VICTORIA State Government | Department of Transport and Planning

Bushfire Assessment

Bannockburn Southeast Precinct Structure Plan

January 2025

Victorian Planning Authority

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Glossary

AS3959:2018	Australian Standard AS3959 Construction of Buildings in Bushfire Prone Areas. The standard provides the construction requirements for buildings in Bushfire Prone Areas and how Bushfire Attack Levels are determined.
Bannockburn Growth Plan	The Bannockburn Growth Plan (Growth Plan) guides the sustainable growth of Bannockburn to the year 2050. The Growth Plan identifies where and when future housing will be developed. It also identifies what infrastructure is needed to support the growing community.
Bushfire Attack Level (BAL)	Is a way of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact.
Bushfire Management Overlay (BMO)	Applies to land that may be significantly affected by extreme bushfires. A planning permit is required to address bushfire risk and demonstrate bushfire protective measures.
Bushfire	An unplanned fire which occurs in managed or unmanaged vegetation.
Bushfire hazard	The materials and conditions which can create bushfires.
Bushfire risk	The likelihood of a fire starting, spreading, and impacting people, property and the environment.
Bushfire Prone Area (BPA)	Applies to land which may be subject to or likely to be impacted by bushfires. Construction standards requirements are to be met in these locations.
Classified vegetation	Vegetation which has been identified as hazardous and classified as per AS3959:2018.
Defendable space	An area of land around a site where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire.
DEECA	Department of Energy, Environment and Climate Action (formerly DEWLP).
DELWP	The Department of Environment, Land, Water and Planning (now currently DEECA).
Environmental Significance Overlay	Identifies areas where the development of land may be affected by environmental constraints. The overlay ensures that development is compatible with identified environmental values.
Ecological Vegetation Classes (EVC)	The standard unit for classifying vegetation types in Victoria. EVC are described through a combination of ecological characteristics and particular environmental attributes.
Effective slope	The slope under classified vegetation.
Ember attack	Occurs when burning twigs and leaves are carried by the wind and land on a home or property, leading to spot fires and or bushfires.
Farming Zone	Areas where the dominant land use relates to agricultural activities.
Fire front	The part of the bushfire where continuous flaming combustion is taking place.

Foliage cover	The proportion of the ground that would be shaded by foliage when the sun is shining directly overhead; expressed as a percentage for each stratum or identifiable layer of vegetation.
Fire Behaviour Index (FBI)	A numerical scale that can be used consistently across Australia, allowing users to make decisions that require finer detail than the four Fire Danger Rating categories allow. The FBI runs from 0 to 100 and beyond, with increasingly high values indicating increasingly dangerous fire behaviour and therefore fire danger risk.
Forest Fire Danger Index (FDI)	Combines a measure of vegetation dryness with air temperature, wind speed and humidity. Creating a measure of the potential danger of a bushfire on a given day and location.
Golden Plains Shire Council (GPSC)	The local council in which the bushfire assessment is being undertaken.
Land Subject to Inundation Overlay	A type of planning control that identifies properties that may be affected by flood risk. An LSIO is designed to prompt the early consideration of flood risks in the planning process and provide guidance and standards on how these sites should respond to that flood risk.
Mixing height	A measurement and indication for smoke conditions of a specific day.
Planning Authority	Any person or body given the power to prepare a planning scheme or an amendment to a planning scheme.
Precinct Structure Plan (PSP)	A Precinct Structure Plan (PSP) is a land use and infrastructure plan to guide the development of an area over time. A PSP sets out the preferred locations of residential land, employment land and infrastructure. It provides guidance for transport, parking, urban design, heritage, open space and integrated water management.
Responsible Authority	Is the body responsible for the administration or enforcement of a planning scheme or a provision of a scheme. A Responsible Authority is responsible for considering planning permit applications and ensuring compliance with the planning scheme, permit conditions and agreement.
Schedule	Together with the Local Planning Policy Framework (LPPF), schedules are the means of including local content in planning schemes. They can be used to supplement or 'fine tune' the basic provisions of a State standard clause, zone or overlay, adapting it to local circumstances and locally defined objectives.
Separation distance	The distance from the site of bushfire hazard to the building.
Urban Growth Zone (UGZ)	A zone which applies to land that has been identified for future urban development.

Executive Summary

The following bushfire assessment was undertaken for the Bannockburn South East precinct. The bushfire risk for the area is relatively low.

This assessment considers advice from TerraMatrix, who peer reviewed this report prior to finalisation. The peer review by TerraMatrix is included as Appendix B to this report.

The precinct can achieve all strategies and objectives of clause 13.02-1S of the Golden Plains Shire planning scheme. Any dwellings built within the precinct which adhere to clause 13.02-1S will be able to achieve a construction standard of Bushfire Attack Level (BAL) 12.5. In addition, the Bannockburn South East precinct adheres to all other relevant clauses of the Golden Plains Shire planning scheme.

The bushfire risk at the site, neighbourhood and local scale are low, however surrounding areas of hazardous vegetation will need to be managed to limit the ability of a landscape scale bushfire. The precinct is predominantly flat, except for the Bruce Creek corridor and is surrounded by either agricultural uses or the existing Bannockburn township.

The Bushfire Prone Area (BPA) applies to the entirety of the precinct. The Bushfire Management Overly (BMO) is not present within the precinct or within 2 kilometres of the precinct. Currently no sites with BAL-LOW ratings exist within the precinct, the closest BAL-LOW rating site is located within the existing Bannockburn township. It is likely that as development occurs within the precinct, sites with BAL-LOW ratings will be established.

The dominant vegetation within and around the precinct is grassland, with pockets of woodland located within the Bruce Creek corridor. Consequently, separation distances range from 19 meters to 60 meters, depending on the future development scenario. The layout and subdivision of the precinct provides an opportunity to further strengthen the resilience of the existing township. The location of lots, reduction in areas of hazardous vegetation and improved access for maintenance activities, all assist in reducing the risk of bushfire hazard on the township.

There are no direct impacts towards biodiversity identified. However, potential revegetation of the Bruce Creek corridor needs to consider hazard intensification and corresponding impacts on biodiversity. It is recommended that revegetation does not exceed or change the current vegetation classification identified in this assessment.

1.0 – Introduction

1.1 – Purpose

The following report:

- Assesses current and future implications of bushfire hazard in and around the Bannockburn South East precinct.
- Informs land use locations for the Bannockburn South East Place Based Plan.
- Informs how the Precinct Structure Plan (PSP) responds, mitigates, and prevents bushfire risk.
- Provides recommendations on how future land use and development should/must respond to bushfire hazard.
- Provides separation distances from areas of bushfire hazard.

The assessment has been prepared in accordance with the following clauses of the Golden Plains Shire planning scheme:

- 02.03-3 Environmental Risks and Amenity – Bushfire
- 12.01-1S Protection of Biodiversity
- 13.01-1S Natural Hazards and Climate Change
- 13.02-1S Bushfire Planning
- 52.12 Bushfire Protection Exemptions
- 53.02 General Requirements & Performance Standards – Bushfire Planning
- 71.02-3 Integrated decision making

In addition, the following materials provided additional guidance and information to support the assessment:

- AS3959:2018 Construction of Buildings in Bushfire-prone Areas
- Planning Practice Note 64 – Local planning for bushfire protection
- Planning Advisory Note 68 – Bushfire State Planning Policy Amendment VC140
- DEWLP Planning Permit Applications Bushfire Management Overlay (September 2017)
- DEWLP Bushfire Mapping Methodology and Criteria (December 2019)
- DEWLP Design Guidelines Settlement Planning at the Bushfire Interface (July 2020)
- CFA Landscaping for Bushfire – Garden Design and Plant Selection
- Building in bushfire prone areas – CSIRO & Standards Australia
- Golden Plains Shire Municipal Fire Management Plan 2018 – 2021 version 3.0
- Golden Plains Shire Strategic Bushfire Assessment

1.2 – Background

Bannockburn is the largest urban centre in the Golden Plains Shire municipality, it is located approximately 70 kilometres southwest of the Melbourne Central Business District. As the population of Bannockburn is expected to reach approximately 13,090 by 2036 (Department of Transport and Planning, 2019), state and local policy[1] support the town's growth and the provision of more housing, employment and community services.

Subsequently, the VPA in partnership with Golden Plains Shire Council prepared the Bannockburn Growth Plan in 2020, a high-level and broad strategy that:

- Sets out the future vision for sustainable growth and land use planning in Bannockburn.
- Identifies future residential and employment areas to ensure adequate land supply for the next 30 years.
- Defines key projects and infrastructure required to support growth.
- Provides a more certain environment for both public and private investment decisions.

The Bannockburn South East precinct was identified as the priority PSP in the Growth Plan to provide residential growth in the short to medium term. The Bannockburn South East precinct will be the focus of this bushfire assessment.

1.3 – Assumptions

At the time of this assessment, assumptions regarding future vegetation, either regenerated or revegetated have been determined based off current ecological findings and data. Separation distances have been applied to the draft Place Based Plan of the Bannockburn South East PSP from September 2024. In the event the FUS is modified, and current bushfire setbacks are impacted, the separation distances will be reassessed and calculated accordingly.

1.4 – Site context

The precinct encompasses an area of 523ha and is expected to accommodate approximately 5,200 dwellings and 16,000 residents. The precinct is bound by the existing urban area to the north, a future growth option to the east, a railway line to the south and the Bruce Creek corridor to the west

The site is currently within the Farming Zone (FZ) and consists of uses which are associated with agricultural activities, such as grazing/cropping of land. The Bruce Creek corridor is partially covered by an Environmental Significance Overlay – Schedule 2 (ESO2) and a Land Subject to Inundation Overlay (LSIO). The entire precinct is also in the designated Bushfire Prone Area (BPA). No Bushfire Management Overlay (BMO) applies within the precinct.

[1] *Planning Policy Framework set out in the Golden Plains Shire Planning Scheme*

G21 Regional Growth Plan (2013)

The Bannockburn Growth Plan (VPA, 2021)

Plan Melbourne 2017-2050 (DEWLP,2017)

2.0 – Bushfire Legislation

The following section summarises all relevant planning, building and environmental mechanisms in relation to bushfire from the Golden Plains Shire planning scheme.

2.1 – Clause 02.03-3 Environmental Risks and Amenity (Bushfire)

'Bushfire is a significant issue across the municipality affecting built communities and natural systems. Development or rezoning of land for residential purposes can have an adverse effect on the natural environment.

Although the protection of human life is the primary consideration, vegetation conservation is a lower, but still important, priority in bushfire prone areas.

Bushfire risk will be mitigated by:

- *Avoiding development in bushfire prone areas.*
- *Avoiding the rezoning of land that allows for settlement in areas of high bushfire risk, particularly where natural assets will be compromised.*
- *Minimising the impact of bushfire protection measures on vegetation with high environmental value'.*

2.2 – Clause 13.01-1S Natural Hazards and Climate Change

Objective:

To minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning.

Strategies:

- *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.*

Policy guidelines:

Consider as relevant:

- *Climate change data and information maintained by the Department of Energy, Environment and Climate Action (DEECA)*

- *Adaptation action plans prepared under Division 2 of Part 5 of the Climate Change Act 2017.*

Policy documents:

Consider as relevant:

- *Climate science report prepared under Part 6 of the Climate Change Act 2017*

The Climate Change Act 2017 provides Victoria with the legislative foundations to ensure climate change and its associated risks are prevented. The act focuses on maximising opportunities for sustainable actions which respond directly to climate change in order to achieve a climate-resilient state and nation.

Although fire is often an ecological process for many of Victoria's biomes, the frequency and intensity of bushfires due to climate change is preventing many species from being able to regenerate. This is leading to the loss of numerous ecosystems and biodiversity (Department of Energy, Environment and Climate Action, 2023)

2.3 – Clause 13.02-1S Bushfire Planning

Policy application:

This policy must be applied to all planning and decision making under the Planning and Environment Act 1987 relating to land that is:

- *Within a designated bushfire prone area;*
- *Subject to a Bushfire Management Overlay; or*
- *Proposed to be used or developed in a way that may create a bushfire hazard.*

Objective:

To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.

Strategies:

Protection of human life

Give priority 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 the consideration of bushfire risk in decision making at all stages of the planning process.*

Bushfire hazard identification and assessment

Identify bushfire hazard and undertake appropriate risk assessment by:

- *Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.*

- *Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.*
- *Applying the Bushfire Management Overlay to areas where the extent of vegetation can create an extreme bushfire hazard.*
- *Considering and assessing the bushfire hazard on the basis of:*
    - *Landscape conditions - meaning conditions in the landscape within 20 kilometres (and potentially up to 75 kilometres) of a site;*
    - *Local conditions - meaning conditions in the area within approximately 1 kilometre of a site;*
    - *Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and*
    - *The site for the development.*
- *Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.*
- *Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.*
- *Not approving development 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.*

Settlement planning:

Plan to strengthen the resilience of settlements and communities and prioritise protection of human life by:

- *Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 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 AS3959:2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018) where human life can be better protected from the effects of bushfire.*
- *Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.*
- *Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reducing bushfire risk overall.*
- *Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.*
- *Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.*

- *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 AS3959:2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018).*

Areas of biodiversity conservation value:

Ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are important areas of biodiversity.

Use and development control in a Bushfire Prone Area:

In a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:

- *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.

When assessing a planning permit application for the above uses and development:

- *Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts.*

The above strategies are analysed and implemented in relation to the Bannockburn South East PSP in section 4.0 and 5.0 of this assessment.

Policy guidelines:

Consider as relevant:

- *Any applicable approved state, regional and municipal fire prevention plan*

Policy documents:

Consider as relevant:

- *AS3959:2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2018)*
- *Building in bushfire-prone areas - CSIRO & Standards Australia (SAA HB36-1993, 1993)*
- *Any bushfire prone area map prepared under the Building Act 1993 or regulations made under that Act.*

2.4 – Clause 52.12 Bushfire Protection Exemptions

Purpose:

- *To facilitate the removal of vegetation in specified circumstances to support the protection of human life and property from bushfire.*
- *To facilitate the construction and protection of community fire refuges and private bushfire shelters.*

Exemptions

- *52.12-1 Exemptions to create defendable space around buildings used for accommodation.*
- *52.12-2 Exemption for vegetation removal along a fence line.*
- *52.12-3 Exemption for buildings and works associated with a community fire refuge.*
- *52.12-4 Exemption for buildings and works associated with a private bushfire shelter.*
- *52.12-5 Exemption to create defendable space for a dwelling under clause 44.06 of this planning scheme.*

Note: The effect of clause 52.12-5 is that if an application for building and works is made and all requirements of the clause are met, that application is not required to be accompanied by a permit application to remove the vegetation covered by this clause.

2.5 – Clause 53.02 General Requirements & Performance Standards - Bushfire Planning

Purpose:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To ensure that the development of land prioritises the protection of human life and strengthens community resilience to bushfire.*
- *To ensure that the location, design and construction of development appropriately responds to the bushfire hazard.*
- *To ensure development is only permitted where the risk to life, property and community infrastructure from bushfire can be reduced to an acceptable level.*
- *To specify location, design and construction measures for a single dwelling that reduces the bushfire risk to life and property to an acceptable level.*

Bushfire Protection Objectives

53.02-4.1 Landscape, Siting & Design Objectives

- *Development is appropriate having regard to the nature of the bushfire risk arising from the surrounding landscape.*
- *Development is sited to minimise the risk from bushfire.*
- *Development is sited to provide safe access for vehicles, including emergency vehicles.*
- *Building design minimises vulnerability to bushfire attack.*

53.02-4.2 Defendable space & construction objective

- *Defendable space and building construction mitigate the effect of flame contact, radiant heat & embers on buildings.*

53.02-4.3 Water supply and access objectives

- *Static water supply is provided to assist in protecting property.*
- *Vehicle access is designed and constructed to enhance safety in the event of a bushfire.*

53.02-5 Tables - Defendable space, construction, water supply, vehicle access, vegetation management & outbuilding construction requirements

- *Notes on each table are located directly under the item in the Golden Shire planning scheme.*

2.6 – Clause 71.02-3 Integrated Decision Making

Victorians have various needs and expectations such as land for settlement, protection of the environment, economic wellbeing, various social needs, proper management of resources and infrastructure. Planning aims to meet these needs and expectations by addressing aspects of economic, environmental and social wellbeing affected by land use and development.

The Planning Policy Framework operates together with the remainder of the scheme to deliver integrated decision making. Planning and responsible authorities should endeavour to integrate the range of planning policies relevant to the issues to be determined and balance conflicting objectives in favour of net community benefit and sustainable development for the benefit of present and future generations. However, in bushfire affected areas, planning and responsible authorities must prioritise the protection of human life over all other policy considerations.

Planning authorities should identify the potential for regional impacts in their decision making and coordinate strategic planning with their neighbours and other public bodies to achieve sustainable development and effective and efficient use of resources.

2.7 – Bushfire Prone Areas & Bushfire Management Overlay

Bushfire Prone Areas are locations where the bushfire hazard has been mapped and identified under the building system. These areas are subject to or likely to be subject to the possibility of bushfires. The Minister of Planning makes the formal determination of the location of the BPA under section 192A of the Building Act 1993. The determination is based off the following three step process and criteria:

1. Hazard data is developed and implemented by relevant state government bodies.
2. Bushfire Hazard Levels (BHL) are determined for the various locations.
3. A verification process is undertaken by the relevant local and state government bodies.

The BPA is reviewed twice a year by local council, emergency services and other relevant stakeholders to ensure that the locations are accurate and up to date.

The Bannockburn South East precinct is located entirely within the BPA. As a result, construction which occurs within the precinct will need to meet specific requirements under Australian Standard 3995:2018 Construction of Building in Bushfire Prone Areas. In addition, the National Construction Code provides provisions and requirements for buildings being constructed in the BPA.

National Construction Code – Part G5O1 Construction in bushfire prone areas

G5O1 Objective

The Objective of this Part is to—

a) *safeguard occupants from injury from the effects of a bushfire; and*
b) *protect buildings from the effects of a bushfire; and*
c) *facilitate temporary shelter for building occupants who may be unable to readily evacuate the building prior to a bushfire.*

Applications:

1. *VIC G5O1(a) and (b) apply in a designated bushfire prone area to—*
    a. *a Class 2 or 3 building; or*
    b. *a Class 10a building or deck associated with a Class 2 or 3 building.*
2. *VIC G5O1(a), (b) and (c) apply in a designated bushfire prone area to—*
    a. *a Class 9a health-care building; and a*
    b. *a Class 9b—*
        A. *early childhood centres; and*
        B. *primary or secondary school; and*
    c. *a Class 9c residential care building; and*
    d. *a Class 10a building or deck immediately adjacent or connected to a building of a type listed in (a) to (c).*
    e. *a Class 4 part of a building associated with a building of a type listed in (2)(a) to (c).*

Notes:

- The additional provisions for *NCC G5O1 Construction in bushfire prone areas* have not been included in this report. Further information of the requirements can be found on the National Construction Code webpage under G5O1.
- *Class 1 buildings are houses (typically standalone dwellings of a domestic or residential nature).*
- *Class 2 buildings are apartment buildings.*
- *Class 3 buildings are a common place of a long term, or transient living for a number of unrelated people (e.g. boarding house, guest house, hostel).*
- *Class 10a buildings are non-habitable buildings including sheds, carports, and private garages.*

In comparison, the Bushfire Management Overlay refers to areas which have the potential to experience extreme bushfire events. Development within these areas requires a variety of actions and mechanisms to be met in order to demonstrate that the site can be safely occupied. The Bannockburn South East precinct is not located within a BMO.

2.8 – Other Controls

2.8.1 – Zoning

The land within the precinct boundary will be zoned as Urban Growth Zone 1 (UGZ1). If land is not zoned UGZ1, an applied zone and any corresponding schedule will be applied.

The UGZ1 schedule includes a requirement that the Responsible Authority must approve a Bushfire Site Management Plan which addresses bushfire risk during, and where necessary, after construction. The plan must specify, amongst other things:

- The staging of development and the likely bushfire risk at each stage.
- An area of land between the development edge and non-urban areas consistent with the separation distances specified in AS3959:2018, where bushfire risk is managed.
- The land management measures to be undertaken by the landowner to reduce the risk from fire within any surrounding rural or undeveloped landscape.
- Provision of adequate access and egress for early subdivisions to minimise bushfire risks for residents prior to the full build out of the PSP.
- How adequate opportunities for access and egress will be provided for early residents, construction workers and emergency vehicles.

2.8.2 – Overlays

The Bruce Creek corridor is subject to Schedule 2 of clause 42.01 Environmental Significance Overlay. Although there is no direct notation to the implications of bushfire hazards within the schedule, the environmental objectives show correlation to that of a bushfire hazard. The following environmental objectives which are being considered within the assessment are those which aim:

- *To protect and encourage the long-term future of fauna and flora habitats along watercourses.*
- *To conserve existing wildlife habitats, close to natural watercourses and where appropriate, to allow for generation and regeneration of habitats.*

3.0 – Bushfire Hazard Assessment

As per clause 13.02-1S of the Golden Plains Shire planning scheme, bushfire hazard identification and the subsequent assessment must be considered on the basis of the following scales:

- Landscape conditions: Meaning conditions in the landscape within 20 kilometres (and potentially up to 75 kilometres) of a site.
- Local conditions: Meaning conditions in the area within approximately 1 kilometre of a site.
- Neighbourhood conditions: Meaning conditions in the area within 400 metres of a site.
- The site for the development: Meaning conditions 100 meters from the site boundary.

Further, clause 13.02-1S notes that best available science should be applied to identify vegetation, topography, and climatic conditions which influence the bushfire hazard. In conjunction, the application of Australian Standards 3959:2018 is required for proposed development occurring in a Bushfire Prone Area, such as the Bannockburn South East precinct. The standards are used to determine the Bushfire Attack Level for a site, based off site features relating to vegetation and slope. The site and its BAL construction standards will not exceed BAL 12.5 in accordance with clause 13.02-1S:

- *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 AS3959:2018 (Standards Australia, 2018).*
- *Directing population growth and development to low-risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS3959:2018 (Standards Australia, 2018).*

The following assessment will examine the existing conditions and the potential impact bushfire hazard may have on the precinct and broader area.

3.0.1 – Bushfire Hazard – Landscape Scale Assessment

The landscape scale consists of analysing the surrounding 20 kilometres of the Bannockburn South East precinct.

The dominant zone around the precinct is Farming Zone, with predominant activities relating to cropping and grazing.

The townships of Teesdale, Inverleigh, Gheringhap and Batesford are all located within close proximity to the precinct. The urban areas of Geelong and the shoreline of Port Phillip Bay are 18 kilometres east of the precinct.

Surrounding the site there are various areas with substantive amounts of vegetation such as the Bannockburn Bushland Reserve, the Bannockburn Flora & Fauna Recreation Reserve (Bannockburn Bush), the Inverleigh Conservation Reserve, the Boonderoo Nature Conservation Reserve, the Brisbane Ranges National Park and both the Bannockburn Golf Club and Inverleigh Golf Club. Although the You Yangs Regional Park and Great Otway Nation Park are located outside the 20 kilometres catchment, their scale and extent of vegetation can cause a catastrophic bushfire event, which is why this assessment has considered their impact.

Within the state of Victoria, a bushfire attack is most likely to occur from the north and northwest, often accompanied by a southwest wind change (Country Fire Authority, 2023). At the landscape scale, the risk of attack from these directions is possible due to the absence of urban areas and wetlands. In addition, most the sites listed above occur in that general direction. These areas contain extensive fuel loads and have the potential to produce embers which can travel many kilometres and start spot fires. More specifically, the embers from these sites have the potential to create grassfires. Under elevated fire danger conditions, such a fire is unlikely to be significantly moderated by the pattern of development and roads in the landscape. This is reflected in the fire history, including large (>5,000 ha) fires to the east and north of the precinct that impacted Little River in 1985 and Anakie in 2006.

Previous bushfires can be noted to occur predominantly from the north, northwest and southwest. The bushfires which have previously occurred all have varying extents, severities and treatment methods.

Most notability, a bushfire occurred approximately 7 kilometres north of the precinct in 1985, which spanned an area of over 20,800 hectares. More recently, in 2013, a bushfire southwest of Inverleigh burned approximately 342 hectares of land.

Other bushfires which have occurred in the vicinity include:

- In 2017, a bushfire west of Inverleigh burnt approximately 53 hectares.
- In 2017, a bushfire north of the precinct in Russells Bridge burnt approximately 8 hectares.
- In 2014, a bushfire northeast of She Oaks, burnt approximately 347 hectares.
- In 2014, a bushfire south of Ceres, burnt approximately 49 hectares of land.

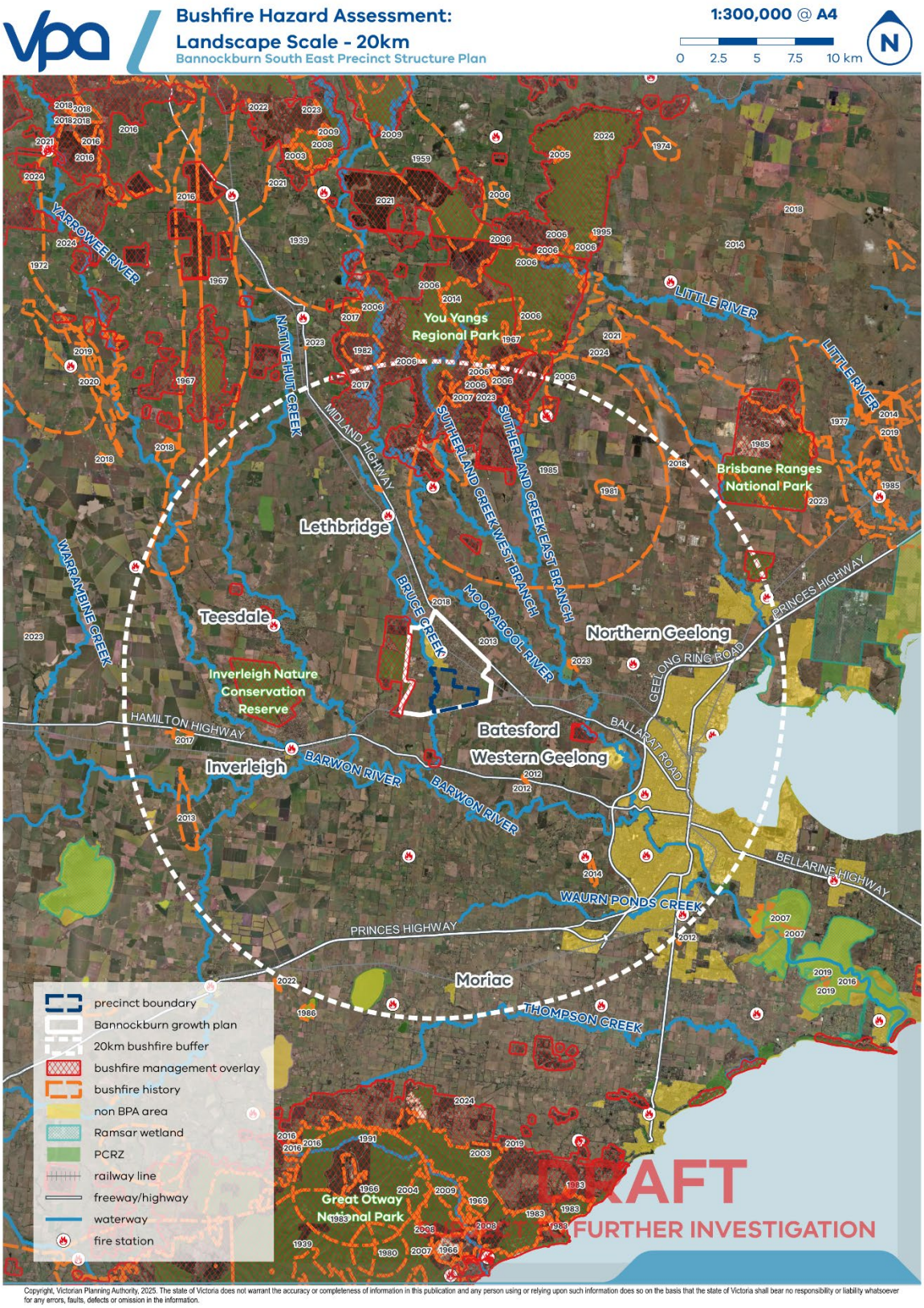

Figure 1: Bushfire Hazard Map - 20km Assessment

3.0.2 – Bushfire Hazard – Local Scale Assessment

The local scale examines the land 1 kilometre around the precinct boundary. There have been no recorded bushfires within the extent of the local scale.

In 2022, controlled burns were undertaken in the Bannockburn Cemetery to reduce fuel loads.

Previous controlled burns were undertaken in 2011 in the Bannockburn Flora and Fauna Recreation Reserve and in 2005 in the Bannockburn Bushland Reserve.

More notably, Forest Fire Management Victoria and CFA's *Joint Fuel Management Program* have identified non-burning treatments and planned burns for the Bannockburn Bushland Reserve. These treatment methods have been proposed to occur within the next two years.

Planned burning has benefits for reducing bushfire threat by:

- *Decreasing fuels loads which reduces the intensity of a fire and reduces its rate of spread.*
- *A reduction in embers which can start spot fires 36 kilometres away.*
- *Increased ability for firefighters to control bushfires in their earlier stages.*
- *Fuel reduction within 150 metres of a house significantly increases the likelihood of house survival by minimising the impact of radiant heat and ember attack (Country Fire Authority 2023b).*

Under extreme or catastrophic conditions, the effectiveness of planned burning reduces the risk to life and property (Country Fire Authority 2023b). Thus, sites which undergo treatment have a reduced ability to create a landscape and local scale bushfire.

Directly north of the precinct is the existing Bannockburn township. In its' current state the township has minimal areas of bushfire hazard. Development and existing buildings limit the occurrence of hazardous vegetation, in addition sites with vegetation are subject to routine maintenance to limit their bushfire threat.

The other areas around the precinct are all used for agricultural uses, such as crop raising, animal grazing and poultry farm operations. There are also seasonal herbaceous wetlands 1.5 kilometres east of the precinct. The vegetation within these properties can be classified as 'Grassland' as per AS3959:2018, with

types varying as either Sown Pastures, Dense Sown Pastures or Low Open Woodland. In addition, there are also scattered pockets of vegetation which can be classified as 'Woodland'.

The Bannockburn Flora and Fauna Recreation Reserve is located 2 kilometres northwest of the site.

Currently the reserve is bound by Mason Road and Stephens Road along the western boundary, with Old Base Road and Harvey Road forming the boundary along the eastern side of the reserve. There are no named roads bounding the northern and southern boundaries. Internal tracks may be present along or near the reserve perimeter, however, the extent and condition of these tracks is unknown. Further, Bannockburn-Shelford Road runs through the centre of the reserve (Figure 5).

The Bannockburn Recreation Reserve and Bannockburn Bushland Reserve are not likely to appreciably mitigate the threat to the precinct from a large bushfire in the landscape. Their relatively small size, distance from the precinct and being Landscape Moderation Zone (LMZ) and Fire Management Zone (FMZ), are more valid factors that mitigate the relatively low threat they pose to development within the precinct.

Firefighting activities to reduce the movement of a bushfire in the reserve would be undertaken from Mason Road, Stephens Road, Old Base Road, Harvey Road and Bannockburn-Shelford Road. Access routes away from the reserve into areas assessed with a BAL – LOW rating are available through Bannockburn-Shelford Road, Old Base Road, Harvey Road and other unnamed roads.

Figure 2: Grassland within the Bruce Creek corridor

Figure 3: Woodland within the Bruce Creek corridor

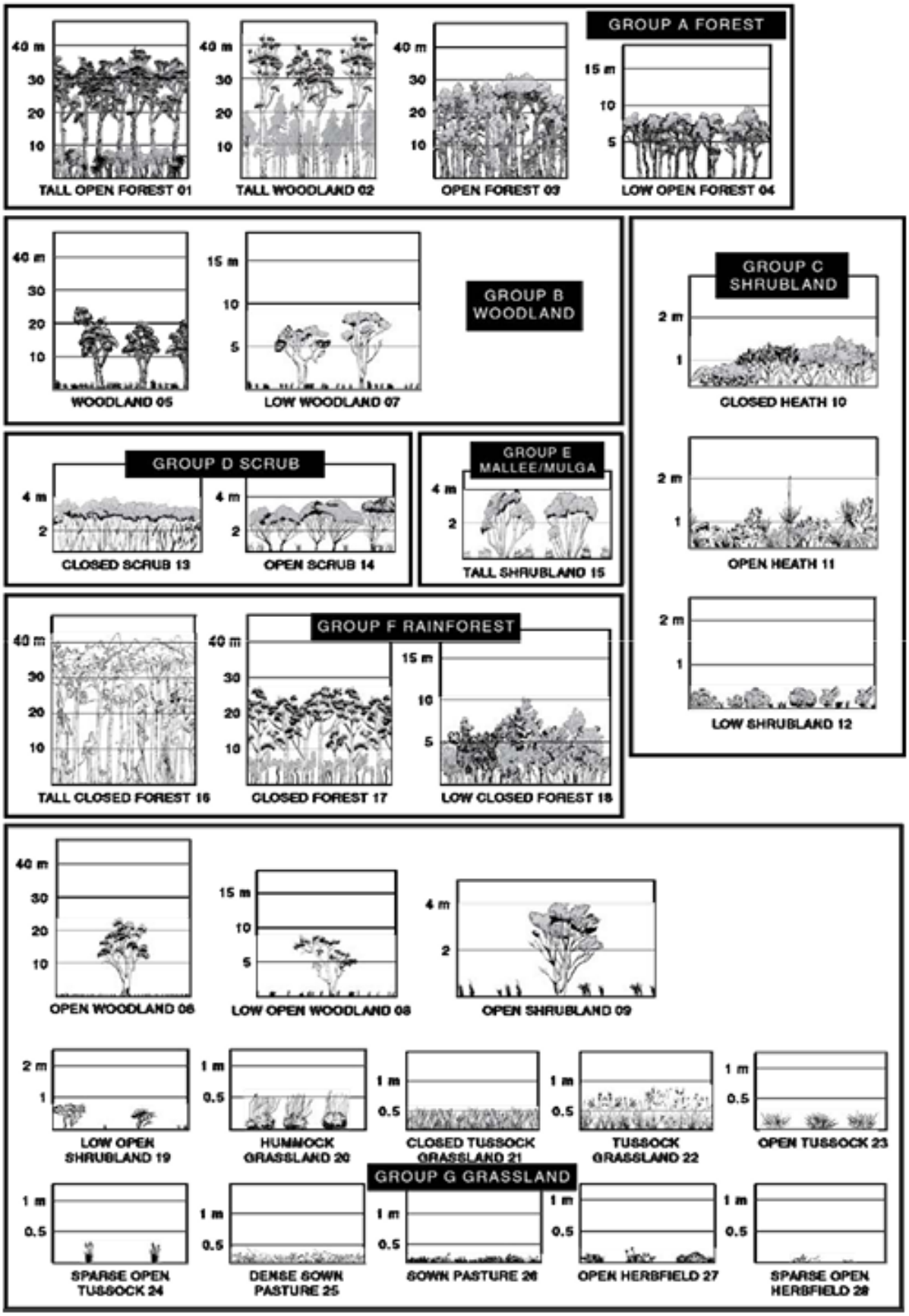

Figure 4: AS3959:2018 Vegetation Classifications (Australian Standard, 2018)

Ultimately, there is the potential for bushfires and or grassfires to impact the study area if vegetation is unmanaged. Despite this, the threat from these areas of vegetation can be mitigated to an acceptable level of safety if the requirements of clause 52.02.-5 are implemented:

Defendable space is provided and is managed in accordance with the following requirements:

- Grass must be short cropped and maintained during the declared fire danger period.
- All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.
- Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.
- Plants greater than 10 centimetres in height must not be placed within 3 metres of a window or glass feature of the building.
- Shrubs must not be located under the canopy of trees.
- Individual and clumps of shrubs must not exceed 5 square metres in area and must be separated by at least 5 metres.
- Trees must not overhang or touch any elements of the building.
- The canopy of trees must be separated by at least 5 metres.
- There must be a clearance of at least 2 metres between the lowest tree branches and ground level.
- Unless specified in a schedule or otherwise agreed in writing to the satisfaction of the relevant fire authority.

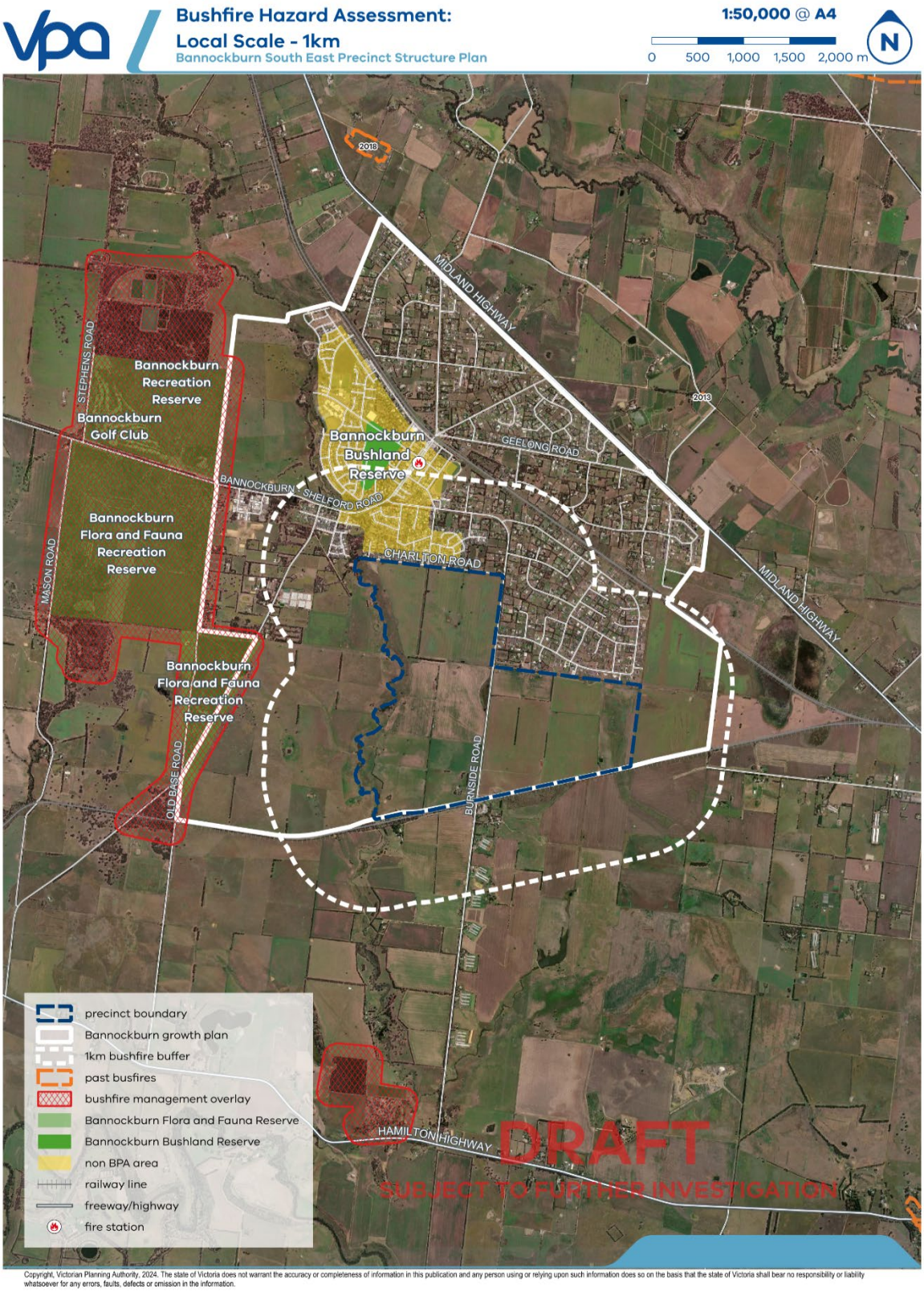

Figure 5: Bushfire Hazard Map – 1km Assessment

3.0.3 – Bushfire Hazard – Neighbourhood Scale Assessment

The analysis of the site at the neighbourhood scale shows similar results to the assessment undertaken for the local scale. There have been no recorded bushfires within the extent of the neighbourhood scale.

As previously identified, the Bannockburn Cemetery which is located adjacent to the precinct, had controlled burns in 2022 to reduce fuel loads. Noting, the site itself is approximately 6 hectares, containing minimal fuel and is located within the existing Bannockburn township; the ability for a landscape scale bushfire is low. There are planned burns forecast for the cemetery in the 2024-2025 year as per the Joint Fuel Management Program. In addition, the Bannockburn Brigade also regularly undertake planned burns and vegetation management on this site and other areas which contain hazardous vegetation. Certain areas of unmanaged vegetation in the Bannockburn Cemetery appear to be at least 100 m from the precinct and therefore, would be excludable as non-hazardous, low threat vegetation under the AS3959-2018 vegetation classification.

The precinct is bound by the existing urban area of Bannockburn to the north, which presents limited opportunities for bushfire hazard and risk. The surrounding agricultural areas have hazardous vegetation which is either 'Grassland' or 'Woodland'. As these types of vegetation have the ability to influence bushfire behaviour, management of their current and future conditions will be needed to ensure bushfire risk is limited. Mapped locations of existing Grassland and Woodland can be found within section 4.2. Specific management techniques are beyond the scope of this assessment. Golden Plains Shire Council and CFA will apply the most suitable management technique subject to the site and its vegetation.

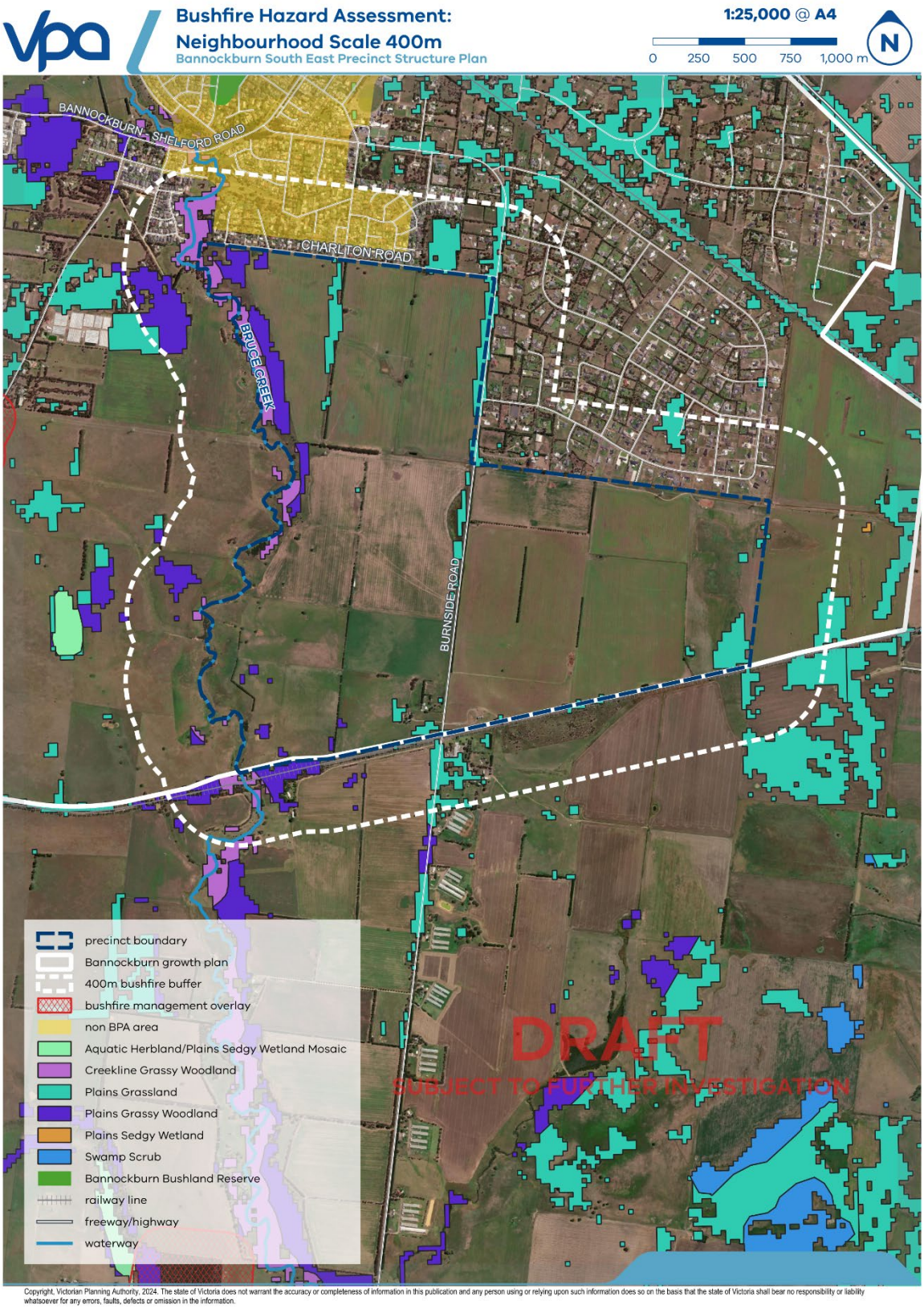

Figure 6 Bushfire Hazard Assessment Neighbourhood Scale 400m

3.0.4 – Bushfire Hazard – Site Scale Assessment

The following assessment will focus on the Bannockburn South East precinct and the area 100 meters from the boundary. The following section will focus on:

- Fire Danger Index (FDI)
- Vegetation classification
- Topography
- Effective slope
- Climatic conditions

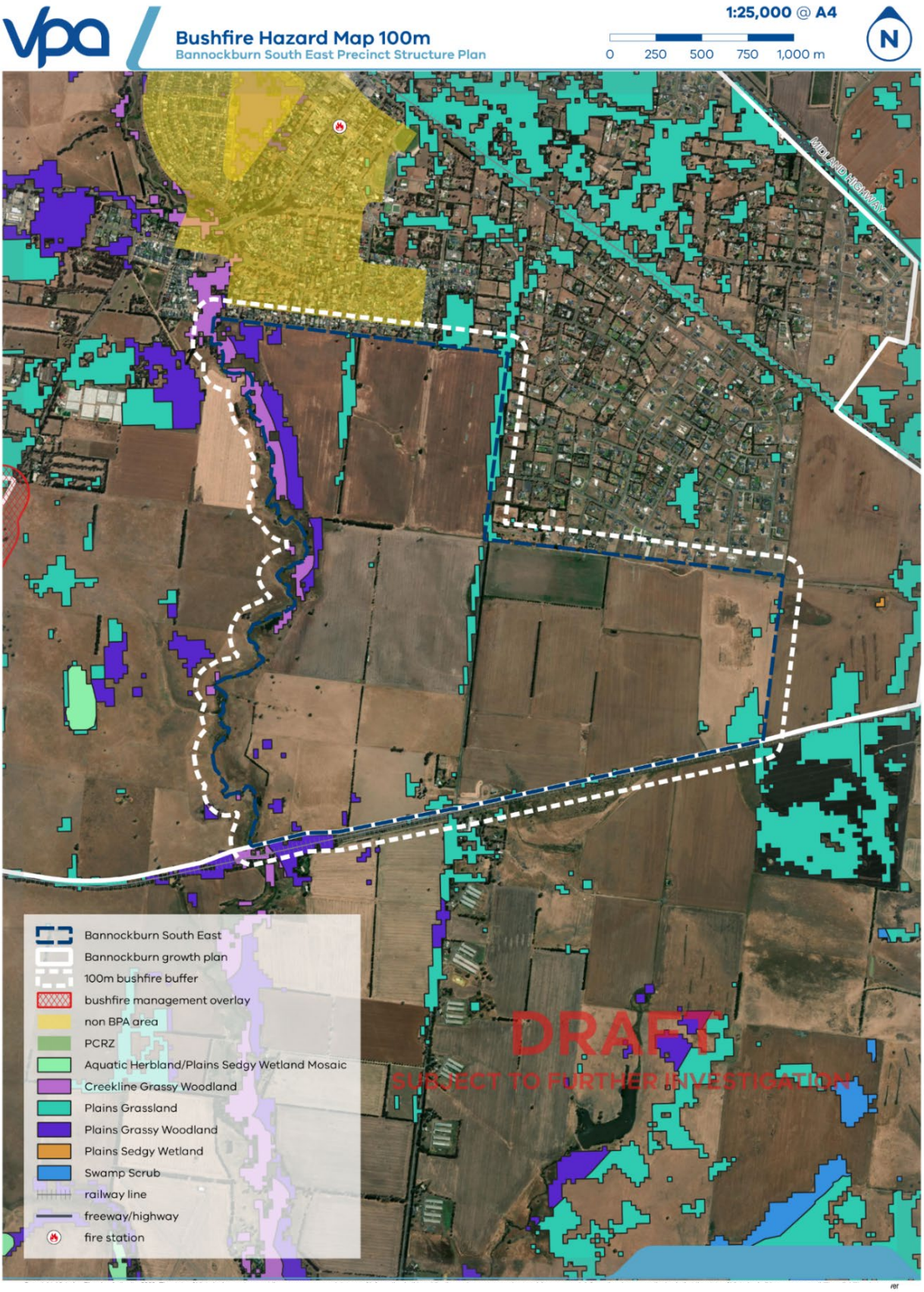

Figure 7 Bushfire Hazard map 100m

3.1 – Forest Fire Danger Index

The Forest Fire Danger Index (FDI) refers to the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression. The index is based on various combinations of air temperature, relative humidity, wind speed and drought effects (Commonwealth Scientific and Industrial Research Organisation, 2021)..

The FDI is a representation of extreme fire conditions that could occur at a point in time, used for determining development setbacks at each BAL rating for various locations. . The average annual accumulated FDI for each state and territory is identified in AS3959:2018. The FDI for the precinct and all other locations in Victoria, excluding alpine areas, is 100.

Australian Fire Danger Rating System

To note, the Australian Fire Danger Rating System (AFDRS) which came into use 1st September 2022, is not based on the FDI. Instead, the AFDRS uses the Fire Behaviour Index (FBI), which is similar to the FDI in that it is a numerical scale from 1-100+ representative of potential fire danger and fire behaviour characteristics. However, it uses very different fire behaviour models for calculating fire characteristics including fire intensity, flame height, rate of spread and spotting potential. It has no mathematical correlation with the FDI, so the FBI based fire danger rating thresholds can only be considered analogous, or similar to the old FDI based fire danger rating thresholds (AFAC,n.d).

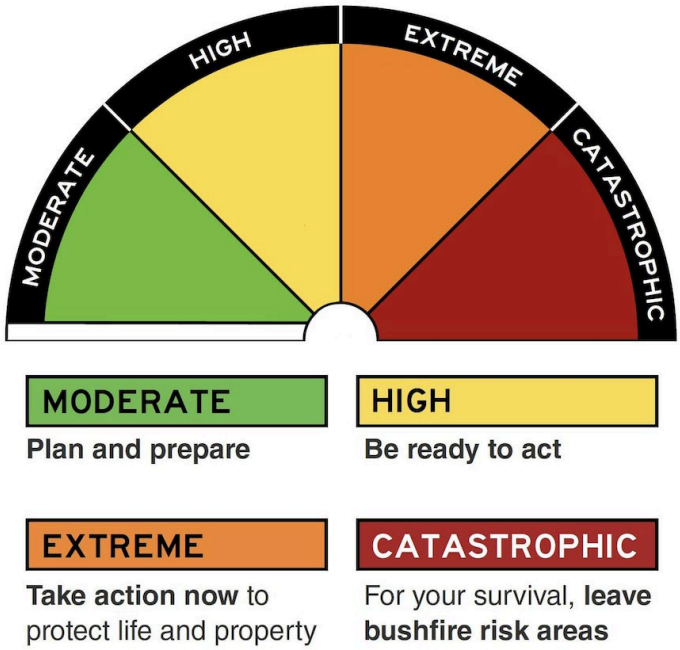

Figure 8: Fire Danger Rating (Country Fire Authority, 2023)

3.2 – Vegetation classification

Understanding and identifying vegetation within and around the site, is a key process in ensuring the precinct can be designed and managed to achieve the strategies of clause 13.02-1S.

Vegetation classification occurs through implementing the classification types and subcategories as per AS3959:2018. The eight classification categories include:

A. Forest
B. Woodland
C. Shrubland
D. Scrub
E. Malee/Mulga
F. Rainforest
G. Grassland
H. Tussock Moorland

In addition, Ecological Vegetation Classes (EVC) are the standard unit for classifying various types of vegetation in Victoria. The classes are based off a combination of distinct biodiversity features and characteristics for given locations (DEECA, 2023). It must be noted that EVC do not directly correlate with the vegetation classifications in AS3959:2018. Instead, EVC provide an insight into vegetation growth and behaviour, which informs vegetation classification.

The following section will explain the current and future vegetation classifications within and around the Bannockburn South East precinct:

3.3 – Current & Future Vegetation

Grassland

The dominant vegetation class surrounding the precinct is Grassland, specifically a combination of low open woodland, dense sown pasture, and sown pasture. As per AS3959:2018, the grassland classification refers to *all forms of vegetation (except tussock moorlands), including situations with shrubs and trees, when the overstorey foliage cover is less than 10%.* In accordance with AS3959:2018, the locations identified as grassland cannot be considered as excluded vegetation; thevegetation is not maintained to minimal fuel conditions, where it can be deemed to be short-cropped grass, with an example nominal height of 100 millimetres.

The corresponding EVC for certain areas of grassland is Plains Grassy Woodland (55). The EVC is often made up of open eucalypt woodland, where trees do no exceed 15 meters in height and the understory consists of sparse shrubs. Further, the EVC is also found in areas which contain poorly drained soil, this is often due to flat or gently undulating plains at low elevations (DEECA, 2023).

The vegetation within the Bruce Creek corridor poses the greatest risk to the precinct. This is attributable to the type of vegetation, the effective slope and its proximity to residential uses. The corridor itself will have no residential development, but may accommodate key infrastructure items, such as drainage assets and shared paths within its boundaries.

Consequently, future grassland vegetation within the corridor will likely consist of native revegetation. Native species, such as scattered trees at widely spaced intervals and a suite of native ground cover species will replace the existing introduced species. It is recommended that revegetation does not exceed or change the current vegetation classification identified in this assessment.

It should be noted that whilst some of the Grassland areas may comprise ecological vegetation class (EVC) Plains Grassy Woodland (Victorian Volcanic Plains EVC 55) (DEECA, 2024), with the cessation of grazing and cropping, Grassland areas may revert to a higher hazard Woodland state through natural recruitment and/or revegetation.

The other areas of grassland occur directly outside the precinct. These locations are currently used for agricultural uses and have been identified as potential growth options for Bannockburn. There are no definitive timeframes for when these areas may be developed. Thus, the PSP will need to include parameters which manage the rolling front of development and future interfaces. Any proposals for development in those locations will require separate bushfire assessments. It should be noted that whilst some of the Grassland areas may comprise ecological vegetation class (EVC) Plains Grassy Woodland (Victorian Volcanic Plains EVC 55) (DEECA, 2024), with the cessation of grazing and cropping, Grassland areas may revert to a higher hazard Woodland state through natural recruitment and/or revegetation.

Woodland

There are isolated pockets of woodland located in the Bruce Creek corridor. Vegetation classified as woodland as per AS3959:2018 refers to, *trees which are between 10 meters to 30 meters tall, with 10% to 30% foliage cover, dominated by eucalypts and/or callistris with a prominent grassy understorey (there may be isolated shrubs).*

The Bannockburn Growth Plan Bushfire Assessment undertaken in 2020, identified and classified an area in the northwest corner of the precinct as Shrubland. Upon further investigation, the current assessment has now identified the area as Woodland, due to the foliage cover and tree height better reflecting the characteristics associated with the Woodland classification.

Natural recruitment and/or revegetation is likely to occur along the Bruce Creek as the waterway and riparian area becomes managed for its biodiversity and recreation values. Woodland (and Grassland) areas can quickly developer a denser, shrubbier understorey, potentially even exceeding their EVC benchmark state, following change of management and associated cessation of grazing, cropping and other disturbance. This is evident, for example in areas of Acacia paradoxa Kangaroo Thorn in the northern part of the corridor.

The corresponding EVC for the vegetation is Creekline Grassy Woodland (68). These areas contain Eucalypt-dominated woodland with trees up to 15 meters in height, with occasional scattered shrub layers, over a grassy ground layer.

Landscape Risk Typologies

To assist in defining landscape risk, four 'Broader Landscape Types' (BLT) are described in the *Technical Guide Planning Permit Applications Bushfire Management Overlay* (DELWP, 2017). They represent different landscape risk levels that are intended to streamline decision making and support more consistent decision making based on the landscape risk.

The BLT are based on descriptive characteristics associated with the surrounding landscape (as seen in Table 2) and represent a spectrum of risk. The spectrum ranges from low risk locations where there is little hazardous vegetation other than grassland beyond 150 m of a site, and extreme bushfire behaviour is not credible, to extreme risk locations with limited or no evacuation options, where fire behaviour could exceed AS3959/BMO design fire conditions.

Whilst no part of the precinct, or surrounding land for over 1 km is affected by the BMO, the BLTs are a useful way of characterising the risk beyond the site scale for strategic planning proposals. To note, many sites in the surrounding landscape can have characteristics that correspond with more than one BLT, and the applicability of a particular BLT's characteristics may vary according to distance from the site (i.e. the scale of the assessment area being considered).

Between 1 km and at least 5 km of the precinct, the landscape best accords with BLT 3, albeit at the lower risk end of the BLT 3 (or alternatively, upper end of the BLT 2) typology. A large (landscape scale) bushfire moving at a quasi-steady state rate of forward spread could occur. Access to a place(s) of relative safety from such a bushfire (e.g. to the Bannockburn central township and established residential areas) would potentially require travel by vehicle for several kilometres along a rural road network that may result in exposure to the fire.

Notwithstanding, other than areas denoted by BMO coverage, the hazard is largely confined to Grassland on generally flat, and therefore from a bushfire perspective, benign topography. Neighbourhood destruction is unlikely as losses would likely be limited to the first row of houses impacted and, given the general lack of tree and shrub vegetation (other than in BMO areas), a relatively low level of ember attack can be expected.

Within 1 km of the precinct, the landscape characteristics best match with BLT 2, and within 400 m, especially once development has substantially commenced and immediate access to places of relative safety (e.g. BAL-LOW areas) become available, BLT 1 attributes would be applicable.

Developed land within the precinct that is at least 60 m from Grassland will likely be eligible for exclusion from the BPA, and BAL-LOW construction would then apply. Accordingly, the landscape risk for the precinct is considered low or relatively low.

Broader Landscape – Type 1	Broader Landscape – Type 2	Broader Landscape – Type 3	Broader Landscape – Type 4
• There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation) • Extreme bushfire behaviour is not possible • The type and extent of vegetation is unlikely to result in neighbourhood-scale destruction of property • Immediate access is available to a place that provides shelter from bushfire	• The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site • Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition • Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area	• The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site • Bushfire can approach from more than one aspect • The site is located in an area that is not managed in a minimum fuel condition • Access to an appropriate place that provides shelter from bushfire is not certain	• The broader landscape presents an extreme risk • Evacuation options are limited or not available • Fires have hours or days to grow and develop before impacting
INCREASING RISK			

Table 1: Landscape Risk Typologies (DEWLP, 2017)

3.4 – Future Land Use Vegetation

Active Open Space

Areas of active open space refer to sites where the primary use is for structured sporting activities. These sites are likely to be grass fields which are consistently mowed, with areas of planted vegetation and landscaping.

As per AS3959:2018, the vegetation in these sites is not deemed to be hazardous. Therefore, no separation distance applies.

Passive Open Space

Areas of passive open space refer to sites where the primary use is for casual play, gatherings and relaxation, more commonly these sites are reflective of local parks. These areas may contain pockets of vegetation, such as trees and shrubs, as well as other landscaping treatments, but will predominantly consist of mowed lawns.

As per AS3959:2018, the vegetation in these sites is not deemed to be hazardous. Therefore, no separation distance applies.

Drainage Assets

The functional designs and quantum of vegetation have not been finalised at the time of this report and may be subject to change during development of the precinct. Therefore, the following options are reflective of the potential outcomes for the drainage assets.

1. Excluded vegetation:

   If the assets are constructed with limited vegetation and are routinely maintained, the assets can be excluded as hazardous vegetation. Examples of this include retarding basins which are predominantly mowed lawn. Thus, no separation distance is required for bushfire prevention purposes.

2. Classified vegetation:
   If the assets are extensively vegetated, with numerous types of species, the sites now contain bushfire hazard and pose a greater risk to the population. Existing drainage basins in other growth areas reflect classified vegetation which is either grassland or shrubland. Thus, the minimum separation distance for buildings to achieve a BAL 12.5 construction standard from these types of vegetation classification is 19 meters.

Roadside Vegetation

The precinct has linear reserves and streets which will contain greater amounts of vegetation, such as boulevards and connector streets. The vegetation along these roads will be low threat due to the quantum and maintenance associated with their location.

In accordance with AS3959:2018, these areas of vegetation will be excluded and not classified. Therefore, no separation distances apply.

Transmission Easement

Ausnet are the Responsible Authority for operation and maintenance of the transmission easement located within the precinct. Ausnet have specific requirements which inhibit the occurrence of hazardous vegetation. Thus, any future uses and proposals for vegetation planting, will require approval from Ausnet. The PSP currently identifies the easement to potentially contain areas of active open space, passive open space, and active transport routes, all of which contain excluded vegetation as per AS3959:2018. No separation distances apply, as the easement is routinely maintained.

3.5 – Excluded Vegetation

The assessment has not classified areas of low threat vegetation and non-vegetated areas in accordance with section 2.2.3.2 of AS3959:2018, if one or more of the following exclusions are met:

a) *Vegetation of any type that is more than 100 m from the site.*
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 condition, 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 windbreaks.*

Notes:

1. *Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).*
2. *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.*

3.6 – Topography

The topography of the precinct is relatively flat, all land located outside of the Bruce Creek corridor does not exceed 5 degrees. In comparison, the Bruce Creek corridor has topography which fluctuates between 0 degrees to 20 degrees. The northern portion of the corridor is the steepest, with most of the slope being over 10 degrees, whereas the southern portion of the corridor has more undulating hills. In addition, the northern portion of the corridor has isolated pockets of slope (which are approximately 1 square meter) where the slope exceeds 20 degrees. However, when analysing average slope for these areas, the slope does not exceed 20 degrees.

3.7 – Effective Slope

The effective slope as per AS3959:2018, refers to *the slope under the classified vegetation, not the slope between the development and vegetation*. Understanding the slope under vegetation is critical due to its ability to directly impact the speed at which a bushfire moves. Noting, that vegetation burns at a quicker rate when moving uphill due to the pre-heating effect, in comparison to it moving downhill (Country Fire Authority 2023a). It has also been identified that for every 10 degree increase in slope, the fire speed will double, whereas, for every 10 degree decrease in slope, the fire speed will halve (Country Fire Authority 2023a).

All vegetation within the Bruce Creek corridor can be identified as being downslope, meaning the slope of the land under the vegetation is downhill from the edge of development. To conceptualise this, if a bushfire occurred in the Bruce Creek corridor near the waterway, it would move quickly uphill to the future residential area.

Slope types summarised:

- Flat and/or Upslope: Land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope: Land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5˚ increments from 0˚ up to 20.[2]

[2] Where the effective slope exceeds 20˚, site-specific calculations using Method 2 of AS 3959 are required to determine tailored defendable space distances.

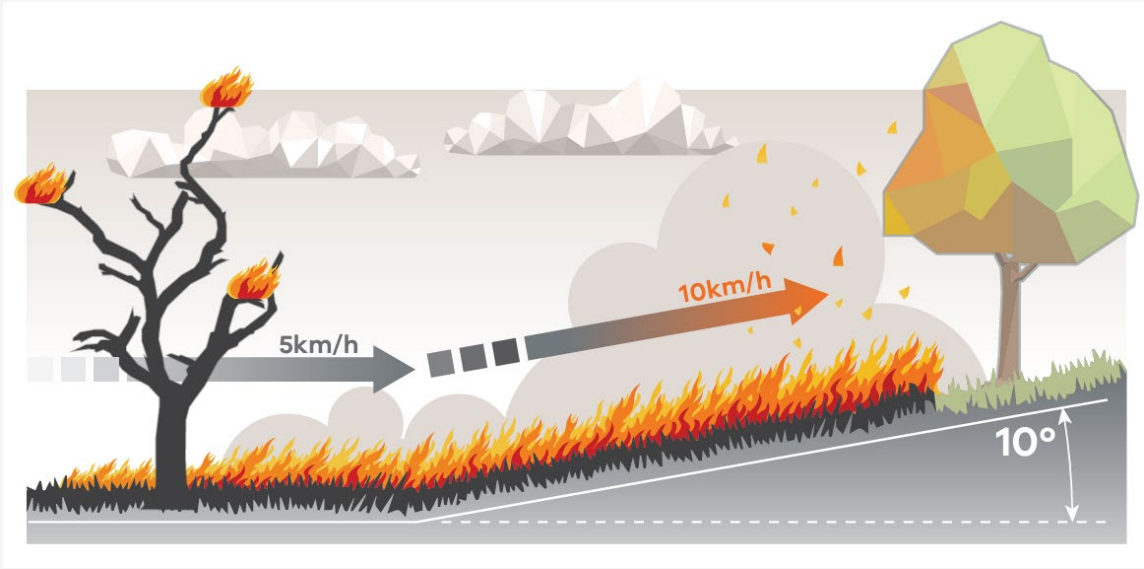

Figure 9: Fire Behaviour and Slope (Adapted from CFA, 2023

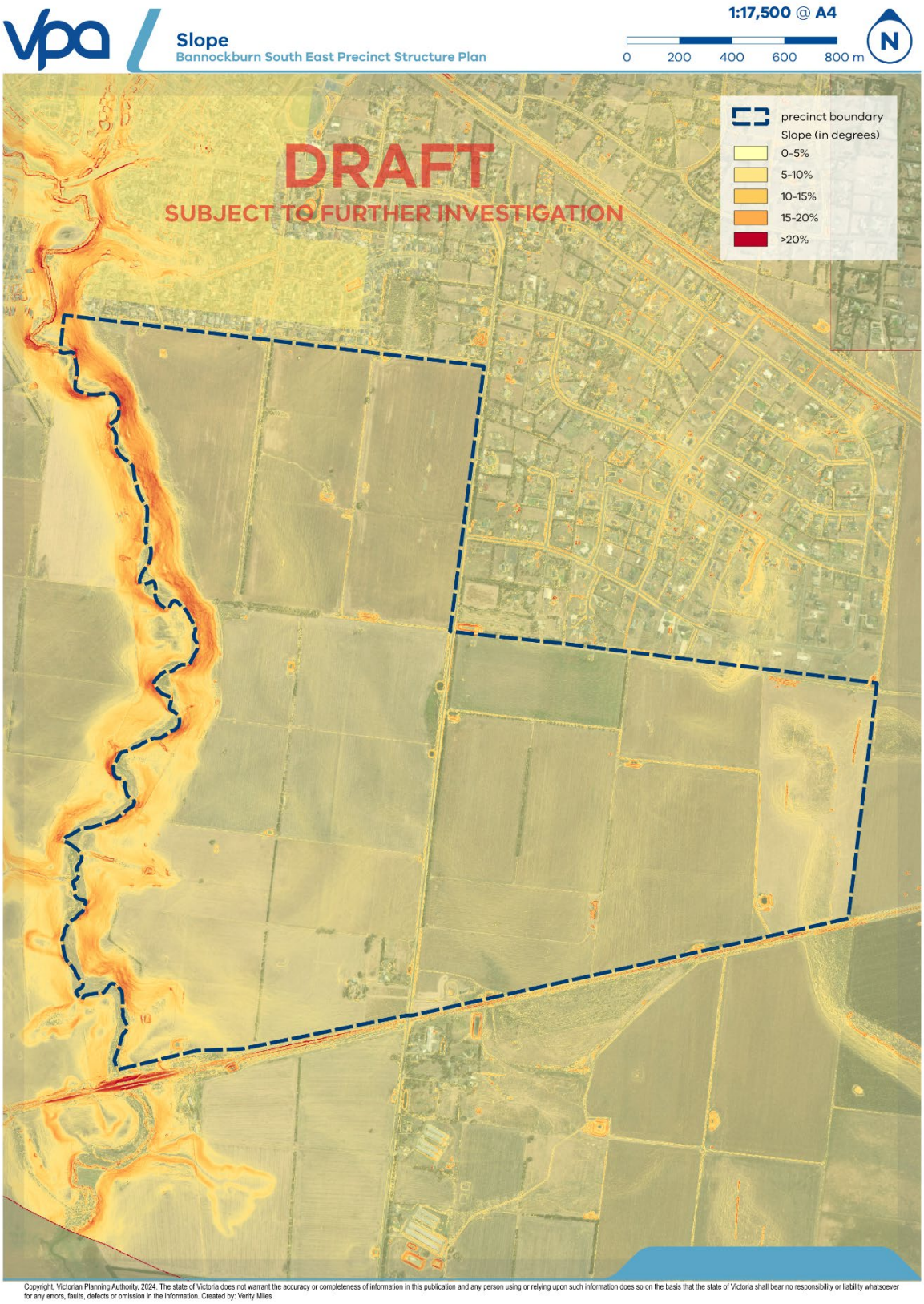

Figure 10: Bannockburn South East PSP Slope

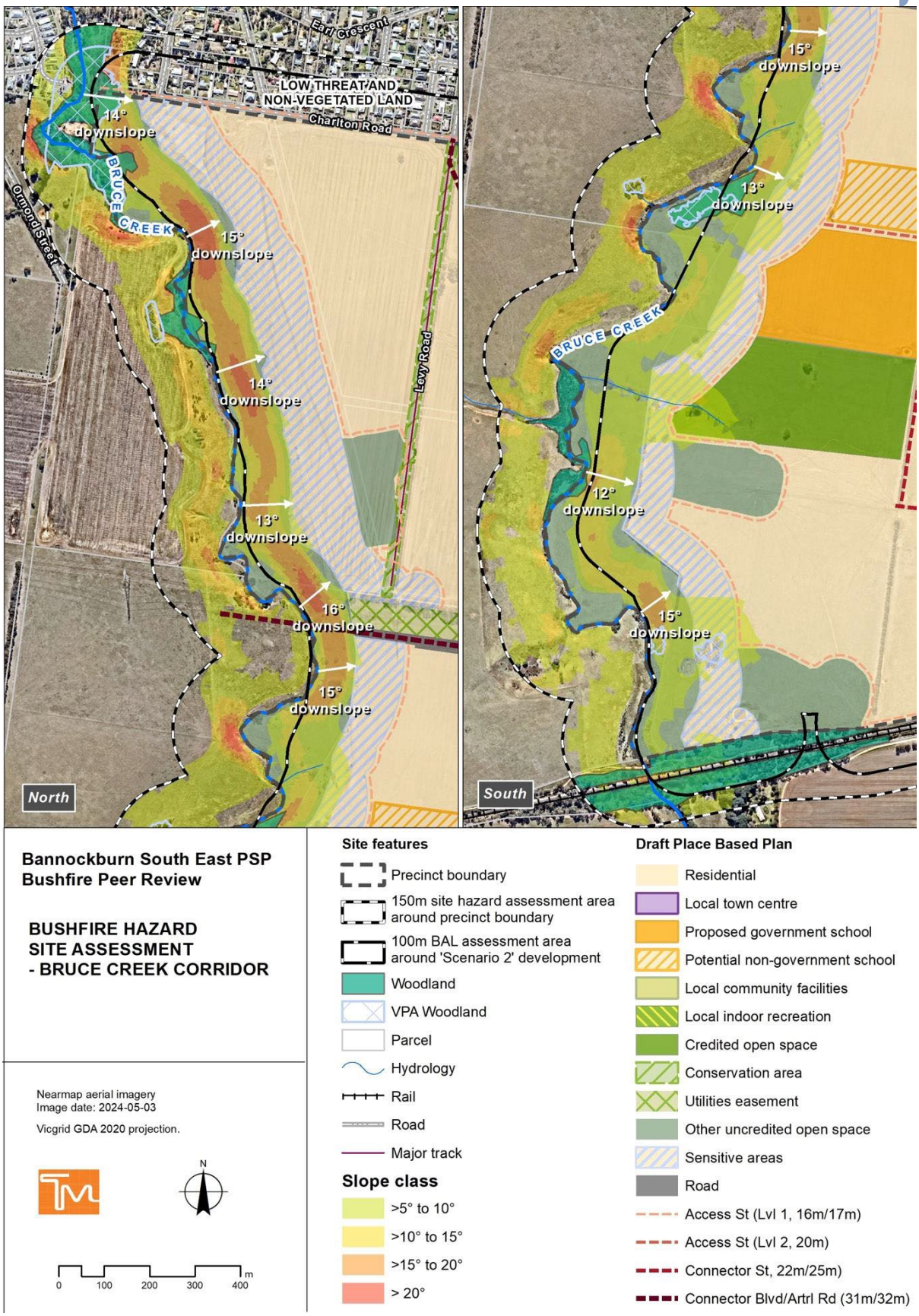

Figure 11: Bannockburn South East - Effective Slopes

3.8 – Weather & Climatic Conditions

Weather conditions refer to short term periods in the atmosphere where conditions can change within minutes or hours. In contrast, climatic conditions refer to long term weather patterns within a given area. Both aspects of weather and climate have the ability to significantly impact the hazard and risk associated with bushfire, these include:

Rainfall

The absence of rainfall within an area has the ability to substantially dry and increase flammability of vegetation. Retrospectively, areas which receive substantial amounts of rainfall can also increase the amount of vegetation and fuel load. In addition, although rainfall can reduce and eliminate potential bushfires, the possibility for erosion and soil/sediment discharge is increased (Bureau of Meteorology, n.d.).

Humidity

Humidity has the ability to influence the bushfire risk and hazard through the amount of atmospheric moisture (water vapour). When humidity is less than 20%, the conditions for vegetation to dry out and become more flammable are heightened (Bureau of Meteorology, n.d.).

Lightning

Bushfire ignition can be created through thunderstorms and lightning strikes, some areas throughout Australia are more prone to strikes and storms, such as eastern New South Wales and the north-eastern Victorian highlands. There are also instances where large scale bushfires can produce their own thunderstorms known as pyrocumulonimbus. These storms are unpredictable and extremely dangerous, they often change the fire direction and intensity, produce spot fires, increase lightning strikes and create downburst of strong windy gusts (Bureau of Meteorology, n.d.).

Temperature inversions

Temperature inversions occurs when a layer of warm air is located above a layer of cold air due to the difference in weight. Inversions are strongest during the early morning and night due to the absence of heat from the sun. However, during the day, inversions are weakened due to sun rays heating up the ground and air.

In addition, strong winds are commonly located above the warmer layers of air and cannot travel to ground-level due to the inversion. Hence, as the inversion weakens during the day, these winds are now able to travel to ground-level. Consequently, this is why bushfires will burn more intensely during the day and afternoon, as the lack of inversion supports greater temperatures and wind force (Bureau of Meteorology, n.d.).

Smoke

Inversions also influence the composition of smoke in an area. For instance, during the morning and night, smoke will hang lower to the ground due to its inability to bypass the inversion, resulting in reduced air quality and visibility. However, during the day smoke can bypass the inversion and mix with clean air, resulting in improved air quality and visibility.

To understand the impact of smoke from bushfires, the application of mixing height is use. Mixing height refers to identifying whether smoke will be trapped at ground level on a certain day. For instance, when the mixing height is low (less than 1000 meters) smoke will be trapped and located closer to the ground. Whereas, when the mixing height is greater

than 2000 meters, smoke will be able to move higher into the atmosphere, providing improved air quality and visibility at ground level (Bureau of Meteorology, n.d.).

Wind

Strong gusts of wind can spread and push a fire to move quicker across an area, these strong winds also enable hot embers to travel considerable distances and start spot fires. Further, a change in wind direction can increase the fire front, these changes are referred to as a trough, cold front or cool change. It has been identified that these cold fronts are the most dangerous factor in southern Australia during the bushfire season; the conjunction of hot and cool air masses will often cause the fire front to abruptly swing 90 degrees (Bureau of Meteorology, n.d.).

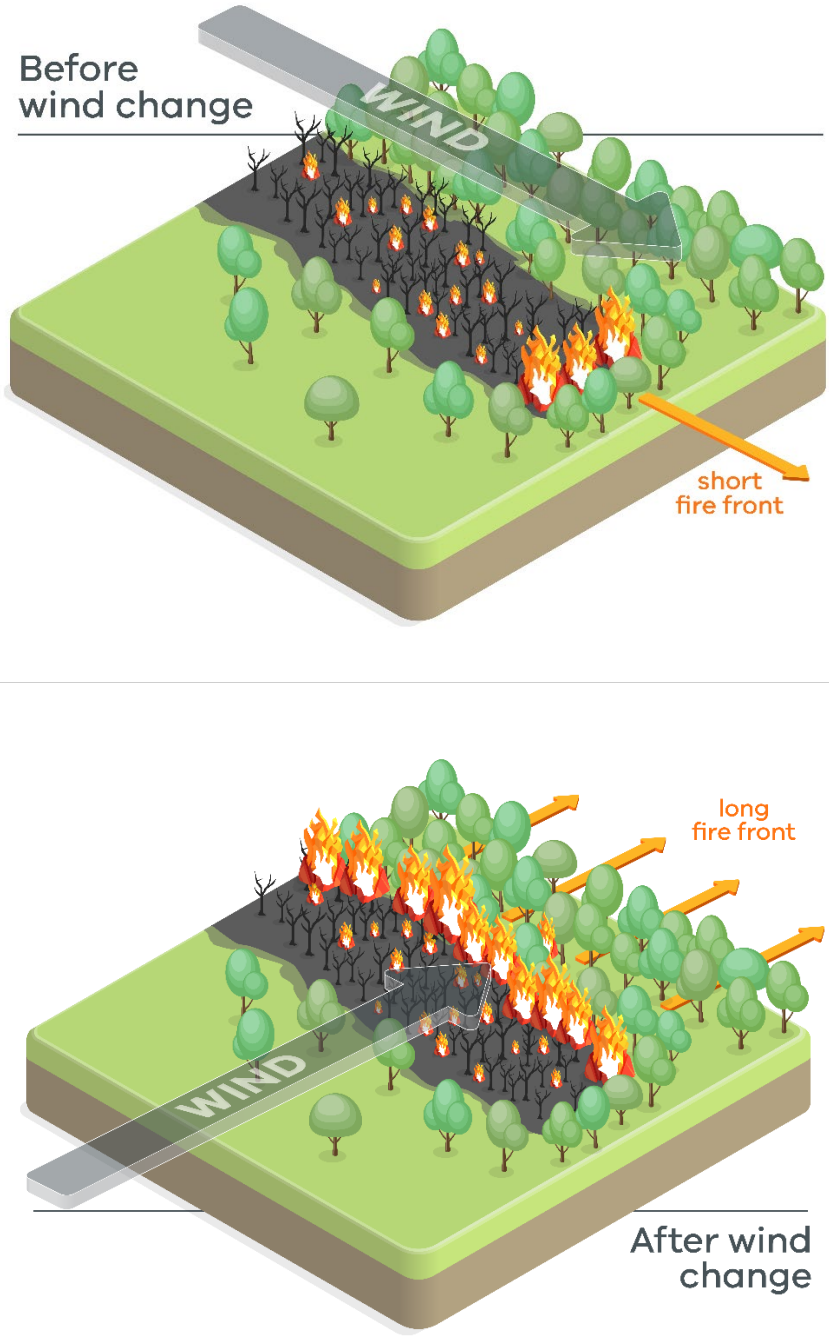

Figure 12: Fire Fronts and Wind Direction (VPA, 2024)

Climate in Bannockburn

The analysis of climatic conditions for the precinct involves examining the overarching climate for Bannockburn and the broader area. As there is no meteorological station located in Bannockburn, data has been extracted from the Bureau of Meteorology She Oaks station, located approximately 16.1 kilometres north of Bannockburn.

It can be recognised that long term average for temperatures during summer do not exceed 26.1 degrees, however, the growing implications of climate change have produced hotter more frequent days, which consequently provide more suitable conditions for bushfires to occur, creating extreme or catastrophic events.

The humidity in the area is relatively high, with the 9am annual average being 78% and 3pm annual average being 58%. As noted earlier, humidity below 20% provides ideal conditions for the air to substantially dry vegetation and increase fuel loads, however, although the annual average is substantially above the optimal conditions, this does not prevent vegetation from drying throughout the year.

4.0 – Planning and Design Response

The following section will demonstrate how planning outcomes can produce a resilient and safe community which responds to bushfire hazard. The application of DEWLP's *Design Guidelines for Settlement Planning at the Bushfire Interface* will provide the basis for this analysis.

4.1 – Form and structure of settlements

A previous bushfire assessment undertaken in August 2020, during development of the Bannockburn Growth Plan has informed the location of the Bannockburn South East precinct. The assessment provided suitable locations for growth in accordance with relevant bushfire legislation and bushfire hazard management. As identified in section 3.0, the bushfire hazard in and around the precinct is relatively low and can be mitigated through preventative measures. The precinct is situated in a location where the greatest form of bushfire risk would be from ember attacks from landscape scale bushfires.

Furthermore, it has been recognised that meteorological conditions associated with increased bushfires in Victoria typically occur from the northwest and southwest (Department of Environment, Land Water and Planning 2020, 2020). Therefore, any growth should be directed to the east of existing settlements (Department of Environment, Land Water and Planning, 2020). In addition, the guidelines also acknowledge that in areas where extreme bushfire behaviour is unlikely, future settlement growth can increase and strengthen settlement wide resilience. The Bannockburn South East precinct reflects these recommendation in its location.

4.1.2 – The distribution of land uses in the settlement

The land use allocations within the precinct have been chosen to ensure vulnerable people are located away from areas of bushfire hazard. These sites have also been selected to ensure emergency service responses can occur efficiently.

The PSP is unable to assign specific locations for all types of activities within the precinct. Site specific locations will be determined through the subdivision stage and corresponding planning processes. The approval of uses and their locations will be subject to Golden Plains Shire Council and other Responsible Authorities. The PSP will provide requirements and guidelines in relation to bushfire safety which can inform and assist Golden Plains Shire Council with these decisions.

The locations of schools within the precinct have been determined by the VPA, with input from the Department of Education, in accordance with the *Victorian Government School Site Selection Criteria – Toolbox (Aug,2022)*. There are two schools located within proximity to an area of bushfire hazard, they are the government primary school and government secondary school adjacent to the Bruce Creek corridor. Therefore, to ensure the DEWLP (currently DEECA) guidelines and 13.02-1S are met, the PSP will include requirements and guidelines relating to school building location, construction, defendable space, landscaping and access. The PSP will also include relevant requirements and guidelines to ensure safety is maintained for other uses such as residential buildings, commercial buildings and leisure/recreation facilities.

The guidelines also note that hazardous uses (which can significantly increase bushfire risk and danger) should be located away from existing bushfire hazards. For instance, the location of petrol stations should be away from vulnerable uses and areas which have classified vegetation.

4.1.3 – Lot sizes in settlement layout

Lot sizes influence how a bushfire interacts within a settlement and the broader area. The way bushfire interacts directly with lot sizes is through ember attack. This form of bushfire occurs when burning embers (such as twigs, leaves or bark) are blown from the fire origin and land within lots and on properties.

Various lot sizes have different implications on bushfires:

- Lots below 800m^2:
  Are less likely to enable an accumulation of fuel sources due to limited space. However, lots which are smaller often have dwellings and structures closer together, which heightens the risk of structure-to-structure fires (Department of Environment, Land Water and Planning, 2020).
- Lots around 0.2ha – 4ha:
  Have the ability for greater amounts of vegetation and materials to accumulate. Consequently, lots of this size will often require substantial amounts of management, to ensure fuel loads are reduced (Department of Environment, Land Water and Planning, 2020).

The lot sizes in the precinct will range between 14 to 17 dwellings per Net Developable Area (NDA) which equates to lot sizes that are approximately 590m^2 - 700m^2. As the PSP does not have the capacity to directly inform built form outcomes, guidelines and requirements relating to subdivision layout will be included to address this matter.

4.1. 4 – Vegetated areas within the settlement

Majority of the vegetation within the precinct will not be classified as hazardous vegetation on the basis of its location and maintenance. These types of vegetation are likely to occur through maintained lawns, backyards, local parks, streetscapes and other landscaped areas. Noting, defendable space for locations with excluded or low threat vegetation is still required to be provided for a distance of 50 metres, or to the property boundary (whichever is smaller), for buildings constructed to all bushfire attack levels. The minimum construction standard is BAL 12.5.

The Bruce Creek corridor will be managed by Golden Plains Shire Council, forms of management and vegetation treatments will be undertaken by them. It is recommended that revegetation does not exceed or change the current vegetation classification identified in this assessment.

As noted in section 3.4, the functional designs and quantum of vegetation have not been finalised for drainage assets at the time of this report and may be subject to change during construction of the precinct. Hence, as the drainage assets are likely to contain vegetation, the following options are reflective of the potential outcomes:

1. Excluded vegetation:

   If the assets are constructed with limited vegetation and are routinely maintained, the assets can be excluded as hazardous vegetation. Examples of this include retarding basins which are predominantly mowed lawn. Thus, no separation distance is required for bushfire prevention purposes.

2. Classified vegetation:
   If the assets are extensively vegetated, with numerous types of species, the sites now contain bushfire hazard and pose a greater risk to the population. Existing drainage basins in other growth areas reflect classified vegetation which is either grassland or shrubland. Thus, minimum the separation distance for buildings to achieve a BAL 12.5 construction standard from these types of vegetation classification is 19 meters.

The drainage assets and their vegetation will be managed by Golden Plains Shire Council. The PSP will include relevant guidance relating to the vegetation of the drainage assets.

4.2 – The settlement interface

4.2.1 – Apply the required development setback

In order to achieve clause 13.02-1S, new developments are required to be setback from areas which contain hazardous vegetation; these setbacks are more commonly referred to as a separation distance. The distance itself is calculated based on the vegetation type, the effective slope and the type of use next to the hazard. This assessment has applied separation distances as per BAL-12.5 building setback distances from Table 2.4 in AS3959:2018, with vegetation being identified as per AS3959:2018 and the slope as per figure 10 and 11. To note, for vulnerable uses and associated buildings, the setbacks from Table S43C2 in Specification 43 of the NCC 2022 have been applied.

The separation distance is measured in the horizontal plane, from the edge of the classified vegetation to the nearest part of an external wall of a proposed building (or the site in absence of detailed building design). For parts of the building where there are no external walls such as carports, decks, landings, verandas, ramps and steps, the distance is measured to the supporting post or column. Noting, the following items are not included when determining the separation distance, these include eaves, roof overhangs, rainwater tanks, domestic fuel tanks, chimneys, pipes, cooling or heating appliances or other services, unroofed pergolas and sunblinds (Standards Australia, 2018).

At the time of this report the development line from the Bruce Creek corridor has yet to be finalised. The development line sets the threshold between areas of hazardous vegetation and residential uses. .The development line acts as the base point from where hazardous vegetation begins and where the separation distances are calculated from.

In addition, given the potential for regeneration and/or revegetation of tree and shrubs along the corridor, providing setbacks that anticipate some increase in the extent of Woodland have been accounted for. This also acknowledges the Environmental Significance Overlay – Schedule 2 (ESO2) that applies along the Bruce Creek corridor. Therefore, to account for an increase in the extent of Woodland along the corridor, a precautionary approach has been applied for defining boundaries for areas of potential future Woodland and thus the determination of future development setbacks from those boundaries. This is seen in figures 13 & 14 as the 'hypothetical future woodland area'.

Further, without a finalised development scenario or line, it is considered appropriate to apply the 'Downslope >10 - 15˚' slope class (i.e. a value of 15˚ for the effective slope) for both the Woodland and Grassland hazard in the Bruce Creek corridor. This allows for both development scenarios and a future increase in the extent of Woodland.
The development scenarios in which the setbacks have been applied are:

- Scenario 1: Development within the Bannockburn South East precinct can occur approximately 200m from the Bruce Creek waterway, accounting for areas of cultural heritage sensitivity and Growling Grass Frog habitat.
- Scenario 2: Development within the Bannockburn South East precinct can occur closer to the Bruce Creek waterway, where slope permits whilst avoiding sites of cultural and environmental significance.

The setbacks for the Bannockburn South East precinct are shown below:

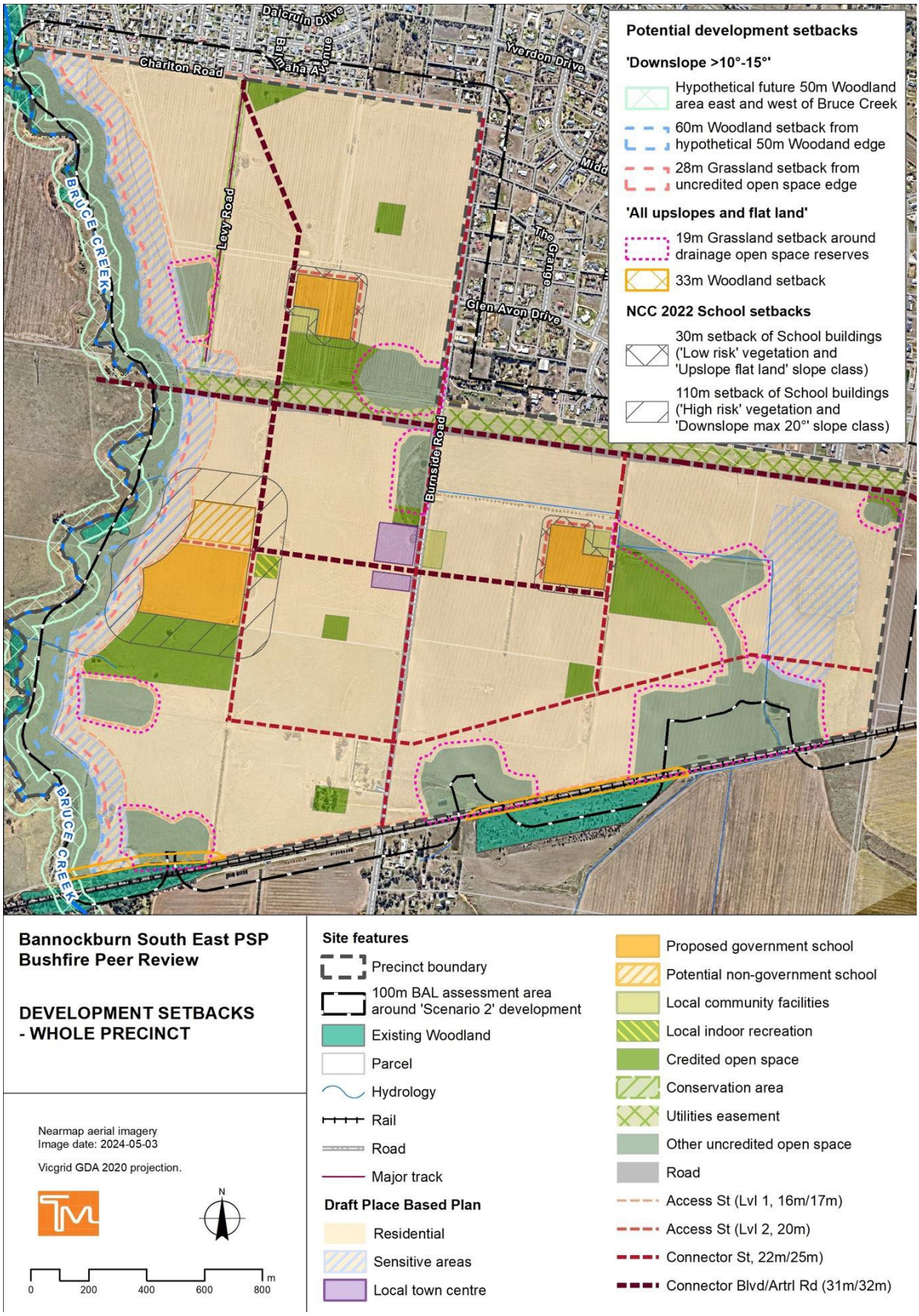

Figure 13: Bannockburn South East - Development Setbacks

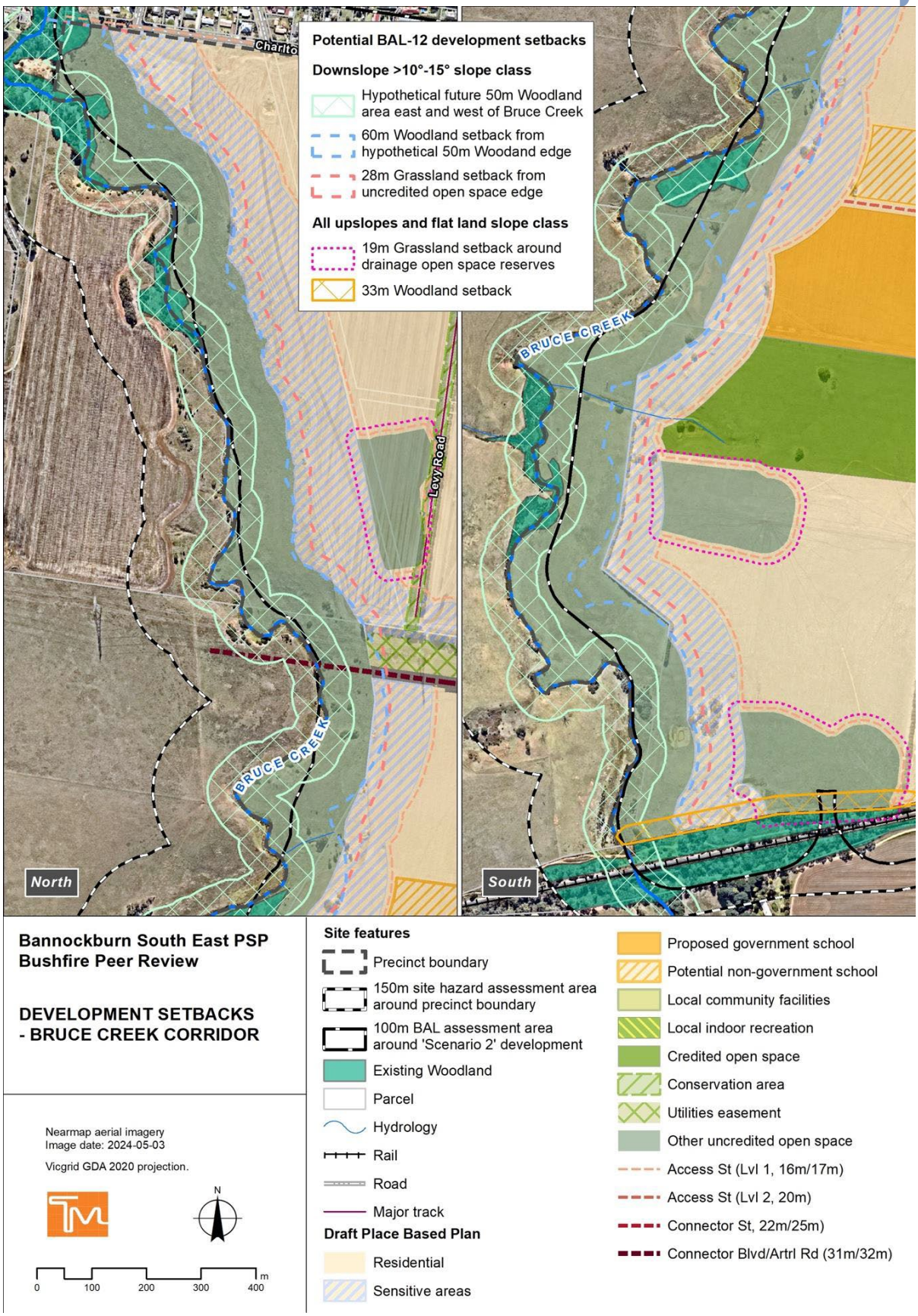

Figure 14: Bannockburn South East - Bruce Creek Development Setbacks

4.2.2 – Designing the settlement interface

The setbacks which have been identified are required to have interfaces which combat and prevent bushfire attack. The following should/must be demonstrated when planning, designing and constructing an interface:

4.2.3 – Exclude development in the separation distances

- No buildings which are permanently occupied can be located within the separation distances identified above.
- Demonstration of how buildings will be excluded in the separation distances.
    - A building envelope (which identifies where development will/can occur on a lot) or a building exclusion area can be used.
- Separation distances and the exclusion of dwellings may only apply to part of a lot.
- Any proposals for development will need to demonstrate how the required setback will be managed and not contain any buildings which are permanently occupied.

4.2.4 – Perimeter roads

- Are the preferred design outcome for separation distances.
    - Perimeter roads limit the ability for areas of vegetation to form and create increased fuel loads.
    - If vegetation is included alongside perimeter roads, their maintenance is typically kept to a level which excludes them from being classified as hazardous vegetation.
- Perimeter roads should be applied to all land uses and developments.
- Perimeter roads should be designed to ensure lots front or face the bushfire hazard, where the rear of lots are the furthest away from the bushfire hazard.
    - As the location of these lots are closest to the hazard, maintenance and monitoring of the hazard can be undertaken more routinely and easily.
    - The rear of lots are often unable to be managed and observed due to privacy, fences and other limitations. Consequently, this means that introduced fuel loads or unmanaged hazardous vegetation can form.
- If perimeter roads are not possible in design outcomes, further details and information should be provided to highlight how the bushfire risk will manage.

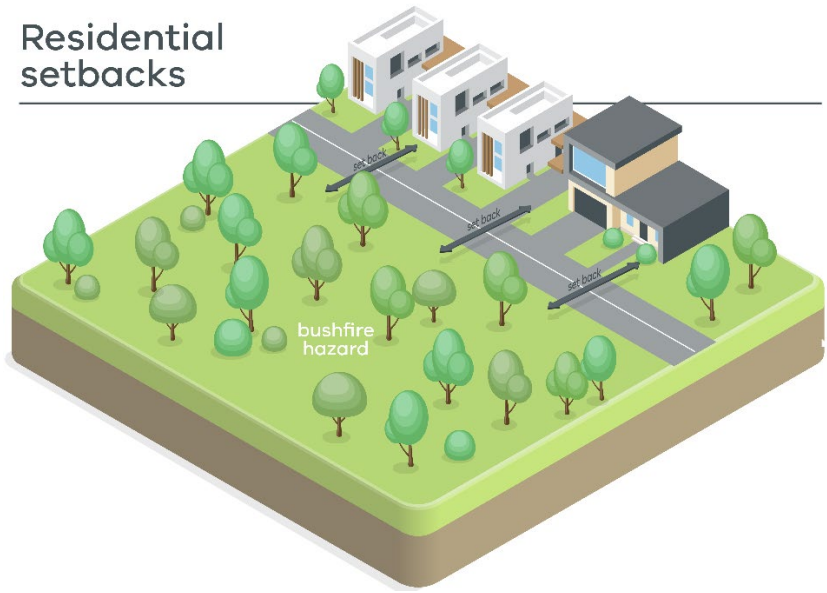

Figure 15: Graphic Concept - Perimeter Road (VPA, 2024)

4.2.5 – Open space on the settlement interface:

- Open spaces which are deemed to be low threat and do not contain dwellings (which are permanently occupied) can be located in the separation distance.
    - Examples include: Bodies of water , sports fields, hard surfaces such as basketball, netball and tennis courts, as well as parking areas.
- If these open spaces contain vegetation or landscaping, they must be managed in accordance with Table 6 of clause 53.02 Bushfire Planning.
    - Management of these spaces and any vegetation is likely to be the responsibility of Golden Plains Shire Council.
    - If open spaces are privately owned, the same requirements for vegetation and site maintenance apply.
- If parts of the open space are located within the separation distance, there must be confirmation and agreement between local council and other parties involved regarding vegetation and site maintenance.

4.2.6 – Design access and egress

Ensuring people can move safely and efficiently away from a bushfire also provides more opportunities for firefighting operations to occur.

- The distance between roads leading away from a bushfire hazard should be no more than 120 metres on average.
- Each lot should have access to a minimum of two roads.
- Key access routes into and out of the settlement should not be alongside a bushfire hazard.
- Access and egress points should also be provided for pedestrian and emergency vehicle movement.
- The road network should be designed satisfaction of Golden Plains Shire Council and CFA.
- Road widths should be designed to the satisfaction of Golden Plains Shire Council and CFA.
- Guidance for road design is provided in the CFA document 'Design Requirements, Vehicle Access and Water Supply Requirements in Residential Developments' (Country Fire Authority, 2022).

4.2.7 – Vegetation management:

- Vegetation is able to be removed subject to clause 13.02-1S which notes that development can occur and implement bushfire protection measures, without unacceptable biodiversity impacts. If the impacts towards biodiversity are unacceptable in relation to broader policy and ecology, the development should not proceed.
- Any vegetation located within the separation distance must be managed to prevent a moving bushfire front.
- Responsibilities between Golden Plains Shire Council and the CFA must be understood in relation to management of public land.
- Defendable space is provided and managed in accordance with the following requirement as per Table 6 in clause 53.02 Bushfire Planning:
    - Grass must be short cropped and maintained during the declared fire danger period.
    - All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.
    - Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.
    - Plants greater than 10 centimetres in height must not be placed within 3 metres of a window or glass feature of the building.
    - Shrubs must not be located under the canopy of trees.
    - Individual and clumps of shrubs must not exceed 5 square metres in area and must be separated by at least 5 metres.
    - Trees must not overhang or touch any elements of the building.
    - The canopy of trees must be separated by at least 5 metres.
    - There must be a clearance of at least 2 metres between the lowest tree branches and ground level.

Unless specified in a schedule or otherwise agreed in writing to the satisfaction of the relevant fire authority.

4.3 – Bushfire protection measures across a whole settlement

4.3.1 – Vegetation management

- The future precinct will contain areas of both hazardous vegetation, as well as low threat vegetation. Management and maintenance of these areas will be determined through their purpose and ownership. No specific controls, overlays or other mechanisms relating to vegetation are deemed necessary.
- A schedule to any zone should include the requirement for a Site Manage Plan. Clause 56.08-1 Site Management of the Golden Plains Shire planning scheme currently focuses on the following in relation to site management:
    - Erosion and sediment
    - Dust
    - Run-of
    - Litter, concrete and other construction wastes
    - Chemical contamination
    - Vegetation and natural features planned for retention.

In addition, the site management plan must also include:

- Bushfire risk at each stage of development
- Where access and egress will be
- Separation distances between the development edge and the bushfire hazard
- Land management and maintenance by the land proponent to demonstrate that risk is being managed and reduced.

4.3.2 – Building construction standards

- As identified via clause 13.02-1S, subdivision and dwelling design should not result in a BAL construction standard which is higher than the minimum 12.5 BAL in Bushfire Prone Areas. In addition, site specific management should be demonstrated through the permit application.

4.3.3 – Fences and other localised fuel sources

- No fence and fuel controls mechanisms are necessary for the precinct.
- The Golden Plains Shire planning scheme contains controls and other building regulations relating to fences and their design.
- Fences which are Colourbond are able to slow the spread of bushfire and act to decrease radiant heat. This factor should be accounted for when making decisions surrounding fences (Department of Environment, Land Water and Planning 2020).

5.0 – Responding to Clause 13.02-1S

The following section will demonstrate how the Bannockburn South East precinct can achieve the objectives and strategies for bushfire planning as per clause 13.02-1S of the Golden Plains Shire planning scheme.

5.1 – Protection of human life

As per clause 13.02-1S, planning must give priority to the protection of human life by:

5.1.1 – Prioritising the protection of human life over all other policy considerations.

The Bannockburn South East precinct appropriately prioritises the protection of human life.

As identified in section 3.0, the site itself exists in a location with a relatively low bushfire threat, due to both quantum of hazardous vegetation and topography. The prioritisation of human life can occur through the implementation of the relevant bushfire objectives, requirements and guidelines identified in the PSP. In addition, adhering to all relevant policy in the Golden Plains Shire planning scheme further ensures human life is maintained and protected.

5.1.2 – 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.

The bushfire assessment undertaken during the preparation of the Bannockburn Growth Plan identified the precinct as a location which would be able to accommodate population growth in a low-risk location. In addition, the Golden Plains Shire Strategic Bushfire Assessment also identified Bannockburn as a lower-risk location for growth on a regional and sub-regional scale. The assessment determined that bushfire risk for the growth areas in Bannockburn is relatively low, due to the quantum of hazardous vegetation, the topography and access to areas outside the BPA.

In the interim development of the precinct, the growing population of the precinct will be able to access safer areas outside the BPA by travelling into the existing Bannockburn township. The site will be able to provide safer conditions to protect human life, as it is deemed BAL-LOW.

At full build out the precinct may be removed from the BPA, however this cannot be confirmed at this time. Reviews for areas located in the BPA are undertaken every 6 months. If the precinct is excluded from the BPA, it will further strengthen Bannockburn's resilience to bushfire and provide greater areas which can foster the protection of human life.

5.1.3 – Reducing the vulnerability of communities to bushfire through the consideration of bushfire risk in decision making at all stages of the planning process.

The assessment provides guidance and information into current and future bushfire risk. The PSP reflects these findings to ensure all members of the community are safe, at all stages of the planning process.

5.2 – Bushfire hazard identification and assessment

5.2.1 – Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.

The findings of this assessment have been crafted off the basis of the latest data in relation to vegetation, topographic and climatic conditions.

Additional guidance was informed by Planning Practice Note (PPN) 64: *Local planning for bushfire*, Planning Advisory Note (PAN) 68: *Bushfire State Planning Policy Amendment* and the technical guide *Planning Permit Applications in the Bushfire Management Overlay*. Further guidance was provided through *Building in bushfire prone areas - CSIRO and Standards Australia*.

The classification of vegetation was determined as per A3959:2018. The following pieces of data were applied:

- Satellite imagery from 2023
- Bannockburn South East Arboriculture assessment
- Bannockburn South East Biodiversity assessment
- Ecological Vegetation Classes data

The data above provided information on tree species and vegetation types, which enabled vegetation classifications to be allocated.

The analysis of topography was constructed through applying 1-meter square grids to the existing contours. The data depicted that the site is mostly flat, with the exception of the Bruce Creek corridor.

5.2.2 – Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.

The location and extent of Bushfire Prone Areas is based on the last review and update undertaken on the 10th of September 2024. 1

5.2.3 – Applying the Bushfire Management Overlay to areas where the extent of vegetation can create an extreme bushfire hazard.

The Bushfire Management Overlay does not apply to any areas located within the Bannockburn South East precinct or 100 meters from the site boundary. The BMO mapping was last updated on the 3rd of October 2017, via amendment GC12. The Bannockburn Flora and Fauna reserve is located with 2 kilometres of the precinct and is the closest site covered under the BMO. No BMO is proposed to be applied within the precinct.

5.2.4 – Considering and assessing the bushfire hazard on the basis of:

- Landscape conditions - meaning conditions in the landscape within 20 kilometres (and potentially up to 75 kilometres) of a site.
- Local conditions - meaning conditions in the area within approximately 1 kilometre of a site.
- Neighbourhood conditions - meaning conditions in the area within 400 metres of a site
- The site for the development.

The hazard assessment examined each of the identified scales as per section 3.0 of this report.

- Landscape conditions were examined at 20 kilometres from the site
- Local conditions were examined at 1 kilometre from the site
- Neighbourhood conditions were examined at 400 metres from the site
- The site for development was analysed at 100 meters from the site as identified in AS3959:2018.

5.2.5 – Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.

The assessment was provided to both Golden Plains Shire Council and the Country Fire Authority for review. The assessment will be amended subject to feedback received.

5.2.6 – Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.

The following clauses of the Golden Plains Shire planning scheme have been used to assess the bushfire risk and inform the corresponding protection measures:

- 02.03-3, 12.01-1S, 13.02-1S, 52.12, 53.02 and 71.02-3.

In addition, the following documents have also informed aspects of this assessment:

- AS3959:2018, relevant practice notes, DEWLP guidance and CFA guidance.

5.2.7 – Not approving development 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.

Development can proceed subject to the objectives and strategies of clause 13.02-1S being achieved. The findings of this assessment in relation to settlement layout, separation distances and vegetation management must also be demonstrated. The PSP and corresponding ordinance will note the execution of these aspects.

5.3 – Settlement planning

The following section of clause 13.02-1S emphasises how plans must strengthen the resilience of communities and prioritise protection of human life.

5.3.1 – Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under* AS3959:2018 Construction of Buildings in Bushfire-prone Areas *(Standards Australia, 2018).

As previously noted, the bushfire assessment undertaken during the Bannockburn Growth Plan identified the South East precinct as an area which can foster population growth due to its lower risk.

If all requirements and measures are implemented, all buildings within the precinct will be able to achieve a radiant heat flux of 12.5 kilowatts/square metre, which reflects the BAL 12.5 construction standard.

5.3.2 – Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under* AS3959:2018 Construction of Buildings in Bushfire-prone Areas *(Standards Australia, 2018) where human life can be better protected from the effects of bushfire.

The existing Bannockburn township provides the closest and safest area where the BPA does not apply. Access to the area is currently available along Burnside road, however, the current Place Based Plan identifies numerous access streets which lead into the existing township.

5.3.3 – Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.

There will be no increase in relation to bushfire risk for the existing and future residents of surrounding areas. All buildings that are permanently occupied will be separated from areas of hazardous vegetation in order for BAL 12.5 construction standards to be met. The future land uses and development will strengthen the resilience of the existing community through facilitating greater opportunities for fire management activities to occur, and through limiting the amount of hazardous vegetation present.

5.3.4 – Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reducing bushfire risk overall.

There will be no net increase in risk to existing and future residents of Bannockburn and surrounding areas. There will also be no increase in risk to infrastructure, as development will provide appropriate bushfire mitigation measures such as adhering to separation distance, BAL 12.5 construction standards, vegetation management, access and egress location and access to hydrants/water supply.

5.3.5 – Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.

The assessment examined bushfire hazard at the landscape, settlement, local, neighbourhood and site scale. The impact of a bushfire on the precinct and broader context is relatively low due to the dominant vegetation type being Grassland and flat topography

Although, grassland fires spread rapidly and move at speeds up to 25 km per hour, their inability to produce substantial amounts of ember attack often means they are unable to enter into developed areas (Country Fire Authority, 2023c). However, their speed and ability to spread rapidly does pose a greater threat to areas of more hazardous vegetation, such as Forest or Woodland. Therefore, as both Grassland and Woodland are present in and around the precinct, the management of these sites and their interfaces is vital to ensure the fire front is limited.

The only area within the precinct which poses the ability to cause destruction above the site scale is the Bruce Creek corridor and the areas of Woodland vegetation within. The steep topography and pockets of dense vegetation will require management to ensure the bushfire hazard and risk is limited.

5.3.6 – Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.

The scope of this assessment does not examine alternative areas for growth. The bushfire assessment undertaken during the Bannockburn Growth Plan identified the Bannockburn South East precinct as an area which was low risk and able to support future growth.

5.3.7 – 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* AS3959:2018 Construction of Buildings in Bushfire-prone Areas *(Standards Australia, 2018

The separation distances identified in this assessment are required to be met in order for development of buildings to not exceed BAL 12.5 construction standards.

5.4 – Areas of biodiversity and conservation value

The ecological assessment undertaken for the Bannockburn South East precinct identified the following biodiversity:

- 8.41 hectares of native vegetation represented by three EVCs
    - Heavier Soils Plains Grassland (EVC 132_63) 7.804 hectares
    - Creekline Grassy Woodland (EVC 68) 0.323 hectares
    - Plains Grassy Woodland (EVC 55_61) 0.288 hectares;
- 6.37 hectares of the nationally significant ecological community Natural Temperate Grassland of the Victorian Volcanic Plain
- 7.804 hectares of the State significant Western (Basalt) Plains Grassland Community
- Melbourne Yellow-gum Eucalyptus leucoxylon subsp connata listed as threatened under the FFG-Act
- Known presence of two nationally significant fauna:
    - Confirmed habitat for Growling Grass Frog along the Bruce Creek corridor;
    - 6.324 hectares of confirmed habitat for Golden Sun Moth within the study area (parcels along Bruce Creek)
- Known presence of one State significant fauna:
    - Tussock Skink (Vulnerable under DEECA's Advisory List for Rare or Threatened Species)
- No nationally significant flora were recorded in the study area.
- In addition to 1456 trees were assessed during the arboriculture assessment. The study examined the species, health and retention value of each tree.

As majority of the biodiversity is located within the Bruce Creek corridor, the amount and type of ecological and bushfire management within the corridor must be considered. This ensures that there isn't an unacceptable impact towards biodiversity, whilst still protecting the settlement, population and ecological values.

5.5 – Use and development control in a Bushfire Prone Areas

As noted in clause 13.02-1S, *'in a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:*

- *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'.*

In addition, clause 13.02-1S also requires *'when assessing a planning permit application for the above uses and development:*

- *Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'*

All uses and their subsequent developments in the Bannockburn South East precinct are able to achieve the required standards and regulations as per the Building Act 1993 and other safety measured identified in this assessment.

6.0 – Conclusion

This bushfire assessment was undertaken for the Bannockburn South East precinct in accordance with the following clauses of the Golden Plains Shire planning scheme:

- 13.02-1S Bushfire Planning
- 02.03-3 Environmental Risks and Amenity - Bushfire
- 12.01-1S Protection of Biodiversity
- 52.12 Bushfire Protection Exemptions
- 53.02 General Requirements & Performance Standards – Bushfire Planning
- 71.02-3 Integrated decision making

AS3959:2018 Construction of Buildings in Bushfire Prone Areas was applied when considering bushfire hazard and risk.

In addition, the following materials provided additional guidance into the assessment:

- Planning Practice Note 64 – Local planning for bushfire protection
- Planning Advisory Note 68 – Bushfire State Planning Policy Amendment VC140
- DEWLP Planning Permit Applications Bushfire Management Overlay (September 2017)
- DEWLP Bushfire Mapping Methodology and Criteria (December 2019)
- DEWLP Design Guidelines Settlement Planning at the Bushfire Interface (July 2020)
- CFA Landscaping for Bushfire – Garden Design and Plant Selection
- Building in bushfire prone areas – CSIRO & Standards Australia
- Golden Plains Shire Municipal Fire Management Plan 2018 – 2021 version 3.0
- Golden Plains Shire Strategic Bushfire Assessment

The examination of current and future hazards and their associated risk on the precinct determined that the threat of bushfire attack is low. The site is principally flat except for the Bruce Creek corridor where topography varies, with the dominant vegetation classification being grassland. The areas surrounding the precinct consist of either residential uses to the north or agricultural uses to the east, south and west; these sites all present low levels of bushfire hazard and therefore risk.

Analysis of the precinct at both the site and neighbourhood scale identified no areas of land affected by a Bushfire Management Overlay or related schedule. Analysis at the landscape scale identified the closest area where a BMO applies is the Bannockburn Flora and Fauna Reserve, which is within approximately 2 kilometres of the site. Due to its proximity, a bushfire at this site has the potential to impact the precinct directly, from both the advancement of the fire front and potential ember attack. Therefore, management of this site is fundamental in ensuring bushfire risk is reduced for the Bannockburn area

The current classified vegetation within the precinct and 100 meters from the site boundary is mostly Grassland with pockets of Woodland. The Grassland within the residential areas of the precinct are expected to be removed during development and construction. The only area where existing Grassland and Woodland vegetation will remain in its similar state is the Bruce Creek corridor, or where areas of biodiversity sensitivity are present. Management of the corridor will be undertaken by Golden Plains Shire Council to ensure bushfire hazard and risk are not increased. The possibility for revegetation of the creek corridor is possible,

however, an increase in the quantum of vegetation may increase the classification and therefore require greater separation distances. Future vegetation within the precinct will occur through active open space, passive open space, drainage reserves, landscaping and front/backyards; all of these areas are deemed low threat due to their consistent management and location.

Interfaces will be needed to ensure the protection of human life from bushfire hazard is the priority. The separation distances identified have been determined off the basis of classified vegetation, effective slope, climatic conditions, and proposed/existing land use to ensure developments upon completion do not have a BAL rating above 12.5.

The interfaces themselves will most likely contain perimeter roads which both limit the occurrence of hazardous vegetation and provide greater opportunities for fire prevention and fighting activities. The specific cross sections for each interface will be developed at a later stage and reflect site conditions.

In addition, the subdivision and layout of parcels will further strengthen the ability for the precinct to build resilience. The location of access and egress routes away from bushfire hazards will ensure efficient movement to BAL-LOW areas, such as the Bannockburn township, whilst locations of active open space can be used as defendable space.

Currently there are no areas of BAL-LOW land within the precinct, however, once development occurs to a substantial level, where hazardous vegetation is being managed and other areas are maintained, there may be the possibility for the BPA to be removed. Noting, the removal of the BPA is not definitive.

The Bruce Creek corridor fosters an abundance of biodiversity and significant ecology and is unable to harbour development. Therefore, the implications towards existing biodiversity will be limited. However, as development will occur in the precinct, regular management and maintenance will ensure bushfire hazards are regulated, whilst biodiversity is protected.

Ultimately, the Bannockburn South East precinct is able to meet all of the objectives and strategies of clause 13.02-1S, where the future development reflects the priority to protect human life. The findings of this assessment have been reflected into the PSP and are all achievable.

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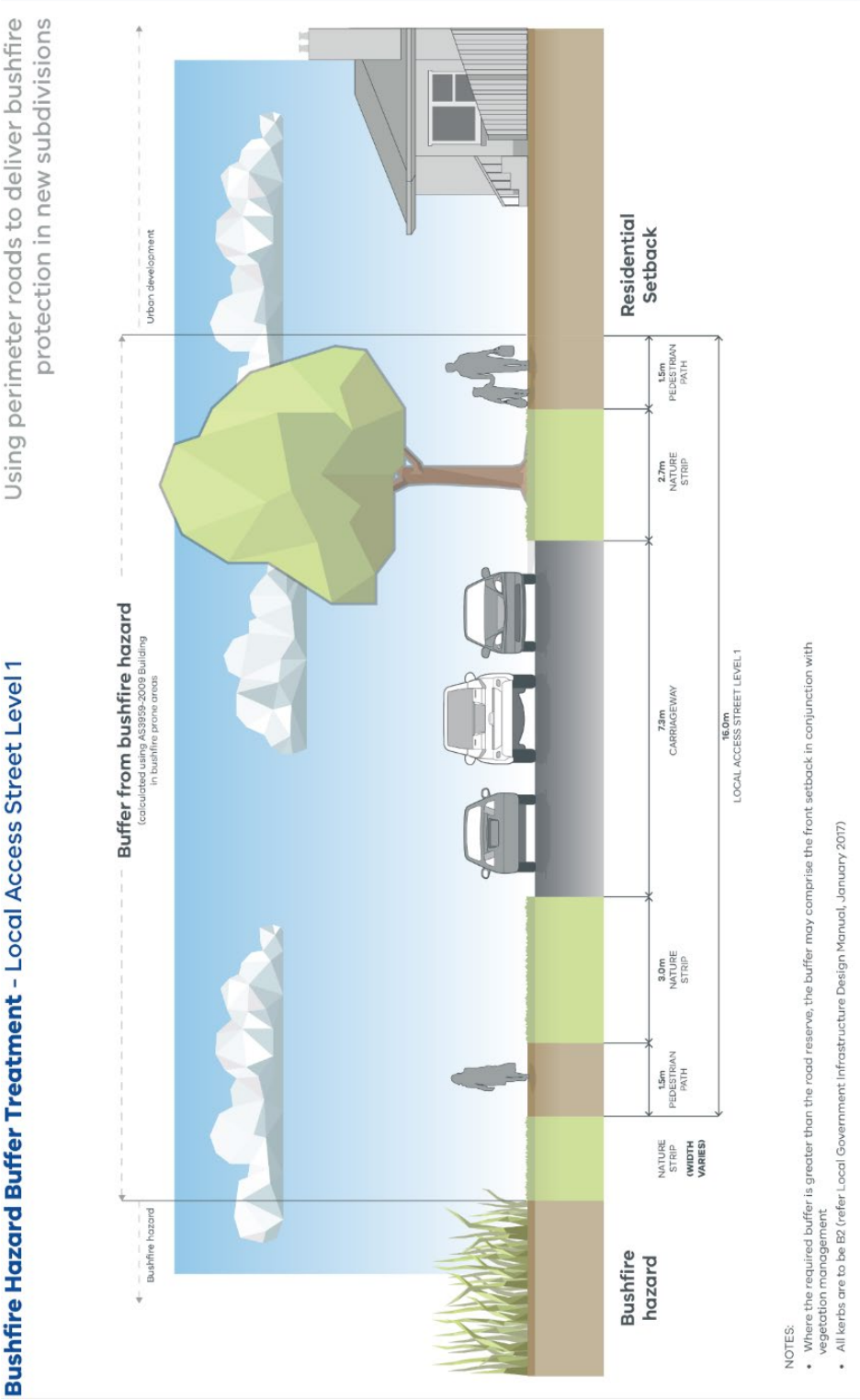
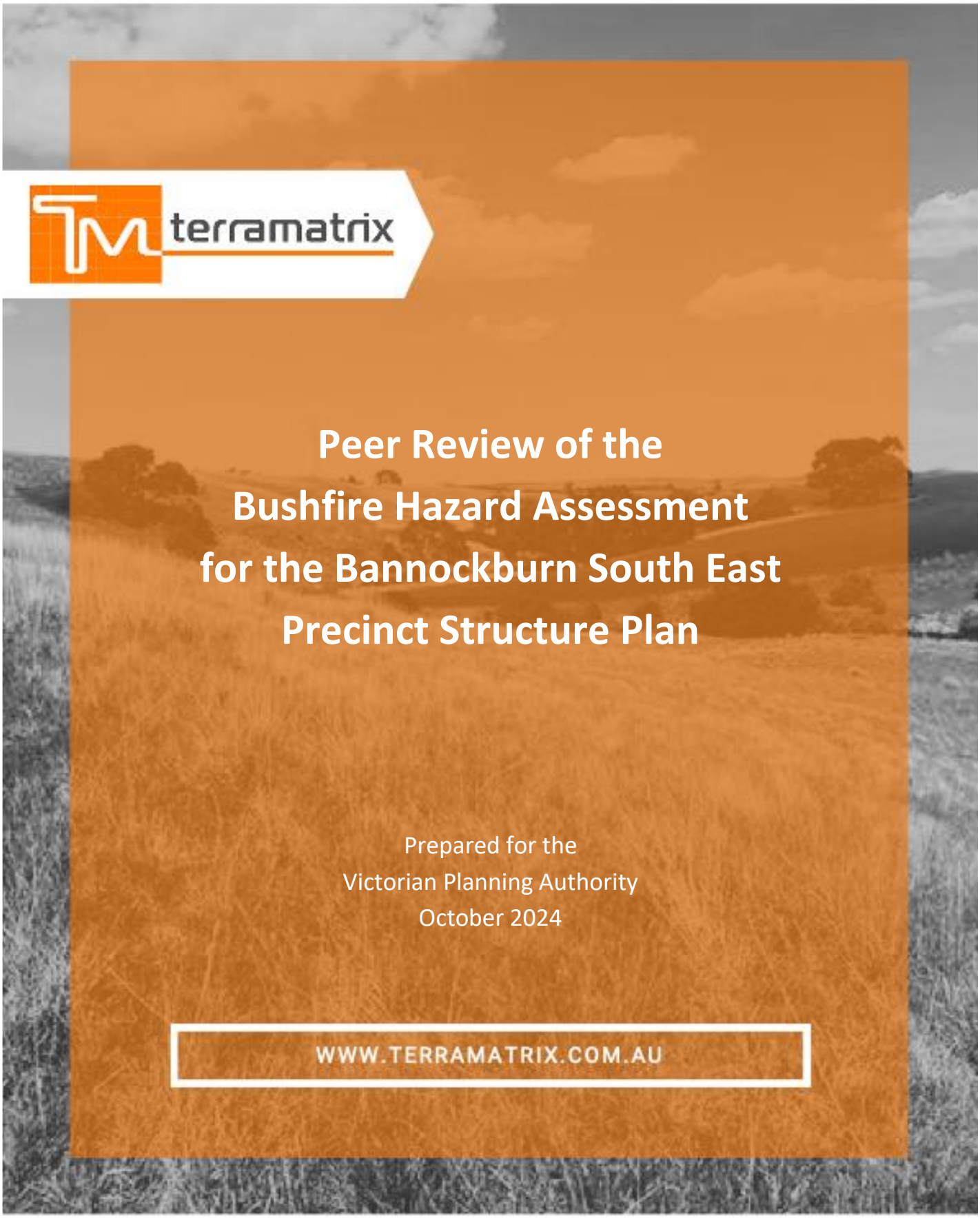
8.0 – Appendices

1.1 Appendix A



Appendix B – TerraMatrix peer review



Peer Review of the Bushfire Hazard Assessment for the Bannockburn South East Precinct Structure Plan

Prepared for the
Victorian Planning Authority
October 2024

WWW.TERRAMATRIX.COM.AU

Terramatrix project: VPA-2024-03 Peer Review-Bannockburn
Cover image: Looking southwest along Bruce Creek from the northwest corner of the precinct.

Accountability

Stage	Date Completed	Undertaken by
Site assessment	3/10/2024	Hamish Allan - Manager, Bushfire Planning and Design
Analysis & report preparation	14/10/2024	Hamish Allan- Manager, Bushfire Planning and Design
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1 Introduction

This report has been prepared for the Victorian Planning Authority (VPA) as a peer review of the draft *Bannockburn South East Precinct Structure Plan Bushfire Assessment* (VPA, 2024), which was prepared by the VPA (henceforth referred to as the 'VPA assessment') to support the development and approval of the Bannockburn South East Precinct Structure Plan (BSEPSP).

The VPA assessment was prepared by VPA staff to assess the bushfire hazard, inform the development of the Place Based Plan (PBP) for the precinct, and show how the BSEPSP responded to the State planning policy for bushfire at Clause 13.02-1S in the Golden Plains planning scheme.

Terramatrix understands that the Country Fire Authority (CFA) requested a peer review of the VPA assessment with a focus on confirming the hazard assessment. VPA have requested that the review should, in particular:

- Examine the details regarding vegetation management of the land within 200 m of Bruce Creek and across the precinct.
- Confirm the identification of the bushfire hazard. Is management of the hazard clear? How can this give effect within the PSP?
- Confirm the identified slope of the land containing the bushfire hazard. Is this correct?
- Confirm the identified setbacks for defendable space. Are they correct? Is further clarity needed on where they are measured from?
- Are terms on the bushfire plans clear?

Accordingly, this peer review is largely limited to reviewing the content in Section 3 *Bushfire Hazard Assessment* and Section 4.2.1 *Apply the required development setback* of the VPA assessment report.

The review has been undertaken in accordance with guidance and principles for peer reviews by accredited bushfire practitioners outlined in the *Advice Note - Peer Review* by the Fire Protection Association of Australia (FPAA, 2024).

The entirety of the precinct is a declared Bushfire Prone Area (BPA), which are locations subject to or likely to be subject to bushfire, as determined by the Minister for Planning. No part of the precinct is affected by the Bushfire Management Overlay (BMO), which denotes areas of highest bushfire risk within a BPA. The nearest area of BMO coverage is associated mainly with remnant vegetation in the Bannockburn Recreation Reserve and is over 1 km to the west of the precinct.

2 Bushfire hazard assessment

2.1 Landscape, local and neighbourhood scale assessments

Overall there are no substantive concerns with the landscape, local or neighbourhood hazard assessments in Sections 3.0.1, 3.0.2 and 3.0.3 respectively of the VPA assessment. The following comments are provided.

2.1.1 Landscape scale hazard assessment

Terramatrix agrees that whilst reserves with larger areas of hazardous remnant vegetation occur in directions typically associated with the approach of severe bushfire (i.e. the north, west and southwest), they are relatively distant from the precinct and, therefore, not a significant threat. The closest reserve is the Bannockburn Recreation Reserve over 1 km away.

Whilst the risk of a grassfire ignition from embers that could be generated by a fire in these areas of tree and shrub vegetation is acknowledged in the VPA assessment, Terramatrix disagrees with the contention that there is limited potential for grassfires to spread '*...due to the harvesting of land, property roads and farm animals grazing, the ability for momentum to occur is limited*' (VPA, 2024 pp15-16). Whilst grazing and cropping may assist to reduce the intensity of any grassfire in the landscape around the precinct, a grassfire can spread across even eaten out pasture and so a large and fast moving grassfire could develop in the surrounding landscape and impact the precinct. Under elevated fire danger conditions such a fire is unlikely to be significantly moderated by the pattern of development and roads in the landscape. This is reflected in the fire history, including large (>5,000 ha) fires to the east and north of the precinct that impacted Little River in 1985 and Anakie in 2006.

It is noted that a number of 'past fires' are missing from the landscape scale (within and beyond 20 km around the precinct) hazard assessment map provided as Figure 1 in the VPA assessment. These include several large fires that have occurred beyond the 20 km area around the precinct, so possibly only fires that impacted within 20 km are shown, which may understate the potential for fires to ignite and develop in the broader landscape around the precinct.

As the You Yangs Regional Park is noted as a significant area of hazard that occurs just outside the 20 km broader landscape area, the Great Otway National Park, which is also shown as occurring beyond the 20 km area, could also be noted as a significant but distant area of hazard.

2.1.2 Local and neighbourhood scale hazard assessments

As with the broader landscape scale assessment, only relatively minor matters are identified with local and neighbourhood scale hazard assessments .

The discussion regarding past and proposed planned burns in the Bannockburn Recreation Reserve, Bannockburn Bushland Reserve and Bannockburn Cemetery emphasises the benefits of burning for reducing 'bushfire threat'. It is suggested the discussion and emphasis overstates the risk reduction that might result from any planned burns in these two reserves due to:

- The reserves are only designated as 'Landscape Moderation Zone' (LMZ) fire management zones (FMZ) in the Forest Fire Management Victoria (FFMVic) and CFA Joint Fuel Management Program (FFMVic, 2024a). An LMZ is a less intensively managed area where planned burning will have a focus on maintaining and improving ecosystem resilience and fuel management will also be undertaken for risk reduction (FFMVic, 2024b). The aim of a LMZ is not to provide an asset protection function by mitigating the rate of spread, flame, radiant heat or ember attack.
- The claim that the effectiveness of any planned burning within them '*…substantially reduces risk to life and property…*' (VPA, 2024 p18) is similarly not credible. Planned burns are difficult to undertake in any year, largely due to the difficulty of aligning fuel conditions, fire weather and resource availability for a day when a burn could occur. Further the fuel reduction that may be achieved, may be short term and temporary, and/or insufficient to mitigate the hazard under extreme fire danger conditions.
- The reserves are small and fuel modification within the Bannockburn Recreation Reserve and Bannockburn Bushland Reserve is not likely to appreciably mitigate the threat to the precinct from a large bushfire in the landscape. Their relatively small size and distance from the precinct (approx. 1 km) are more valid factors that mitigate the relatively low threat they pose to development within the precinct. It is suggested that simply noting this last point and that the reserves are an LMZ FMZ, is preferable to the more detailed summation of prescribed burning provided in the VPA assessment.
- Areas of unmanaged vegetation in the Bannockburn Cemetery appear to be at least 100 m from the precinct and therefore, would be excludable as non-hazardous, low threat vegetation under the AS 3959-2018 vegetation classification schema (Standards Australia, 2020).

It is noted that the local scale hazard assessment map provided as Figure 5 only shows the Bannockburn Recreation Reserve as occurring west of Old Base Road and does not include an area of vegetation between Old Base Road and Harvey Road as being part of the Bannockburn Recreation Reserve. It is also noted that the Figure 5 does not show the Bannockburn Bushland Reserve and appears to incorrectly show the reserve area as land that is not designated as a BPA (as does Figure 6, which appears to be incorrectly labelled as the 1 km local hazard assessment map, but it actually shows the 400 m neighbourhood assessment area).

The local and neighbourhood scale hazard assessments identify Woodland and Grassland on surrounding properties as a potential hazard, but neither of the assessments mention the existing and potential hazard posed by Woodland patches along the Bruce Creek corridor (although Figures 2 and 3 are of Grassland and Woodland in the Bruce Creek corridor), or Woodland in the rail reserve that runs along and adjacent to the southern boundary of the precinct.

2.1.3 Landscape risk characterisation

As identified in the VPA assessment, Clause 13.02-1S stipulates that proposals must appropriately consider the hazard in the surrounding landscape (and the resultant risk arising) within 400 m, 1 km and up to 75 km around a site (Golden Plains Planning Scheme, Clause 13.02-1S). BMO applications at Clause 53.02-4.1, must also have regard to the nature of the bushfire risk beyond the 150 m BMO site assessment area (Golden Plains Planning Scheme, Clause 53.02).

To assist in defining landscape risk, four 'Broader Landscape Types' (BLT) are described in the Technical Guide *Planning Permit Applications Bushfire Management Overlay* (DELWP, 2017). They represent different landscape risk levels that are intended to streamline decision making and support more consistent decision making based on the landscape risk.

The BLT are based on descriptive characteristics associated with the surrounding landscape (see Table 1) and represent a spectrum of risk; ranging from low risk locations where there is little hazardous vegetation other than grassland beyond 150 m of a site, and extreme bushfire behaviour is not credible, to extreme risk locations with limited or no evacuation options, where fire behaviour could exceed AS 3959/BMO design fire conditions.

Whilst no part of the precinct, or surrounding land for over 1 km is affected by the BMO, the BLTs are a useful way of characterising the risk beyond the site scale for strategic planning proposals, and they are applied and understood by the CFA. Accordingly, it may be useful for the VPA assessment to characterise the landscape according to the BLTs. Note that for many sites the surrounding landscape can have characteristics that correspond with more than one BLT, and the applicability of a particular BLT's characteristics may vary according to distance from the site (i.e. the scale of the assessment area being considered).

Between 1 km and at least 5 km of the precinct, the landscape best accords with BLT 3, albeit at the lower risk end of the BLT 3 (or alternatively, upper end of the BLT 2) typology. A large (landscape scale) bushfire moving at a quasi-steady state rate of forward spread could occur. Access to a place(s) of relative safety from such a bushfire (e.g. to the Bannockburn central township and established residential areas) would potentially require travel by vehicle for several kilometres along a rural road network that may result in exposure to the fire.

Notwithstanding, other than areas denoted by BMO coverage, the hazard is largely confined to Grassland on generally flat, and therefore from a bushfire perspective, benign topography. Neighbourhood destruction is unlikely as losses would likely be limited to the first row of houses impacted and, given the general lack of tree and shrub vegetation (other than in BMO areas), a relatively low level of ember attack can be expected.

Within 1 km of the precinct, the landscape characteristics best match with BLT 2, and within 400 m, especially once development has substantially commenced and immediate access to places of relative safety (e.g. BAL-LOW areas) become available, BLT 1 attributes would be applicable.

Developed land within the precinct that is at least 60 m from Grassland will likely be eligible for exclusion from the BPA, and BAL-LOW construction would then apply. Accordingly, the landscape risk for the precinct is considered low or relatively low, which concurs with the findings of the VPA assessment (e.g. Section 5.1.2, p50).

Table 1 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
• *There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).* • *Extreme bushfire behaviour is not possible.* • *The type and extent of vegetation is unlikely to result in neighbourhood-scale destruction of property.* • *Immediate access is available to a place that provides shelter from bushfire*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.* • *Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can approach from more than one aspect.* • *The site is located in an area that is not managed in a minimum fuel condition.* • *Access to an appropriate place that provides shelter from bushfire is not certain.*	• *The broader landscape presents an extreme risk.* • *Evacuation options are limited or not available.* • *Fires have hours or days to grow and develop before impacting.*
I N C R E A S I N G R I S K →			

2.2 Climate and fire weather

Section 3.1 of the VPA assessment discusses the Forest Fire Danger Index (FFDI) and presents the Australian Fire Danger Rating System (AFDRS). However, the AFDRS, which came into use 1st September 2022, is not based on the FFDI as is incorrectly shown in Table 1 of the VPA assessment (VPA, 2024 p28).

The AFDRS uses the Fire Behaviour Index (FBI), which is similar to the FFDI in that it is a numerical scale from 1-100+ representative of potential fire danger and fire behaviour characteristics. However, it uses very different fire behaviour models for calculating fire characteristics including fire intensity, flame height, rate of spread and spotting potential. It has no mathematical correlation with the FFDI, so the FBI based FDR thresholds can only be considered analogous, or similar to the old FFDI based FDR thresholds (AFDRS, 2022).

The VPA assessment correctly notes the FFDI 100 is applied in non-alpine areas of Victoria for BAL assessments in accordance with AS 3959-2018. However, the FDI 100 value is not '*The average annual accumulated FDI...*' as stated. Rather, it is a representation of extreme fire conditions that could occur at a point in time, used for determining development setbacks at each BAL (and is the threshold for the previous 'Code Red' FDR).

There is no justification for applying a different FFDI for the PSP to the 'default' FFDI 100 used in the planning and building system.

Section 3.8 in the VPA assessment discusses weather and climate conditions for the precinct and presents some monthly average weather data from the nearest Bureau of Meteorology (BOM) Automatic Weather Station (AWS), which is the She Oaks AWS that is located 17.8 km to the north of the precinct at an elevation 237 m.

Terramatrix suggest the discussion of weather is not particularly useful or relevant and could be omitted. The data presented and some of the statements are potentially misleading as they focus on annual or monthly averages that bear no relation to the fire threat or potential fire behaviour on days of elevated fire danger e.g. under Extreme or Catastrophic conditions.

2.3 Vegetation

Sections 3.2 to 3.5 in the VPA assessment consider the hazard posed by existing and future vegetation in and around the precinct. Figures 12-15 in the assessment show the classification of vegetation (and potentially applicable BAL setbacks) within, and up to 100 m around the precinct boundaries, according to the AS 3959 methodology; based on two different scenarios for development adjacent to the Bruce Creek corridor:

(1) Development occurs beyond approximately 200 m from the Bruce Creek waterway, accounting for areas of cultural heritage sensitivity and Growling Grass Frog habitat.
(2) Development can occur closer to the Bruce Creek waterway, where slope permits, whilst avoiding sites of cultural and environmental significance (VPA, 2024).

For this peer review, vegetation within a larger 150 m assessment zone around the precinct has been classified. Whilst for the purpose of determining a BAL, a 100 m site assessment area is used, guidance for bushfire state planning policy suggests considering the hazard within and beyond 150 m of a site (DELWP, 2018). AS 3959-2018 also notes that for BAL determination the assessment of

vegetation (and slope) beyond 100 m may be required. For strategic planning purposes therefore, it Is prudent and precautionary to apply the larger 150 m site hazard assessment area. The maps in this peer review also show the 100 m BAL assessment area around potential future residential areas, based on Scenario 2 above, which anticipates development closer to the Bruce Creek.

Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective. As noted in the VPA assessment, 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, which is based on structural attributes. Classification for bushfire assessment purposes must be based on the anticipated mature state of the vegetation and the likely fire behaviour that it will generate.

2.3.1 Grassland

The VPA assessment correctly identifies the predominant hazard to the precinct as Grassland and that Grassland (and Woodland) in the Bruce Creek corridor is the main hazard to future development.

It should be noted that whilst some of the Grassland areas may comprise ecological vegetation class (EVC) Plains Grassy Woodland (Victorian Volcanic Plains EVC 55) (DEECA, 2024), with the cessation of grazing and cropping, Grassland areas may revert to a higher hazard Woodland state through natural recruitment and/or revegetation.

Areas of Grassland shown in the Terramatrix site hazard assessments in Map 1 and Map 2, are those areas not shown as Woodland or land labelled low threat and non-vegetated.

Photo 1 - Grassland (and Woodland patch in distance) along the Bruce Creek corridor.

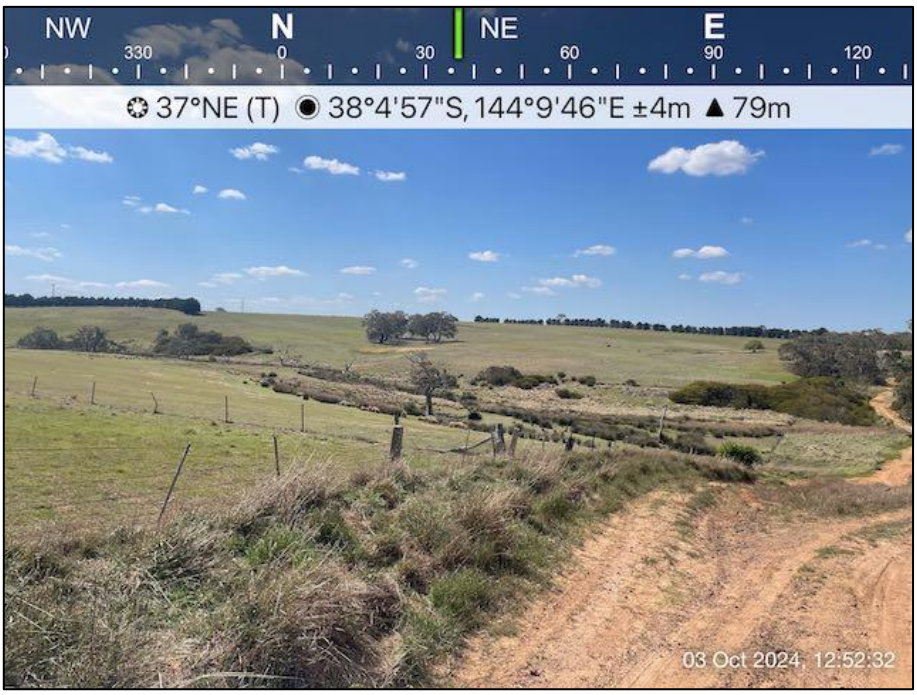


Photo 2 – Grassland west and east of Bruce Creek, along the southern boundary of the precinct near the southwest corner.

2.3.2 Woodland

The VPA assessment identifies several small patches of Woodland within the Bruce Creek Corridor. This peer review considers some of these smaller patches comprise no more than a Grassland

hazard, but in other areas are more extensive than shown in the VPA assessment. Map 1 and Map 2 show the areas assessed as Woodland by VPA and Terramatrix, noting the larger 150 m site hazard assessment area used in the Terramatrix assessment. Additional patches of Woodland identified by Terramatrix include remnant tree and shrub vegetation in the rail reserve and Bruce Creek corridor near the southwestern corner of the precinct, and a patch to the southeast.

As identified in Section 2.3.1 above, natural recruitment and/or revegetation is likely to occur along the Bruce Creek as the waterway and riparian area becomes managed for its biodiversity and recreation values. In Terramatrix's experience Woodland (and Grassland) areas can quickly develop a denser, shrubbier understorey, potentially even exceeding their EVC benchmark state, following change of management and associated cessation of grazing, cropping or other disturbance. This is evident, for example, in areas of *Acacia paradoxa* Kangaroo Thorn in the northern part of the corridor.

To account for an increase in the extent of Woodland along the corridor, a precautionary approach is recommended in defining boundaries for areas of Woodland and determining future development setbacks from those boundaries. Section 3, Map 5 and Map 6 discuss and show assumptions and development setbacks that could be considered for the corridor in the PSP.

Photo 3 – Woodland and Grassland along the Bruce Creek corridor in the northwest of the precinct.

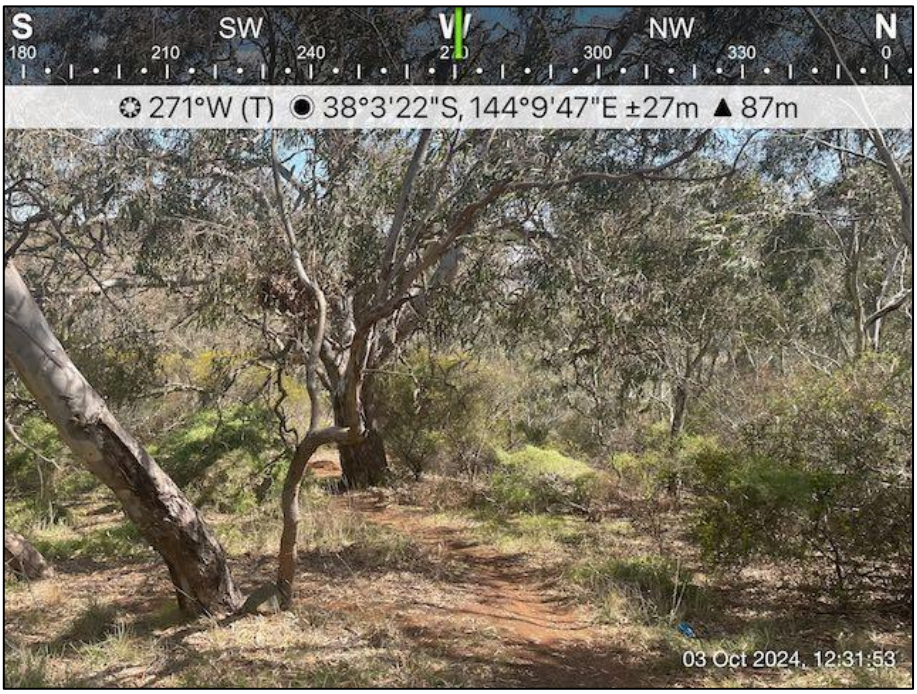


Photo 4 - Woodland in the Council reserve at the end of Charlton Road in the northwestern corner of the precinct.

Photo 5 - Woodland in the rail reserve along the southern precinct boundary.

Photo 6 - Woodland to rear of image, south of the rail reserve along the southwestern precinct boundary.

2.3.3 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 m[1] from the site.

(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 condition[2], 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

[1] This distance extends to 150 m in BMO areas.

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

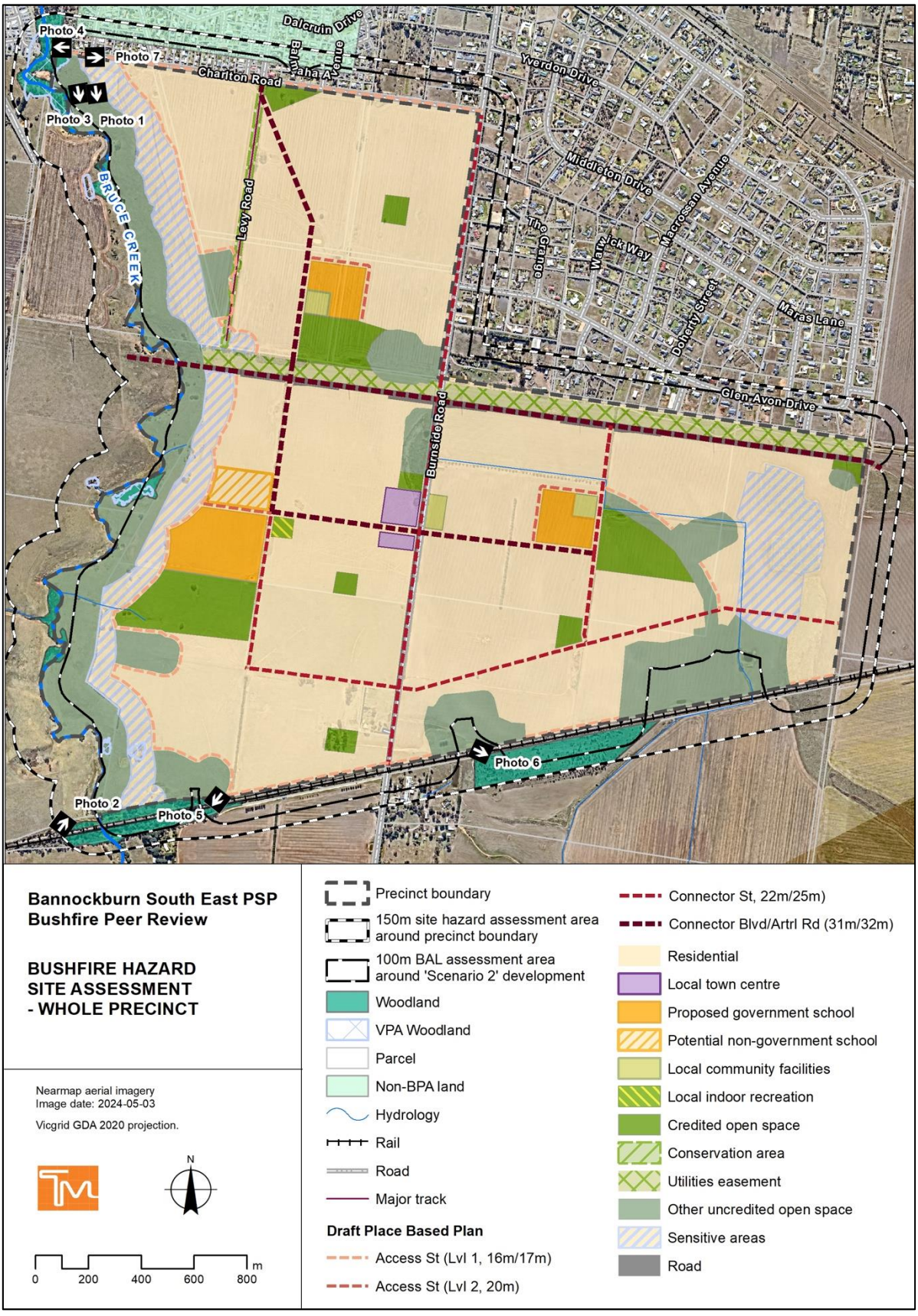
(and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks' (Standards Australia, 2020).

Low-threat and non-vegetated land excluded from classification includes the properties to the north, northeast and northwest of the precinct.

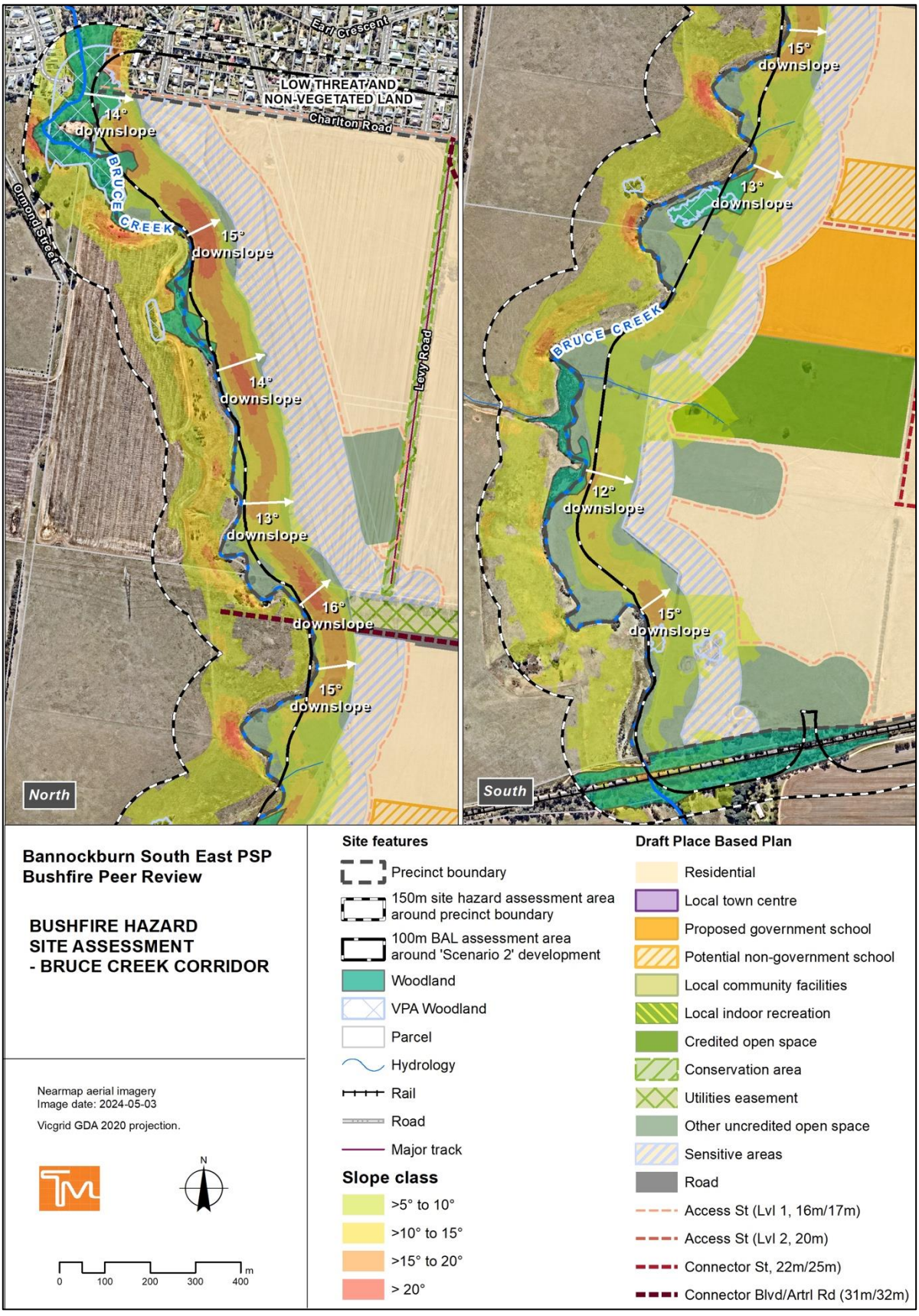
Other than areas proposed for conservation and other uncredited open space (see Map 1), it is reasonable to assume all land within the precinct will become low threat or non-vegetated as development progresses. This agrees with the VPA assessment that categorises proposed Passive and Active Open Space reserves, roadsides and the Ausnet transmission line easement as low threat. The VPA assessment notes that Drainage reserves may be low threat or managed, depending on the level of management and vegetation that may be planted within them.

It is recognised that further growth around the precinct may occur in the long term, which will create additional areas of low threat land adjacent to the precinct.

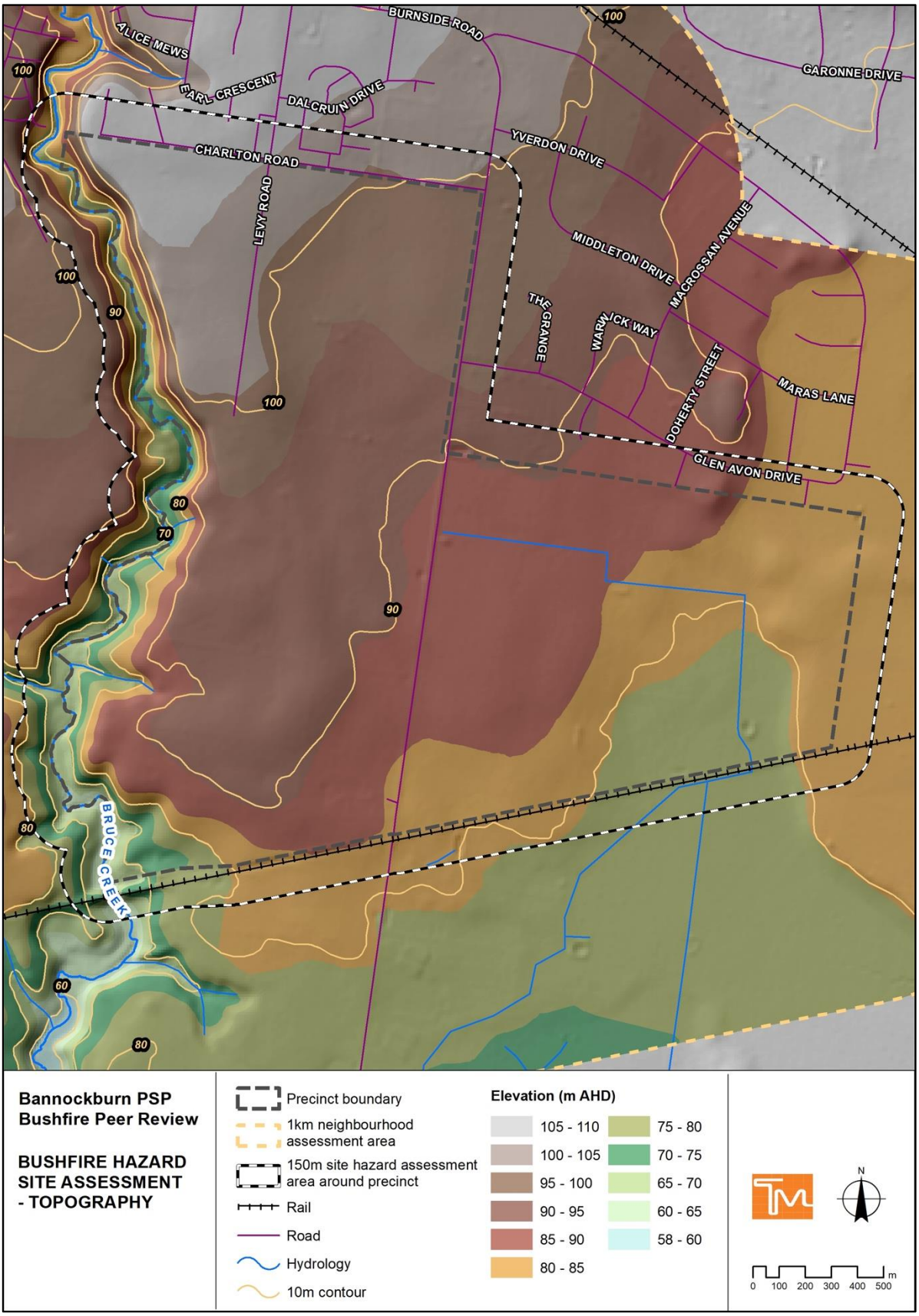
Photo 7 - Looking east along Charlton Road, showing low threat residential land in left of image and Grassland in the precinct in right of image.



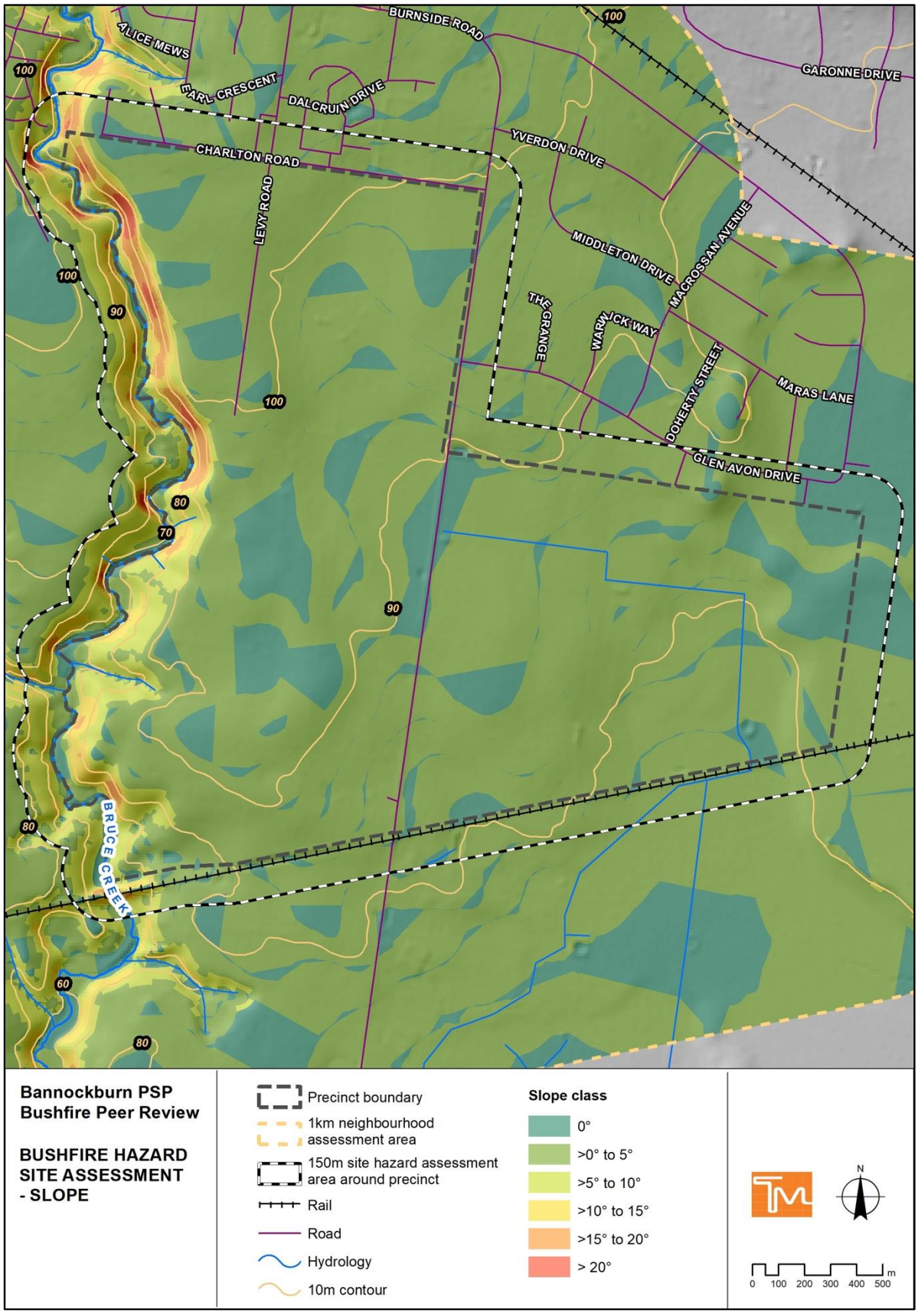
Map 1 – Bushfire hazard site assessment map of the precinct.



Map 2 - Bushfire hazard site assessment map of the Bruce Creek corridor.



Map 3 - Elevation map of the precinct and 1 km local assessment area.



Map 4 - Slope map of the precinct and 1 km local assessment area.

2.4 Topography

The site assessment methodology requires that the 'effective slope' be identified to determine BALs and vegetation-development setback distances (defendable space). The effective slope is the slope of land under the classified vegetation that will most significantly influence the bushfire attack. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5˚ increments from 0˚ up to 20˚[3].

A digital elevation model (DEM) of the precinct was prepared, which shows in Map 3 and Map 4 the elevation and slopes comprising the topography in and up to 1 km around the precinct.

Other than along the Bruce Creek corridor, the topography is relatively benign, with no significant changes in elevation that would significantly influence the rate of spread and exacerbate the bushfire attack. Therefore, under the Grassland to the south and east, where the land is essentially flat, the applicable slope class for BAL-12.5 setbacks is 'All upslopes and flat land' (see Map 1).

The DEM shows that in the Bruce Creek corridor the land rises steeply up from the creek channel, forming downslopes that are generally steeper in the northern part of the corridor, north of the proposed east-west connector boulevard, than in the south. Overall, however, the effective slopes over the approximately 100 m distance up from the creek up to the edge of the proposed 'uncredited open space' reserve, are consistently in the Downslope >10˚ - 15˚ slope class, as shown in Map 2. Whilst steeper sections occur on these creek slopes, based on their size, likely distance from future development and the potential fire behaviour, Terramatrix considers it reasonable that the 'averaged' 15˚ slope up from the creek to the open space reserve edge be applied as the effective slope for determining setbacks along the precinct's western development interface.

Once the preferred development scenario is finalised, and development setbacks along the creek interface are confirmed, it may be possible to reduce or vary the applicable effective slope classes through more detailed site-specific assessment, and hence reduce the BAL-12.5 building setback distances required, especially in the southern half of the corridor where the creek slopes are generally less steep.

[3] Where the effective slope exceeds 20˚, site-specific calculations using Method 2 of AS 3959 are required to determine tailored defendable space distances.

Currently, most of the Woodland patches occur lengthwise along the Creek, and generally extend only a short distance up the creek sides towards the precinct, resulting in relatively short lengths of downslope under Woodland. Accordingly, the 'All upslopes and flat land' slope class is potentially the effective slope for most Woodland areas along the waterway and is applicable for the two Woodland patches along the southern precinct boundary (see Map 1).

However, in a few areas Woodland extends farther uphill creating longer downslopes, such as in and adjacent to the Council Reserve at the western end of Charlton Road (see Photo 4) where the Woodland is on a downslope of at least 80 m with an effective slope of 14˚.

The steeper slopes in the corridor generally occur closer to the waterway, with the gradient decreasing significantly as the land flattens farther east, closer to future development. Therefore under 'Scenario 1' in the VPA assessment (where residential development would not occur in the 'Sensitive areas' shown in the draft Place Based Plan (see Maps 1, 2 and 5)) the effective slope would be the less steep land that is closer to future buildings.

At this stage, without a confirmed development (or vegetation management) scenario, it is considered appropriate to apply the 'Downslope >10 - 15˚' slope class (i.e. a value of 15˚ for the effective slope) for both the Woodland and Grassland hazard in the Bruce Creek corridor. This allows for both development scenarios and a future increase in the extent of Woodland up the slope towards development, as may occur through regeneration and/or revegetation (see Section 3).

3 Implications for future development and the Place Based Plan

This section identifies potentially applicable development setbacks based on the assumptions discussed and the hazard assessments in Section 2.

3.1 BAL 12.5 setbacks along the Bruce Creek corridor

Section 4.2.1 of the VPA assessment includes Figures 12-15 that show a range of setbacks for development from a proposed draft 'development line' representing the edge of hazardous vegetation (VPA, 2024 p41). The setbacks applied are '*…separation distances as per Clause 53.02-5 of the Golden Plains Shire Plains scheme…'* (VPA,2024, p41). They are shown for the two development scenarios under consideration (see Section 2.3 above), being no or limited development within 200 m of the creek, and development '*...closer to the Bruce Creek waterway where slope permits whilst avoiding sites of cultural and environmental significance...*' (VPA,2024, p41).

The setbacks shown include an unspecified '*custom setback (due to slope)*' and other distances that range from 19 m to 60 m in various locations. It is not made clear what combination of BAL, vegetation and slope the setbacks respond to. Table 2 below shows the proposed setbacks applied in Figures 12-15 of the VPA assessment, and the potentially corresponding vegetation group and slope classes inferred by Terramatrix from Tables 2 and 3 to Clause 53.02-5.

As no part of the precinct is in a BMO, Tables 2 and 3 to Clause 53.02-5 do not apply, and whilst the distances in Table 2 to Clause 53.02-5 are the same as those in Table 2.4 in AS 3959-2018, the use in the VPA assessment of Clause 53.02 may cause confusion about the controls being applied. Instead, it is recommended that based on the site hazard assessment the BAL-12.5 building setback distances from Table 2.4 in AS 3959-2018, and the commensurate slope classes and vegetation classifications being applied, be used.

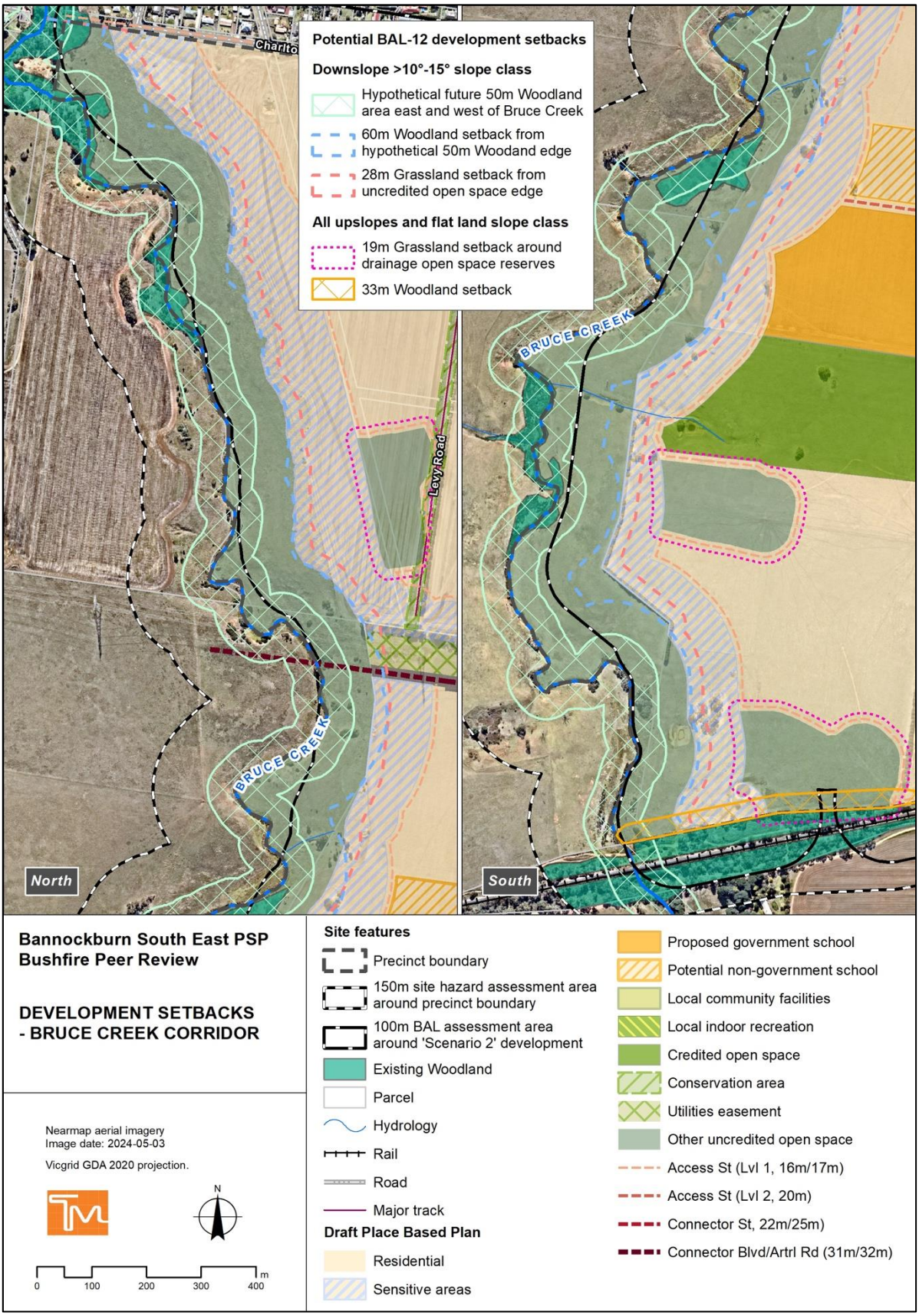
Similarly, for vulnerable uses such as schools, the setbacks from Table S43C2 in Specification 43 of the NCC 2022 are applicable (See Section 3.3), rather than the setbacks in Table 3 to Clause 53.02-5, which applies different setback distances.

Table 2 - Setbacks proposed in the VPA assessment and the basis for them inferred by Terramatrix.

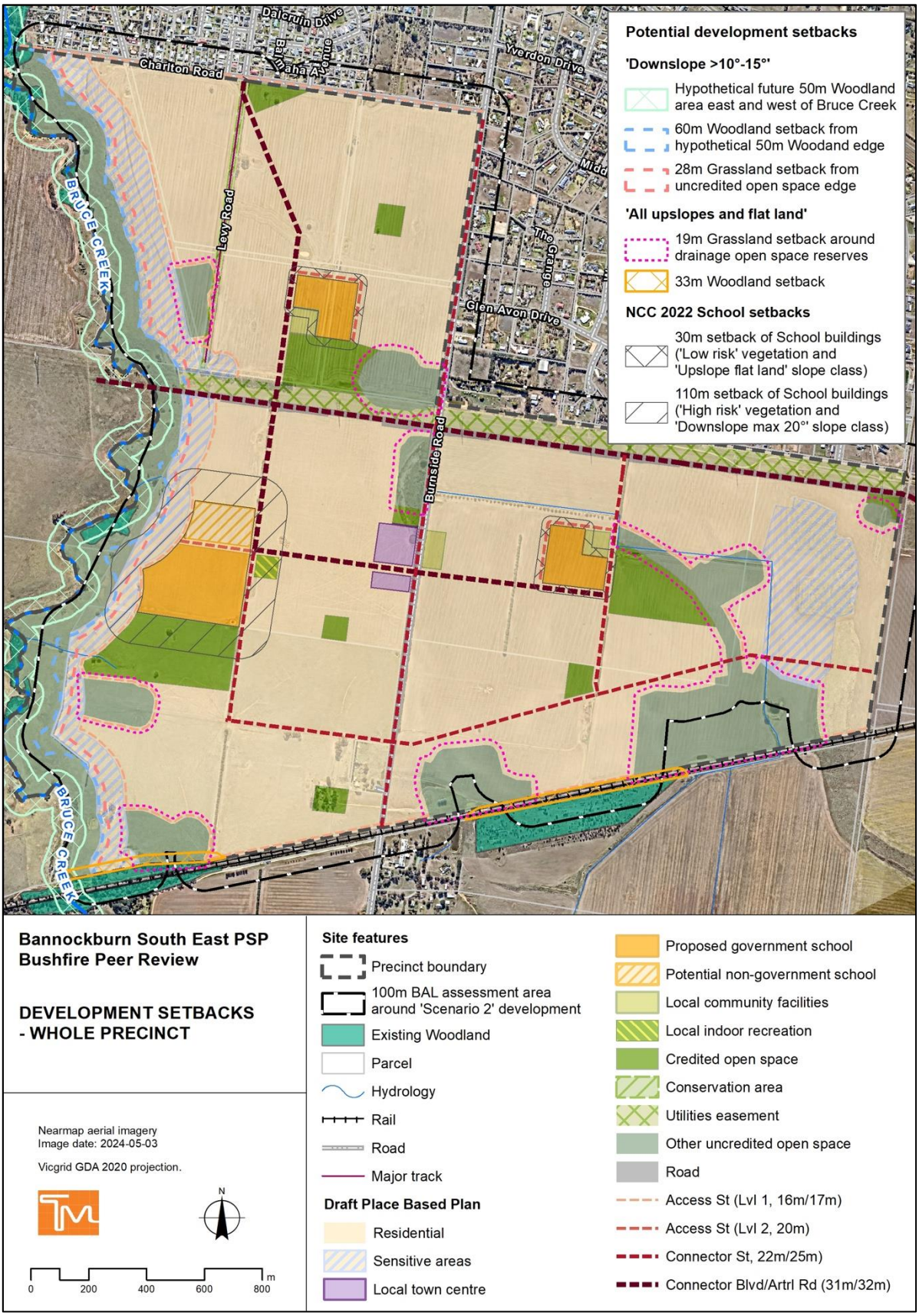
Development scenario	Slope class	Vegetation-building setback (m)	
		Grassland	Woodland
Scenario 1	All upslopes and flat land	19	-
	Downslope >0˚-5˚	22	-
	Downslope >5˚-10˚	25	-
	Downslope >10˚-15˚	-	*60?*
	40 m and 60 m setbacks also specified – possibly both for schools from Grassland in the 'Downslope >0˚-5˚' slope class and Woodland in the 'All upslopes and flat land' slope class respectively, from Table 3 to Clause 53.02? A 'custom setback due to slope' of unknown distance is also shown in Figures 12 and 13.		
Scenario 2	All upslopes and flat land	19	-
	Downslope >0˚-5˚	22	-
	Downslope >5˚-10˚	25	-
	Downslope >10˚-15˚	28	
	Downslope >15˚-20˚	32	-
	45 m and 50 m setbacks also specified – possibly both for schools from Grassland in the 'Downslope >5˚-10˚' and 'Downslope >10˚-15˚' slope classes respectively, from Table 3 to Clause 53.02? A 'custom setback due to slope' of unknown distance is also shown in Figures 14 and 15.		

As identified in Section 2.4 above, Terramatrix propose setbacks for development in the Bruce Creek corridor from Grassland and Woodland based on the 'Downslope >10˚-15˚' slope class. This can be confirmed once the preferred development scenario is finalised, as lesser setbacks could apply if development is setback further from the steeper slopes.

Setbacks could be varied in some parts of the corridor, although increased complexity in defining setbacks and locations may be problematic to understand for future development. The BSEPSP could consider specifying a 'break of slope' line with a minimum setback or range of setbacks from that line, and/or a table of potential setbacks that could be confirmed at the subdivision stage, this could be via a requirement for a Bushfire Management Plan to be submitted as a subdivision application requirement, showing future lots and development setbacks that comply. More simply, the BSEPSP could simply specify setbacks in accordance with BAL-12.5 in Table 2.4 of AS 3959.



Map 5 - Potentially appliable BAL-12.5 setbacks along the Bruce Creek corridor.



Map 6 - Potentially appliable development setbacks – whole precinct.

An edge for the unmanaged vegetation along the creek, from which to apply setbacks, should be agreed with stakeholders such as the VPA, CFA and Golden Plains Shire Council. By way of example, Map 5 shows potentially applicable BAL-12.5 setbacks from:

(1) The eastern edge of the 'Other uncredited open space' reserve adjacent to the creek in the draft Place Based Plan, based on this potentially being the edge of unmanaged Grassland closest to future development.
(2) The eastern edge of a 'hypothetical' 50 m wide strip of Woodland vegetation either side of the Bruce Creek waterway. This indicative 50 m wide buffer for Woodland has been applied, for considering the extent of existing and potential future Woodland areas, and hence, what and where setbacks from Woodland may be required.

As identified in Section 2.3.2, given the potential for regeneration and/or revegetation of tree and shrubs along the corridor, providing setbacks that anticipate some increase in the extent of Woodland would be prudent. This also acknowledges the Environmental Significance Overlay – Schedule 2 (ESO2) that applies along the Bruce Creek corridor and, as the VPA assessment identifies, has objectives that include:
'To protect and encourage the long term future of fauna and flora habitats along watercourses. To conserve existing wildlife habitats close to natural watercourses and, where appropriate, to allow for generation and regeneration of habitats.' (Golden Plains Planning Scheme, Schedule 2 to Clause 42.01).

Note that setbacks from Woodland and Grassland in combination will likely be required. Map 5 shows that in all but one small area, if Woodland occurred within 50 m of the waterway[4], the required 60 m Woodland setback would be within the 28 m setback required from Grassland, based on the Grassland edge matching the open space reserve edge shown in the draft Place Based Plan.

Some areas of Woodland currently extend further than 50 m from the waterway, but the 60 m setback from them is within the 28 m Grassland setback in all these instances, including from the Woodland in the Council Reserve to the northwest.

Note that the 28 m setback for BAL-12.5 development from unmanaged Grassland could be provided entirely, or partially, *within* the proposed open space reserve along the creek, rather than beyond it as shown in Maps 4 and 5. This could be for example, by proposing and ensuring low threat and managed parkland (e.g. a linear park with shared trail) along the eastern boundary of the reserve. A perimeter road and setbacks within lots could also contribute to the setback being achieved.

If development is limited to beyond the 'Sensitive areas' as envisaged under Scenario 1, then the current draft Place Based Plan achieves the required BAL-12.5 setbacks.

[4] It can be seen that Woodland could extend further east towards development in most locations and still be within the 28 m Grassland setback.

3.2 BAL-12.5 setbacks for other locations in the precinct

Map 6 shows the setbacks for BAL-12.5 development elsewhere across the precinct. It shows 33 m setbacks from Woodland in the rail reserve to the southwest, and from Woodland south of the railway in the southeastern part of the precinct.

In the southeast, the rail reserve provides the entirety of the 33 m low threat setback required for BAL-12.5 development though some parts of it may comprise hazardous Grassland during the fire danger period, and therefore, its management in a low threat state would need to be assured. The Woodland patch to the southwest, which extends north of the railway, requires the setback to be achieved within the precinct, which may necessitate an amendment to the draft Place Based Plan.

The other uncredited open space reserves, which are proposed to have a drainage function, may pose a Grassland or Shrubland hazard (or higher hazard), if not all vegetation within them is managed in a low threat state. This is recognised by the VPA assessment (VPA, 2024 p31) and the likely applicable 19 m BAL-12.5 setbacks associated with Grassland and Shrubland are shown in Map 6.

Whilst the easternmost drainage reserve is less than 1 ha in area, it is within 50 m of Grassland, and therefore cannot be excluded from classification and development will likely require a 19 m setback from it as shown in Map 6, if it is not assured to be low threat.

3.3 Setbacks for schools and child care centres

Buildings associated with vulnerable uses, including primary and secondary schools, kindergartens and other child care centres, and hospitals and aged care facilities, are required by the National Construction Code (NCC) 2022 to have minimum setbacks from hazardous vegetation[5], for deemed-to-satisfy (DTS) compliance with the NCC 2022 performance requirements that apply to these classes of buildings[6].

The DTS setback distances from classified vegetation that are applicable for these classes of buildings are specified in Table S43C2 in 'Specification 43' in the NCC 2022. The applicable setbacks from Table S43C2 for the Schools that are proposed to occur within the precinct, are shown in Map 6. Note that Grassland is defined in Table S43C2 as 'Low risk' vegetation and Woodland as 'High Risk' vegetation; also, Table S43C2 defines only two potentially applicable slope classes, 'Upslope and flat land' or 'Downslope max 20 degrees'.

[5] As defined by AS 3959-2018.

[6] 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, or Class 10a buildings, associated with these Class 9 buildings.

For the two western-most school locations, nearest the Creek corridor, shown in the draft Place Based Plan, the applicable setback is 110 m in response to High Risk vegetation (Woodland along the creek) in the 'Downslope max 20 degrees' slope class. A 30m setback is applicable to the two other school locations in response to Low Risk vegetation (Grassland in the drainage reserves) in the 'Upslope and flat land' slope class. It can be seen that all currently proposed school locations can achieve these NCC 2022 DTS setbacks that relate to siting of buildings.

Note that additional setbacks would be required for these schools to meet the DTS requirement for Radiant Heat Flux (RHF) to not exceed 1 kW/m^2. This RHF safety threshold (and greater setback distances) would only be applicable if an external area was proposed where students and staff were to shelter from bushfire in the open.

4 Conclusion

Terramatrix has undertaken a peer review of the draft *Bannockburn South East Precinct Structure Plan Bushfire Assessment* (VPA, 2024), which was prepared by the VPA to support the development and approval of the Bannockburn South East Precinct Structure Plan.

The entirety of the precinct is a declared BPA, but no part of the precinct or land within 1 km of it is affected by the BMO that denotes areas of highest bushfire risk within a BPA.

Overall, there are no substantive concerns with the landscape, local or neighbourhood hazard assessments in the VPA assessment. Terramatrix agrees that whilst reserves with larger areas of hazardous remnant vegetation occur in directions typically associated with the approach of severe bushfire, they are relatively distant from the precinct and, therefore, not a significant threat.

However, Terramatrix disagrees with the contention that there is limited potential for grassfires to spread. A large and fast moving grassfire could develop in the surrounding landscape and impact the precinct. Under elevated fire danger conditions such a fire is unlikely to be significantly moderated by the pattern of development and roads in the landscape.

Notwithstanding, other than in the Bruce Creek corridor, the hazard is largely confined to Grassland on generally flat, and, from a bushfire perspective benign, topography. Neighbourhood-scale destruction is unlikely as impacts would likely be limited to the first row of houses and, given the general lack of tree and shrub vegetation, a relatively low level of ember attack can be expected. Once development has substantially commenced, immediate access to places of relative safety will be available. Accordingly, the landscape risk for the precinct is considered low or relatively low, which concurs with the findings of the VPA assessment.

At the site scale, the VPA assessment correctly identifies the predominant hazard to the precinct as Grassland and that Grassland (and Woodland) in the Bruce Creek corridor is the main hazard to future development.

The VPA assessment identifies several relatively small patches of Woodland within the Bruce Creek corridor. The peer review considers some of the smallest patches comprise no more than a Grassland hazard, but in other areas are more extensive than shown in the VPA assessment. Two additional patches of Woodland are identified by the peer review to the south of the precinct.

The VPA assessment proposes a rather complex range of slope classes and development setbacks from Woodland and Grassland areas, which appear to be for BAL-12.5 development from Tables 2 and 3 to Clause 53.02-5 in the Golden Plains Planning Scheme that would be applicable for BMO applications. It is recommended instead, that BAL-12.5 building setback distances from Table 2.4 in AS 3959-2018 be applied and their commensurate slope classes and vegetation classifications be clearly stated.

For vulnerable uses and associated buildings, the setbacks from Table S43C2 in Specification 43 of the NCC 2022 are applicable, rather than the setbacks in Table 3 to Clause 53.02-5.

Terramatrix proposes setbacks for development in the Bruce Creek corridor from Grassland and Woodland based on the 'Downslope >10˚-15˚' slope class. This can be confirmed once the preferred development scenario is finalised, as lesser setbacks could apply if development is setback further from the steeper slopes.

A precautionary approach is recommended in defining boundaries for Woodland areas and future development setbacks from those boundaries. Accordingly an edge for the unmanaged Woodland and Grassland vegetation along the creek corridor, from which to apply setbacks, should be agreed with stakeholders such as the VPA, CFA and Golden Plains Shire Council. This should recognise the potential for regeneration and/or revegetation of tree and shrub vegetation, with setbacks that anticipate some increase in the extent of Woodland. The peer review mapping shows a 'hypothetical' 50 m buffer of the Bruce Creek waterway as a potential Woodland area, with commensurate development setbacks from the 50 m buffer to assist in this consideration.

Setbacks from both Woodland and Grassland in combination will likely be required. Based on a 15˚ effective slope, in all but one small area, if Woodland occurred within 50 m of the waterway the required 60 m Woodland setback would be within the 28 m setback required from Grassland, based on the Grassland edge matching the open space reserve edge shown in the draft Place Based Plan.

Setbacks for BAL-12.5 development from unmanaged Grassland could be provided entirely, or partially, within the proposed open space reserve along the creek, rather than beyond it. A perimeter road and setbacks within lots could also contribute to the setbacks being achieved.

If development is limited to beyond the 'Sensitive areas' as envisaged under Scenario 1 in the draft PSP, then the current draft Place Based Plan achieves the required BAL-12.5 setbacks. However under Scenario 2, amendments to the draft Place Based Plan would be required to provide sufficient setbacks.

Setbacks could be varied in some parts of the corridor, although increased complexity in defining setback locations may be problematic (i.e. difficult to interpret) for future development. The PSP could consider specifying a 'break of slope' line with a minimum setback or range of setbacks from that line, and/or provide a table of potential setbacks that could be confirmed at the subdivision stage. This could be via a requirement for a Bushfire Management Plan to be submitted as a subdivision application requirement, showing future lots and development setbacks that comply. More simply the BSEPSP could simply specify a requirement for setbacks that comply with BAL-12.5 in Table 2.4 of AS 3959.

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