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Environmental Impact Statement

EnergyConnect (NSW – Eastern Section)

Technical paper 12 – Bushfire impact assessment

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December 2021

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Glossary

Term/Acronym	Description
Asset Protection Zone	A fuel reduced area surrounding a built asset or structure.
Brake/winch sites	A brake and winch site is a temporarily cleared area where plant and equipment is located for the purposes of spooling and winching a conductor into place on erected transmission line towers along a transmission line corridor. Dependent upon the angle of line deviation, the location of the brake and winch site at that angle may or may not be within the nominated transmission line easement. The brake and winch site is only required for the construction phase of the proposal. It does not need to be maintained for ongoing operation and / or maintenance of the transmission line.
Commonwealth	Reference to Commonwealth as an entity such as Commonwealth Government or Commonwealth land
Construction impact area	Refers to the area that would be directly impacted by construction of the proposal comprising the following: > construction of all proposal infrastructure elements (including the proposed transmission line alignment, transmission line easement, substation site works (at both the proposed Dinawan 330kV and upgraded and expanded Wagga Wagga substations), optical repeater infrastructure, and other ancillary works) > locations for construction elements such as construction compounds and accommodation camps, access tracks (excluding public roads proposed to be used for access routes), site access points, water supply points, laydown and staging areas, concrete batching plants, brake/winch sites and site offices. The area is identified based on realistic project component locations and areas however it is indicative at this stage. The area would be confirmed during finalisation of the design and construction methodology and would be developed as part of the consideration of avoidance and impact minimisation. This area includes the operational impact area (including areas required for maintenance) (refer definition below).
DPIE	(NSW) Department of Planning Industry and Environment
EIS	environmental impact statement
EnergyConnect	An electrical interconnector of around 900 kilometres between the electricity grids of South Australia and New South Wales, with an added connection to north west Victoria. In NSW, EnergyConnect comprises two sections – Western Section (which has been the subject of a separate environmental assessment and approval) and the Eastern Section (the proposal the subject of this EIS).
EP&A Act	*(NSW) Environmental Planning and Assessment Act 1997*

Term/Acronym	Description
Hazard/high risk tree	Hazard/high risk trees are defined under Transgrid procedures and include any tree or part of a tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines. Hazard/high risk trees shall be identified during finalisation of the proposal design based on the transmission line conductor profile. All hazard/high risk trees posing a risk to the corridor shall be removed, subject to assessment by an arborist for health and risk of falling prior to removal.
NEM	National Electricity Market
NSW	New South Wales
Operational impact area	Refers to the area that would be directly impacted by permanent components of the proposal, including all proposed infrastructure elements such as the proposed transmission towers, any new substation infrastructure and permanent access tracks.
Proponent, the	NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage (HV) transmission network in NSW and the Australian Capital Territory (ACT), and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
Proposal, the	The proposal is known as 'EnergyConnect (NSW – Eastern Section)' as described in Chapter 5 and Chapter 6 of this document.
RFA	*Rural Fires Act 1997*
SEARs	Secretary Environmental Assessment Requirements
SSI	State Significant Infrastructure
Transmission line easement	An area surrounding and including the transmission lines, which is a legal right allowing for construction of the transmission line, along with ongoing access and maintenance of the lines and will be acquired from landholders either by agreement or pursuant to compulsory acquisition process. The easement width would be 80 metres wide.

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1. Introduction

1.1 Proposal context and overview

Transgrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect aims to reduce the cost of providing secure and reliable electricity transmission between NSW and SA in the near term, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (NSW Department of Planning and Environment (DPE), 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

EnergyConnect comprises of several sections (shown on Figure 1-1) that would be subject to separate environmental planning approvals under the relevant jurisdictions. It includes:

- NSW sections including:
  - Western Section, which would extend from:
    - the SA/NSW border (near Chowilla in SA) to Transgrid's existing Buronga substation
    - Buronga substation to the NSW/Victoria border at Monak (near Red Cliffs in Victoria)
  - Eastern Section, which would extend from the Buronga substation to the existing Wagga Wagga substation
- A Victorian Section, which would extend from the NSW/Victoria border to Red Cliffs substation
- A SA Section, which would extend from Robertstown to the SA/NSW border.

Transgrid is currently seeking planning approval for the NSW – Eastern Section (the proposal), which is the subject of this EIS.

Transgrid has previously sought and received separate environmental planning approvals for the NSW – Western Section of EnergyConnect and Victorian Section. ElectraNet is responsible for obtaining environmental planning approval for the section of EnergyConnect located in SA.

1.1.1 Proposal objectives

The primary objective for EnergyConnect (which the proposal comprises an extensive component of) is to reduce the cost of electricity by providing secure electricity transmission between NSW and SA in the near term and facilitate the longer-term transition of the energy sector across the NEM to low emission energy generation sources. More specifically, EnergyConnect (including the proposal) aims to:

- lower power prices
- improve energy security
- increase economic activity
- support the transition to a lower carbon emission energy system
- support a greater mix of renewable energy in the NEM.

Figure 1-1 Overview of EnergyConnect

1.2 The proposal

Transgrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State significant infrastructure under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 30 September 2020 and requires a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*. The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

1.3 Proposal overview

1.3.1 Bushfire study area

The bushfire study area for this bushfire impact assessment comprises a generally one kilometre wide corridor between the Buronga substation and the Wagga Wagga Substation. It traverses around 540 kilometres in total. It has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal from a bushfire perspective. Nominated access tracks would generally be located within the bushfire study area.

The bushfire study area is located in regional western NSW across a number of Local Government Areas (LGAs), being the following: Wentworth Shire; Balranald Shire; Murray River; Edward River; Hay Shire; Murrumbidgee; Federation; Lockhart Shire; and Wagga Wagga LGAs.

1.3.2 Key proposal features

The key components of the proposal include:

- about 375 kilometres of new 330 kilovolt (kV) double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the existing Buronga 330kV substation
- construction of a new 330kV substation around 30 kilometres south of Coleambally, referred to as the proposed Dinawan 330kV substation
- connection of the proposed transmission lines to the proposed Dinawan substation
- about 162 kilometres of new 500 kilovolt (kV) double circuit transmission line and associated infrastructure between the proposed Dinawan substation and the existing Wagga Wagga substation at Wagga Wagga, NSW
- upgrade and expansion of the Wagga Wagga substation to accommodate the new transmission line connections including the installation of new line bays, relocation and upgrade of existing bays and associated electrical and civil works (road, kerb, gutter, drainage works and earthworks)
- provision of three optical repeater structures and associated connections to existing local electrical supplies
- new/and or upgrade of access tracks as required
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-2. Further detail on the key infrastructure components of the proposal and construction activities are provided in Chapter 5 and Chapter 6 of the main EIS document, respectively.

1.3.3 Construction

Key construction works

Key construction works for the proposal would typically include (but not be limited to):

- site establishment works, which may include (but not be limited to):
  - establishment of construction compound and accommodation sites, access tracks and service relocations
  - vegetation clearance
  - transportation of equipment such as steelwork, high voltage plant, switchgear, between dock and site as part of the construction works
- ancillary works to facilitate the construction of the proposal (e.g. intermediate laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps)
- construction of the proposed transmission lines, which would include (but not be limited to):
  - access tracks to accommodate safe access of construction machinery and materials to each transmission line tower site
  - earthworks (including establishment of construction pads) and the construction of footings and foundations for each transmission line tower
  - erection of the new transmission line towers using crane(s) and or helicopter(s)
  - stringing of the conductors and overhead earth wires and optical ground wire
  - installation of earthing conductors
  - testing and commissioning of the transmission lines

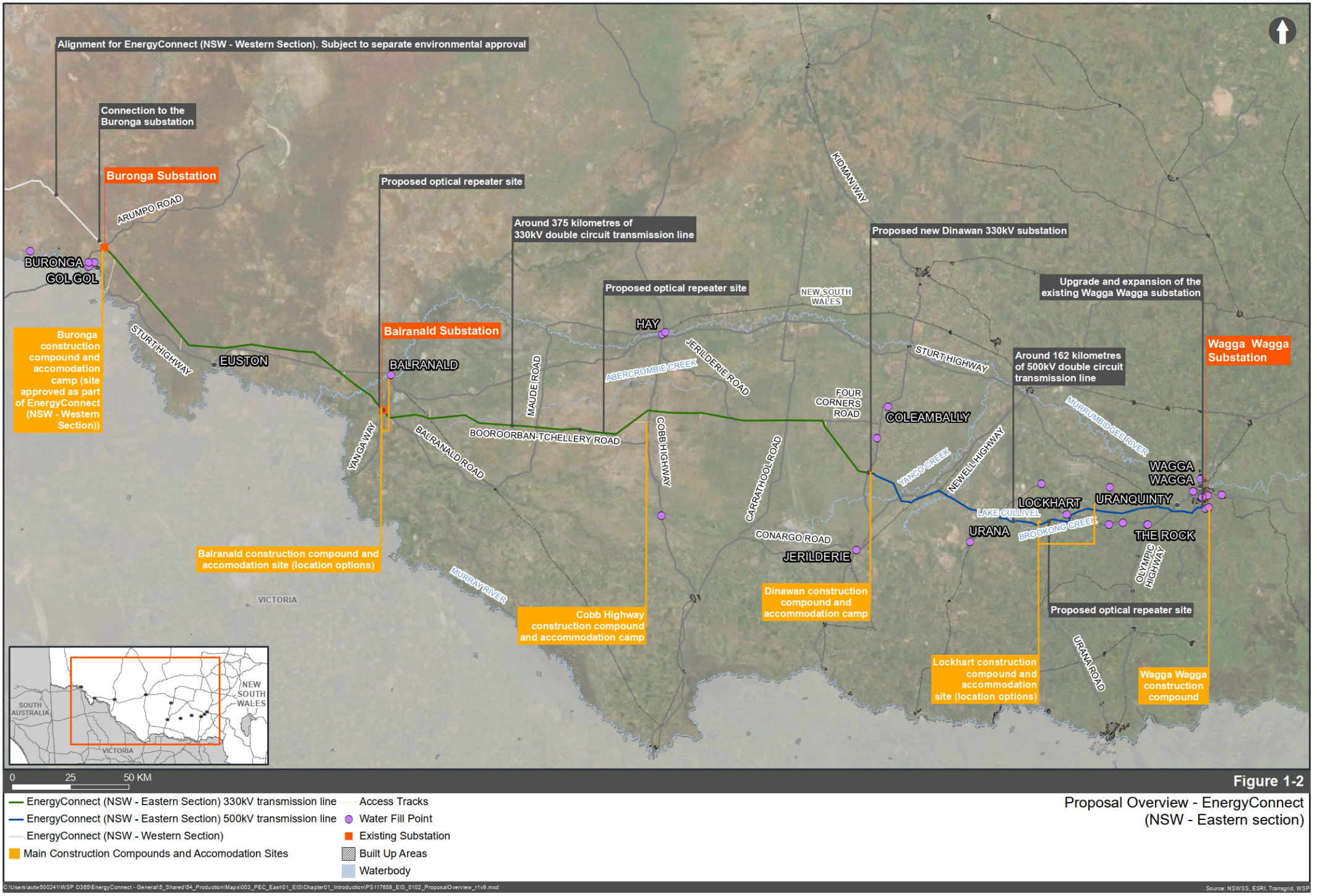


Figure 1-2

Proposal Overview - EnergyConnect (NSW - Eastern section)

- construction of the proposed 330kV Dinawan substation, which would include (but not be limited to):
  - civil construction works including earthworks
  - slab construction at the new substation site
  - electrical fit out with new substation equipment
  - testing and commissioning of the new substation equipment
- upgrade and expansion of the existing Wagga Wagga substation to enable the proposed connection and operation of the new transmission lines which would include (but not be limited to):
  - civil construction works including earthworks and slab construction at the expanded substation site
  - electrical fit out with new substation equipment
  - testing and commissioning of the new substation equipment
- connection of the proposed transmission lines to the Buronga substation
- demobilisation and remediation of areas disturbed by construction activities.

A detailed description of construction works for the proposal is further described in Chapter 6 of the Environmental Impact Statement (EIS).

1.3.3.1 Construction program

Construction of the proposal would commence in late-2022 (enabling works phase), subject to NSW Government and Commonwealth planning approvals.

The construction of the transmission lines and substation facilities would take around 18 months. The upgraded Wagga Wagga substation and new Dinawan substation are expected to be operational by late-2024. Site decommissioning and remediation would extend around six months beyond the commissioning (operational) phase, with estimated completion in mid-2025.

The final program would be confirmed as part of finalisation of the proposal infrastructure following approval of the proposal

1.3.3.2 Indicative duration of transmission line construction activities

Construction at each transmission line tower would be intermittent and construction activities would not occur for the full duration at any one location. Figure 1- presents an indicative duration of construction activities associated with the transmission line towers. These durations could vary and breaks between activities may be shorter which may lead to longer inactive periods in subsequent stages of construction at an individual transmission line tower. Durations of any particular construction activity, and respite periods, may vary for a number of reasons including (but not limited to), multiple work fronts, resource and engineering constraints, works sequencing and location.

These activities would also have multiple work fronts, therefore (for example) foundation works or tower erection would be occurring in several locations along the easement at the same time.

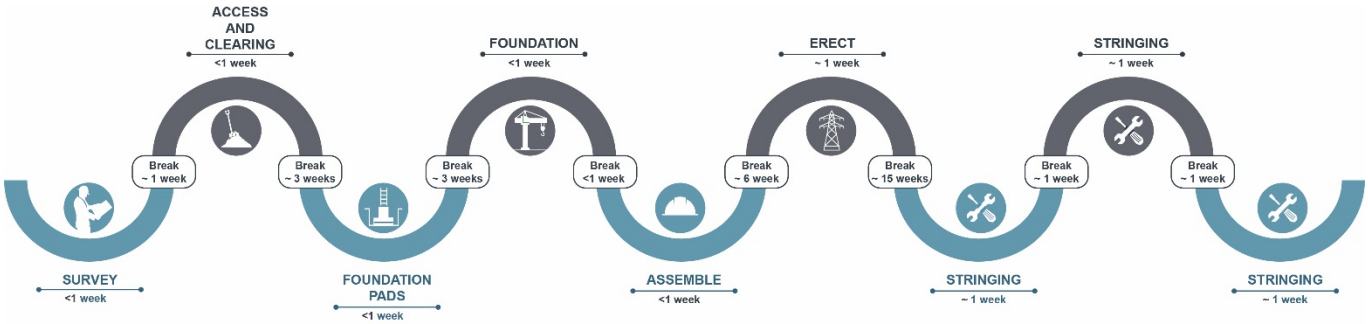


Figure 1-3 Indicative duration of construction activities at each transmission line tower site

1.4 Purpose of this technical report

This technical paper is one of a number of technical papers that form part of the EIS for the proposal.

The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to bushfire risks and responds directly to the Secretary's environmental assessment requirements (SEARs) (refer to Section 1.4.1).

Australian Bushfire Protection Planners Pty Limited has been commissioned by WSP on behalf of Transgrid to prepare this Bushfire Risk Assessment (BFRA) for the proposal.

The objectives of the BFRA are to:

> provide an assessment of the bushfire risk during the construction and operation of the proposal
> provide recommendations on the provision of measures which, when applied, mitigates the threat of bushfire to and from the proposal and/or surrounding areas during the construction and operation phase.

1.4.1 Secretary's Environmental Assessment Requirements

The NSW Department of Planning, Industry and Environment (DPIE) has provided the Secretary's Environmental Assessment Requirements (SEARs) for the EIS which specifically outlines the specialist study requirements of the EIS.

The purpose of this report is to examine the potential bushfire risk to the proposal, assess the potential bushfire risks associated with the and address the specialist study requirements associated with bushfire risk in the SEARs. The table below outlines the specific requirements and where in the report these aspects are addressed in this technical report.

Table 1-1 Secretary's Environmental Assessment Requirements – Bushfire hazards

Reference	Secretary's environmental assessment requirements	Section of report where requirement addressed
Key Issues – Hazard	An assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation.	Sections 4.4 and 4.5 of this BFRA assess bushfire risks associated with the proposal. All other matters are addressed in Chapter 19 (Hazards and Risk) of the EIS

This BFRA is one of a number of technical reports supporting the EIS for the proposal.

1.5 Structure of this report

The structure and content of this report is as follows:

> *Chapter 1 – Introduction:* Outlines the background and need for the proposal, and the purpose of this report

> *Chapter 2 – Legislative and policy context:* Provides an outline of the key legislative requirements and policy guidelines relating to bushfire risk for the proposal

> *Chapter 3 – Proposal context:* Describes the proposal location and existing infrastructure within and surrounding the bushfire study area

> *Chapter 4 – Bushfire risk assessment*, which includes:

  – A desktop assessment of the existing environment within and surrounding the bushfire study area including the fire history, bushfire ignition sources, topography, climate and weather and vegetation

  – An examination of the factors influencing bushfire risk, including the two elements of risk – likelihood which is described as the chances of a bushfire occurring, and consequence, the impact of the bushfire when it occurs

  – An assessment of the potential bushfire risk to the proposal

  – An examination of the bushfire risk created by the construction and operation of the proposal

> *Chapter 5 – Mitigation measures:* Outlines the proposed mitigation measures for the proposal, including bushfire protection measures to be implemented to manage and reduce the level of bushfire risk

> *Chapter 6 – References*: Identifies the key reports and documents used to generate this report.

1.6 Limitations

There are no limitations associated with the preparation of this technical report.

2. Legislative and policy context

This chapter outlines the legislation and policy that are relevant when assessing bushfire risk for the proposal.

2.1 Environmental Planning and Assessment Act 1979

The proposal has been declared as Critical State significant infrastructure, and is subject to assessment under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

2.2 Rural Fires Act 1997

The *Rural Fires Act 1997* outlines the operational role of the NSW Rural Fire Service, their functions and their powers in relation to protecting the people, infrastructure and natural environment of NSW from fire related threats.

The objectives of the *Rural Fires Act 1997* are to provide:

- the prevention, mitigation and suppression of fires;
- coordination of bushfire fighting and prevention;
- protection of people and property from fires; and
- protection of the environment.

In relation to the management of bushfire fuels on public and private lands within NSW, sections 63(1) and 63(2) require public authorities and owners / occupiers of land to take all practicable steps to prevent the occurrence of bushfires on, and to minimize the danger of the spread of bushfires.

Under Part 5.23 of the EP&A Act, the proposal, which is deemed State significant infrastructure, does not require authorisation for development on bushfire prone land from a bushfire authority under section 100B of the Rural Fires Act to proceed.

2.3 Planning for Bushfire Protection – 2019

The *Planning for Bushfire Protection – 2019* (NSW Rural Fire Service) document provides and explains the legal requirements, framework and protection measures needed for all types of development on bushfire prone land in NSW.

2.4 National Electricity Network Safety Code

The *National Codes National Electricity Network Safety Code* (NENS) 01 and 04 in conjunction with the NSW Code of Practice for Electricity Transmission and Distribution Asset Management and HB C(b) 1- 2003 'Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines' provide information on safety clearances from overhead transmission lines. These guidelines state that trees should be kept away from overhead lines to:

- ensure public safety
- minimise the risk of fire caused by the contact between trees and overhead lines
- reduce the number of interruptions to supply caused by trees; and
- protect the assets from damage.

When determining the amount of clearance between trees and transmission lines, consideration should be given to the:

- type of line – whether it is bare, covered or insulted overhead conductors
- conductor sag and swing
- tree movement, soundness and regrowth; and
- overhanging branches.

3. Proposal context

3.1 Proposal location and surrounding environment

The proposal spans from the western region of NSW at Buronga to Wagga Wagga in the southern-central portion of NSW. The proposal is around 540 kilometres in length and runs in a generally east-west orientation from the existing Buronga substation on the northern outskirts of Buronga to the existing Wagga Wagga substation around 10 kilometres south of Wagga Wagga, NSW. The proposal is located across a number of local government area (LGAs) comprising the following: Wentworth Shire, Balranald Shire, Edward River, Hay Shire, Murrumbidgee, Federation, Lockhart Shire, and Wagga Wagga City.

The proposal also spans several Local Aboriginal Land Councils (LALCs), including the following: Dareton LALC, Balranald LALC, Hay LALC, Deniliquin LALC, Cummeragunja LALC, Griffith LALC, Narrandera LALC, and Wagga Wagga LALC.

The proposal would traverse three main bioregions, being:

- the Murray Darling Depression
- Riverina bioregion
- South Western Slopes.

While each of these regions present generally distinct characteristics, the proposal would typically traverse areas of rural land that has been developed primarily for agricultural uses including sheep grazing for wool and meat, cattle grazing and cropping (including irrigated cropping). Other land uses within and surrounding the bushfire study area include farm buildings and infrastructure, roads and road reserves, broadacre rural residential development, drainage channels for irrigation and existing transmission line easements.

A majority of the bushfire study area is predominantly flat with some greater topography changes at the eastern and far eastern ends of the bushfire study area. Overall, the sections of the bushfire study area can be categorised as follows:

- Western section – This section is generally flat with minimal undulating elevations. Land is predominantly used for grazing with some cropping areas.
- Central section – This section of the alignment consists of generally flat areas minimal elevations changes. The elevation is generally rising when moving towards the eastern side of the section. Land in this area is predominantly used for grazing, cropping and irrigated cropping.
- Eastern section – This section of the alignment consists of some slightly undulated terrain as well as low hills and undulating terrain, primarily east of The Rock. Land in this area is predominantly used for grazing and cropping (including irrigated cropping).

However, while large areas have been cleared and disturbed for agricultural activities, the bushfire study area also contains some areas of remnant vegetation. Where possible during route refinement, the proposal has been located parallel with existing transmission lines or road corridors for large sections of the alignment, which would provide an already disturbed or ‘brownfield’ site and reduce potential fragmentation.

The proposal would be located predominantly within rural and regional areas of western NSW. The major population and service centres located within the broader vicinity of the proposal would include Buronga, Gol Gol, Euston, Balranald, Hay, Coleambally, Jerilderie, Urana, Lockhart, The-Rock, Uranquinty and Wagga Wagga.

The bushfire study area also crosses other key land uses of note, namely:

- Murrumbidgee Valley Nature Reserve to the east of Balranald
- Cullivel State Forest to the west of Lake Cullivel
- Brookong State Forest to the west of Lockhart
- The buffer zone for the Uranquinty RAAF base at Uranquinty.

There are no certified aerodromes, Commonwealth lands or mining tenements identified in the immediate bushfire study area.

The bushfire study area would also cross a series of major watercourse including the Murrumbidgee River at Balranald; Abercrombie Creek; Yanco Creek; the Coleambally Outfall Drain, Colombo Creek; Hallidays Cut (at Lake Cullivel); Burkes Creek (The Rock) and several other smaller creek crossings.

The bushfire study area is classed as lands in bushfire prone areas.

3.2 Existing infrastructure within the bushfire study area

Several sections of the proposal would be located near or parallel to existing electrical or road infrastructure (refer to Figure 1-2).

From the existing 330kV Buronga substation, the transmission line would run parallel to the existing 220kV transmission line (on the northern side of existing easement) for about 55 kilometres in a generally south-east direction. At this point the alignment would continue in a parallel alignment in a predominantly east-west direction for a further 66 kilometres. At this point the alignment would cross the Sturt Highway and the continue in a south-east direction parallel to the existing 220kV transmission line towards the existing Balranald substation (a distance of around 27 kilometres). It is not proposed to connect the proposal to the existing 220kV Balranald substation.

From the 220kV Balranald substation, the transmission line would continue in a generally east-west alignment (parallel on the northern side of the existing 220kV transmission line) for around 196 kilometres to a point along Four Corners Road at Mabins Well (around 25 kilometres to the east of the roads intersection with Kidman Way). This section of the alignment would cross and/or be located parallel to a number of key north-south roadways including Yanga Way; Balranald Road; Maude Road; Booroorban-Tchellery Road; the Cobb Highway; Jerilderie Road; Carathool and Conargo Roads and Four Corners Road.

From the point along Four Corners Road, the alignment would deviate from a parallel alignment to the existing transmission line infrastructure and would continue in a generally south-east alignment for around 31 kilometres towards Kidman Way. At this point, the alignment would cross Kidman Way and connect to the proposed new 330kV Dinawan substation. From the proposed 330kV Dinawan substation, the alignment would travel in a typically south-east direction for around19 kilometres, generally following the alignments of Bundure Road and Thurrowa Road to a crossing point with the Newell Highway.

From this point, the alignment would have a generally east-west alignment for around 45 kilometres, generally following the alignments of a section of transmission line parallel to the existing (disused) Narrandera-Tocumwal Railway (a distance of around 10.5 kilometres); Coonong Road, West Gums Road and Gums Road to Boree Creek Road, west of Lake Cullivel.

From Boree Creek Road, the alignment would be located to the south of Lake Cullivel through to Urana-Lockhart Road. At this point, the alignment would generally follow the alignments of Urana-Lockhart Road, Tenison Lane and Kings Lane to the Lockhart–The Rock Road. This alignment would be located to the south of the township of Lockhart. The distance of this section of the transmission line would be around 36 kilometres.

The sections of transmission line between the proposed 330kV Dinawan substation and the Lockhart–The Rock Road would be located within a new transmission line easement and would not be parallel to any existing high voltage electrical infrastructure.

From the point at which the transmission line crosses the Lockhart–The Rock Road, the alignment would be located parallel to an existing 132kV transmission line for around 39 kilometres (south side of existing easement). This section of the alignment would cross a series of key roadways including: County Boundary Road, Bullenbong Road and The Rock-Collingullie Road. At this point, the alignment would continue parallel (south side of existing easement) to an existing 330kV transmission line for around 24 kilometres to connect with the existing Wagga Wagga substation.

4. Bushfire risk assessment

4.1 Introduction

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment. Bushfire risk has two elements:

- likelihood – the chance of a bushfire occurring; and
- consequence – the impact of a bushfire when it occurs.

Risk reduction can be achieved by reducing the likelihood of a bushfire, the opportunity for a bushfire to spread or the consequence of a bushfire (on natural and built assets). Bushfire management should have a clear objective to reduce both the likelihood of bushfires and reduce the negative impacts of bushfires. It should also consider the costs, inconvenience and dangers of measures taken to reduce the risk of bushfires.

The consequences of bushfire management activities alone and the failure to implement programs also need to be considered.

A range of factors influence bushfire risk and these include:

- the likelihood of human and natural fire ignitions, as influenced by time, space and demographics;
- the potential spread and severity of a bushfire, as determined by fuel, topography and weather conditions;
- the proximity of assets vulnerable to bushfire fuels, and likely bushfire paths; and
- the vulnerability of assets including natural assets, or their capacity to cope with, and recover from bushfire.

4.2 Methodology

The Australian Standard AS/NZS ISO 31000:2009 and the Emergency Management Australia (EMA) emergency risk management process provides the framework for establishing the context, analysis, evaluation, treatment, monitoring and communication of risk.

Context defines the problem, which in the case of the proposal is the threat posed by bush/grassfire events that may occur on land within and adjoining the proposed transmission line easement and threats to compounds and accommodation camps. A further problem is the potential ignition of the vegetation within and adjoining the corridor by a malfunction of the transmission line or substation or from works during the construction phase of the proposal.

Analysis (determine the likelihood and consequence) and the evaluation of risks of bushfire on the proposal, require the following criteria to be examined:

- fire history in the area
- possibility, probability and sources of ignition
- vegetation type and fuel loads of available vegetation
- topography
- likely fire runs
- climatic or seasonal influences
- surrounding influences on fire behaviour
- the type of development proposed and type of construction.

These criteria are examined in detail in the following sections.

4.3 Existing environment

4.3.1 Fire history

The NSW Government Central Resources for Sharing and Enabling Environmental Data (SEED) provides information on wildfires that have occurred in the area of the corridor. This information is contained in the following maps.

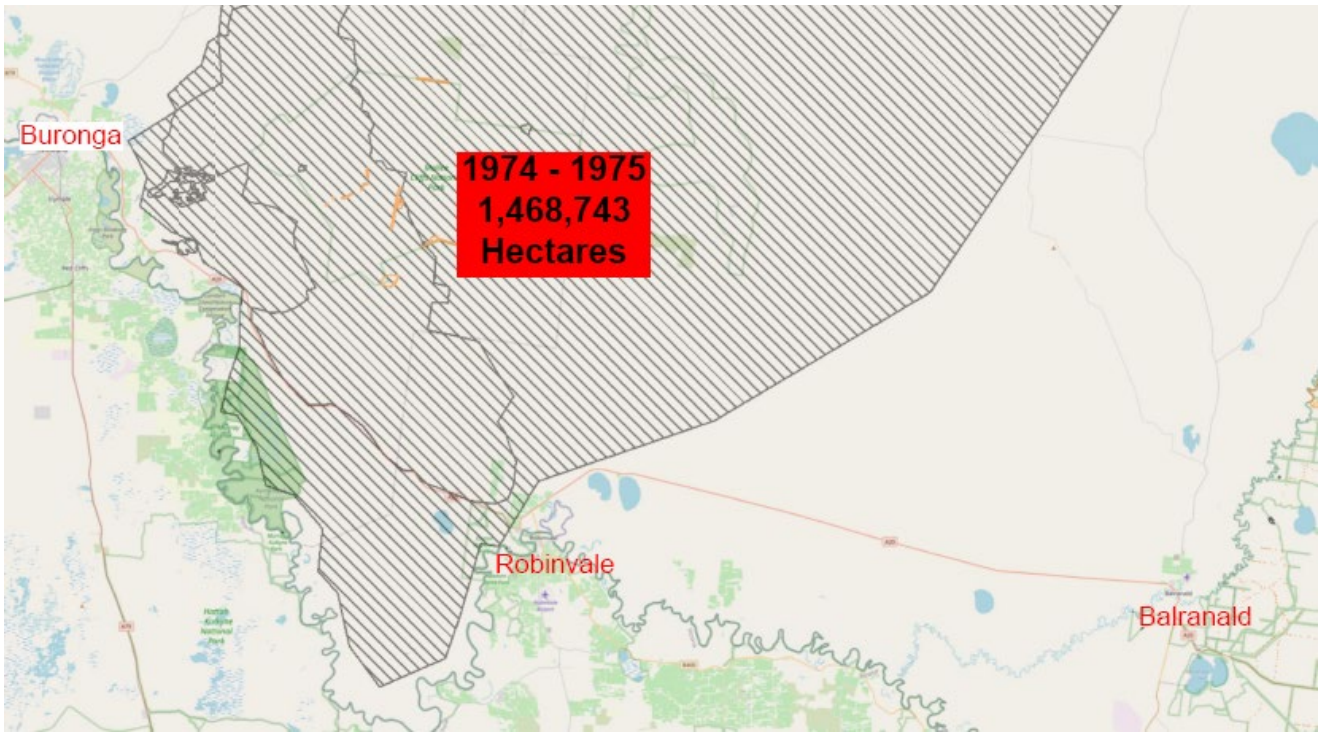


Figure 4-1 Map of fire season – 1974 – 1975

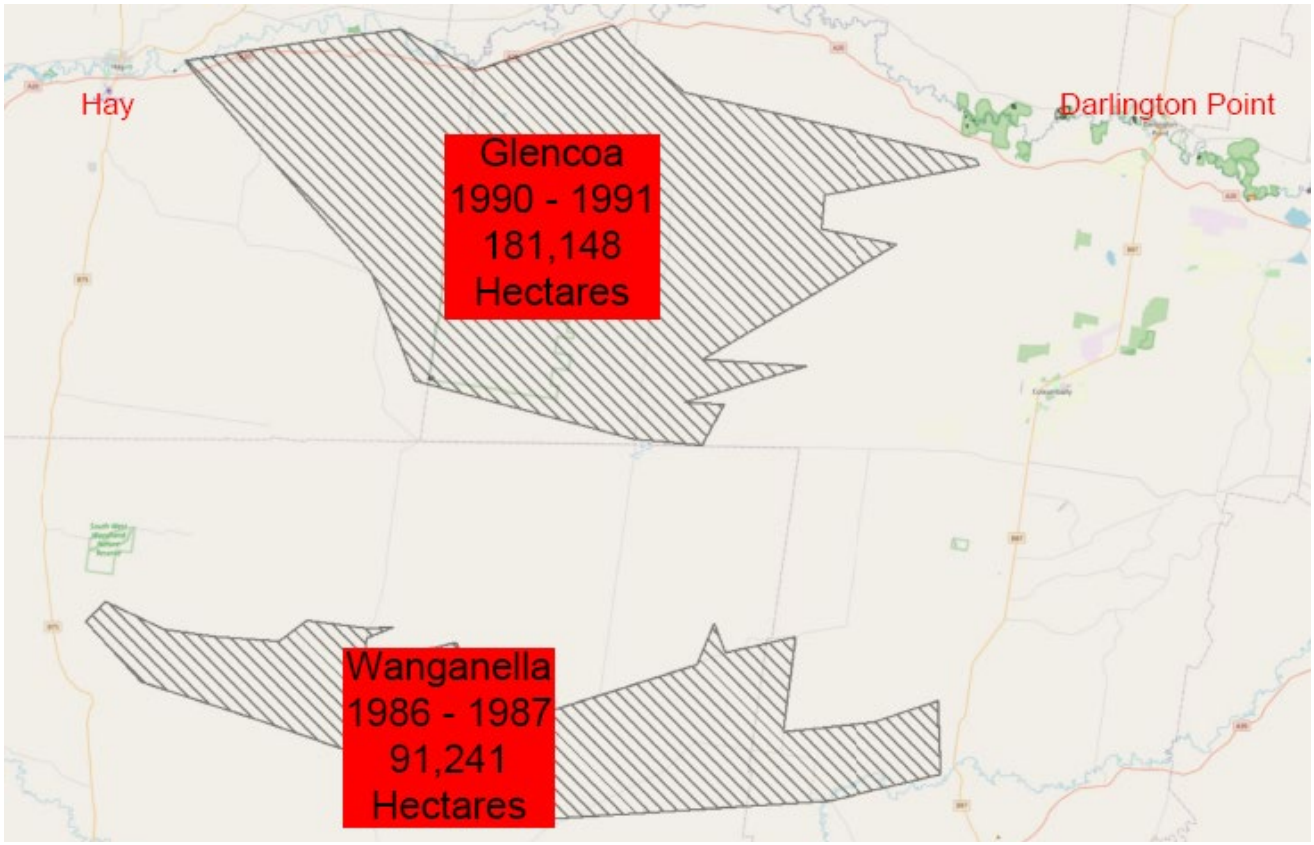


Figure 4-2 Fire Season – 1986 – 1987 – Wanganella and Fire Season – 1990 – 1991 – Glencoa

Figure 4-3 Map of Fire Season – 2004 – 2005 – Lake Urana Fire and fire season – 2006 – 2007 – Tarabah

4.3.2 Bushfire ignition / fire sources

Causes of bushfires are natural or human caused. Human causes can be categorised as:

- malicious – including arson;
- careless – such as escaped campfires, children and illegal burn-offs;
- accidental – uncommon but includes motor vehicle and industrial accidents, farming operations, sparks from machinery (e.g. grinders), fires associated with utilities such as power lines and escaped prescribed hazard reduction burns.

The only common natural cause of bushfires is lightning. The vast majority of bushfires within NSW are human caused, with many classified as arson.

Due to the length of the bushfire study area, the likely causes of a bushfire impacting the vegetation within the bushfire study area are varied. Accidental fire ignition, malicious fire ignition, embers from a remote fire or an uncontrolled fires' advance has the potential to allow fire to extend across the broader landscape, developing, under northerly, north-westerly, westerly and south-westerly wind influence into a large 'campaign fire', impacting upon the vegetation within the bushfire study area.

Accidental/careless ignition of the vegetation within the road corridors, particularly the Sturt Highway, Newell Highway, Olympic Highway, Cobb Highway and the Kidman Highway, may also develop into a large 'campaign fire' that has the potential to travel at speed for some distance across the open landscape.

4.3.3 Climate and weather

4.3.3.1 General

The use of climatic indices such as air temperature, rainfall, relative humidity and wind (both speed and direction) allow predictions of likely fire behaviour and determine the severity of a bushfire event.

The fire season in the western portion of NSW corresponds with the summer months' high temperatures, low rainfall and very low humidity and can occur from September to April with a proclaimed bushfire danger period from October to March.

Bushfire risk management, planning and operations must take into account the likelihood of severe fire weather and the challenges it presents. Extreme and uncontrollable bushfires typically occur when the fire danger rating is over 50, a rating of Extreme. Very High and Extreme Forest/Grass Fire Danger conditions mainly occur between November and March in this region.

4.3.3.2 Temperature and humidity

The Bureau of Meteorology (BoM) collects meteorological data at Automatic Weather Station (AWS) across Australia and can be used for determining climate statistics over a long period.

There are four meteorological stations near the proposal alignment. These are:

- Mildura Airport AWS (station number 076031) located approximately 21.9 kilometres south-west of the closest section of the transmission line (western end). The AWS commenced operation in 1946 and is situated at an elevation of 50 metres
- Balranald RSL AWS (station number: 049002) located approximately 12 kilometres to the north-east of the closest section of the transmission line. The AWS commenced operation in 1879 and is situated at an elevation of 60 metres
- Hay Airport AWS (station number: 075019) located approximately 29.2 kilometres north of the closest section of the transmission line (approximately mid-way along the proposal alignment). Hay Airport AWS commenced operation in 2007 and is situated at an elevation of 92 metres. Long-term climate statistical data is not available for this station
- Wagga Wagga Aerodrome Meteorological Observation (AMO) [station number: 072150] located approximately 7.5 kilometres north-east of the closest section of the transmission line (eastern end). This AMO commenced operation in 1941 and is situated at an elevation of 212 metres.

The climate statistical data from 1990 – 2021 Bureau of Meteorology records for Mildura Airport AWS, Balranald RSL and Wagga Wagga AMO are presented in Table 4-1, Table 4-2 and Table 4-3. The local climate at Mildura Airport AWS is characterised by:

- an average maximum temperature of 33.3°C in January
- an average minimum temperature of 4.4°C in July
- an annual average rainfall of 273.5 millimetres and average rainy days of 39.7.

Table 4-1 Summary of climate statistics at Mildura Airport AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANN[1]
Daily mean temperature (1990 to 2020)													
Max (°C)	33.3	32.5	28.8	24.1	19.5	16.3	15.8	17.8	21.2	25.0	28.5	31.0	24.5
Min (°C)	17.4	16.9	13.8	10.0	7.2	5.2	4.4	5.1	7.5	10.0	13.1	15.3	10.5
Rainfall (1991 to 2020)													
Mean rainfall (mm)	25.2	23.1	16.2	16.8	18.7	20.3	21.2	21.6	26.1	24.8	27.7	31.9	273.5
Mean days of rain	2.5	1.9	1.9	2.4	3.2	4.3	4.9	4.5	4.0	3.9	3.4	2.8	39.7

Note 1: ANN: Annual

The local climate at Balranald RSL AWS is characterised by:

- an average maximum temperature of 33.5°C in January
- an average minimum temperature of 3.8°C in July
- an annual average rainfall of 327.7 millimetres and average rainy days of 47.3.

Table 4-2 Summary of climate statistics at Balranald RSL

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANN[1]
Daily mean temperature (1991 to 2020)													
Max (°C)	33.5	32.8	29.0	24.6	19.5	16.3	15.8	17.9	21.2	25.0	28.2	30.7	24.5
Min (°C)	17.2	16.8	13.7	9.8	6.7	4.8	3.8	4.6	7.0	9.7	12.9	15.1	10.2
Rainfall (1991 to 2020)													
Mean rainfall (mm)	25.9	30.2	16.9	22.6	22.9	25.6	29.7	25.7	28.8	26.5	39.9	32.9	327.7
Mean days of rain	3.2	2.6	2.3	3.0	3.9	5.1	6.0	5.1	4.6	4.1	4.2	3.2	47.3

Note 1: ANN: Annual

The local climate at Wagga Wagga AMO is characterised by:

- an average maximum temperature of 33°C in January
- an average minimum temperature of 3.1°C in July
- an annual average rainfall of 558.3 millimetres and average rainy days of 66.8.

Table 4-3 Summary of climate statistics at Wagga Wagga AMO

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANN[1]
Daily mean temperature (1991 to 2020)													
Max (°C)	33.0	31.5	28.0	23.2	18.1	14.3	13.3	14.9	18.4	22.8	26.9	30.1	22.9
Min (°C)	17.2	16.8	13.4	9.1	5.7	4.0	3.1	3.3	5.2	8.0	11.8	14.4	9.3
Rainfall (1991 to 2020)													
Mean rainfall (mm)	38.3	45.2	47.7	32.2	38.5	57.4	50.4	47.1	49.7	48.1	53.9	49.3	558.3
Mean days of rain (≥1mm)	4.1	4.0	3.8	3.8	4.7	7.6	8.5	7.5	6.2	5.8	5.9	4.9	66.8

Note 1: ANN: Annual

Analysis of the Bureau of Meteorology records for all locations indicate the mean maximum temperature occurs in December and January (30°C +) with temperature commonly exceeding 40°C. Annual mean rainfall data across the stations shows increasing rainfall totals and rainy days from west to east.

The use of climatic indices such as air temperature, rainfall, relative humidity and wind (both speed and direction) allow predictions of likely fire behaviour and determine the severity of a bushfire event.

The fire season in the western portion of NSW corresponds with the summer months' high temperatures, low rainfall and very low humidity and can occur from September to April with a proclaimed bushfire danger period from October to March.

These weather conditions will influence the behaviour of fires burning within the Woodland/grasslands vegetation to all aspects of the transmission line route.

A summary of the mean rainfall and temperature for Mildura, Balranald and Wagga Wagga is shown below in Figure 4-4, Figure 4-5 and Figure 4-6 respectively.

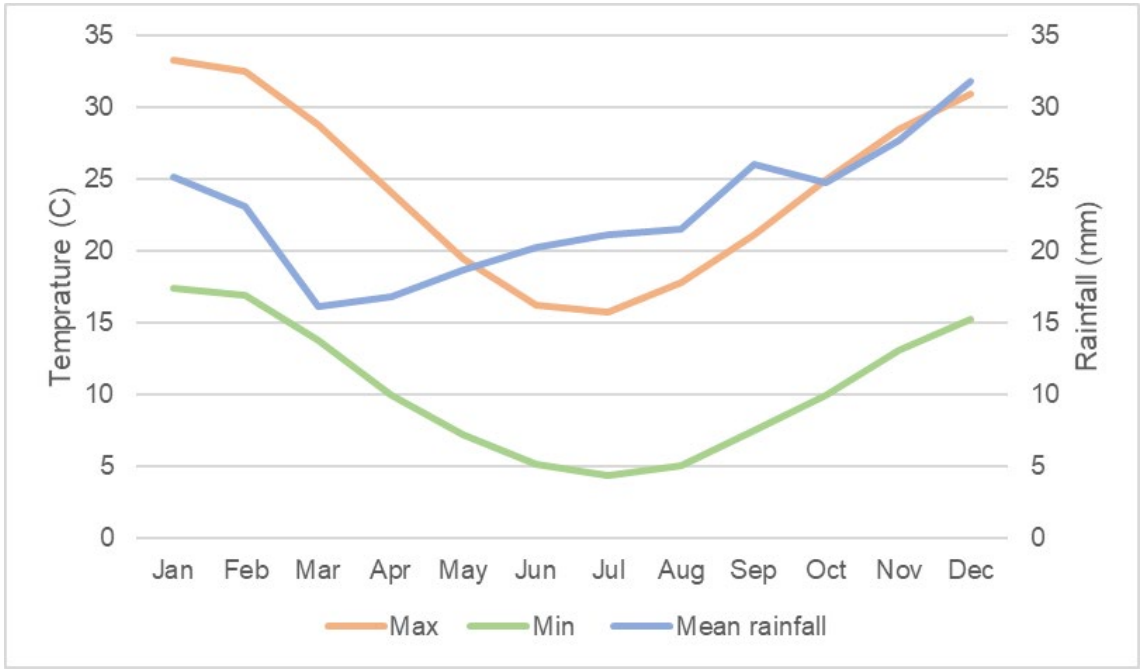


Figure 4-4 Mean rainfall and temperature – Mildura

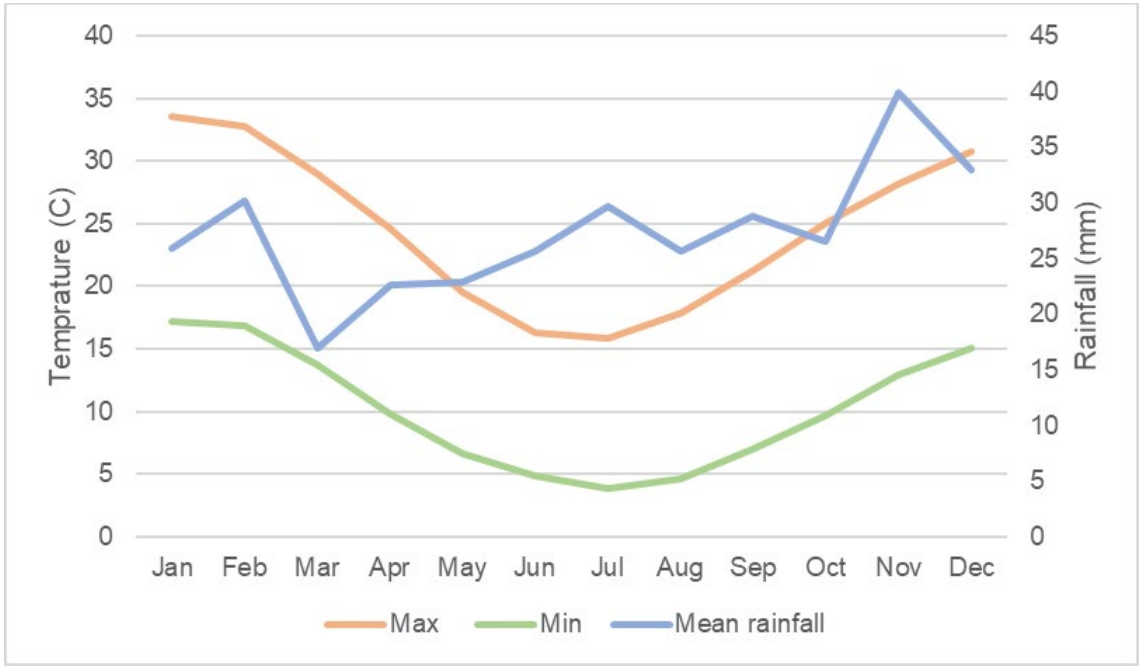


Figure 4-5 Mean rainfall and temperature – Balranald

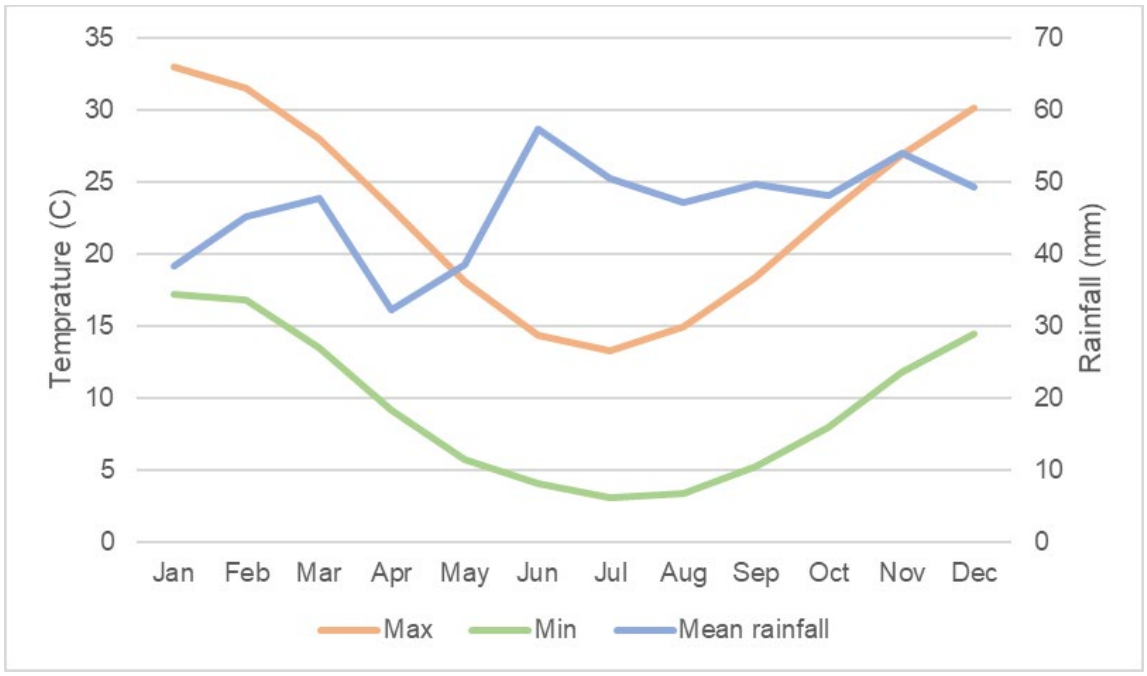


Figure 4-6 Mean rainfall and temperature – Wagga Wagga

4.3.3.3 Wind

Detailed wind conditions were recorded at Mildura Airport AWS, Hay Airport AWS and Wagga Wagga Aerodrome AMO. Figure 4-7, Figure 4-8 and Figure 4-9 presents annual seasonal wind roses showing the frequency and direction of winds for the past five years (2016 to 2020).

The wind roses at Mildura Airport AWS indicate the following:

- wind direction over five years (2016 to 2020) is predominately southerly and then south-westerly with an annual wind speed of 3.6 metres per second and 3.2 per cent calm conditions (wind speeds less than 0.5 metres per second)
- during summer, winds are most frequently southerly followed by south-westerly with an average wind speed of 3.9 metres per second and 1 per cent calm conditions
- in autumn, winds are most frequently southerly followed by south-westerly with an average wind speed of 3.2 metres per second and 4.3 per cent calm conditions.

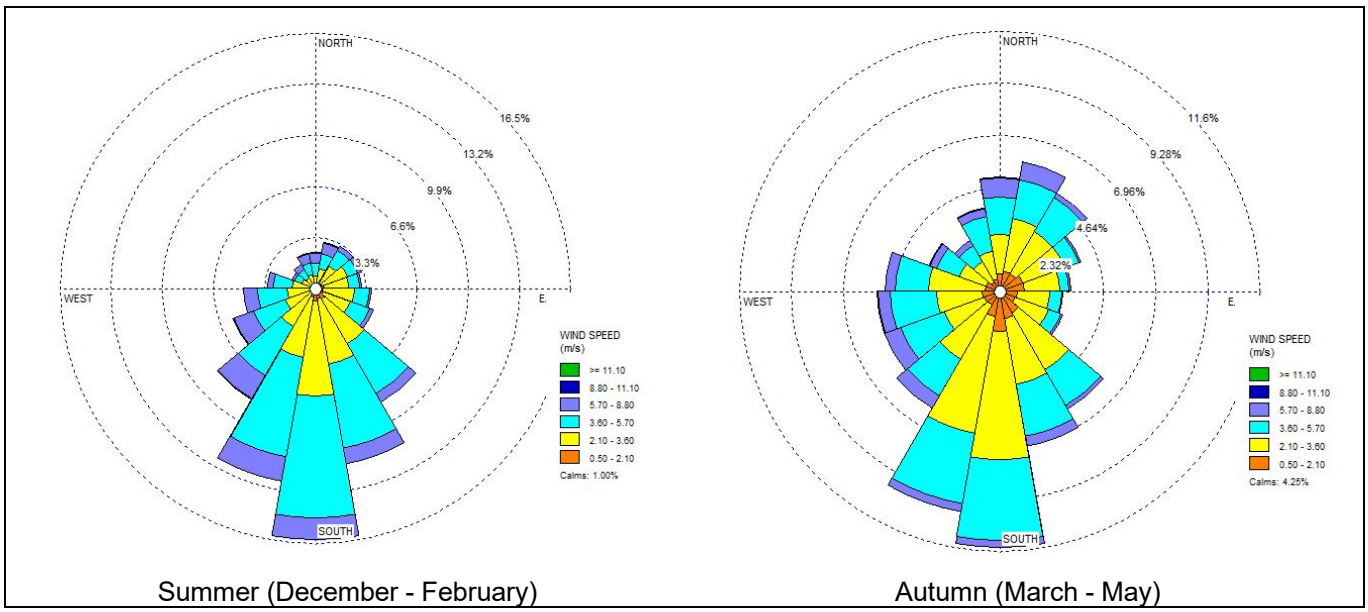


Figure 4-7 Mildura Airport AWS seasonal wind roses Summer and Autumn (2016 – 2020)

The wind roses at Hay Airport AWS indicate the following:

- wind direction over five years (2016 to 2020) is predominately south-westerly followed by northerly with an annual wind speed of 4.6 metres per second and 2.7 per cent calm conditions (wind speeds less than 0.5 metres per second)
- during summer, winds are most frequently south-westerly followed by southerly with an average wind speed of 4.9 metres per second and 1.5 per cent calm conditions
- in autumn, winds are most frequently south-westerly followed by northerly with an average wind speed of 4.2 metres per second and 3.1 per cent calm conditions

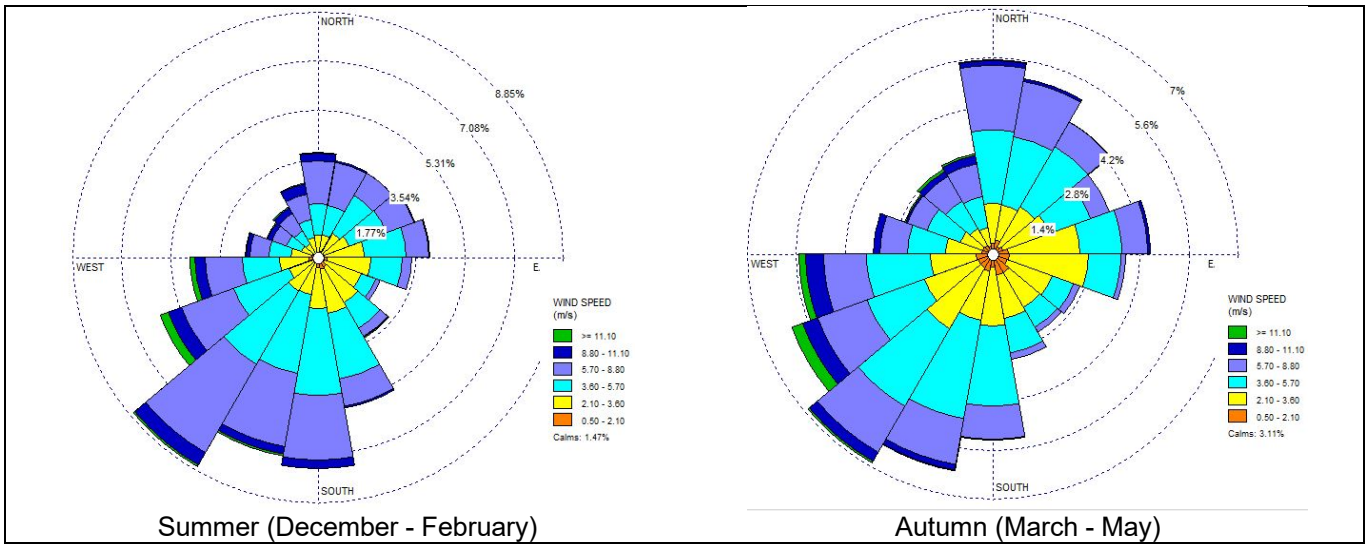


Figure 4-8 Hay Airport AWS seasonal wind roses Summer and Autumn (2016 to 2020)

The wind roses at Wagga Wagga AMO indicate the following:

- wind direction over five years (2016 to 2020) is predominately easterly followed by south-easterly with an annual wind speed of 3.7 metres per second and 5.9 per cent calm conditions (wind speeds less than 0.5 metres per second)
- during summer, winds are most frequently easterly followed by north-easterly with an average wind speed of 4.4 metres per second and 3.1 per cent calm conditions
- in autumn, winds are most frequently easterly with an average wind speed of 3.3 metres per second and 6.0 per cent calm conditions

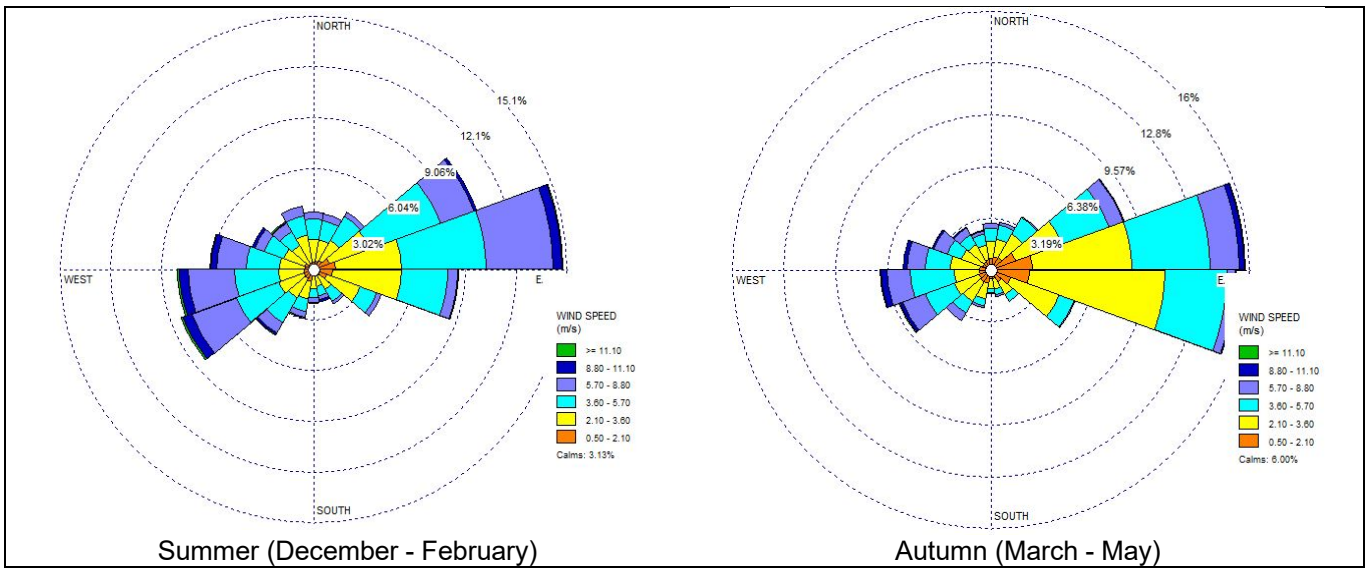


Figure 4-9 Wagga Wagga Aerodrome AMO seasonal wind roses Summer and Autumn (2016 to 2020)

Wind is an important factor in bushfire behaviour as it influences the rate of spread of the fire front and spreads burning embers / sparks, providing ignition sources for spot fires to distances up to 35 kilometres ahead of the main fire front.

Severe fire weather is typically associated with a north-westerly air flow due to the presence of high pressure systems over the Tasman Sea and the Great Australian Bight with a trough of low pressure separating these systems.

The exposure to wind effects will not vary along the length of the transmission line route due to the gently undulating nature of the landscape. Prevailing strong northwest, west and southwest winds will rapidly spread fires across the open landscape.

4.3.4 Topography

Slope is a critically important factor when assessing fire risk and likely fire behaviour. The rate of fire propagation doubles up a slope of 10 degrees (18 per cent) and increases almost fourfold up a slope of 20 degrees (40 per cent).

The rate of progress downslope tends to slow at a corresponding rate although wind direction in the lee of the hills/ridgelines tends to be unpredictable and can cause fires to change direction unpredictably.

The bushfire study area traverses country which is predominantly flat with minor undulations across the flood plains to the creeks and rivers. At a macro level, the landform from east to west with the eastern end of the study area at about 200 metres above sea level and the western end of the study area at about 40 metres above sea level at Mildura. Localised topographic highs of up to approximately 380 mAHD occur approximately 10 kilometres west of the existing Wagga Wagga substation and are associated with the Gregadoo Hills (granitic mountain ridge).

For the purpose of examining bush/grass fire behaviour the topography of the land within the bushfire study area is considered to be level.

4.3.5 Bushfire fuels

Fuel is a critical element in bushfire risk management, as it is the one factor relating to fire behaviour that can be managed.

There are four ‘types’ of fuel that contribute to bushfire hazard. They relate to the distribution and nature of combustible material within a vegetated environment and are defined by the *Overall Fuel Hazard Guide – Fourth Edition* (Department of Sustainability & Environment Victoria, July 2010) – (industry standard), as:

- bark fuel hazard
- elevated fuel load
- near surface fuel load; and
- surface fine fuels.

Elevated material is defined as shrubs, heath and suspended material greater than 0.5 metres above ground.

The level of bushfire hazard depends on fuel continuity, height, amount of dead material, foliage thickness and flammability of live foliage.

Flammability of vegetation is at the highest when composition is fine, it contains a lot of dead material, is dense vertically and horizontally and has low moisture content.

Surface and near surface fine fuels are defined as the litter bed and vegetation up to 0.5 metres above the ground. Grasses add to the surface fine fuels and therefore need to be taken into account when assessing the hazard. The risk is higher where greater depth and volume of litter and surface material are present.

Bark has the potential to travel significant distances in a fire situation (spotting) and act as a ladder between surface fuels and the forest crown. Bark contributes to fire hazard when it is loose and fibrous, present in large quantities and in long loose ribbon forms.

4.3.5.1 Assessment of bushfire fuel hazard – Mallee Woodland (Western Portion of the Corridor)

While large areas have been heavily modified and disturbed, the portion of the proposed transmission line easement between Buronga and Balranald contains areas of remnant vegetation including Mallee Woodlands of mixed age, Low Open Chenopod shrub land dominated by stretches of heavily grazed and degraded to highly degraded low open chenopod of Black-bush (*Maireana pyramidata*) with a notable absence of palatable species.

Mallee Woodland and sparse shrublands are dominated by low, multi-stemmed, sclerophyllous eucalypts to 10 metres in height with a sparse to dense understorey which is dependent on rainfall and land use management.

Understorey may be dominated by sclerophyllous or non-sclerophyllous shrubs, hummock grasses, chenopods or tussock grasses. Ground layer is strongly influenced by rainfall and fires. Following heavy rain a prominent cover of ephemeral herbs with tussock grasses occur.

Whilst most of the grassland vegetation and grazed Woodland has some level of management by grazing, the success of this management practice can vary depending on the amount of rainfall in the spring period to produce abundant growth of grasses and also the stock loading and their ability to crop the grasses to levels which will mitigate the intensity of fires that may occur in the cured grass.

Therefore, the assessment of fuel hazard will be determined for unmanaged Woodland/Low Chenopod Shrub vegetation which is the vegetation which will create the most potential for a severe fire event on and within the proposed transmission line easement.

Source Department of the Environment and Energy NVIS Fact Sheet

Figure 4-10 Photograph of Mallee Open Woodland

Using the methodology provided within the *Department of Sustainability and Environment (Victoria) Overall Fuel Hazard Guide* (industry standard), the following Fuel Hazard observation was determined.

(a) Bark Hazard

Mallee Woodland has a smooth trunk with ribbons of bark along the trunk and limbs of the tree. Therefore, this vegetation has a High Bark hazard.

(b) Elevated Fuel Hazard

Elevated fuel comprises Chenopod shrub and suspended material.

The level of hazard depends on the fuel continuity (horizontal and vertical), height, and proportion of dead material, thickness of the foliage and twigs and flammability of the live foliage. The flammability of the elevated fuel is highest when:

- the foliage, twigs and other fuel particles are very fine (e.g. maximum thickness one to two millimetres)
- the proportion of dead material is high
- the fuels are arranged with a high level of density and horizontal and vertical continuity that promotes the spread of flame; and
- the live foliage has low, fuel moisture content.

The vegetation type and time elapsed since the most recent modification (e.g. fire or grazing) substantially determines the level of elevated fuel hazard.

A review of the elevated vegetation in and adjoining the bushfire study area has determined that the Mallee Woodland, when note managed, has a High – Very High Elevated Fuel Hazard.

(c) Near Surface and Surface Fine Fuel Hazard

Near Surface Fine Fuel consists of low Chenopods and grasses such as Tussock Grass. The Surface Fine Fuels consist of deposited leaf litter and low grasses with the hazard assessed by measuring litter-bed height.

The Fuel Hazard rating for the Near Surface and Surface Fine Fuel in the Mallee Woodland vegetation is Very High to Extreme.

The Overall Fuel Hazard of unmanaged Mallee Woodland Vegetation is Very High.

4.3.5.2 Assessment of bushfire fuel hazard – grassland & crops (Eastern Portion of the Corridor)

The eastern portion of the bushfire study area typically traverses areas of rural land, and land that has been developed primarily for agricultural uses such as dry-land grazing and farmland cropping (such as wheat and canola).

Unmanaged grassland and cured (dry) crops present a High to Very High Fuel Hazard Rating.

4.3.6 Potential fire runs

Wind and topography of the land create the potential path that a fire will take.

The topography of the land through which the transmission line traverses is typically level or gently undulating within a predominantly open landscape (in particular the further to the east of the proposal away from Buronga).

Fires which occur in this landscape have the potential to spread in the direction of the wind with the dominant fire spread likely from the north-west, west and south-west.

4.4 Assessment of bushfire risk during construction of the proposal

The potential sources of ignition of bushfires resulting from the construction of the proposal include:

- construction equipment including bulldozers, excavators and cranes
- motor vehicles
- vegetation removal including mulching
- hot works such as welding and grinding
- electrical faults in equipment
- chemical fires
- activities undertaken at the construction compound and accommodation camps
- arson
- blasting (if required).

These sources of ignition are explained further in the below sections. In general the risk of bushfire impact on the proposed transmission line easement and substation site during construction is high to extreme and is dependent on factors such as fuel loads, weather and the scale (size) of fires which may occur. There is a threat to construction personnel from fast moving bushfire events which may impact large lengths of the proposed transmission line easement.

Management measures are required to manage and minimise these risks and these are consolidated in Chapter 5.

4.4.1 Construction equipment including bulldozers, excavators and cranes

The use of heavy construction equipment including bulldozers and excavators for building roads, excavating pads and drilling bore holes can create situations where these activities can give off sparks when steel blades encounter rock, resulting in a high level of risk of ignition of vegetation. This risk can occur over a wider area from the machine operational area.

To reduce the level of risk, the use of this equipment in areas where rock is known to occur would be accompanied by a fire-fighting appliance such as a ‘slip-on’ fire-fighting unit or tanker trailers. This work would also need to include restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than ‘high’ based on a risk assessment endorsed by an appropriately qualified person being completed.

4.4.2 Motor vehicles

Motor vehicle exhaust systems are known to ignite grassland vegetation. Diesel powered trucks with pollution control devices in the exhaust system have the potential to emit burning diesel particles which ignite grassland vegetation and forest ground fuels, resulting in a high level of risk of ignition of vegetation.

4.4.3 Vegetation removal including mulching

The use of specialised slashers, mulching machines and bulldozers used for clearing vegetation create high risk situations when blades contact rock outcrops.

4.4.4 Hot works

Hot works undertaken such as welding, grinding, drilling can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation. To reduce the level of risk precaution would be used during all external hot works with shielding and a water supply (such as with an appropriately sized water fire extinguisher) provided.

4.4.5 Electrical faults in equipment

Electrical faults, including faulty power leads and generators also create a high level of risk of ignition of vegetation. To reduce the level of risk equipment would be checked in accordance with Australian Standard requirements for potential faults.

4.4.6 Chemical fires

The inappropriate storage of incompatible or flammable chemicals have the potential to cause a chemical fire or explosion. The failure to clean up a flammable chemical spill or address leaking containers can also lead to a fire.

4.4.7 Bushfire risk to associated with construction compound and accommodation camps

The proposal includes the establishment of:

- potential options for either a combined or separate construction compound and accommodation camp sites at Balranald
- a new combined construction compound and accommodation camp along the Cobb Highway
- a new combined construction compound and accommodation camp along the proposed Dinawan substation site
- a new combined construction compound and accommodation camp at Lockhart (currently two options identified to the west and north east of the Lockhart township)
- a construction compound site (only) at Wagga Wagga.

The locations of the proposed combined construction compound and accommodation camps (and separate construction compounds) are shown in Figure 4-11 to Figure 4-14 and include an allowance for the required Asset Protection Zones to be incorporated within the area shown.

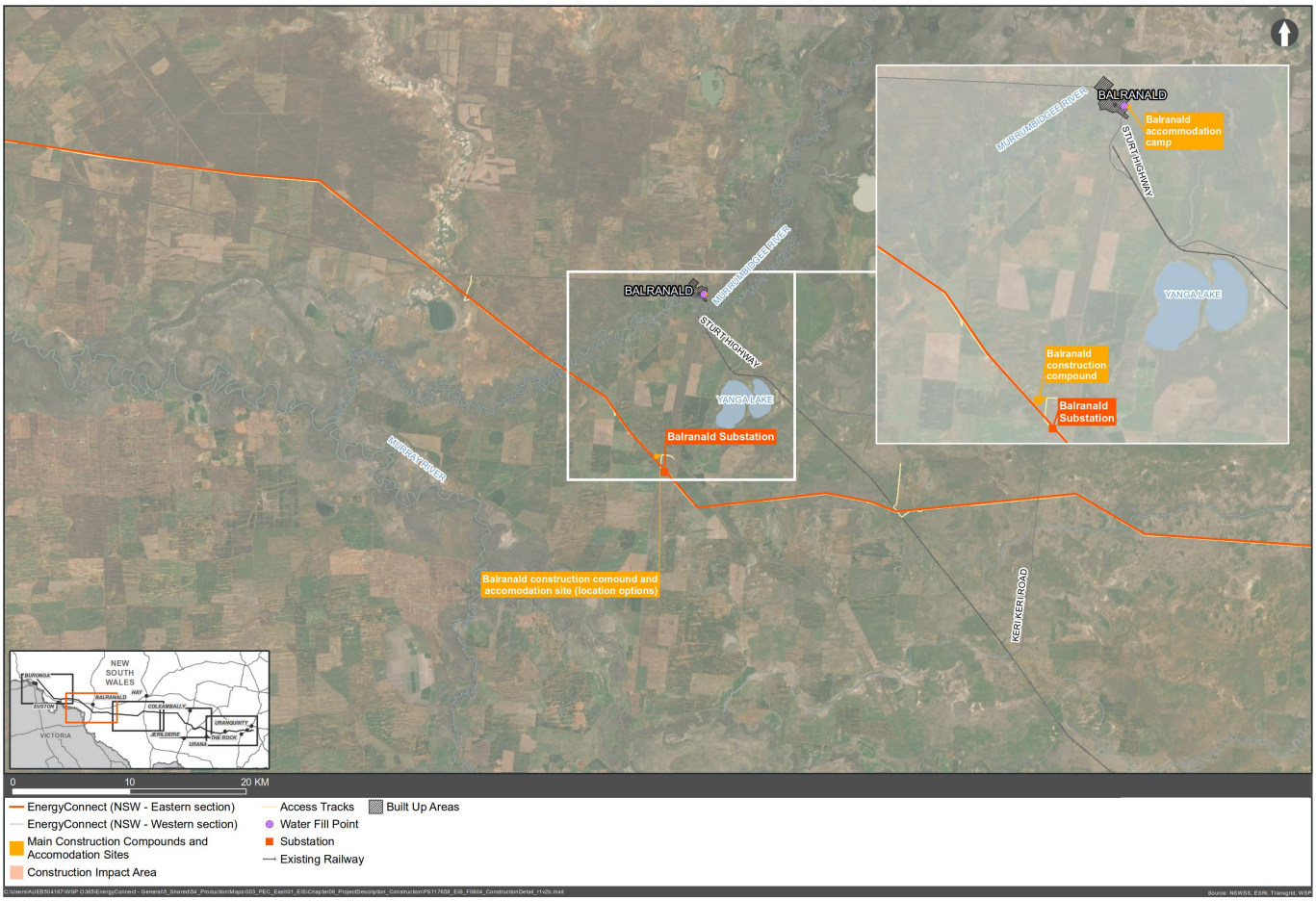


Figure 4-11 Site of the proposed construction compound site at Balranald

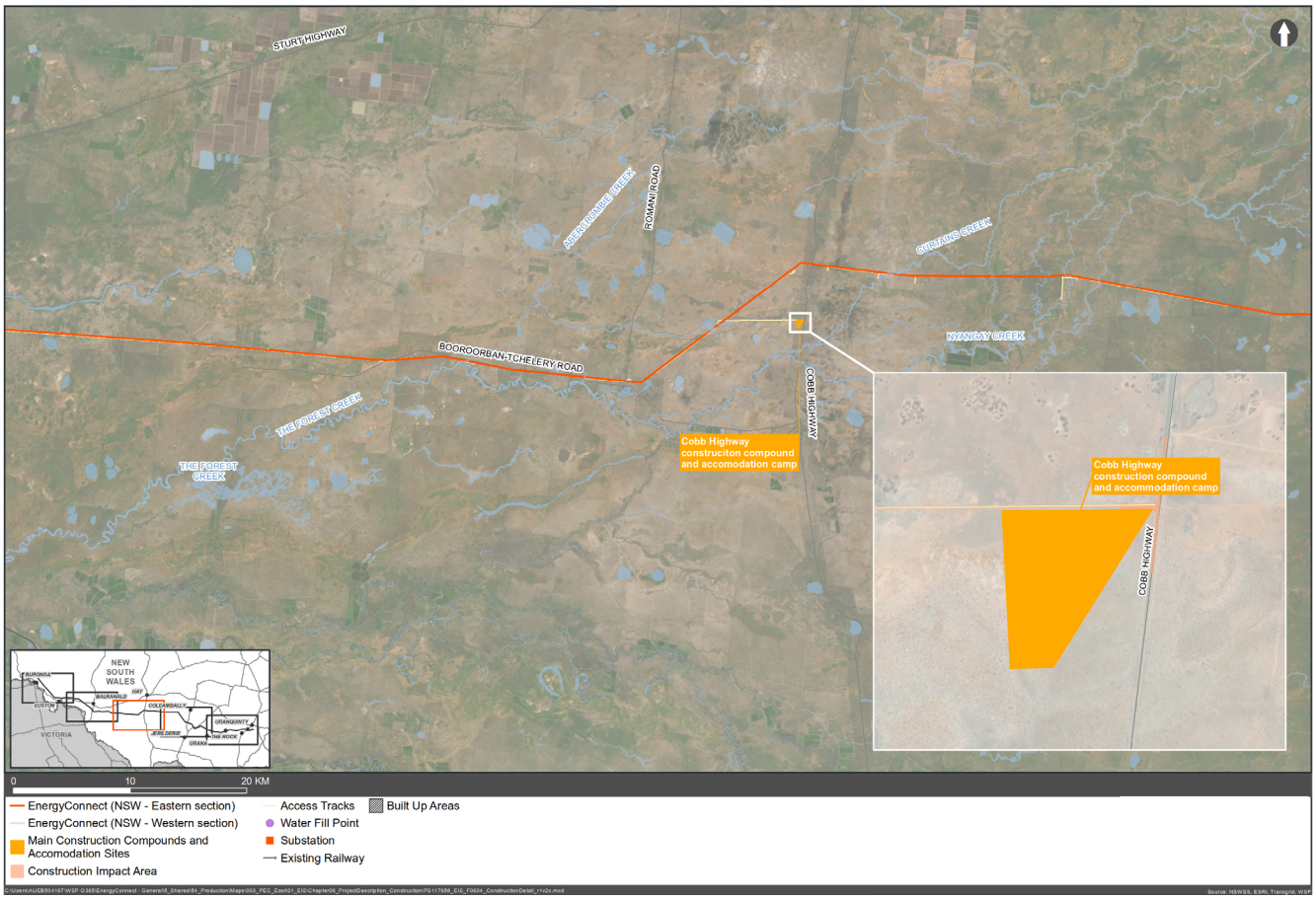


Figure 4-12 Site of the proposed construction and compound accommodation camp site at the Cobb Highway

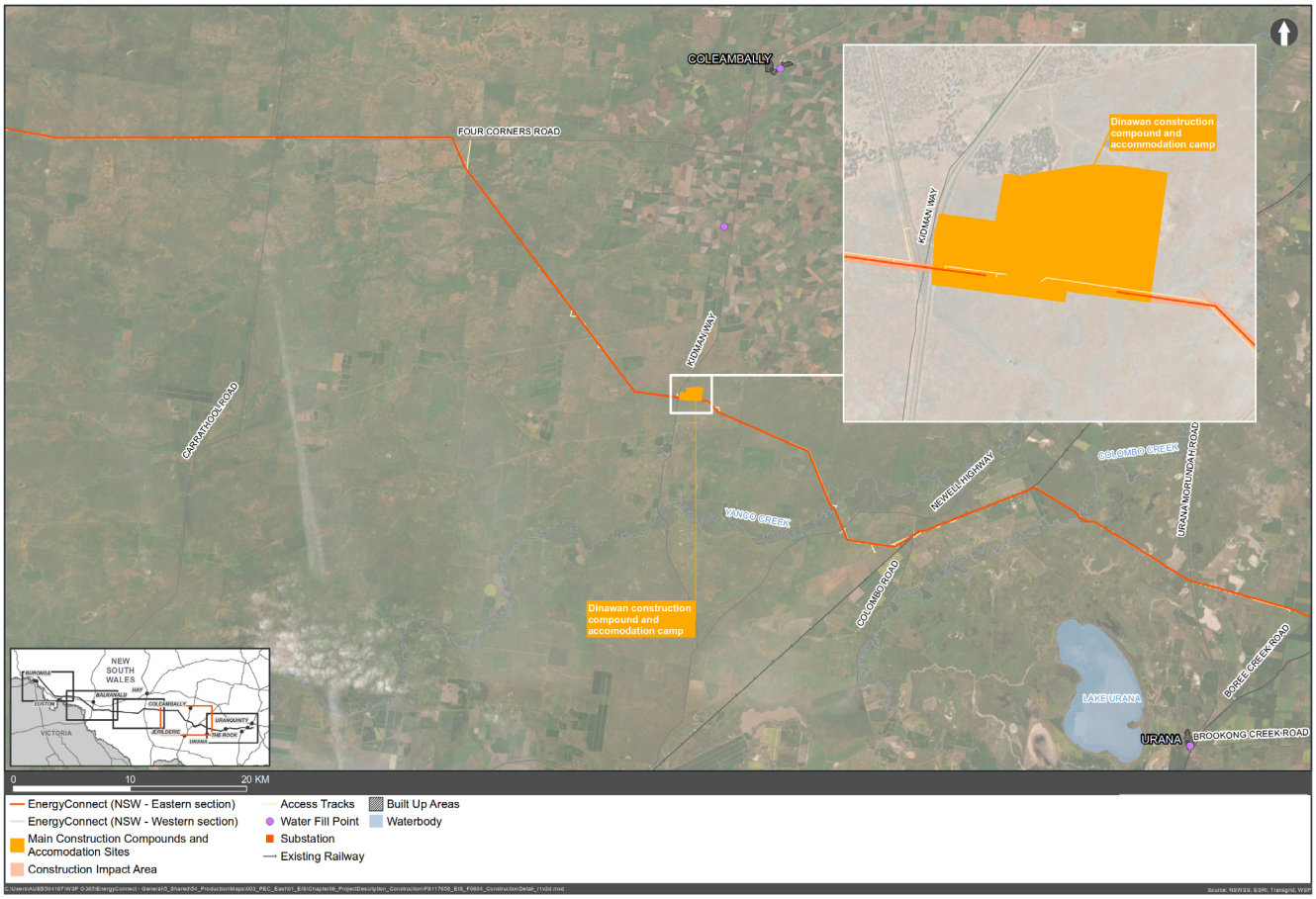


Figure 4-13 Site of the proposed construction and compound accommodation camp site at Dinawan

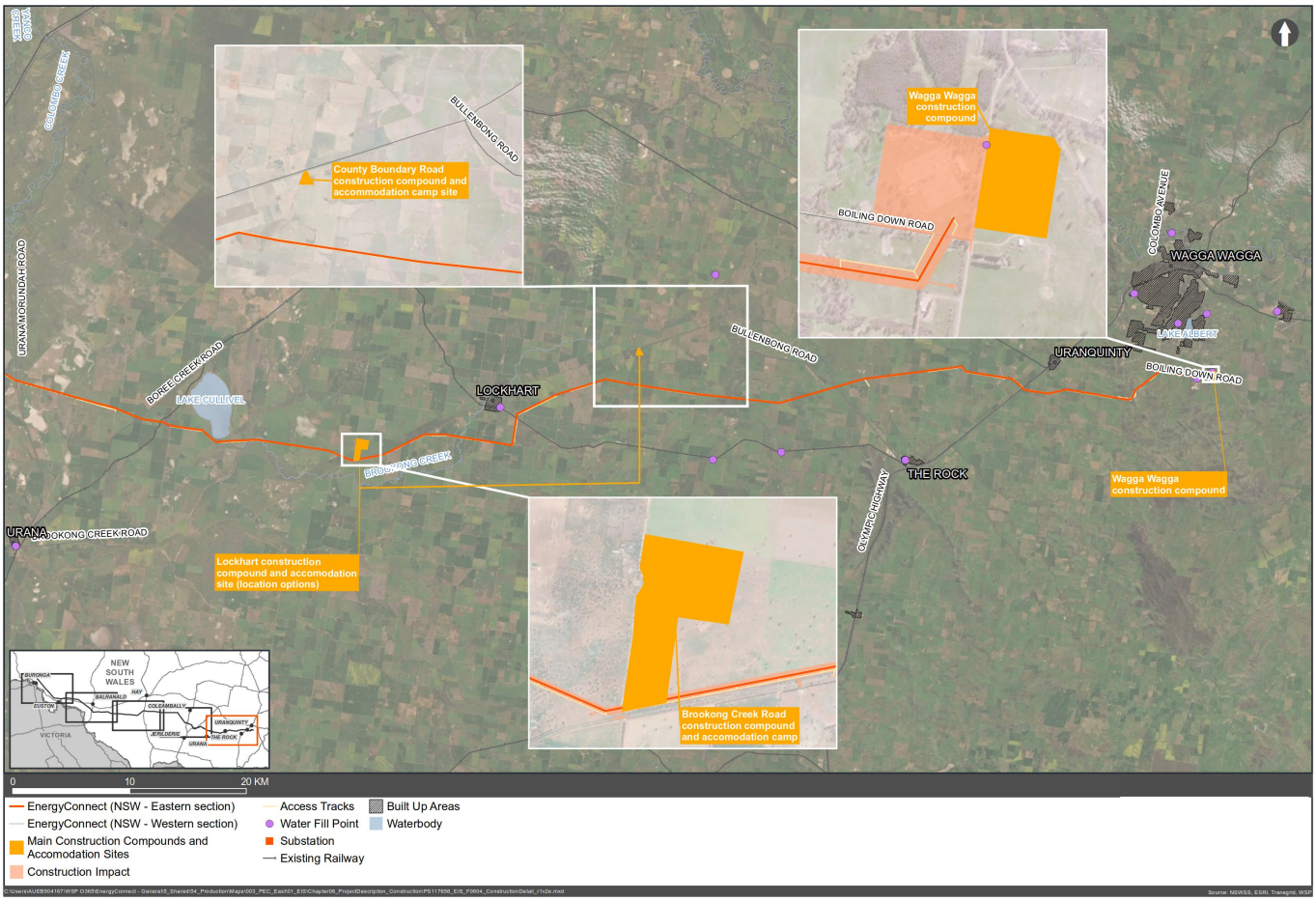


Figure 4-14 Site of the proposed construction and compound accommodation camp sites at Lockhart and proposed construction compound site at Wagga Wagga

Hot works undertaken within the construction compound, such equipment maintenance which includes welding and grinding and vegetation management such as mechanical slashing can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation.

External cooking fires (such as BBQ), electrical faults and the inappropriate discarding of lit cigarettes can cause ignition of grassland within and external to the camp site.

With the proposed protection measures in place the potential bushfire risk to the proposed construction and compound accommodation camps is considered to be low – moderate.

4.4.8 Arson

A malicious act (e.g. arson) can occur where-ever human activity occurs and can result in high risk to the proposal and the operators of the equipment.

4.4.9 Blasting

Controlled blasting may be required to be used in some locations along the alignment to loosen and break up existing rock to allow for creation of transmission tower pads and or development of the proposed Dinawan 330kV and/or Wagga 300kV substation works.

To reduce the level of risk of ignition of the surrounding vegetation Transgrid would need to engage appropriate measures to ensure fire-fighting resources are available before blasting occurs.

4.5 Assessment of bushfire risk during operation

4.5.1 Bushfire risk to the proposed transmission lines during operation

There is a high probability that the proposed transmission lines could be impacted by a bush/grass fire when ignition occurs in any unmanaged vegetation during periods of high fire danger, when excessive dry (cured) fuel is available and weather conditions result in high temperatures, low humidity and strong winds travelling across the landscape from the northwest, west and southwest direction.

The risk to the transmission lines under these conditions would be dependent on the scale (size) of the fire. The risk from large scale fire events would be high to extreme. However, the transmission lines would be constructed within easements which would be cleared of vegetation / maintained in line with the following principles which are standard Transgrid transmission line management procedure:

> All tall growing vegetation on the easement corridor would be removed. Tall growing vegetation is any vegetation species which may intrude on the vegetation clearance requirements at maximum line operating conditions (refer Table 4-4) (maximum conductor sag and maximum conductor blowout) at that location now or at any time in the future. The assessment of tall growing vegetation would be undertaken prior to and throughout construction by a qualified Level 4 or Level 5 arborist. An arborists report would be required to be provided identifying the vegetation to be removed along the transmission line route in relation to the final transmission line conductor profiles.

Table 4-4 Transgrid vegetation clearance requirements for easements

Nominal System Voltage	Vegetation Clearance at Maximum Line Operating Conditions (Minimum Safe Working Distance + Regrowth Rate)
220 kV	1.8m + Regrowth allowance
330 kV	3.0m + Regrowth allowance
500 kV	3.9m + Regrowth allowance

Source: (Transmission Line Construction Manual – Major New Build, Transgrid February 2020)

In relation to the transmission lines proposed, the clearance distances required are expected to be:

- nine metre clearance between vegetation the ground and maximum conductor sag point for the 330kV line: and
- eleven metre clearance between vegetation the ground and maximum conductor sag point for the 500kV line.

Based on the expected tower and conductor heights, vegetation with growth heights generally below four metres from ground level would be able to be retained in centre section of the easements while still maintaining the required vegetation clearances identified in Table 4-4. Vegetation taller than this at the maximum sag point (centre section of the easement) would be required to be cleared.

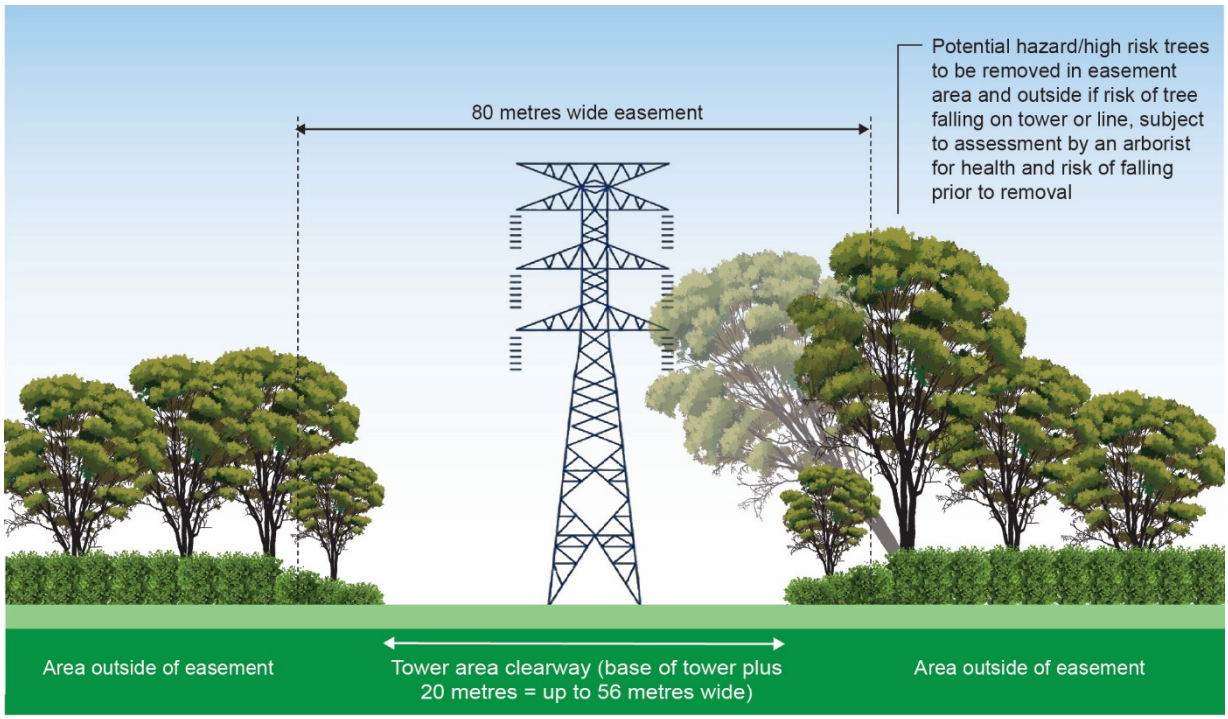
Based on these requirements, and in consideration of the construction methodology for transmission line stringing, the following vegetation clearing and retention is proposed for the easements:

- Centreline cleared area (construction phase only)
  - for the 330kV transmission line section a 10 metre wide cleared area directly underneath the centreline of the transmission line (i.e. five metres either side of the transmission line centreline).
  - for the 500kV transmission line section, this would consist of a 20 metre wide cleared area (i.e. 10 meters either side of the transmission line centreline).
  - in the construction phase these centreline areas would be cleared to low ground level. Vegetation with growth heights of up to four metres would be able to be grown and retained in these areas during operation and maintenance activities (during operation these areas would form part of the inner maintenance zone – see below).

- Inner maintenance zone:
  - for the 330kV transmission line easement, vegetation with growth heights of up to four metres can be retained from the centreline out to 20 metres distance from the centreline (i.e. a 40 metre wide inner section of the easement)
  - for the 500kV transmission line easement, vegetation with growth heights of up to four metres can be retained from the centreline out to 30 metres distance from the centreline (i.e. a 60 metre wide inner section of the easement)
- Outer maintenance zone:
  - for the 330kV transmission line easement, vegetation with growth heights of up to 10 metres would be able to be retained in the easement section which is 20 metres to 30 metres from the centreline. This is permitted as the maximum sag point height is increased at this greater distance for the centreline and therefore taller vegetation is permitted without impacting on the vegetation clearance requirements which are identified in Table 4-4
  - for the 500kV transmission line easement, vegetation with growth heights of up to 10 metres would be able to be retained in the easement section which is 30 metres to 40 metres from the centreline. This is permitted as the maximum sag point height is increased at this greater distance for the centreline and therefore taller vegetation is permitted without impacting on the vegetation clearance requirements which are identified in Table 4-4.
- For the 80 metre wide 330kV easement, vegetation clearing would generally only be required for the centre 60 metre wide section (which includes the centreline cleared area, inner and outer maintenance zones combined). Vegetation which would encroach within the easement that would encroach on these clearance distances would be removed.
- For the 80 metre wide 500kV easement, vegetation clearing would be required for whole of the 80 metre wide easement (which includes the centreline cleared area, inner and outer maintenance zones combined). Vegetation which would encroach within the easement that would encroach on these clearance distances would be removed.

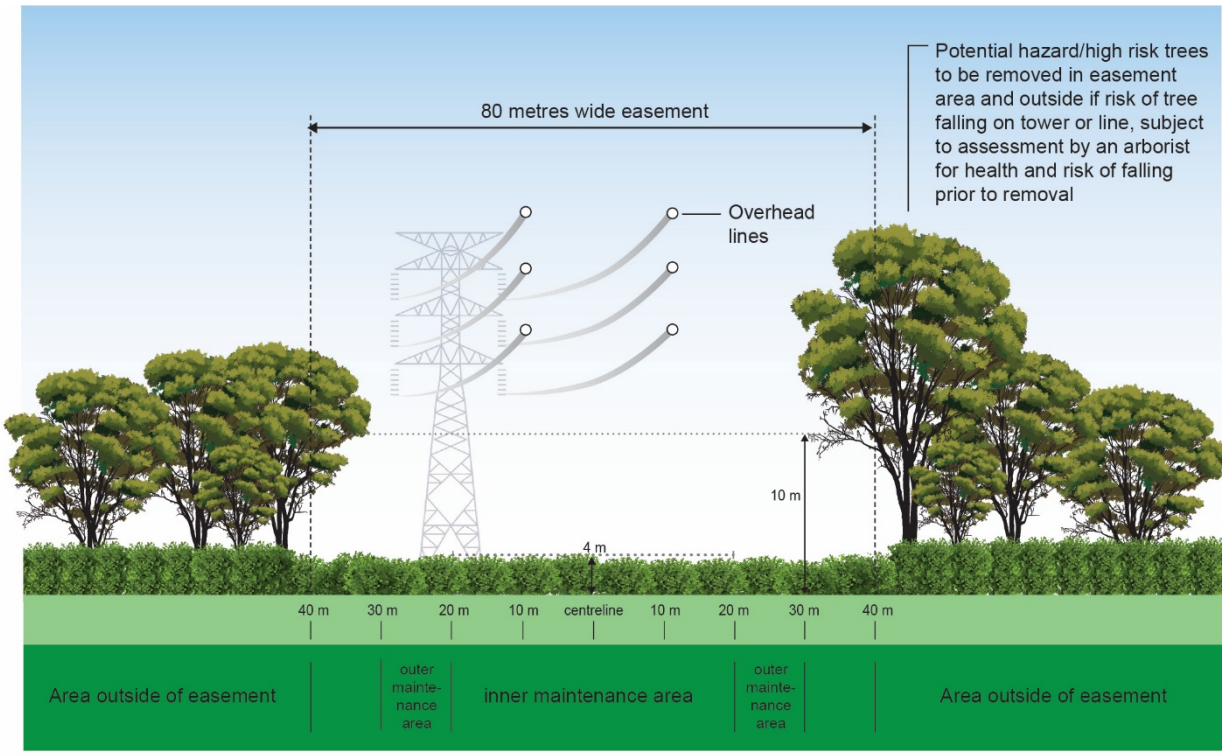
> All hazard trees located on the easement corridor would be removed. Hazard trees are any tree or part of a tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines. Hazard/high risk trees shall be identified during finalisation of the proposal design based on the transmission line conductor profile. All hazard/high risk trees posing a risk to the corridor would be removed, subject to assessment by a Level 4 or Level 5 arborist for health and risk of falling prior to removal.

Figure 4-15 to Figure 4-18 provide an overview of the clearing requirements for both the 330kV and 500kV transmission line easements for the operational phase of the proposal.



Vegetation in the easement to be maintained to achieved minimum clearance requirements.

Figure 4-15 Elevation of the indicative proposed vegetation clearing requirements within the 330kV transmission line at tower locations – operational phase



Vegetation in the centre 60 metres wide section of 80 metres wide easement to be maintained to achieved minimum clearance requirements (based on growth heights).(Assessed as up to 4 metres growth heights in inner maintenance area and up to 10 metres in outer maintenance area)

Figure 4-16 Elevation of the indicative proposed vegetation clearing requirements within the 330kV transmission line mid easement between towers – operational phase

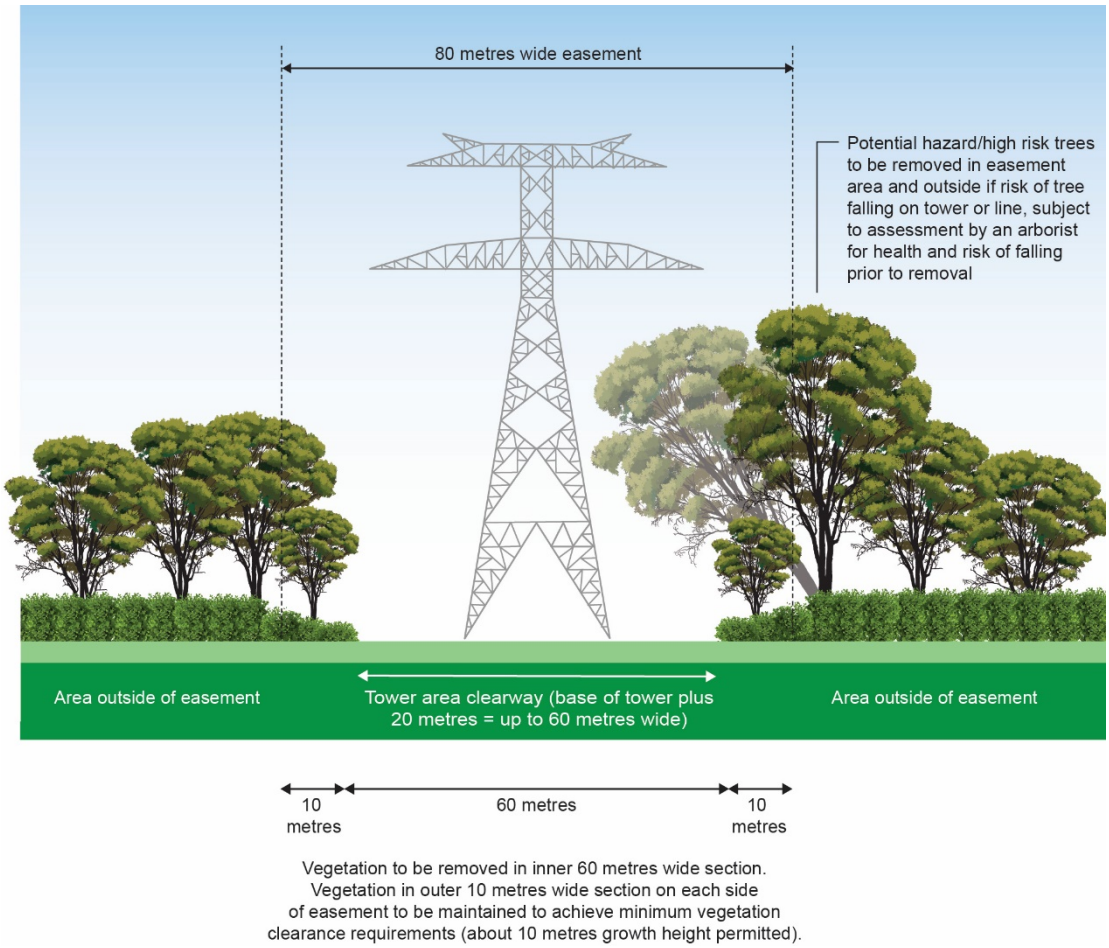


Figure 4-17 Elevation of the indicative proposed vegetation clearing requirements within the 500kV transmission line at tower locations – operational phase

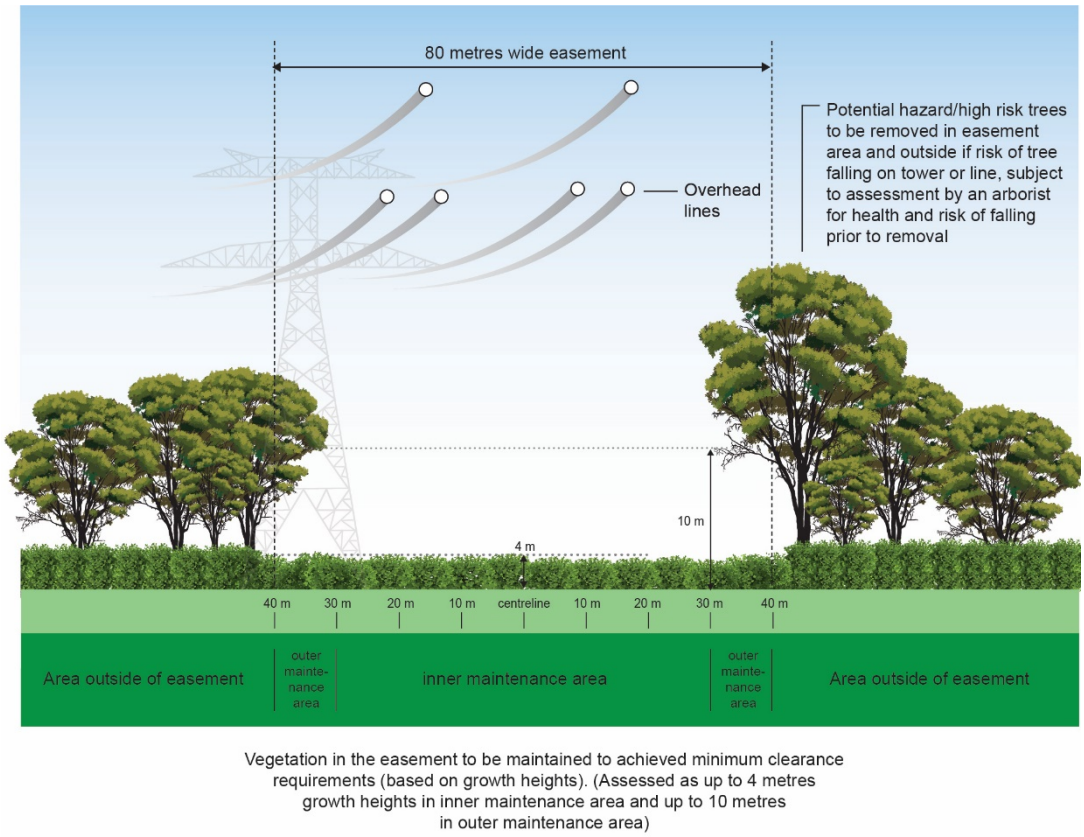


Figure 4-18 Elevation of the indicative proposed vegetation clearing requirements within the 500kV transmission line mid easement between towers – operational phase

The transmission line towers would be up to 65 metres tall for both the 330kV and 500kV towers and constructed from steel, which is a non-combustible material. This means that the towers would be high enough above the ground so that fires occurring within the grassland and Woodland vegetation surrounding the easement would not be expected to generate sufficient flame height to directly impact the conductors with flame contact.

The towers and conductors would likely be impacted by radiant heat from these fire occurrences. The levels of radiant heat are not likely to impact upon the integrity of the tower, the conductors and their connectors (insulators).

The residual risk of bushfire on the transmission lines and their supporting towers is therefore reduced to moderate.

4.5.2 Bushfire risk created by the proposed transmission lines during operation

The distribution of electricity via high voltage transmission lines and associated equipment has the potential to cause ignition of bushfire fuels, either within or adjoining the transmission line easement.

Ignition sources which can be attributable to high voltage transmission lines and associated equipment include:

- trees or tree branches falling/touching conductors and bird strikes
- equipment malfunction – transmission line failure including damage caused by high winds, lightning strike or mechanical damage [i.e. aircraft strike]
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by Ionise particles in dense bushfire smoke
- heat causing power lines to sag and connect with the ground/vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power line including breakage of wires, poles, cross arms, insulators and associated equipment
- pole-top fires caused by dust build up on insulators, causing arcing from the conductor to the tower/cross arm
- arcing to ground through smoke plumes
- electrically induced fire – current or voltage transfer due to fault and failure of the earthing system at transmission line towers.

The incidence of these ignition sources from transmission lines supported on high towers which are maintained clear of trees and combustible materials is rare.

However, if one of these ignition sources occurred during prolonged drought conditions when combustible fuels are available, the risk of ignition is high, necessitating monitoring and rapid response to any incident/emergency that is likely to cause line failure and therefore the potential for fire ignition within the bushfire prone vegetation.

The bushfire risk from the transmission lines infrastructure to the surrounding environment is therefore moderate.

4.5.3 Bushfire risk to the proposed Dinawan substation during operation

The proposal includes the construction of the proposed Dinawan substation on Lot 4 in DP 593483, Lot 52, Lot 53, Lot 54 and Lot 55 in DP 756396 and Lot 7 in DP 113903 Kidman Way, southwest of Coleambally.

As shown in Figure 4-, the substation site is located to the east of the intersection of Kidman Way and Cadel Road and is adjoined to all aspects by agricultural grazing land (refer Figure 4-20).

With the proposed protection / mitigation measures in place the potential bushfire risk to the substation is considered to be low – moderate.

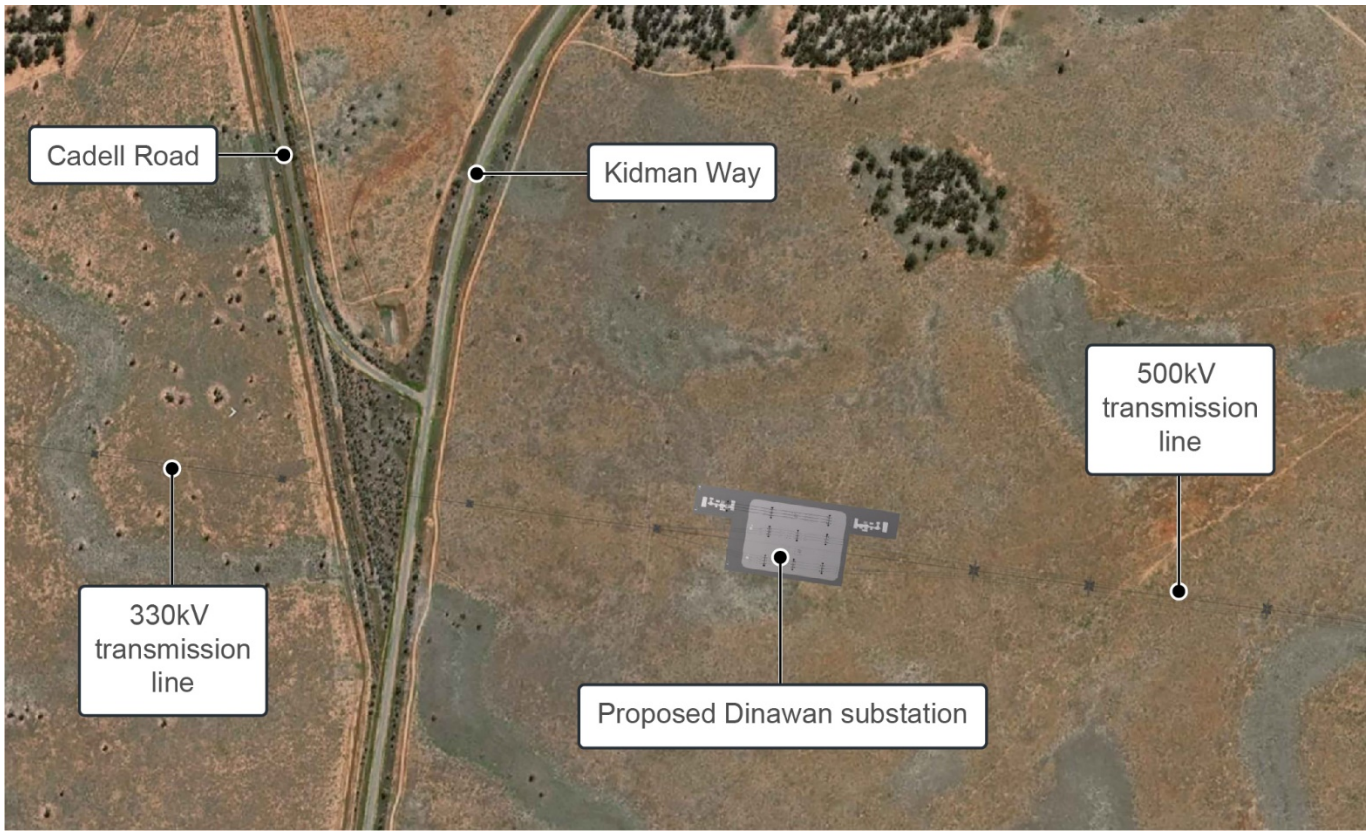


Figure 4-19 Dinawan substation location plan

Figure 4-20 Photograph of the proposed Dinawan substation site. This vegetation is typical to all aspects of the substation site

4.5.5 Bushfire risk to the Wagga Wagga substation during operation

The proposal includes the expansion of the existing Transgrid Wagga Wagga substation within the existing substation area on Lot 1 in DP 52449, Boiling Down Road and Ashfords Road, Wagga Wagga.

Figure 4-21 shows the approximate area of the upgrade and expansion area to the existing Wagga Wagga substation.

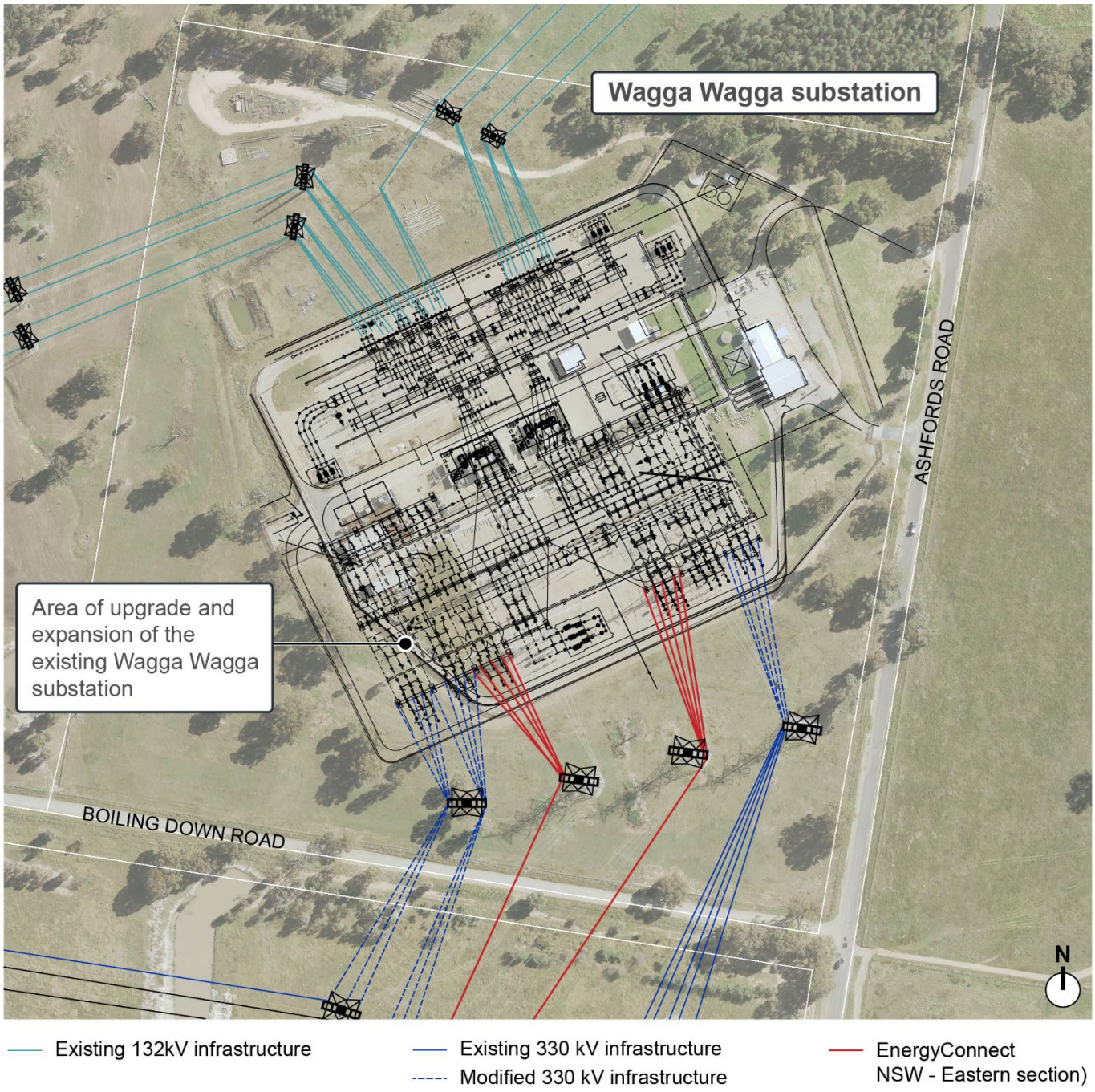


Figure 4-21 Approximate extent of the Wagga Wagga substation upgrade and expansion location

The existing substation site is managed and provides a satisfactory defendable space to the existing facilities and proposed expansion which reduces the potential bushfire risk to the substation equipment to low – moderate.

Figure 4-22 Photograph of Wagga Wagga substation site. The grasslands vegetation is typical to all aspects of the substation site

4.5.6 Bushfire risk from the proposed Dinawan and Wagga Wagga substations during operation

The generation and distribution of electricity has the potential to cause fire ignition within the Dinawan and Wagga Wagga substations. Ignition sources include:

- equipment malfunction – transformer explosion; burn out of motors/fans; wiring failure
- human error.

The incidence of equipment malfunction is rare. Transformers can explode and have the potential to spread molten metal and burning oil for some distance from the transformer.

Fans and motors fail with the potential impact restricted to localised sparks and in some cases, the shedding of hot/molten metal. Overhead wiring failure is uncommon and is usually the result of physical damage from lightning strikes or sparks given off during light rain, as a result of dust build up on the insulators over extended dry periods.

Whilst these occurrences may generate a potential ignition source, it is the human error factor that would cause the greatest level of risk of ignition to the surrounding bushfire prone vegetation.

The extent of the proposed clearance between the proposed Dinawan and Wagga Wagga substation equipment and the compound fence, combined with the gravel ground cover within the compound, would mitigate the risk of the transfer of an ignition within the compound to the surrounding vegetation.

The bushfire risk from the operation of the substation is considered to be low – moderate.

5. Mitigation measures

Broad strategies to manage bushfire risk include:

- eliminate the bushfire risk (make the land-use decision first by asking the question about whether development should or should not proceed in a given area)
- design or substitution (review location)
- engineering controls (infrastructure, building standards and landscaping)
- administration and organisation; (community preparedness measures).

This section summarises the mitigation measures recommended for the proposal to mitigate bushfire risk.

Table 5-1 Mitigation measures

ID	Identified mitigation measure	Timing	Applicable location(s)
BF-1	A Bushfire Risk Management sub-plan (or other Emergency Plan) would form part of the final documentation for the proposal. The sub-plan would be prepared by a suitably qualified professional and would include (but not limited to): - protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan) - protocols for the management of bushfire risk and fuel management during construction. This would include restriction and/or prevention of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities - training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.	Pre-construction	All locations
BF-2	A minimum 50 metre wide managed Asset Protection Zone (APZ) would be provided to the hazard perimeter of the fixed construction equipment and camp site buildings unless an alternative fire protection approach that achieves the same level of bushfire risk management is identified by a suitably qualified specialist. Any APZ would be regularly maintained to provide a maximum grass height of up to 150mm during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70 per cent cured. Vegetation inside the construction and camp sites would be regularly maintained to a maximum height of 75mm.	Construction	Main construction compounds and accommodation camp sites

ID	Identified mitigation measure	Timing	Applicable location(s)
BF-3	Buildings within the construction compound and accommodation camp site would be constructed to comply with Section 3 and Section 5 (BAL 12.5) of AS 3959 – 2018 – *'Construction of Buildings in Bushfire Prone Areas'.* The sub-floor space of each building would be enclosed with stainless steel flymesh securely fixed to the external wall/s and buried into the ground. All joints would be overlapped and sealed.	Construction	Main construction compounds and accommodation camp sites
BF-4	Water for fire-fighting operations would be confirmed prior to construction with consideration to occupancy density and site layout. This would include onsite static water supply and fire-fighting hose reels when working in areas where vehicles may travel through environments such as areas of: > known rocks where equipment such as bulldozers and excavators may create sparks > long cured (dry) vegetation (grass and crops) All weather access having a minimum width of 4.0 metres would be provided to the static water supply tanks.	Construction (prior to camp occupation)	Main construction compound and accommodation camp sites
BF-5	Security measures would be implemented to minimise the risk of ignition leading to bushfire(s). Sources of potential ignition would be secured at the end of each shift or as sites are left unattended.	Construction	Main construction compound and accommodation camp sites
BF-6	Consultation with emergency services (the NSW Rural Fire Service and Fire and Rescue NSW) would be undertaken prior to construction to ensure emergency access provisions are provided during operation	Construction	All locations
BF-7	Prior to occupation of the construction camps and offices, all bushfire protection and mitigation measures would be certified as compliant with relevant regulatory requirements by a suitably qualified bushfire consultant.	Construction (prior to camp occupation)	All locations
BF-8	Controls to minimise potential ignition of vegetation would be implemented and a water supply (suitable extinguisher) and trained operator on hand during all outdoor hot works/grinding activities, and during vegetation slashing within and adjacent to the construction compounds and accommodation camps. No outdoor hot works would be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days unless there is a suitable fire suppression unit present on site and only with prior agreement with local fire services.	Construction	All locations

ID	Identified mitigation measure	Timing	Applicable location(s)
BF-9	Equipment would be checked in accordance with Australian Standard requirements for potential electrical faults, including faulty power leads and generators.	Construction	All locations
BF-10	To reduce the level of risk of ignition of the surrounding vegetation Transgrid would need to engage appropriate measures to ensure fire-fighting resources are available before blasting occurs.	Construction	All locations blasting proposed
BF-11	The proposal would be operated and maintained in accordance with Transgrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of APZs and inspections of infrastructure	Operation	All locations
BF-12	The Wagga Wagga substation Emergency Response Manual would be updated to include the new proposed design and required revised emergency response procedures.	Pre-operation	Wagga Wagga substation
BF-13	An Emergency Response Manual would be prepared for the proposed Dinawan substation and include emergency response procedures.	Pre-operation	Dinawan substation

6. References

Australian Standard A.S. 3959 – 2018 – *'Construction of Buildings in Bushfire Prone Areas'.*

Building Code of Australia.

Climate Council - 'Be Prepared: Climate Change and the NSW Bushfire Threat' Transgrid, February 2020 – *Transmission Line Construction Manual – Major New Build.*

Bryant, Colleen, 2008. *Understanding bushfire trends in deliberate vegetation fires in Australia*. Australian Institute of Criminology.

NSW Department of Sustainability & Environment Victoria, July 2010. *Overall Fuel Hazard Guide – Fourth Edition.*

NSW Rural Fire Service, 2021. *Bushfire Environmental Assessment Code 2021.*

NSW Rural Fire Service, 2015. *Guideline for Bushfire Prone Land Mapping.*

NSW Rural Fire Service, 2019. *Planning for Bushfire Protection.*

Wentworth Shire Council Website, accessed June 2020.