9 – Looking east across Grassland at pine trees and small patch of Woodland along Cardinia Creek in the Part 1 precinct area.



Figure 10 – Vegetation and Precinct 1 interface along Cardinia Creek just north of the Part 2 precinct area.

Modelled EVC mapping shows remnant vegetation along the creek corridor as 'EVC 83 Swampy Riparian Woodland' (DEECA, 2026). The bioregional benchmark description of this EVC, which is in the 'Riparian Scrubs or Swampy Scrubs and Woodlands' EVC group, is:

'Woodland to 15 m tall generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer' (DSE, 2004).

The Forest and Woodland vegetation groups are differentiated largely by the extent of canopy (and as appropriate understorey) foliage cover, as a surrogate for their fuel hazard levels. Whilst Swampy Riparian Woodland has a benchmark canopy cover of 20% it can have a dense understorey including medium to tall shrubs and immature canopy trees with a benchmark cover of 55% (DSE, 2004).

Typically, Woodland vegetation does not exceed an overstorey foliage cover threshold of 30% with a grassy understorey containing few shrubs, whilst Forest vegetation can have 30-70% foliage cover, which may include understorey vegetation (Standards Australia, 2020).

The same fire behaviour model is used for both of these vegetation groups to calculate building setback distances, and hence BALs, however the fuel load inputs differ. Forest is presumed to have an understorey fine fuel load of 25 t/ha and a total fine fuel load of 35 t/ha, whilst Woodland is presumed to have an understorey fine fuel load of 15 t/ha and a total fine fuel load of 25 t/ha (Standards Australia, 2020).

The differing fuel inputs have a significant impact on the extent of defensible space⁶ (vegetation setback area) required around a building, with reduced setback distances being required for Woodland vegetation, as a result of its lesser fuel load.

The composition of the vegetation along the Creek is variable and in places is significantly modified from its presumed 'natural' state as described in the EVC benchmark. It includes planted and remnant Eucalypts with a grassy or shrubby understorey in the northern section, mature Pine trees with scattered remnant shrubs in the understorey in the mid-section (see Figure 9), and a more 'intact', less modified remnant composition of indigenous trees, shrubs and ground covers in the southern section (see Figure 7 and Figure 8).

Structurally, most areas of treed vegetation near the CCSP2 area accord best with a Forest classification; at least where it has a denser overstorey foliage cover and shrubby understorey. Fuel hazard assessments could not be undertaken due to time and access constraints.

In the absence of more detailed analysis, for the purposes of this report, as a precaution, the Forest classification has been uniformly adopted for all the treed vegetation along the Creek corridor. Note the higher hazard areas of riparian vegetation that are more commensurate with Forest, occur in the

⁶ 'An area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire' (Casey Planning Scheme, Cl. 73.01). This term is used in BMO areas and is equivalent to the minimum setback distance a building must be from the classified vegetation in a BPA.

southern section of the creek corridor. Whereas in the northern section, where a Woodland classification was uniformly adopted by Terramatrix in 2017, the riparian vegetation was less dense and its structure more clearly resembled Woodland.

Note that due to the nature of the observed fuel hazard overall in the riparian vegetation, and as a narrow area of hazard along the lower threat eastern side of the precinct, a Woodland classification could be argued as being applicable.

The width of the vegetation currently averages only approximately 30 m (see Map 2). This narrow width of the vegetation will result in a lesser rate of forward spread and hence reduced flame lengths and radiant heat impacts to that presumed in the AS 3959 model, for a fire in the corridor: burning either across the creek directly towards development in the precinct, or, along the creek as a flanking fire. Note that the intensity of a fire along its flank is significantly less than that generated at the head of a fire.

Additional, more detailed, investigation could differentiate Forest areas from Woodland if required. This is not considered necessary, however, as the vegetation is sufficiently distant from development in the CCSP2 precinct not to influence BAL outcomes.

3.2.2 Grassland

Vegetation comprising the pastures west, south and east of the CCSPS2 area has been classified as Grassland (see Map 1). The Grassland group includes pasture, cropland⁷ and other forms of grassy vegetation (except tussock moorlands), including situations with shrubs and trees where the overstorey foliage cover is less than 10% (Standards Australia, 2020).

Grassland is considered hazardous and therefore classifiable, when it is not managed in a minimal fuel condition. Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (e.g. short-cropped grass, to a nominal height of 100 mm) (Standards Australia, 2020).

Grassland areas are presumed to be unmanaged and classifiable unless there is 'reasonable assurance' that they will be managed in perpetuity in a low threat state. It is important to note the Grassland abutting the western precinct boundary is a temporary hazard only, as it will be permanently removed once development to the west commences.

3.2.3 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959:2018, if they meet one or more of the following criteria:

(a) *'Vegetation of any type that is more than 100 m⁸ from the site.*

⁷ Non-curing cropland is regarded as low threat vegetation that is, therefore, not classified as Grassland.

⁸ This distance extends to 150 m in BMO areas.

- (b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.*
- (c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.*
- (d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.*
- (e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*
- (f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition⁹, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks¹⁰ (Standards Australia, 2020).*

Apart from existing and future areas of tree and shrub vegetation in the conservation reserve along the creek corridor, and potentially, grassland or shrubland areas in drainage reserves, it is reasonable to assume all other land within the PSP area will be either non-vegetated or comprise vegetation that will be managed in a low threat state that can be excluded from classification, e.g. managed parklands, cultivated gardens and lawns on residential allotments and managed streetscapes and landscaping.

3.2.4 Topography

The site assessment methodology requires that the 'effective slope' be identified to determine applicable vegetation setback distances commensurate with a BAL construction standard. The effective slope is the slope of land under the classified vegetation that will most influence the bushfire attack.

The topography in and around the precinct is benign from a bushfire perspective. It is generally flat, with no significant changes in elevation that will appreciably influence the bushfire attack (see Map 1).

There are sections of the creek channel that are deeply incised and form steep, but relatively short (approx. 5 m-10 m long), creek embankments. Because of their relatively short length, and their upslope and downslope aspect, these steep embankments are not considered to be a factor influencing the effective slope for determining vegetation setbacks and BALs.

Accordingly, the applicable slope class is the 'All upslopes and flat land' slope class.

⁹ Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, short-cropped grass, for example, to a nominal height of 100 mm (Standards Australia, 2020).

¹⁰ A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees (Standards Australia, 2020).

4 Development response

This section summarises the ability of development in the precinct to be able to satisfy the objective and strategies of Clause 13.02-1S *Bushfire Planning*.

Consistent with these strategies, CFA general principles for strategic and settlement planning state that proposals should:

- *'Direct development to locations of lower bushfire risk.*
- *Carefully consider development in locations where there is significant bushfire risk that cannot be avoided.*
- *Avoid development in locations of extreme bushfire risk.*
- *Avoid development in areas where planned bushfire protection measures may be incompatible with other environmental objectives.*
- *Design out risk and for reduction, resilience and response' (CFA, 2025).*

4.1 Alternative low risk locations

A key purpose of the State planning policy for bushfire is to create bushfire resilient communities and prioritise protection human life by directing population growth and development to low risk locations. It explicitly requires that alternative locations at a range of scales, including regional, are considered when deciding where to direct growth (Casey Planning Scheme, Cl.13.02-1S).

Planning Practice Note 64 *Local planning for bushfire protection* also states that *'Directing development to the lowest risk locations is the most effective way to prioritise the protection of human life. This should be the key strategy to enhance resilience to bushfire. Alongside this is the need to avoid future development in extreme risk locations'* (DELWP, 2015).

Considering alternative locations beyond the precinct is not within the scope of this study. It has been noted, however, that regional growth plans and planning policy in the Casey Planning Scheme (see Section 2.1) identify the precinct as suitable for growth, and the landscape considerations of this assessment (see Section 3) confirm it is an acceptably low risk location. The site based BAL assessment following, also confirms the precinct is low risk and appropriate for growth and development in accordance with State planning policy for bushfire and Planning Practice Note 64.

4.2 BAL-LOW and BAL-12.5 development areas

Key settlement planning safety thresholds for radiant heat flux (RHF) exposure and BAL standards, based on appropriate development setbacks from hazardous vegetation, help to define low risk locations, as well as access and egress to those locations. The safety thresholds are defined in the following key settlement planning strategies:

- *‘Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than¹¹ 12.5 kilowatts/square metre under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018).*
- *Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018) where human life can be better protected from the effects of bushfire.*
- *Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018)’ (Casey Planning Scheme, Cl. 13.02-1S).*

Areas for future development to meet these thresholds are identified in Map 2, based on the assessment of vegetation and topography and assumptions below about the future vegetated state of land in and around the precinct.

1. Potential ‘low risk’ areas where BAL-12.5 development could occur, i.e. where RHF is calculated to not exceed 12.5 kW/m².

Based on the ‘All upslopes and flat land’ slope class, setbacks of at least 48 m from Forest and 19 m from Grassland would be required for BAL-12.5.

2. Potential BAL-LOW areas where human life may be better protected from the effects of bushfire.

Setbacks of at least 100 m from Forest and 50 m from Grassland would be required for BAL-LOW.

3. Setback likely required for land to be excised from the BPA (non-BPA setback)

The setback is shown as a red dotted line 60 m from grassland to the south and 150 m from the creek. Consistent with the non-BPA area to the north, beyond this line (i.e. to west and north of it) land could become eligible for excision from the BPA (see criteria in Section 2.2).

Assumptions about Forest areas

Tree and shrub vegetation along the Cardinia Creek corridor comprises Forest that occurs for 30 m either side of the creek centreline i.e. Forest setbacks are measured from the outside edge of a 30 m buffer of the creek.

Assumptions about Grassland areas

Unmanaged Grassland comprises pasture to the west, east and south of the precinct, and the:

- Linear drainage reserve along running diagonally through the precinct.
- Retarding basin/WQT wetland.
- All land in the conservation reserve along Cardinia Creek that is not Forest.

¹¹ Note that this strategy is to ensure RHF is less than 12.5 kW/m² (author’s emphasis). The third strategy above stipulates a maximum BAL-12.5 construction standard (which requires that RHF not exceed 12.5 kW/m²). It is assumed the intent of both strategies is to ensure that BAL-12.5 is a maximum construction standard for settlement planning, which is consistent with the wording of the latter strategy and the criteria and setback distances for BAL-12.5 in AS 3959:2018.

Note whilst the BAL setbacks are shown to the west, it is reiterated that the Grassland in this direction is a temporary hazard only, that will be permanently removed as that precinct is developed.

These potentially required setbacks for BAL-12.5 development are shown in Map 3. Note that as identified in Section 3.2.1, the Forest (assumed as a 30 m buffer of the creek) is sufficiently distant (i.e. at least 48 m from development) not to be an influence, and accordingly, only 19 m setbacks are shown from likely permanent and temporary Grassland areas.

When considering setbacks from classified vegetation, areas that are less than 20 m wide and less than 0.25 ha in area, and are not within 20 m of development or other classified vegetation, can be excluded from classification and be deemed low threat in accordance with the criteria for in Section 2.2.3.2 of AS 3959:2018 (see exclusion criteria in Section 3.2.3 of this report).

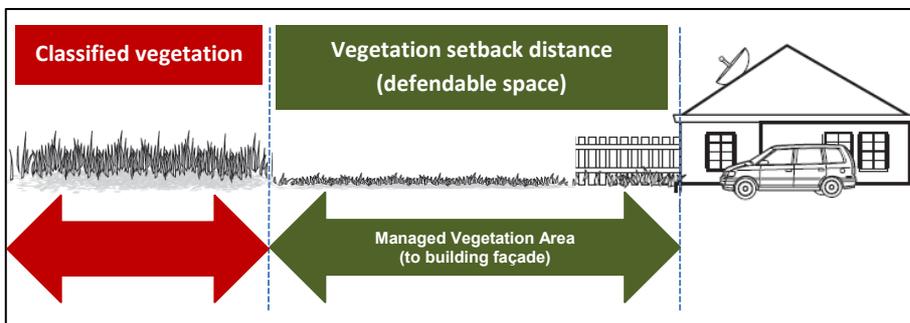
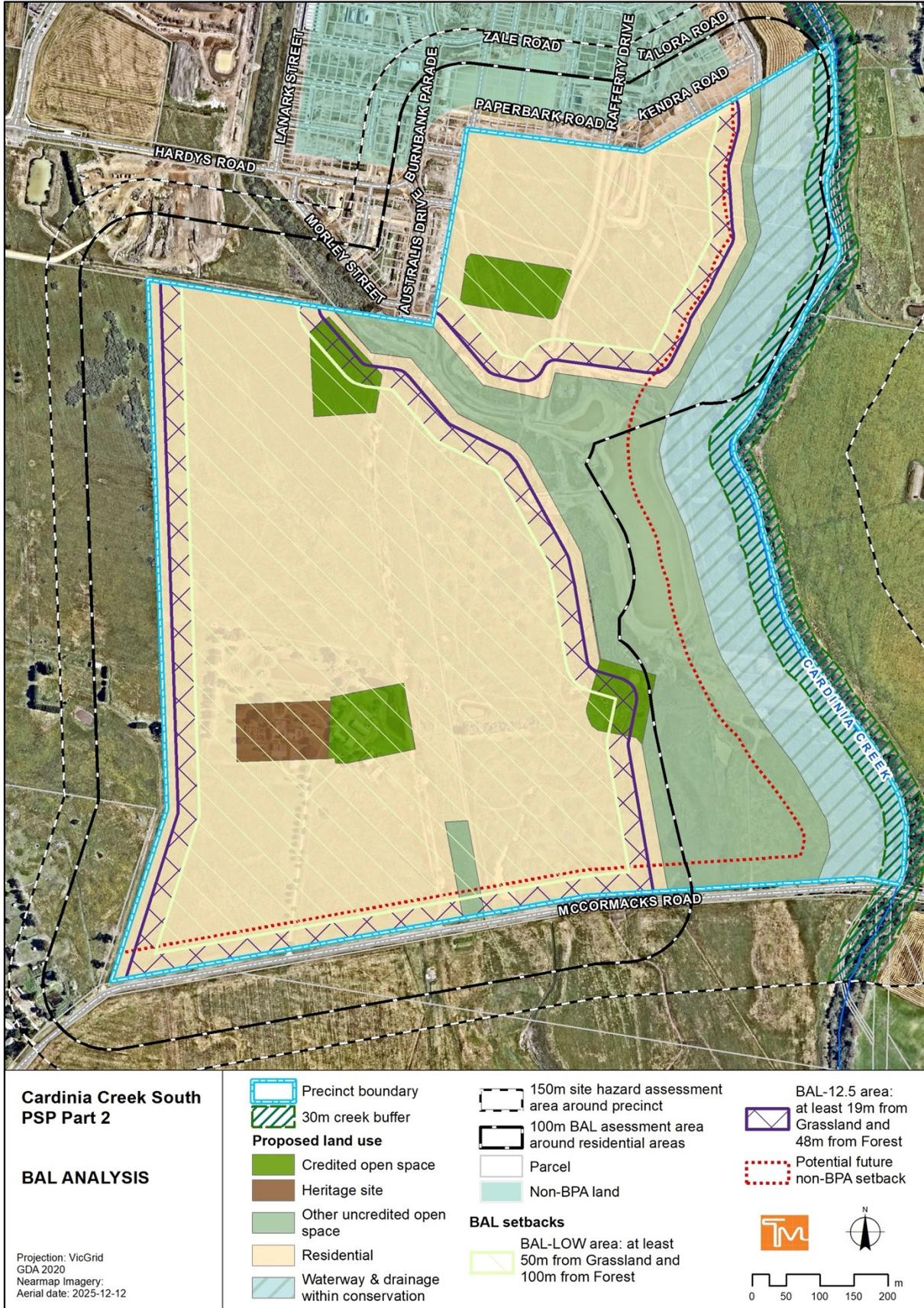
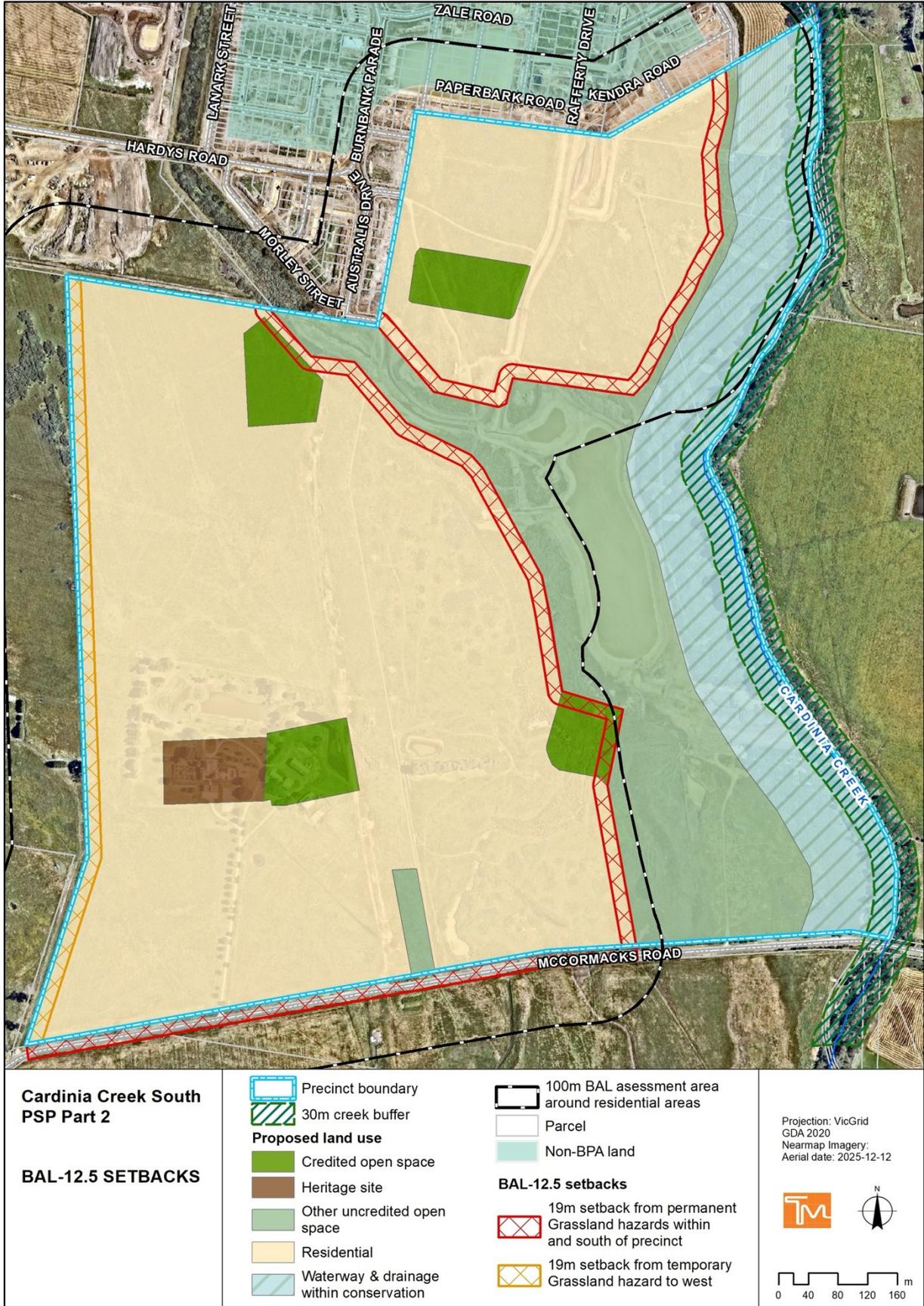


Figure 11 - Example of building-classified vegetation setback (adapted from CFA, 2013). Roads, pathways and shared trails etc. can be sited within the setback.



Map 2 – BAL analysis of the proposed Place Based Plan (note all BAL-LOW areas are also where BAL-12.5 applies i.e. BAL-LOW are a subset of BAL-12.5 areas).



Map 3 - BAL-12.5 setbacks potentially required.

4.3 Low risk locations and access and egress to safer areas

In addition to directing population growth and development to low risk locations that can meet BAL-LOW/BAL-12.5 safety thresholds, Clause 13.02-1S states that human life must be protected by ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire (Casey Planning Scheme, Cl. 13.02-1S).

Upon completion of development, most, if not all, of the precinct, will become a large area of reliably safe refuge from the impacts associated with bushfire. As shown in Map 2, this will result in most of the precinct becoming eligible for excision from the BPA.

An urban road network that complies with the access objectives and standards for residential subdivision (Casey Planning Scheme, Cl. 56.06-4) can be deemed to provide acceptable safety for bushfire purposes. Roads should comply with the CFA's *Design Requirements, Vehicle Access and Water Supply Requirements in Residential Developments* (CFA 2022). This should be supplemented with a perimeter road along the eastern edge of the development area where it interfaces with the proposed conservation and drainage reserves.

Perimeter roads are a highly desirable design feature; to achieve or contribute to BAL setbacks, separate future development from hazardous vegetation with a 'hard' non-vegetated edge and facilitate property protection and fire fighting (see Figure 12).

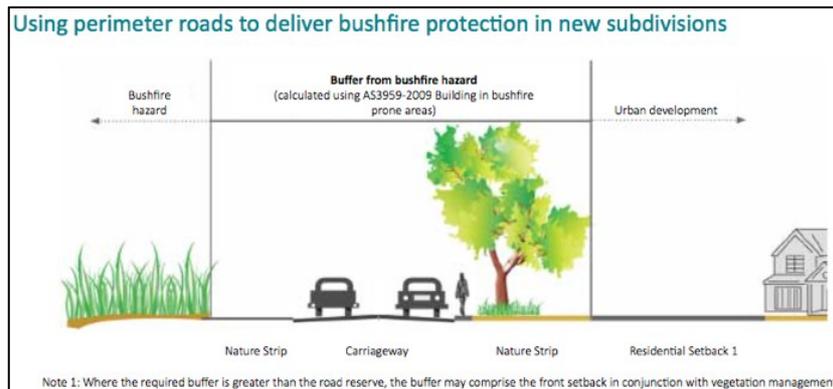


Figure 12 - Illustration of a perimeter road (DELWP, 2015).

4.4 Implementation of measures

The building regulations associated with a BPA designation (and/or bushfire policy when triggered) require the consideration of bushfire protection measures and this typically results in a construction response for those classes of buildings that require a BAL.

This building response along with measures in this assessment are considered sufficient to the relatively low level of risk for the CCSP2 precinct. This includes provision of adequate access/egress as above, and a reliable reticulated water supply for fire fighting that can be achieved by satisfying the fire hydrants objective for residential subdivision (Casey Planning Scheme, Cl. 56.09-3).

5 Conclusion

The precinct is a lower risk location at the landscape, local, neighbourhood and site scales, and accordingly, it is a suitable location for siting growth and development.

In the long term the only enduring landscape scale hazard will be Grassland beyond the urban growth boundary along the south and west precinct boundaries. Development within the precinct will have immediate access to reliably large and low threat areas within, and to the north and west of it, that will offer reliable safety from bushfire.

Site scale hazards could include the drainage reserves within the precinct, and open areas in the conservation reserve along the creek corridor, which in an unmanaged state may comprise hazardous Grassland. Tree and shrub vegetation along Cardinia Creek may comprise the more hazardous Forest vegetation type, although the shape, size and aspect of this vegetation mean it is unlikely to pose a significant threat and could arguably be deemed a Woodland hazard.

As a precaution, Forest setbacks from this riparian vegetation for BAL-12.5 development have been mapped, and along with BAL-12.5 setbacks for Grassland, most of the precinct's proposed residential areas are sufficiently distant to achieve BAL-12.5 i.e. at least 48 m from Forest and 19 m from Grassland.

Large areas of the precinct can achieve BAL-LOW setbacks and will become eligible for excision from the BPA as the hazard is removed and development is completed within and to the west of the precinct.

An urban road network that complies with the access objectives and standards for residential subdivision can be deemed to provide acceptable safety for bushfire access purposes. A perimeter road is required between development and the eastern conservation reserve, as well as adjacent to any drainage reserves that may comprise a permanent Grassland hazard.

A reliable reticulated water supply for fire fighting can be achieved by satisfying the fire hydrants objective for residential subdivision.

6 Appendix 1 - BALs & RHF

Table 1 - BALs explained.

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to...	Comment
BAL-LOW	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4 kW/m ² pain to humans after 10 to 20 seconds exposure. Critical conditions at 10 kW/m ² and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m ² .	At 12.5 kW/m ² standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m ² .	At 19 kW/m ² screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m ² .	At 29 kW/m ² ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m ² .	At 42 kW/m ² ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m ² .	At 45 kW/m ² ignition of timber in 20 seconds (without piloted ignition).

Adapted from Standards Australia (2020).

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