



South Jerrabomberra Regional Job Precinct

Bushfire Assessment Report

26 May 2023

Project No.: 0621304

Document details	
Document title	South Jerrabomberra Regional Job Precinct
Document subtitle	Bushfire Assessment Report
Project No.	0621304
Date	26 May 2023
Version	Final
Author	Joanne Woodhouse
Client Name	Department of Regional NSW

Document history

Version	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Name	Date	
Draft	00	Joanne Woodhouse	Karie Bradfield	Karie Bradfield	14 April 2022	Draft for Agency Review
Final	01	Joanne Woodhouse	Karie Bradfield	Karie Bradfield	19 August 2022	Final based on agency comments
Final	02	Joanne Woodhouse	Karie Bradfield	Karie Bradfield	26 May 2023	Final based on web accessibility guidelines

Signature Page

26 May 2023

South Jerrabomberra Regional Job Precinct

Bushfire Assessment Report



Joanne Woodhouse
ERM Project Manager



Karie Bradfield
ERM Partner In Charge

Environmental Resources Management Australia Pty Ltd
Level 15 309 Kent Street
Sydney NSW 2000

© Copyright 2022 by ERM Worldwide Group Ltd and/or its affiliates ("ERM").
All rights reserved. No part of this work may be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM.

EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by the New South Wales (NSW) Government to prepare a Bushfire Assessment Report for the proposed South Jerrabomberra Regional Job Precinct (RJP). The report aims to establish the relevant specifications and requirements to assist in the development of the masterplan.

The South Jerrabomberra RJP comprises several parcels of land bordering the ACT. These parcels of land have the potential to be activated and possibly expanded to become sub-precincts that may include a technology park, industrial estate, business innovation hub, regional sports hub, new high school and a potential freight and logistic hub. The precinct will leverage opportunities associated with the Poplars Innovation Precinct to create a hub of defence, space, cyber-security, information technology and scientific research sectors.

Complying development will not be applicable to all land use types or where a referral to the NSW RFS is required. The remaining commercial and industrial type development can be addressed within the masterplan through the aims and objectives of Planning for Bush Fire Protection 2019. Specifically:

- Complying development is only permitted on lower risk bushfire prone land (BAL-29 or lower);
- Where hazardous industries are proposed, consultation with the NSW RFS and preparation of a performance based solution will be required. These development types will not be considered for complying development;
- Developments classified as special fire protection purpose (SFPP) would trigger referral to the NSW Rural Fire Service under s100b NSW *Rural Fires Act* 1997 and will not be considered complying development; and
- Other land uses such as places of public worship and other public assembly buildings (i.e., function centres) also require referral to the NSW RFS under s.4.14 of the NSW *Environmental Planning and Assessment Act* 1979. Any buildings used for public assembly with a floor space area of greater than 500m² will be treated as SFPP.

At a strategic level, the masterplan has taken into consideration the bushfire prone land mapping and new development within the precinct can be designed to meet the requirements of Planning for Bush Fire Protection 2019. This includes the provision of defendable space within the boundary of the South Jerrabomberra RJP. These areas of defendable space may include the perimeter road network, drainage channels and maintained public open space. All recreational space and landscaped areas should be designed and managed to meet the requirements of an Asset Protection Zone (APZ), and must be maintained in perpetuity to ensure ongoing protection from the impact of bushfires, particularly in advance of the bushfire season.

The development of the structure plan has also considered the application of suitable APZs across the precinct to result in a Bushfire Attack Level of:

- BAL 29 or lower to all the future building envelopes;
- BAL 12.5 or lower to all SFPP; and
- BAL 12.5 or lower to all potential hazardous industry.

The South Jerrabomberra RJP may also require the creation of APZs that need to be maintained sequentially until the final phase of development is completed to afford each stage of the development the appropriate level of bushfire protection.

Key specifications and requirements to assist in the development of the masterplan are provided in Table E-1.

Table E-1 Proposed Performance Criteria – Bushfire

Performance Criteria No.	Performance Criteria Description
1	Asset Protection Zones are managed and maintained to prevent the spread of a fire within the precinct in accordance with the requirements of Appendix 4 of Planning for Bush Fire Protection 2019 to result in a Bushfire Attack Level of BAL 29 or lower (not BAL 40 or BAL FZ) to all future building envelopes that are being assessed as complying development. This includes part of a staged or partial development of the South Jerrabomberra RJP.
2	Where referral to NSW RFS is required (SFPP, hazardous development and/or places of public worship), Asset Protection Zones should be managed and maintained to result in a Bushfire Attack Level of BAL 12.5 or lower (not BAL 29, BAL 40 or BAL FZ). These developments will not be assessed as complying development.
3	All landscaping is to comply with Appendix 4 of Planning for Bush Fire Protection 2019 and relevant environmental approvals required under the NSW <i>Biodiversity Conservation Act 2016</i> and/or Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Where environmentally sensitive vegetation such as endangered ecological communities or threatened species habitat are to be cleared, the proposals will need to be carefully considered and may no longer be consistent with complying development.
4	Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface. The requirements for access identified in Planning for Bush Fire Protection 2019 must be met for all stages of development within the South Jerrabomberra RJP.
5	Adequate water supplies are provided for firefighting purposes. Hydrants are to be installed to achieve compliance with AS 2419.1 – 2005 Fire Hydrant Installations - System Design, Installation and Commissioning (AS 2419) and must be located less than 70m from each building envelope.
6	The location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings. Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used.
7	The location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings and must comply with requirements of Planning for Bush Fire Protection 2019.

CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	1
1.1 Project Description	1
1.2 South Jerrabomberra Investigation Area.....	1
1.3 Strategic Bushfire Planning	3
2. LEGISLATIVE AND POLICY CONTEXT	4
3. THE BUSHFIRE ENVIRONMENT (LANDSCAPE ASSESSMENT).....	7
3.1 Bushfire Prone Land Mapping.....	7
3.2 Vegetation Hazard	7
3.3 Topography.....	8
3.4 Fire History within the Project Area	9
3.5 Climate and Fire Weather	14
3.6 Climate Change and Bushfires	15
3.7 Key Assets and Land Use within and Surrounding the Investigation Area	15
3.8 Suppression and Fire Response Difficulties.....	20
3.9 Summary.....	21
4. LAND USE ANALYSIS	23
4.1 Complying Development	23
4.2 Special Fire Protection Purpose (SFPP) Development	24
4.3 Hazardous Industry.....	25
4.4 Commercial / Industrial Development	26
5. OTHER CONSIDERATIONS.....	27
5.1 Firefighter and Public Safety	28
5.2 Asset Protection Zones and Defendable Space.....	28
5.3 APZs on Environmentally Protected Lands	29
5.4 Landscaped Areas and Recreational Spaces	31
5.5 Staged Development.....	31
5.6 Building Construction, Siting and Design	32
5.7 Access	32
5.8 Water Supply	34
5.9 Electricity and Gas	34
6. CONCLUSION.....	35
REFERENCES.....	37
APPENDIX A TABLES FOR DETERMINING MINIMUM DISTANCES FOR APZ, PLANNING FOR BUSH FIRE PROTECTION 2019	
APPENDIX B KEY ASSETS WITHIN THE INVESTIGATION AREA (LAKE GEORGE BFMC 2018)	
APPENDIX C DESIGN PRINCIPLES FOR EMERGENCY SERVICE VEHICLE ACCESS, PLANNING FOR BUSH FIRE PROTECTION 2019	

List of Tables

Table E-1	Proposed Performance Criteria – Bushfire	ii
Table 2-1	Key Legislation and Policies	4
Table 3-1	Broad Vegetation Groups	7
Table 3-2	Planning for Bush Fire Protection 2019_slope classes	9
Table 3-3	Identification of Assets within the South Jerrabomberra RJP	16
Table 5-1	Indicative separation distances	29
Table 5-2	Acceptable Solutions for Access Roads (General)	33
Table 6-1	Proposed Performance Criteria – Bushfire	36

List of Figures

Figure 1-1	Locality	2
Figure 3-1	Bushfire Prone Land Mapping	10
Figure 3-2	Vegetation Classification within the South Jerrabomberra RJP	11
Figure 3-3	Slope and Elevation within the South Jerrabomberra RJP	12
Figure 3-4	Bushfire History Map	13
Figure 3-5	Fire Danger Seasons	14
Figure 3-6	Key Assets and Land Use within the South Jerrabomberra RJP	19
Figure 3-7	Bushfire Hazard Class (Slope and Vegetation Overlay) within the South Jerrabomberra RJP	22
Figure 5-1	Overview of Bushfire Protection Measures	27
Figure 5-2	Indicative BAL for the Structure Plan	30

Acronyms and Abbreviations

Name	Description
APZ	Asset Protection Zones
Asset	anything valued by the community which includes houses, crops, heritage buildings and places, infrastructure, the environment, businesses, and national parks, that may be at risk from bushfire.
AS 3959-2018	<i>Australian Standard 3959 - 2018 Construction of Buildings in Bushfire-prone Areas</i>
BAL	Bushfire Attack Level
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BFMC	Bushfire Management Committee
BFRMP	Bushfire Risk Management Plan
Bushfire Hazard	the potential severity of a bushfire, which is determined by fuel load and topography under a given climatic condition
BOM	Bureau of Meteorology
Bushfire Hazard	the potential severity of a bushfire, which is determined by fuel load and topography under a given climatic condition
Bushfire Risk	the chance of a bushfire igniting, spreading and causing damage to the community or the assets they value
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERM	Environmental Resources Management Australia Pty Ltd
GIS	Geographic Information System
Ha	Hectare
IFEG	International Fire Engineering Guidelines
IPA	inner protection area
km/h	Kilometres per hour
kW/m ²	Kilowatts per metre squared
LGA	Local Government Area
Major Bushfire	A bushfire which requires the attendance of multiple brigades, or causes damage to property or injury to one or more persons
MNES	Matter of National Environmental Significance
NSW	New South Wales
NPWS	National Parks and Wildlife Service
NSW RFS	NSW Rural Fire Service
PBP	Planning for Bush Fire Protection 2019
RF Act	NSW <i>Rural Fires Act 1997</i>
RFS	Rural Fire Service
RJP	Regional Job Precinct
RJP Investigation Area	This is the focus of investigation for the South Jerrabomberra RJP and is approximately 950 hectares in size.
SFAZ	Strategic Fire Advantage Zone
SFP	Special Fire Protection
SFPP	"special fire protection purpose" means the purpose of the following:

Name	Description
	(a) a school, (b) a child care centre, (c) a hospital (including a hospital for the mentally ill or mentally disordered), (d) a hotel, motel or other tourist accommodation, (e) a building wholly or principally used as a home or other establishment for mentally incapacitated persons, (f) seniors housing within the meaning of State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004, (g) a group home within the meaning of State Environmental Planning Policy No 9--Group Homes, (h) a retirement village, (i) any other purpose prescribed by the regulations.
TOBAN	Total Fire Ban
VM	Verification Method

Note:

Despite the mitigation measures and treatments that are put in place, it is noted that some bushfire risk will always remain and that some of the infrastructure may be subject to direct flame contact. The absence of any identified hazard or asset within the RJP Investigation Area should not be interpreted as a guarantee that such hazards or impacts do not exist. The approval authority may require that a Bushfire and Emergency Management Policy is prepared based on the approved Master Plan design in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, and adjoining property owners and employees.

Disclaimer:

Any representation, statement of opinion, or advice expressed or implied in the bushfire assessment will be made in good faith on the basis that ERM employees and / or agents are not liable (whether by reason of negligence, lack of care or any other reason) to any person, company or their agents for any damage or loss whatsoever which has occurred or may occur in relation to that person taking (or not taking) action in respect of any representation, statement or advice provided within the bushfire assessment.

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by the New South Wales (NSW) Government to prepare a Bushfire Assessment Report for the proposed South Jerrabomberra Regional Job Precinct. The report aims to establish the relevant specifications and requirements to assist in the development of the masterplan.

1.1 Project Description

The NSW Government's Regional Job Precincts (RJP) will provide planning support to drive growth, investment and development opportunities within regional NSW. Four locations have been chosen for the first round of this initiative: Albury, Richmond Valley, South Jerrabomberra and Namoi.

The South Jerrabomberra Regional Job Precinct will leverage opportunities associated with the Poplars Innovation Precinct to create a hub of defence, space, cyber-security, information technology and scientific research sectors.

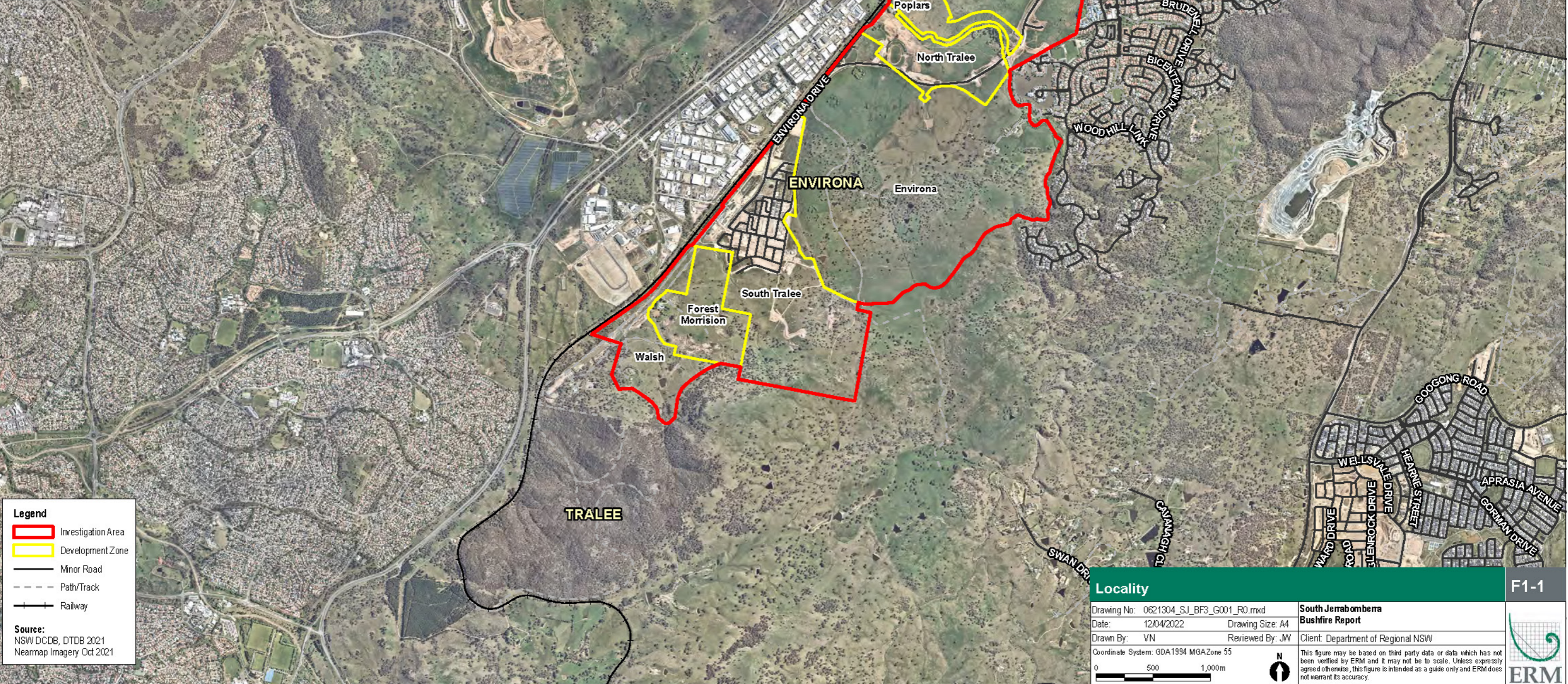
By reducing delays and simplifying the planning processes, the precinct will attract investment and diversify business opportunities, creating jobs for the young and a skilled and growing local workforce in South Jerrabomberra.

1.2 South Jerrabomberra Investigation Area

The South Jerrabomberra RJP comprises several parcels of land bordering the ACT. These parcels of land have the potential to be activated and possibly expanded to become sub-precincts that may include a technology park, industrial estate, business innovation hub, regional sports hub, new high school and a potential freight and logistic hub.

The initial boundary of the investigation area includes 950 hectares of land, located approximately 5.5km south of Queanbeyan, bordering the ACT and existing Hume Industrial Estate. Tomsitt Drive bisects the Investigation Area from East to West in the northern section of the development zone. The Investigation Area includes land that is already developed or approved for development so that infrastructure and environmental factors can be properly considered as part of a holistic planning process for the precinct. This includes the:

- existing Poplars Grassland Reserve;
- existing Poplars Retail Services Precinct with proposed expansion;
- proposed Poplars Innovation Precinct;
- planned new Jerrabomberra High School due to open in 2023;
- Regional Sports Complex currently under construction;
- proposed North Tralee Industrial Precinct;
- existing early 20th century subdivision Environa;
- South Tralee Residential Development (Stage 1) currently under construction; and
- proposed South Tralee Residential Development (Stage 2).



Legend

- Investigation Area
- Development Zone
- Minor Road
- Path/Track
- Railway

Source:
NSW DCDB, DTDB 2021
Nearmap Imagery Oct 2021

Locality		F1-1
Drawing No: 0621304_SJ_BF3_G001_R0.mxd		South Jemabomberra Bushfire Report
Date: 12/04/2022	Drawing Size: A4	
Drawn By: VN	Reviewed By: JW	Client: Department of Regional NSW
Coordinate System: GDA1994 MGAZone 55		<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>
0 500 1,000m <div style="display: flex; align-items: center;"> <div style="width: 100px; border-bottom: 1px solid black; margin-right: 5px;"></div> <div style="font-size: 10px;">N</div> <div style="margin-left: 5px;">↑</div> </div>		



1.3 Strategic Bushfire Planning

Bushfire presents a threat to human life and assets and can adversely impact ecological values. In planning for the use of land in the rural or urban context, it is important to consider the potential threat from bushfire. Bushfire risk is a major constraint to future development, and with the impacts of climate change already being observed, the need to address these issues as early as possible within the planning process is critical.

In accordance with the Section 4 of NSW RFS Planning for Bush Fire Protection 2019, in bushfire prone areas strategic planning should provide for the exclusion of inappropriate development. Development should be avoided as follows:

- where a development area is exposed to a high bushfire risk;
- where a development is likely to be difficult to evacuate during a bushfire due to its siting in the landscape, access limitations, fire history and/or size and scale;
- where the development will adversely affect other bushfire protection strategies or place existing development at increased risk;
- where density of existing development may cause evacuation issues for both existing and new occupants; and
- where the development has environmental constraints to the area which cannot be overcome.

This report provides an overview of the bushfire landscape, and also broadly identifies how the preferred scenario for the proposed masterplan can be designed to satisfy the aims and objectives of Planning for Bush Fire Protection 2019. It does not provide any advice or recommendations for alternative solutions and does not provide any site or industry specific advice in terms of bushfire hazard or risk mitigation. This will need to be addressed separately as part of any future development applications, including the preparation of a vegetation management plan which will include recommended hazard reduction and ecological fire regimes.

It is also important to note that despite the mitigation measures and treatments that are put in place, some bushfire risk will always remain and that some of the infrastructure may be subject to direct flame contact. The approval authority may require that a Bushfire and Emergency Management Policy is prepared based on the approved Master Plan design in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, and adjoining property owners and employees.

2. LEGISLATIVE AND POLICY CONTEXT

This baseline assessment has been undertaken with consideration of regulatory frameworks and associated legislation. Table 2-1 summarises the relevant legislation and policies applicable to this baseline assessment. In summary, the NSW land use planning framework provides two main phases: strategic planning and development assessment (future development within the precinct). Planning for Bush Fire Protection 2019 provides the foundation for bushfire protection during both of these phases of development.

Table 2-1 Key Legislation and Policies

Key Legislation/Guideline	Description
<i>NSW Rural Fires Act 1997</i>	<p>The main objectives of the <i>NSW Rural Fires Act 1997</i> (RF Act) are to:</p> <ul style="list-style-type: none"> ■ prevent, mitigate and suppress bush and other fires in NSW; ■ co-ordinate bushfire fighting and bushfire prevention throughout the State; ■ protect people from injury or death and property from damage as a result of bushfires; ■ protect infrastructure and assets from damage as a result of bushfires; and ■ protect the environment. <p>With specific reference to the South Jerrabomberra RJP, the subdivision of bushfire prone land that could lawfully be used for residential or rural residential purposes (already under construction within the precinct, additional subdivision of land for residential purposes is unlikely), or development of bushfire prone land for a Special Fire Protection Purpose (SFPP) would trigger referral to the NSW Rural Fire Service (NSW RFS) under s100b NSW RF Act. <u>These developments would not be considered under complying development.</u></p> <p>It is also noted that under Section 63 of the RF Act, owners and occupiers of land have a duty to take practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of bushfires on, or from, that land.</p>
<i>Planning for Bush Fire Protection 2019</i>	<p><i>Planning for Bush Fire Protection 2019</i> (NSW Rural Fire Service, 2019) is a planning document to link responsible planning and development control with the protection of life, property and the environment. Planning for Bush Fire Protection 2019 was legislatively adopted in the <i>Environmental Planning & Assessment Regulations 2000</i> on 1 March 2020. It is the culmination of significant investment in scientific research and policy development to provide appropriate bushfire protection whilst still having due consideration for development potential and economic sustainability.</p> <p>During precinct selection and development of the masterplan, consideration has been given to the overall aims and objectives of Planning for Bush Fire Protection 2019 and the expectation will be that the future development will be able to comply with Planning for Bush Fire Protection 2019 at the DA stage.</p>
<i>NSW Biodiversity Conservation Act 2016</i>	<p>Projects determined by a statutory authority of the NSW State Government are required to be assessed in accordance with the <i>NSW Environmental Planning and Assessment Act 1979</i> (EP&A Act) and the <i>Biodiversity Conservation Act 2016</i> (BC Act).</p> <p>The NSW BC Act requires the consideration of threatened species and their habitats in the developmental planning process and a responsibility of the proponent to determine potential impacts on listed species and Endangered Ecological Communities. Schedule 3 of the NSW BC Act lists Key Threatening Processes for species, populations and ecological communities within NSW. 'Clearing of native vegetation', 'high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition', and 'removal of dead wood and dead trees', are listed by the NSW BC Act as Key Threatening Processes and need to be carefully considered and managed when implementing fire management activities.</p>

Key Legislation/Guideline	Description
<p><i>Commonwealth Environment Protection and Biodiversity Act 1999</i></p>	<p>The Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) is the primary piece of Federal legislation relating to the environment.</p> <p>Under the Commonwealth EPBC Act any action that has, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES) requires approval from the Commonwealth Minister for the Environment. An action is defined as a project, development, undertaking, activity (or series of activities), or alteration to any of these.</p>
<p><i>Queanbeyan Local Environmental Plan (South Jerrabomberra) 2012</i></p>	<p>Queanbeyan Local Environmental Plan (South Jerrabomberra) 2012 aims to make local environmental planning provisions for land in Queanbeyan City known as South Jerrabomberra in accordance with the relevant standard environmental planning instrument under section 3.20 of the <i>Environmental Planning and Assessment Act 1979</i>.</p> <p>With specific reference to bushfire, Section 5.11 states that bushfire hazard reduction work authorised by the NSW RF Act may be carried out on any land without development consent. Bushfire hazard reduction work is defined as:</p> <ul style="list-style-type: none"> (a) the establishment or maintenance of fire breaks on land, and (b) the controlled application of appropriate fire regimes or other means for the reduction or modification of available fuels within a predetermined area to mitigate against the spread of a bush fire, but does not include construction of a track, trail or road.
<p><i>Queanbeyan Local Environmental Plan (West Jerrabomberra) 2013</i></p>	<p>Queanbeyan Local Environmental Plan (West Jerrabomberra) 2013 aims to make local environmental planning provisions for land in Queanbeyan City known as South Jerrabomberra (or Poplars) in accordance with the relevant standard environmental planning instrument under section 3.20 of the <i>Environmental Planning and Assessment Act 1979</i>.</p> <p>With specific reference to bushfire, Part 4 (4.1) states that minimum lot size must have areas and dimensions that enable the appropriate siting and construction of a building and associated works in order to minimise and avoid the threat of natural hazards (including bush fire).</p> <p>Section 5.11 states that bushfire hazard reduction work authorised by the NSW RF Act may be carried out on any land without development consent. Bushfire hazard reduction work is defined as:</p> <ul style="list-style-type: none"> (a) the establishment or maintenance of fire breaks on land, and (b) the controlled application of appropriate fire regimes or other means for the reduction or modification of available fuels within a predetermined area to mitigate against the spread of a bush fire, but does not include construction of a track, trail or road.
<p><i>Queanbeyan Local Environmental Plan 1998</i></p>	<p>Queanbeyan Local Environmental Plan 1998 aims to make local environmental planning provisions for land in Queanbeyan City (excluding South and West Jerrabomberra). With specific reference to bushfire, Section 46(2) states that bushfire hazard reduction work authorised by the NSW RF Act may be carried out on any land without development consent.</p> <p>As outlined within Section 72, the Council may grant development consent for the subdivision of land or to the erection of a building on land which, in the Council's opinion, is subject to bushfire hazard only if it is satisfied that—</p> <ul style="list-style-type: none"> (a) adequate provision is made for access for fire fighting vehicles, and (b) adequate safeguards will be adopted in the form of fire breaks, reserves and fire radiation zones, and (c) adequate water supplies will be available for fire fighting purposes, and (d) appropriate measures can be taken to reduce the hazard, after having regard to any guidelines, development control plan or the like adopted from time to time by the Council.

Key Legislation/Guideline	Description
<p><i>Australian Standard 3959 - 2018 Construction of Buildings in Bushfire-prone Areas (AS 3959-2018)</i></p>	<p>For the purposes of this assessment, the South Jerrabomberra RJP is considered 'other development' under AS 3959-2018, as it is unlikely to include additional residential subdivision, residential infill, or SFPP and the National Construction Code 2019 does not provide for any bushfire specific performance requirements. This may vary as the planning and detailed design process progresses. The existing bushfire management measures that apply to the approved developments within the precinct will be included within the masterplan to ensure no increased bushfire risk to that already approved.</p> <p>General fire safety provisions and the methodology for determining the bushfire attack level (refer to Section 2 of the AS 3959-2018) are taken as acceptable solutions. The aims and objectives of PBP 2019 apply in relation to other matters such as access, water and services, emergency planning and landscaping/vegetation management. The assessment considers the aims and objectives of Planning for Bush Fire Protection 2019.</p> <p>Future development may also need to consider application of the <i>Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021</i>.</p>

3. THE BUSHFIRE ENVIRONMENT (LANDSCAPE ASSESSMENT)

In accordance within Planning for Bush Fire Protection 2019, this landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape. It includes consideration of vegetation, topography, weather, history of bushfire in the area; and the difficulty in accessing and suppressing a fire.

3.1 Bushfire Prone Land Mapping

Bushfire prone land is land that has been identified by local council, which can support a bushfire or is subject to bushfire attack. Bushfire prone land maps are prepared by local council and certified by the Commissioner of the NSW RFS.

The Bushfire Prone Land mapping is shown in Figure 3-1. The mapping identifies areas of Category 1 vegetation within the southern corner of the Investigation Area and on the steep slopes west of Waterfall Drive. The remainder of the Investigation Area, excluding the existing portions of South Tralee Residential Development, are identified as Category 3 (grassland) vegetation and classified as bushfire prone land.

This map is the trigger for the consideration of bushfire protection measures for all development, including the South Jerrabomberra RJP.

3.2 Vegetation Hazard

Vegetation growth can be encouraged by periods of wet weather, increasing the amount of fuel available (grass, leaf litter, twigs, bark). When the weather is hot, the humidity is low, and there has been little recent rain, this vegetation dries out and becomes more flammable. A fire is more likely to start, and continue to burn, in hot, dry and windy weather.

Filkov *et al.* (2019) in their study on the frequency of dynamic fire behaviours in Australian forest environments collected data on all fires greater than 1000 ha in Australia that occurred between 2006 and 2016. The fires occurred primarily in the following vegetation formations: eucalypt open forests (48%); mallee woodlands and shrublands (16%); eucalypt woodlands (15%); eucalypt open woodlands (5%); heathlands (4%); other grasslands, herblands, sedgeland and rushlands (4%); eucalypt tall open forests (3%); other shrublands (1%).

For the purposes of this assessment, the vegetation mapping as reported in the biodiversity analysis report (ERM 2022) has been simplified in line with the vegetation formations as per Keith (2004) and Planning for Bush Fire Protection 2019. The fuel groups consist of the following:

Table 3-1 Broad Vegetation Groups

Broad Habitat Type (Keith 2004)	Vegetation Community
Grassy Woodland	1334 - Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion
	1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
Grasslands	320 - Kangaroo Grass - Redleg Grass forb-rich temperate tussock grassland of the northern Monaro, ACT and upper Lachlan River regions of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
	1202 - Speargrass grassland of the South Eastern Highlands Bioregion

Broad Habitat Type (Keith 2004)	Vegetation Community
	1289 - Wallaby Grass - Red-grass - Tall Speargrass - Kangaroo Grass dry tussock grassland of the North-western and Eastern Southern Tablelands in the South Eastern Highlands Bioregion
Non-Native	0 – Non-native grassland
	Exotic shrubland

The vegetation classifications are shown in Figure 3-2

Based on the layout of the masterplan plan as depicted in Figure 1-1 the vegetation that will have the greatest influence on bushfire behaviour within the precinct is the areas of Grassy Woodland to be retained within the conservation sub-precinct as well as the green infrastructure zones (open space and rural landscape sub-precincts). These areas tend to have continuous fuels that are available to burn during average seasons. They are highly combustible and the regional climatic conditions (see Section 3.5 - low rainfall, low humidity, high temperatures and high winds) may support crown fires. These areas will be subject to APZs.

Grassland includes pasture, crops, native tussock grasses as well as those areas of open space in and around the urban areas. Grassfires should not be underestimated and can start and spread quickly. They can travel up to 25 km per hour and pulse even faster over short distances. As described by Sullivan *et al.* (2012), grass is a fine, high surface area to volume ratio fuel with high thermal conductivity, low density and vertical orientation, which rapidly ignites (and rapidly burns out). Grassfires are also generally more open to wind than forest fuels (Cheney and Sullivan 2008) making them unpredictable. Grassfires tend to be less intense and produce fewer embers than bushfires, but still generate enormous amounts of radiant heat. Grassfires can also start earlier in the day than bushfires, because grass dries out more quickly when temperatures are high and humidity is low. It should be assumed that, under the most extreme weather, a fire would spread even in heavily grazed grass and embers may breach any APZ.

3.3 Topography

Steeper slopes significantly increase the rate of spread of fires, and the relationship of the steepness of slope, and whether a fire moves upslope or downslope, is vital to understanding bushfire behaviour potential. For every 10 degree slope, the fire will double its speed. Slope and wind are often the major factors determining the direction of fire spread.

As identified within Figure 3-3, the topography within the RJP investigation area is generally flat to undulating, with localised steeper slopes along Jerrabomberra Creek with one minor peak to the north of the creek (within the south west Poplars precinct) and east of Waterfall Drive. There are also a number of peaks and ridgelines within the C2 conservation lands to the south.

Research by Sharples (2011) has shown that dynamic fire behaviour can occur on steep slopes of over 24-26 degrees and areas downwind of these slopes can be exposed to a much greater risk of damage than normal. On lesser slopes, a fire's plume will rise into the air but, when slopes become sufficiently steep, there is greater preheating of fuels ahead of the fire, resulting in the fire spreading more rapidly.

In the case of eruptive fire behaviour, the spread will be dominated by convective heat transfer (by strong air movement) rather than radiant heat transfer alone. In addition, eruptive fires may produce a larger area of active flame than the standard fire front, which makes containment of a bushfire more difficult. This is not a key risk across the majority of the South Jerrabomberra RJP with only small localised steep slopes.

Table 3-2 Planning for Bush Fire Protection 2019_slope classes

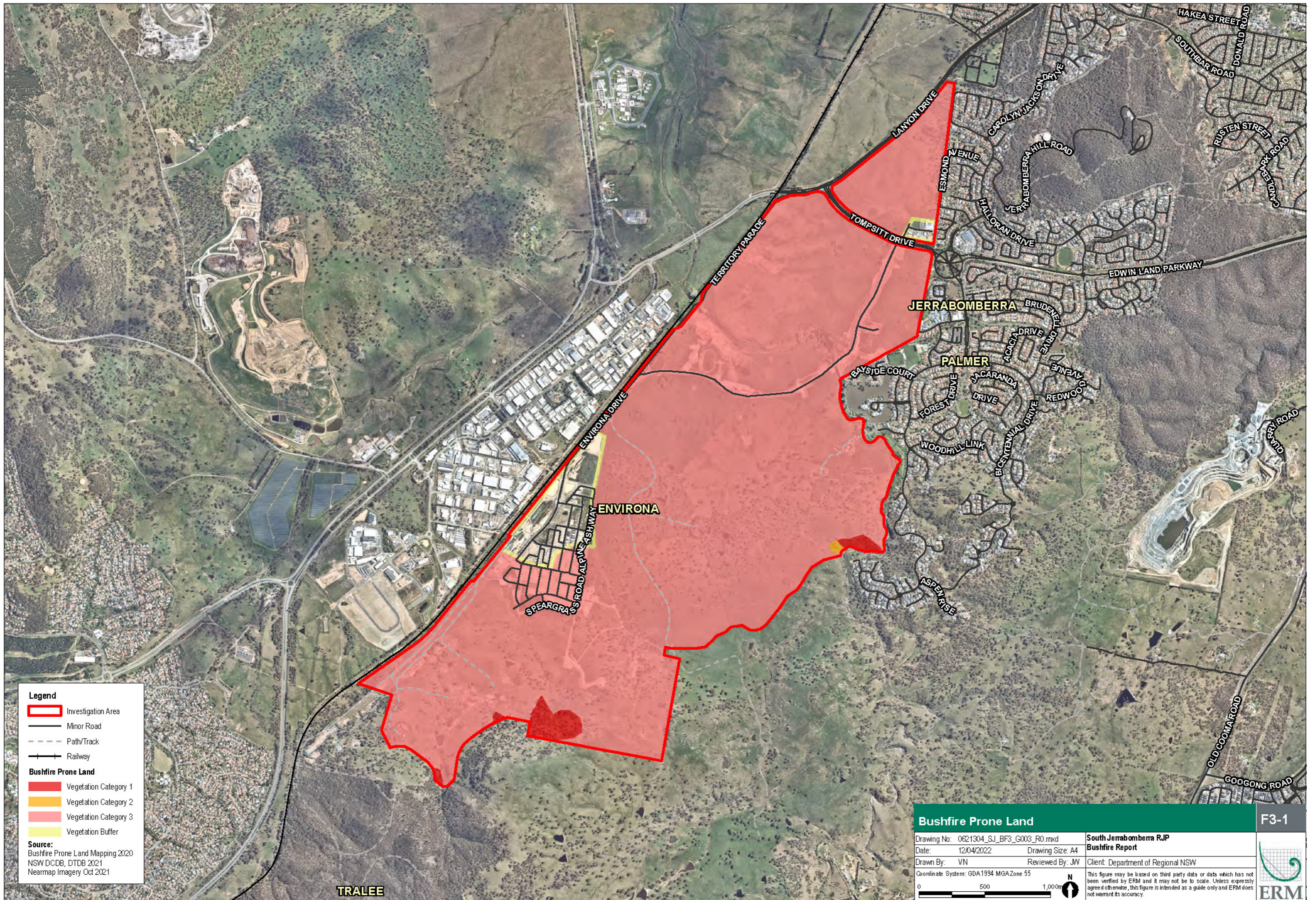
Upslope or Downslope	PBP Slope Class	Mapped within the South Jerrabomberra RJP
Upslope / Flat Land	Flat land and all upslope land leading away from the development	✓
Downslope	>0-5 degrees downslope leading away from the development	✓
	>5-10 degrees downslope leading away from the development	✓
	>10-15 degrees downslope leading away from the development	✓
	>15-18 degrees downslope leading away from the development	✓

3.4 Fire History within the Project Area

Bush Fire Management Committees (BFMC) are an integral part of the framework of coordinated bush fire risk assessment, mitigation and suppression in NSW. South Jerrabomberra RJP is located within the jurisdiction of the Lake George BFMC. As reported in the Lake George Bushfire Risk Management Plan (2018), the region has on average 30 bushfires per year (in excess of 10 hectares in size) and in the last 5 years (2013-2018) 3 were considered to be major fires.

Based on a review of the publically available information, no fires have been reported within the RJP investigation area in over 35 years, although bushfires occur in most years in this broader district. Escapes from legal burning off, lightning and human activity remain the top three causes of bushfire in the zone. As reported by Lake George Bushfire Management Committee (BFMC) (2018) the main sources of ignition in the Lake George BFMC area are:

- lightning;
- human activity (accidental or deliberate);
- illegal burning off – these ignitions are mainly concentrated in the rural areas, and largely occur during mid to late spring;
- legal burning off – these ignitions again are mainly concentrated in the rural areas, and occasionally fire escapes during these activities. This type of activity is generally concentrated in late August and September; and
- camp fires – ignitions have been experienced from fires lit by campers at the popular camping spots in the district.



Legend

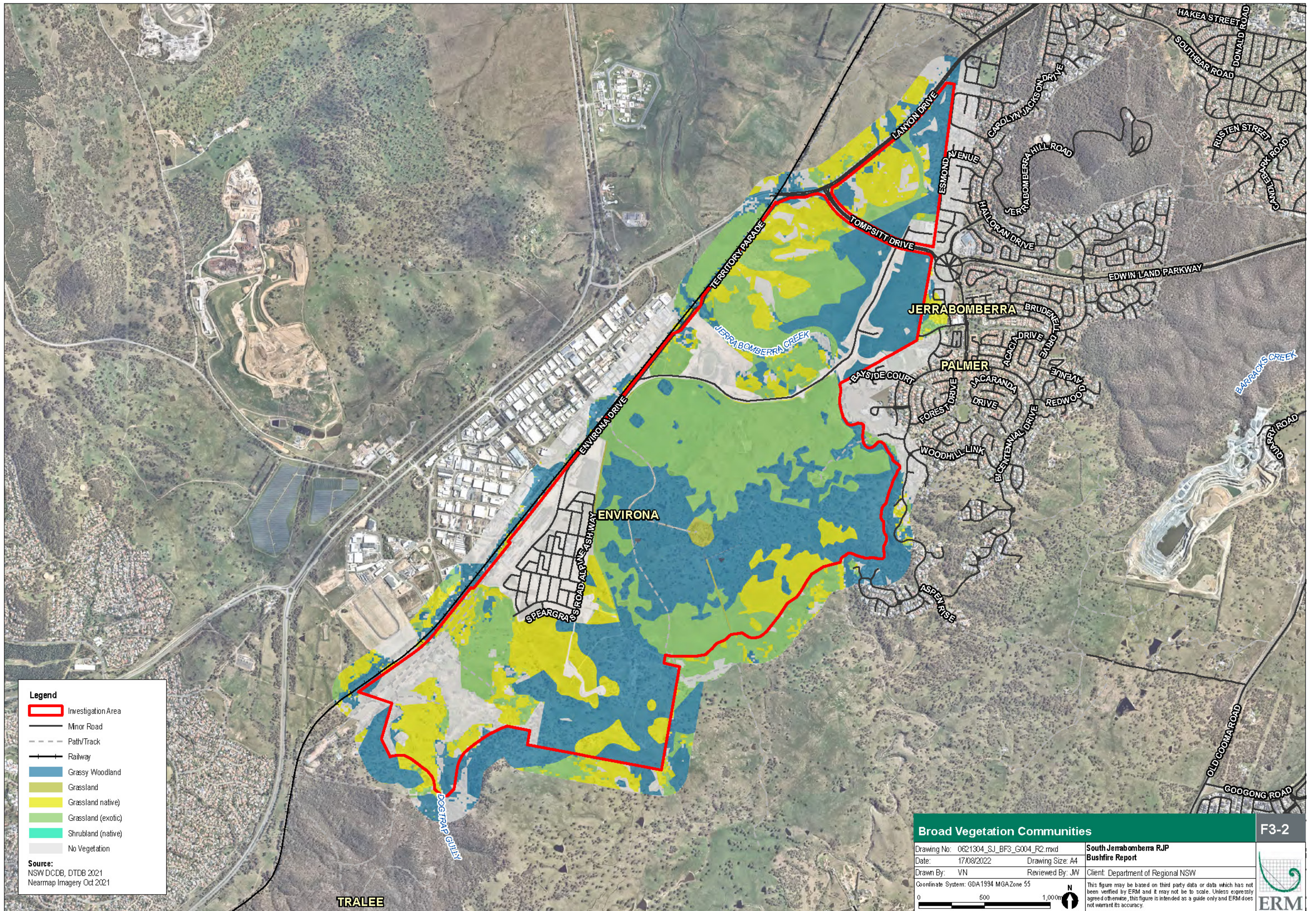
- Investigation Area
- Minor Road
- Path/Track
- Railway

Bushfire Prone Land

- Vegetation Category 1
- Vegetation Category 2
- Vegetation Category 3
- Vegetation Buffer

Source:
 Bushfire Prone Land Mapping 2020
 NSW DCDB, DTDB 2021
 Nearmap Imagery Oct 2021

Bushfire Prone Land		F3-1
Drawing No: 0621304_SJ_BF3_G003_R0.mxd	South Jenabomberra RJP	
Date: 12/04/2022	Bushfire Report	
Drawn By: VN	Reviewed By: JW	
Coordinate System: GDA1994 MGAZone 55		Client: Department of Regional NSW
0 500 1,000m		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



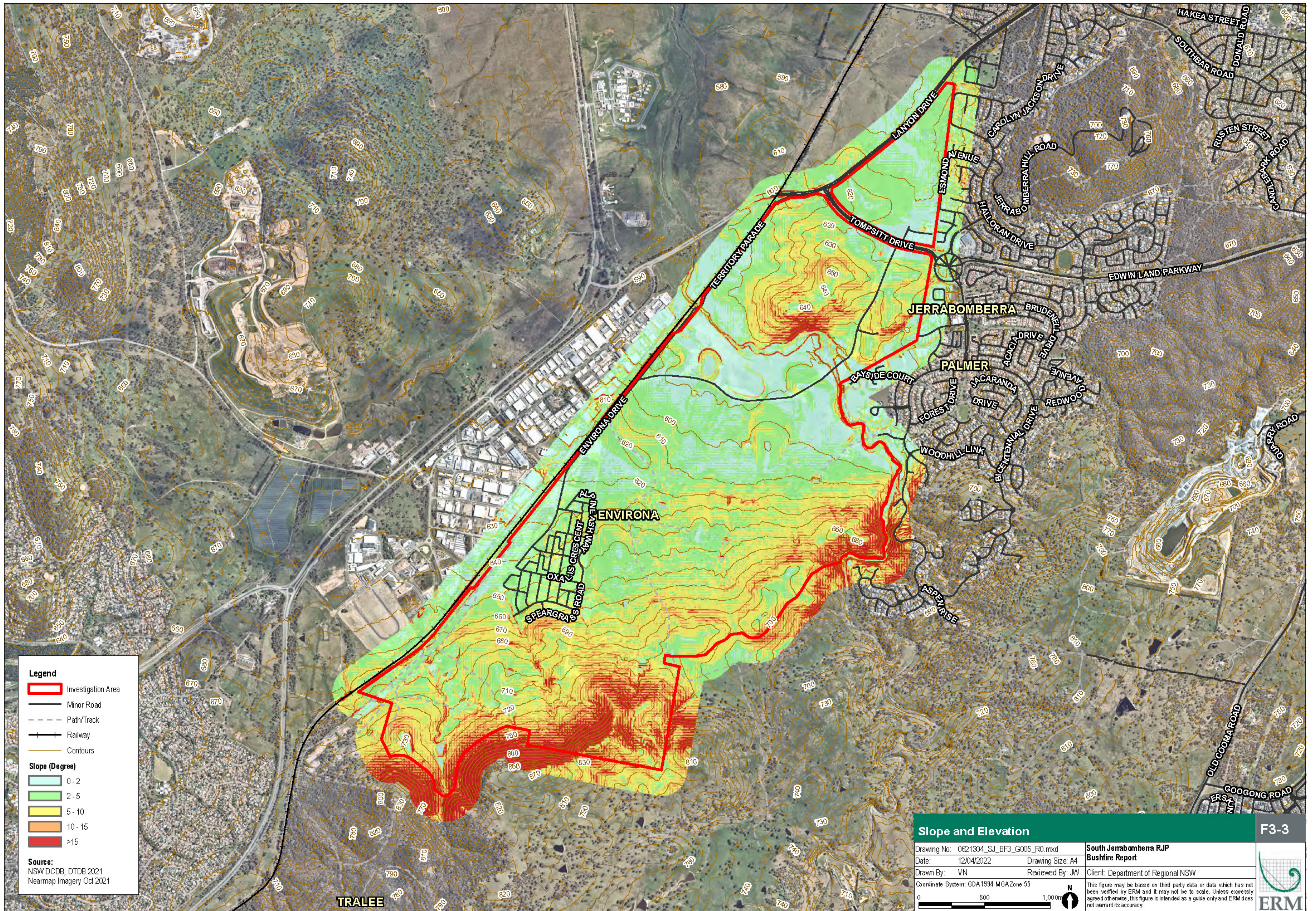
Legend

- Investigation Area
- Minor Road
- Path/Track
- Railway
- Grassy Woodland
- Grassland
- Grassland native
- Grassland (exotic)
- Shrubland (native)
- No Vegetation

Source:
NSW DCDB, DTDB 2021
Nearmap Imagery Oct 2021

Broad Vegetation Communities		F3-2
Drawing No: 0621304_SJ_BF3_G004_R2.mxd	South Jerrabomberra RJP	
Date: 17/08/2022	Drawing Size: A4	Bushfire Report
Drawn By: VN	Reviewed By: JW	Client: Department of Regional NSW
Coordinate System: GDA1994 MGA Zone 55		
		<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>

TRALEE



Legend

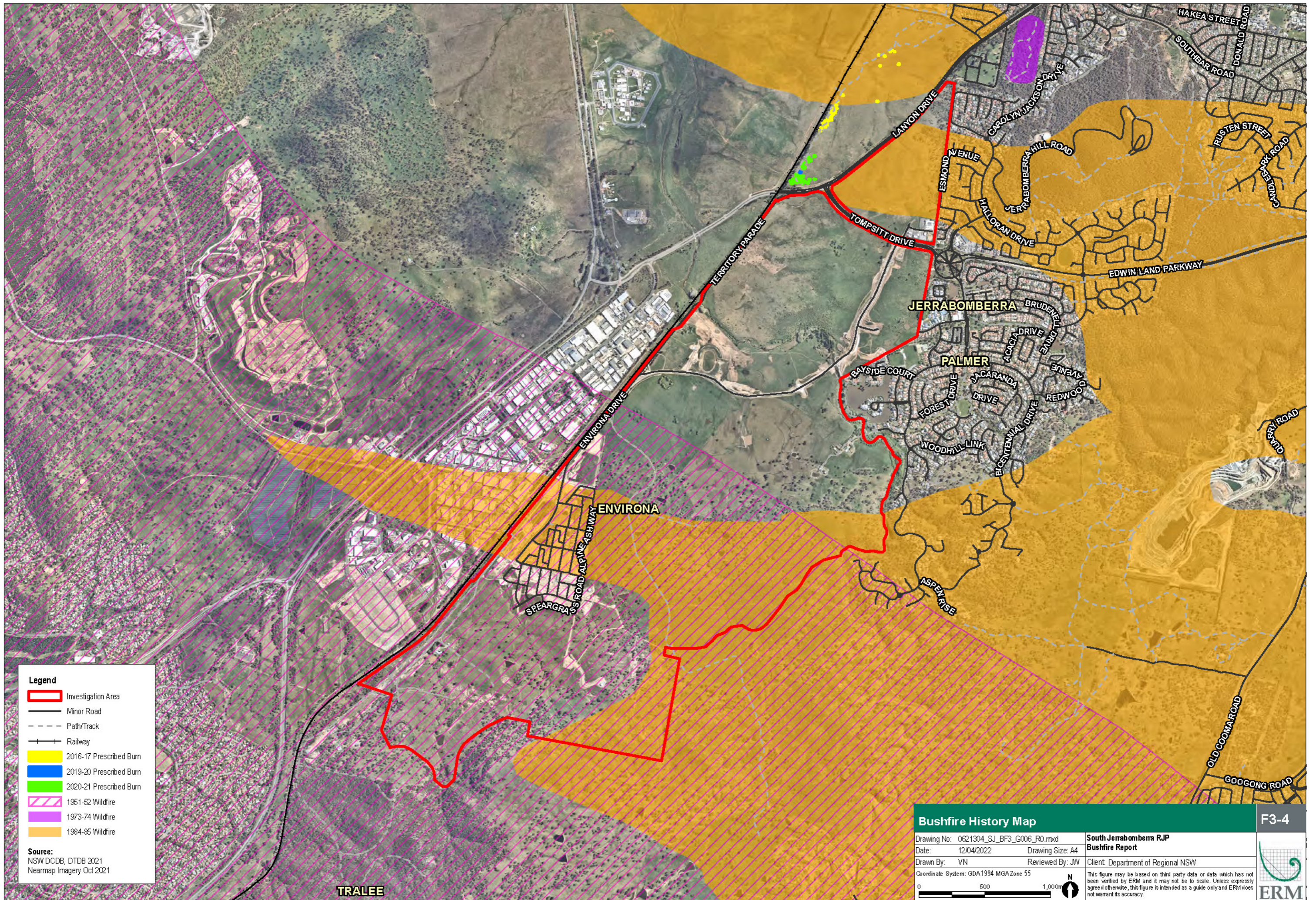
- Investigation Area
- Minor Road
- Path/Track
- + Railway
- Contours

Slope (Degree)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 15
- >15

Source:
NSW DCDB, DTDB 2021
Nearmap Imagery Oct 2021

Slope and Elevation		F3-3
Drawing No: 0621304_SJ_BF3_G005_R0.mxd	South Jerrabomberra RJP	
Date: 12/04/2022	Bushfire Report	
Drawn By: VN	Client: Department of Regional NSW	
Reviewed By: JW		
Coordinate System: GDA1994 MGA Zone 55		
<div style="display: flex; align-items: center; justify-content: center;"> <div style="width: 100px; border-bottom: 1px solid black; margin-right: 5px;"></div> <div style="margin-right: 5px;">0</div> <div style="margin-right: 5px;">500</div> <div style="margin-right: 5px;">1,000m</div> <div style="text-align: center; margin-left: 10px;"> <div style="border: 1px solid black; width: 8px; height: 8px; display: inline-block; margin-bottom: 2px;"></div> <div style="font-size: 8px; margin-bottom: 2px;">N</div> </div> </div>	<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>	



Legend

- Investigation Area
- Minor Road
- Path/Track
- + Railway
- 2016-17 Prescribed Burn
- 2019-20 Prescribed Burn
- 2020-21 Prescribed Burn
- 1961-62 Wildfire
- 1973-74 Wildfire
- 1984-85 Wildfire

Source:
NSW DCDB, DTDB 2021
Nearmap Imagery Oct 2021

Bushfire History Map		F3-4
Drawing No: 0621304_SJ_BF3_G006_R0.mxd		South Jerrabomberra RJP
Date: 12/04/2022		Bushfire Report
Drawn By: VN	Reviewed By: JW	Client: Department of Regional NSW
Coordinate System: GDA1994 MGAZone 55		
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.		

TRALEE

3.5 Climate and Fire Weather

Weather conditions influence the size, intensity, speed, and predictability of bushfires and how dangerous they can be to the community. While bushfires can happen at any time of the year in Australia, the time of peak bushfire activity varies across the country with the changes in the seasonal weather patterns. In NSW and southern Queensland this generally occurs in spring to mid-summer.



Source: Bureau of Meteorology – Bushfire Weather (2021)

<http://www.bom.gov.au/weather-services/fire-weather-centre/bushfire-weather/index.shtml>

Figure 3-5 Fire Danger Seasons

As described by the Bureau of Meteorology (BOM) (2021), the greatest danger occurs following a dry winter and spring (as seen during the bushfires in 2019). The worst conditions occur when deep low-pressure systems near Tasmania bring strong, hot and dry, westerly winds to the coastal districts. The end of the fire season is determined by the onset of moister conditions, sometimes the result of a tropical cyclone developing near the Queensland coast.

As reported by the Lake George BFMC (2018), the typical / average climate in the Lake George BFMC is warm to dry. The southern ranges within the BFMC area experience significant thunderstorm activity during summer, causing many lightning strikes. Access to these lightning strikes can cause problems due to inaccessibility created by rough terrain. The bushfire season generally runs from October to March with September and/or April included some years.

Prevailing weather conditions associated with the bushfire season in the Lake George BFMC area consist of strong north-westerly fronts generated from the interior, which may be extremely dry and hot. Most of the major fires in recent times have occurred when strong north-westerly winds precede a southerly change. Dry thunderstorms can occur at any time during summer, but are a significant problem between December-February where fires started by lightning strikes in remote areas can reach a large size quickly (Lake George BFMC 2018).

Strong gusty winds help fan the flames and cause a fire to spread faster across the landscape. Strong winds can carry hot embers long distances - these can start spot fires many kilometres ahead of the main fire front. Smoke attributed to bushfire can also have a major impact on various assets and the environment. Wind direction, fuel moisture content, and ignition source should be considered and managed to reduce the likelihood of smoke issues.

3.6 Climate Change and Bushfires

Eastern Australia is documented to be one of the most bushfire-prone areas in the world. As reported by the Bureau of Meteorology (BOM 2020), human induced climate change is influencing the frequency and severity of dangerous bushfire conditions in Australia and other regions of the world, influencing temperature, environmental moisture, weather patterns, and fuel conditions. Observed changes in southern and eastern Australia include more extreme conditions during summer, as well as an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring than they used to.

While climate change might not ignite the fire, it is giving fires the chance to turn into catastrophic fires by creating warmer temperatures, increasing the amount of fuel (dried vegetation) available, and reducing water availability due to higher evaporation. In relation to fire ignition, there is some indication that human induced climate change could also influence the risk of ignitions from dry-lightning (i.e., lightning that occurs without significant rainfall).


Bushfire weather conditions in future years are projected to increase in severity for many regions, including South Jerrabomberra. This will result in:



- an earlier start to the bushfire season;
- reduced opportunities for fuel reduction burning;
- management of fire risk to property, people and biodiversity will become increasingly challenging; and
- an increase in the number of extreme fire danger days.



3.7 Key Assets and Land Use within and Surrounding the Investigation Area

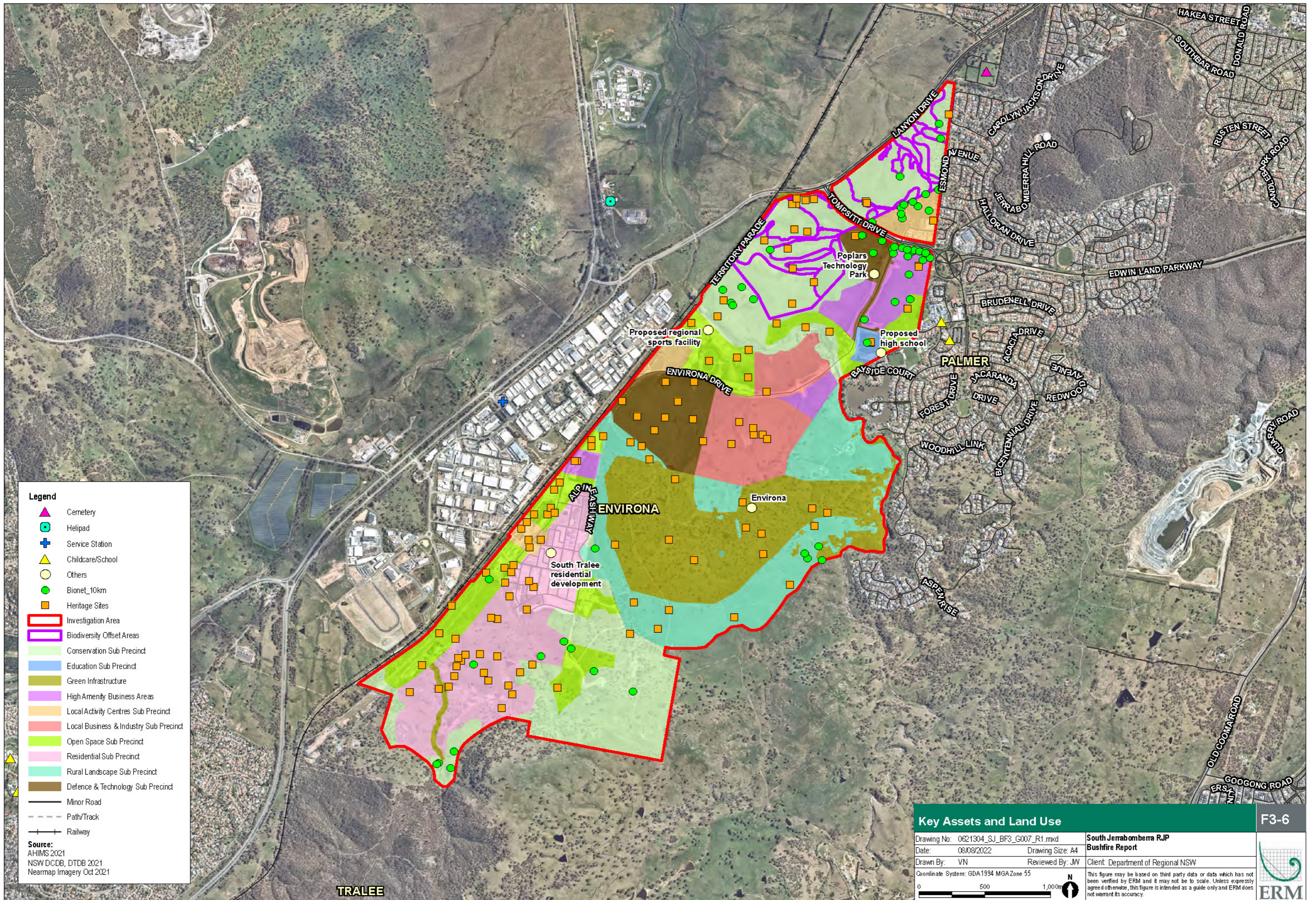
Key assets and land use within and surrounding the South Jerrabomberra RJP have been very broadly classified in Table 3-3. A separate asset register has also be included in Appendix B, based on the Lake George Bushfire Management Committee Bushfire Risk Management Plan (2018).

Table 3-3 Identification of Assets within the South Jerrabomberra RJP

Asset		Description of asset	Vulnerable to bushfire impacts?
Residential areas and Special Fire Protection (SFP) assets.	 	<p>The precinct includes existing and planned residential development and associated infrastructure including the:</p> <ul style="list-style-type: none"> ■ existing early 20th century subdivision Environa; ■ South Jerrabomberra Residential Development (Stage 1) currently under construction; and ■ proposed South Jerrabomberra Residential Development (Stage 2). <p>Special Fire Protection (SFP) assets within the precinct also include the planned new Jerrabomberra High School due to open in 2023. Being a Special Fire Protection Purpose (SFPP) development, the development proposal is currently being assessed in accordance with Section 100B of the NSW RF Act and Planning for Bushfire Protection (NSW RFS 2019).</p> <p>It is also noted that existing residential development in the Environa area only refers to existing homesteads. No future residential development would be planned here due to the constraints of the ANEF 20 contour.</p>	✓

Asset		Description of asset	Vulnerable to bushfire impacts?
Commercial and Industrial Infrastructure		<p>A wide variety of commercial and industrial development have been identified within the precinct. This includes a number of assets that are vulnerable to bushfire, including (but not limited to) the:</p> <ul style="list-style-type: none"> ■ existing Poplars Retail Services Precinct with proposed expansion. This first phase of Poplars Development includes Aldi Australia, food outlets; KFC, McDonald's and 7-Eleven service station; ■ proposed Poplars Innovation Precinct; ■ Regional Sports Complex currently under construction; and ■ proposed North Tralee Industrial Precinct. 	✓
Threatened ecological communities		<p>Searches of relevant databases and a literature review have confirmed that one Critically Endangered community listed under the NSW BC Act 2016 may be present in the Investigation Area:</p> <ul style="list-style-type: none"> ■ White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland <p>Three EPBC listed Endangered Ecological Communities may also be present in the Investigation Area:</p> <ul style="list-style-type: none"> ■ White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ■ Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia; and ■ Weeping Myall Woodlands. 	✓

Asset		Description of asset	Vulnerable to bushfire impacts?
Threatened species		<p>A total of six threatened flora species have been recorded in the database searches within the Investigation Area, with two endangered and one protected species or species habitat known to occur in the Investigation Area:</p> <ul style="list-style-type: none"> ■ Button Wrinklewort ■ Hoary Sunray ■ Silky Swainson-pea <p>A total of nine threatened fauna species have been recorded within the Investigation Area:</p> <ul style="list-style-type: none"> ■ Diamond Firetail; ■ Dusky Woodswallow; ■ Gang-gang Cockatoo; ■ Scarlet Robin; ■ Flame Robin; ■ Golden Sun Moth; ■ Striped Legless Lizard; ■ Grassland Earless Dragon; and ■ Pink-tailed Worm Lizard. 	✓
Cultural heritage		<p>The RJP investigation area and the local region contains a number of Aboriginal and historic heritage sites that will need to be considered during the masterplan process. Indigenous land use and burning practices were recognised in the recent 2020 National Bushfire and Climate Summit and are being addressed within the Royal Commission into National Natural Disaster Arrangements. The masterplan may also present an opportunity to explore additional options and integrate Indigenous land use and fire management practices.</p>	✓



Legend

- Cemetery
- Helipad
- Service Station
- Childcare/School
- Others
- Bionet_10km
- Heritage Sites
- Investigation Area
- Biodiversity Offset Areas
- Conservation Sub Precinct
- Education Sub Precinct
- Green Infrastructure
- High Amenity Business Areas
- Local Activity Centres Sub Precinct
- Local Business & Industry Sub Precinct
- Open Space Sub Precinct
- Residential Sub Precinct
- Rural Landscape Sub Precinct
- Defence & Technology Sub Precinct
- Minor Road
- Path/Track
- Railway

Source:
 AHIMS 2021
 NSW DCDB, DTDB 2021
 Nearmap Imagery Oct 2021

Key Assets and Land Use		F3-6
Drawing No:	0621304_SJ_BF3_G007_R1.mxd	South Jenabomberra RJP Bushfire Report
Date:	08/08/2022	
Drawn By:	VN	Client: Department of Regional NSW
Reviewed By:	JW	
Coordinate System: GDA1994 MGAZone 55		<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>

3.8 Suppression and Fire Response Difficulties

The firefighters likely to respond to a bushfire in this area would be volunteers from the NSW RFS and/or individual property owners. Based on the locality of the site, NSW RFS may also work closely with the ACT Fire and Rescue (subject to consultation to ensure access arrangements facilitate acceptable response times) in the event of any major fires in this area.

This assessment has identified that some areas of the precinct are located within bushfire prone land. It is also important to note that much of the broader area and existing development within the precinct (existing Poplars Retail Services Precinct, new Jerrabomberra High School, Regional Sports Complex and South Tralee Residential Development) is already managed to reduce the risk of bushfires impacting existing life and property. These existing bushfire management measures and strategic advantage zones will need to be included within the masterplan to ensure no increased bushfire risk to life and property. With specific reference to the South Tralee Residential Development (Eco Logical 2014), this includes:

- Asset Projection Zones (APZ) up to 20m wide (for residential development);
- all bushfire prone areas should have an alternate access or egress option. This is usually achieved by providing more than one public road into and out of areas of development within 100m of the bushland interface;
- more than one access point should be provided between the study area and adjacent (future) residential lands to the north and northeast (within the current RJP); and
- all bushland interface areas containing an APZ for a significant bushfire hazard should feature a perimeter public road within the APZ.

Although main roads are often treated as fire advantages, firefighting access and evacuation potential must be considered across the RJP and an assessment of traffic volumes and evacuation routes will be required as many of these roads have been reported as being at capacity. The potential for these evacuation routes to be non-trafficable during a bushfire event will be factored into the Traffic and Transport Assessment (separate package) and alternate routes identified. It will also be important to consider any increase in traffic volume on the main evacuation pathways and the various local roads. Improved public transport networks proposed as part of the masterplan will also assist in removing some of this pressure from the local road network and these main evacuation pathways. The masterplan will need to consider appropriate site access points and design of access roads to enable safe access and egress for residents/site users attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. For example, the masterplan should avoid single lane roads and dead ends and is further assessed in Section 5.7.

3.9 Summary

Bushfire hazard classes were identified across the landscape by applying relative weightings to the varying fuel groups and combining them with available slope classes (i.e., <2°, 2-5°, 5-10°, 10-15° and >15°) within a Geographic Information System (GIS) model. The vegetation fuel load and slope data sets were loaded into a Weighted Overlay Model, to combine the data and highlight areas of overall higher hazard considering both fuel load and slope. Slope was calculated in degrees and bushfire hazard rating was based on steepness and movement speeds of potential bushfire up or down these slopes. The model assumed in this case that both slope and fuel load were equally important or weighted the same in the analysis process.

The result is an overlay that identifies broad bushfire hazard classes for the South Jerrabomberra RJP (refer to Figure 3-7). This analysis does not indicate how often an area will receive potentially damaging fires or the actual intensity of a fire, it does however, provide a useful comparative ranking, identifying sites of higher and lower potential fire behaviour compared to others in an area.

Based on the information provided in the fire weather and fire hazard analysis above, likely fire behaviour can be predicted. The evaluation of existing bushfire behaviour shows that the greatest hazard is a combination of undesirable fire weather (i.e., strong north-westerly fronts) and the potential for a fire to spread towards key infrastructure and assets in the surrounding area. A fire under the influence of wind may travel fast, reaching assets before fire fighters can attend the scene as was observed across Australia during the recent 2019/2020 fire season.

4. LAND USE ANALYSIS

As outlined within Planning for Bush Fire Protection 2019, land use planning can be an effective tool in minimising or avoiding the impact of natural hazards such as bushfire. From a risk management perspective, the safest approach is always to avoid high risk areas. In a bushfire context, strategic planning must ensure that future land uses are in appropriate locations to minimise the risk to life and property from bushfire attack. Services and infrastructure that facilitate effective suppression of bushfires also need to be provided for at the earliest stages of planning.

The design of the precinct includes the retention of large areas of high value biodiversity conservation lands which presents a clear, well defined interface between the hazard and planned development within the RJP. This interface will be the focus of the bushfire mitigation measures and required setbacks (APZs) as outlined within Section 5 of this Bushfire Assessment Report. These areas may act as fire runs from surrounding landscape scale fires into the site. These fire runs may need to be broken up/managed before they reach the development precincts such that they do not provide direct fire runs. Some bushfire risk will always remain, and the approval authority may require Bushfire Emergency Management Plan to be prepared in conjunction with relevant stakeholders. It is also noted that this assessment does not provide any recommendations or mapping of the required asset protections for the existing and approved South Tralee Residential Development as this already forms part of the Stage 1 and Stage 2 development design and approval.

It is also noted that at the strategic land use planning stage, the range of possible tenants, activities and associated hazards are unknown. Hence, it is not possible to undertake a detailed land use assessment and the following information provided is general in nature.

4.1 Complying Development

It is understood that to streamline future building construction works the Precinct is intended to maximise the type and number of developments which can occur through complying development pathways. Considerations for assessing applications located on bushfire prone land are outlined in Part 5A, Division 4, Clause 5A.29 of State Environmental Planning Policy (Exempt and Complying Development Codes) 2008, as follows:

5A.29 Development standards for bushfire prone land

(1) This clause applies—

- (a) to all development specified in clause 5A.2(1) for this code that is to be carried out on a lot that is wholly or partly bushfire prone land, and*
- (b) in addition to all other development standards specified for this code.*

Note - See clause 1.19A for additional provisions relating to bushfire prone land.

(2) The development may be carried out on the lot only if—

- (a) the development conforms to the specifications and requirements of Planning for Bushfire Protection that are relevant to the development, and*
- (b) (Repealed)*
- (c) the lot has direct access to a public road or a road vested in or maintained by the council, and*
- (d) a reticulated water supply is connected to the lot, and*
- (e) a fire hydrant is located less than 70m from the location on the lot of the proposed development, and*
- (f) mains electricity is connected to the lot, and*

(g) reticulated or bottled gas on the lot is installed and maintained in accordance with AS/NZS 1596:2014, The storage and handling of LP Gas and the requirements of relevant authorities (such as the requirement that metal piping be used), and

(h) any gas cylinders on the lot that are within 10m of a dwelling—

(i) have their release valves directed away from the dwelling, and

(ii) are enclosed on the hazard side of the installation, and

(iii) have metal connections to and from the cylinders, and

(i) there are no polymer sheathed flexible gas supply lines to gas meters adjacent to any dwelling on the lot or an adjoining lot.

Note - The requirements relating to the construction of buildings in bushfire prone areas set out in the Building Code of Australia also apply.

At this masterplan phase, one of the important items is the ability for future complying development to provide suitable APZs to result in a Bushfire Attack Level of BAL 29 or lower (not BAL 40 or BAL FZ) to the future building envelopes in accordance with the requirements of Planning for Bush Fire Protection 2019. The identification, application and management of APZs is further considered in Section 5.2.

In addition to these requirements, the proposed development MUST comply with all relevant provisions of:

- Planning for Bush Fire Protection 2019,
- Australian Standard AS 3959-2018: Construction of Buildings in Bushfire-Prone Areas,
- Any other documents prescribed by the Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021.

These requirements are in addition to any other standards prescribed by the relevant code and applying to a particular development type (e.g., setbacks, landscaped area, building height, etc).

4.2 Special Fire Protection Purpose (SFPP) Development

SFPP uses would attract larger minimum required APZs and more onerous Bushfire Protection Measures. **Examples of SFPP developments relevant to the South Jerrabomberra RJP and the potential land uses are child care facilities and education facilities.**

Information and education facilities are defined in the Standard Instrument (Local Environmental Plans) Order 2006 as a building or place used for providing information or education to visitors, and the exhibition or display of items, and includes an art gallery, museum, library, visitor information centre and the like. For the purposes of this assessment and in accordance with Section 8.3.11 of Planning for Bush Fire Protection 2019, any buildings used for public assembly with a floor space area of greater than 500 m² will be treated as SFPP.

Other land uses such as places of public worship and other public assembly buildings (i.e., function centres) are not defined as SFPP under section 100B of the NSW RF Act but do require referral to the NSW RFS under s.4.14 of the NSW EP&A Act. For the purposes of this assessment and as outlined above, any buildings used for public assembly with a floor space area of greater than 500 m² will also be treated as SFPP.

Commercial and industrial development is also captured by NSW EP&A Act s.4.14 only where a manager's residence is included. Where no residential component is included, commercial and industrial development would be addressed through the aims and objectives of Planning for Bush Fire Protection 2019.

A SFPP development is one which is occupied by people who are considered to be at-risk members of the community. In a bushfire event, these occupants may be more susceptible to the impacts of bushfire. Evacuating at-risk members of the community is more challenging because they may be physically or psychologically less able to relocate themselves or are unfamiliar with their surroundings.

Due to the potential vulnerable nature of the occupants, there is more reliance on the provision of a wider APZ and emergency management. The specific objectives for SFPP developments are to:

- minimise levels of radiant heat, localised smoke and ember attack through increased APZ, building design and siting;
- provide an appropriate operational environment for emergency service personnel during firefighting and emergency management; ensure the capacity of existing infrastructure (such as roads and utilities) can accommodate the increase in demand during emergencies as a result of the development; and
- ensure emergency evacuation procedures and management which provides for the special characteristics and needs of occupants.

The identification, application and management of increased APZs is further considered in Section 5.2. It is also noted that the location of sensitive land uses will be defined by a number of additional restrictions (addressed separately) such as access capabilities, air quality, noise impacts and consideration of other planned facilities (co-location).

It is also important to note that development of bushfire prone land for a Special Fire Protection Purpose (SFPP) triggers referral to the NSW RSF under s100b NSW RF Act 1997 and cannot be considered 'complying development' under any environmental planning instrument.

4.3 Hazardous Industry

Some developments are considered by their very nature to be hazardous, as much for their ability to start bushfires as their susceptibility to bushfire impacts. Where hazardous industries are proposed, consultation with the NSW RFS and preparation of a performance based solution will be required. These development types will also not be considered for complying development.

Hazardous industries include but are not limited to:

- power generating works;
- sawmills;
- junk yards;
- liquid fuel depots;
- hazardous industries/storage;
- chemical industries/storage;
- service stations;
- ammunition storage/manufacture; and
- fireworks manufacture/storage.

Hazardous and offensive industries are types of industries and storage establishments that cannot comply with the conditions of their EPA licence, and present a risk to life, property and the environment. Hazardous developments are unlikely to be suitable within the South Jerrabomberra RJP due to land use conflicts.

Potentially hazardous development such as service stations that can comply with their license and conditions of consent may be permitted. The Resilience and Hazards SEPP (which includes Environmental Planning Policy No 33 – Hazardous and Offensive Development) will continue to apply. Consultation with the NSW RFS and preparation of a performance based solution will be required.

These development types will not be considered for complying development within the South Jerrabomberra RJP.

4.4 Commercial / Industrial Development

Under the building classification system within the National Construction Code (NCC), Class 5 to 8 buildings include offices, shops, factories, warehouses, public car parks and other commercial and industrial facilities. The NCC does not provide for any bushfire specific performance requirements for these particular classes of buildings and as such Australian Standard 3959 'Construction of buildings in bushfire-prone areas' does not apply as a set of 'deemed to satisfy' provisions.

In this case (and as outlined within Section 8.3.1 of Planning for Bush Fire Protection 2019), the following objectives will be applied in relation to access, water and services, and emergency and evacuation planning to provide:

- safe access to/from the public road system for firefighters providing property protection during a bushfire and for occupant egress for evacuation;
- suitable emergency and evacuation (and relocation) arrangements for occupants of the development;
- adequate services of water for the protection of buildings during and after the passage of bushfire, and to locate gas and electricity so as not to contribute to the risk of fire to a building; and
- storage of hazardous materials away from the hazard wherever possible.

Construction requirements for bushfire protection will need to be considered on a case-by-case basis. Where a manager's residence is included in the proposal for a commercial and industrial development, it is captured by s4.14 of the NSW EP&A Act (refer to Section 4.2).

Where no residential component is included, commercial and industrial development is addressed through the objectives of Planning for Bush Fire Protection 2019, being:

- i. afford buildings and their occupants protection from exposure to a bushfire;
- ii. provide for a defensible space to be located around buildings;
- iii. provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;
- iv. ensure that appropriate operational access and egress for emergency service personnel and residents is available;
- v. provide for ongoing management and maintenance of BPMs; and
- vi. ensure that utility services are adequate to meet the needs of firefighters.

The scale of the development and numbers of people likely to be occupying the building will directly influence the bushfire protection measures. While there is no minimum required APZs applicable to commercial / industrial development to satisfy the aim and objectives of Planning for Bush Fire Protection 2019, the buildings must be located outside Flame Zone.

To satisfy the requirements of complying development, commercial and industrial development should have a Bushfire Attack Level of BAL 29 or lower (refer to Section 5.2).

5. OTHER CONSIDERATIONS

It is neither possible nor desirable to eliminate bushfires in NSW – they are inevitable across all fire-prone vegetation types. When high fuel loads, ignition sources and adverse weather inevitably coincide, wildfires will result. Modern fire management requires the assessment, measurement and mitigation of risks – to social, economic and environmental values. As reported by OEH (2012), this creates an imperative to work closely with adjoining land managers, community groups and fire authorities to continually improve our understanding of bushfires, and to work together in managing the risks associated with living in a fire-prone environment.

As outlined within Planning for Bush Fire Protection 2019, land use planning can be an effective tool in minimising or avoiding the impact of natural hazards such as bushfire. From a risk management perspective, the safest approach is always to avoid high risk areas. In a bushfire context, strategic planning must ensure that future land uses are in appropriate locations to minimise the risk to life and property from bushfire attack. Services and infrastructure that facilitate effective suppression of bushfires also need to be provided for at the earliest stages of planning.

The capacity of the current road network to deal with increased traffic volumes associated with the development of the South Jerrabomberra RJP, including evacuating existing and potential residents and workers, is being addressed separately in the Traffic and Transport Technical Report (SMEC, 2022).

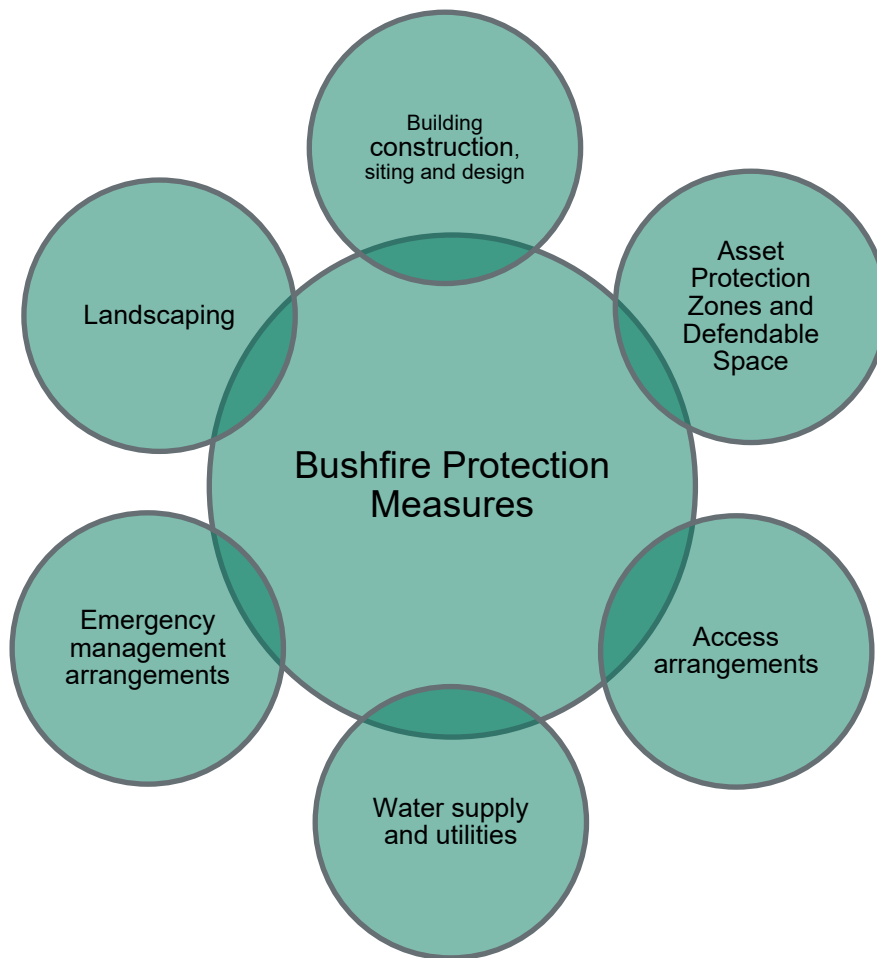


Figure 5-1 Overview of Bushfire Protection Measures

5.1 Firefighter and Public Safety

The firefighters likely to respond to a bushfire in this area would be volunteers from the NSW RFS and/or individual property owners. Based on the locality of the site, NSW RFS may also work closely with the Fire and Rescue NSW in the event of any major fires in this area.

These agencies and groups work together through local bushfire management committees across NSW. Set up under the NSW RF Act, these committees coordinate fire management planning, prevention and suppression in local areas.

NSW Police, NSW Ambulance and the NSW State Emergency Services will also assist in active support roles in bushfire and emergency incidents.

Emergency service capacity may need to expand to meet suppression requirements based on the type, nature and size of development within the RJP over the coming years. Once the scale and type of development is known, a decision to scale up emergency resources in the region may be required.

5.2 Asset Protection Zones and Defendable Space

An APZ is a buffer zone between a bushfire hazard and buildings, and is managed to minimise fuel loads and reduce potential radiant heat levels, flame, localised smoke and ember attack. The appropriate APZ distance is based on vegetation type, slope and the nature of the development (refer to Appendix A).

The APZ can include roads, fences, boardwalks, signage, seating or other passive recreational activities managed to be consistent with the NSW RFS document Standards for Asset Protection Zones. A fuel-reduced, physical separation between buildings and bushfire hazards is a key element in the suite of bushfire measures and has a major influence on the type of construction necessary to mitigate bushfire attack.

Irrespective of the bushfire prone land mapping, it is important to ensure that a defendable space is provided for the size and scale of the development. Proposed measures must operate in combination to minimise the impact of bushfires and ensure that access and services are adequate. At this stage of the masterplan process, it is important to highlight the need to provide suitable APZs across the precinct to result in a Bushfire Attack Level of:

- BAL 29 or lower to all the future building envelopes;
- BAL 12.5 or lower to all SFPP; and
- BAL 12.5 or lower to all hazardous industry.

As indicated within Figure 5.1, the width of the APZ will differ based on the location of the hazard (slope and vegetation type) relevant to the development footprint. These have been applied to the development zones only. As an indication, the following separation distances in Table 5-1 will apply to all areas located 0-5 degrees downslope (the hazard is downslope or lower than the development footprint). Additional information is provided in Appendix A.

Table 5-1 Indicative separation distances

KEITH VEGETATION FORMATION		BUSH FIRE ATTACK LEVEL (BAL)*				
		BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
		Distance (m) from the asset to the predominant vegetation formation				
^ 0 > 5 degrees	Grassy Woodland	< 10m	10 -< 13m	13 -< 19m	19 -< 28m	28 -< 100m
	Grassland	< 8m	8 -< 11m	11 -< 16m	16 -< 23m	23 -< 50m
		Not complying development	Not complying development	BAL 29 or lower to all the future building envelopes		Potentially Hazardous Industry and SFPP

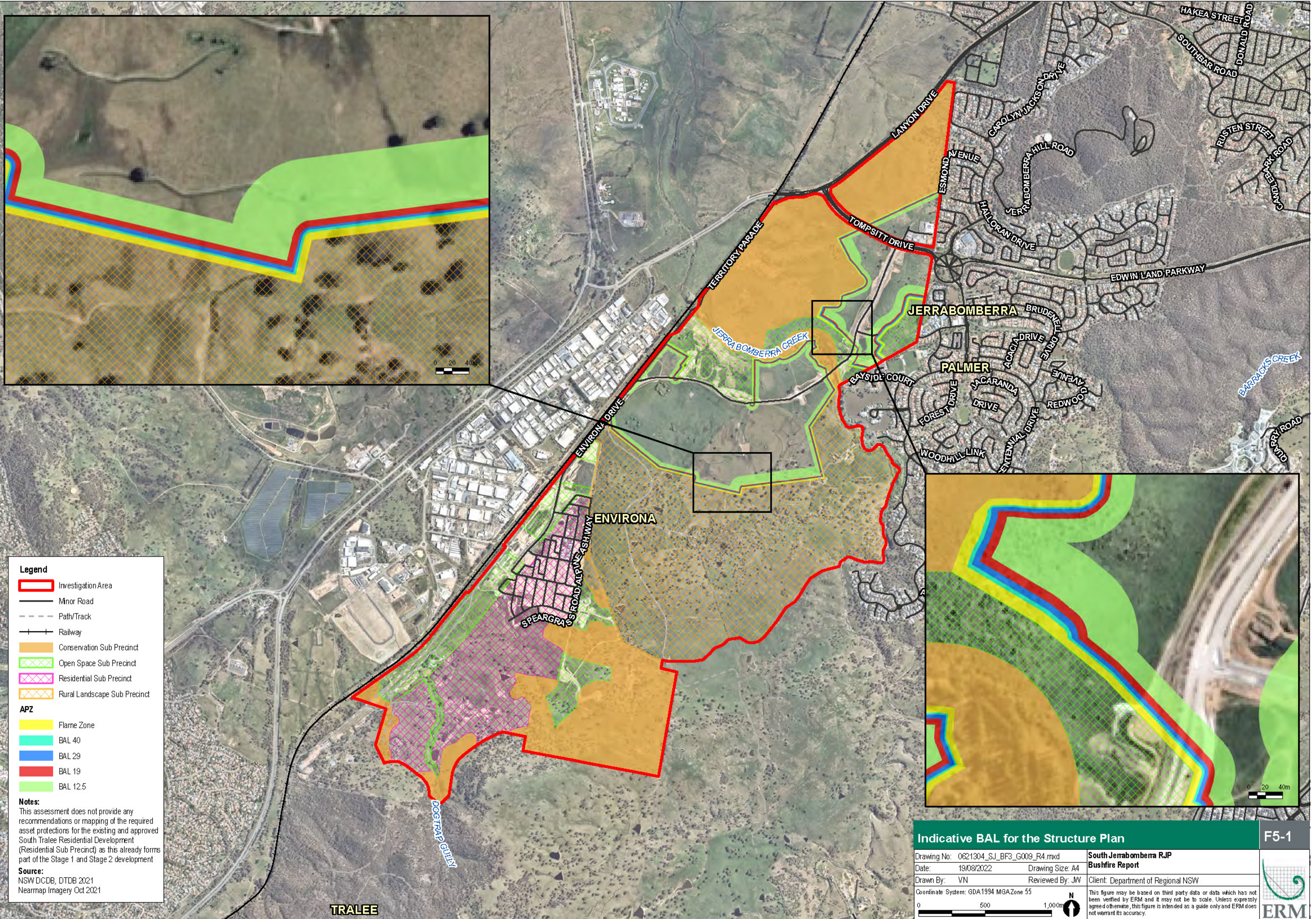
*Based on 0-5 degrees downslope. Refer to Table A1.12.6 Planning for Bushfire Protection 2019

As much of the Precinct is located on the bush-urban interface, consideration should also be given to the DPE Fire Management Manual 2021-2022 (updated annually) which highlights the complexities of managing fires along the interface.

5.3 APZs on Environmentally Protected Lands

Bushfire protection measures such as APZs may not necessarily be compatible with environmental protection and conservation objectives. It must not be assumed that any APZs can extend into an adjoining vegetated area or riparian corridor. Where environmentally sensitive vegetation such as endangered ecological communities or threatened species habitat are to be cleared for the purposes of an APZ, the proposals will need to be carefully considered and may no longer be consistent with complying development.

All APZ should be external to the C2 Environmental Conservation and E3 Environmental Management lands. A detailed Vegetation and Bushfire Hazard Management Plan should also be considered for the large areas of C2 Environmental Conservation and E3 Environmental Management to be retained.



- Legend**
- Investigation Area
 - Minor Road
 - Path/Track
 - + Railway
 - Conservation Sub Precinct
 - Open Space Sub Precinct
 - Residential Sub Precinct
 - Rural Landscape Sub Precinct
- APZ**
- Flame Zone
 - BAL 40
 - BAL 29
 - BAL 19
 - BAL 12.5

Notes:
 This assessment does not provide any recommendations or mapping of the required asset protections for the existing and approved South Tralee Residential Development (Residential Sub Precinct) as this already forms part of the Stage 1 and Stage 2 development

Source:
 NSW DCDB, DTDB 2021
 Nearmap Imagery Oct 2021

Indicative BAL for the Structure Plan		F5-1
Drawing No: 0621304_SJ_BF3_G009_R4.mxd	South Jerrabomberra RJP	
Date: 19/08/2022	Drawing Size: A4	Bushfire Report
Drawn By: VN	Reviewed By: JW	Client: Department of Regional NSW
Coordinate System: GDA1994 MGA Zone 55		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
<div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;">0</div> <div style="margin-right: 10px;">500</div> <div style="margin-right: 10px;">1,000m</div> <div style="text-align: center;"> <div style="border: 1px solid black; width: 10px; height: 10px; margin: 0 auto;"></div> <div style="font-size: 8px; margin: 0 auto;">N</div> </div> </div>		

5.4 Landscaped Areas and Recreational Spaces

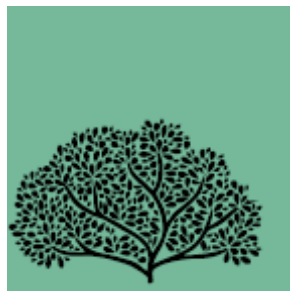
All landscaping is to comply with Appendix 4 of Planning for Bush Fire Protection 2019 and relevant environmental approvals required under the NSW BC Act 2016 and/or Commonwealth EPBC Act 1999. All landscaped areas should be designed and managed to meet the requirements of an APZ. These areas should be maintained in perpetuity to ensure ongoing protection from the impact of bushfires, particularly in advance of the bushfire season. As a minimum:

Trees



- tree canopy cover should be less than 30%; and
- canopies should be separated by 2 to 5 m.

Shrubs



- shrubs should not form a continuous canopy; and
- shrubs should form no more than 20% of ground cover.

Grass



- grass should be kept mown to a height of less than 100 mm; and
- leaf and other debris should be removed.

Provided that these areas are designed (and maintained) to comply with Appendix 4 of Planning for Bush Fire Protection 2019, no additional APZs need to be applied to these areas.

5.5 Staged Development

As outlined within Planning for Bush Fire Protection 2019 and relevant to the South Jerrabomberra RJP, often a time lag can occur between one or more stages of development which can result in persons and property being unprotected in the event of a bushfire. The precinct may require the creation of APZs that need to be maintained sequentially until the final phase of development is completed to afford each stage of the development the appropriate level of bushfire protection.

5.6 Building Construction, Siting and Design

Construction measures should not be applied as a stand-alone mitigation solution, but will form part of a suite of bushfire management measures. Building design needs to ensure adequate protection of vulnerable building elements. Construction standards are outlined in AS 3959 and the NCC to provide various levels of protection for different building elements. This would be addressed separately at the development approvals stage and would be individual to each development application.

The NCC does not provide any bushfire specific performance requirements for Class 5 to 8 buildings including offices, shops, factories, warehouses, public car parks and other commercial and industrial facilities.

5.7 Access

Design of the internal road network must enable safe access and egress for occupants attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. In a bushfire prone area, the purpose of the road system is to:

- provide firefighters with access to structures, allowing more efficient use of firefighting resources;
- provide evacuation routes for firefighters and the public; and
- provide access to areas of bushfire hazard for firefighting and hazard mitigation purposes.

The capacity of the current road network to deal with increased traffic volumes associated with the development of the South Jerrabomberra RJP, including evacuating residents and workers, is being addressed separately in the Traffic and Transport Technical Report (SMEC, 2022). The new access links proposed within the Masterplan are supported, including a new link road from Environa Drive to Sheppard Street as well as upgrades to local interchanges and additional connections into the local road network. Improved public transport networks proposed as part of the masterplan will also assist in removing some of this pressure from the local road network.

A perimeter road should be provided where possible to separate retained bushland from the development precincts, allowing more efficient use of firefighting resources. A perimeter road usually runs parallel to the bush land interface and provides space to conduct active firefighting operations and hazard reduction activities. Where this is not provided, the application of defensible space within each of the lots should be considered. The precinct should be designed to ensure that no lots directly adjoin the retained environmental protection areas.

Roads must provide sufficient width and other dimensions to ensure safe unobstructed access and allow firefighting crews to operate equipment around the vehicle. Road width is defined as the trafficable width from kerb to kerb or the inside edge of the table drain.

Dead-end roads should be avoided. However, where they are present, they must incorporate a sufficient turn-around area to minimise the need for vehicles to make multipoint turns.

Appendix C provides a summary of the design principles that will need to be considered for the internal road network. Table 5-2 identifies the Acceptable Solutions under the Planning for Bush Fire Protection 2019.

Table 5-2 Acceptable Solutions for Access Roads (General)

Performance criteria	Acceptable solutions*
<p>Firefighting vehicles are provided with safe, all-weather access to structures.</p>	<ul style="list-style-type: none"> ■ property access roads are two-wheel drive, all-weather roads; ■ traffic management devices are constructed to not prohibit access by emergency services vehicles; ■ maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; ■ all roads are through roads; ■ dead end roads are not recommended, but if unavoidable, are not more than 200 m in length, incorporate a minimum 12 m outer radius turning circle, and are clearly sign posted as a dead end; ■ where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; ■ where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and ■ one way only public access roads are no less than 3.5 m wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.
<p>The capacity of access roads is adequate for firefighting vehicles.</p>	<ul style="list-style-type: none"> ■ the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/ causeways are to clearly indicate load rating.
<p>There is appropriate access to water supply.</p>	<ul style="list-style-type: none"> ■ hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression; ■ hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005; and ■ there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.
<p>Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.</p>	<ul style="list-style-type: none"> ■ all roads are two-way sealed roads; ■ minimum 8m carriageway width kerb to kerb; ■ parking is provided outside of the carriageway width; ■ hydrants are located clear of parking areas; ■ all roads are through roads, and these are linked to the internal road system at an interval of no greater than 500 m; ■ curves of roads have a minimum inner radius of 6m; ■ the maximum grade road is 15 degrees and average grade of not more than 10 degrees; ■ the road crossfall does not exceed 3 degrees; and ■ a minimum vertical clearance of 4 m to any overhanging obstructions, including tree branches, is provided.

*Planning for Bushfire Protection (NSW Rural Fire Service, 2019)

5.8 Water Supply

An adequate supply of water is essential for firefighting purposes and suitable water supply arrangements must be provided for firefighting that meet the NSW RFS requirements. It is essential to ensure that any water sources are maintained at the appropriate capacity.

Where a non-reticulated water supply is provided or the reticulated water supply is deemed inadequate, an additional on site dedicated supply of water for firefighting will be required.

Any future development must comply with the water supply requirements detailed in Planning for Bush Fire Protection 2019. These requirements can be achieved in two ways, being:

- reticulated water is to be provided to the development, where available; and
- a static water supply is provided where no reticulated water is available.

Given the scale of the proposal, it would be considered likely that any future development will be serviced by a hydrant system:

- the fire hydrant spacing, design and sizing must comply with the Australian Standard AS 2419.1:2005;
- hydrants are not located within any road carriageway;
- reticulated water supply uses a ring main system for areas with perimeter roads;
- fire hydrant flows and pressures comply with AS 2419.1:2005; and
- all above-ground water service pipes external to the building are metal, including and up to any taps.

5.9 Electricity and Gas

Planning for Bushfire Protection also addresses the installation of services (i.e., electricity and gas) within bushfire prone areas. The following are the requirements for the relevant services:

- where practicable, electrical transmission lines are underground;
- where overhead, electrical transmission lines are proposed as follows:
 - lines are installed with short pole spacing (30 m), unless crossing gullies, gorges or riparian areas; and
 - no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.
- reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used;
- all fixed gas cylinders are kept clear of all flammable materials to a distance of 10 m and shielded on the hazard side;
- connections to and from gas cylinders are metal;
- polymer-sheathed flexible gas supply lines are not used; and
- above-ground gas service pipes are metal, including and up to any outlets.

6. CONCLUSION

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by the New South Wales (NSW) Government to prepare a Bushfire Assessment Report for the proposed South Jerrabomberra Regional Job Precinct (RJP). This assessment considers the bushfire landscape, land use, access and egress and emergency services capacity. Based on these factors, it is anticipated that new development within the precinct can be designed to meet the requirements of Planning for Bush Fire Protection 2019.

Complying development will not be applicable to all land use types or where a referral to the NSW RFS is required. The remaining commercial and industrial type development can be addressed within the masterplan through the aims and objectives of Planning for Bush Fire Protection 2019.

Specifically:

- complying development is only permitted on lower risk bushfire prone land (BAL-29 or lower);
- where hazardous industries are proposed, consultation with the NSW RFS and preparation of a performance-based solution will be required. These development types will not be considered for complying development;
- developments classified as special fire protection purpose (SFPP) would trigger referral to the NSW RFS under s100b NSW RF Act and will not be considered complying development; and
- other land uses, such as places of public worship and other public assembly buildings (i.e., function centres), also require referral to the NSW RFS under s.4.14 of the NSW EP&A Act. Any buildings used for public assembly with a floor space area of greater than 500m² will be treated as SFPP.

Development of the South Jerrabomberra RJP should ensure complementary bushfire management and mitigation strategies to ensure that the precinct is designed to reduce the risk of bushfire to the new site users as well as the surrounding assets. Of particular note is the importance to consider existing access and egress routes across the locality and to recognise that existing development (Poplars Retail Services Precinct, new Jerrabomberra High School, Regional Sports Complex and South Tralee Residential Development) is already managed and/or designed to reduce the risk of bushfires impacting life and property. These existing bushfire management measures and strategic advantage zones should be included within the masterplan to ensure no increased bushfire risk to life and property.

The development of the structure plan has also considered the application of suitable APZs across the precinct to result in a Bushfire Attack Level of:

- BAL 29 or lower to all the future building envelopes;
- BAL 12.5 or lower to all SFPP; and
- BAL 12.5 or lower to all potential hazardous industry.

The South Jerrabomberra RJP may also require the creation of APZs that need to be maintained sequentially until the final phase of development is completed to afford each stage of the development the appropriate level of bushfire protection. APZs should be applied to meet the objectives of Planning for Bush Fire Protection 2019 and will consider the possibility of direct flame contact in accordance with AS3959:2018. Decisions on where and how APZs should be maintained will be based on a site specific risk assessment. Other factors such as loss of visual amenity, potential erosion, loss of biodiversity and cultural heritage values and the indirect implications for the long-term management of the precinct will also be considered.

A detailed Vegetation and Bushfire Hazard Management Plan should also be considered for all areas of retained vegetation within the large areas of C2 Environmental Conservation and E3 Environmental Management to be retained.

Key specifications and requirements to assist in the development of the masterplan are provided in Table 6-1.

Table 6-1 Proposed Performance Criteria – Bushfire

Performance Criteria No.	Performance Criteria Description
1	Asset Protection Zones are managed and maintained to prevent the spread of a fire within the precinct in accordance with the requirements of Appendix 4 of Planning for Bush Fire Protection 2019 to result in a Bushfire Attack Level of BAL 29 or lower (not BAL 40 or BAL FZ) to all future building envelopes that are being assessed as complying development. This includes part of a staged or partial development of the Precinct.
2	Where referral to NSW RFS is required (SFPP, hazardous development and/or places of public worship), Asset Protection Zones should be managed and maintained to result in a Bushfire Attack Level of BAL 12.5 or lower (not BAL 29, BAL 40 or BAL FZ). These developments will not be assessed as complying development.
3	All landscaping is to comply with Appendix 4 of Planning for Bush Fire Protection 2019 and relevant environmental approvals required under the NSW <i>Biodiversity Conservation Act 2016</i> and/or Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Where environmentally sensitive vegetation such as endangered ecological communities or threatened species habitat are to be cleared, the proposals will need to be carefully considered and may no longer be consistent with complying development.
4	Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface. The requirements for access identified in Planning for Bush Fire Protection 2019 must be met for all stages of development within the Precinct.
5	Adequate water supplies are provided for firefighting purposes. Hydrants are to be installed to achieve compliance with AS 2419.1 – 2005 Fire Hydrant Installations - System Design, Installation and Commissioning (AS 2419) and must be located less than 70 m from each building envelope.
6	The location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings. Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used.
7	The location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings and must comply with requirements of Planning for Bush Fire Protection 2019.

Despite the mitigation measures and treatments that are put in place, it is noted that some bushfire risk will always remain and that some of the infrastructure may be subject to direct flame contact. The absence of any identified hazard or asset within the South Jerrabomberra RJP should not be interpreted as a guarantee that such hazards or impacts do not exist. The approval authority may require that a Bushfire and Emergency Management Policy is prepared based on the approved Master Plan design in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, and adjoining property owners and employees.

Any representation, statement of opinion, or advice expressed or implied in the bushfire assessment will be made in good faith on the basis that ERM employees and / or agents are not liable (whether by reason of negligence, lack of care or any other reason) to any person, company or their agents for any damage or loss whatsoever which has occurred or may occur in relation to that person taking (or not taking) action in respect of any representation, statement or advice provided within the bushfire assessment.

REFERENCES

BOM (2021) Fire Weather. <http://www.bom.gov.au/weather-services/fire-weather-centre/bushfire-weather/index.shtml> Accessed August 2021

Cheney, Phil & Sullivan, Andrew (2008). Grassfires: Fuel, Weather and Fire Behaviour.

DPIE (2020) Online Vegetation Formation Profiles.
<https://www.environment.nsw.gov.au/threatenedSpeciesApp/>

Filkov, Alexander I.; Duff, Thomas J.; Penman, Trent D. 2020. Frequency of dynamic fire behaviours in Australian forest environments. *Fire* 3(1):1.
<https://doi.org/10.3390/fire3010001>

Lake George Bushfire Management Committee (2018) Lake George Fire Risk Management Plan.

Keith, D.A. (2004) From ocean shores to desert dunes: the vegetation of New South Wales and the ACT. Department of Environment and Conservation NSW.

NSW Rural Fire Service (2019) Planning For Bushfire Protection. A guide for councils, planners, fire authorities and developers. November 2019

Standards Australia (2018) Australian Standard AS 3959 - 2009 Construction of Buildings in Bushfire Prone Areas.

Sullivan, Andrew & Mccaw, Lachie & Cruz, Miguel & Matthews, Stuart & Ellis, P.F.. (2012). Fuel, fire weather and fire behaviour in Australian ecosystems. In book: Flammable Australia (pp.51-77) Edition: 2nd Publisher: CSIRO Publishing.

**APPENDIX A TABLES FOR DETERMINING MINIMUM DISTANCES FOR
APZ, PLANNING FOR BUSH FIRE PROTECTION 2019**

Minimum distances for APZs – SFPP developments ($\leq 10\text{kW/m}^2$, 1200K)

KEITH VEGETATION FORMATION	EFFECTIVE SLOPE				
	Up slopes and flat	>0°-5°	>5°-10°	>10°-15°	>15°-20°
	Distance (m) from the asset to the predominant vegetation formation				
Rainforest	38	47	57	69	81
Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland	67	79	93	100	100
Grassy and Semi-Arid Woodland	42	50	60	72	85
Forested Wetland (excluding Coastal Swamp Forest)	34	42	51	62	73
Tall Heath	50	56	61	67	72
Short Heath	33	37	41	45	49
Arid-Shrublands (acacia and chenopod)	24	27	30	34	37
Freshwater Wetlands	19	22	25	28	30
Grassland	36	40	45	50	55

Minimum distances for APZs – FFDI 100 areas ($\leq 29\text{kW/m}^2$, 1090K)

KEITH VEGETATION FORMATION	EFFECTIVE SLOPE				
	Up slopes and flat	>0°-5°	>5°-10°	>10°-15°	>15°-20°
	Distance (m) from the asset to the predominant vegetation formation				
Rainforest	11	14	18	23	30
Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland	24	29	36	45	56
Grassy and Semi-Arid Woodland	12	16	20	25	32
Forested Wetland (excluding Coastal Swamp Forest)	10	12	16	20	26
Tall Heath	16	18	20	22	25
Short Heath	9	10	12	13	15
Arid-Shrublands (acacia and chenopod)	6	7	8	9	10
Freshwater Wetlands	5	6	6	7	8
Grassland	10	12	13	15	17

Determination of BAL, FFDI 100

KEITH VEGETATION FORMATION		BUSH FIRE ATTACK LEVEL (BAL)*				
		BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
		Distance (m) from the asset to the predominant vegetation formation				
ALL UPSLOPE AND FLAT LAND	Rainforest	< 8	8-<11	11 -< 16	16 -< 23	23 -< 100
	Forest (wet and dry sclerophyll) including CoastalSwamp Forest, Pine Plantations and Sub-Alpine Woodland	< 18	18 -< 24	24 -< 33	33 -< 45	45 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 9	9-< 12	12 -< 18	18 -< 26	26 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 7	7-<10	10 -< 14	14 -< 21	21 -< 100
	Tall Heath	< 12	12 -< 16	16 -< 23	23-< 32	32 -< 100
	Short Heath	< 7	7-<9	9-<14	14 -< 20	20 -< 100
	Arid-Shrublands (acacia and chenopod)	< 5	5-<6	6-<9	9-<14	14 -< 100
	Freshwater Wetlands	< 4	4-<5	5-<7	7-<11	11 -< 100
	Grassland	< 8	8-<10	10 -< 15	15 -< 22	22 -< 50
> 0 > 5 DEGREES – DOWNSLOPE	Rainforest	< 11	11-< 14	14 -< 21	21 -< 29	29 -< 100
	Forest (wet and dry sclerophyll) including CoastalSwamp Forest, Pine Plantations and Sub-Alpine Woodland	< 22	22 -< 29	29 -< 40	40 -< 54	54 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 12	12 -< 16	16 -< 23	23-< 32	32 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 9	9-< 12	12 -< 18	18 -< 26	26 -< 100
	Tall Heath	< 13	13 -< 18	18 -< 26	26-< 36	36 -< 100
	Short Heath	< 8	8-<10	10 -< 15	15 -< 22	22 -< 100
	Arid-Shrublands (acacia and chenopod)	< 5	5-<7	7-<11	11 -< 16	16 -< 100
	Freshwater Wetlands	< 4	4-<6	6-<8	8-<12	12 -< 100
	Grassland	< 9	9-< 12	12 -< 17	17 -< 25	25 -< 50
> 5 > 10 DEGREES – DOWNSLOPE	Rainforest	< 14	14 -< 18	18 -< 26	26 -< 37	37 -< 100
	Forest (wet and dry sclerophyll) including CoastalSwamp Forest, Pine Plantations and Sub-Alpine Woodland	< 28	28 -< 36	36 -< 49	49 -< 65	65 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 15	15-< 20	20 -< 28	28 -< 39	39 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 12	12 -< 16	16 -< 23	23-< 33	33 -< 100
	Tall Heath	< 15	15-< 20	20 -< 29	29 -< 40	40 -< 100
	Short Heath	< 9	9-< 12	12 -< 18	18 -< 25	25 -< 100
	Arid-Shrublands (acacia and chenopod)	< 6	6-<8	8-<12	12-< 18	18 -< 100
	Freshwater Wetlands	<5	5-<6	6-<10	10 -< 14	14 -< 100
	Grassland	< 10	10 -< 13	13 -< 20	20 -< 28	28 -< 50

KEITH VEGETATION FORMATION		BUSH FIRE ATTACK LEVEL (BAL)*				
		BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
		Distance (m) from the asset to the predominant vegetation formation				
>10 > 15 DEGREES – DOWNSLOPE	Rainforest	< 17	17-< 23	23 -< 34	34 -< 46	46 -< 100
	Forest (wet and dry sclerophyll) including CoastalSwamp Forest, Pine Plantations and Sub-Alpine Woodland	< 36	36 -< 45	45 -< 60	60 -< 77	77 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 19	19 -< 25	25 -< 36	36-< 49	49 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 15	15-< 20	20 -< 29	29 -< 41	41 -< 100
	Tall Heath	< 17	17-< 22	22 -< 32	32 -< 44	44 -< 100
	Short Heath	< 10	10 -< 13	13 -< 20	20 -< 29	29 -< 100
	Arid-Shrublands (acacia and chenopod)	< 7	7-<9	9-<14	14 -< 20	20 -< 100
	Freshwater Wetlands	< 5	5-<7	7-<11	11 -< 16	16 -< 100
>15 > 20 DEGREES – DOWNSLOPE	Grassland	< 11	11 -< 15	15 -< 23	23-< 32	32 -< 50
	Rainforest	< 23	23 -< 30	30 -< 42	42-< 56	56 -< 100
	Forest (wet and dry sclerophyll) including CoastalSwamp Forest, Pine Plantations and Sub-Alpine Woodland	< 46	46 -< 56	56 -< 73	73-< 92	92 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 24	24 -< 32	32 -< 44	44 -< 59	59 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 19	19 -< 26	26 -< 37	37 -< 50	50 -< 100
	Tall Heath	< 19	19 -< 25	25 -< 36	36-< 49	49 -< 100
	Short Heath	< 11	11 -< 15	15 -< 23	23-< 32	32 -< 100
	Arid-Shrublands (acacia and chenopod)	< 7	7-<10	10 -< 16	16 -< 23	23 -< 100
>15 > 20 DEGREES – DOWNSLOPE	Freshwater Wetlands	< 6	6-<8	8-<13	13-< 18	18 -< 100
	Grassland	<13	13 -< 17	17 -< 26	26-< 36	36 -< 50

**APPENDIX B KEY ASSETS WITHIN THE INVESTIGATION AREA (LAKE
GEORGE BFMC 2018)**

**Table B.0-1 Assets within South Jerrabomberra and surrounds
(extract from Lake George Bushfire Risk Management Plan (Lake George BFMC 2018))**

Asset Name	Asset Location	Asset Type	Subtype	Risk Level	Priority	Treatment	Comment
Mt Jerrabomberra GRN Site	Jerrabomberra	Economic	Infrastructure	Very High	2A	Hazard reduction	Inspect SFAZ & maintain as required
Jerrabomberra	Jerrabomberra	Human Settlement	Residential	Very High	2A	Community Education	Undertake Community Engagement Activity as required. Activities including Adult/Youth/Awareness Programs (Including Community Protection Plans and Hotspots Program) Publish media release for commencement of Bushfire Danger Period
						Hazard Reduction	Inspect and maintain APZ and SFAZ
Environa Rural Development in QPRC	Jerrabomberra	Human Settlement	Residential	Medium	4	Community Education	Undertake Community Engagement Activity as required. Activities including Adult/Youth/Awareness Programs (Including Community Protection Plans and Hotspots Program) Publish media release for commencement of Bushfire Danger Period
Jerrabomberra Community Centre Car Park	Jerrabomberra	Human Settlement	Other	Very High	2A	Hazard Reduction	Inspect and maintain Neighbourhood Safer Places

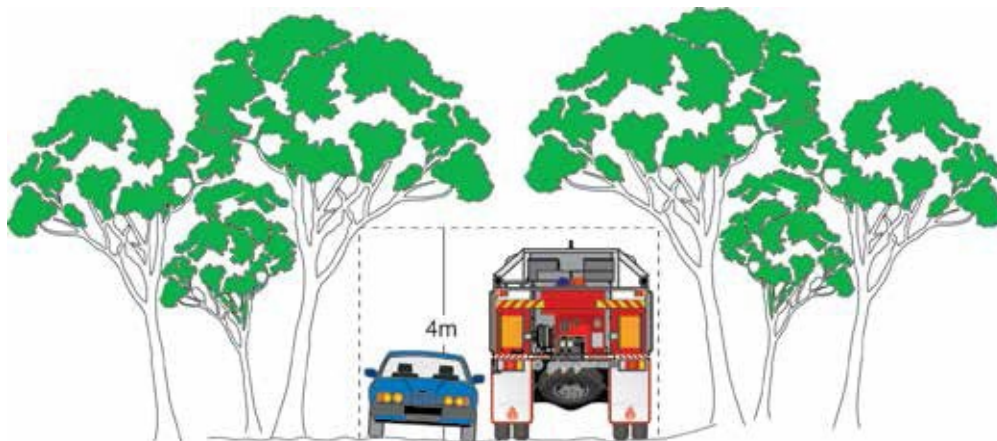
**APPENDIX C DESIGN PRINCIPLES FOR EMERGENCY SERVICE
VEHICLE ACCESS, PLANNING FOR BUSH FIRE
PROTECTION 2019**

ACCESS

This appendix provides design principles for emergency service vehicle access and is an extract from Appendix 4, Planning for Bush Fire Protection 2019

Vertical clearance

An unobstructed clearance height of 4 metres should be maintained above all access ways including clearance from building construction, archways, gateways and overhanging structures (e.g. ducts, pipes, sprinklers, walkways, signs and beams). This also applies to vegetation overhanging roads.



Vehicle turning requirements

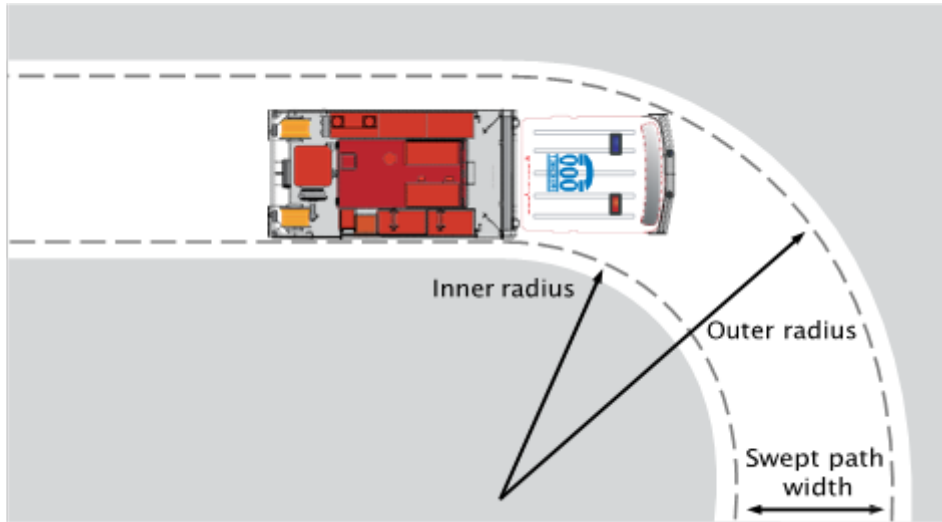
Curved carriageways should be constructed using the minimum swept path as outlined in the Table below:

Minimum curve radius for turning vehicles.

Curve radius (inside edge in metres)	Swept path (metres width)
< 40	4.0
40 - 69	3.0
70 - 100	2.7
> 100	2.5

Swept path width for turning vehicles.

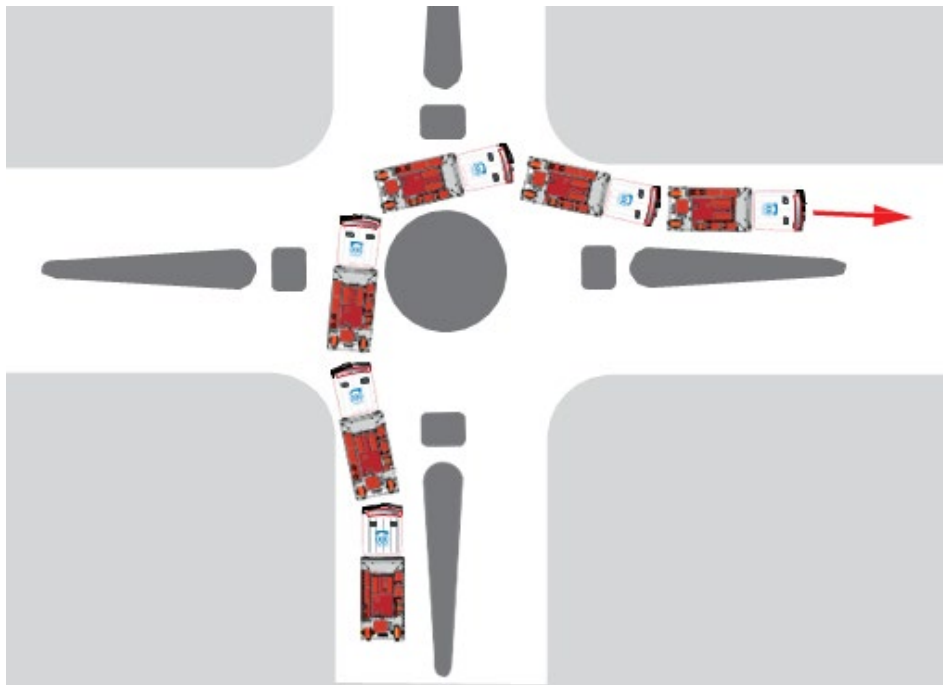
The radius dimensions given are for wall to wall clearance where body overhangs travel a wider arc than the wheel tracks (vehicle swept path). The swept path shall include an additional 500mm clearance either side of the vehicle.



Roundabout swept path.

Example of a swept path as applied to a roundabout.

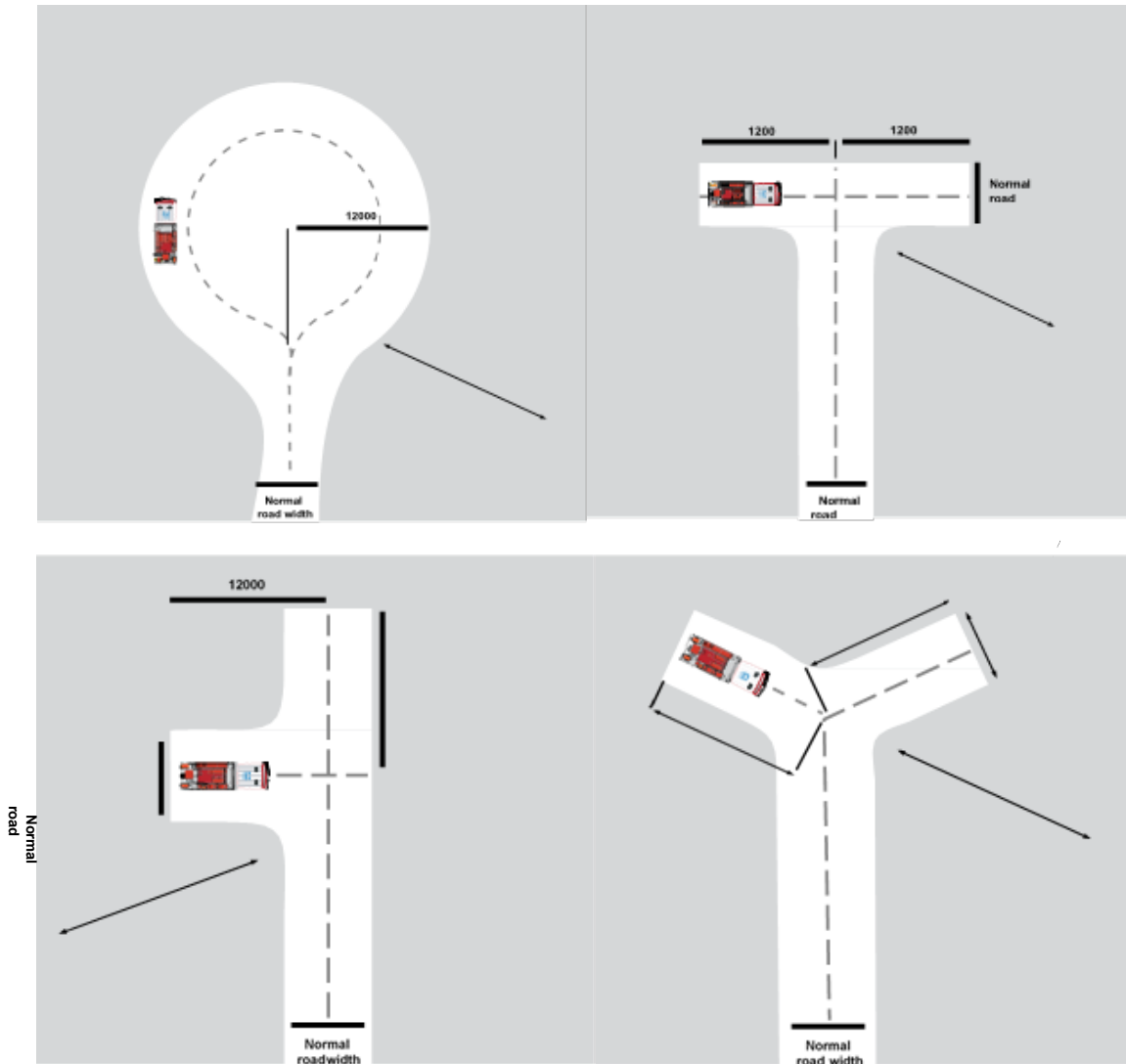
The distance between inner and outer turning arcs allows for expected vehicle body swing of front and rear overhanging sections.



Vehicle turning head requirements

Dead ends that are longer than 200m must be provided with a turning head area that avoids multipoint turns. "No parking" signs are to be erected within the turning head.

The minimum turning radius shall be in accordance with Table A3.2 of Planning for Bush Fire Protection 2019. Where multipoint turning is proposed the NSW RFS will consider the following options:



Services

Hydrant services should be located outside the carriageway and parking bays to permit traffic flow and access. Setup of standpipes within the carriageway may stop traffic flow. Hydrant services shall be located on the side of the road away from the bushfire threat where possible.

Passing bays

The construction of passing bays, where required, shall be 20m in length and provide a minimum trafficable width at the passing point of 6m.

Passing bays can provide advantages when designed correctly. Poor design can and does severely impede access.



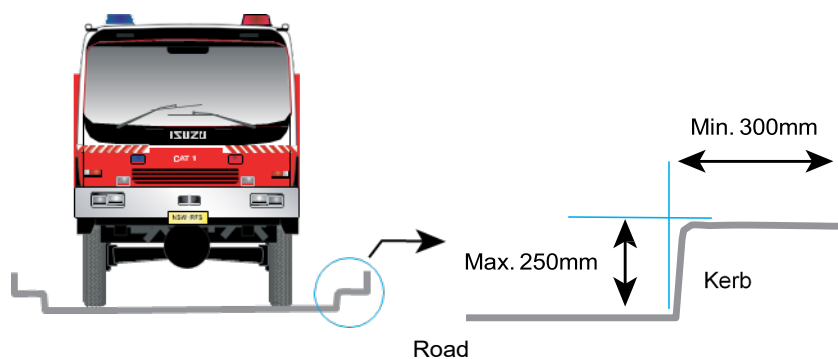
Parking

Parking can create a pinch point in required access. The location of parking should be carefully considered to ensure fire appliance access is unimpeded. Hydrants shall be located outside of access ways and any parking areas to ensure that access is available at all times.



Kerb dimensions

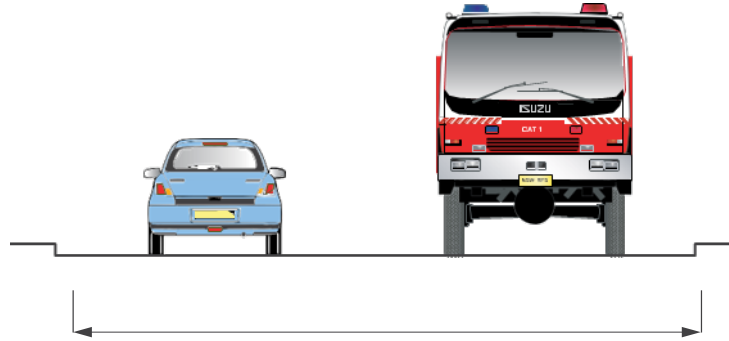
All kerbs constructed around access roads should be no higher than 250mm and free of vertical obstructions at least 300mm back from the kerb face to allow clearance for front and rear body overhang.



ROAD TYPES

Perimeter Roads

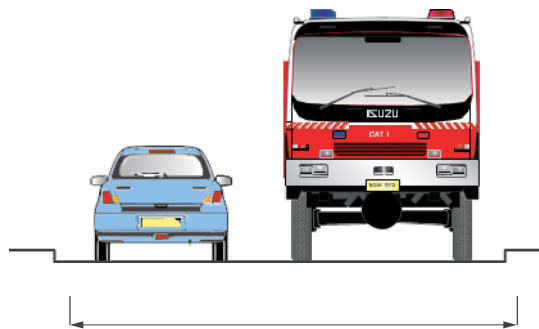
Perimeter roads are to be provided with a minimum clear width of 8m. Parking and hydrants are to be provided outside of carriageways. Hydrants are to be located outside of carriageways and parking areas.



Perimeter roads = 8m to kerb

Non-perimeter Roads

Non-perimeter roads shall be provided with a minimum clear width of 5.5m. Parking is to be provided outside of the carriageway and hydrants are not to be located in carriageways or parking areas.



Non-perimeter roads = 5.5m to kerb

Property access

Property access roads are to be a minimum of 4m wide.



Property access road
4m wide carriage way

ERM has over 160 offices across the following countries and territories worldwide

Argentina	The Netherlands
Australia	New Zealand
Belgium	Norway
Brazil	Panama
Canada	Peru
Chile	Poland
China	Portugal
Colombia	Puerto Rico
France	Romania
Germany	Senegal
Ghana	Singapore
Guyana	South Africa
Hong Kong	South Korea
India	Spain
Indonesia	Sweden
Ireland	Switzerland
Italy	Taiwan
Japan	Tanzania
Kazakhstan	Thailand
Kenya	UAE
Malaysia	UK
Mexico	US
Mozambique	Vietnam

ERM's Newcastle Office

Level 1, Watt Street Commercial Centre
45 Watt Street
Newcastle NSW 2300

T: (02) 4903 5500

F: (02) 4929 5363

www.erm.com