



APPENDIX N BUSHFIRE RISK ASSESSMENT



Keri Keri Wind Farm

Bushfire Risk Assessment

PREPARED FOR



Acciona Energy Australia Global Pty
Ltd

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
Applicant	Acciona Energy Australia Global Pty Ltd
Application	Application for Development Consent under Part 4, Division 4.7 of EP&A Act and Sections 18 and 18A of EPBC Act
AFAC	Australasian Fire and Emergency Services Council
APZ	Asset Protection Zones

Acronyms	Description
AS 3959-2018	<i>Australian Standard 3959 - 2018 Construction of Buildings in Bushfire-prone Areas</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BESS	battery energy storage system
BOM	Bureau of Meteorology
CASA	Civil Aviation Safety Authority
Cth	Commonwealth
Disturbance Footprint	The area of land that is directly impacted by the Project including: all temporary and permanent disturbance areas; and all areas where vegetation may be removed during project construction and operation
EIS	Environmental Impact Statement
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
ERM	Environmental Resources Management Australia Pty Ltd
ha	hectare
Host Landholder	Landholder where physical project elements are to be located on their land
m	metres
MNES	Matter of National Environmental Significance
NSW RFS	New South Wales Rural Fire Service
PBP 2019	Planning for Bushfire Protection 2019
Permanent Disturbance	The area of land that will be subject to permanent alteration as a result of construction and operation of the Project's infrastructure until decommissioning
Project	The development to which the Application applies generally
Project Area	Red boundary to which the Application applies as shown in Figure 1-2
RF Act	<i>NSW Rural Fires Act 1997</i>
SCADA	supervisory control and data acquisition
SEARs	Secretary's Environmental Assessment Requirements
SFAZ	Strategic Fire Advantage Zone
SSD	State Significant Development
Study Area	The area which applies to specific technical studies and includes Disturbance Footprint (within which all Project disturbance will occur unless otherwise stipulated in the Project Description)
Temporary Disturbance	The area of land that will be temporarily disturbed during construction of the Project, and later rehabilitated
TOBAN	Total Fire Ban
WTG	wind turbine generators

Important 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 in the Project Area should not be interpreted as a guarantee that such hazards or impacts do not exist. It is also important that a Bushfire Emergency Management and Operations Plan is prepared prior to the commencement of any construction works in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, NPWS, landowners and adjoining property owners.

Important 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 Acciona Energy Australia Global Pty Ltd (the Applicant) to consider bushfire risk in the vicinity of the proposed Keri Keri Wind Farm (the Project). The Applicant is seeking State Significant Development (SSD) consent for the Project under Part 4, Division 4.7 of the *Environmental Planning & Assessment Act 1979* (EP&A Act).

This Bushfire Risk Assessment supplements the Environmental Impact Statement (EIS) prepared by Environmental Resources Management Pty Ltd (ERM) for the Project and is required to be prepared as part of the SSD consent process.

The need for a Bushfire Risk Assessment was identified within the Secretary's Environmental Assessment Requirements (SEARs) and relates to the requirement under the *Rural Fires Act 1997* (RF Act) which imposes obligations on land occupiers to take all practicable steps to prevent the occurrence and spread of wildfire to adjoining lands from lands under their care and management.

This report identifies potential hazards and risks associated with the Project and use of bushfire prone land. It contains management and mitigation measures designed to address these obligations consistent with similar projects of this nature and in accordance with NSW Rural Fire Service (RFS) guidelines including *Planning for Bush Fire Protection* (PBP) (2019) inclusive of the PBP Addendum (2022). It does not assess the individual design or engineering components of the turbines (or other infrastructure as described in **Section 1.2**) but does consider locations of the infrastructure relative to identified hazards and the requirements for separation distances.

Electrical hazards including battery fires, turbine fires and transformer fires are addressed separately as part of the Preliminary Hazard Assessment and are not included in this assessment.

1.1 SITE CONTEXT

The Project is situated about 30 kilometres (km) southeast of Balranald, and 75 km southwest of Hay in the Murray River Local Government Area (LGA) (refer **Figure 1-1**). The Project is located within the South West Renewable Energy Zone (REZ) and is directly south of the Sturt Highway on land that is predominately used for sheep grazing and cropping. The Project extends over an area of approximately 18,012 hectares (ha) across 66 freehold land parcels (Project Area) as shown in **Figure 1-2**.

The under-construction Project EnergyConnect intersects the Project Area. Project EnergyConnect is a new 900 km TL (interconnector) that will connect power grids across three (3) Australian states between Wagga Wagga in NSW and Robertstown in SA, with a connection to Red Cliffs in VIC. The Applicant intends to bid for Access Rights to this interconnector. The 330 kV overhead TL will connect the Project to Project EnergyConnect.

Further information on locality and land use relating to the Project is provided in **Section 3.1**.

1.2 PROJECT DESCRIPTION

The Project involves the construction, operation, maintenance, and decommissioning of a wind farm, with up to 155 wind turbine generators (WTGs), together with associated and ancillary infrastructure.

The Project consists of the following key components:

- Up to 155 WTGs, each comprising:
 - Three blades mounted to a rotor hub (hub height of 200 m) on a nacelle above a tubular steel tower, with a blade tip height (blade length plus hub height) of up to 291.5 m AGL;
 - A gearbox and generator assembly housed in the nacelle; and
 - Adjacent hardstands for use as crane pads, assembly and laydown areas;
- Electrical infrastructure comprising:
 - A battery energy storage system (BESS) of up to 200 MW/800 MWh (approximately four hours of storage);
 - Three 33/330 kV electrical substations, including control room, communications tower, transformers, circuit breakers, switches, lighting protection and other ancillary equipment;
 - 64.5 km of overhead 33 kV and 175.3 km of underground 33 kV electrical reticulation connecting the WTGs to the onsite substations (where practicable, these are generally following site access tracks);
 - 20.0 km of 330 kV overhead transmission line connecting the three substations to a new electrical switchyard (including circuit breakers, switches and other ancillary equipment) to provide connection to the planned NSW-SA interconnector, Project EnergyConnect currently under construction;
- Ancillary infrastructure:
 - Four site access points with one along Sturt Highway and three along Keri Keri Road;
 - Three operations and maintenance (O&M) facilities and four security huts;
 - Four biosecurity wash bays;
 - Internal access tracks connecting the WTGs and associated Project infrastructure with the public road network;
 - Decommissioning of four temporary meteorological monitoring masts and installation of up to four permanent meteorological monitoring masts for power testing. The permanent monitoring masts will be located close to a WTG location and will have a maximum height of approximately 159 m AGL; and
- Upgrades to public roads and intersections required for the delivery of oversize and overmass (OSOM) WTG components, transformers and associated construction-phase materials and vehicular movements.

The following temporary elements will be required during the construction phase of the Project:

- Two temporary construction site compounds, comprising site buildings and facilities for construction contractors / equipment, site offices, car parking and amenities for the construction workforce;
- Mobile concrete batching plants to supply concrete for WTG footings and substation construction works;
- Earthworks for access tracks, WTG platforms and foundations;
- Rock crushing facilities for the generation of suitable aggregate for concrete batching and/or for access track and hardstand construction;
- One workers' accommodation compound;
- Hardstand laydown areas for the storage of construction materials, plant, and equipment;
- Up to four temporary meteorological monitoring masts. The temporary monitoring masts will be located close to a WTG location with a maximum height of approximately 159 m AGL;
- External water supply and storage for concrete batching and construction activities;
- The transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure; and
- Beneficial reuse of materials won from within the Disturbance Footprint during cut and fill and WTG foundation excavation works for use in access track, hardstands and foundation material.

Ultimately the project will be decommissioned and the Project Area will be rehabilitated.

TABLE 1-1 DETAILED PROJECT COMPONENTS

Project Component	Description	Quantity
Project footprint		
Project Area	Total area to which the Application applies	18,012 ha
Disturbance Footprint	The area of land that is directly impacted by the Project including: all temporary and permanent disturbance areas; and all areas where vegetation may be removed during project construction and operation.	Up to 1,137 ha
Permanent Disturbance Footprint	The area of land that will be subject to permanent alteration as a result of the Project's infrastructure until decommissioning.	Up to 574 ha
WTGs		
Rotor diameter	183 m	155 WTGs
Blade length	91.5 m	
Uppermost blade tip	291.5 m	
Tower (hub) height	200 m	

Project Component	Description	Quantity
WTG hardstand	2.83 ha per WTG required for construction. 0.67 ha per WTG during operation after partial rehabilitation following construction	
Ancillary Infrastructure		
New 330 kV transmission line	Towers approx. 40 m high, spaced approx. 500 m (subject to terrain), with 60 m easement	20 km
Underground 33 kV cables	Trenching for underground electrical cabling will be approx. 0.6 m wide per circuit by 1.0 m deep.	175.3 km
Overhead 33 kV cables	Where ground conditions are not suitable for open cut trench installation, overhead single circuit electricity lines will be installed using concrete poles, with 30 m easement	64.5 km
33/330 kV Substation	200 m x 300 m + 35 m APZ all sides	3
Switchyard	200 m x 300 m + 35 m APZ all sides	1
200 MW/800 MWh BESS	400 m x 300 m + 35 m APZ all sides	1
O&M Facility including carpark	100 m x 100 m + 35 m APZ all aides	3
Security hut	20 m x 20 m near each site access point	4
Biosecurity wash bays	70 m x 110 m near each site access point	One at each site access
New internal access tracks and drainage	Approximately 15 m wide formation including 5.5 m roadway plus shoulders and drainage as required.	148.3 km
Transport route and site access	Site access off Keri Keri Road and Sturt Highway. Upgrades will be required at several locations along the route.	N/A
Permanent meteorological masts (with concrete footings for mast and guy wires)	Sensor height at 159 m on approximately 3 m x 3 m concrete foundation.	4
Temporary Facilities		
Concrete batching plants	150 m x 100 m + 15 m batters	2
Laydown Areas	200 m x 150 m + 15 m batters	3
Borrow pit	200 m x 200 m + 15 m batters	1
Construction compound (site office, car parking and storage areas)	100 m x 100 m + 15 m batters	2
Temporary meteorological masts (with concrete footings for mast and guy wires)	Sensor height at 159 m on approximately 3 m x 3 m concrete foundation.	4
APZ requirements	- Minimum 10 m per meteorological mast - Minimum 20 m all sides of buildings	N/A

Project Component	Description	Quantity
Other Project elements		
Duration and start of construction phase	- Commencing late 2027 for approximately 24 months - Peak construction activities to occur over approximately 12 months - Mechanical completion: Late 2029 - Testing/commissioning completion: Mid 2029	
Construction hours	- Monday to Friday: 7.00 am to 6.00 pm; - Saturday: 8.00 am to 6.00 pm; and - No works on Sunday or public holidays.	
Construction workforce	Up to 650 FTE	
Duration of operation phase	30 years	
Operational workforce	Approximately 12 long-term service and maintenance jobs will be created during Project operation.	
Decommissioning	2055 or later subject to approval	
Capital investment	\$2.8 billion AUD	
Net reduction in greenhouse gas emissions	2.6 million tonnes CO ² equivalent per annum	

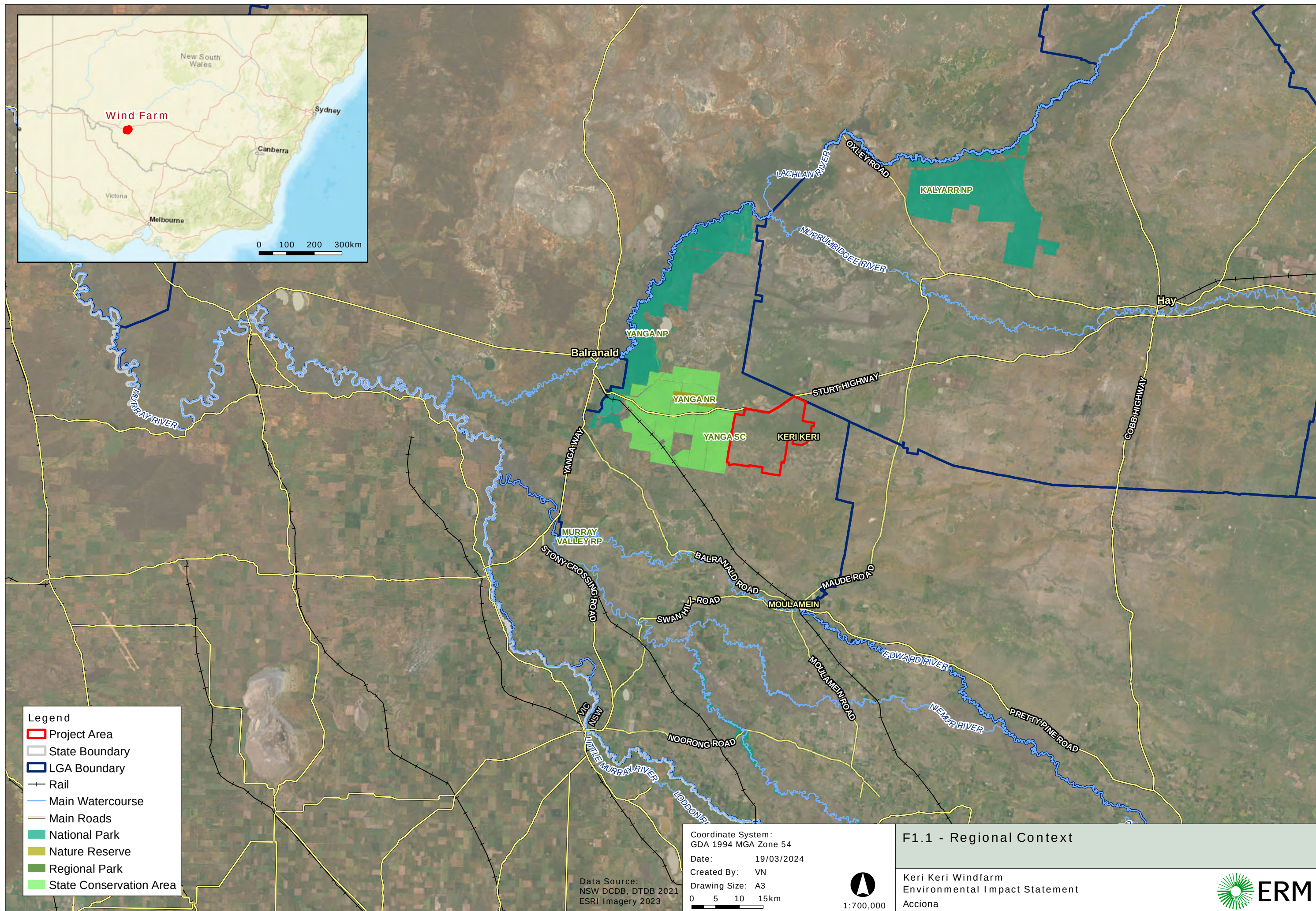
1.3 AIMS AND OBJECTIVES

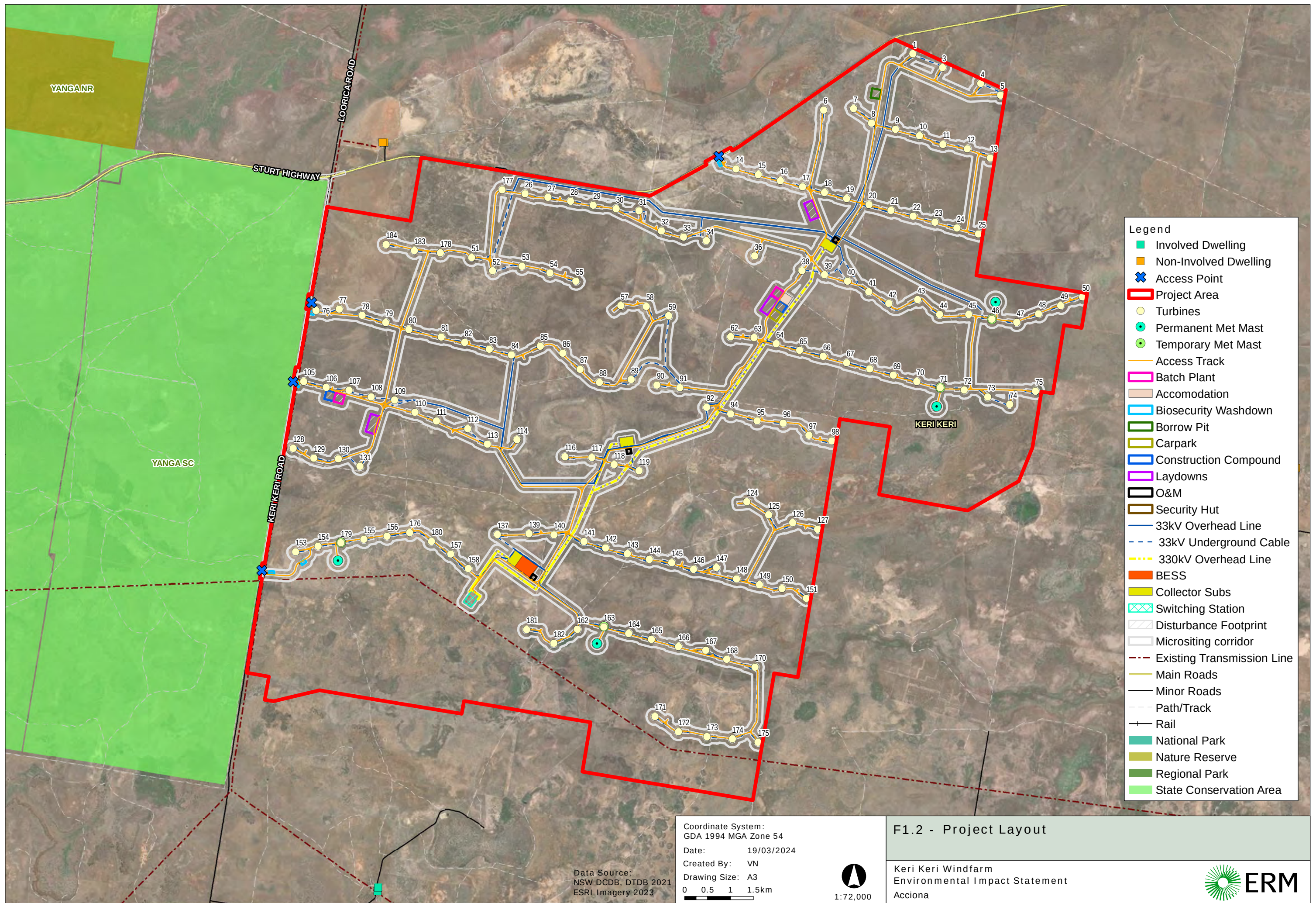
Bushfire presents a threat to human life and assets and can adversely impact ecological values. Bushfire risk can be considered in terms of environmental factors that increase the risk of fire (e.g., fuel quantity and type, topography and weather patterns), as well as specific activities (e.g., hot works and construction activities) or infrastructure components that exacerbate combustion or ignition risks (e.g., transmission lines and other electrical components).

This Bushfire Risk Assessment aims to address the requirements identified by the SEARs to identify potential hazards and risks associated with bushfires / use of bushfire prone land, and demonstrate that the proposed wind farm can be designed, constructed and operated to minimise ignition risks and provide for asset protection consistent with relevant NSW RFS design guidelines PBP 2019 and Standards for Asset Protection (both available on the NSW RFS website www.rfs.nsw.gov.au).

The objectives of this assessment are to identify and where possible reduce the likelihood of a bushfire impacting the Project Area or spreading from the Project Area to surrounding properties.

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 in the Project Area should not be interpreted as a guarantee that such hazards or impacts do not exist.





2. PLANNING FRAMEWORK

2.1 RELEVANT LEGISLATION AND GUIDELINES

Table 2-1 outlines the relevant legislation and guidelines and how they have been considered in this Bushfire Risk Assessment.

TABLE 2-1 RELEVANT LEGISLATION AND GUIDELINES

Relevant Legislation/Guideline	Description
<i>Environment Planning and Assessment Act 1979 (NSW)</i>	The Project was declared a State Significant Development (SSD) and will be assessed under Part 4 of the <i>Environmental Planning and Assessment Act 1979</i> (EP&A Act). Section 4.41 of the EP&A Act excludes projects approved under Part 4 of the EP&A Act from requiring "a bush fire safety authority under section 100B of the <i>Rural Fires Act 1997</i>".
<i>Rural Fires Act 1997 (NSW)</i>	The NSW Rural Fire Service (NSW RFS) administers the <i>Rural Fires Act 1997</i> (RF Act). The main objectives of the RF Act are to: • 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; and • Protect the environment. It is 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. This assessment considers the risk of spread of bushfires from the Project to the surrounds and provides measures to minimise the risk of bushfires. Additionally, as the occupier, in accordance with Section 64 of the RF Act, if a fire is burning on any land at any time during a bushfire danger period, the wind farm operators must: • Immediately on becoming aware of the fire and whether the occupier has lit or caused the fire to be lit or not, take all possible steps to extinguish the fire; and • If the occupier is unable without assistance to extinguish the fire and any practicable means of communication are available, ensure that the fire is reported immediately to the 000 emergency telephone number. The wind farm operators must also be aware of operations that can be carried out on days of Total Fire Ban and any prohibited activities or exemptions that are notified by the Commissioner of the NSW RFS under Section 99 of the RF Act. The proposed development does not require subdivision of land and is not defined as a special fire protection purpose development under Section 100B of the RF Act. Accordingly, the Project does not require a bushfire safety authority. <u>Bushfire Management Committee</u> Set up under the RF Act, bushfire management committees (BFMCs) coordinate fire management planning, prevention and suppression in local areas. The relevant committee for the Project is the Mid Murray Zone BFMC. Each BFMC is required to prepare and submit to the Bush Fire Risk Management Plan (BFRMP). The relevant plan to the

Relevant Legislation/Guideline	Description
	Project is the Mid Murray Zone BFRMP (2009) and has been referred to as part of this assessment
<i>Planning for Bushfire Protection 2019 (NSW)</i>	PBP 2019 is a planning document to link responsible planning and development control with the protection of life, property and the environment. PBP 2019 was legislatively adopted in the <i>Environmental Planning & Assessment Regulations</i> on 1 March 2020. The PBP Addendum (November 2022) is effective date from 1 May 2023 to coincide with adoption of the National Construction Code (NCC) 2022. Consideration has been given to the following overall aims and objectives of PBP 2019: • Afford buildings and their occupants protection from exposure to a bushfire; • Provide for a defensible space to be located around buildings; • Provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition; • Ensure that appropriate operational access and egress for emergency service personnel and residents is available; • Provide for ongoing management and maintenance of bushfire protection measures; and • Ensure that utility services are adequate to meet the needs of firefighters. PBP 2019 provides specific requirements for wind farm development and notes that wind and solar farms require special consideration and should be provided with adequate clearances to combustible vegetation as well as firefighting access and water. The following minimum standards should be provided for wind farms (noting that the recommendations of this assessment exceed these minimum standards): • 10 m Asset Protection Zone (APZ) from the structures / associated buildings / infrastructure; and • The APZ will be maintained to the standard of an inner protection area for the life of the development to provide adequate access for firefighting purposes. Essential equipment should be designed and housed in such a way as to minimise the impact of bushfires on the capabilities of the infrastructure during bushfire emergencies. It should also be designed and maintained so that it will not serve as a bushfire risk to surrounding bush.
<i>Environment Protection and Biodiversity Act 1999 (Cth)</i>	The <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) is the primary piece of Federal legislation relating to the environment. Under the 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. <i>Consideration of the impact of the proposed activity on MNES has been provided in Keri Keri Wind Farm Biodiversity Development Assessment Report (ERM, 2024) (Appendix G of the EIS).</i>

Relevant Legislation/Guideline	Description
<i>Biodiversity Conservation Act 2016 (NSW)</i>	The <i>Biodiversity Conservation Act 2016</i> (BC Act) requires the consideration of threatened species and their habitats in the developmental planning process and a responsibility of the Applicant to determine potential impacts on listed species and Endangered Ecological Communities. Schedule 3 of the 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 TSC Act as Key Threatening Processes and need to be carefully considered and managed when implementing fire management activities. The Project Area contains threatened species that may be impacted by the Project. <i>Refer to Keri Keri Wind Farm Biodiversity Development Assessment Report (ERM 2024) for more detail on the habitat requirements and confirmed records of these species (Appendix G of the EIS).</i>

2.2 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Project-specific SEARs were issued on 14 April 2022. The Project was referred under the EPBC Act (EPBC Ref: 2022/9176) and was determined to be a controlled action on 2 May 2022. Supplementary SEARs were issued detailing the requirements under the Commonwealth EPBC Act for the Environmental Impact Statement (EIS).

The SEARS state the following with regard to bushfire risk:

'Bushfire – identify potential hazards and risks associated with bushfires / use of bushfire prone land, potential impacts on Yanga State Conservation Area including the risks that a wind farm would cause bush fire and any potential impacts on the aerial fighting of bushfires and demonstrate compliance with Planning for Bush Fire Protection 2019.'

Four Government agencies provided bushfire related advice on the SEARs, as reproduced in **Table 2-2** below.

TABLE 2-2 SEARs AGENCY ADVICE

Agency	Date	Advice	Where addressed
NSW Rural Fire Service	5 May 2022	The development application should incorporate a bush fire hazard assessment undertaken by a suitably qualified consultant to address the aims and objectives of PBP 2019 and the specific matters within section 8.3.5 - Wind and Solar Farms.	This report
Fire and Rescue NSW	31 March 2022	There is currently insufficient information available regarding the fire safety and emergency response management aspects of the project. FRNSW requests to be consulted and given the opportunity to review and provide comment regarding the proposed fire and life safety systems at the preliminary and final design phases of the project.	Section 2.3

Agency	Date	Advice	Where addressed
NSW Department of Primary Industries Agriculture (DPI Ag)	4 April 2022	The proposal is to detail contingency plans to enable the operation to deal with emergency situations. The proposal is to detail Emergency Management procedures and responsibilities for responding to bushfire threats and other possible hazardous events. A bushfire management plan and risk assessment should be undertaken.	Section 6

2.3 CONSULTATION

To inform the preparation of this bushfire risk assessment, ERM consulted with key local stakeholders to gain a better understanding of the local fire conditions and to ensure that management and mitigation measures are developed to meet the needs of those on the ground. All these stakeholders have been provided an opportunity to review the draft project layout and have been invited to provide input into the development of the recommended mitigation strategies.

A summary of the consultation is provided in **Table 2-3** below. A detailed consultation log is included within the EIS.

TABLE 2-3 SUMMARY OF KEY CONSULTATION [DRAFT]

Contact	Summary	Key Response/Action
NSW Rural Fire Service: Supervisor Development Assessment & Plan Built & Natural Environment	ERM sent an email to NSW RFS on 5 October 2022 providing the Project description and layout.	The advice provided by NSW RFS in their response dated 8 March 2023 was consistent with that provided in previous correspondence dated 5 May 2022 which stated that the development application should <i>'incorporate a bush fire hazard assessment undertaken by a suitably qualified consultant to address the aims and objectives of PBP 2019 and the specific matters within section 8.3.5 - Wind and Solar Farms'</i> . This advice has been addressed by way of this report.
NSW National Parks & Wildlife Service	Introductory Project letter sent via email by ERM on 5 October 2022.	No response received.

3. EXISTING CONDITIONS

In developing an understanding of existing conditions relating to bushfire risk, the following steps were undertaken:

- Determine whether the development area has been mapped as bushfire prone land (**Figure 3-1**) and whether the Project is in compliance with NSW RFS guidelines including PBP 2019;
- Identification of the assets within and surrounding the Project Area requiring protection (**Section 5.1**);
- Identification of the bushfire risk factors such as bushfire history and known bushfire behaviour in the Project Area and within the surrounding lands (**Section 5**);
- Potential impacts on Yanga State Conservation Area including consideration if the Project would cause bushfire risk and any potential impacts on the aerial fighting of bushfires (**Section 5**); and
- Produce risk mitigation and management treatments and satisfy PBP 2019 requirements (**Section 6**).

3.1 LOCALITY AND LAND USE CONTEXT

The Project Area is located within the rural locality of Keri Keri, NSW, approximately 680 km west of Sydney and within the Southwest Region of NSW near the border between NSW and Victoria. The Project Area is situated within the Murray River local government area (LGA), which formed in 2016 through the amalgamation of the former Murray Shire and Wakool Shire Councils. A section of the Project Area approximately 2.7 km in length is situated adjacent to the boundary of the Hay LGA.

The Project Area occupies approximately 18,012 ha and has predominately run Merino sheep for meat and wool production with some irregular cropping on a share farming basis. Properties surrounding the Project Area are also generally used for sheep grazing and irrigated cropping. Many of these contain an extensive network of irrigation channels.

The Project Area is entirely located on land zoned RU1 – Primary Production under the Wakool Local Environmental Plan (LEP). The surrounds are also zoned RU1 – Primary Production, except for the Yanga State Conservation Area to the west of the Project Area, which is zoned C1 – National Parks and Nature Reserves.

The rural locality of Keri Keri recorded a population of 10 people in 2016 (ABS, 2016). No count was provided in the 2021 Census as Keri Keri either had no people or a population too low to report in the Census. The Project Area is also located adjacent to small towns and localities including Maude to the north (population 110), and Yanga to the west (population 5) (ABS, 2021).

The closest population centre is the town of Balranald, NSW, which is located approximately 30 km to the north west of the Project Area (or 40 km by road). Balranald has a population of 1,240 (ABS, 2021) and is located at the intersection between the Sturt Highway and the Murrumbidgee River.

3.2 BUSHFIRE PRONE LAND

A review of the NSW RFS Bushfire Prone Land mapping confirms that the Project Area is not currently recognised as being bushfire prone (refer **Figure 3-1**). The nearest areas of bushfire prone land are located approximately 7.5 km east of the nearest turbine (WTG 50). It is noted that the Yanga State Conservation Area is located immediately west of the Project Area, which is not mapped as bushfire prone land though is considered a bushfire hazard as part of this assessment (refer **Section 5**).

Although the Project Area itself is not currently mapped as bushfire prone land, it is recognised that Category 3 vegetation (including but not limited to grasslands and freshwater wetlands) will likely be added to the bushfire prone land mapping at some stage to align with the requirements of the NSW RFS *Guide for Bush Fire Prone Land Mapping* (RFS, 2015).

This is supported by Murray River Council who report in the *Local Strategic Planning Statement 2020-2040* (MRC, 2020) that bushfire prone land mapping is subject to review in collaboration with NSW RFS; and have stated that this will likely result in a significant increase in bushfire-prone land in the Murray River LGA.

3.3 CURRENT BUSHFIRE MANAGEMENT CONTROLS

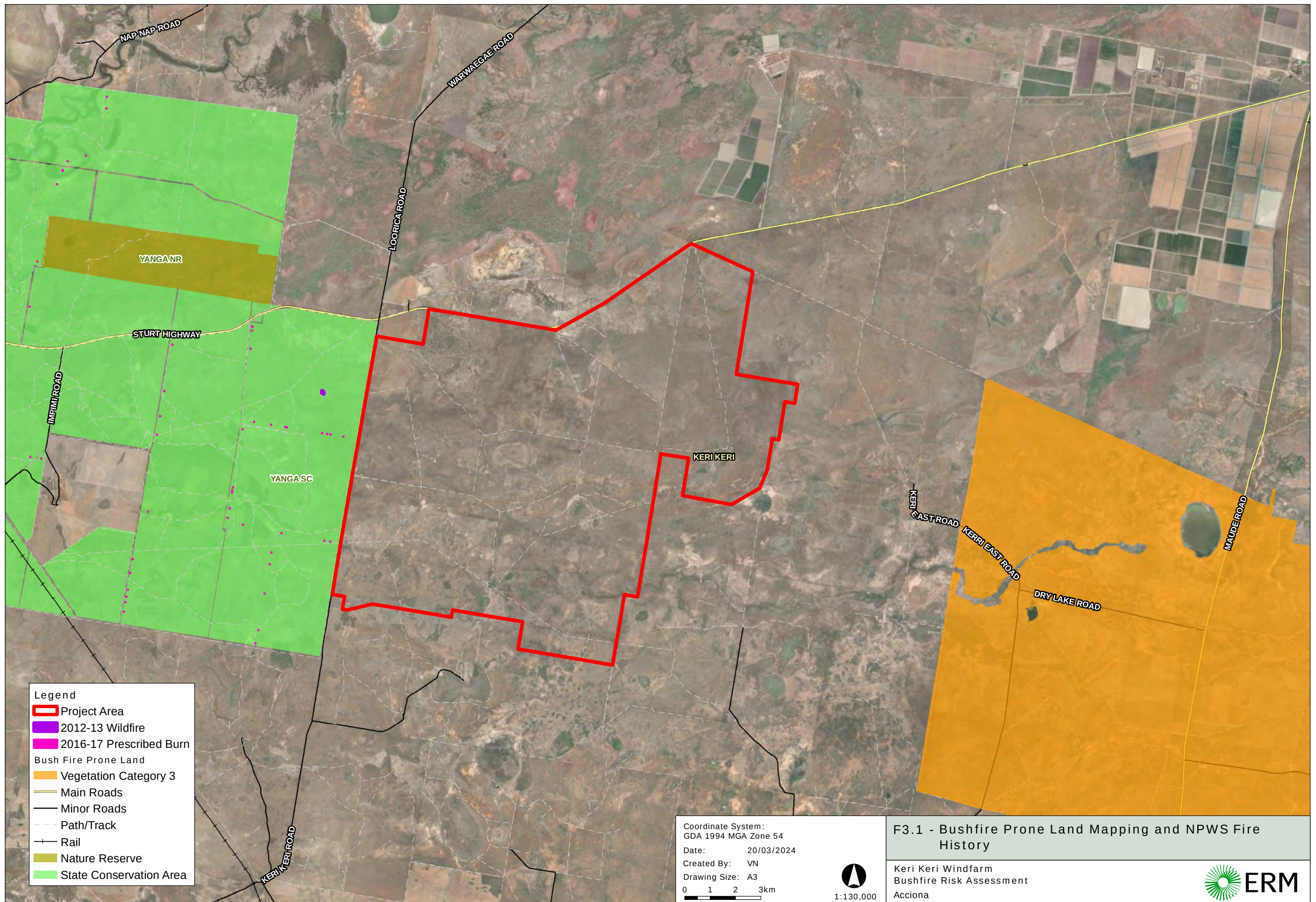
The existing land uses surrounding the Project Area are predominantly agricultural and current bushfire control is limited to general land management practices including maintenance of access tracks and consideration of fire danger ratings and total fire bans.

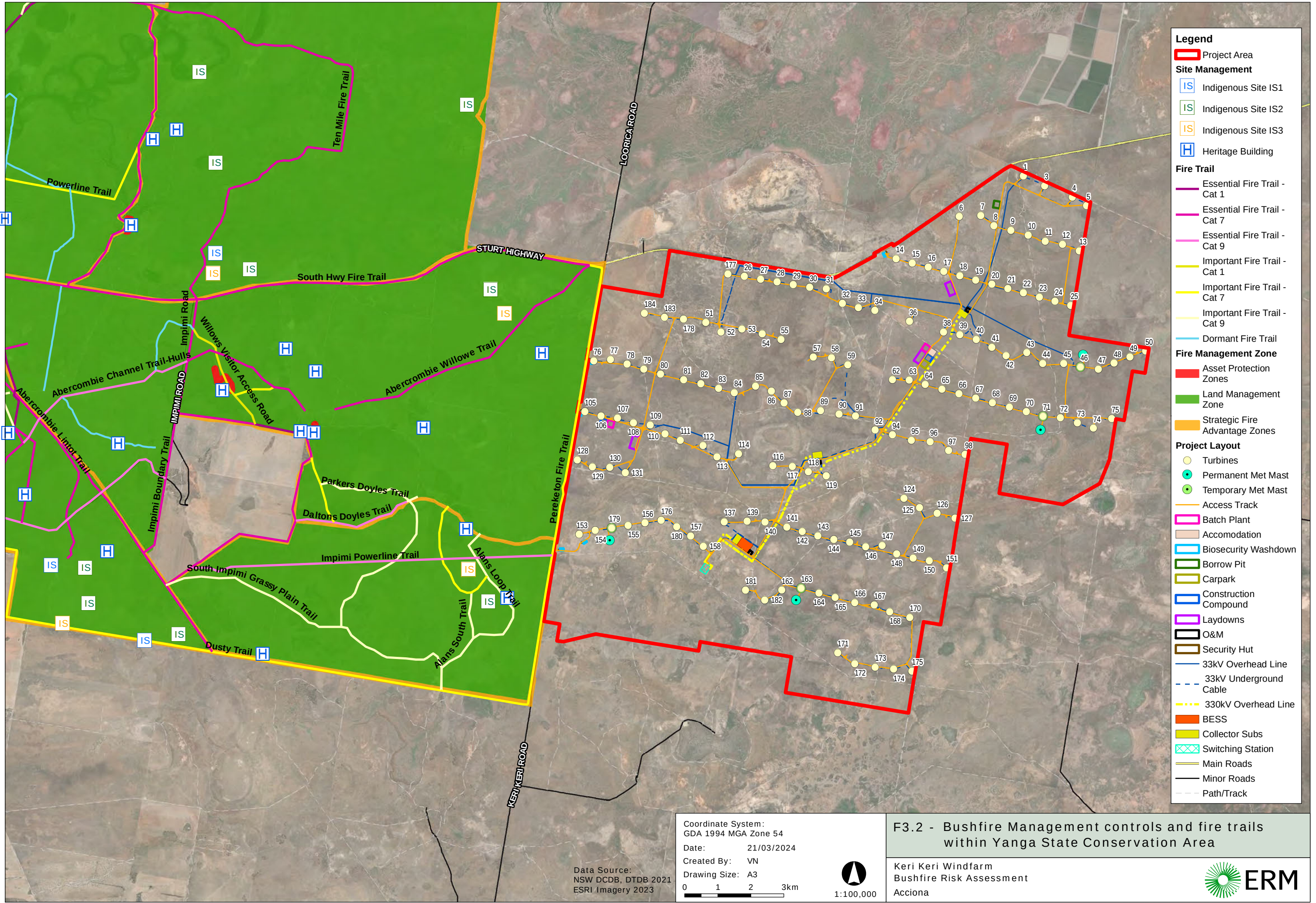
The relevant Bush Fire Risk Management Plan (BFRMP) for the Project is the Mid Murray Zone BFRMP (2009). No land within the Project Area is mapped as a bushfire management zone (refer **Appendix A**).

Yanga State Conservation Area is located to the west of the Project Area and is managed in accordance with the Yanga Precinct Fire Management Strategy (2014) (refer **Appendix A** and **Figure 3-2**). It is important that the construction and operation of the windfarm considers the existing bushfire management controls within the park and that access to all essential and important fire trails off Keri Keri Road remain open and accessible at all times, specifically:

- Perekerton Fire Trail;
- Abercrombie Willows Trail;
- South Highway Fire Trail;
- Parkers Trail; and
- Impimi Powerline Trail.

Consultation with NPWS and other key stakeholders will be ongoing during detailed design and during preparation of the bushfire management plan and traffic management plan and will consider the most current information available regarding fire risk from and to surrounding land uses. All roads within the wind farm will be designed to meet NSW RFS performance criteria and will complement the fire trail network already available within the adjoining Conservation Area.





- Legend**
- Project Area
 - Site Management**
 - Indigenous Site IS1
 - Indigenous Site IS2
 - Indigenous Site IS3
 - Heritage Building
 - Fire Trail**
 - Essential Fire Trail - Cat 1
 - Essential Fire Trail - Cat 7
 - Essential Fire Trail - Cat 9
 - Important Fire Trail - Cat 1
 - Important Fire Trail - Cat 7
 - Important Fire Trail - Cat 9
 - Dormant Fire Trail
 - Fire Management Zone**
 - Asset Protection Zones
 - Land Management Zone
 - Strategic Fire Advantage Zones
 - Project Layout**
 - Turbines
 - Permanent Met Mast
 - Temporary Met Mast
 - Access Track
 - Batch Plant
 - Accommodation
 - Biosecurity Washdown
 - Borrow Pit
 - Carpark
 - Construction Compound
 - Laydowns
 - O&M
 - Security Hut
 - 33kV Overhead Line
 - 33kV Underground Cable
 - 330kV Overhead Line
 - BESS
 - Collector Subs
 - Switching Station
 - Main Roads
 - Minor Roads
 - Path/Track

Coordinate System:
GDA 1994 MGA Zone 54
Date: 21/03/2024
Created By: VN
Drawing Size: A3
0 1 2 3km
1:100,000

Data Source:
NSW DCDB, DTDB 2021
ESRI Imagery 2023

F3.2 - Bushfire Management controls and fire trails within Yanga State Conservation Area

Keri Keri Windfarm
Bushfire Risk Assessment
Acciona



3.4 FIRE HISTORY

The Mid Murray Zone BFMC (2009) has reported that the zone has on average 250 bush/grass fires per year, of which six to 10 on average are major fires (refer **Section 4**). The main sources of ignition of bushfires in the Mid-Murray Zone BFMC are lightning strikes, unattended camp fires, power lines, machinery and traffic, escaped agricultural burns, and the use of cutting and welding equipment.

Recent Fire Extent and Severity Mapping (FESM) (accessed via NSW Seed) prepared by NSW RFS and DPE revealed there were no fire events within proximity to the Project Area which were >10 ha between the 2021/22 and 2019/20 fire year, or >100 ha between the 2018/19 and 2016/17 fire year.

There is a FESM record of a fire burning 14 km to the northwest of the Hay township in the 2016-2017 fire season. The fire was approximately 1,900 ha in size and resulted in a full canopy scorch (extreme severity rating) in some areas. This fire was recorded over 60 km to the northeast of the Project Area. The closest FESM record to the Project Area (40 km northeast) burned in the same year but was approximately 10–15% in size of the previous record. The fire resulted in mostly full canopy and partial canopy scorch.

Within Yanga State Conservation Area which adjoins the Project Area to the west, NPWS (2020) reports that ignitions are generally caused by lightning strikes in the form of dry lightning storms that occur frequently in the summer months. Since acquisition of Yanga Station by the NSW Government in 2005, wildfire ignitions have resulted in three fires of approximately 11 ha, one fire less than 3 ha, and one fire less than 1 ha. The closest fire to the Project Area (1.8 km west of WTG 76) occurred for two days in November 2012 and burnt 0.47 ha (Fire No. 12112759632, The Willows) (refer **Figure 3-1**). The cause of the fire was attributed to lighting.

The forested wetlands on the western perimeter of Yanga National Park and the Murrumbidgee River are noted to greatly reduce the potential for fires entering from or escaping into neighbouring farming properties. While there is greater potential for fires to enter the parks from the east and south, NPWS consider this low risk as the trend for fires in the region is to run from west to east (NPWS, 2020).

The Yanga Precinct Fire Management Strategy (OEH, 2014) (refer **Appendix A**) acknowledges that while fire history data in Yanga State Conservation Area is incomplete, there are no verbal or recorded history of large scale fires occurring across the reserve area.

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 the peak bushfire season varies across the country relative to changes in seasonal weather patterns. In New South Wales, peak bushfire season is generally from spring to mid-summer. Within the Murray River region, the bushfire season generally runs from October-November through to March-April depending on seasonal conditions (Mid Murray Zone BFMC, 2009). This is consistent with the statutory Bushfire Danger Period which generally runs from 1 October to 31 March each year.

As described by the Bureau of Meteorology (BOM, 2023), the greatest danger in NSW occurs following a dry winter and spring (as seen in the 2019-20 Black Summer fires). 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 and lighter winds.

Prevailing weather conditions associated with the bushfire season, as reported by the Mid Murray Zone Bush Fire Management Committee (BFMC) (2009), are winds from the west around to the north accompanied by high daytime temperatures and low relative humidity. Dry lightning storms occur frequently during the bushfire season, often starting forest and grass fires. Data from a BOM weather station in the vicinity of the Project Area (Balranald RSL Station No: 049002) confirms that both low humidity and high temperature occur within the bushfire season and would contribute to the fire hazard within this region (refer to **Figure 3-3**).

FIGURE 3-3 LOW HUMIDITY AND HIGH TEMPERATURE WITHIN THE BUSHFIRE SEASON

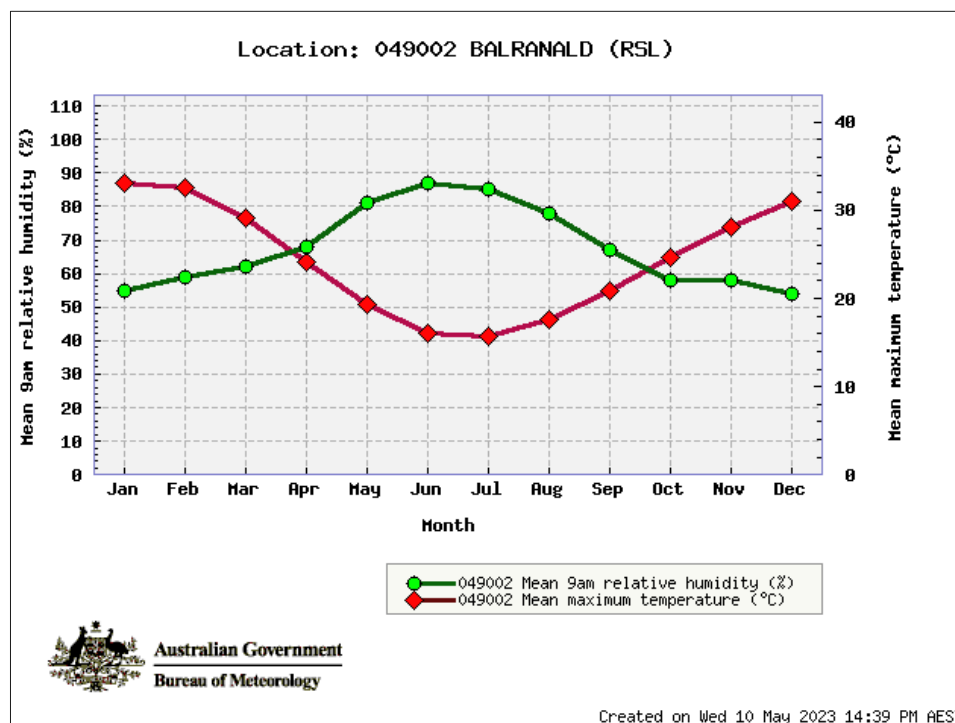


FIGURE 3-4 BALRANALD (STATION NO. 049002) WIND ROSE: 1993-2023 (MEAN 9AM)

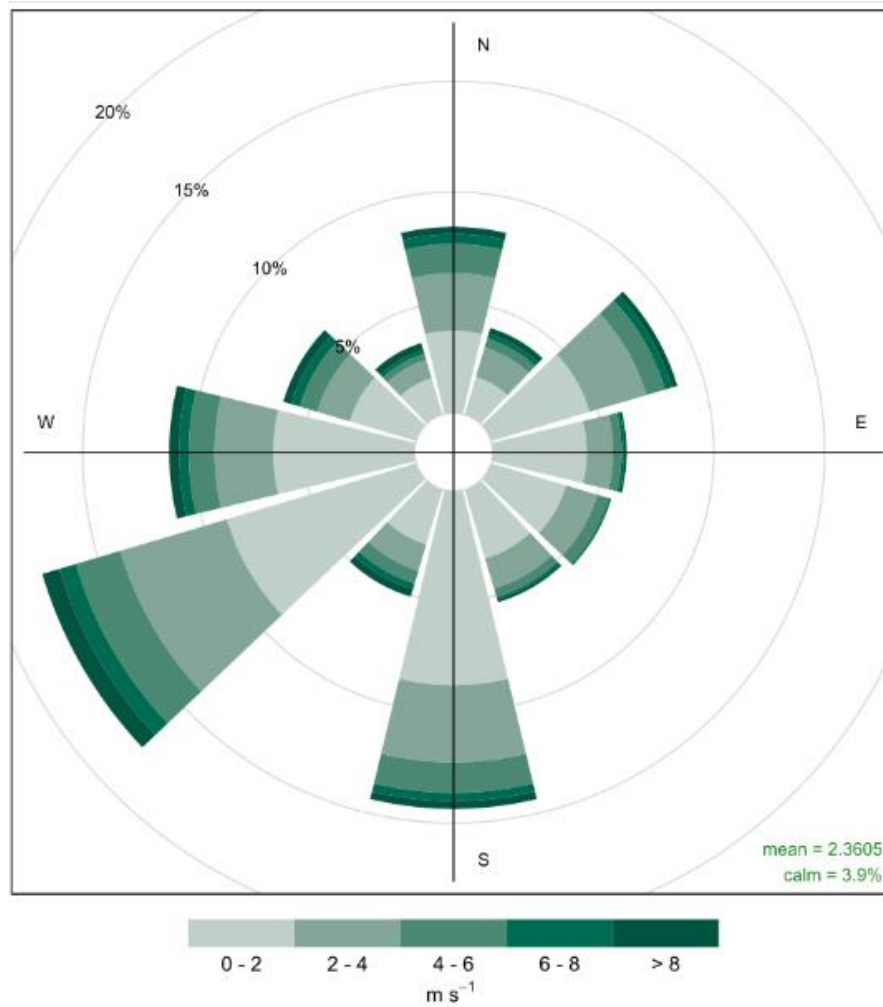
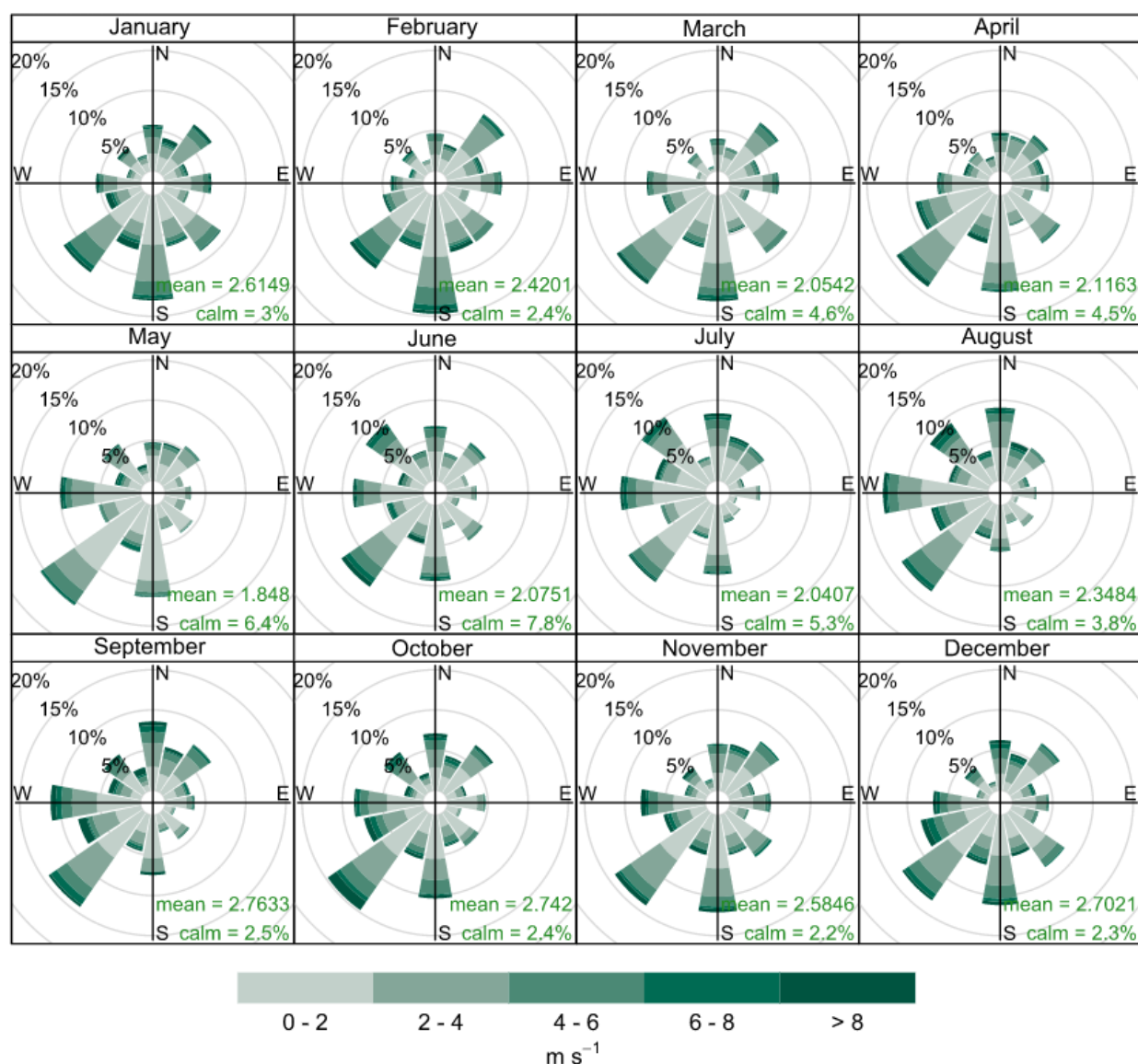


FIGURE 3-5 BALRANALD (STATION NO. 049002) WIND ROSE: 1993-2023 (MEAN 9AM, MONTHLY)



3.6 SLOPE

Slope and wind are often the major factors determining the direction of fire spread. 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.

The Project Area is situated within the Hay Plains, which is characterised by a relatively flat topography with low relief and slight variation to elevations, which generally differs by only a few metres.

3.7 VEGETATION HAZARD

Descriptions of the vegetation types including species composition and structural diversity is provided in Keri Keri Wind Farm Biodiversity Development Assessment Report (ERM, 2024) (refer Appendix G of the EIS).

Vegetation growth can be encouraged by periods of wet weather, which can increase the amount of fuel available (e.g., grass, leaf litter, twigs, bark). When the weather is hot, the humidity low and there's 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.

The vegetation classifications are shown in **Table 3-1** and **Figure 3-6** and for the purposes of this bushfire risk assessment, they have been simplified in line with the vegetation formations as per Keith (2004). The dominant vegetation types across the Project Area that would influence fire behaviour are Riverine Chenopod shrublands and Riverine grasslands, with isolated pockets of Sandhill woodlands and shrublands. Chenopod shrublands are less flammable than most other vegetation and are fire-sensitive.

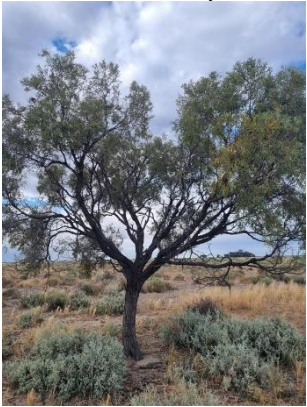
Most of the Project Area has some level of management by grazing. Fuel load is dependent on several factors including the amount of rainfall in the spring period leading to abundant growth of grasses in summer as well as the stock loading across the various paddocks which will vary across years and seasons. It is intended that the vegetation fuel around the turbines (hardstands), within the overhead transmission line easements and access tracks will continue be maintained in a low fuel state by mechanical or manual clearing methods. Ongoing grazing may also be considered within the windfarm and use of herbicides would only be used in consultation with the landowners. Refer to **Section 6.1** for detailed description of the recommended APZ.

The assessment of dominant fuel hazard has been determined for grazed grassland across the entire Project Area. The smaller patches of woodland, whilst recognized as a higher hazard vegetation, are not the dominant vegetation type that would carry a fire across this site.

The proposed Accommodation Compound is also located greater than 1 km to areas of mapped woodland vegetation and the dominant vegetation affecting this infrastructure is also noted to be grazed grassland and Chenopod Shrubland.

TABLE 3-1 DESCRIPTION AND CHARACTERISTICS OF FUEL GROUPS WITHIN THE PROJECT AREA

Vegetation Formation^{1, 2}	Area within the Project Area	Bushfire Characteristics³	Overall Fuel Load⁴
Arid Shrublands (Chenopod sub-formation) (Aeolian Chenopod Shrublands) 	297.32 ha	Mid-high open shrubland generally less than one meter high dominated by Black Bluebush (<i>Maireana pyramidata</i>) which may be dominant. It is likely that intense fire would kill bluebush. This community very rarely burns. Wildfires may burn the landscape, perhaps every 50-150 years.	3.2 t/ha
Semi-arid Woodland (Grassy sub-formation) (Inland Floodplain Woodlands) 	11.74 ha	Lignum shrubland wetland of the semi-arid (warm) plains (mainly Riverina Bioregion and Murray Darling Depression Bioregion). Occurs on black, brown and grey-cracking clay soils and clay loam soils in river channels and depressions on floodplains subject to regular flooding in south-western NSW extending into Victoria and South Australia mainly in the semi-arid (warm) climate zone. Ground cover varies depending on flooding regimes and grazing pressure. Some landholders burn Lignum to promote herbaceous ground cover for stock grazing but frequent fire can kill it but it can survive occasional fire by resprouting. An appropriate inter-fire period may be in the order of several decades.	9.0 t/ha
Freshwater Wetlands (Inland Floodplain Shrublands) 	406.16 ha	Freshwater wetlands are ecosystems that are affected by permanent or temporary inundation. There is considerable floristic variation across its range and soils are red-grey compact clay or sandy clay that crack very little. These soils form claypans that pond from local runoff after rain. Little ground cover is present to carry a fire - dense stands may occasionally burn.	4.4 t/ha

Vegetation Formation ^{1, 2}	Area within the Project Area	Bushfire Characteristics ³	Overall Fuel Load ⁴
Arid Shrublands (Riverine Chenopod Shrublands) 	16,009.24 ha	Arid shrublands occur in arid and semi-arid regions of western NSW, where limited, sporadic rainfall and low soil moisture are unable to support tree-dominated vegetation. Chenopod shrublands have low flammability, although occasional summer wildfires occur after spring rain. They are considered extremely fire-sensitive. Chenopod species are mostly obligate seeders with only local seed dispersal and no effective post-fire seedbank.	3.2 t/ha
Grasslands (Riverine Plain Grassland) 	1,135.96 ha	Typically displays as a grassland, with a species-rich, moderately dense shrub layer and ground cover that is predominantly native forbs and a mix of native and exotic grasses. Grazing and fire affects species composition and abundance. Species composition alters with the seasons and from year to year depending on rainfall. Legumes such as Swainsona appear to germinate profusely after fire but intense frequent fire is likely to eliminate some chenopod shrubs. All grasslands are capable of sustaining a fire. They are unpredictable, can start easily and spread quickly.	6 t/ha
Semi-arid Woodland (Grassy sub-formation) (Riverine Plain Woodlands) 	0.65 ha	Mid-high open woodland up to 8 m high dominated by Weeping Myall (Acacia pendula). The ground cover may be dense or sparse depending on rainfall. Occurs on brown clays or loam soils on alluvial plains mainly in the Riverina and NSW South-western Slopes Bioregions of south-western NSW. Response to fire is unknown, the seed of Acacia pendula is long-lived and may germinate after fire.	9.0 t/ha

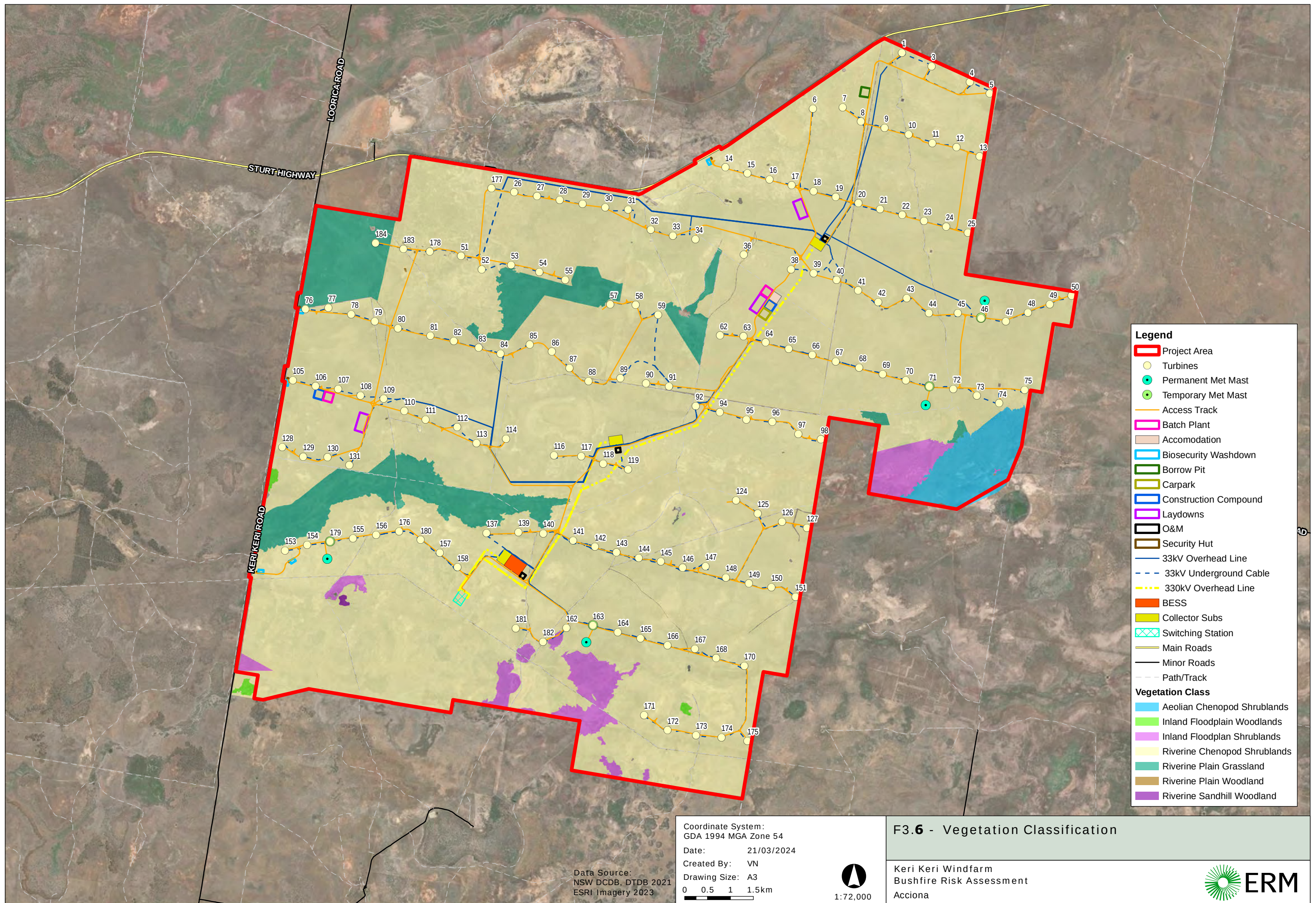
Vegetation Formation ^{1, 2}	Area within the Project Area	Bushfire Characteristics ³	Overall Fuel Load ⁴
Semi-arid Woodland (Shrubby sub-formation) (Riverine Sandhill Woodland) 	4.14 ha	Open woodland or a derived grassland with scattered trees up to 15 m high. Occurs on sandy loam soils. Often present in a mosaic with Belah - Western Rosewood, Acacia or Eucalyptus communities. Few sites are in good condition due to grazing and clearing. Intense fire may kill Callitris. Fire rarely burns remnants due to lack of ground cover and fragmentation of remnants.	14.5 t/ha

1. Keith (2004) *From ocean shores to desert dunes: the vegetation of New South Wales and the ACT*.

2. DPE (2023) *Online Vegetation Formation Profiles*. <https://www.environment.nsw.gov.au/threatenedSpeciesApp/>

3. DPE (2023) *Bionet Vegetation Classification Database*. <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet/about-bionet-vegetation-classification>

4. Fuel loads are expressed in tonnes per hectare as per NSW RFS – *Comprehensive Vegetation Fuel Loads* (NSW Rural Fire Service, 2019)



3.8 INDICATIVE FIRE BEHAVIOUR

While not identified on the current bushfire prone land mapping, grassfires should not be underestimated and can start and spread quickly. It should be assumed that, under the most extreme weather, a fire would spread even in heavily grazed pastures and embers may breach any APZ. For this reason, we have considered all the native vegetation communities across the Project Area as a bushfire hazard and minimum APZ have been recommended for all wind farm infrastructure.

Grassfires are the main bushfire risk at this site due to the dominance of Chenopod shrublands and Riverine Plain grassland and 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.

As described by AFAC (2022) grass fuel load has a strong influence on flame size, flaming duration, radiation output and suppression difficulty. Grass fuel types are divided into three main fuel conditions in the Australian Fire Danger Rating System (AFDRS) system:

1. Undisturbed or natural (i.e. uncut and/or ungrazed);
2. Grazed or cut; and
3. Eaten-out or very heavily grazed grasslands.

The Fire Behaviour Index (FBI) assists operational decision making and provides a scale of potential fire danger (should a fire start) based on the predicted rate of fire spread. Based on the overall fuel load and reduced flammability of the Chenopod shrublands as identified in **Table 3-1** and **Table 3-2**, the Wind Farm Project Area has a low to moderate bushfire danger rating.

TABLE 3-2 FIRE BEHAVIOUR INDEX, GRAZED PASTURE

Dominant Vegetation Formation ¹	Overall Fuel Load ²	Fire Behaviour Index ³	Fire Danger Rating ³
Arid Shrublands (Chenopod Shrublands)	3.2 t/ha	11	Low
Grasslands (Riverine Plain Grassland)	6 t/ha	15	Moderate

1. Keith (2004) *From ocean shores to desert dunes: the vegetation of New South Wales and the ACT*.
2. Fuel loads are expressed in tonnes per hectare as per NSW RFS – *Comprehensive Vegetation Fuel Loads* (NSW RFS 2019)
3. CSIRO Grassland Fire Spread Model available online <https://aurora.landgate.wa.gov.au/fbc/#!/csiro-grass>. Input values: grass continuity: discontinuous; temperature 30 °C; relative humidity 30%; windspeed at 10m height 20 km/h; curing 60%; slope 0 degrees.

TABLE 3-3 GRASSLAND, FIRE BEHAVIOUR INDEX

Fire Behaviour Index	Fire Danger Rating ³	Fire Suppression and Containment	Potential for Impact
0-5	Low	Fire difficult to ignite and sustain. Fires generally unlikely to spread and likely to self-extinguish.	Community losses are unlikely.
6-11	Low	Fire easily sustained. Typically wind driven fires that can spread quickly. Fires usually contained within road networks and fuel breaks	Community losses are unlikely however unattended infrastructure may be at risk.
12-23	Moderate	Typically wind driven and rapidly spreading fires with the potential to gain size quickly. Fires typically controlled within established road networks and fuel breaks together with using direct, indirect or parallel attack suppression strategies.	Possible agricultural/pasture/crop/stock losses together with loss of rural assets such as fencing, machinery and buildings. Unattended infrastructure may be at risk.
24-49	High	Wind driven, rapidly spreading fires with potential for development into large fire area/size and with the potential for short distance spotting and long flame lengths. Increasing focus on defensive suppression strategies.	High likelihood of agricultural/pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing, machinery and buildings.
50-99	Extreme	Extremely rapid fire growth and increasing likelihood of large final fire area/size. Possibility for fire behaviour to become erratic and plume driven. High levels of threat to life and property. Elevated risk to firefighter safety	Increasingly high likelihood of agricultural/pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing, machinery and buildings. Limited visibility due to smoke and dust. High risk to the community related to inappropriate pre-considered plans, inadequate sheltering. Strong winds are likely to impact infrastructure (e.g. power lines) and fall trees increasing the likelihood of obstructed roads and power outages.
100+	Catastrophic	Extremely rapid fire growth and high likelihood of large final fire area/size. Possibility for fire behaviour to become erratic and plume driven. Fire control is extremely difficult and unlikely until conditions ease.	High probability of loss of life and property

Source: <https://www.afac.com.au/docs/default-source/afdrs/afdrs-quick-guide---grassland.pdf>

4. HISTORY OF FIRE AND WIND FARMS IN AUSTRALIA

A review of available literature identifies that there have been seven reported fires involving wind farms in Australia:

- Ten Mile Lagoon in Western Australia in the mid-1990s. Damage limited to the relevant turbines, no damage to surrounding environment. Involved technology that is now redundant;
- Lake Bonney in South Australia in 2006. This fire was related to maintenance works during a shutdown. Damage limited to the relevant turbines, no damage to surrounding environment (Renate Metzger, 2011);
- The Star Fish Hill Wind Farm near Cape Jervis in South Australia experienced a turbine fire in October 2010. The turbine was damaged and surrounding spot fires were extinguished. The blades did not cease rotating in this instance, compounding the firefighting response due to the exclusion perimeter that was established and the spot fires due to flames coming off the rotating blades (The Courier, 2012);
- The Currandooley Fire in January 2017 was caused when a crow connected with overhead electrical infrastructure, caught alight and dropped into dry foliage underneath a power line that transfers electricity from Infigen's Woodlawn Wind Farm to a substation at their Capital Wind Farm in NSW. The fire burnt approximately 3,400 hectares and was subject to a class action (The Canberra Times, 2017);
- The Cullerin Wind Farm near Gunning, NSW in January 2023 was caused by an electrical fire in the turbine generator. The RFS were immediately notified and attended the scene until the fire was safely extinguished later that morning (ABC, 2023);
- Turbine fires occurred at Cathedral Rocks Wind Farm, South Australia, in February 2009 and January 2023. In the 2009 event, the turbine was damaged and surrounding spot fires required extinguishing (Parsons Brinckerhoff, 2012). The motor of the wind turbine is believed to have been the ignition point of the 2023 event, with two blades also burning. Debris from the turbine sparked a small grass fire approximately 150 m in length below (CFS SA, 2023); and
- in February 2024, a turbine fire detected at Clements Gap Wind Farm in South Australia. Smoke from the turbine was spotted by a maintenance crew and emergency services were alerted to the incident immediately. Firefighters were required to put out multiple spot fires caused by falling debris which burnt around 30 ha of grassland. The cause of the fire has not yet been reported.

Another example of a fire that impacted on a wind farm (as opposed to the previous examples that involved wind farm infrastructure) is that a bushfire started on a paddock near the Waterloo Wind Farm in South Australia. Fanned by gusty westerly and north westerly winds, the fire quickly spread through the area and raced up the ridge where the wind farm was located. Two-hundred Country Fire Service volunteers were involved in firefighting operations and were supported by three water bombing aircraft. The wind farm operator confirmed that there was no damage to any wind farm infrastructure and no danger at any time to human life as a result of the fire. Normal wind farm operations resumed once the Country Fire Service advised the operator that it was safe to do so. Similarly, a bushfire near Taralga Wind Farm in January 2018 was attended by NSW RFS firefighting teams on the ground, supported by firefighting aircraft and heavy plant. Turbines were shut down to assist aerial firefighting and no injuries to staff or damage to the wind farm was reported.

Several learnings for emergency management procedures and protocols in relation to wind farms and bushfires have been reported by AFAC (2018) and Clean Energy Council (2017). These include:

- The wind farm's access tracks were beneficial in helping fight the bushfire on the ground and provided an effective firebreak;
- The wind farm's turbines did not present a hazard to aerial firefighting and the turbines were clearly visible to the pilots involved in operations. However, transmission infrastructure, transmission lines and meteorological masts were difficult to see by pilots and did pose a safety risk;
- To maximise air space for firefighting between the turbines, turbines should be locked in the 'Y' position;
- Improved communication protocols need to be in place between wind farm operators and fire and land management agencies to direct turbine shut-down procedures in an emergency situation and initiate emergency response plans;
- Wind farm operators should ensure that they have the capacity to respond to emergency events; and
- Additional precautionary measures should be considered to allow for aerial identification of meteorological masts (measurement towers), guy wires and other infrastructure such as transmission lines that are not easily visible from air.

The Australia Institute (2006) describe the fire risk associated with wind farms as minuscule provided the wind farm is properly constructed and managed. They determine fires caused by wind turbines are very rare and pose little risk to surrounding property. While it is possible for a catastrophic failure to cause fire within the turbine mechanism, the system is designed to contain fire and the likelihood of fire commencing from a tower equipment failure is much lower than from a faulty header or other farm machinery. The Government of South Australia (2004) also concluded that with normal maintenance and servicing practices in place, a wind farm will not pose an increased fire hazard to the host community and further that there has never been an incident involving a member of the public during normal operation.

Sophisticated monitoring technology is used to ensure that electrical, mechanical and hydraulic systems are functioning correctly and to isolate equipment if operating thresholds such as temperature or blade speed are reached (Government of South Australia 2004). Instances of extreme wind have been linked to wind turbine fire due to friction generated by the excessive speed of the blades (Government of South Australia 2004). Fire hazards can present when turbine bearings wear out, crankcases run out of lubricant, cables are damaged during rotation, there are electrical shorts or electrical arcing occurs in the transmission and distribution facilities (Government of South Australia 2004). This highlights the importance of scheduled and preventative maintenance routines as well as monitoring systems.

5. BUSHFIRE RISK

5.1 CLIMATE CHANGE AND BUSHFIRES

Eastern Australia is described as one of the most bushfire-prone areas in the world. BOM (2023), states that 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. 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). Additionally, there has recently been several devastating fire events in Australia associated with extreme pyroconvection (including thunderstorm development in a fire plume), with recent research indicating a long-term trend towards increased risk factors associated with pyroconvection in southeast Australia.

Bushfire weather conditions in future years are projected to increase in severity for many regions. 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.

5.2 FIRE IGNITION

Bushfires are common in the region surrounding the Project, and natural ignitions such as lightning strikes are the common cause of these. Other potential causes of fires in the area are human induced ignitions (both accidental and arson), extreme heat leading to deterioration of equipment, and equipment malfunctions (e.g., damaged or poorly installation equipment). Notably, there are no ignition occurrence records for the Project Area that provide statistical validity or a guide to likelihood of ignition at the site.

Importantly, the risk of fire starting because of a lightning strike may be reduced by the presence of wind turbines (AFAC, 2018). Wind turbines include an in-built lightning protection system which safely dissipates the electricity from the blades or the nacelle to the ground. Wind turbines also have a variety of in-built control systems specifically designed to mitigate the risk of fire. Each wind turbine is connected to a control centre which constantly monitors the wind turbine and shuts down the turbines if there is a risk of overheating. In-built controls will also automatically shut down a wind turbine if its operation nears the limits of its design conditions such as wind speeds greater than 25 m/s. WTG towers are also made from non-combustible material.

Earth moving equipment, power tools (e.g., welders, grinders), mowers and slashers are well known for starting bushfires under conditions of high temperature, low humidity and high wind. Therefore, construction and ongoing maintenance of the wind farm will be a potential source of ignitions.

As evidenced by the Currandooley fire in 2017 (refer **Section 4**), bird flashover faults on high voltage power lines can also cause bushfires when fuel conditions beneath the fault location are conducive to fire ignition and spread. This risk can be reduced by maintaining reduced fuel loads beneath transmission lines.

5.3 IDENTIFICATION OF ASSETS

Assets within and surrounding the Project Area are shown in **Figure 1-1** and **Figure 1-2** and described in **Table 5-1** below.

A detailed description of the Project components is provided in Section 3 of the EIS (ERM, 2024), noting that this assessment does not address the individual design or engineering components of the turbines (or other infrastructure). Electrical hazards including battery fires, turbine fires and transformer fires are addressed separately as part of the Preliminary Hazard Assessment (Appendix P of EIS) and are not included here.

All these assets, including the wind farm infrastructure may be exposed to bushfire impacts.

TABLE 5-1 IDENTIFICATION OF ASSETS

Asset	Description
Assets within the Project Area	
Project Infrastructure	<u>Wind Turbine Generators</u> The WTG model selected for the Project is the Nordex N163-5.X with the following specifications: • Power: 5.7 Megawatts (MW) • Rotor diameter: 183 m • Blade length: 91.5 m • Tip height: 291.5 m • Tower (hub) height: 200 m • WTG hardstand: Approx. 2.83 ha per WTG required for construction. Approx. 0.67 ha per WTG during operation after rehabilitation.
	<u>Meteorological Monitoring Mast</u> The Project includes the commissioning and decommissioning of four temporary meteorological monitoring masts (met mast) for power testing, and installation of up to four permanent met masts. The permanent met masts will be located close to a WTG location and will have a maximum height of approximately 159 m AGL. The sensor height dimensions are approximately 159 m on a 3 m by 3 m concrete foundation. The met masts consist of a buried concrete base foundation and guy wires which are attached to buried anchor points. These will be marked using three-dimensional coloured objects attached to the wire or cables (for example spheres or pyramids) if necessary. The Project also includes the decommissioning and removal of four existing met masts used during project development to measure the wind resource within the Project Area.
	<u>Permanent Operations and Maintenance Facilities (O&M facilities)</u> Three permanent site O&M facilities will be constructed to provide for all operations and maintenance activities associated with the Project. The buildings of the O&M facility will contain the control room, switch room, and storage shed with workshops. The control room will contain an office, communications equipment, and staff amenities (toilet, kitchen, first aid, potable water supply, etc.). During

Asset	Description
	the long-term operational phase, the O&M facilities collectively will cater for up to 12 permanent staff. <u>Overhead Transmission Line Connection</u> A 330 kV overhead transmission line connection of approximately 20.0 km is proposed to connect the Project to the grid. The Applicant intends to bid for access rights to the proposed NSW-SA interconnector, Project EnergyConnect. For the safe operation of the transmission line, certain activities will be restricted within the easement such as planting and growing trees, construction of buildings, or erection of antennae or masts. While it has not been confirmed how the easement will be formally registered, for the purposes of this bushfire risk assessment, key responsibilities and management measures will be applied in accordance with the relevant guiding plans. <u>33 kV Electrical Reticulation</u> Each of the 155 WTGs will be connected to the onsite substations via overhead and underground 33 kV electrical cables. The total length of underground 33 kV electrical reticulation is 175.3 km, and the total length of 33 kV overhead electrical reticulation is 64.5 km. The trenching for underground cabling will be approximately 0.6 m wide per circuit by 1.0 m deep. Where ground conditions are not suitable for open cut trench installation for the overhead cables, overhead single circuit electricity lines will be installed using concrete poles. <u>Onsite Substations</u> Three 330 kV substations (one main and two collector substations) will be constructed in the Project Area to transform the 33 kV received from the internal electrical reticulation network to the 330 kV transmission voltage. The primary purpose of an electrical substation is the reception, transformation and distribution of electrical power and energy. The electrical substations will house a series of transformers, switch gear, and ancillary equipment for the transformation and distribution of energy. <u>Electrical Switchyard</u> An electrical switchyard (including circuit breakers, switches and other ancillary equipment) will be constructed to provide connection to the planned NSW-SA interconnector <u>Battery Energy Storage System (BESS)</u> The Project includes the installation of a lithium-ion battery energy storage system (BESS) of up to 200MW/800MWh with approximately four hours of storage (subject to detailed economic and technical considerations). The BESS will likely utilise a pre-assembled and pre-tested, fully integrated system that includes the battery modules, inverters, thermal management system, circuit breakers and other controls. The model and design specification of the BESS will be determined during detailed design. However, the final model and design specifications will remain within the specifications assessed under the SEPP Resilience and Hazards in the Preliminary Hazard Analysis (PHA) (Arriscar, 2023).
Site Access and Internal Access Tracks	Site access is proposed off Keri Keri Road and Sturt Highway which will connect to a network of internal access tracks (refer Figure 1-2). The internal access tracks will provide for ongoing access to the WTGs and other Project infrastructure including the transmission line during the operation of the Project. The internal access tracks will typically be 5.5 m trafficable width on straights, with localised widening on curves and where required to support transportation of the over-dimensional WTG component vehicles. The internal access tracks will be constructed using unsealed pavements and will be generally in accordance with the Australian Road Research Board Unsealed Roads Manual.

Asset	Description
Temporary Facilities	Construction of the Project will require a range of temporary buildings and facilities for construction personnel and equipment. These will include a construction compound (including site offices, car parking, and amenities for the construction work force), mobile concrete batching plants, laydown and storage areas for the temporary storage of construction materials, plant, equipment and WTG components, and temporary power supply for construction.
Residential Properties and Farms	For the purposes of the EIS, dwellings whose owners are hosting Project infrastructure or have entered into an agreement in relation to the Project are referred to as 'associated' dwellings with all other dwellings within the relevant assessment area (generally up to 8.0 km) to a WTG referred to as 'non-associated' dwellings.

Assets Surrounding the Project Area

Residential Properties and Farms	There are two non-associated dwellings within 3.1 km of a WTG; zero non-associated dwellings between 3.1 km and 4.55 km of a WTG; and nine non-associated dwellings between 4.55 km and 8.0 km of a WTG (refer Section 3.2.3 of EIS).
Potential Dwellings	Based on a review of publicly available development application records on the Hay Council and Murray River Council websites as at 20 February 2024 the following approved or under assessment dwellings occur within a 5 km radius of a proposed turbine: • There have been no dwellings approved in the past five years; and • One development application for 1543 Tchelery Road, Moulamein is currently 'determined' (PAN-266654) and one under 'review of determination' (PAN-281738). It is noted that 1543 Tchelery Road, Moulamein is a host landowner for the proposed Baldon Wind Farm directly east of the Project Area.
National Parks and Conservation Areas	Yanga National Park, Yanga State Conservation Area and Yanga Nature Reserve, collectively referred to as the 'Yanga Parks' lies to the west and north-west of the Project Area. Yanga Parks is also within the administrative areas of Balranald Local Aboriginal Land Council, Mid Murray Bush Fire Management Committee and Murray Local Land Services (NPWS, 2020). A Fire Management Strategy has been prepared for Yanga Parks by NPWS (2014) and is provided in Appendix A . The strategy outlines recent fire history, key assets within and adjoining the parks, fire management zones and fire control advantages such as management trails and water supply points. It also contains fire regime guidelines for conservation of the parks' vegetation communities.
Crown Land	No Crown Lands are within the Project Area, but there are several Crown paper roads.

5.4 FIREFIGHTER AND PUBLIC SAFETY

The firefighters likely to respond to a bushfire in this area would be volunteers from the NSW RFS, NPWS and / or individual property owners.

The materials for individual components within the wind farm infrastructure have not yet been finalised, therefore, the flammability and toxicity of burning components have not been determined in detail, although this information may form part of the recommended Bushfire Emergency Management and Operations Plan that will be developed prior to construction. The risks to firefighter safety associated with a fire burning the turbines and associated equipment include inhalation of potentially toxic fumes and smoke from any plastic components such as cables (although the main structure of the WTG will be steel or concrete/steel hybrid) or other decomposed products (Allianz Risk Consulting, 2012).

Any volunteer firefighters from the NSW RFS, NPWS or property owners from neighbouring farms attending bushfires in this area may not be trained in structural and electrical firefighting. The Bushfire Emergency Management and Operations Plan will detail appropriate risk control measures that would need to be implemented to safely mitigate potential risks to the health and safety of the firefighters and first responders. At least two copies of the Emergency Management and Operations Plan will be stored in an Emergency Information Cabinet located at the main entrance points and will be accessible to all first responders. Two copies of the Emergency Management and Operations Plan will also be stored within the operations facilities and one at the NSW RFS Balranald Brigade office. This plan will be prepared in consultation with NSW RFS and NPWS and will consider the existing fire management regimes within the National Parks estates as detailed in the Yanga Precincts Fire Management Strategy (OEH, 2014) (refer **Appendix A**).

As reported by AFAC (2018) wind farms can interfere with local and regional radio transmissions by physical obstruction and radio frequency electromagnetic radiation (Australian Wind Energy Association, 2004). The risk of radio communications affecting emergency response operations has been assessed in the Electro-Magnetic Interference (EMI) Assessment prepared by Middleton Group and provided as Appendix N to the EIS. Based on assessment, the Project is not expected to have a material impact on telecommunication services.

The combination of dense smoke and hot gases generated by a large fire directly under or near a high voltage power line can create a conductive path that increases the potential for a 'flashover'. The National Guidelines on Electrical Safety for Emergency Personnel provide critical information relating specifically to fire control near high voltage power lines, including the special conditions that apply to the use of water in fire control activities near power lines. This industry code will be considered in the preparation of the Bushfire Emergency Management and Operations Plan.

The increased risk of arcing in dense smoke has been considered. In terms of arcing potential, the WTGs will have a detection system that protects them from surges, arcing and other electrical hazards. Arcing would be detected, and electrical systems shut off if these persisted over several split seconds.

Most of the electrical reticulation will be underground however in areas where overhead transmission is required, similar detection systems to the above will be installed to monitor changes over split seconds and within tight bands. Automatic Circuit Breakers at either end of the lines would open to stop transmission of electricity if any arcing is detected.

If a fire does breach any containment lines and threatens the wind farm assets, it is possible that the windfarm infrastructure will sustain direct flame contact and that firefighting will require aerial support. Aerial support was used during the catastrophic 2019/2020 fires across NSW and Aviation Projects (2024) recommends that the Proponent consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the Project site.

Wind turbines, like high voltage transmission lines, are part of the landscape and would be considered in the incident action plan and NSW RFS would be provided with maps and GPS coordinates of the final wind turbine layout and identification information for individual wind turbine sites for their internal response planning. Any risk of wake turbulence from wind turbines influencing fire behaviour will be mitigated through the shutting down of wind turbines in a bushfire event.

In the unlikely event that a fire did spread from the wind farm to surrounding properties, the turbines would not limit aerial firefighting capabilities on other properties in the surrounding area.

5.5 SUMMARY OF BUSHFIRE RISK FACTORS

The Project Area does not have a history of bushfire (refer **Section 3.4**), and the risk that a wind farm itself will cause a fire is considered low given appropriate protection measures proposed (AFAC 2018) (refer **Section 6**).

The proposed internal road network would increase the level of access available to fire fighters from Keri Keri Road which forms a strategic fire advantage zone (refer **Figure 3-2**) and ongoing consultation and planning with NPWS will ensure that access to the Yanga Conservation Area and the mapped fire trail network is maintained during the construction and operation of the Project.

The development of the Project will create additional assets that require protection during a fire. If an 'external' bushfire threatens the wind farm, Project infrastructure may sustain direct flame contact. Aerial firefighting will be required to support and defend Project infrastructure. WTG towers are made from non-combustible material and therefore do not present a significant risk relative to other Project infrastructure. Firefighting efforts would thus be concentrated on defending assets that could contribute to widespread fire, such as the switching station, substations, BESS and O&M buildings. These assets must therefore all have adequate defensible space on all sides.

This will be considered in the Bushfire Emergency Management and Operations Plan.

6. MITIGATION STRATEGIES

Consideration is given to whether the proposed wind farm will result in people congregating in large numbers. The operation of the proposed wind farm is considered to be a low intensity use in terms of the number of people on site at any one time, with only 12 permanent staff onsite during the operational phase. However, there could be up to 650 full time equivalent staff onsite during construction over a period of up to 24 months. Although the construction period does not pertain to the expected end use of the Project Area, the number of people who could be within the Project Area at one time warrants consideration in terms of providing adequate defensible space (e.g., APZs) and access / egress as the first stage of construction (prior to the installation of any wind turbine or related infrastructure). The proposed road upgrades will support more options to evacuate within the local area and will aim to complement the existing fire control strategies within the adjacent Yanga Conservation Area.

Mitigation will be a combination of complementary strategies, all of which are required to provide the best possible protection outcome for the wind farm and the community. In terms of design principles to minimise risk, the wind farm layout will be designed to:

- Provide a defensible space around infrastructure; and
- Ensure that appropriate access, egress and manoeuvrability within the wind farm is provided for first responders.

6.1 ASSET PROTECTION ZONE

An APZ is typically designed to separate a vulnerable asset from the bushfire hazard (vegetation/fuel). APZs do not eliminate the fire risk but may lower it to an extent where fire control is more feasible or damage to the asset is reduced or eliminated. The ongoing maintenance of APZs are recognised under the Rural Fires Act 1997.

Understanding the value and limitations of APZ is important, as is the understanding that bushfires attack built assets by either flame contact, radiant heat or burning debris. An APZ can be used to lower or eliminate the bushfire attack from flame contact and radiant heat around the perimeter of the wind farm and all built assets, but under strong winds or during a major fire event burning debris can result in a fire breaching an APZ.

Note: A minimum 10m APZ is required to comply with Section 8.3.5 of PBP 2019 and must be established on all sides of the WTG, substations, switching station, and O&M Buildings. The project design currently exceeds this requirement for all project infrastructure as follows:

- A minimum 20 m APZ will be established around each meteorological monitoring mast;
- Each WTG will be mounted on a concrete foundation (approximately 25 m in diameter) located on a cleared hardstand area; and
- A minimum 20 m APZ will be established on all sides of the substations, switching station, BESS and O&M Buildings and would be the focus of any firefighting activities.

It is noted that current project designs includes an up to 35m wide APZ around the BESS and substation.

For the Accommodation Compounds, a minimum APZ of 24 m is required in accordance with Table 6.8a and Table A1.12.1 of PBP 2019. This will ensure that radiant heat levels do not exceed critical limits for firefighters and other emergency services personnel undertaking operations, including supporting or evacuating occupants. Construction standards for BAL-12.5 apply.

The specifications recommended for the APZ are as follows:

- All APZ are to be managed as an inner protection zone (IPA) for the life of the development as outlined within Appendix 4 of PBP 2019, and NSW RFS 'Standards for Asset Protection Zones';
- APZ will not extend beyond the property boundary or rely on actions being undertaken by adjacent landowners. This includes the neighbouring National Parks estates;
- Mineral earth fire break i.e., dirt or gravel;
- No trees and shrubs planted within the APZ; and
- Where possible, increase the distance between the trees and the APZ.

Important note: There will be no expectation of additional hazard reduction or other works on neighbouring lands including National Parks estates.

6.2 WIND FARM CONSTRUCTION

As considered in **Section 5.1**, human induced climate change is influencing the frequency and severity of dangerous bushfire conditions in Australia including an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring than they used to. With this in mind, the following measures are recommended to be implement during the entire period of construction:

- Construct the APZ and access track prior to the installation of any wind turbine or related infrastructure;
- Ensure appropriate bunding in areas where there is potential for flammable fuels and oils to leak and create bushfires or other environmental risks. These must also be located in cleared areas away from any potential ignition sources;
- Install appropriate signs to assist emergency response crews determine track names, location and turbines etc.;
- Ensure that appropriate permits have been issued for work during the Fire Danger Period, and that any conditions on permits are adhered to;
- Adhere to restrictions on Total Fire Ban or days of high fire danger;
- Ensure suitable firefighting equipment (specific requirements to be confirmed in consultation with NSW RFS) is present onsite;
- Carry fire extinguishers or firefighting equipment in vehicles;
- Carry emergency communications equipment;
- Where practicable, site vehicles during the construction phase will have diesel engines and/or will use the site access tracks (if available) to minimise the likelihood of igniting dry grass;

- Combustible waste including cleared vegetation, must be removed to minimize the risk fire. If it is not possible, the temporary storage must have sufficient space to prevent fire propagation;
- Vehicle refueling process will be carried out following a protocol to minimise the likelihood of fire and in designated areas only;
- A manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location must be prepared. Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills is to be provided and available onsite;
- Restrict smoking to prescribed areas, and provide suitable ash and butt disposal facilities;
- Ensure all plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g., vegetation);
- A Bushfire Management Plan will be developed prior construction; and
- On days when Very High fire danger or worse is forecast, the “fires near me’ app is to be checked regularly for the occurrence of any fires likely to threaten the Project Area.

6.3 WIND FARM OPERATION

Fuel Reduction

It is recommended that vegetation fuels throughout the wind farm are maintained in a minimal condition by grazing, or with additional slashing or mowing if required. This will minimise the radiant heat exposure to wind farm components and reduce the risk of a fire spreading beyond the wind farm. If grazing or slashing is not possible under the WTG other lower risk ground cover should be considered e.g., gravel or a non-curing ground cover and/or a very low above ground biomass.

Days of Very High or Worse Fire Danger

Fire Danger Ratings give you an indication of the consequences of a fire if one was to start. The higher the fire danger, the more dangerous the conditions. These forecasts are updated daily during the fire danger season and are available on the NSW RFS website (<http://www.rfs.nsw.gov.au/fire-information/fdr-and-tobans>) and the BOM website (<http://www.bom.gov.au/nsw/forecasts/fire-danger-ratings.shtml>).

To reduce the risk of fires damaging or destroying life, property and the environment the NSW RFS Commissioner may also declare a Total Fire Ban (TOBAN). In a TOBAN no fire may be lit in the open and all fire permits are suspended. No general-purpose welding, grinding, soldering or gas cutting can be done in the open.

Emergency Management and Operations Plan

An Emergency Management and Operations Plan should be prepared for the windfarm in accordance with Section 8.3.5 and Table 6.8d of PBP 2019. The management plan will also be prepared with consideration of the NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan and Australian Standard 3745: Planning for emergencies in facilities.

An Emergency Management and Operations Plan should be prepared for the wind farm that provides the following:

- A detail site plan identifying, using GPS coordinates, each turbine tower location;
- Wind turbines are shut down immediately during emergency operations – where possible, blades should be stopped in the 'Y' or 'rabbit ear' position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle;
- Protocols should be explicit about what party has the authority to direct turbine shut-down procedures;
- Control and coordination arrangements for emergency response (e.g., evacuation procedures, emergency assembly areas and procedures for response to hazards);
- Location of all fire control advantages within the Project Area (e.g., access track, gates, water points);
- Location of all Project infrastructure;
- Management and maintenance of the APZ and access tracks in accordance with NSW RFS guidelines;
- Agreed roles and responsibilities of onsite personnel (e.g., equipment isolation, liaison, evacuation management);
- Up-to-date contact details of site personnel and any relevant offsite personnel who could provide technical support during an emergency;
- A manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location. Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills is to be provided and available onsite;
- Clearly states work health safety risks and procedures to be followed by firefighters, including personal protective clothing;
- Minimum level of respiratory protection;
- Minimum evacuation zone distances;
- Activation of water spray/foam systems and any other response/protection measures; and
- Any other risk control measures required to be followed by firefighters.

The Emergency Management and Operations Plan will be prepared with consideration of Australian Standard/ISO 31000 Risk management principles and guidelines and Australian Standard 3745: Planning for emergencies in facilities.

Two copies of the Emergency Management and Operations Plan should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at each vehicle entrance point to the wind farm, external to any security fence or locked gate, and a copy provided to local emergency responders. Two copies of the Emergency Management and Operations Plan will also be stored within the operations facilities and one at the NSW RFS Balranald Brigade office.

The Emergency Information Cabinets will be clearly visible, installed at a height of 1.2 m - 1.5 m and accessible by all emergency services.

A schedule for ongoing site familiarisation to account for changing personnel, site infrastructure and hazards should be developed in conjunction with the NSW RFS as well as the NPWS.

6.4 ACCESS TRACKS AND ROAD NETWORK

Figure 1-2 shows the site access locations off Keri Keri Road.

Site access points will be constructed as the first stage of development and the final design of access tracks will consider the existing fire control measures within the Yanga Conservation Area and will enable safe access and egress for residents attempting to leave the area while emergency service personnel are arriving to undertake firefighting operations.

Site access points will be maintained for the life of the Project and include appropriate signs throughout the wind farm to assist emergency response crews determine track names, location of turbines and location of any locked gates.

All access tracks will be upgraded to provide sufficient width and other dimensions to ensure safe unobstructed access and allow firefighting crews to operate equipment around the vehicle. Dead-end roads should be avoided. However, where they are present, they will incorporate a sufficient turn-around area to minimise the need for vehicles to make multipoint turns. As a minimum, and to enable access for RFS all roads will be maintained to the minimum standards as outlined within the NSW RFS Fire Trail Standards (NSW RFS, 2023) and the NSW RFS Fire Trail Design, Construction and Maintenance Manual (NSW RFS, 2017).

This includes:

- The trafficable surface has a minimum width of 4 m except for short constrictions to 3.5 m for no more than 30 m in length where an obstruction cannot be reasonably avoided or removed;
- Trail surfaces and crossing structures can carry vehicles with a gross vehicle mass of 15 tonnes and an axle load of nine tonnes;
- The maximum grade of a trail is not more than 15 degrees. Any localised sections of road with steeper grades will be designed to meet performance criteria in consultation with the NSW RFS and clearly sign posted to ensure that the roads provide for traction and safe working angles within the physical operational capability of the firefighting vehicles;
- The cross fall of the trail surface is not more than six degrees;
- Drainage structures, feature crossings, or other significant changes in the grade of the trail are in accordance with the NSW RFS Fire Trail Design, Construction and Maintenance Manual;
- A minimum vertical clearance of 4 m is provided above the surface of the trafficable surface clear of obstructions;
- Passing Bays must be constructed no more than 250m between the end of one bay and the start of another along the trail, and with one in five bays permitted to be up to 300m apart (no two consecutive bays can be greater than 250m apart); and
- A turning area is provided at the termination of a trail and every 500 m.

6.5 WATER STORAGE

The availability of water is a critical element in the control of a bushfire. Water for the project will be supplied by truck and stored in an on-site water tank, which will be available for firefighting if required. The volume and location of the tanks will be confirmed in consultation with the NSW RFS, although it is likely to require minimum 50,000 litre tanks, based on refilling six tanker units (4,000 litres) twice each.

The control room will contain an office, communications equipment, and staff amenities (toilet, kitchen, first aid, potable water supply, etc.). Guttering and a water tank will collect rainwater.

The accommodation compound will also include a static water supply for firefighting/bushfire management (may be part of above water supply) as well as a septic system. The control room, switch room and storage shed will each contain essential fire safety equipment, including fire extinguishers and hose reels.

6.6 TOTAL FIRE BANS

It is important to be aware of operations that may be carried out on days of TOBAN and any prohibited activities or exemptions that are notified by the Commissioner of the NSW RFS under section 99 of the RF Act.

Under Section 63 of the RF Act it is the responsibility of the landowner to limit the ignition and prevent the spread of fires from the property. On days declared TOBAN you cannot light, maintain or use a fire in the open, or carry out any activity in the open that has the potential for a fire to develop. General purpose hot works (such as welding, grinding or gas cutting or any activity that produces a spark or flame) are not to be done in the open.

Fire permits are also suspended on days of total fire ban. Permits may resume after the Total Fire Ban is lifted, as long as the permit hasn't expired. The NSW RFS Commissioner is responsible for exemptions to TOBAN. These exemptions are detailed in the NSW Government Gazette each time a TOBAN is declared under the RF Act section 99.

6.7 CUMULATIVE IMPACTS

The proximity of multiple construction and/or operational projects provides opportunity for potential cumulative impacts. The cumulative impacts related to bushfire mitigation are as follows:

- Volunteer fire-fighter workload – Response call outs should not significantly increase because the ignition risk will be very low. There will, however, be an ongoing requirement for briefing on the Emergency Management and Operations Plan;
- Construction stage transport and road use – The bushfire mitigation will add a small percentage to the total construction traffic and road use; and
- Ongoing operations – there would not be any cumulative operational impacts.

The proximity of multiple projects actively managing fire risk could assist in management responses and may create a positive cumulative impact, in comparison with existing conditions. In consultation with key stakeholders, the preparation of the Emergency Management and Operations Plan will consider the most current information available regarding fire risk from and to surrounding land uses.

6.8 SUMMARY OF RECOMMENDED MITIGATION STRATEGIES

Table 6-1 summarises the bushfire mitigation strategies and recommendations made in this document.

TABLE 6-1 SUMMARY OF RECOMMENDED MITIGATION STRATEGIES

Mitigation Strategy	Action	Timing
Asset Protection Zone (APZ)	- A minimum 20 m APZ will be established around each monitoring mast and WTG. - A minimum 20 m APZ will be established on all sides of the substations, switching station, BESS and O&M Buildings and would be the focus of any firefighting activities. It is noted that current project designs currently provide up to 35m wide APZ around the BESS and substation. - A minimum APZ of 24m is required around the accommodation compound and minimum construction standards for BAL-12.5 apply. - All APZ are to be managed as an inner protection zone (IPA) as outlined within Appendix 4 of PBP 2019, and NSW RFS 'Standards for Asset Protection Zones'. APZ will not extend beyond the property boundary or rely on actions being undertaken by adjacent landowners.	The APZ and perimeter road will be constructed as the first stage of development and maintained for the life of the Project.
Monitoring masts	- Monitoring masts are to be recorded in the Tall Structures Database maintained by Air Services Australia (Civil Aviation Safety Authority 2018). - Install visible markers (such as orange balls) on all masts to minimise risks during aerial firefighting operations. Aviation Projects (2024) has confirmed that temporary / permanent monitoring masts that are installed near a wind turbine will not require obstacle lighting to maintain an acceptable level of safety to aircraft. However, temporary monitoring masts that are installed prior to wind turbine installation, and monitoring masts that are not near a wind turbine, will require obstacle lighting to maintain an acceptable level of safety.	Prior to construction. Maintained for the life of the Project.
Wind farm construction	The following measures are recommended to be implemented during the entire period of construction: - Any additional water supplies required to be installed and accessible prior to commencing construction; - Appropriate bunding will be put in place in areas where there is potential for flammable fuels and oils to leak and create bushfires or other environmental risks; - Appropriate signs will be installed to assist emergency response crews determine track names, location and turbines etc; - Any necessary permits will be obtained for work during first danger periods; - Adhere to restrictions on Total Fire Bans or days of high fire danger will be considered in operations; - Suitable firefighting equipment (specific requirements to be confirmed in consultation with NSW RFS) will be present onsite; - Fire extinguishers or firefighting equipment will be carried in vehicles where practicable; - Emergency communications equipment will be carried where practicable; - Where practicable, all site vehicles during the construction phase will have diesel engines and will use the site access tracks to minimise the likelihood of igniting dry grass;	During Construction.

Mitigation Strategy	Action	Timing
	- Combustible waste including cleared vegetation, must be removed to minimize the risk fire. If it is not possible, the temporary storage must have sufficient space to prevent fire propagation; - Vehicle refueling process will be carried out following a protocol to minimise the likelihood of fire and in designated areas only; - A manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location must be prepared. Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills is to be provided and available onsite; restrict smoking to prescribed areas, and provide suitable ash and butt disposal facilities; - Ensure all plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g., vegetation); - A Bushfire Management Plan will be developed prior construction; and - On days when Very High fire danger or worse is forecast, the "fires near me" app is to be checked regularly for the occurrence of any fires likely to threaten the Project Area.	
During operation	- The Project will be controlled by a remote SCADA system from a control room located within the permanent site operations and maintenance facility. The SCADA system will allow remote operation of all WTGs with the ability to shut-down individual or all WTGs if required. - NSW RFS will be provided with maps and GPS coordinates of the final wind turbine layout and identification information for individual wind turbine sites for their internal response planning. - Liaise with CASA and the RAAF Aeronautical Information Service will be consulted. - Liaise with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the Project site. - Safe working and emergency response procedures for all work tasks will be developed and implemented. - Maintenance staff will be trained in the basic first response firefighting techniques. - Firefighting equipment will be provided and maintained capable of controlling and suppressing small initial outbreaks of fire. As a minimum, these will be located on the outside of the switching station, substation, BESS and O&M buildings. - Vegetation fuels throughout the windfarm are to be maintained in a minimal condition by grazing, or with additional slashing or mowing if required.	During operation. Maintained for the life of the Project.
Access tracks and road network	Site access points will be constructed as the first stage of development and the final design of access tracks will enable safe access and egress for residents attempting to leave the area while emergency service personnel are arriving to undertake firefighting operations. Site access points will be maintained for the life of the Project and include appropriate signs throughout the wind farm to assist emergency response crews determine track names, location of turbines and location of any locked gates.	During construction and operation.

Mitigation Strategy	Action	Timing
	Roads shall provide sufficient width and other dimensions to ensure safe unobstructed access and allow firefighting crews to operate equipment around the vehicle. As a minimum, and to enable access for NSW RFS all roads will be maintained to the following minimum standards outlined within the NSW RFS Fire Trail Standards and the NSW RFS Fire Trail Design, Construction and Maintenance Manual and will complement the fire trail network already available within the adjoining Conservation Area.	
Fire preparedness and response	Prior to construction, an Emergency Management and Operations Plan will be prepared and stored at 'Emergency Information Cabinet' at main entrance to the wind farm and provided to local emergency responders. The ERP will include: • A detail site plan identifying, using GPS coordinates, each turbine tower location; • A safe method of shutting down and isolating the WTG if required (noting that the turbines automatically shut down if they are close to functioning outside their design conditions); • Control and coordination arrangements for emergency response (e.g., evacuation procedures, emergency assembly areas and procedures for response to hazards); • Agreed roles and responsibilities of onsite personnel (e.g., equipment isolation, liaison, evacuation management); • Up-to-date contact details of site personnel and any relevant off-site personnel who could provide technical support during an emergency; • A manifest (and safety data sheets) for any battery, diesel or other dangerous goods storage/handling, including the class identification, quantity, type (bulk or packaged) and location. Appropriate material (including absorbent, neutralisers, equipment and personal protective equipment) for the clean-up of spills is to be provided and available onsite; • Clearly states work health safety risks and procedures to be followed by firefighters, including personal protective clothing; • Minimum level of respiratory protection; • Minimum evacuation zone distances; • Activation of water spray/foam systems and any other response/protection measures; and • Any other risk control measures required to be followed by firefighters. A schedule for ongoing site familiarisation to account for changing personnel, site infrastructure and hazards should be developed in conjunction with the local RFS and NPWS.	Prior to construction.
Transmission lines	For the safe operation of the transmission line, certain activities will be restricted within the easement such as planting and growing trees, construction of buildings, or erection of antennae or masts. While it has not be confirmed how the easement will be formally registered, for the purposes of this bushfire risk assessment, key responsibilities and management measures will be applied in accordance with the TransGrid Bushfire Risk Management Plan and ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets which requires assets to be maintained to minimise the risk of fire ignition and to ensure that vegetation clearance are maintained.	Maintained for life of the Project.

Mitigation Strategy	Action	Timing
Water storage	Reticulated water supply is not provided to the site. Water supply should be designed to provide filling points for fire tanker units near the wind farm entrance. A storage of 50,000 litres is recommended, based on refilling six tanker units (4,000 litres) twice each although the required capacity will be confirmed in consultation with RFS.	Considered during Project design. Maintained for life of the Project.

7. CONCLUSION

The risk that the wind farm itself will cause a fire is minimal (AFAC 2018) and the proposed development is not located within a bushfire prone landscape (based on the current bushfire prone land mapping). While not identified as a bushfire prone vegetation community within the current bushfire prone land mapping, fires within grasslands and arid shrublands should not be underestimated and can start and spread quickly. For this reason, we have considered these as a bushfire hazard. Mitigation measures and treatments will be a combination of complementary strategies, all of which are required to provide the best possible protection outcome for the wind farm and the community.

Despite any mitigation measures applied, bushfire risk will always remain and it is therefore important that a Bushfire Emergency Management and Operations Plan is prepared in conjunction with relevant stakeholders, including NSW RFS, NSW Fire and Rescue, NPWS, landowners and adjoining property owners.

If a fire does breach any containment lines and threatens the wind farm assets, it is possible that the wind farm infrastructure will sustain direct flame contact and that firefighting may require aerial support. This requirement would not be the result of the wind farm itself although it is recognised that the wind farm would result in additional assets that would need to be protected.

The detailed mitigation measures outlined in the bushfire risk assessment have been developed to ensure that the wind farm development does not present any increased risk of widespread fire across the landscape. These mitigation measures will be applied for the life of the Project.

Important 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 in the Project Area should not be interpreted as a guarantee that such hazards or impacts do not exist. It is also important that a Bushfire Emergency Management and Operations Plan is prepared prior to the commencement of any construction works in conjunction with relevant stakeholders, including local fire services, NSW RFS, NSW Fire and Rescue, NPWS, landowners and adjoining property owners.

Important 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.

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APPENDIX A RELEVANT FIRE MANAGEMENT PLANS



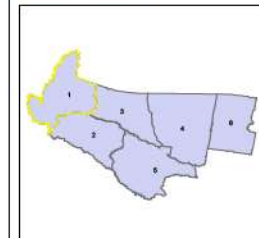
Map 1 of 6

The aim of this BPPMP is to reduce the adverse impact of bush fires on life, property and the environment.

The objectives of this IFFMOP are to:

- reduce the number of human-induced bush fire ignitions that cause damage to life property or the environment;
- manage fuel to reduce the spread and intensity of bush fire while maintaining environmental/ecological aspects;
- reduce the community's vulnerability to bush fire by improving its preparedness; and
- effectively contain fire with a potential to cause damage to life, property and the environment.

This map forms part of the IFPMAP for the Mid-Murray Zone IFMC, covering the local government area(s) of . It should be viewed in conjunction with the accompanying IFPMAP document which provides further details on the IFMC area, the map assessed on the <http://www.environment.sa.gov.au> used.



- changes to the business risk in the same; or
- following a major fire event.

Assets
The DPMAP identifies the assets that are controlled by the Mid Murray Zone DPM and currently to be at risk from bush fire, assesses the bush fire risk to each asset and assigns treatments designed to mitigate the risk. Assets in the DPM are categorised in respect of maximum fire risk in the assets table. Lower values indicate the DPM zone that would be assessed as not requiring treatment within the life of the plan as detailed in the approach to the DPMAP document. The Map Ref number 'NA' denotes non-assessable assets.

Treatments:
Specific Investments assigned to assets in the MLC Money Zone are based on the investments held and include the assets which are designated to protect, diversify and/or enhance the portfolio. Investments are not based on a specific asset which could earn superior returns with the SPARC zone are:

- reducing the cash in the general pool
- increasing the participation in the high-risk peers lead comply with Planning for Retirement
- using the Local Structural Funds (LEF) to extend development in areas with:
 - low risk
 - varying the structural funds the longer period as required
 - requiring periods during high-risk longer periods
 - providing of services to the community
 - increasing of health care
 - normal life expectancy
 - assessing and managing compliance with strategic high-risk resource allocation at management systems

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Note on LME: All areas not specifically mapped as an APE, SPAZ or PEZ are considered an LME for this risk management plan. For areas identified by an LME polygon on the map, please refer to the SPRMP document for the specific land management objectives.

[illegible]

Disclaimer
The National Library of Medicine makes every effort to ensure the quality of the information available on this map before relying on the information on this map. Users should carefully evaluate its accuracy, completeness and relevance for their purposes, and should obtain any appropriate professional advice relevant to their particular circumstances.

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Authorized by _____ of Mid Mary Zone IFMC



Treatments			
ID	Treatment strategy	Action	Agencies (support)
T1	Hazard Reduction	Brushing, Shedding, Gearing or Gaiting	LOA, RTA, CPI (WB)
T2	Community Education	Public notice releases at start of the season	RP (LOA)
T3	Ignition Management	Implementer's management notification during	NRWFS, RFD, CPI (LOA)
T4	Cooperative Education	School visits	NRFS

*Note - Shares have date issues may not be disclosed on time

Murrumbidgee Valley National Park
Yanga Precinct
Fire Management Strategy
2014



Mapsheet 1 of 2

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Contact: OEH PWG Regional Office: 200 Yambill St, Griffith NSW 2680 P.O. Box 1049 Griffith NSW 2680 Ph. 02 6966 8100

ISBN: 978 1 74359 796 5 OEH: 2014/0794

Last Updated: February 2015

Version No. 3

Map Details

Datum: Geocentric Datum of Australia (GDA) 1994
Projection: Australian Map Grid (AMG) Zone 54
Data: Spot Satellite Imagery: 2005.

1:50k Topographic Map: Balranald 7628-N, Perekerten 7628-S
1:100 K Topographic Map: Paika 7629
Scale: Noted scales are true when printed on A1 size paper

Related Documents

OEH Fire Management Manual 2013 - 2014.

NPWS Estate

Rivers

Site Management (see guideline tables)

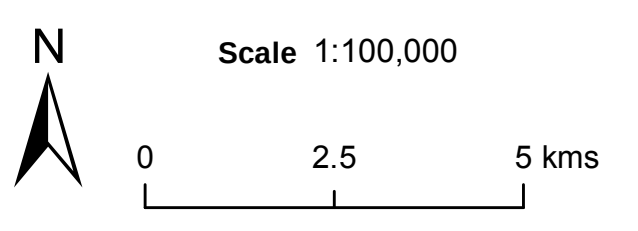
- IS Indigenous Site IS1
- IS Indigenous Site IS2
- IS Indigenous Site IS3
- FA Threatened Fauna
- HB Heritage Buildings
- WP Water Point - Vehicle
- WH Water Point - Helicopter
- TA Threatened Property
- R Refuge Area
- H Potential Helipad
- MA Machinery Exclusion Area

Fire Trails

- Essential Fire Trail - Cat 1
- Essential Fire Trail - Cat 7
- Essential Fire Trail - Cat 9
- Important Fire Trail - Cat 1
- Important Fire Trail - Cat 7
- Important Fire Trail - Cat 9
- Dormant Fire Trail

Roads

- Major Road - Sealed
- Major Road - Unsealed
- Secondary Road - Sealed
- Secondary Road - Unsealed
- Bridge (load limit - tonnes)
- Powerlines



Fire History

- Prescribed Burn
- Wildfire

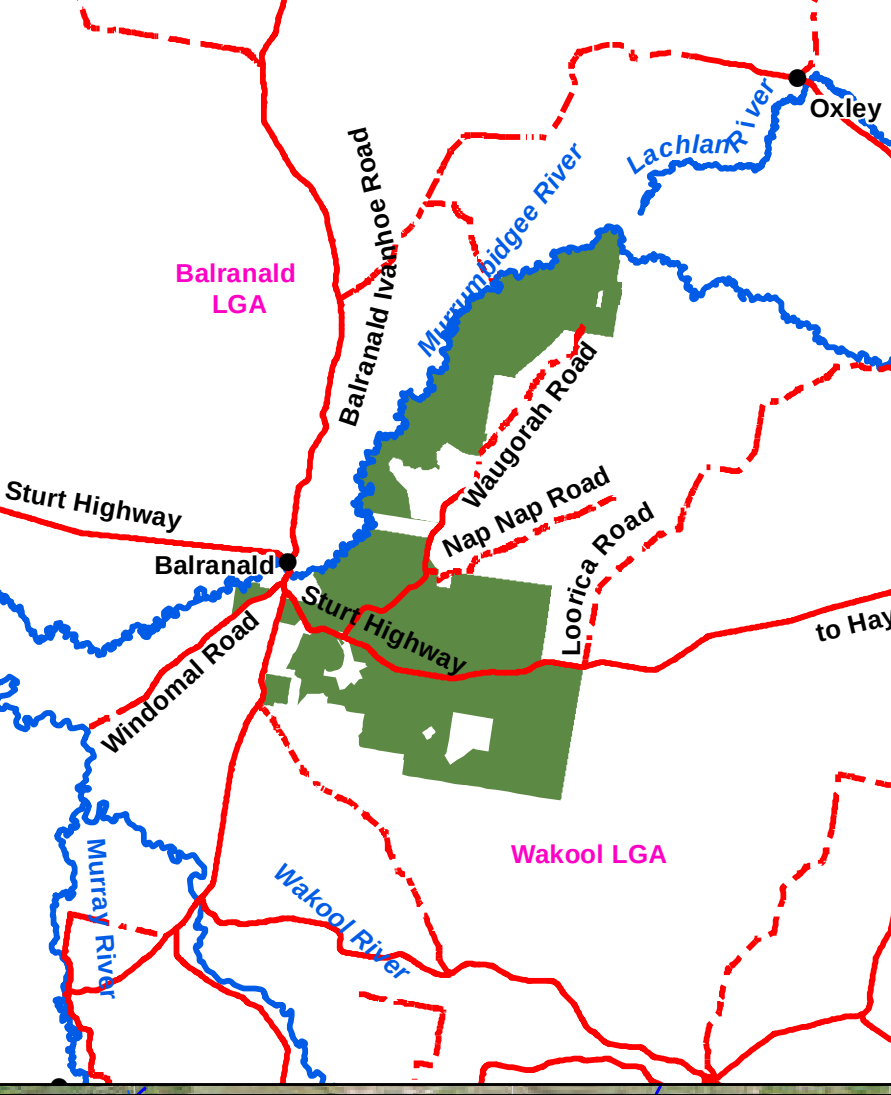
Incident Map

Yanga Woolshed Precinct
(see Mapsheet 2 of 2)

Yanga Homestead Precinct
(see Mapsheet 2 of 2)

Regatta beach

Locality



Contact Information

Agency	Position / Location	Phone
National Parks & Wildlife Service	Duty Officer	02 6332 6350
	Regional Office – 200 Yambill St, Griffith	02 6966 8100
	Yanga NP (bus. Hrs)	03 5020 1764
	Zone Manager - Steve Walker	0428 598 376
Lower Western Zone NSW Rural Fire Service	Dareton Fire Control Centre	03 5027 4422
MIA District NSW Rural Fire Service	Zone Manager – Kevin Adams	0428 285 582
	Duty Officer (Griffith)	02 6966 7887
	Hay Fire Control Centre	02 6993 4213
Fire and Rescue NSW	Balranald Fire Station	03 5020 1577
	Deniliquin – Duty Mobile	0408 675 211
State Forests Emergency Services		000
SES	Balranald Volunteer Units	13 2500 03 5020 0444 or 0417 200 444
Police Station (not open 24 hrs)	Balranald	03 5020 1404
Hospital	Balranald	03 5020 1606
Parks Victoria Council	Duty Officer Murray	0417 351 668
	Balranald Shire Council	03 5020 1300

Fire Season Information

- The critical wildfire season generally occurs during December to February. This period may extend into the first half of March.
- Dry lightning storms frequently occur and typical fire weather conditions are winds from the west to the north, high day time temperatures and low humidity.
- Particular care is required following periods of Winter rain and after periods of negative Southern Oscillation Indices.
- Prescribed burning should generally be undertaken before decreases in autumn temperatures occur.
- Burning may also be undertaken during late winter and early Spring when ephemeral fuels pose a potential high fire threat.
- Care should be taken to ensure a low intensity burn over most of the area treated.
- An exception to these guidelines is burns targeting the thinning of artificially created dense stands of trees, which may require a higher intensity fire. Also the timing may occur in either Autumn or late Spring to achieve a higher intensity result.

Communications Information

Service	Channel	Location and Comments
RFS PMR	P035	Balranald
	P029	Moulamein
	P016	Lake Poon Boon (Murray Downs)
	P062	Lowbidgee
UHF - CB	2	Car and hand held radios
Mobile Phones		Do not rely on mobile phones, scattered coverage over whole reserve.

Murrumbidgee Valley National Park

Yanga Precinct

Fire Management Strategy 2014

NSW

Office of Environment & Heritage

NSW National Parks & Wildlife Service

Mapsheet 2 of 2

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ISBN: 978 1 74359 796 5 1 OEH/2014/0794

Last updated: February 2015

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Yanga Homestead Precinct

Yanga Woolshed Precinct

Vegetation

Status of Biodiversity Thresholds

Prescribed Burn Availability Map

Prescribed Burning Availability Map Legend

Available	This area is available for prescribed burning, subject to fuel levels and ecological thresholds.
Available in Ephemeral Conditions	This area generally has NIL or LOW OFH, except during seasons producing continuous ground cover.

Broad Vegetation Class	Vegetation Type	Biodiversity Thresholds	Fire Behaviour	
Arid and Semi-arid Shrublands	Chenopod Shrublands	Fire should be avoided.	These vegetation communities will generally not carry fire unless there are high ephemeral fuel loads, which generally occur after flooding events. In favourable years the River Red Gum forests can be scattered with 2m high reed beds, which can result in isolated areas of very high to extreme fire behaviour. In years of high ephemeral fuels, landscape fires are possible as fire potential will be very high to extreme, characterised by spotting from Black Box and River Red Gum communities and fast moving fires in other communities.	
Freshwater Wetlands	Chenopod Shrublands	Fire should be avoided.		
Semi-arid Woodlands (Grassy sub-formation)	Black Box Woodlands	An interval between fire events less than 10 years and greater than 40 years should be avoided. There was insufficient data to give definite intervals. Two fires in the same area in a period of less than 10 years apart may remove younger Black Box trees.		
Arid and Semi-arid Woodlands	Prickly Wattle (<i>Acacia victoriae</i>) Woodlands	An interval between fire events less than 6 years and greater than 40 years should be avoided. There was insufficient data to give definite intervals.		
Sclerophyll Grassy Woodlands	Myall (<i>Acacia pendula</i>) Woodlands	An interval between fire events less than 5 years and greater than 40 years should be avoided.		
Water Body	Chenopod Shrublands in Yanga Lake	Fire should be avoided in Yanga Lake.	Belah / Rosewood Woodlands and Lignum Shrublands will not carry fire unless there is high ephemeral fuel loads. Yarran and Red Mallee Woodlands fire intensity ranges from moderate to high and is largely influenced by ephemeral growth. Unless weather conditions are extreme, low ground fuels during normal years will only allow for patchy fires. Spike-rush Sedgelands will not carry fire unless there are high cured ephemeral fuel loads. High intensity fast moving fire once grasses have cured. In drought years minimal growth will result in moderate fire behaviour but potentially still fast moving depending on weather conditions at the time.	
Forested Wetlands	River Red Gum Forests	An interval between fire events less than 7 years and greater than 35 years should be avoided. River Red Gums will only tolerate low intensity fires. Individual trees may survive canopy scorch if they are not under stress and are in older age classes. Younger trees will not survive moderate to high intensity fires. Two fires occurring in the same area in a period of less than 20 years apart may reduce the extent of River Red Gum Forests. Fire should be avoided where Chenopod species occur.		
Semi-arid Woodlands (Shrub sub-formation)	Belah / Rosewood Woodlands Yarran (<i>Acacia melvillei</i>) Woodlands Red Mallee (<i>Eucalyptus oleosa</i>) Woodlands	An interval between fire events less than 6 years and greater than 40 years should be avoided. There was insufficient data to give definite intervals.		
Freshwater Wetlands	Spike-rush Sedgelands Lignum Shrublands	An interval between fire events less than 6 years and greater than 35 years should be avoided.		
Cleared Land	Grasslands consisting of previously cropped land and improved pastures	An interval between fire events less than 2 years and greater than 10 years should be avoided.		
Fire History	The fire history data is incomplete. Wildfires generally occur due to lightning ignitions. Accidental fires in the River Red Gum Forests, periodic burning of Yanga Lake bed and yearly prescribed burning of reed bed areas were undertaken prior to NPWS acquisition in 2005. There is no verbal or recorded history of fire scale fires occurring across the reserve area.			
Ephemeral Conditions	Ephemeral fuel conditions occur after consecutive years of effective rainfall. This in turn leads to the growth and build up of fine surface fuels such as grasses and herbs, which can create a continuous fuel load across all of the above vegetation communities.			
Drought Conditions	During drought conditions and when vegetation communities are visibly stressed or experiencing dieback no prescribed burning will be permitted and wildfires areas will be minimised.			

Bushfire Risk Management Strategies

Operational Guidelines

Brief all personnel involved in suppression operations on the following issues:

General	Guidelines
Aerial Water Bombing	- The use of bombing aircraft should support containment operations by aggressively attacking hotspots and spot-overs. - The use of bombing aircraft without the support of ground based suppression crews should be limited to very specific circumstances. - Where practicable foam should be used to increase the effectiveness of the water. - Ground crews must be alerted to water bombing operations.
Aerial Ignition	- Aerial ignition may be used during back-burning or fuel reduction operations where practicable, but only with the prior consent of NPWS Senior Officer. - Section 44 delegate or as prescribed in an operational burn plan. - The use of aerial ignition as a fire suppression tool should be specified in the IAP or within the prescribed burn plan. - Aerial ignition will only be undertaken by qualified and competent navigators and bombardiers. - Utilise aerial ignition to rapidly burn out large areas.
Back-burning	- Temperature and humidity trends must be monitored carefully to determine the safest times to implement back-burns. Generally, when the FDI is Very High or greater, back-burning should commence when the humidity begins to rise in the late afternoon or early evening, with a lower FDI back-burning may be safely undertaken during the day. - Where practicable, clear a 1m radius around dead and hollow bearing trees adjacent to containment lines prior to back-burning, or wet down these trees as part of the back-burn ignition. - Use parallel containment lines when applicable. - All personnel must be fully briefed before back-burning operations begin.
Command & Control	- Standard Incident Management Systems are to be applied. - The first combatant agency on site may assume control of the fire, but then must ensure the relevant land management agency is notified promptly. - On the arrival of other combatant agencies, the Incident Controller will consult with regard to the ongoing command, control and incident management team requirements as per the relevant BFMC Plan of Operations, and be consistent with BFCC Policy 2-2006.
Containment Lines	- Construction of new containment lines should be avoided, where practicable, except where they can be constructed with minimal environmental impact. - New containment lines require the prior consent of a senior NPWS officer (AM or RM). - Use parallel containment lines when applicable. - All containment lines not required for other purposes should be closed at the cessation of the incident. - All personnel involved in containment line construction should be briefed on both natural and cultural heritage sites in the location. - Containment line construction using earthmoving equipment must be in accordance with the earthmoving guidelines contained within the RFMS.
Earthmoving Equipment	- Earthmoving equipment may only be used with the prior consent of a senior NPWS officer, and then only if the probability of its success is high. - Earthmoving equipment must always be guided and supervised by an appropriately experienced person, and accompanied by a support vehicle. When engaged in direct or parallel attack this vehicle must be a fire fighting vehicle. - Containment lines constructed by earthmoving equipment should consider the protection of drainage features, observe the Threatened Species and Cultural Heritage Operational Guidelines, and be surveyed, where possible, to identify unknown cultural heritage sites. - Earthmoving equipment must not leave tracks or create new tracks in Machinery Exclusion areas as marked on the Incident Map of a RFMS. - Earthmoving equipment must be washed down, where practicable, prior to it entering NPWS estate and again on exiting NPWS estate. - Where multiple items of earthmoving equipment are being used, the IMT should consider the establishment of a Plant Operations Manager. Machinery must be excluded from all machinery exclusion zones including the Yanga Woolshed and Yanga Homestead Precincts. This is due to the many indigenous sites that are present across the reserve.
Fire Advantage Recording	All fire advantages used during wildfire suppression operations must be mapped and where relevant added to the database.
Fire Suppression Chemicals	- Use of wetting and foaming agents (surfactants) is permitted on the reserve. - The use of fire retardants are only permitted with the prior consent of the senior NPWS officer and should be avoided where reasonable alternatives are available. - Exclude the use of surfactants and retardants within 50m of watercourses, dams and swamps. - Areas where fire suppression chemicals are used must be mapped and the used product's name recorded. - The Threatened Species Operational Guidelines are to be observed.
Rehabilitation	Where practicable, containment lines should be stabilised and rehabilitated as part of the wildfire suppression operation.
Smoke Management	- The potential impacts of smoke and possible mitigation tactics must be considered when planning for wildfire suppression and prescribed burning operations. - If smoke becomes a hazard on local roads or highways, the police and relevant media must be notified. - Smoke management must be in accordance with relevant RTA traffic management guidelines.
Structural Fire Fighting	- OEH personnel are not trained in structural fire fighting and must not enter a structure in order to undertake structural fire fighting. - Fire suppression activities may be undertaken from outside a structure in accordance with the policies in the NPWS FMM, in order to protect a built asset.
Visitor Management	The reserve may be closed to the public during periods of extreme fire danger or during wildfire suppression operations.
WARNINGS	- Beware of overhead powerlines. - Beware of any gas bottles on the reserve and any dangerous goods storage areas. - Reserve prone to flooding and only some trails will be trafficable after flood events or rainfall.

Threatened Sites Guidelines

Site	Guidelines
Aboriginal Cultural Heritage Site Management	
IS1	- Do not cut down trees - As far as possible protect the site from fire - Use of foams, wetting agents & retardant is acceptable.
IS2	- Avoid all ground disturbance including the use of earthmoving machinery, handline construction and driving over sites - Sites may be burnt by bushfire, backburn or prescribed burn without damage.
IS3	- Avoid all ground disturbance including the use of earthmoving machinery, handline construction and driving over sites. - Avoid water bombing which may cause ground disturbance. - Permission required from Aboriginal Heritage Environment Officer and Aboriginal community.
Historic Heritage Site Management	
H1	- As far as possible protect the site from fire - Avoid all ground disturbance including the use of earthmoving machinery, handline construction and driving over sites - Avoid water bombing which may cause ground disturbance - Use of foams, wetting agents & retardant is acceptable.
H2	- As far as possible protect the site from fire - Avoid all ground disturbance including the use of earthmoving machinery, handline construction and driving over sites - Water bombing, use of foams, wetting agents & retardant is acceptable.
Threatened Fauna Management	
FA7	Exclude fire from habitat and avoid the use of machinery and chemicals.

Although not shown on the Incident map some vulnerable species of birds are known to frequent the reserve. Ensure that threatened species registers and local knowledge are used when completing burn planning for prescribed burns.



APPENDIX B NSW RFS FIRE TRAIL STANDARDS



RFS

NSW Fire Trail Standards

November 2023
Version 2.0

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1. Introduction

1.1. Background

Bush fires have been a natural part of the landscape for many thousands of years. As communities have developed and properties and towns have been established, the risk of bush fires impacting on communities has increased.

Throughout NSW there are approximately 1.3 million properties on bush fire prone land. Firefighters rely on roads, trails and other tracks on public and private land to access the landscape to prevent, fight, manage and contain bush fires. It is critical to identify and maintain an effective network of accessible fire trails that suit the firefighting operations conducted across NSW.

Historically, decisions regarding the establishment and maintenance of fire trails have rested with land managers, guided by a cooperative framework established by the NSW Bush Fire Co-ordinating Committee (BFCC). A need for a different approach was identified to achieve a more consistent and strategic outcome across all the various land managers.

The *Rural Fires Act 1997 (NSW)* (the Act) was amended to provide a legislative basis for the establishment and maintenance of an enhanced network of fire trails and to create the ability for the RFS Commissioner (the Commissioner) to make fire trail standards.

This document constitutes the Fire Trail Standards (the Standards) made by the Commissioner pursuant to section 62K of the Act.

These Standards primarily define the criteria for development and certification of Strategic Fire Trails and aspects of these Standards maybe applied differently in accordance with different influencing factors. The Standards also serve as a benchmark to inform the design and construction of all fire trails on land throughout the State.

These Standards should be read in conjunction with the *NSW Rural Fire Service Fire Trail Design, Construction and Maintenance Manual*.

1.2. Definitions

Terms and expressions as defined in the Act apply to the Standards. Key additional terms relevant to the Standards are included below:

- **Acceptable Solution:** The primary standard specified by the Commissioner for the certification of fire trails. All Strategic Fire Trails are to, as far as reasonably possibly, conform to the Acceptable Solution as outlined in these Standards.
- **Asset Attributes:** Physical attributes of fire trails that have less direct impact on operational factors of appliances.
- **Asset Performance Solution Criteria:** means the criteria of function that forms the basis for a Performance-Based Solution for the Asset Attributes.
- **BFCC:** Bush Fire Co-ordinating Committee.
- **BFMC:** Bush Fire Management Committee.
- **FAFT:** Fire Access and Fire Trail.
- **Land manager:** any person or agency who is legally responsible for the maintenance, use and development of resources for a section of land or piece of property. For the purposes of these Standards the RFS is the designated land manager for fire trails located on private land.
- **Operational Capability:** The ability to safely access an appliance's cabin and equipment and undertake firefighting operations.

- **Operational Confidence Attributes:** Fire trail attributes that directly impact on the operational factors applicable to fire trails. These attributes directly impact the movement of appliances.
- **Operations Performance Solution Criteria:** The three criteria that make up a Performance Solution for the Operational Attributes, namely Accessibility, Operations and Safety, and Environmental and Cultural.
- **Performance-Based Solution:** Supporting performance requirements that are acceptable under circumstances where the Acceptable Solution cannot be met. Performance-Based Solutions are the responsibility of the land manager, and the onus is on the land manager to maintain the specified performance level and provide evidence of conformance to these solutions.
- **Strategic Fire Trail:** A fire trail on any tenure identified by a BFMC during the FAFT planning process, or by the Commissioner, to be of significant value in the suppression or management of fire within the landscape. These may include multi-purpose trails.
- **Tactical Fire Trail:** A fire trail on any tenure identified by a BFMC during the FAFT planning process, or by the Commissioner, that supports the prevention and suppression of fire. These may include multi-purpose trails.
- **Track/Other:** means vehicular tracks (other than Strategic and Tactical Fire Trails), within the landscape that may be used in the event of a fire.
- **VCC:** stands for Vehicle Carrying Capacity and relates to the highest expected appliance category to safely traverse the fire trail (refer Appendix A for details).

1.3. The operating environment for fire trails

There are several key considerations that have been included in the development of these Standards that relate to the operating environment for the prevention and suppression of bush fires in NSW.

These include:

- the safety and protection of firefighters;
- the nature of incident management procedures in NSW and the use of Australasian Inter-service Incident Management System (AIIMS) across NSW, especially in relation to management of field operations;
- the nature of the fleet that provides primary response, ongoing firefighting and bush fire mitigation activities; and
- the ability of these assets in supporting effective firefighting operations in support of community protection.

Fire trail design should give consideration to the operational nature of the asset and how that can be maximised, whether through provision of attributes that support effective operations (water points, control points, staging areas) or the logistical ability to manage the movement of heavy plant.

Consideration should also be given to ensuring that the design and construction requirements are suitable for the firefighting capability within NSW. Matching these Standards with capability will ensure the most effective firefighting operations can be conducted. Across all combat agencies in NSW, the predominance of first response and ongoing ‘campaign’ firefighting is through the use of Category 1 (or equivalent) appliances. Given this, the design and construction of fire trails that allow for the passage of Category 1 (or equivalent) appliances should seek to meet the Standards for Category 1 VCC as a foundation, noting environmental and strategic limitations to some trails and the primary use of Category 7 and/or Category 9 appliances in appropriate locations (e.g. remote areas).

1.4. What is a fire trail for the purpose of these Standards?

There are a range of access ways across the landscape available for use by firefighters. These include public roads, tracks and trails or other roads used for land management, asset management or recreational purposes. The purpose of these Standards is to define criteria for the development and maintenance of fire trails for appliance use identified through the processes established by the Act and deemed necessary for the protection of the community and its assets.

These trails will be identified at a local level by the BFMC and recorded in a Fire Access and Fire Trail (FAFT) Plan, or 'Designated' by the Commissioner.

While these Standards are principally concerned with fire trails identified as 'Strategic' within FAFT Plans, it is recognised that other fire trails and access ways will continue to exist and serve an important role in bush fire suppression and bush fire management.

Generally, a Strategic trail holds the highest level of priority and value in the suppression and/or management of bush fires in a region. These trails are vital in accessing bush fires from key staging areas. This document prescribes the standards for the design, construction and maintenance of Strategic Fire Trails.

Tactical trails support the prevention and suppression of bush fires by allowing access to localised areas. Tactical trails do not require certification, but landowners are required to maintain their level of operational confidence. These Standards should be used to inform the design, construction and maintenance of Tactical trails.

These Standards are also to be used as a guide for the design, construction and maintenance of track/other trails identified in the FAFT Planning process.

1.5. Directions issued under s62L of the Act

Under s62L of the Act, the Commissioner may give a Direction, in writing, that a fire trail be established and maintained on specified public land in accordance with particulars deemed appropriate by the Commissioner. This may apply to a new and/or existing fire trail.

If a Direction under section 62L of the Act applies to a fire trail, the relevant public land manager must establish and maintain the fire trail in accordance with that Direction. For the avoidance of doubt, the particulars provided in a Direction issued under section 62L of the Act take precedence over any particulars provided for that fire trail in a FAFT Plan, including where a Direction is made after a FAFT Plan is approved.

2. Objectives of the Fire Trail Standards

2.1. Scope

These Standards provide requirements for identified fire trails on land throughout NSW, and in particular, to provide, as far as possible, a practical network of fire trails.

These Standards are to be used by organisations and land managers across NSW responsible for undertaking Fire Access and Fire Trail planning, design, construction and maintenance of fire trails.

The objectives of these Standards, in accordance with Section 62K of Act are (without limitation):

- to set out the structure and form of FAFT Plans, including to outline a process for recording changes to the FAFT Plans between the five-year rolling periods;
- to require a FAFT Plan to include a Treatment Register for fire trails that is approved by the Commissioner;
- to set minimum requirements for identified fire trails on land throughout NSW including by setting standards for fire trails that:
 - allow standard off-road capable appliances to safely and effectively traverse the landscape;
 - provide a consistent level of assurance to both drivers and crew leaders of their ability to safely operate on and from each fire trail;
 - require fire trails to be of an expected standard that is known and understood by firefighters, can be readily identified (including in limited visibility conditions) and are available when required;
 - support operational activities and requirements, maximises operational effectiveness, minimises adverse impacts on the environment and delivers value for money; and
 - maximise resource allocation and the available operating window (including time and range of conditions) across each fire trail for firefighting operations.

While these Standards refer to the requirements for certification of Strategic Fire Trails, there may be considerable benefit in fire trail design and construction allowing for the Standards to be exceeded. One such example is a new crossing structure that is able to provide a higher vehicular Gross Vehicle Mass (GVM) carrying capacity to allow for potential heavy plant movements. This approach is encouraged.

2.2. Assumptions and Limitations

These Standards have been prepared based on the following assumptions:

- The identified fire trail network will be used by suitably trained and competent firefighters capable of operating in the expected physical environment; and
- The existing fleet type and make up of appliances will be retained and be driven by licenced and competent drivers in accordance with local and state procedures.

These Standards have been prepared considering the following limitations:

- Fire trails as identified in these Standards are for the purposes of bush fire suppression and other fire management purposes. While it is recognised that fire trails may also be used for other purposes (including other land management and commercial purposes, forming a part of fire break and the like), such uses do not fall within the scope of these Standards;
- The design and construction Acceptable Solutions and Performance Solutions specified in these Standards cater for standard off-road capable appliances currently used in NSW.

3. Fire Access and Fire Trail (FAFT) Planning

3.1. FAFT Plan requirements

In order to provide a consistent approach to FAFT planning across NSW, the Act requires BFMCs to prepare a draft FAFT Plan for their area. FAFT Plans must be prepared in accordance with requirements set out in these Standards, BFCC Policies and otherwise as required by the Act.

FAFT Plans are to provide a structure for the identification of an integrated and strategic network of fire trails for the protection of the community and its assets, including environmental and cultural values.

The Act adds FAFT Plans to the suite of existing fire planning activities undertaken at the local level (such as bush fire risk management planning). A FAFT Plan identifies the appropriate means of accessing land to prevent, fight, manage or contain bush fires. The FAFT planning process will consider a wide range of factors that will review the adequacy of the firefighting network for firefighting to provide access for the protection of life, property and environmental and cultural values in an area.

A FAFT Plan shall:

- be prepared having regard to the relevant Bush Fire Risk Management Plan and Plan of Operations;
- be prepared in accordance with any RFS guidelines and in a form specified by the Commissioner;
- include all identified trails that form the fire trail network, along with other access ways; and
- be prepared with a planning horizon of five years.

A FAFT Plan shall comprise:

- a map showing:
 - a base layer containing all existing vehicular tracks, trails and roads;
 - the identified fire trail network comprising:
 - all Strategic fire trails;
 - all Tactical fire trails; and
 - other fire access ways, such as existing roads, tracks and trails that may be of use for fire management, but do not form part of the fire trail network.
- a schedule of the identified fire trails that constitute the fire trail network detailing:
 - Fire Trail Name;
 - Unique Identification Number;
 - Total Trail Length (km);
 - BFMC Classification (Strategic, Tactical, etc.);
 - Vehicle Carrying Capacity (VCC);
 - Trail Status;
 - Tenure; and
 - Other matters as determined by the Commissioner.

3.2. FAFT Plan amendment process

The basis of the FAFT Plan amendment process is to cater for improvements and allow for those improvements to be collated for inclusion in future iterations. It is expected that BFMCs and firefighting agencies may identify changes that provide an overall better outcome for firefighters and the community in the period between FAFT Plans.

Amendments to FAFT Plans can arise from a variety of sources:

- incorrect data at the initial development of plan, including omitted trails;
- ground-truthing and implementation planning identifies alternatives that provide better operational outcomes;
- private land holders not agreeing to trails being located on their property;
- implementation of the fire trail raises environmental or operational constraints that necessitate a change to the fire trail;
- experience and fire history identifies opportunities to improve the network;
- the need to ensure the mapped network is a consistent and effective routable network to support dispatch arrangements;
- as a result of a Direction by the Commissioner; and/or
- identification of new trails or existing trails that have substantially changed over time.

Amendments to FAFT Plans need to be managed having regard to the following factors:

- improvements and opportunities should continually be identified and logged into a FAFT Amendment Log to ensure it is a dynamic and responsive process;
- refinements and changes are expected to occur during implementation as physical works and environmental impact assessments are undertaken;
- a FAFT Plan including the associated mapping is a BFMC plan and cannot be unilaterally changed by any single agency or member. Any significant and final changes need to be endorsed by the BFMC; and
- FAFT Plan reviews need to take into consideration any changes made and logged during implementation, as well as any new changes and opportunities identified during the review process.

Amendments to FAFT Plans, once agreed or endorsed by the BFMC, should be recorded in a FAFT Amendment Log, in a form specified by the Commissioner.

3.3. Fire trail Treatment Register

A Treatment Register shall be prepared and submitted to the Commissioner for approval concurrently with the submission of a draft FAFT Plan.

A Treatment Register shall:

- be prepared in accordance with the Guideline for Preparation of FAFT Plans and in a format specified by the Commissioner; and
- detail planned fire trail works for the nominal five-year planning horizon of the FAFT Plan to improve the network over time.

4. A Performance-Based Approach

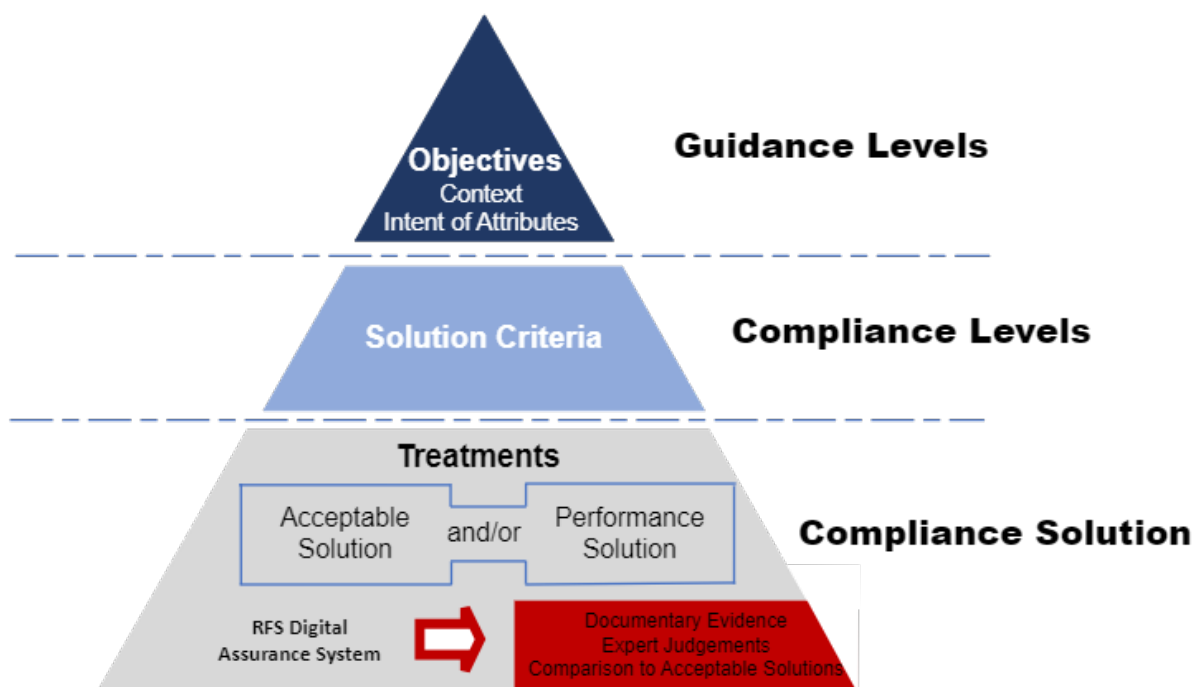
In the development of attribute solutions, this document uses a performance-based approach and identifies objectives and detailed solution criteria to satisfy the context and meet the intent for each attribute. Ultimately, any performance-based approach must demonstrate the maintenance of the safety and operational performance of firefighting resources.

This can be achieved by either applying the identified acceptable solutions, or by preparing a performance-based solution for each attribute. A performance-based solution must be designed to achieve the appropriate level of protection by tailoring an outcome that meets the relevant intent of the solution criteria.

The solution criteria can be satisfied in one of the following ways:

- adopting the acceptable solutions; or
- developing a performance-based solution; or
- a combination of the above.

The attribute solutions are described in Section 5 below.



Acceptable Solutions:

Acceptable Solutions provide a prescriptive criteria to meet the attribute context and intent (where applicable).

Performance Solutions:

Performance solutions allow flexibility and innovation in responding to site-specific opportunities and constraints while still meeting the identified solution criteria. They also allow the consideration of a broad range of issues and information, including trail accessibility, firefighting operations and safety, and environmental and cultural aspects of the trails.

When performance-based solutions are proposed, they must be considered on their merits and individual circumstances. In these circumstances, a process (through the RFS Digital Assurance System) can be undertaken, which would involve early agreement on the key elements and acceptance criteria from all stakeholders.

When developing a performance-based solution, several key factors should be considered:

- **Specific Objectives:** Clearly define the objectives of the fire trail attribute.
- **Solution Criteria:** Identify how the performance criteria will be used to assess the effectiveness of the solution. These criteria should align with the objectives of this document.
- **Equivalent level of safety:** Determine if the proposed performance-based solution provides an equivalent or higher level of safety compared to acceptable solutions. It should be demonstrated that the proposed design achieves the desired intent and is at least as effective as the acceptable solution approach.
- **Stakeholder consultation:** Engage with relevant stakeholders, including landowners and other agency experts. Seek their input and expertise throughout the process to ensure a comprehensive and practical solution. Consider their feedback in refining the solution and addressing any concerns.
- **Documentation and communication:** Document the performance-based solution thoroughly through use of the RFS Digital Assurance System, including the analysis, modelling results and rationale behind the decisions. Clearly communicate the proposed treatments to all stakeholders involved, ensuring they understand the intent, objectives and any unique considerations.
- **Ongoing evaluation and maintenance:** Recognise that fire trails are a dynamic asset and should be regularly evaluated and maintained. Develop a plan for periodic reviews of the performance-based solution to address any changes in the treatment required.

By considering these factors, a comprehensive and effective performance-based solution can be developed, tailored to the specific risks and characteristic of the site.

The onus is on the land manager (subject to any written agreement with the RFS) to demonstrate compliance with relevant provisions of these Standards.

Each fire trail must be assessed by the land manager against the Acceptable Solution or demonstrate compliance with all the listed Performance Solution criteria.

Performance Solutions should be reviewed in consultation with the relevant stakeholders, such as the RFS, land managers, private landowners and any relevant third parties (e.g., fire trail construction contractors).

4.1. Attributes

The Fire Trails Standards Attributes in Section 5 have been divided into two categories, being:

- Operational Confidence Attributes; and
- Asset Attributes.

The reason for this division is to ensure that fire trails meet firefighting requirements and are available for use by firefighters on an ongoing basis.

Operational Confidence Attributes are attributes that directly impact on the operational factors applicable to fire trails. These attributes directly impact the movement of appliances. Meeting the Acceptable Solutions and Performance Solutions, where applicable, of these attributes assists in creating and maintaining the strategic operational performance of the fire trail and safety of firefighters in a fire event. The Operational Confidence Attributes are:

- Trafficable Width;
- Clearance;
- Grade;

- Crossfall;
- Horizontal Curves;
- Passing Bays;
- Turnaround Bays;
- Crossing Structures;
- Trafficable Surface; and
- Corridor Hazards.

Asset Attributes: are physical attributes of fire trails that have less direct impact on operational appliances (but are necessary for trail longevity and safety). These attributes contribute to the physical condition of the fire trail. The asset attributes are:

- Operational Support Points;
- Water Management Systems:
 - Table and Mitre Drains;
 - Cross Banks; and
 - Spoon Drains;
- Pavement Materials;
- Trail Access and Access/Egress Points;
- Trail Signage; and
- Fixed Water Points.

For certification of a fire trail under section 62N of the Act, all fire trail attributes (i.e., both Operational Confidence Attributes and Assets Attributes), must comply with either:

- the Acceptable Solution; or
- **all** the Performance Solution Criteria for the relevant Performance Solution.

See Section 6 (“Certification and Condition Monitoring”) of this document for further details.

4.2. Planning/environmental approvals

Regardless of whether Acceptable Solution or Performance Solutions are adopted, or whether works relate to Operational Confidence Attributes or Asset Attributes, fire trail works are required to be undertaken in accordance with all applicable planning, environmental and other regulatory requirements.

Some of the key planning and environment approval mechanisms for fire trails may include:

- a Bush Fire Hazard Reduction Certificate issued in accordance with the Bush Fire Environmental Assessment Code; or
- a Review of Environmental Factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*; or
- other relevant environmental approval pathways.

Works on fire trails are to be conducted in accordance with the requirements of all relevant environmental and other regulatory approvals and legislation and are the responsibility of the Land Management Authority undertaking the works.

5. Fire Trail Attributes

The Acceptable Solutions and Performance Solutions for fire trail attributes have been developed for each appliance category and each fire trail classification within NSW. The specifications outlined in each attribute are based on the appliance category details contained in Appendix A.

These Standards provide for the categorisation of fire trails based on the type of appliance required to access an area. Three categories are provided:

- Category 1: A fire trail that can be safely traversed by a Category 1 firefighting appliance.
- Category 7: A fire trail that can be safely traversed by a Category 7 firefighting appliance.
- Category 9: A fire trail that can be safely traversed by a Category 9 firefighting appliance.

The primary purpose of trail classification is to ensure the appropriate management of the fire trail and the degree to which the standards are reasonably applied. Classification allows for more efficient use of limited resources by prioritising trails. Trail classifications are to be included in the FAFT Plan prepared by a local area BFMC or as otherwise determined by the RFS Commissioner.

The fire trail classification system allows for consistent resource allocation for all trails in the network according to priority. Understanding between trail managers, the RFS Commissioner and firefighters in the context of trail classification allows for uniformity in user expectations, operational capabilities and the provisions for an overall safe and economically viable trail network.

5.1. Heavy Vehicles

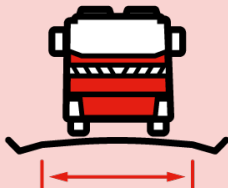
In NSW heavy vehicles are categorised dependent on the vehicle mass, dimension and configuration, or a combination of all three. While these standards do not outline the requirements for Heavy Vehicle movements on Fire Access and Fire Trails, it is acknowledged that firefighting operations can incorporate the use of heavy plant and bulk water appliances where the topography allows (including low loaders/floats). The appliance details are contained in Appendix A.

As a result, consideration should be made during design and construction of fire trails, in particular drainage structures such as cross banks (also referred to as roll overs), for the safe and effective transport of heavy vehicles, where appropriate, for the support of firefighting operations.

5.2. Operational Confidence Attributes

Trail Width

Intent: The width of the trail provides for safe, reliable and unobstructed passage for a firefighting appliance within acceptable operational limits.

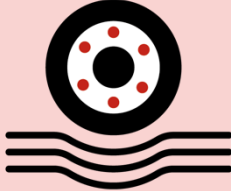
Acceptable Solution			
Appliance Type:	Category 1	Category 7	Category 9
Criteria: 	Option 1: The trail must have a minimum width of 4.0m. Where there is a curve with a radius <30m, refer to Performance Solution. Option 2: If <120m linear distance from the end of a passing bay to the start of the next passing bay, the width can be reduced to 3.5m. Where there is a curve with a radius <30m, refer to Performance Solution. No more than 5% of the total length of the fire trail may be narrower than the Acceptable Solution.	Option 1: The trail must have a minimum width of 3.5m. Where there is a curve with a radius <20m, refer to Performance Solution. Option 2: If <120m linear distance from the end of a passing bay to the start of the next passing bay, the width can be reduced to 3m. Where there is a curve with a radius <20m, refer to Performance Solution.	Option 1: The trail must have a minimum width of 3.0 m. Where there is a curve with a radius <20m, refer to Performance Solution. Option 2: If <120m linear distance from the end of a passing bay to the start of the next passing bay, the width can be reduced to 2.5m. Where there is a curve with a radius <20m, refer to Performance Solution.

Performance Solution	
Accessibility 	Context: Refer to Appendix A for minimum appliance dimensions. A narrower trail increases the risk of damage to the appliance and may impede operational movement of the appliance. Criteria: The fire trail must provide a width for: – the unobstructed traversing of the terrain without damage to the appliance; – the traversing of the terrain at a speed appropriate for safe firefighting operations; and – the ability of an appliance to navigate the section without reversing manoeuvres.
Operations 	Context: A narrow trail increases the risk of: – damage to the appliance; – low speeds leading to extended reaction times or reduced operating windows; – inaccessibility leading to poor tactical response; – routes becoming inaccessible due to higher obstruction risk; and – overgrown trails rendering them inaccessible and leading to more frequent maintenance. Criteria: – the fire trail must not be of a width that impedes the tactical movement of appliances; – the fire trail must not impede firefighting personnel's access to the appliance (egress and ingress); and provides an unobstructed view for firefighters. –
Safety, Environmental and Cultural 	Context: Insufficient trail width may: – increase risk to safety of firefighting personnel; and – increase risk to environment due to inability to suppress/fight fires. Criteria: The fire trail is of a width that: – does not pose an increased risk to firefighting personnel safety in any way; – does not impact on evacuation of the area in any way; – considers any negative impacts on the surrounding environment; and – has appropriate signage (for example, longer sections of a fire trail that are narrower than the Acceptable Solution must be appropriately signposted). –

Trafficable Surface

Intent: The construction and formation of the trail is trafficable under all* weather conditions for a firefighting appliance.

Acceptable Solution

Appliance Type:	Category 1	Category 7	Category 9
Criteria: 	Trail surfaces under all* weather conditions must be able to carry: – a Gross Appliance Mass of 15 tonnes; and – an Axle Load of 9 tonnes	Trail surfaces under all* weather conditions must be able to carry: – a Gross Appliance Mass of 8 tonnes; and – an Axle Load of 6 tonnes	Trail surfaces under all* weather conditions must be able to carry: – a Gross Appliance Mass of 4 tonnes; and – an Axle Load of 2 tonnes

Performance Solution

Accessibility



Context: An unsuitable trafficable surface could:

- cause damage to the appliance;
- prevent tactical movement by rendering areas unreachable; and
- lead to appliances being rendered immobile; and
- prevent evacuation of the area in case of an emergency.

Criteria: The fire trail trafficable surface must:

- be constructed and able to be maintained such that the surface is accessible under all* conditions;
- provide sufficient traction to allow traversing of the terrain under all conditions (except for flood, storm surge and snowfall); and
- provide sufficient carrying capacity to ensure safe passage for appliances without losing traction or being rendered immobile.

Operations



Context: An unsuitable trafficable surface could:

- prevent tactical movement and manoeuvres required for effective firefighting measures;
- require re-routing and time delays of appliances; and
- increase risk to surrounding areas should operations not be able to move in a predictable manner.

Criteria: The fire trail trafficable surface must:

- be free from major defects that may interfere with appliance operational speed; and
- allow for a safe working platform for personnel to access the appliance cabin and equipment.

Safety, Environmental and Cultural



Context: An unsuitable trafficable surface could:

- pose and increased risk of damage to appliances;
- increase the risk of injury to firefighter personnel; and
- increase the propensity for accumulation of surface water if required drainage measures are not adhered to.

Criteria: The trafficable surface must:

- ensure a safe working environment for personnel and should have sufficient integrity for its expected term of use in the event of an incident;
- be free of contaminants; and
- incorporate, as far as possible local and sustainable materials.

*Expected weather conditions (i.e., not during flood, storm surge or snowfall)

Clearance

Intent: A cleared corridor is provided around the trail to permit the unobstructed passage of a firefighting appliance and enable firefighters to egress and access equipment in the vehicle. In providing clearance, consideration for vegetation regrowth is required so that a minimum 1m clearance is provided at all times (including between maintenance activities). Greater vegetation clearance should be considered at locations where visibility may be reduced.

Acceptable Solution

Appliance Type:	Category 1	Category 7	Category 9
Criteria: 	The trail must have: – an envelope free of obstructions, including dense vegetation, to allow for unimpeded operations; – a minimum vertical clearance of 4m above the trafficable surface; and – a minimum horizontal clearance of 3m from the trafficable surface centreline.	The trail must have: – an envelope free of obstructions, including dense vegetation, to allow for unimpeded operations; – a minimum vertical clearance of 4m above the trafficable surface; and – a minimum horizontal clearance of 2.75m from the trafficable surface centreline.	The trail must have: – an envelope free of obstructions, including dense vegetation, to allow for unimpeded operations; – a minimum vertical clearance of 4m above the trafficable surface; and – a minimum horizontal clearance of 2.5m from the trafficable surface.

Performance Solution

Accessibility



Context: Insufficient clearance could impede forward and night time visibility and impact on the effective movement of appliances.

Criteria: The fire trail clearance must:

- provide a cleared envelope free from obstructions preventing access or thoroughfare;
- provide sufficient clearance from protrusions that could cause damage to the appliance;
- in the event of overgrowth, be of such a nature to allow safe thoroughfare of the appliance; and
- enable clear visibility for free forward movement of appliances.

Operations



Context: Insufficient clearance could pose risk to appliances and personnel by restricting movement and introducing obstructions.

Criteria: The fire trail trafficable surface must:

- allow appliances to travel at an operational speed (inline with the conditions on the trail);
- allow personnel unimpeded access to appliance cabin and equipment; and
- afford suitable footing and freedom of movement for personnel.

Safety, Environmental and Cultural



Context: Insufficient clearance could:

- increase risk of ignition and flare up; and
- increase the risk of fire jumping over appliances and personnel;
- increase the risk of overrun.

If not managed correctly:

- increasing the trail clearance could cause loss of habitat;
- increasing trail clearance could possibly impact culturally sensitive sites; and
- trails could act as a barrier impeding wildlife movement.

Criteria: In all cases, the fire trail clearance must:

- provide sufficient space for the safe access to the appliance by personnel, except where there are significant environmental constraints. In this case, alternative clearance solutions may be considered in consultation with the RFS;
- be achieved and maintained through environmentally conscious and responsible methods; and
- be achieved and maintained in accordance with relevant environmental approvals.

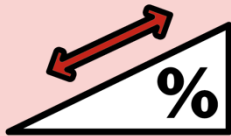
Grade

Intent: The vertical profile of the trail provides for traction and safe working angle within the physical operational capability of a firefighting appliance (including design that does not impede the undercarriage of an appliance).

Acceptable Solution

Appliance Type: All Categories

Criteria: There is no defined grade criteria, refer to Performance Solution.



Performance Solution

Accessibility



Context: Unacceptable trail grades¹ could:

- cause loss of traction and impede effective movement of the appliances; and
- cause damage to or loss of operational capability of the appliance.

Criteria: The grade of the trail must:

- provide sufficient traction for a fully laden appliance while ascending and descending;
- provide a safe working angle that does not impede physical operational capability of the appliance; and
- not exceed the physical ground clearance capabilities of the appliance.

Operations



Context: Unacceptable trail grades¹ may:

- pose an unstable working angle from which firefighters must access and operate appliance equipment;
- increase the risk of injury to personnel during egress or access to appliances; and
- reduce effective operating speeds.

Criteria: The grade of the trail must ensure that:

- a fully laden appliance is capable of traversing the terrain; and
- operational capability of the appliance and personnel are not adversely impacted.

Safety, Environmental and Cultural



Context: Poor trail grades² may:

- increase or stagnate stormwater velocity and increase the risk of erosion; and
- cause bottoming out and damage to both the appliance and the trail.

Criteria: The grade of the trail must:

- minimise impacts to the environment and reduce earthworks required; and
- possess appropriate surface water management.

¹ Unacceptable Trail Grades: The trail is badly damaged. Most, if not all, drainage structures are non-functional. Major repair or reconstruction works are now required.

² Poor Trail Grades: Trail is still usable, BUT significant reduction in trafficability. Low Range, Low gear is required. Significant evidence of compromised drainage, resulting in rutting, scouring and loss of material from the carriage way. Major repair or remediation works are now required.

Crossfall

Intent: The vertical profile of the trail provides for traction and safe working angle with the physical operational capability of a firefighting appliance (including design that does not impede the undercarriage of an appliance).

Acceptable Solution

Appliance Type: All Categories

Criteria:



Unless transitioning between cross sections, the crossfall of the trail is no more than 6 degrees (10.5%).

Performance Solution

Accessibility



Context: Inadequate crossfall may:

- increase the risk of poor traction; and
- increase the risk of rollover as quick lateral shifts can cause sloshing within the appliance's water tank.

Criteria:

- The crossfall of the trail must provide sufficient traction for fully laden appliances while ascending and descending; and
- Ensure the risk of roll over and uncontrolled movement of appliances is managed

Operations



Context: See Accessibility.

Criteria:

- Crossfall of the trail must provide a stable foundation for appliances and personnel to ensure operational capability.

**Safety,
Environmental
and Cultural**



Context: Inadequate crossfall may:

- increase the risk of rollover as quick lateral shifts can cause sloshing within the appliance's water tank;
- increase the potential for an appliance to slide sideways on the trail during wet conditions, posing risks to personnel and appliances; and.
- pose risk of injury to personnel alighting from appliances.

Criteria: The crossfall of the trail:

- must provide sufficient traction for fully laden appliances;
- ensure that the risk of rollover and uncontrolled movement of vehicles is managed; and
- safety of personnel in firefighting operations is managed.

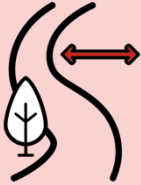
Horizontal Curves

Intent: The design of the trail provides for safe, manoeuvrable and operationally effective passage by a firefighting appliance within acceptable operational limits.

Acceptable Solution

Appliance Type: All Categories

Criteria: There is no defined criteria for horizontal curves, refer to Performance Solution.



Performance Solution

Accessibility



Context: Tight curves may not:

- allow for an appliance to manoeuvre in line with its capabilities;
- restrict visibility of oncoming traffic or personnel; and
- increase risk of roll over.

Criteria: The horizontal curves must allow the relevant appliance to navigate through a curve in a single movement without coming to a stop or having to reverse.

Operations



Context: Multiple tight curves can:

Criteria:

- impede safe travel speed, reducing operational effectiveness;
- impact hazard reduction ignition or back burning operations; and
- increase risk to personnel working on the ground, where appliances are unable to identify hazards when travelling around sharp curves.

Safety, Environmental and Cultural



Context: Poorly designed and constructed curves may:

- have an unnecessary environmental impact;
- impede appliance movement, posing a safety risk to operators during an emergency scenario; and
- impede personnel's ability to react to hazards as a result of poor visibility.

Criteria: The horizontal curves shall:

- allow for appropriate sight distances to any identified hazards; and
- minimise environmental impact by following natural contours of the land when possible.

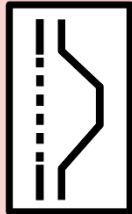
Passing Bays

Intent: The trail provides for two firefighting appliances to pass at appropriate operational and safe intervals.

Acceptable Solution

Appliance Type: All Categories

Criteria:



A passing bay is defined as a constructed bay or widening of the trafficable surface to provide access under all weather conditions and provide capability for appliance passing. Passing Bays must be constructed no more than **250m between the end of one bay and the start of another along the trail, and with one in five bays permitted to be up to 300m apart** (no two consecutive bays can be greater than 250m apart).

A passing bay must comprise:

- pavement materials to match the trafficable surface;
- an area large enough to allow the appliance to enter and exit without requiring a reversing manoeuvre; or
- where a turnaround bay is used as a passing bay, it must allow for the safe positioning of the appliance, parallel to and off the main carriageway; and
- a space that allows the safe passing of another appliance while firefighters are working.

Category 1

Capacity for passing bays is to be a widened trafficable surface of at least 6 metres.

Category 7

Capacity for passing bays is to be a widened trafficable surface of at least 5.5 metres.

Category 9

Capacity for passing bays is to be a widened trafficable surface of at least 5 metres.

Performance Solution

Accessibility



Context: Poorly constructed passing bays or inadequate spacing may:

- impede strategic movement of appliances; and
- render an appliance immovable due to insufficient structural support.

Criteria: A passing bay must:

- allow for the effective and safe passing of two appliances without avoidable delays to operations;
- be capable of supporting the required appliance mass and axle load;
- allow for the free flow of multiple appliances on the fire trail; and
- allow for the access and passing of appliances without reversing.

Operations



Context: Poorly constructed passing bays or inadequate spacing could:

- impede access to appliance equipment; and
- increase risk of appliance congestion and operational delay.

Criteria: A passing bay must:

- ensure unimpeded access to the appliance cabin and equipment off the trail and away from vegetation; and
- provide opportunities for appliances to pass at appropriate intervals for continuous operational movement.

Safety,
Environmental
and Cultural



Context: Poorly constructed or maintained passing bays could:

- have increased risk of vegetation ignition from stationary appliances;
- introduce delays of appliances using the trail as an escape route;
- pose significant risk to personnel by creating traffic jams in an emergency situation; and
- be hard to identify.

Criteria: A passing bay must be designed and constructed to minimise environmental impact.

Turnaround Bays

Intent: The trail provides for a turning manoeuvre for a firefighting appliance to return in the direction from which it came from, at appropriate intervals.

Acceptable Solution			
Appliance Type:	Category 1	Category 7	Category 9
Criteria: 	Turnaround bays are to be constructed as surfaces to provide access under all weather conditions and must be provided every 500m along the trail, where a trail changes VCC and at the termination of a trail. Each turnaround bay must enable the whole vehicle to be off the trafficable trail and: – be constructed with an area clear of the trafficable surface at least 6m wide and 6m deep, which is accessible for a three-point turn or u-turn; OR – have a turning circle which has a minimum outer diameter of 22m.	Turnaround bays are to be constructed as surfaces to provide access under all weather conditions and must be provided every 500m along the trail, where a trail changes VCC and at the termination of a trail. Each turnaround bay must enable the whole vehicle to be off the trafficable trail and: – be constructed with an area clear of the trafficable surface at least 5.5m wide and 6m deep, which is accessible for a three-point turn or u-turn; OR – have a turning circle which has a minimum outer diameter of 17m.	Turnaround bays are to be constructed as surfaces to provide access under all weather conditions and must be provided every 500m along the trail, where a trail changes VCC and at the termination of a trail. Each turnaround bay must enable the whole vehicle to be off the trafficable trail and: – be constructed with an area clear of the trafficable surface at least 5.5m wide and 6m deep, which is accessible for a three-point turn or u-turn; OR – have a turning circle which has a minimum outer diameter of 16m.
Performance Solution			
Accessibility 	Context: Poorly constructed turnaround bays could: – restrict tactical movement of appliances due to trail termination and insufficient turning space; and – lead to trail obstruction due to immobile appliances. Criteria: The turnaround bays must be: – large enough to allow for the relevant appliance to return in the direction from where it came through a three-point turning manoeuvre; – provide sufficient space for the relevant appliance to change direction without obstructing the fire trail; and – present at the end of each fire trail.		
Operations 	Context: Poorly constructed or inadequately spaced turnaround bays could: – restrict directional change opportunities, introducing operational delays; and – impede access to an appliance when bay is used as a passing bay. Criteria: The turnaround bays must: – provide tactical manoeuvrability locations for appliances; – provide sufficient space for personnel to access firefighting equipment and implement likely firefighting tactics; and – not prevent thoroughfare of other appliances along the fire trail.		
Safety, Environmental and Cultural 	Context: Poorly constructed, spaced or maintained turnaround bays could lead to: – delays for appliances using the trail as an escape route due to trail blockage; and – the loss of habitat and detrimental environmental impacts. Criteria: The turnaround bays must: – provide directional change opportunities particularly when an escape route is required; and – be constructed to minimise environmental impact.		

Engineered Culverts and Bridges

(Major Crossing Structures)

Intent: The structures are adequate to ensure the crossing of a drainage feature of a trail to provide safe, functional passage of firefighting appliances.

Acceptable Solution

Appliance Type:	Category 1	Category 7	Category 9
Criteria: 	Crossing structures must: – have appropriate guidepost delineation for safe visibility; and – be able to carry: – a Gross Appliance Mass of 15 tonnes; and – an Axle Load of 9 tonnes. Where new crossing structures can provide a higher vehicular GVM carrying capacity, then this is strongly encouraged.	Crossing structures must: – have appropriate guidepost delineation for safe visibility; and – be able to carry: – a Gross Appliance Mass of 15 tonnes; and – an Axle Load of 6 tonnes. Where new crossing structures can provide a higher vehicular GVM carrying capacity, then this is strongly encouraged.	Crossing structures must: – have appropriate guidepost delineation for safe visibility; and – be able to carry: – a Gross Appliance Mass of 15 tonnes; and – an Axle Load of 2 tonnes. Where new crossing structures can provide a higher vehicular GVM carrying capacity, then this is strongly encouraged.
Refer to NSW Rural Fire Service Fire Trail Design, Construction and Maintenance Manual for guidance on types of crossing structures.			

Performance Solution

Accessibility 	Context: <i>Inadequate crossing structures could render the entire trail non-functional.</i> Criteria: Crossing structures must: – possess adequate bearing capacity for safe crossing of appliances; – have adequate width to allow movement of the relevant appliance; and – allow for the effective strategic movement of appliances.
Operations 	Context: <i>Inadequate crossing structures may:</i> – provide limited options for alternative routes if closed from traffic; – impede tactical movement of appliances; and – lead to appliances being stranded on parts of a fire trail should the crossing structure be damaged and rendered un-crossable. Criteria: Crossing structures must: – not impede the operational capability of appliances; and – not affect the trail's integration with the network.
Safety, Environmental and Cultural 	Context: <i>Poorly designed crossings could:</i> – impede the natural flow of water, impacting the surrounding environment; and – lead to unexpected closures and isolate appliances and personnel already on the trail. Criteria: Crossing structures must: – be clearly delineated; – have appropriate guidepost delineation for safe visibility; – allow for unobstructed flow of natural watercourses (unless in accordance with a relevant water authority approval); and – not divert natural flow of the watercourse (unless in accordance with a relevant water authority approval).

Bed Level Crossings and Piped Culverts

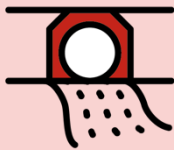
(Minor Crossing Structures)

Intent: The structures are adequate to ensure the crossing of a drainage feature of a trail to provide safe, functional passage of firefighting appliances.

Acceptable Solution

Appliance Type: All Categories

Criteria:



Crossing structures must:

- be able to carry a Gross Appliance Mass of 15 tonnes; and
- have appropriate guidepost delineation for safe visibility.

Refer to *NSW Rural Fire Service Fire Trail Design, Construction and Maintenance Manual* for guidance on types of crossing structures.

Performance Solution

Accessibility



Context: *Inadequate crossing structures could render the entire trail non-functional.*

Criteria: Crossing structures shall:

- possess adequate bearing capacity for safe crossing of appliances;
- have adequate width to allow movement of the relevant appliance; and
- allow for the effective strategic movement of appliances.

Operations



Context: *Inadequate crossing structures may:*

- provide limited options for alternative routes if closed from traffic;
- impede tactical movement of appliances; and
- lead to appliances being stranded on parts of a fire trail should the crossing structure be damaged and rendered un-crossable.

Criteria: Crossing structures shall:

- not impede the operational capability of appliances; and
- not affect the trail's integration with the network.

**Safety,
Environmental
and Cultural**



Context: *Poorly designed crossings could:*

- impede the natural flow of water, impacting the surrounding environment; and
- lead to unexpected closures and isolate appliances and personnel already on the trail.

Criteria: Crossing structures must:

- have appropriate guidepost delineation for safe visibility;
- allow for unobstructed flow of natural watercourses (unless in accordance with a relevant water authority approval); and
- not divert natural flow of the watercourse (unless in accordance with a relevant water authority approval).

Corridor Hazards

Intent: The trail provides for a low safety risk to reduce obstruction or damage to firefighting appliances from uncontrolled hazards, e.g., overhanging tree limbs or rock falls.

Acceptable Solution

Appliance Type: All Categories

Criteria: There is no defined criteria for corridor hazards, refer to Performance Solution.



Performance Solution

Accessibility



Context: Uncontrolled corridor hazards can impede movement of appliances, potentially cause trail closure and potentially damage appliances.

Criteria: Corridor hazards must:

- be identified by appropriate signage or spatially; and
- be assessed for their potential risk and, if deemed significant, be rectified such that the risk for the trail becoming inaccessible is reduced to an acceptable level.

Operations



Context: Corridor hazards, such as overhanging trees or narrow passes, can impact firefighters being able to perform operations safely and effectively.

Criteria: Corridor hazards must be:

- addressed such that impacts to the whole fire trail network are minimised;
- controlled if they pose a risk to firefighters being able to perform operations safely and effectively; and
- prioritised based on the importance of the trail within the network and the severity of the hazard.

Safety, Environmental and Cultural



Context: Hazards increase risk of injury to firefighters and damage to appliances. A balance between safety and effectiveness of operations and environmental and cultural impact is required, and any risk to safety arising from a hazard should be identified by agencies during an incident.

Criteria: Corridor hazard management must examine:

- trees and tree limbs to extend beyond the cleared area of a fire trail, which presents a safety risk. These are generally mature trees with:
 - a lean towards the trail and weaknesses in their root structure; and/or
 - branches with weaknesses which extend over the trail; and
- mature trees (high potential) to be environmentally and culturally sensitive. Therefore, the environmental cost of removing the tree partially or fully must be considered against the safety risk; and
- areas with a history of instability such as batter failure or rock falls require inspection schedules to minimise the risk of damage to appliances and personnel.

5.3. Asset Attributes

Operational Support Points

Intent: The assets are locatable, accessible and of appropriate dimension and construction for the access and use for firefighting appliances within operational limits.

Acceptable Solution	
Appliance Type:	All Categories
Criteria:	Functionally, operational support points (OSP) may include, but are not limited to, coordination, aerial support, welfare, logistics support, refuge, turning circle, communications support, bulk water points, amenities and resupply operations.
	Operational support points are to be: – identified and mapped³; – located in strategic and accessible locations with respect to the trail network, historic fires and anticipated future operations; – constructed with pavement materials that support the proposed usage; – of appropriate dimensions for functional requirements (refer to Performance Solution); and – if a trail is >10km, at least one SMALL OSP is required on the trail (strategically placed).
Performance Solution	
Accessibility	Context: Poor construction and preparation of the site could lead to ineffective fire response and tactical planning. Criteria: The operational support point must: – comprise clear pathways for appliances to enter and exit the OSP onto the trail or road network; – have a surface which can support the load of anticipated appliances and structures; and – have appropriate dimensions and be strategically located for: SMALL OSP: – control point; or – bulk water point; or – staging a strike team of appliances. MEDIUM OSP – combination of: – control point; and/or – helicopter point; and/or – staging more than one strike team of appliances; and/or – catering/amenities support.
	

³ This is an operational benefit for use in the FAFT spatial data overlay which can be used for operational decision making.

Water Management Systems

Intent: The trail is drained effectively to manage water flows and prevent damage to the trafficable surface.

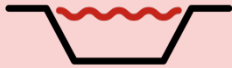
Acceptable Solution

Appliance Type:

All Categories

Criteria:

There is no defined criteria for water management systems, refer to Performance Solution.



Performance Solution

Accessibility



Context: Poor water management systems may:

- damage or destroy the trail;
- lead to damage of the trafficable surface, which can impede the movement and manoeuvrability of appliances;
- damage the surrounding area due to concentrated water flow leading to scouring and erosion;
- alter the environmental surroundings; and
- cause ponding of water on the fire trail.

Criteria: Water management systems must:

- be constructed so that appliances do not damage the trail or water management structures such as cross banks, or render the trail inaccessible after reasonable repeated use;
- not exceed the break over angle of ground clearance of appliances; and
- manage surface runoff to prevent damage to the water management systems, trafficable surface and the surrounding area.

Refer to the *Fire Trail Design, Construction and Maintenance Manual* for further guidance.

Pavement Materials

Intent: The trail surface needs to be appropriate for all* weather conditions to ensure safe, long term, operational movement of appliances.

Acceptable Solution

Appliance Type:

All Categories

Criteria:



Pavement materials need to be appropriate for all* weather conditions. Refer to Performance Solutions.

Performance Solution

Accessibility



Context: The fire trail pavement materials could:

- prevent tactical movement of appliances if the trail is in poor condition due to poorly performing materials;
- result in a weak structure that can deform, posing a risk to tactical movement and fire response; and/or
- cause damage to appliances if not adequate to manage load and movement volume.

Criteria: The fire trail carriageway pavement materials must:

- provide a structure with a consistent trafficable surface;
- not deteriorate with anticipated usage under the movement of appliances across the terrain; and
- not contain environmentally damaging and/or hazardous materials.

*Expected weather conditions, i.e., not during flood, storm surge or snowfall

Trail Access and Access/Egress Points

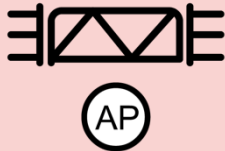
Intent: The access is provided to manage the safety of firefighters and appliances, and the accessibility to and longevity of the trail.

Acceptable Solution

Appliance Type:

All Categories

Criteria:



- Where gates are required, there must be at least one passing bay located adjacent to the access point;
- have sufficient set back and vegetation clearance around the gate and access point for safe egress into oncoming traffic; and
- Any gate or control mechanism installed across a trail shall:
 - be operable by a single person in a practical timeframe;
 - be a sufficient distance from the adjoining road edge to allow for safe parking of appliance out of traffic and for safe egress from the trail into oncoming traffic; and
 - have fencing setbacks as required around the access.

Performance Solution

Accessibility



Context: *Unauthorised closure of the fire trail may:*

- *prevent appliances from entering/exiting the trail;*
- *impede the effective tactical movement and fire response of appliances; and*
- *unauthorised access may lead to damage to the fire trail, rendering it unsafe or untrafficable.*

Criteria: Where gates are required, the fire trail entrance/exit must:

- be clearly identifiable by personnel, including having appropriate guidepost delineation for safe visibility (including during night operations);
- be a functional entry and exit point for the relevant appliance category;
- be positioned to allow for the safe refuge of an appliance from traffic;
- have sufficient set back and vegetation clearance around the gate and access point for safe egress into oncoming traffic;
- consist of a lock mechanism, which must not unreasonably impede access of appliances into the trail; and
- consist of a trail access/egress gate of sturdy construction that is both weather and vandal resistant.

Trail Signage

Intent: Signs ensure that trails are easily identified, hazards are marked in advance and critical points are subjects of focus.

Acceptable Solution

Appliance Type: All Categories

Criteria:



Standardised signs as per Appendix B should be installed and maintained throughout the fire trail network. Signs ensure that trails are easily identified, hazards are marked in advance and critical points are subjects of focus.

Signage that improves operational capability is to be installed, such as reflectors for night time operations.

Trail Signage must be placed at the last exit point of the trail for any 'no through' trail to denote a lack of alternative escape route.

Performance Solution

Accessibility



Context: Inadequate fire trail directional signage could cause extensive delay in the tactical movement of appliances.

Criteria: The fire trail signage must be:

- signposted (outlining the fire trail name) at each entry point and intersection of another fire trail;
- adequate to convey current information on the fire trail classification and warnings; and
- suitable and acceptable to private landholders to ensure privacy and reduce potential unauthorised access.

If existing signage blades with correct trail name are in place and in good condition, the addition of the appropriate "VCC Blade" only directly underneath the existing name blade is a suitable solution.

Fixed Water Points

Intent: The fixed water point assets are locatable, accessible and of appropriate dimension and construction for use by firefighting appliances within operational limits.

Acceptable Solution

Appliance Type:

All Categories

Criteria:



Where fixed water points exist, they are to be:

- identified and mapped⁴;
- located in strategic locations with respect to the trail network, historic fires and anticipated future operations;
- water points must allow for safe positioning of an appliance to conduct water resupply operations;
- access to fixed water points is to be constructed with pavement materials that support the proposed usage; and
- of appropriate dimensions for functional requirements (refer to Performance Solution).

Performance Solution

Accessibility



Context: Poor construction and preparation of the site including inaccessible or elusive fixed water points could lead to ineffective operational capability.

Criteria: Fixed water points:

- must not obstruct pathways for appliances to enter and exit onto the trail or road network;
- must facilitate access using standard appliance equipment for draughting;
- must have a surface that can support the load of anticipated appliances and structures; and
- must have appropriate dimensions and be strategically located for water resupply.

⁴ This is an operational benefit for use in the FAFT Spatial data overlay which can be used for operational decision making.

6. Certification and Condition Monitoring

6.1. Certification

A fire trail may only be certified end to end (tenure blind) by the Commissioner under the Act if it fully complies with these Standards at the time of the certification.

The Commissioner may certify the following trails:

- a. a fire trail situated on public land – if the fire trail is the subject of a direction under section 62L, or
- b. a fire trail situated on private land – if the fire trail is the subject of an agreement under section 62M, or
- c. an existing fire trail situated on public land – if the fire trail is referred to in a FAFT Plan, or
- d. an existing fire trail situated on private land – if the fire trail is referred to in a FAFT Plan and the fire trail is the subject of an agreement for the establishment of a fire trail entered into before the commencement of this section.

To be eligible for certification:

- The fire trail must meet each attribute either to an Acceptable Solution or, where a performance solution is applied, this must adhere to all of the performance solution criteria for that attribute; and
- the land manager (or the RFS for private land) responsible for the fire trail must have utilised and adequately completed the relevant sections of the RFS Fire Trail Digital Assurance System (or such alternative as the RFS may advise) prior to requesting the Commissioner certify any fire trail under the Act.

6.2. Condition monitoring

Ensuring that fire trails are available for use is a key component of achieving a practical network of fire trails. Condition monitoring should therefore be undertaken regularly, and as a minimum:

- prior to bush fire season; and
- after extreme weather events such as severe storms, flooding or heavy rain, natural disaster declaration or extreme winds (for fire trails identified as likely to be affected).

A land manager shall provide to the Commissioner annually a statement as to the condition of each designated, and registered fire trail on its land, and whether each of those trails meet these Standards. The statement must be made in the form as specified by the Commissioner.

Where a fire trail is located on private land, arrangements for any inspection will be made having regard to any agreement between the Commissioner and the landowner.

The Act gives powers to the Commissioner to undertake inspections of fire trails on both public and private land. At least an annual assessment of all other fire trails (i.e., those that are not designated or registered) in a FAFT Plan should be undertaken by the responsible agency and a condition report provided to the BFMC.

6.3. Maintenance of registered fire trails

Fire trails must be maintained to the condition certified for the life of the trail, ensuring it continues to meet the selected Acceptable Solution or Performance Solutions at time of registration.

It is the duty of the owner, occupier or land manager of the land on which a designated or registered fire trail is situated to ensure ongoing availability and maintenance. In the event that the fire trail is situated on private land, the responsibility resides with the RFS.

6.4. Legacy of existing fire trails

Fire trails that are registered, or on which works have commenced at the time of publication of these standards, will be legacied and required to meet the standards at the time of registration or commencement of works. Legacy arrangements will remain in place until a time determined by the Commissioner.

7. Document Review

The Fire Trail Standards may be reviewed and amended by the Commissioner as required. A review must be undertaken within three years of publication.

Appendix A: Firefighting Appliance Specifications

Category 1 Firefighting appliance specifications

Table A.1: Category 1 Firefighting appliance specifications

Unit	Measurement
Length	8,000mm
Width	2,450mm
Mirror length	450mm
Height	3,900mm (including 600mm for aerials)
Ground clearance	380mm
Approach angle	25°
Departure angle	28°
Wheelbase	4,250mm
Turning circle – wall to wall	18m diameter
Weight	14,200kg
Maximum axle loading	9,000kg

Category 7 Firefighting appliance specifications

Table A.2: Category 7 Firefighting appliance specifications

Unit	Measurement
Length	6,250mm
Width	2,230mm
Mirror length	450mm
Height	3,350mm (including 600mm for aerials)
Ground clearance	380mm
Approach angle	25°
Departure angle	28°
Wheelbase	3,395mm
Turning circle – wall to wall	14m diameter
Weight	7,500kg
Maximum axle loading	5,600kg

Category 9 Firefighting appliance specifications

Table A.3: Category 9 Firefighting appliance specifications

Unit	Measurement
Length	5,500mm
Width	1,900mm
Mirror length	450mm
Height	2,800mm (including 600mm for aerials)
Ground clearance	320mm
Approach angle	27°
Departure angle	23°
Wheelbase	3,180mm
Turning circle – wall to wall	14m diameter
Weight	3,780kg
Maximum axle loading	2,000kg

Additional Appliances

Category 6 and 13 Firefighting appliance specifications

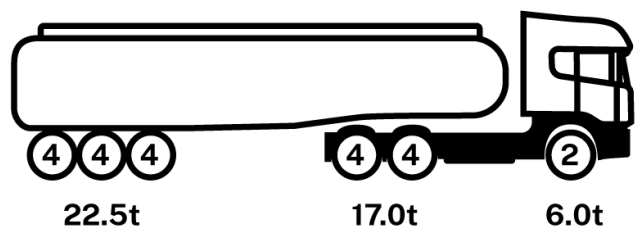
Table A.4: Category 6 and 13 Firefighting appliance specifications (Heavy Rigid Bulk Water Tanker)

Unit	Measurement
Length	8,700mm
Width	2,400mm
Mirror length	450mm
Height	3,600mm (including 600mm for aerials)
Ground clearance	300mm
Approach angle	13°
Departure angle	23°
Wheelbase	4,410mm
Turning circle – wall to wall	19m diameter
Weight	22,500kg
Maximum axle loading	16,500kg

Semi-trailer Watercart appliance specifications

Table A.5: Semi-trailer appliance specifications (Articulated Water Tanker)

Unit	Measurement
Length	Up to 19,000mm
Maximum Total Combination Mass	Up to 45,500kg

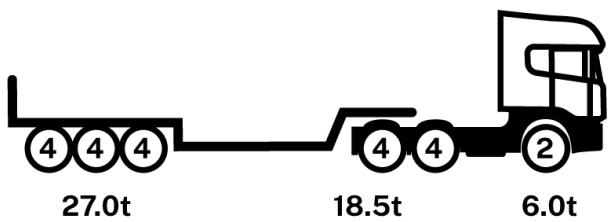


Semi-trailer appliance design example (axle masses included)

Low loader appliance specifications

Table A.6: Low loader appliance specifications (Heavy Plant Float)

Unit	Measurement
Length	Up to 30,000mm
Maximum Total Combination Mass	Up to 51,500kg



Low loader appliance design example (axle masses included)

Appendix B: Fire Trail Signage

Strategic Fire Trail Signs

Primary Fire Trail Directional Signs
– Single end mounted post



Bi-Directional Fire Trail Signs
– Centre mounted post

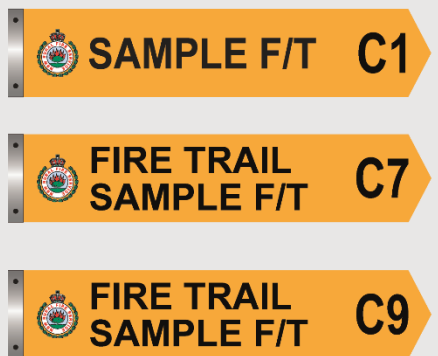


Certified Indicative Signs
– Single end mounted post

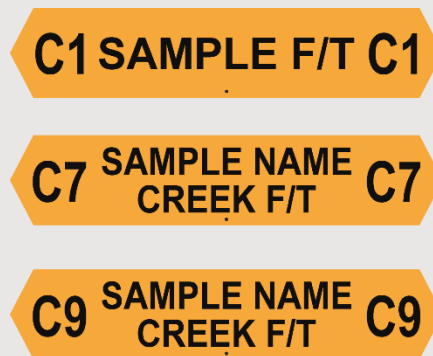


Tactical Fire Trail Signs

Primary Fire Trail Directional Signs
– Single end mounted post



Bi-Directional Fire Trail Signs
– Centre mounted post



Tactical Indicative Signs
– Single end mounted post

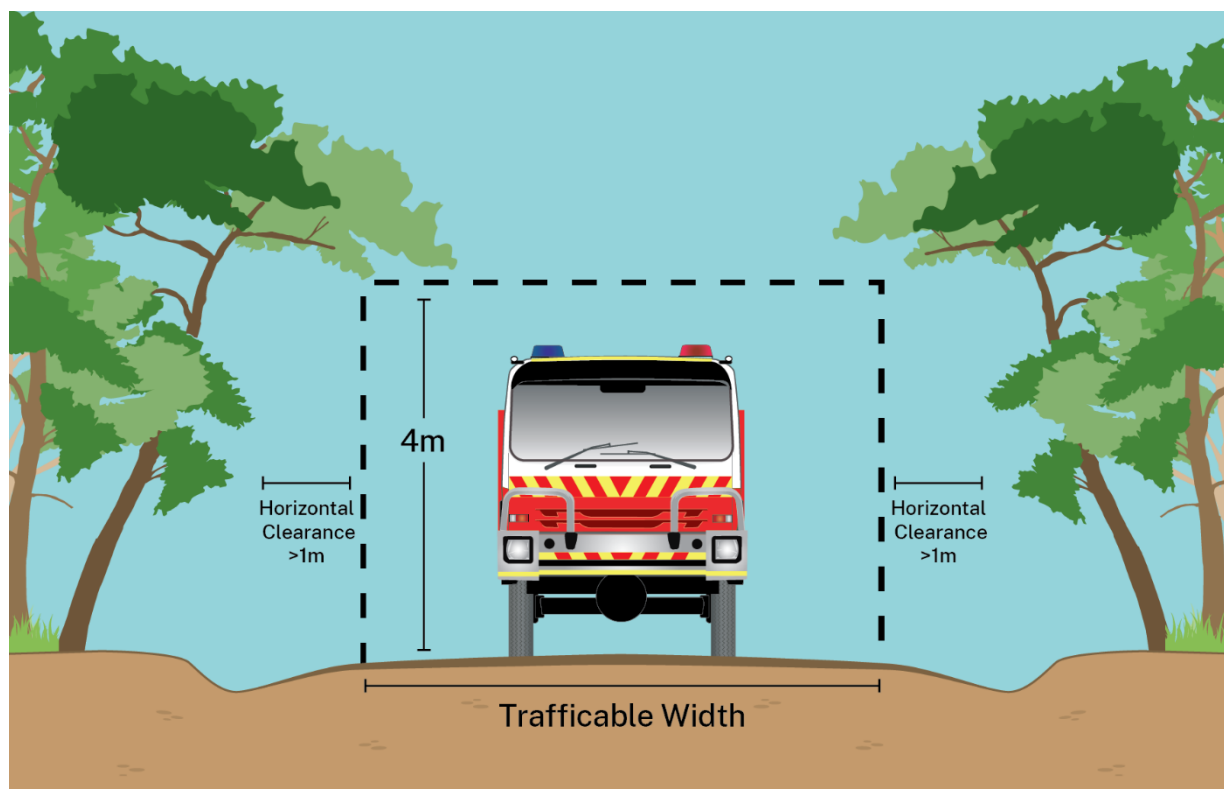


Appendix C: Attribute Considerations

This appendix is a guide to provide best practice samples and options for consideration when planning, designing and constructing fire trails to meet the Acceptable Solutions contained in this standard. This appendix provides figures to illustrate appropriate best practice techniques for identified attributes, however, given the variability in any given landscape, the figures may not cover all applications.

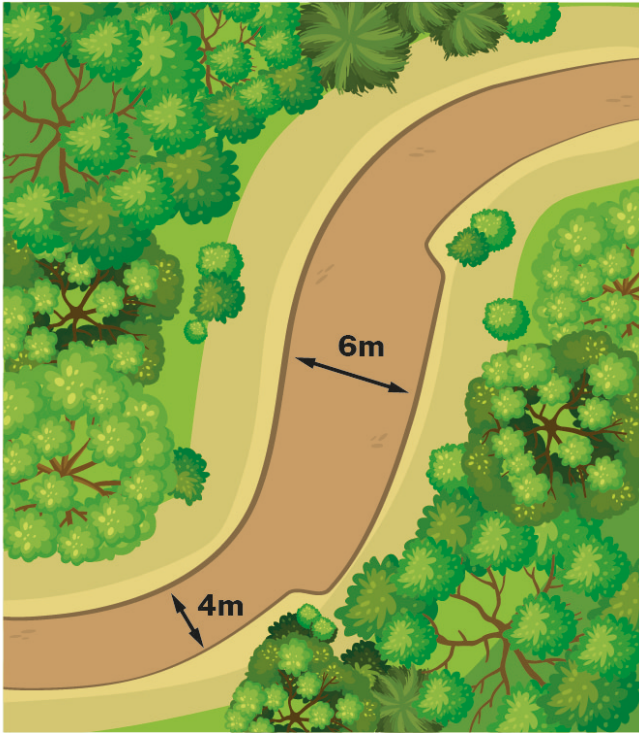
For further details, refer to the *RFS Fire Trail Design, Construction and Maintenance Manual*.

C.1. Clearance



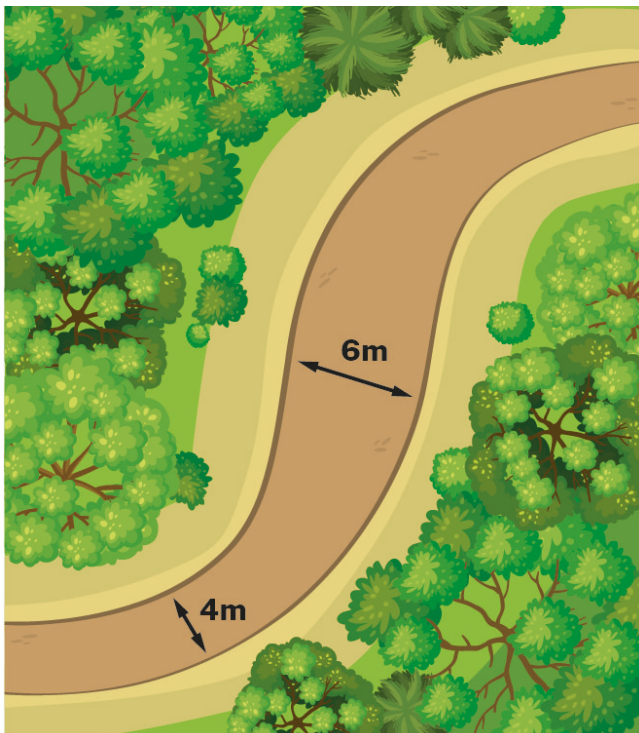
A cleared corridor around the trail is required for unobstructed passage and visibility of appliances for firefighting operations. This includes 4m above the trafficable surface and no less than 1m horizontal clearance at all times (including between maintenance activities).

C.2. Passing Bays



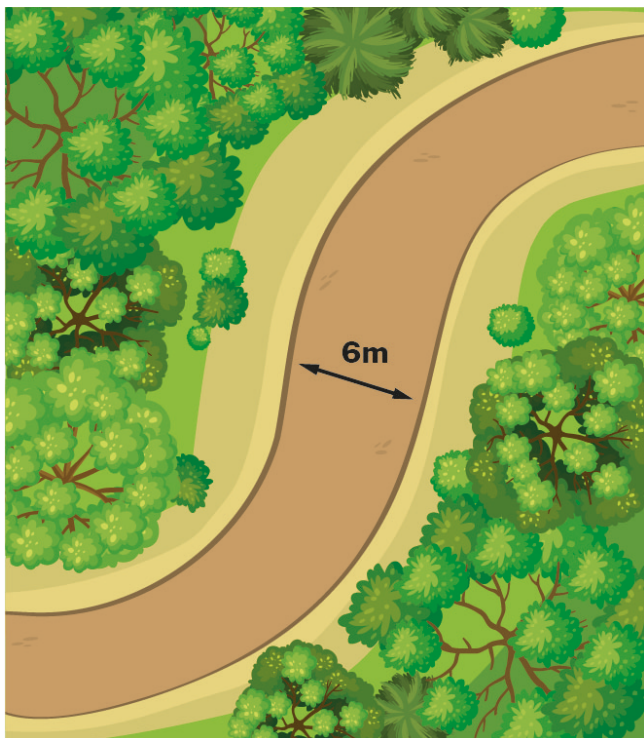
Formed Passing Bay

(e.g., Cat 1 trail dimensions)
Formed and defined bay which allows for entry and exit in a single movement.



Widened Trail

Undefined bay expressed as a widened section of trafficable surface that allows for entry and exit in a single movement.



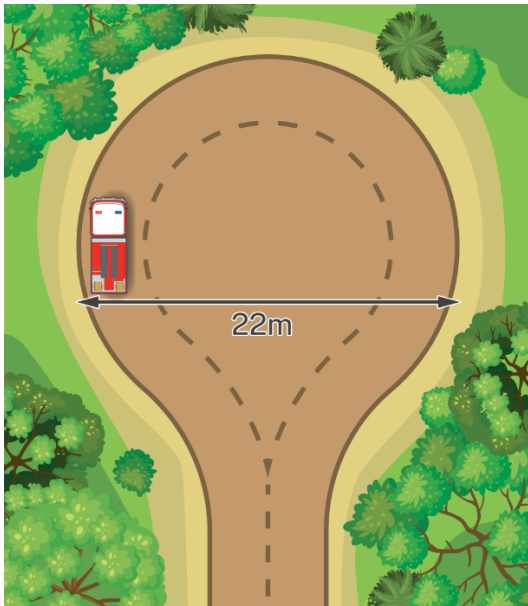
Widened Trail Width

Trafficable surface of $\geq 6\text{m}$

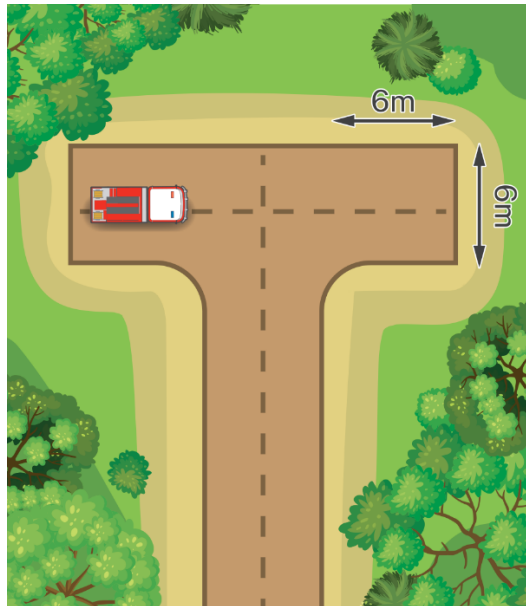
Bays are not defined but passing can occur frequently along the length of the trail.

C.3. Turnaround Bays

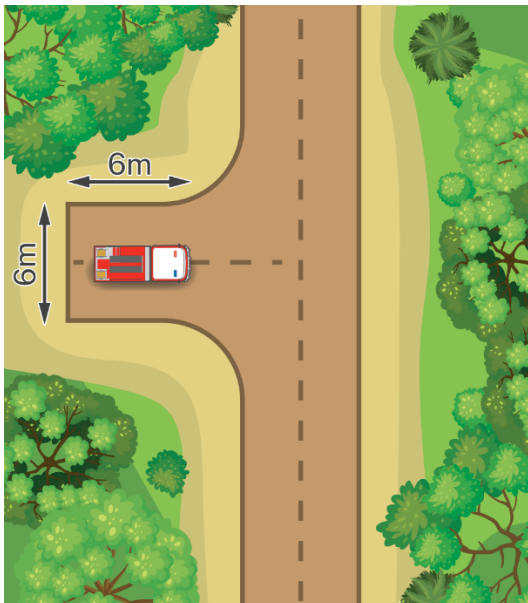
Various configurations are available to meet the attribute criteria for turnaround bays, as long as the dimension criteria are met for the Fire Trail Category. Images below represent a Category 1 Fire Trail for dimensions.



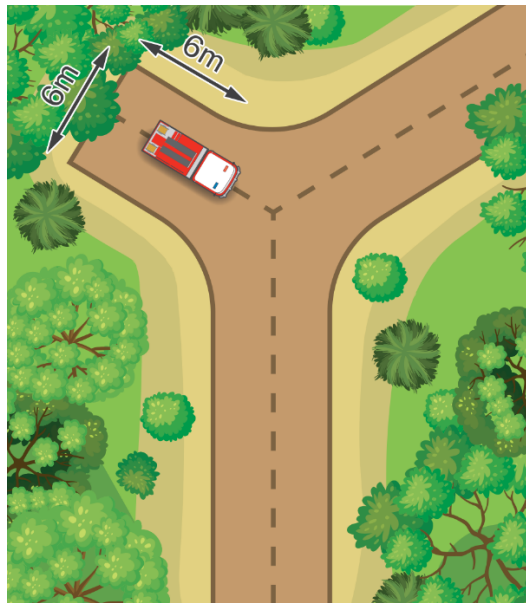
Turning Circle



T-configuration (termination of trail)



T-configuration (mid trail)



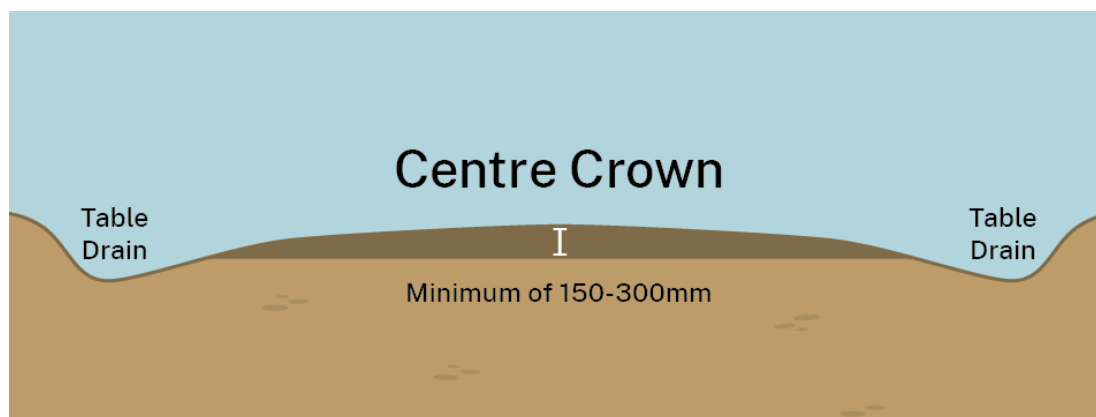
Y-configuration (mid or termination of trail)

C.4. Water Management Systems

Various aspects form the attribute for water management systems on trails. Effective surface drainage is required on fire trails to control runoff.

Crowning

Drainage is easiest on tracks that are “crowned”, as this allows water to be shed to both sides of the track.



Cross Bank Design

Cross banks (also referred to as roll overs) can be constructed across the fire trail to intercept runoff and direct it across the trail surface for drainage.

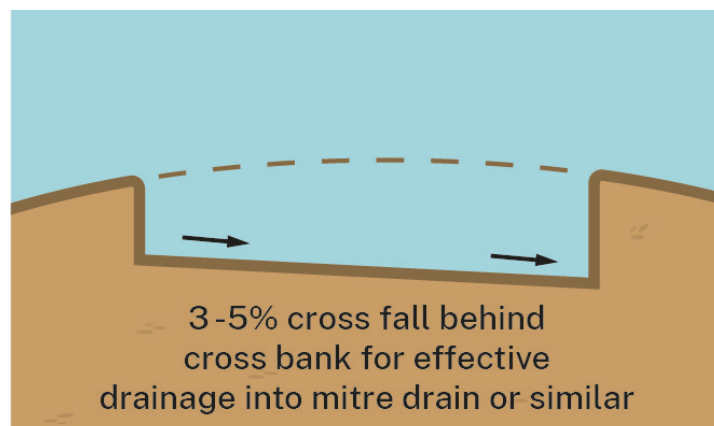
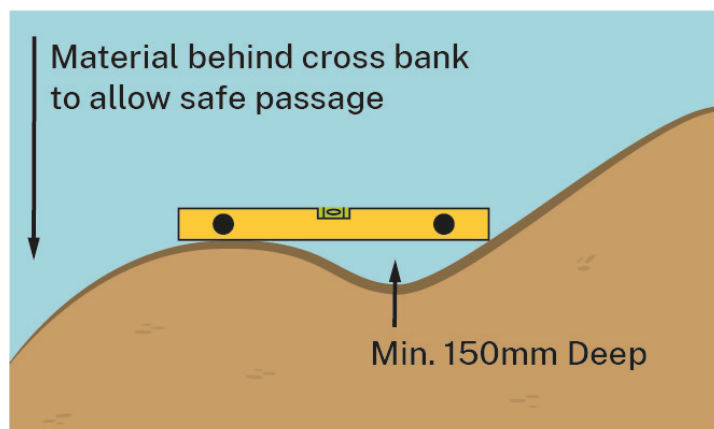
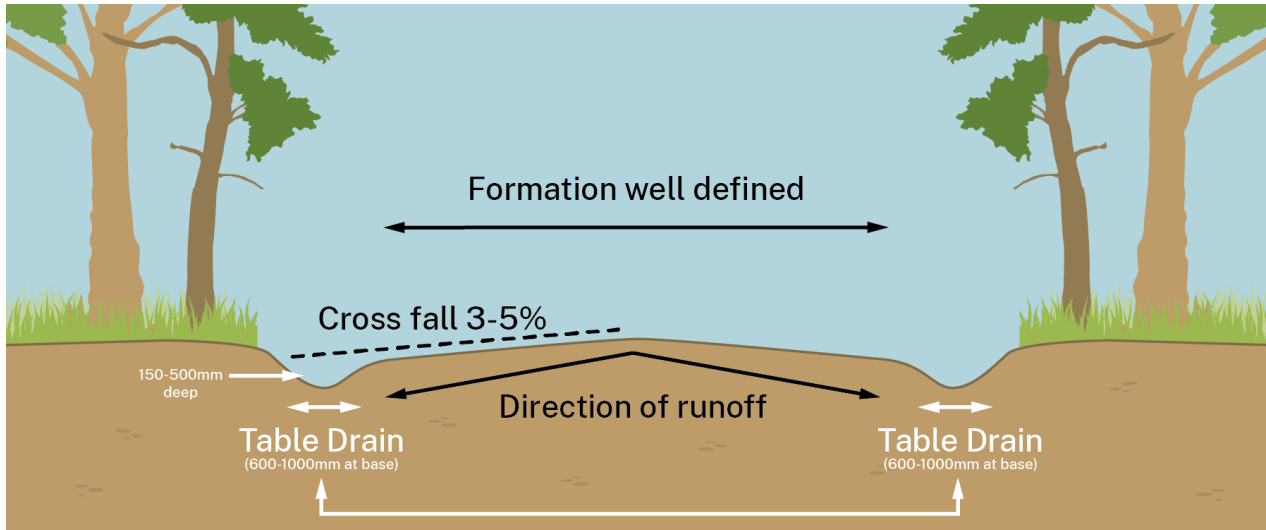


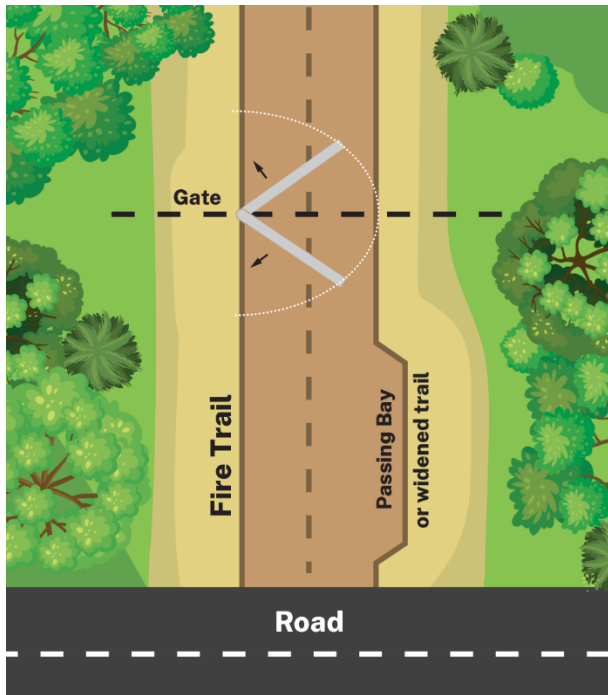
Table Drains

Table drains need to have depth and capacity to accommodate volume with frequent drainage outlets such as mitre drains.



C.5. Trail Access and Access Points

A passing bay is required to be located adjacent to a trail gate (or access point) to ensure appliance and firefighter safety, by enabling the appliance to be a sufficient distance (completely withdrawn) from the adjoining road edge during access.





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