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HumeLink

Bushfire Risk Assessment Report
EIS Technical Report 13

HumeLink

EIS Technical Report 13 – Bushfire Risk Assessment Report

Transgrid

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Executive summary

This Bushfire Risk Assessment Report (BRAR) supports the HumeLink Environmental Impact Statement (EIS) and identifies and assesses the bushfire risk during construction and operation of the project. Bushfire events have the potential to ignite vegetation and structures and pose a risk to life, assets, and commercial operations. Bushfire risk is influenced by regional fire weather and climate, vegetation, slope, and access. In accordance with the project's Planning Secretary's Environmental Assessment Requirements (SEARs), this BRAR constitutes an assessment of the risks to public safety from bushfire and provides mitigation measures to appropriately manage bushfire risk.

The bushfire assessment includes surveys undertaken at areas within the project footprint, which have been identified as having an elevated bushfire risk, such as areas located within land classified as Bush Fire Prone Land (BFPL), and where project related personnel may work, sleep, or assemble. These include substations, construction compounds, and worker accommodation facilities. These bushfire survey areas have been assessed against the performance criteria outlined in *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (PBP) (NSW RFS, 2019).

Due to the extensive, dynamic and varying landscape across the transmission line easement, the transmission line has been conservatively classified as having the highest bushfire risk. This is consistent with Transgrid's risk approach to asset management and assumes that every transmission line has the potential to be impacted by fire, or to initiate fire, including bushfire (Transgrid, 2003). Therefore, site specific assessments were not undertaken for the proposed transmission lines. Vegetation management within the transmission line easement would be applied uniformly across the entire transmission line and managed in accordance with Transgrid's existing vegetation management standards (as per Transgrid 2020a, 2020b, and 2021) and in accordance with in AS/NZS7000:2016 Overhead Line Design.

Structures located on BFPL must satisfy the aims and objectives outlined in PBP (NSW RFS 2019). These aims and objectives would be satisfactorily met provided mitigation measures outlined in Section 9.9 are implemented for the project.

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Glossary and abbreviations

Abbreviation or term	Description
ACT	Australian Capital Territory
APZ	Asset Protection Zone
AS	Australian Standard
AS2419.1:2005	Australian Standard AS2419.1:2005: Fire hydrant installations - System design, installation and commissioning
AS3959:2018	Australian Standard 3959:2018: Construction of Buildings in Bushfire-Prone Areas
AS5577:2013	Australian Standard 5577:2013: Electricity Network Safety Management Systems
Asl	Above sea level
AS/NZS7000:2016	Australian/New Zealand Standard 7000:2016: Overhead Line Design
BAL	Bushfire Attack Level
Bannaby 500 kV substation	The existing 500 kV substation at Bannaby.
Bannaby 500 kV substation compound (C12)	The construction compound within the existing 500 kV substation property at Bannaby.
BCA	Building Code of Australia
BEEP	Bushfire Emergency Evacuation Plan
BFEMEP	Bush Fire Emergency Management and Evacuation Plan
BFMC	Bush Fire Management Committee
BFPL	Bush Fire Prone Land, which are areas able to support a bushfire or be subject to a bushfire attack
BRAR	Bushfire Risk Assessment Report
BoM	Bureau of Meteorology
BRMP	Bush Fire Risk Management Plans
bushfire	An uncontrolled fire in a bush area
bushfire survey area	An area identified by the bushfire discipline where surveys and investigative works have occurred for bushfire risk assessment. This encompasses the main facilities that may experience exposure to bushfire risk during construction and operation. Refer to Section 1.6.2.
CEMP	Construction Environmental Management Plan
construction compounds	Main construction compounds proposed for construction of the project. Each main construction compound would accommodate a range of facilities which may include (but not limited to): ■ laydown areas ■ site offices ■ amenities ■ construction support facilities such as vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas ■ parking.
DPE	NSW Department of Planning and Environment
easement	A legal right attached to a parcel of land that enables the non-exclusive use of the land by a third party other than the owner. For transmission lines, an easement defines the corridor area where the lines are located and that allows access, construction and maintenance work to take place. The easements for the 500 kV transmission lines would typically be 70 metres wide. However, a few locations would require wider easements up to 110 metres wide at transposition locations and up to 130 metres wide where the new transmission line would parallel the relocated section of Line 51. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets.
EIS	Environmental Impact Statement
ENSMS	Electricity Network Safety Management System

Abbreviation or term	Description
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FCNSW	Forestry Corporation of New South Wales
FFDI	Forest Fire Danger Index is a measure of fire danger, based on vegetation dryness, air temperature, wind speed and humidity, and considers the chance of starting a fire, and potential spread, intensity, and difficulty of suppression. FFDI varies according to geography, and can range from 50 in some Alpine areas, to 100 in forested areas. The higher FFDI is indicative of a higher degree of fire danger in the area (NSW RFS, 2019). Average FFDI are assigned to local government areas for use in accordance with AS3959:2018 Construction of Buildings in Bushfire-Prone Areas (Standards Australia, 2018) and PBP (NSW RFS, 2019).
Future Maragle 500 kV substation	The future Maragle 500/330 kV substation that would be built under the Snowy 2.0 Transmission Connection Project, which is subject to separate planning approval (reference SS1-9717, EPBC 2018/836)
HumeLink	The project
kV	kilovolt
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NASH	National Association of Steel Framed Housing
NCC	The National Construction Code 2022 (it is effective 1 May 2023)
NEM	National Electricity Market
No.	Number
NSW	New South Wales
NSW RFS	New South Wales Rural Fire Service
PBP	*Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (NSW RFS 2019)
PCT	Plant Community Type
project (the)	The Critical State Significant Infrastructure project “HumeLink”, which is the subject of the Environmental Impact Statement
project footprint	The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
Proposed Gugaa 500 kV substation	The new 500/ 330 kV substation proposed near Wagga Wagga
QLD	Queensland
Rd	Road
SA	South Australia
REZs	Renewable Energy Zones
SEARs	Planning Secretary’s Environmental Assessment Requirements
SFPP	Special Fire Protection Purpose development as defined under the *Rural Fires Act 1997*
TAS	Tasmania
Transgrid	The project is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the ACT and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
transmission line route	The location of the transmission line structures along the middle of the transmission line easement

Abbreviation or term	Description
transmission line structures	Proposed free standing structures to support the transmission lines
VIC	Victoria
Wagga 330 kV substation	The existing 330/132 kV substation located in Wagga Wagga

1 Introduction

1.1 Overview

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley. The location of the project is shown on Figure 1-1.

HumeLink would involve construction of a new substation east of Wagga Wagga as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the Wagga Wagga and Tumut Renewable Energy Zones (REZs). The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the state's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. Once construction has commenced, the project is estimated to take approximately 2.5 years to build and would become operational by the end of 2026.

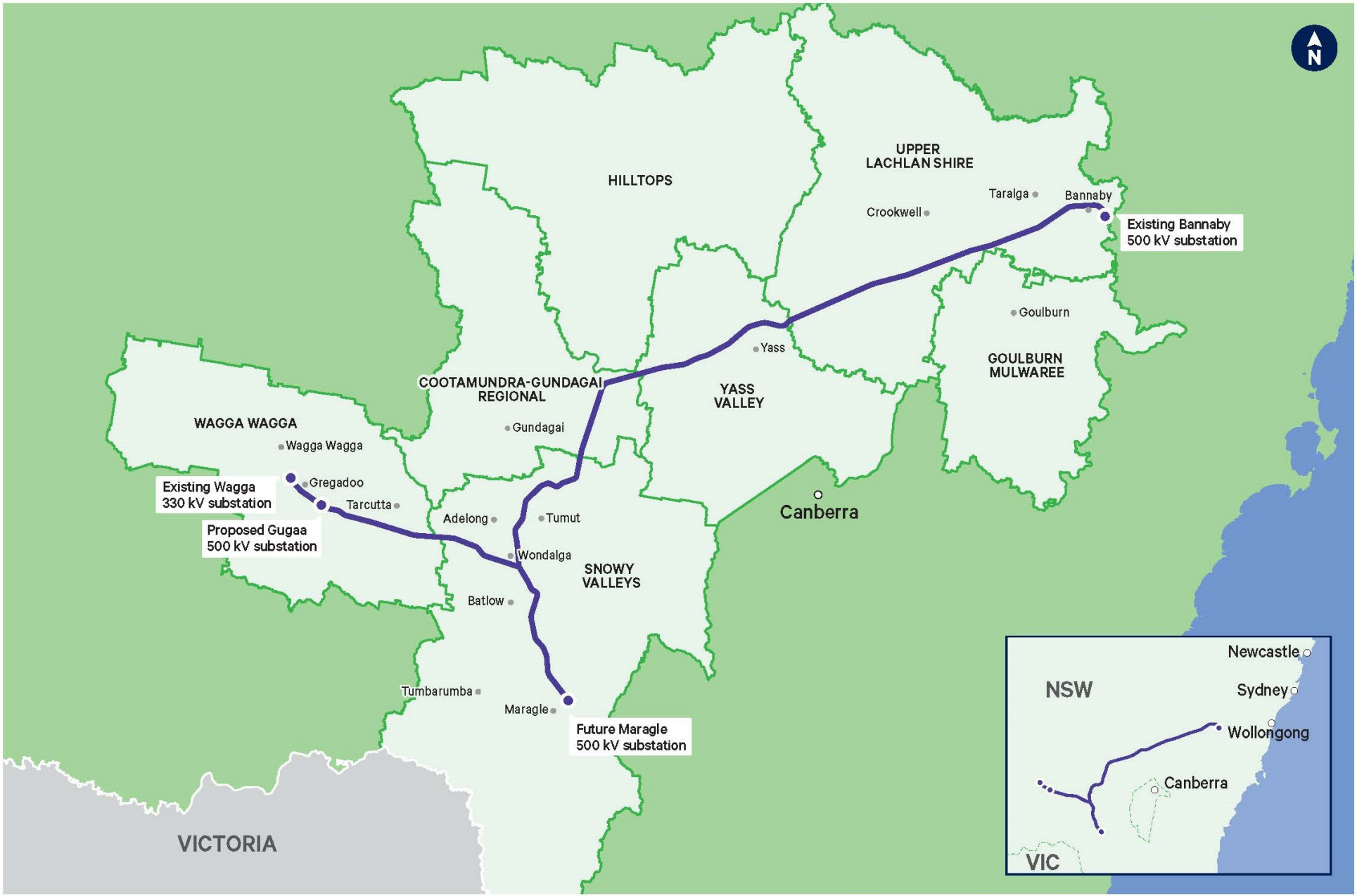
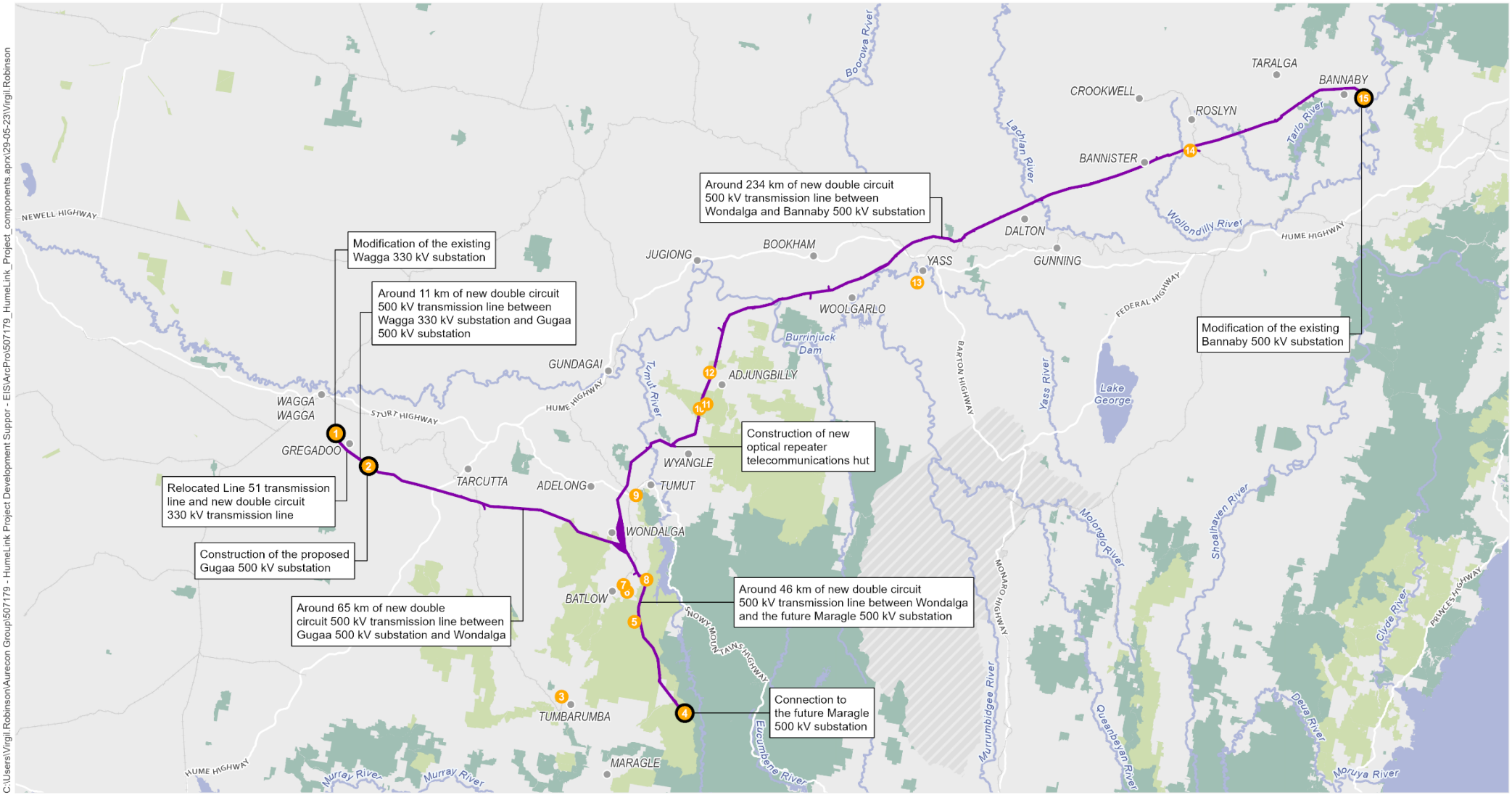


Figure 1-1 Location of the project

1.2 Key components

The project includes the following key components (refer to Figure 1-2):

- construction and operation of around 360 kilometres of new double circuit 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle
- construction of a new 500/330 kV substation at Gregadoo (Gugaa 500 kV substation) approximately 11 kilometres south-east of the existing Wagga 330/132 kV substation (Wagga 330 kV substation)
- demolition and rebuild of a section of Line 51 (around two kilometres in length) as a double circuit 330 kV transmission line connecting into the Wagga 330 kV substation
- modification of the existing Wagga 330 kV substation and Bannaby 500/330 kV substation (Bannaby 500 kV substation) to accommodate the new transmission line connections
- connection of transmission lines to the future Maragle 500/330 kV substation (Maragle 500 kV substation, approved under the Snowy 2.0 Transmission Connection Project (SSI-9717))
- provision of one optical repeater telecommunications hut and associated connections to existing local electrical infrastructure
- establishment of new and/or upgraded temporary and permanent access tracks
- ancillary works required for construction of the project such as construction compounds, worker accommodation facilities, utility connections and/or relocations, brake and winch sites, and helipad/helicopter support facilities.



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

FIGURE 1-2: Key components of the project

1.3 Purpose and scope of this report

This Bushfire Risk Assessment Report (BRAR) supports the HumeLink Environmental Impact Statement (EIS) and was prepared to comply with the NSW Department of Planning and Environment (DPE) Planning Secretary's Environmental Assessment Requirements (SEARs) (refer to Section 1.4). It identifies and assesses the risk from bushfire to assets within the project footprint and provides mitigation measures that would be applied during construction and operation of the project, in accordance with *Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers* (PBP) (NSW RFS, 2019). This report also details the methods to avoid and reduce bushfire risks, as well as mitigation measures to address residual impacts.

The specific objectives of this assessment are to:

- identify the bushfire hazard around key project infrastructure (including construction compounds, substations, and worker accommodation facility, as well as the transmission lines)
- reduce the potential impact on assets from bushfire (ember, radiant heat, and direct flame contact) by separating the development from bushfire hazards as well as minimising the vulnerability of buildings and transmission line infrastructure to ignition and fire spread from flames, radiation, and embers through identification of appropriate Asset Protection Zones (APZs) and vegetation clearance zones
- confirm that appropriate access and egress for workers, contractors, the public, and firefighters is provided in accordance with PBP
- confirm adequate water supplies for bushfire suppression are available at key infrastructure locations
- identify emergency planning and maintenance requirements of APZs, fire trails, access for firefighting, and on-site equipment for fire suppression, including consideration of public safety risks.

This BRAR is prepared in accordance with legislation and regulations provided in Chapter 2.

This report is not a Bush Fire Emergency Management and Evacuation Plan (BFEMEP), which is proposed as part of management measures for the project. The BFEMEP specifies procedures to respond to a bushfire starting and spreading in relation to the project construction and operation activities.

1.4 Secretary's environmental assessment requirements

The DPE has provided the SEARs for the project. The requirements specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements for HumeLink

Reference	Relevant SEARs	Where addressed in this report
Key Issues - Hazards	An assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, the handling and use of any dangerous goods, and potential impacts to high pressure gas pipelines.	▪ Chapter 5 addresses existing environmental factors associated with potential bushfire risks. ▪ Chapters 6 addresses potential construction impacts of the project associated with bushfire risk including risks to public safety and project assets. ▪ Chapter 7 addresses operational issues associated with bushfire risk and public safety. ▪ Chapter 9 addresses the management of risks, including emergency egress and evacuation. ▪ There are no high pressure gas pipelines located within the project footprint or associated with the project. However, general hazards and risks associated with interacting with utilities and the handling and use of dangerous goods is further addressed within Chapter 19 of the EIS.

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 project, and the purpose of this report
- Chapter 2 – Project description summary: provides an outline and summary of the key components of the project
- Chapter 3 - Legislative and policy context: provides an outline of the key legislative requirements and policy guidelines relating to the project
- Chapter 4 – Methodology: provides an outline of the methodology used for the preparation of this BRAR
- Chapter 5 – Existing environment: describes the existing environment with regards to bushfire risk
- Chapter 6 – Assessment of construction impacts: describes the potential construction impacts associated with the project related to bushfire risk
- Chapter 7 – Assessment of operational impacts: describes the potential operational impacts associated with the project related to bushfire risk
- Chapter 8 – Assessment of cumulative impacts: outlines the potential cumulative impacts on bushfire risk with respect to other known developments within the vicinity of the project
- Chapter 9 – Mitigation measures: outlines the proposed mitigation measures for the project
- Chapter 10 – Conclusion: provides a conclusion on the potential bushfire risk to and from the project
- Chapter 11 – References: identifies the reports and documents used to generate this report.

1.6 Key project terms

1.6.1 Project footprint

The project footprint is the area that has been assumed for the purpose of the EIS to be directly affected by the construction and operation of the project (refer to Figure 1-1).

It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.

This would generally be the area of direct bushfire risks to and from the project and has been adopted as the bushfire study area, however, some risks to the project such as bushfire ignition sources may occur beyond the project footprint.

1.6.2 Bushfire survey areas

Bushfire survey areas are locations within the project footprint that may experience elevated exposure to bushfire risk during construction or operation, such as areas located in Bush Fire Prone Land (BFPL). They comprise structures or locations where project related personnel may work, sleep, or assemble and includes both permanent and temporary facilities. These include substations, construction compounds and worker accommodation facilities. Bushfire survey areas were subject to site specific assessments. Their locations are provided in Table 1-2 and shown in Figure 1-2.

Table 1-2 Bushfire survey areas

Bushfire survey area	Location
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	Intersection of Ashfords Road and Boiling Down Road, Gregadoo 2650
Snowy Mountains Highway compound (C02)	Killarney Road, off Adelong Road, Gilmore 2720
Snubba Road compound (C03)	Snubba Road, Gilmore 2720
Maragle 500 kV substation compound (C05)	Elliott Way, near intersection of East Bago Powerline Road, Nurenmerenmong 2649
Gugaa 500 kV substation and Gregadoo Road compound (C06)	1070 Livingston Gully Road, Gregadoo 2650
Honeysuckle Road compound (C07)	Honeysuckle Road, Adjungbilly 2722
Red Hill Road compound (C08)	Red Hill Road, Adjungbilly 2722
Adjungbilly Road compound (C09)	1581 Adjungbilly Road, Adjungbilly NSW 2727
Yass substation compound (C10)	Perry Street, Yass 2582
Woodhouselee Road compound (C11)	Lot 2 Woodhouselee Road, Woodhouselee 2580
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	Hanworth Road, Bannaby 2580
Memorial Avenue compound (C14)	14 Memorial Avenue, Batlow 2730
Bowmans Lane compound (C15)	Keenans Rd/Bowmans Lane, Batlow 2730
Snubba Road compound (C16)	Part Bago State Forest Batlow Road, Buddong 2720
Tumbarumba Accommodation Facility (AC1)	38 Alfred Street, Tumbarumba 2653

2 Project description summary

The project description in this chapter is based on a concept design and indicative construction methodology for the project. The design and construction methodology would continue to be refined and confirmed during detailed design and construction planning by the construction contractors. Further details on the project are provided in Chapters 3 and 4 of the EIS.

2.1 Summary of key components of the project

Key components of the project are summarised in Table 2-1.

Table 2-1 Summary of key components of the project

Component	Description
Transmission lines and supporting infrastructure	
Transmission lines and structures	The project includes the construction of new 500 kV transmission line sections between: ■ Wagga 330 kV substation and Gugaa 500 kV substation (approximately 11 km) ■ Gugaa 500 kV substation and Wondalga (approximately 65 km) ■ Wondalga and Maragle 500 kV substation (approximately 46 km) ■ Wondalga and Bannaby 500 kV substation (approximately 234 km). The transmission line section between the Wagga 330 kV substation and proposed Gugaa 500 kV substation would operate at 330 kV under HumeLink. The project also includes the rebuild of approximately 2 km of Line 51 as a new 330 kV transmission line between the Wagga 330 kV substation and around Ivydale Road, Gregadoo. This would be adjacent to the new transmission line between the existing Wagga 330 kV and proposed Gugaa 500 kV substations. The 500 kV transmission lines would be supported on a series of free-standing steel lattice structures that would range between around 50 m up to a maximum of 76 m in height and generally spaced between 300 to 600 m apart. The typical transmission line structure height would be around 60 m. Earth wire and communications cables would be co-located on the transmission line structures. The 330 kV structures for the rebuild of Line 51 would range between 24 m and 50 m in height and have a typical height of 40 m. Indicative configurations of transmission line structures that may be used as part of the project are shown in Figure 2-1. The type and arrangement of the structures would be refined during detailed design. The footings of each structure would require an area of up to 300 m^2 to 450 m^2, depending on ground conditions and the proposed structure type. Additional disturbance at each structure site may be required to facilitate structure assembly and stringing.
Transmission line easements	The easements for the 500 kV transmission lines are typically 70 m wide. However, a number of locations may require wider easements of up to 110 m wide at transposition locations[1] and up to 130 m wide where the new transmission line would parallel the relocated section of Line 51. The easement provides a right of access to construct, maintain and operate the transmission line and other operational assets. The easement also generally identifies the zone of initial vegetation clearance and ongoing vegetation management to enable provision of safe electrical clearances during the operation of the lines. Vegetation management beyond the easement may also occur where nearby trees have the potential to fall and breach safety clearances.
Telecommunications hut	Telecommunications huts, which contain optical repeaters, would be required to boost the signal in the optical fibre ground wire (OPGW). One telecommunications hut would be required for the project. The telecommunications hut would be located adjacent to existing transmission line structures. Cables would be installed between the transmission line structure and the local power supply. The telecommunications hut would be surrounded by a security fence. A new easement would be established for the telecommunications hut power connection. The project also involves a telecommunications connection of OPGW between two proposed transmission line structures and the future Rye Park Wind Farm substation (SSD-6693). This removes the need for an additional telecommunications hut in this area of the project.

[1] Transposition is the periodic swapping of positions of the conductors of a transmission line in order to improve transmission reliability.

Component	Description
Substation activities	
Construction of the proposed Gugaa 500 kV substation	A new 500/330 kV substation would be constructed at Gregadoo, about 11 km south-east of the Wagga 330 kV substation. The substation would include seven new 500/330 kV transformers and three 500 kV reactors. The proposed Gugaa 500 kV substation is expected to occupy an area of approximately 22 hectares.
Modification of the existing Bannaby 500 kV substation	The existing Bannaby 500 kV substation on Hanworth Road, Bannaby would be expanded to accommodate connections for new 500 kV transmission line circuits. The modification would include changes to the busbars, line bays, bench and associated earthworks, steelwork, drainage, external fence, internal/external substation roads, secondary containment dams, sediment containment dams, cabling, and secondary systems. All of the works would be restricted to the existing substation property.
Modification of the existing Wagga 330 kV substation	The existing Wagga 330 kV substation on Ashfords Road, Gregadoo would be reconfigured to accommodate new bays for two new 500 kV transmission line circuits within the existing substation property. This would include modifications to the busbars, line bays, existing line connections, bench and associated earthworks, relocation of existing high voltage equipment, drainage, external fence, internal substation roads, steelwork, cabling, and secondary systems.
Connection to the future Maragle 500 kV substation	The project would connect to the future Maragle 500 kV substation approved under the Snowy 2.0 Transmission Connection Project (SS1-9717). Construction of the Maragle substation is proposed to be undertaken between 2023 and 2026. Further detail on the Snowy 2.0 Transmission Connection project is available at the Department of Planning and Environment's Major Projects website: www.planningportal.nsw.gov.au/major-projects/project/10591.
Ancillary facilities	
Access tracks	Access to the transmission line structures and the substations would be required during construction and operation. Wherever possible, existing roads, tracks and other existing disturbed areas would be used to minimise vegetation clearing or disturbance. Upgrades to existing access tracks may be required. In areas where there are no existing roads or tracks, suitable access would be constructed. This may include waterway crossings.
Construction compounds	Construction compounds would be required during construction to support staging and equipment laydown, concrete batching, temporary storage of materials, plant and equipment and worker parking required to construct the various elements of the project. Fourteen potential construction compound locations have been identified. The proposed use of the construction compounds and their proposed boundaries/layout would be refined as the project design develops in consultation with relevant stakeholders and the construction contractors. Construction compound locations not assessed in this report would require a bushfire assessment report to be prepared for approval where located on bush fire prone lands.
Worker accommodation facility	Existing accommodation facilities within towns adjacent to the project would provide temporary accommodation for the majority of the construction workers. However, a potential shortage in accommodation has been identified close to the project footprint. A potential option to provide additional temporary worker accommodation during the construction period is the establishment of a temporary worker accommodation facility at the corner of Courabyra Road and Alfred Street, Tumbarumba to accommodate about 200 construction workers. This potential location is not covered by this bushfire assessment. The worker accommodation facility would consist of demountable cabins and would be connected to existing utilities. All required amenities for the accommodation facility would be provided including services and worker parking for light and heavy vehicles. However, the ultimate delivery of the project may include multiple temporary worker accommodation facilities in various forms, which would be outlined in the Worker Accommodation Strategy for the project. The strategy will be developed in consultation with councils, and other relevant stakeholders. Any new or changed worker accommodation facility would be subject to additional environmental assessment and bushfire assessment, as required.

Component	Description
Helipad/helicopter facilities	To facilitate construction of the project, helicopters may be used to deliver materials/equipment and transfer personnel to construction areas particularly within high alpine regions. To enable helicopters to operate safely and allow easy access to the site, a helicopter landing pad would be required. The helipad is expected to occupy an area of around 30 m by 30 m, and would be remediated after construction. These areas would typically be located on existing disturbed land not subject to inundation and a reasonable distance from waterways, sensitive receivers and drainage lines. Eight locations have been identified and assessed as potential helipad locations. The exact locations to be used would be confirmed during detailed design by the construction contractors. In addition to this, the existing facilities at the Wagga Wagga Airport and Tumut Airport may be used.
Utility connections, adjustments, and protection	The project would require utility connections, adjustments and protection. Such works include interfaces with other transmission lines and connections to existing services for temporary facilities. Potential impacts to existing services and utilities would be confirmed during detailed design and any proposed relocation and/or protection works would be determined in consultation with the relevant asset owners.

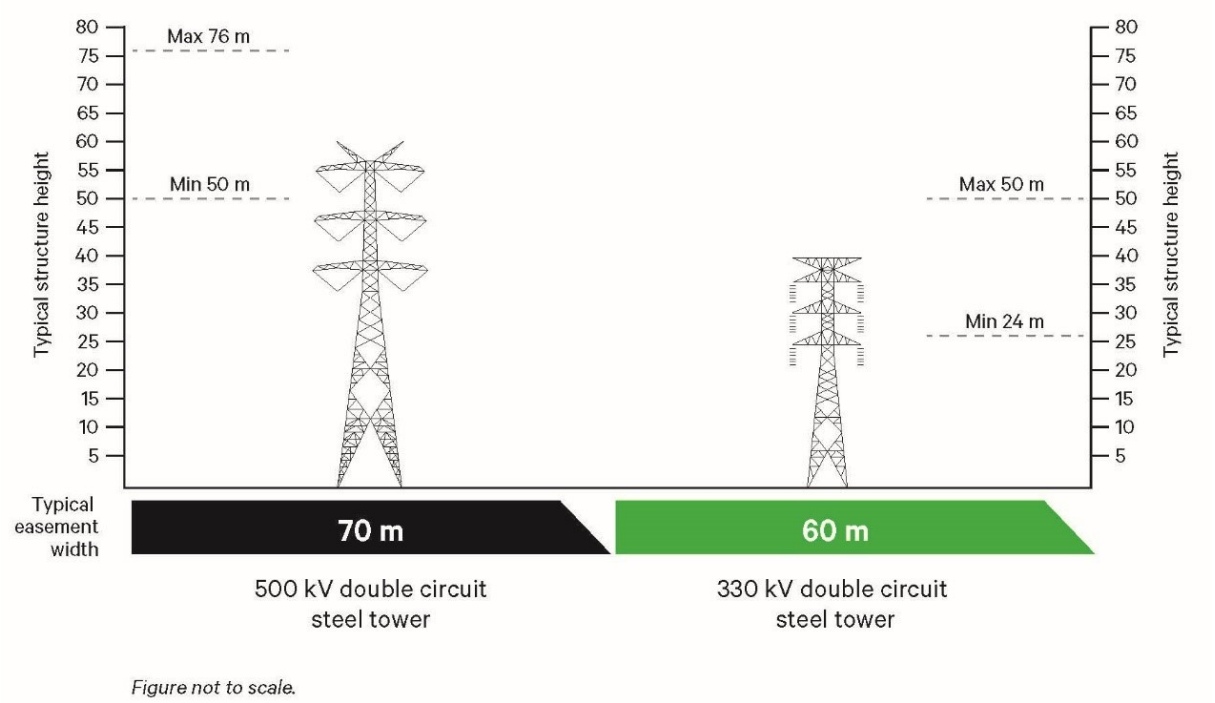


Figure 2-1 Indicative transmission line structures

2.2 Construction of the project

2.2.1 Construction activities

Key construction activities would generally include (but are not limited to):

- site establishment work, such as:
  - clearing of vegetation and topsoil
  - establishment of construction compounds and helipad/helicopter facilities
  - utility relocations and/or adjustments
  - construction of new access tracks and waterway crossings and/or upgrade of existing access tracks to transmission line structures
  - road improvement work
  - establishment of environmental management measures and security fencing
  - construction of temporary worker accommodation
- construction of the transmission lines, including:
  - earthworks and establishment of construction benches and brake and winch sites for each transmission line structure
  - construction of footings and foundation work for the new transmission line structures including boring and/or excavation, steel fabrication works and concrete pours
  - erection of the new transmission line structures
  - stringing of conductors, overhead earth wires and OPGW
  - installation of associated transmission line structure fittings inclusive of all earthing below ground level
- relocation of a section of Line 51, including:
  - demolition of the existing section of Line 51
  - erection of new transmission line structures for the rebuild of Line 51 in a new location
  - stringing of conductors, overhead earth wires and OPGW
  - installation of associated transmission line structure fittings inclusive of all earthing below ground level
- construction of the proposed Gugaa 500 kV substation, including:
  - bulk earthworks to form the substation bench, access roads, drainage and oil containment structures
  - installation of concrete foundations, bund walls, fire walls, noise walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment work and associated concrete pits, pipes and tanks including excavation
  - installation of new ancillary and equipment control buildings
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - erection of the substation site boundary security fencing, including site access gates
  - connection of the proposed transmission lines to the substation

- modification of the existing Wagga 330 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - demolition and removal of redundant electrical equipment, fencing and cabling
  - bulk earthworks to form the extended substation bench and modified drainage structures
  - installation of concrete foundations and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, and modified site stormwater drainage including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - testing and commissioning
  - connection of the proposed transmission lines to the substation
- modification of the existing Bannaby 500 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - bulk earthworks to form the extended substation bench, new access road, modified stormwater drainage, modified oil containment and modified sediment control structures
  - installation of concrete foundations, retaining walls, bund walls, fire walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment works and associated concrete pits, pipes and tanks including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - demolish redundant fencing including footings and kerbs
  - testing and commissioning
  - connection of the proposed transmission lines to the substation
- connection of the proposed transmission lines to the future Maragle 500 kV substation, including:
  - stringing conductors between transmission line structures and the future Maragle 500 kV substation gantry (including overhead earth wire (OHEW) and OPGW)
  - installing droppers from the future substation gantry to the switchgear
- construction of the telecommunications hut, including:
  - bulk earthworks to form the pad for the hut
  - excavation and preparation for concrete foundations
  - installation of reinforced concrete and piled foundations
  - excavation and installation of electrical equipment conduits, trenches and general site drainage work

- installation of the building, site wiring and electrical equipment
- installation of security fencing and site access gates

- installation of buried cabling from the 500 kV transmission line structures to Rye Park Wind Farm substation
- testing and commissioning of new electrical infrastructure
- demobilisation and rehabilitation of areas disturbed by construction activities.

A number of activities are expected to commence in accordance with the project conditions of approval before the key construction activities outlined above. These activities are considered pre-construction minor work and would comprise low impact activities that would begin after planning approval but prior to approval of the Construction Environmental Management Plan.

2.2.2 Construction program

Construction of the project is targeted to commence in 2024, and is estimated to take about 2.5 years to complete. The project is expected to be fully operational by the end of 2026 (refer to Figure 2-2).

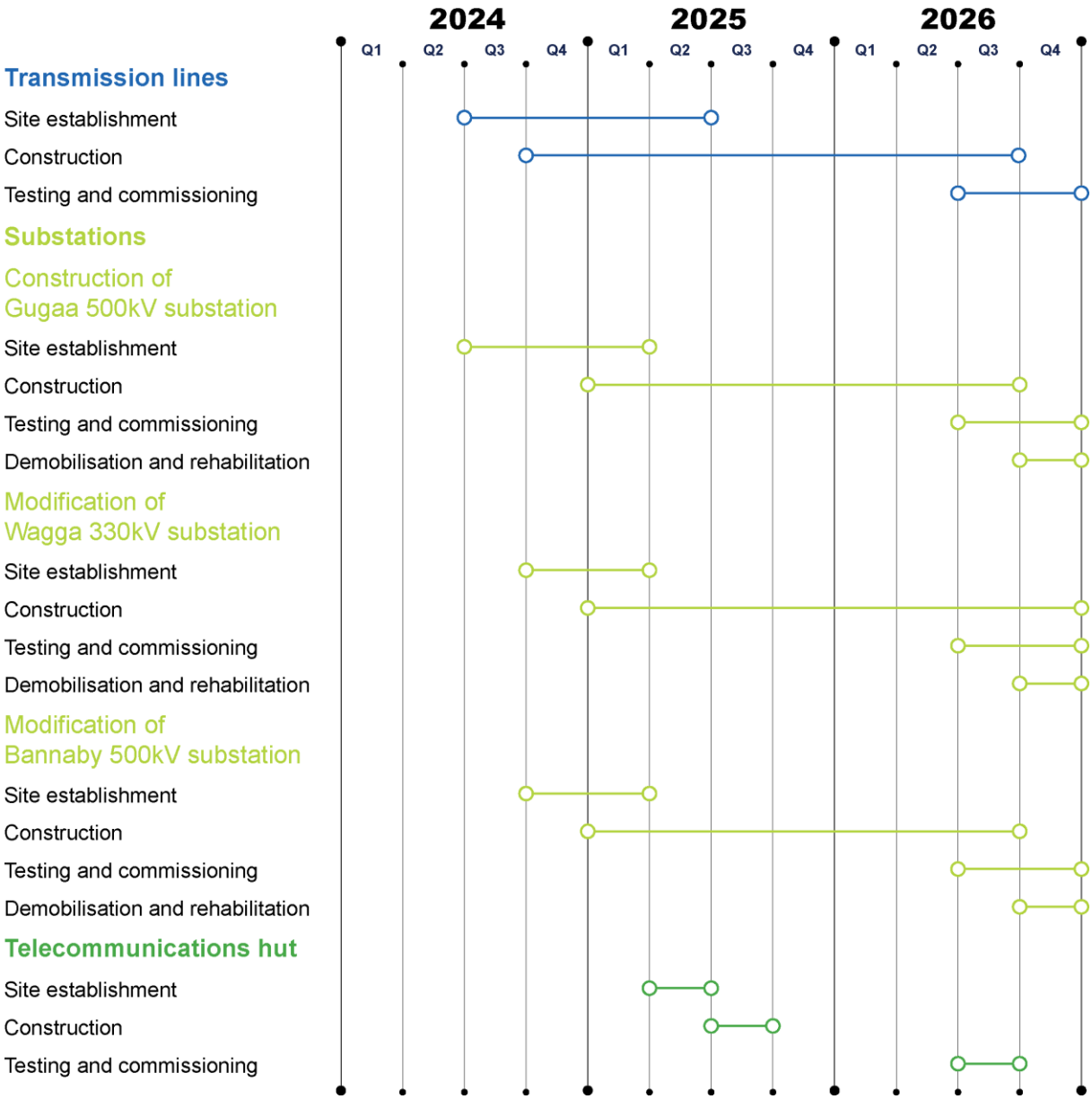


Figure 2-2 HumeLink indicative construction program

Indicative duration of construction activities

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Durations of any particular construction activity, and inactive/respite periods, may vary for a number of reasons including (but not limited to):

- multiple work fronts
- resource and engineering constraints
- work sequencing and location.

Figure 2-3 presents an indicative duration of construction activities associated with an individual transmission line structure.

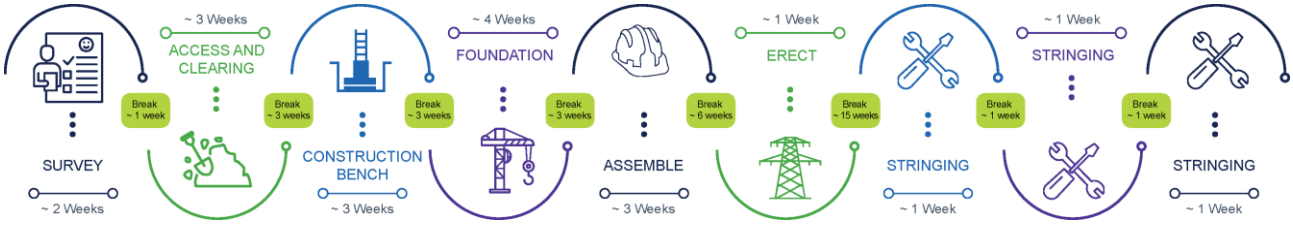


Figure 2-3 Indicative duration and sequence of construction activities for transmission line structures

Construction of the proposed Gugaa 500 kV substation could take up to 2.5 years.

2.2.3 Construction hours

It is expected that construction activities would largely be undertaken during standard construction hours. However, there would be times when working outside of standard construction hours would be required (as defined by the *Interim Construction Noise Guideline* (DECC, 2009)), subject to approval. As the details of construction methodology and project needs are developed, these hours will be refined for certain activities.

Where extended hours are proposed for activities in proximity to sensitive receivers, additional measures would be implemented and the work would be managed through an out-of-hours work protocol.

A series of work outside the standard construction hours is anticipated to include (but is not limited to) the following:

- transmission line construction at crossings of a main road or railway as these locations are expected to have restricted construction hours requiring some night work for activities such as conductor stringing over the crossing(s)
- work where a road occupancy licence (or similar) is required, depending on licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- limited substation assembly work (eg oil filling of the transformers)
- connection of the new assets to existing assets under outage conditions (eg modification and/or connection work at Bannaby 500 kV substation, Wagga 330 kV substation and Maragle 500 kV substation), which is likely to require longer working hours
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected sensitive receivers
- activities that do not generate noise in excess of the applicable noise management level at any sensitive receiver.

2.2.4 Construction plant and equipment

An indicative list of construction plant and equipment likely to be required during construction is provided below:

- air compressor
- backhoe
- bobcat
- bulldozers
- concrete agitator
- concrete pump
- cranes (various sizes up to 400 tonnes)
- crawler crane with grab attachments
- drill and blast units and associated support plant/equipment
- drones
- dumper trucks
- elevated working platforms
- excavators (various sizes)
- flatbed hiab trucks
- fuel trucks
- generators
- graders
- helicopters and associated support plant/equipment
- mulchers
- piling rig
- pneumatic jackhammers
- rigid tippers
- rollers (10 to 15 and 12 to 15 tonnes)
- semi-trailers
- tilt tray trucks
- trenchers
- transport trucks
- watercarts
- winches.

2.2.5 Construction traffic

Construction vehicle movements would comprise vehicles transporting equipment, waste, materials and spoil, as well as workers' vehicles. A larger number of heavy vehicles would be required during the main civil construction work associated with the substations. Non-standard or oversized loads would also be required for the substation work (eg for transformer transport) and transportation of transmission line structure materials and conductors.

Hume Highway, Sturt Highway, Snowy Mountains Highway, Batlow Road and Gocup Road are the main national and state roads proposed to provide access to the project footprint. These roads would be supported by regional and local roads throughout the LGAs of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional and Upper Lachlan Shire that connect to the project footprint.

2.2.6 Construction workforce

The construction worker numbers would vary depending on the stage of construction and associated activities. During peak construction activities, the project could employ up to 1,200 full-time equivalent construction workers across multiple work fronts. It is expected that the maximum number of construction workers at any one location would not exceed 200.

2.2.7 Testing and commissioning

Prior to energisation of the infrastructure, a series of pre-commissioning activities would be conducted. This would include testing the new transmission lines and substation earthing, primary and secondary equipment.

2.2.8 Demobilisation and rehabilitation

Demobilisation and site rehabilitation would be undertaken progressively throughout the project footprint and would include the following typical activities:

- demobilisation of construction compounds and worker accommodation facility
- removal of materials, waste and redundant structures not required during operation of the project
- removal of temporary fencing and environmental controls.

2.3 Operation and maintenance of the project

The design life of the project is 50 years, which can be extended to more than 70 years for some assets. The substations and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). The project would require about five workers (in addition to Transgrid's existing workers) during operation for ongoing maintenance activities. Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, asset protection zone and access road/track
- vegetation clearing/trimming within the easement
- fire detection system inspection and maintenance
- stormwater drainage systems maintenance.

It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

3 Legislative and policy context

3.1 Rural Fires Act 1997

The *Rural Fires Act 1997* (Rural Fires Act) regulates the suppression and management of bushfires. The objectives of the Act are to provide for the:

- prevention, mitigation, and suppression of bush and other fires in LGAs (or parts of areas) and other parts of the State constituted as rural fire districts
- co-ordination of bush firefighting and bushfire prevention throughout the State
- protection of persons from injury or death arising from fires, and the protection of property from damage arising from fires, including protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires
- protection of the environment by requiring certain activities referred to in paragraphs (a)-(c1) to be carried out having regard to the principles of ecologically sustainable development described in Section 6 (2) of the *Protection of the Environment Administration Act 1991.*

The Rural Fires Act details duties and requirements regarding the NSW Rural Fire Service (NSW RFS), Neighbourhood Safer Places, Fire Trails, and Bush Fire Prevention.

Section 63 of the Rural Fires Act details duties of public authorities and owners and occupiers of land to prevent bushfires. Under Section 63, it is the duty of a public authority to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bushfires on, and to reduce the danger of the spread of a bushfire on or from any land vested in or under its control or management, or any highway, road, street, land or thoroughfare, the maintenance of which is charged on the authority.

3.2 Bush Fire Risk Management Plans

Bush Fire Risk Management Plans (BRMP) are developed by local Bush Fire Management Committees (BFMCs) to outline mitigation measures applied to bushfire risks within a BFMC area. BRMPs provide information regarding regional fire weather and climate risks, and historic fire occurrence. The bushfire survey areas (refer to Section 1.6.2) are encompassed in the following BRMPs:

- The Riverina BRMP (Riverina BFMC, 2018) was prepared for the Coolamon, Junee, Lockhart and Wagga Wagga City LGAs.
- The Southern Tablelands BRMP (Southern Tablelands BFMC, 2019) was prepared for the Yass Valley, Upper Lachlan Shire and Goulburn-Mulwaree LGAs.
- The South West Slopes BRMP (South West Slopes BFMC, 2020) was prepared for the Cootamundra-Gundagai Regional and Hilltops LGAs (encompassing the former council areas of Harden, Young and Boorowa).
- The Snowy Valleys BRMP (Snowy Valleys BFMC, 2018) was prepared for the Snowy Valleys LGA.

Refer to Chapter 5 for regional fire weather and climate risks, and historic fire occurrence associated with each BRMP area.

3.3 Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers (NSW RFS, 2019)

Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers (PBP) (NSW RFS, 2019) provides the basis for development on BFPL in NSW (BFPL are areas able to support a bushfire or be subject to a bushfire attack).

The PBP (NSW RFS, 2019) aims to:

- afford buildings and their occupants' protection from exposure to a bushfire
- provide for a defendable space to be located around buildings
- provide appropriate separation between a hazard and buildings through an APZ which, in combination with other measures, prevents the likely fire spread to buildings
- provision of appropriate operational access and egress for emergency service personnel and occupants is available
- provide for ongoing management and maintenance of bushfire protection measures
- provisions of utility services are adequate to meet the needs of firefighters.

Bushfire protection strategies are based on the following principles:

- control the types of development permissible in bushfire prone areas
- reduce the impact of radiant heat and direct flame contact by separating development from bushfire hazards
- reduce the vulnerability of buildings to ignition and fire spread from flames, radiation, and embers
- enable appropriate access and egress for the public and firefighters
- provide adequate water supplies for bushfire suppression operations
- focus on property preparedness, including emergency planning and property maintenance requirements
- facilitate the maintenance of APZs, fire trails, access for firefighting, and on-site equipment for fire suppression.

3.4 Electricity Supply Act 1995 and Electricity Supply (Safety and Network Management) Regulation 2014

The *Electricity Supply Act 1995* and the Electricity Supply (Safety and Network Management) Regulation 2014 regulate the production and use of electricity. The objectives of the Act and Regulation are to:

- promote the efficient and environmentally responsible production and use of electricity and to deliver a safe and reliable supply of electricity
- confer on network operators the powers that are necessary to enable them to construct, operate, repair, and maintain their electricity works
- promote and encourage the safety of persons and property in relation to the generation, transmission, distribution and use of electricity
- to enable any major disruption to the supply of electricity in an emergency to be managed effectively.

Transgrid, like other transmission network operator, is required to manage bushfire risk relating to electricity lines under the Act and Regulation.

3.5 National Electricity Network Safety Code

The National Electricity Network Safety Code (Energy Networks Australia, 2019) provides an overview of the safety principles applying to design, construction, operation, maintenance, commissioning and decommissioning of Electricity Networks. The Code operates in conjunction with several regulations and Australian Standards, providing additional information to guide the development of appropriate, fit for purpose and consistent solutions for Electricity Networks. The objectives of this Code are:

- promotion of safety as a priority for customers, the public and industry workers
- alignment with the relevant Australian Standards

- nationally consistent practices to improve safety
- economic efficiency through standardisation.

3.6 National Construction Code

The *National Construction Code* (NCC) (Australian Building Codes Board (ABCB), 2022) contains all the Performance Requirements for the construction of new buildings and new building work, comprising the Building Code of Australia (BCA) as Volumes 1 and 2, and the Plumbing Code of Australia as Volume 3. The BCA is applied through the *Environmental Planning and Assessment Act 1979* (EP&A Act) in NSW. The NCC covers performance requirements and provisions for the construction of buildings in bushfire prone areas. Provisions apply to buildings of Class 1, Class 2, Class 3, Class 4, Class 10, and buildings considered Special Fire Protection Purpose (SFPP). For buildings in designated BFPL areas, the NCC references the *Australian Standard 3959:2018 Construction of Buildings in Bush Fire Prone Areas* and the *National Association of Steel-framed Housing (NASH) Standard: Steel Framed Construction in Bushfire Areas 2014*.

There are no specific bushfire protection requirements for NCC Class 5-8 buildings under the BCA, however structures located on BFPL must satisfy the aims and objectives outlined in PBP (NSW RFS, 2019). To meet these objectives construction requirements would apply to all buildings, including those at substations. Refer to Section 9.7 for NCC bushfire protection requirements as they apply to the structures proposed for the project.

3.7 Australian Standard AS3959

The *Australian Standard 3959:2018* (AS3959:2018) *Construction of Buildings in Bushfire-Prone Areas* (Standards Australia, 2018) is applicable to construction activities on BFPL throughout Australia. Its requirements aim to improve the resistance of structures from ember attack, radiant heat loads and direct flame contact.

The project includes construction within BFPL and may be subject to requirements under AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas*. Refer to Section 5.3 for information regarding bushfire prone areas in relation to the bushfire survey areas.

3.8 Australian Standard AS5577

The *Australian Standard 5577:2013* (AS5577:2013) *Electricity Network Safety Management Systems* (ENSMS) (Standards Australia, 2013) identifies national standards for an ENSMS for an Electricity Network Operator to provide for the safe design, construction, commissioning, operation, maintenance and decommissioning of its electricity network. The ENSMS specifically requires Transgrid to address the safety aspects from the protection of the environment, including ignition risk from network assets.

3.9 Australian/New Zealand Standard AS/NZS7000

The *Australian/New Zealand Standard* (AS/NZS7000:2016) *Overhead Line Design* (Standards Australia, 2016) specifies general requirements for new overhead powerlines, so that they are suitable for their intended purpose, including construction, maintenance, and operational safety requirements, and environmental considerations, including bushfires. The standard includes guidance on clearance and easement widths. Vegetation within transmission line corridors would be actively managed to reduce the potential for ignitions in the easement in accordance with Transgrid's existing vegetation management standards, and the clearance widths identified in AS/NZS7000:2016 *Overhead Line Design*.

3.10 Forestry Act 2012

The *Forestry Act 2012* regulates the Forestry Corporation of NSW (FCNSW). The object of the Act is the maintenance of a long-term sustainable timber supply for NSW. The Act integrates the regulatory regimes for environmental planning and assessment, for the protection of the environment and for threatened species conservation. There are large areas of non-native vegetation across the project footprint, including softwood radiata pine plantations established on the southern slopes (FCNSW, 2021b) (refer to Section 5.6).

The following impacts on forestry and timber are addressed in this BRAR:

- assessment and recommendations to mitigate the impact of fire in the landscape, particular from ignitions from transmission lines within native forests and plantations (refer to Chapter 5)
- assessment and recommendations to mitigate the impact of firefighting adjacent to transmission lines within native forests and plantations through Transgrid's existing vegetation management requirements (refer to Section 9.4).

3.11 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* regulates conservation and land management. The objectives of the Act are:

- the conservation of nature, including but not limited to, habitats, ecosystems, species, biological diversity, and landscapes
- the conservation of objects, places, or features of cultural, historic, architectural, or scientific value within the landscape, including those of significance or value to Aboriginal people, and the people of NSW
- fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation
- providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.

The objectives of the Act are to be achieved by applying the principles of ecologically sustainable development.

Consideration would be given to the aims of this Act through the mitigation measures outlined in Chapter 9, which are to be carried out in accordance with existing access and operational protocols established between Transgrid and the National Parks and Wildlife Service. Areas of the project footprint categorised as BFPL (refer to Section 5.3) are associated with forests, woodlands, and timber plantations of State forests and Crown lands. These vegetation types have historically supported large and intense bushfires.

3.12 Environmental Planning and Assessment Act 1979

The NSW EP&A Act and the Environmental Planning and Assessment Regulation 2021 regulate the planning approval and environmental assessment process in NSW. The objectives of the Act and Regulation are to:

- promote the social and economic welfare of the community and a better environment by the proper management, development, and conservation of the State's natural and other resources
- facilitate ecologically sustainable development by integrating relevant economic, environmental, and social considerations in decision-making about environmental planning and assessment
- promote the orderly and economic use and development of land
- promote the delivery and maintenance of affordable housing
- protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities, and their habitats
- promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)

- promote good design and amenity of the built environment
- promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants
- promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State
- provide increased opportunity for community participation in environmental planning and assessment.

Consideration would be given to the aims of this Act through meeting bushfire protection requirements.

3.13 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) serves as the Commonwealth's main tool for environmental conservation and protection. As a Commonwealth instrument, the EPBC Act focuses on actions located on or impacting upon Commonwealth land, actions carried out by a Commonwealth agency, and actions involving Matters of National Environmental Significance (MNES) for which the Commonwealth government views as its responsibility regarding environmental protection. The currently listed MNES are:

- world heritage
- national heritage
- wetlands of international importance (often referred to as Ramsar wetlands)
- nationally threatened species and communities
- listed migratory species
- protection from nuclear actions
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- water resources impacted by coal seam gas or other large coal mining development.

The Act also protects the environment when actions are taken on Commonwealth land or impact upon Commonwealth land. Actions which have the potential to impact upon any of the above must be assessed to determine the significance of the impact. If the impact is found to be significant then the action must be referred to the Minister for the Environment for approval. Significance of impact is determined via the following guidelines:

- Significant impact guidelines 1.1: Matters of National Environmental Significance (DoE, 2013a)
- Significant impact guidelines 1.2: Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies (DoE, 2013b).

In the context of this assessment, consideration would be given to the aims of this Act including through the mitigation measures to manage bushfire risk which require vegetation clearance, including APZs (refer to Chapter 9).

3.14 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* serves as a key NSW legislative tool to protect threatened species, ecological communities, protected plants, and animals, and identify associated key threatening processes. The purpose of this Act is to maintain a healthy, productive, and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. In this context of this assessment, consideration would be given to the aims of this Act including through the mitigation measures to manage bushfire risk which require vegetation clearance, including APZs (refer to Chapter 9).

4 Methodology

4.1 Overview of approach

Key steps taken in preparation of this report, based on the requirements of the PBP (NSW RFS 2018), include:

- identification of specific bushfire survey areas, which include the areas within the project footprint that may experience exposure to bushfire risk during construction and operation
- desktop assessment of risks to project footprint through general vegetation assessment and climate data
- desktop assessment of risks to bushfire survey areas, including vegetation mapping, satellite imagery and contour data
- field investigations assessing existing vegetation, slope and access to bushfire survey areas (while site visits were not considered to be required for the entirety of the transmission line route, the potential risks and impacts are discussed in Chapters 6 and 7)
- desktop mapping of bushfire survey areas, including spatial analysis and modelling of bushfire values including Bushfire Attack Level (BAL) and APZs
- identification of mitigation measures for bushfire risks for the project.

4.2 Criteria adopted

This report is consistent with the legislation and guidelines outlined in Section 2.2.5, including AS3959:2018 *Construction of buildings in bushfire-prone areas* and PBP (NSW RFS, 2019) and construction requirements specified in the NCC. The key input criteria identified in these documents to assess bushfire risk for bushfire survey areas are the regional Forest Fire Danger Index (FFDI), vegetation class, proximity to vegetation, and slope. PBP (NSW RFS, 2019) provides the basis for development on BFPL in NSW and contains performance criteria relating to aspects of bushfire protection including APZs, vegetation management, access requirements, and water supply and services. The PBP performance criteria need to be met with acceptable solutions, as outlined in PBP. Compliance with the PBP performance criteria is only assessed for each bushfire survey area, and not the entire transmission line route or easement (refer to Section 4.3.1).

The transmission line has been conservatively classified as having the highest bushfire risk due to the extensive, dynamic and varying landscape encompassed within the transmission line corridor. Site specific assessments are not required for the transmission line under the PBP performance criteria and therefore were not undertaken.

4.3 Limitations and uncertainty

4.3.1 Bushfire survey areas

The bushfire survey areas are those areas identified in Table 1-2. Specific site assessments were not undertaken for the transmission line, as the transmission line has been conservatively classified as having the highest bushfire risk (of all the temporary or permanent components of the project) due to the extensive, dynamic and varying landscape encompassed within the transmission line corridor. The residual bushfire risk along the transmission line route would be managed through Transgrid's well-established standard mitigation measures for vegetation management within the transmission line easements. Vegetation management within the transmission line easement is applied uniformly across the entire transmission line and is managed in accordance with Transgrid's existing vegetation management standards (as per Transgrid 2020a, 2020b, and 2021) and are consistent with the easement widths identified in national standards AS/NZS7000:2016 *Overhead Line Design*.

These management measures assume the highest potential risk across the entire transmission line route. Refer to Section 9.4 for transmission line management, including impacts on aerial and ground firefighting.

The proposed telecommunications hut has not been surveyed or assessed in this report, as there was no consent to enter the property, and the final location of the telecommunications hut would require assessment prior to the commencement of construction.

4.3.2 Vegetation clearance requirements

The vegetation clearances identified in this report, including for APZs are subject to a biodiversity assessment. Refer to *Technical Report 1 – Biodiversity Development Assessment Report* for more detail on the vegetation clearing proposed to be undertaken during construction and operation.

4.3.3 Limitations of the BRAR

This report is not a BFEMEP. Development of a BFEMEP would be addressed separately and should be consistent with *Development Planning: A guide to developing a bush fire emergency management and evacuation plan* (NSW RFS, 2014).

4.3.4 Survivability of structures

The measures identified in this assessment cannot guarantee that a building or structure would survive a bushfire event on every occasion. This is largely due to the degree of vegetation management within a site and adjoining lands, the unpredictable nature and behaviour of fire, and extreme weather conditions. The survivability of a building or structure is also dependent on a combination of measures such as landscaping, water supplies, access, building design and condition, and ongoing building maintenance.

5 Existing environment

This chapter identifies existing bushfire risks for the project footprint, specifically:

- regional fire weather and climate risk
- Bush Fire Prone Lands
- historic fire occurrence
- climate change
- bushfire ignition sources
- vegetation risk
- slope
- access.

5.1 Regional fire weather and climate risk

There are several general climatic conditions that can increase the risk and spread of bushfires, including:

- wet spring and summer in the preceding year, increasing grass fuels
- dry winter and spring in the current year, reducing moisture
- blocking summer high pressure system, resulting in strong north-westerly winds.

Five Bureau of Meteorology (BoM) weather stations were selected to give an overview of the regional weather (refer to Figure 5-1):

- Wagga Wagga AMO (212 metres above sea level (asl); BoM station number (no.) 072150) is located approximately 10 kilometres from the project footprint near **Wagga Wagga**. This BoM station records a mean annual rainfall 571.4 millimetres, average highest temperature in January 31.9°C, and average lowest temperature in July 2.8°C.
- Taralga Post Office (845 metres asl; BoM station no. 070080) is located approximately nine kilometres from the project footprint and 22 kilometres near **Bannaby**. This BoM station records a mean annual rainfall 804.0 millimetres, average highest temperature in January 26.3°C, and average lowest temperature July 0.6°C.
- Nangus Road, Gundagai (225 metres asl; BoM station no. 073141) is located approximately 20 kilometres from the project footprint near **Tumut**. This BoM station records a mean annual rainfall 600.4 millimetres, average highest temperature in January 32.8°C, and average lowest temperature in July 2.6°C.
- Tumbarumba Post Office (645 metres asl; BoM station no. 072043) is located approximately 25 kilometres from the project footprint near **Maragle**. This BoM station records a mean annual rainfall 974.2 millimetres, average highest temperature in January 29.0°C, and average lowest temperature in July -0.1°C.
- Cabramurra SMHEA automatic weather station (1,482 metres asl; BoM station no. 072161) is located approximately 16 kilometres from the transmission line near **Maragle**. This BoM station records a mean annual rainfall 1,190.3 millimetres, average highest temperature in January 21.6°C, and average lowest temperature July -0.8°C.

The general climate across the project footprint is variable, with cooler weather generally experienced with higher elevation. Average annual rainfall conditions vary across the project footprint, between approximately 600 and 1,500 millimetres. Southern areas near Maragle experience a maximum rainfall between winter and spring, and minimum rainfall between summer and autumn, while the rest of the project footprint experiences a consistent annual rainfall pattern (BoM, 2021).

Prevailing wind conditions vary across the project footprint and the time of day. Areas near Wagga Wagga and Tumut generally experience morning easterly winds, and westerly and south-westerly afternoon winds up to 30 kilometres per hour, with higher wind gust speed in spring-summer. Areas near Bannaby generally experience westerly and north-westerly winds up to 20 kilometres per hour, with higher wind gust speed between spring and summer.

Between spring and summer, the southern areas near Maragle generally experience northerly and north-westerly winds between 0 to 10 kilometres per hour, with higher winds experienced in elevated areas, and some areas experiencing slightly higher wind gust speed late winter-spring.

The areas near **Wagga Wagga** are encompassed within Riverina BFMC BRMP area (Riverina BFMC, 2018), extending from Wagga Wagga to Oberne Creek. The BRMP identifies the region as having:

- a temperate climate, with warm to hot and dry summers, and cool winters
- predominantly winter and autumn rainfall
- bushfire danger period between October and March
- prevailing bushfire weather conditions which include north-westerly winds, high daytime temperatures, low humidity, and dry lightning storms.

The areas near **Bannaby** are within the Southern Tablelands BFMC BRMP area (Southern Tablelands BFMC, 2019), extending from approximately Berrima to Burrinjuck Nature Reserve and Burrinjuck Dam. The BRMP identifies the region as having:

- a temperate to cool climate, with warm to hot summers, and cool winters
- predominantly winter and spring rainfall
- bushfire danger period October and March/April
- prevailing bushfire weather conditions which include north/north-westerly winds, with late afternoon southerly and easterly winds, and frequent lightning strikes during storms.

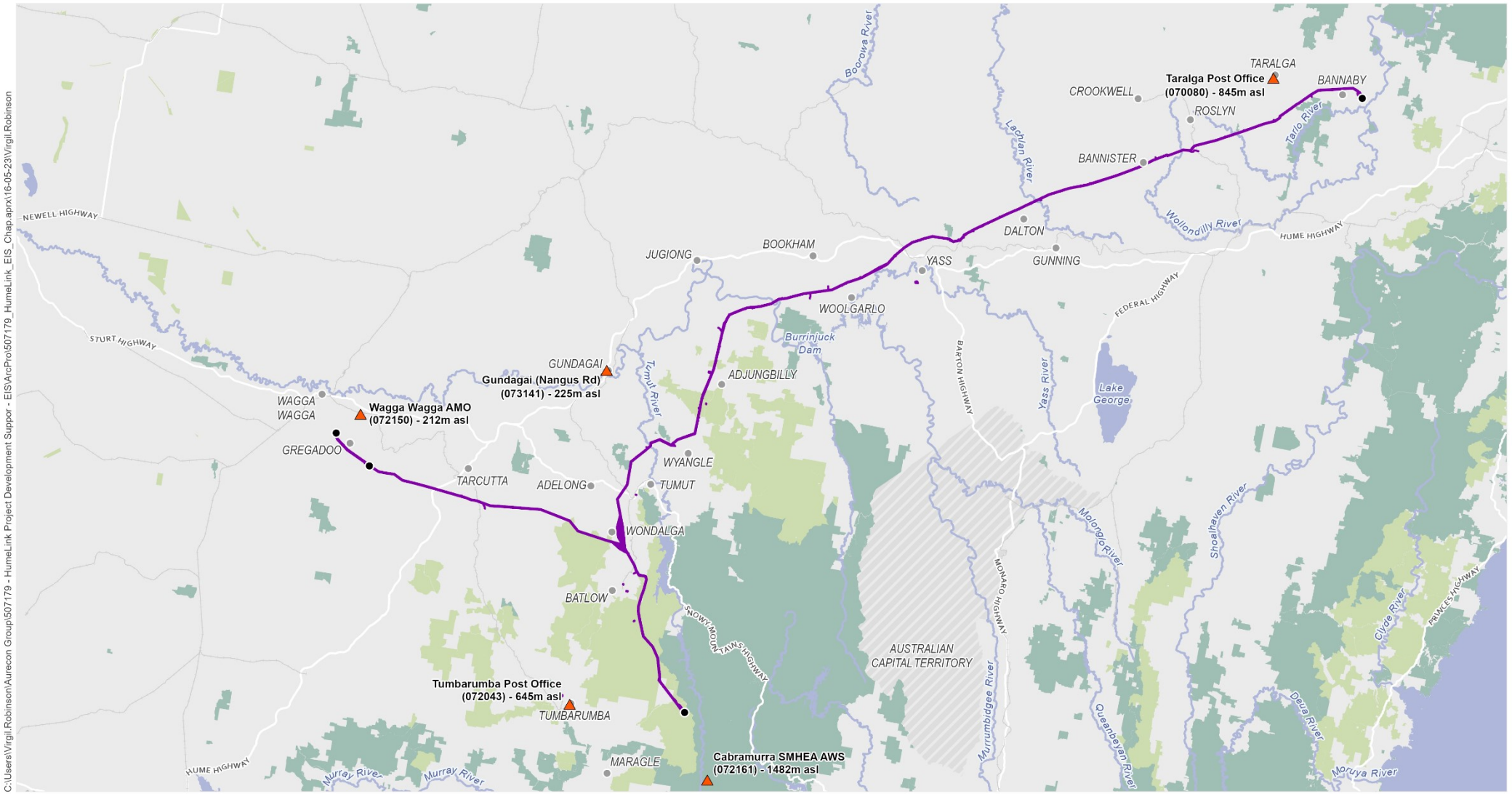
The areas near **Tumut and Maragle** are encompassed within the Snowy Valleys BFMC BRMP area (Snowy Valleys BFMC, 2018), extending from south of Cabramurra to Brungle to the south and north, Oberne Creek to the west, and Brindabella to the east. The BRMP identifies the region as having:

- a cool temperate climate
- predominantly winter rainfall
- bushfire danger period between November and March
- prevailing bushfire weather conditions which include north-westerly winds, high daytime temperatures, low humidity, and frequent dry lightning storms.

The areas near **Adjungbilly** and the northern areas of **Red Hill State Forest** are encompassed within the South West Slopes BFMC BRMP area (South West Slopes BFMC, 2020). The BRMP identifies the region as having:

- a temperate climate
- winter and spring rainfall
- bushfire danger period between October and March
- prevailing bushfire weather conditions which include north-westerly to south-westerly winds, high daytime temperatures, low humidity, and frequent dry lightning storms.

The higher summer temperatures, and higher westerly wind gust speeds between spring and summer dry out and cure vegetation during summer months and increase the potential for fires to start and spread. The hot dry westerly and north-westerly winds experienced across the project footprint increase susceptibility to bushfires spreading from the west, south-west, and north-west.



Source: *Aurecon, Transgrid, BoM, Spatial Services (DCS), ESRI Basemap*

1:925,000

0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Bushfire Assessment**

FIGURE 5-1: BoM weather stations

5.2 Climate change

Climate change may alter the duration of some bushfire seasons, which may be extended by starting earlier and/or finishing later. The frequency of elevated fire danger days that may support high intensity fire events is predicted to increase (Abram et al 2021, Dowdy 2020, Lucas et al 2007). This may subsequently increase bushfire events which have the potential to negatively impact Transgrid infrastructure (as has occurred historically, most recently during the Dunns Road Fire in the 2019/2020 bushfire season) and the community.

The environmental conditions used to complete the analysis for this report (such as vegetation risk) are based on worst case conditions, using the maximum FFDI and fuel loads specified for the region as per PBP (NSW RFS, 2019) and AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas*.

5.3 Bush Fire Prone Lands

BFPL are areas that have been identified by Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Yass Valley, and Upper Lachlan Shire councils as able to support a bushfire or be subject to a bushfire attack. BFPL maps are certified by the Commissioner of the NSW RFS. BFPL are categorised as follows:

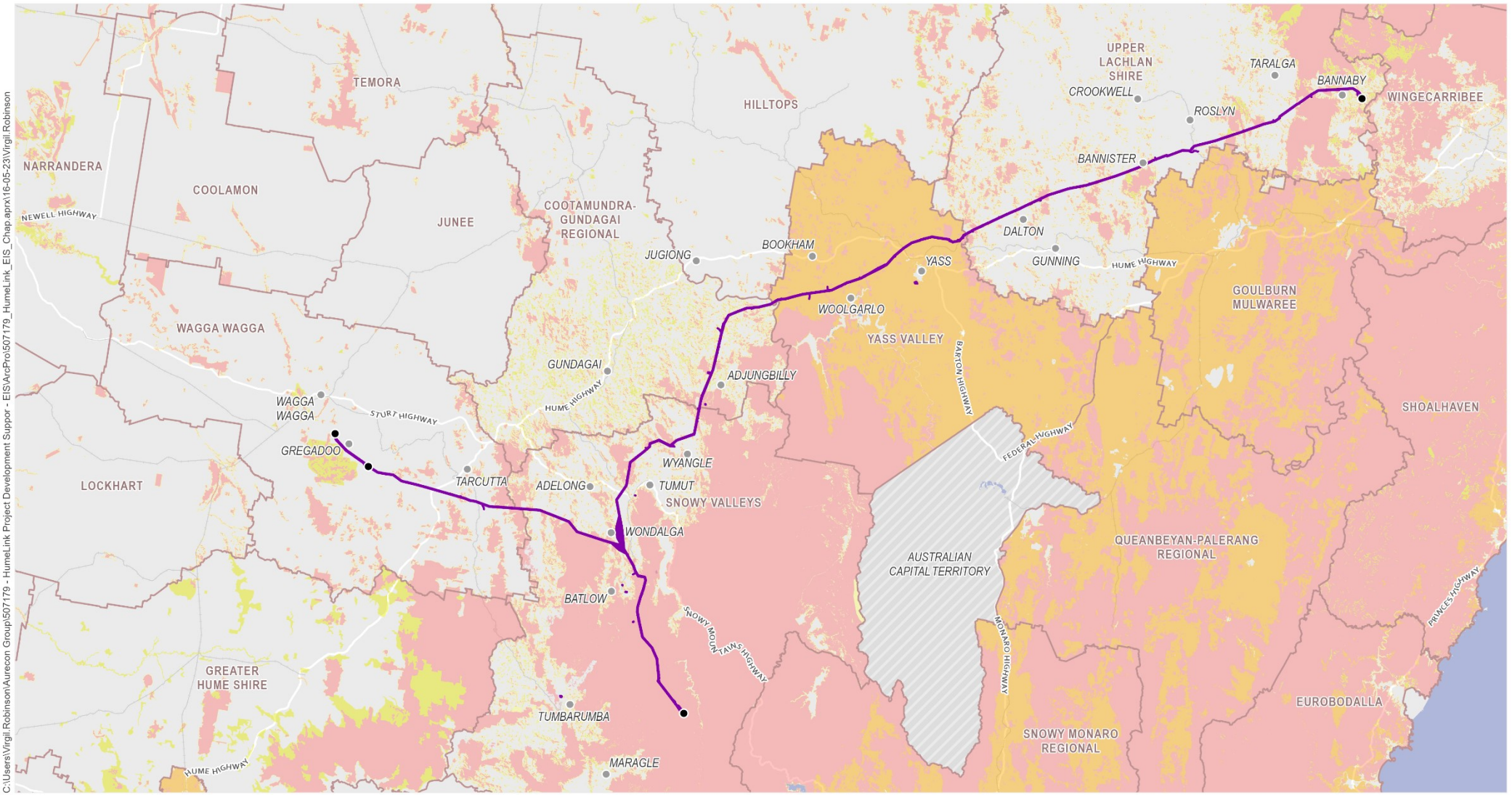
- Vegetation Category 1 are areas of forests, woodlands, heaths (tall and short), forested wetlands, and timber plantations. These areas generally support the highest intensity bushfires and are considered the highest risk vegetation.
- Vegetation Category 2 comprises lower risk vegetation including rainforest, remnant vegetation, and vegetation separated from other larger tracts of vegetation.
- Vegetation Category 3 comprises grasslands, freshwater wetlands, semi-arid woodlands, alpine complex, and arid shrublands. This category includes grazed grasslands and woodlands. These areas can support faster moving bushfires than other categories in high winds.
- Buffer areas are either 30 metres from Vegetation Category 2 and 3 or 100 metres from Vegetation Category 1.

Large areas of the project footprint are categorised as Category 1 BFPL (refer to Figure 5-2), which is associated with forests, woodlands, and timber plantations of State forests, Crown lands, and adjoining national parks. This category has historically supported large and intense bushfires. A large southern area of the project footprint consisting of predominantly Category 1 BFPL was affected by the 2019/2020 bushfire season, burning at high intensity across many areas. The remaining parts of the project footprint consist of Category 2 and 3 BFPL which has historically supported fast moving grassfires, resulting in loss of life, and major property and stock losses.

Most bushfire survey areas are mapped either within Category 1 BFPL, or within a buffer BFPL area adjoining Category 1 BFPL (NSW RFS, 2022) (refer to Figure 5-2). Field assessment confirmed that bushfire prone vegetation is present immediately adjoining each bushfire survey area. This vegetation is mainly forest, woodland and grassland (refer to Section 5.6 for vegetation risk). Low threat vegetation areas under Section 2.2.3.2 of AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* are not included as BFPL and are generally excluded following site assessment. Low threat vegetation includes areas such as golf courses, maintained public parks, sporting fields, and market gardens. The BFPL category around the bushfire survey areas are outlined in Table 5-1.

Table 5-1 BFPL category relevant to the bushfire survey areas (NSW RFS, 2022)

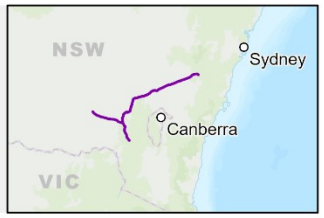
Site	LGA and BRMP	BFPL Category
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	■ Wagga Wagga City LGA ■ Riverina BRMP (Riverina BFMC, 2018).	Not on BFPL, but adjacent to Category 1 BFPL
Snowy Mountains Highway compound (C02)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Spots of Category 1 BFPL, and vegetation buffer
Snubba Road compound (C03)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL
Maragle 500 kV substation compound (C05)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL
Gugaa 500 kV substation and Gregadoo Road compound (C06)	■ Wagga Wagga City LGA ■ Riverina BRMP (Riverina BFMC, 2018).	Not on BFPL, approximately 2 km from Category 1 BFPL
Honeysuckle Road compound (C07)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL, and vegetation buffer
Red Hill Road compound (C08)	■ Cootamundra-Gundagai Regional Council LGA ■ South West Slopes BRMP (South West Slopes BFMC, 2020) ■ On the border of Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL, and vegetation buffer
Adjungbilly Road compound (C09)	■ Cootamundra-Gundagai Regional Council LGA ■ South West Slopes BRMP (South West Slopes BFMC, 2020).	Category 1 BFPL
Yass substation compound (C10)	■ Yass Valley Council LGA ■ Southern Tablelands BRMP (Southern Tablelands BFMC, 2019).	Not on BFPL but adjacent to Category 3 BFPL, and vegetation buffer
Woodhouselee Road compound (C11)	■ Upper Lachlan Shire LGA ■ Southern Tablelands BRMP (Southern Tablelands BFMC, 2019).	Not on BFPL, approximately 1 km from Category 1 BFPL
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	■ Upper Lachlan Shire LGA ■ Southern Tablelands BRMP (Southern Tablelands BFMC, 2019).	Not on BFPL but adjacent to Category 1 and Category 2 BFPL
Memorial Avenue compound (C14)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Not on BFPL, but adjacent to Category 1 BFPL
Bowmans Lane compound (C15)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL, and vegetation buffer
Snubba Road compound (C16)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Category 1 BFPL
Tumbarumba Accommodation Facility (AC1)	■ Snowy Valleys LGA ■ Snowy Valleys BRMP (Snowy Valleys BFMC, 2018).	Not on BFPL, but adjacent to Category 1 BFPL and vegetation buffer



Project footprint
Local Government Area
Major road
Railway
Substation

Bush Fire Prone Land

Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Vegetation Buffer



Source: *Aurecon, Transgrid, NSW Rural Fire Service, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink **Bushfire Assessment**

FIGURE 5-2: Bush Fire Prone Land

5.4 Historic bushfire events

The project is located across several BRMP areas, which commonly experience between 60 and 200 fires per year:

- The Riverina BRMP area on average has two major fires and 198 smaller fires per year (Riverina BFMC, 2018).
- The Snowy Valleys BRMP area on average has four significant fires per year, and 62 smaller fires (Snowy Valleys BFMC, 2018).
- The Southern Tablelands BRMP area on average has five large fires per year, and 260 smaller fires. The Yass Valley LGA has a 2.5-year cycle of major fires (Southern Tablelands BFMC, 2019).

In the past decade, two major bushfire events have affected the region:

- In January 2013, the Cobbler Road bushfire burnt over 14,000 hectares of the project footprint, south of the Hume Highway near Talmo, causing major damage to farming country, with the loss of over 10,000 livestock, as well as sheds and fencing. The Cobbler Road fire was a grass fire (NSW RFS, 2013).
- In December/January 2020, the Dunns Road bushfire burnt more than 330,000 hectares of the southern extent of the project near Maragle, causing extensive damage to commercial assets. The Dunns Road fire was a forest fire, ignited by lightning in a pine plantation west of Adelong (NSW RFS, 2020). The fire impacted Transgrid transmission infrastructure including 330 kV transmission lines and associated structures (Transgrid, 2020).

5.5 Bushfire ignition sources

There are a range of ignition sources which are a potential risk to starting fires that may impact project infrastructure, or where ignition sources are generated by the project, may result in fires that impact areas outside the project footprint. The project is encompassed within several BRMPs, which identify a range of existing ignition sources (refer to Table 5-2). Refer to Chapter 6 and Chapter 7 for project related ignition sources.

Table 5-2 Existing ignition sources

Ignition source	Details	Reference
Lightning	■ **Details**: Lightning activity in storms is usually associated with rainfall. Ignition is most likely in years with below average rainfall or a dry landscape. ■ **Timing:** Late spring to summer. ■ **Risk Areas:** Across the project footprint, within Riverina, Southern Tablelands, and Snowy Valleys BRMP areas.	■ Riverina BFMC (2018) ■ Snowy Valleys BFMC (2018) ■ Southern Tablelands BFMC (2019).
Legal and illegal burning off	■ **Details:** Fire escapes from legal and illegal burning. ■ **Timing:** Mid to late spring, early summer; between autumn and spring. ■ **Risk Areas:** Generally in rural/ agricultural areas.	■ Riverina BFMC (2018) ■ Snowy Valleys BFMC (2018) ■ Southern Tablelands BFMC (2019).
Operations and machinery	■ **Details**: Can include harvesting, faulty equipment and inappropriate equipment use, or hot works during inappropriate times. ■ **Timing:** Anytime. ■ **Risk Areas:** Where machinery and operations occur, specifically hot works (slashing, welding, motor mowers).	■ Riverina BFMC (2018) ■ Snowy Valleys BFMC (2018) ■ Southern Tablelands BFMC (2019).
Accidental	■ **Details**: Can include motor vehicle accidents, smoking/ cigarette butt disposal, and escapes from campfires. ■ **Timing:** School and summer holiday periods. ■ **Risk Areas:** Along roadways/ highways, and campfires at formal and informal camping grounds. Particularly along rivers/dam, State forests and national park areas.	■ Riverina BFMC (2018) ■ Snowy Valleys BFMC (2018) ■ Southern Tablelands BFMC (2019).

Ignition source	Details	Reference
Incendiarism	■ **Details:** Fire escape from arson activities. ■ **Timing:** School and summer holiday periods. ■ **Risk Areas:** Grasslands and forests adjacent to townships; or urban areas near rubbish tips.	■ Riverina BFMC (2018) ■ Snowy Valleys BFMC (2018) ■ Southern Tablelands BFMC (2019).
Tree fall	■ **Details**: Increased risk of ignition from tree fall in contact with electrical infrastructure. ■ **Timing:** Summer months when fire spread is possible. Only if growth rates do not correspond with the vegetation maintenance cutting cycle. ■ **Risk Areas:** Transmission line route from trees either growing in or falling into the easement.	■ Energy Networks Australia (2016).
Failure of electrical infrastructure	■ **Details:** Ignition from non-project related electrical infrastructure failure. ■ **Timing:** Summer months when fire spread is possible. ■ **Risk Areas:** Within the easement where mechanical failure results in ignition of vegetation.	■ Energy Networks Australia (2016).

5.6 Vegetation risk

Vegetation is an important characteristic that influences fire behaviour and can elevate fire risk. The attributes of vegetation fuel (type, amount, arrangement, moisture content) vary between vegetation groups, and these attributes affect fire characteristics (ignition, spread, intensity).

Forest and woodland vegetation communities can support the highest intensity bushfires, with shrublands and heathlands supporting medium intensity fires, and grasslands supporting relatively lower intensity and fast-moving grassfires. Vegetation within the proposed transmission line corridor is highly variable but would be actively managed in accordance with Transgrid's existing vegetation management standards (Transgrid 2020a, 2020b and 2021), and the clearance widths identified in AS/NZS7000:2016 *Overhead Line Design*.

In line with the methodology required under PBP (NSW RFS, 2019), vegetation is assessed within 140 metres of each of the bushfire survey areas (refer to Table Table 1-2) to determine its formation and classification, as per Keith (2004). When areas of vegetation classifications mix, priority is given to the classification providing the greater bushfire hazard.

There are large areas of non-native vegetation across the project footprint, including softwood radiata pine plantations, which have the ability to support high intensity bushfires. Pine plantations have been long established on the southern slopes (NSW Forestry Corporation, 2021b), and include the following State forests:

- Bago State Forest, located in the southern extent of the project footprint near Maragle, includes historic plantation stands and commercial radiata pine plantations (NSW Forestry Corporation, 2021a).
- Green Hills State Forest, located in the west of the project footprint, is predominantly a radiata pine plantation (NSW Forestry Corporation, 2021a).
- Red Hill State Forest, located 18 kilometres north-east of Tumut, is a mix of commercial radiata pine plantation and native forest.

Large parts of these areas south of Tumut were impacted by the December/January 2020 Dunns Road bushfire which burnt a range of plant community type (PCT) vegetation groups.

5.6.1 Vegetation assessment

PCTs are the main vegetation classification system used in NSW. The PCT types occurring in the project footprint have been mapped by Niche (2022) and are outlined in *Technical Report 1 – Biodiversity Development Assessment Report*. Non-native vegetation such as pine plantations are not included as a PCT, but they are classified as a 'Forest' formation under the Keith classification system (Keith 2004, as in PBP 2019) when assessing bushfire risk. Vegetation within the project footprint is predominantly classified as either Forest or Woodland. Classifications are sourced from the BioNet Vegetation classification PCT tool (DPE, 2021a). In accordance with PBP requirements, vegetation formation (as per Keith 2004) within 140 metres of the bushfire survey areas are outlined in Table 5-3.

Table 5-3 Vegetation assessment values for bushfire survey areas

Site	Vegetation description	Vegetation formation (Keith 2004)	FFDI[2]	Elevation (m)
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	**North**: Visual assessment confirmed mixture of forest, and woodland with overstory removed but capable of regenerating	Woodland/ grassland	80	230
	South: Visual assessment confirmed woodland	Woodland		
	East: Visual assessment confirmed mixed exotic plantings, currently grassland dominated but would regenerate as woodland (climax community)	Woodland/ grassland		
	West: Visual assessment confirmed woodland	Woodland/ grassland		
Snowy Mountains Highway compound (C02)	**North**: Visual assessment confirmed forest	Forest	80	300
	East: Visual assessment confirmed forest	Forest		
	South: Visual assessment confirmed forest, suggested to be koala habitat, although no sightings	Forest		
	West: Visual assessment confirmed predominantly non-vegetated	N/A		
Snubba Road compound (C03)	**North**: Visual assessment confirmed potential regrow to forest	Forest/ grassland	80	830
	South: Visual assessment confirmed forest	Forest/ grassland		
	East: Visual assessment confirmed forest	Forest/ grassland		
	West: Unable to be visually assessed	Forest/ grassland		
Maragle 500 kV substation compound (C05)	**North**: Visual assessment confirmed forest	Forest	80	1165
	South: Visual assessment confirmed forest	Forest		
	East: Visual assessment confirmed forest	Forest		
	West: Visual assessment confirmed forest	Forest		
Gugaa 500 kV substation and Gregadoo Road compound (C06)	**North:** Visual assessment confirmed canola crop fields	Grassland	80	225
	South: Visual assessment confirmed canola crop fields	Grassland		
	East: Visual assessment confirmed canola crop fields	Grassland		
	West: Visual assessment confirmed crop fields (not canola)	Grassland		

[2] FFDI is a measure of fire danger, based on vegetation dryness, air temperature, wind speed and humidity, and considers the chance of starting a fire, and potential spread, intensity, and difficulty of suppression. FFDI varies according to geography, and can range from 50 in some Alpine areas, to 100 in forested areas. The higher FFDI is indicative of a higher degree of fire danger in the area (NSW RFS, 2019). Average FFDI are assigned to LGAs for use in accordance with AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* and PBP (NSW RFS, 2019).

Site	Vegetation description	Vegetation formation (Keith 2004)	FFDI[2]	Elevation (m)
Honeysuckle Road compound (C07)	**North**: Visual assessment confirmed grazing grassland/ woodland	Woodland	80	775
	South: Visual assessment confirmed forest (clear-felled)	Forest		
	East: Visual assessment confirmed forest	Forest		
	West: Visual assessment confirmed forest	Forest		
Red Hill Road compound (C08)	**North**: Visual assessment confirmed forest	Forest	80	720
	South: Visual assessment confirmed forest	Forest		
	East: Visual assessment confirmed forest	Forest		
	West: Visual assessment confirmed forest	Forest		
Adjungbilly Road compound (C09)	**North:** Visual assessment confirmed forest	Forest	80	625
	South: Visual assessment confirmed forest	Forest		
	East: Visual assessment confirmed forest	Forest/ grassland		
	West: Visual assessment confirmed forest (clear-felled to be re-established)	Forest		
Yass substation compound (C10)	**North:** Visual assessment confirmed grassland that would regenerate to forest	Grassland	100	505
	South: Visual assessment confirmed woodland or forest	Grassland		
	East: Visual assessment confirmed grassland/ woodland, but is currently mapped as forest	Grassland		
	West: Visual assessment confirmed woodland	Grassland		
Woodhouselee Road compound (C11)	**North:** Visual assessment confirmed grass or woodland	Grassland	100	885
	South: Visual assessment confirmed grass or woodland	Grassland		
	East: Visual assessment confirmed grass or woodland	Grassland		
	West: Visual assessment confirmed grass or woodland	Grassland		
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	**North**: Visual assessment confirmed woodland or forest	Forest	100	660
	South: Visual assessment confirmed open woodland	Woodland		
	East: Visual assessment confirmed open woodland	Woodland		
	West: Visual assessment confirmed open woodland	Woodland		
Memorial Avenue compound (C14)	**North:** Visual assessment confirmed non-vegetated/ housing	N/A	80	770
	South: Visual assessment confirmed woodland or forest	Forest		
	East: Visual assessment confirmed woodland or forest	Forest		
	West: Visual assessment confirmed woodland	Forest		

Site	Vegetation description	Vegetation formation (Keith 2004)	FFDI[2]	Elevation (m)
Bowmans Lane compound (C15)	**North:** Visual assessment confirmed forest/ cleared pine plantation	Forest/ grassland	80	750
	South: Visual assessment confirmed garden/ grass	Forest/ grassland		
	East: Visual assessment confirmed forest	Forest/ grassland		
	West: Visual assessment confirmed farmland/ grass	Forest/ grassland		
Snubba Road compound (C16)	**North:** Visual assessment confirmed forest	Forest	80	1060
	South: Visual assessment confirmed forest	Forest		
	East: Visual assessment confirmed forest	Forest		
	West: Visual assessment confirmed forest	Forest		
Tumbarumba Accommodation Facility (AC1)	**North:** Visual assessment confirmed forest	Grassland	80	705
	South: Visual assessment confirmed farmland	Forest / Grassland		
	East: Visual assessment confirmed forest	Forest / Grassland		
	West: Visual assessment confirmed pasture	Grassland		

5.7 Slope

Slope is an important risk factor that influences fire behaviour. Fires burning upslope are faster and more intense than those burning on even ground or downslope (NSW RFS, 2019), and are of greatest intensity in forest and woodland areas. Across the entire existing transmission line network, slope risk is addressed by the maintenance of vegetation management standards, and the clearance widths identified in AS/NZS7000:2016 *Overhead Line Design*. Slope is assessed within 100 metres of each bushfire survey area (refer to Table 5-4), to satisfy the aims and objectives outlined in PBP (NSW RFS 2019).

5.7.1 Effective slope

The effective slope is the slope of the land, under the vegetation hazard (as opposed to the slope of the land between the hazard and the asset) (NSW RFS, 2019) and is assessed when hazards are present on slopes less than 20 degrees.

In line with PBP (NSW RFS, 2019) requirements, slope is classified for each of the bushfire survey areas as one or more of the following:

- all upslope vegetation (considered 0°)
- > 0 to 5° downslope
- > 5° to 10° downslope
- > 10° to 15° downslope
- > 15° to 20° downslope.

Slope classes were assessed using 10 metre contour data and confirmed by field assessment. Slope classes represent the effective slope under vegetation within 100 metres of the perimeter of bushfire survey areas (refer to Table 5-4).

Table 5-4 Slope classes associated with bushfire survey areas

Site	Slope Description	All flat/ upslope	>0-5°	>5-10°	>10-15°	>15-20°
	North: downslope to woodland **North-east**: downslope to forest **North-west**: flat/ upslope	✓	✓			
	East: downslope to woodland		✓			

Site	Slope Description	All flat/ upslope	>0-5°	>5-10°	>10-15°	>15-20°
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	**South**: flat/ upslope **South-west**: downslope to woodland	✓	✓			
	West: flat/ upslope, downslope to woodland	✓	✓			
Snowy Mountains Highway compound (C02)	**North**: downslope north of the creek, and flat/ upslope further north	✓	✓			
	East: upslope, predominantly in northern part of the site Hazards to the east has been reduced by Snowy Valleys Council waste facility, private landfill which would be developed in three parts, and Snowy Valleys Council development of central part of the site.	✓				
	South: downslope south of the creek toward southern boundary then upslope. A development proposal has been lodged for the central part by Snowy Valleys Council for a waste facility, which would remove the vegetation hazard		✓			
	West: Gilmore Mill industrial area and road – no hazard	-	-	-	-	-
Snubba Road compound (C03)	**North**: flat/ upslope	✓				
	East: very steep toward forest, towards Blowering Dam					✓
	South: flat/ upslope **South-east**: very steep toward forest, towards Blowering Dam	✓				✓
	West: slight downslope toward forest		✓			
Maragle 500 kV substation compound (C05)	**North**: downslope to cleared transmission line and forest area				✓	
	East: downslope varying toward forest. **South-east**: downslope varying toward forest. Note: area marked as future Maragle 500 kV substation but currently forest vegetation.		✓	✓		
	South: downslope to cleared transmission line and forest area **South-west**: downslope to cleared transmission line and forest area			✓		
	West: downslope varying toward forest.		✓	✓		
Gugaa 500 kV substation and Gregadoo Road compound (C06)	**North**: flat/ upslope to crop fields, slight downslope	✓	✓			
	East: flat/ upslope to crop fields with tree break	✓				
	South: flat/ upslope to crop fields	✓				
	West: flat/upslope flat/ upslope to crop fields	✓				
Honeysuckle Road compound (C07)	**North**: North and north-west downslope **North-east**: flat toward grazing land/ woodland	✓	✓	✓		
	East: flat/ upslope toward forest	✓				
	South: flat/ upslope toward forest	✓	✓			
	West: downslope toward forest (harvested)		✓			
Red Hill Road compound (C08)	**North**: north flat/ upslope toward forest **North-east**: downslope toward forest **North-west**: downslope toward forest	✓	✓	✓		
	East: downslope toward forest		✓			

Site	Slope Description	All flat/ upslope	>0-5°	>5-10°	>10-15°	>15-20°
	South: downslope toward forest **South-east**: flat/ upslope toward forest **South-west**: flat/ upslope toward forest	✓	✓			
	West: downslope toward forest		✓			
Adjungbilly Road compound (C09)	**North**: downslope toward forest		✓			
	East: flat/ upslope	✓				
	South: downslope to forest in south and south-west direction		✓			
	West: flat/ upslope	✓				
Yass substation compound (C10)	**North**: downslope toward grassland/ forest; potential likely fire run from north-east		✓			
	East: downslope to grassland		✓			
	South: upslope to forest or woodland in south-east direction	✓				
	West: downslope in north direction		✓	✓		
Woodhouselee Road compound (C11)	**North**: flat/ upslope to grass or woodland	✓				
	East: flat/ upslope to grass or woodland	✓				
	South: flat/ upslope, and downslope to grass or woodland	✓		✓		
	West: downslope to grass or woodland				✓	
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	**North**: flat/ upslope to Bannaby 500 kV substation, or to open woodland	✓				
	East: downslope varying to Bannaby 500 kV substation, or to open woodland **South-east**: downslope varying to Bannaby 500 kV substation, or to open woodland		✓			
	South: flat/ upslope to other temporary construction/ laydown areas, or to open woodland	✓				
	West: flat/ upslope from all temporary laydown/ construction areas to open woodland	✓				
Memorial Avenue compound (C14)	**North**: flat/ upslope	✓				
	East: flat/ upslope **South-east:** downslope to forest	✓	✓			
	South: downslope to forest		✓			
	West: flat/upslope **South-west**: upslope directly west, downslope heading south	✓	✓			
Bowmans Lane compound (C15)	**North**: flat/ upslope, and downslope in west direction	✓		✓		
	East: steep downslope to grass/ farmland					✓
	South: flat/ upslope	✓				
	West: downslope to forest		✓			
Snubba Road compound (C16)	**North**: part flat/ upslope, part gully downslope to forest	✓	✓			
	North-east: flat/ upslope **South-east:** downslope to forest	✓	✓			
	South: parts flat/ upslope, part downslope to forest in east direction	✓		✓		
	West: flat/ upslope	✓				

Site	Slope Description	All flat/ upslope	>0-5°	>5-10°	>10-15°	>15-20°
Tumbarumba Accommodation Facility (AC1)	**North**: flat/ upslope to forest	✓				
	East: flat/ upslope to forest or woodland	✓				
	South: flat/ upslope to farmland	✓				
	West: flat/ upslope to pasture	✓				

5.8 Access

Road access is required for the construction and operation of the project, including construction equipment and worker vehicle access, emergency services access, and safe evacuation routes. The project contains several existing access routes including access from a range of several major roads:

- Hume Highway (M31) crosses the project footprint about 13 kilometres south-east of the Wagga 330 kV substation and 5.5 kilometres north-west of Yass and near Nangus.
- Sturt Highway (A20) crosses the project footprint about 24 kilometres north-east of the Wagga 330 kV substation.
- Barton Highway (A25) crosses the project footprint about seven kilometres north-west of Yass.
- Snowy Mountains Highway (B72) crosses the project footprint north of Blowering Dam.
- The project footprint crosses or is close to several other major roads as well as several local and private rural roads with varying speed limits and conditions.

Access routes assessed in this assessment were limited to the access routes to bushfire survey areas, consistent with the aims and objectives outlined in PBP (NSW RFS, 2019).

Primary and secondary access provide a route for emergency response as well as evacuation, with secondary access providing an alternative option should primary access become cut off by fires or fallen burnt trees (refer to Section 6.2 and Section 7.2.3 for further details) . Existing primary and secondary access routes were considered for the bushfire survey areas as outlined in Table 5-5. Refer to Section 5.8 for access requirements and compliance for bushfire survey areas, in accordance with the aims and objectives outlined in PBP (NSW RFS, 2019).

Table 5-5 Existing access routes associated with bushfire survey areas

Site	Access route	Approximate distance	Type	Description
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	**Primary:** Ashfords Road	0.6 km	■ sealed ■ local road.	Ashfords Road is a sealed two-way local road. Access to Ashfords Road includes: ■ northern access from Mitchell Road (site access 0.6 km from Mitchell Road) ■ southern access from Gregadoo East Road, via Ivydale Road (site access approximately 5 km from Gregadoo East Road via Ivydale Road).
	Secondary: Boiling Down Road	1.8 km	■ unsealed.	Boiling Down Road is an unsealed two-way road providing western access to Wagga 330 kV substation compound (C01). Access to Boiling Down Road includes: ■ northern access from Redbank Road ■ western access from Plumpton Road and Rowan Road.

Site	Access route	Approximate distance	Type	Description
Snowy Mountains Highway compound (C02)	**Primary:** Snowy Mountains Highway	-	■ sealed ■ state road.	Snowy Mountains Highway is a major two-way sealed road, extending west and east of the Snowy Mountains Highway compound (C02). Access to Snowy Mountains Highway includes: ■ western access from Adelong (site access 13.7 km from Adelong) ■ eastern access from Tumut (site access 6.1 km from Tumut). a
	Secondary: Batlow Road	23.7 km	■ sealed ■ state road.	Batlow Road joins the Snowy Mountains Highway 1.7 km south of the Snowy Mountains Highway compound (C02). Batlow Road access to Snowy Mountains Highway from Batlow (site access 6.1 km from Tumut).
Snubba Road compound (C03)	**Primary:** Snubba Road (western access)	7.3 km	■ unsealed ■ local road.	Snubba Road is unsealed, with a steep drop on the eastern side to Blowering Dam. Access to Snubba Road includes: ■ western access from Yellowin Access Road ■ eastern access from Yellowin Forest Road ■ private roads only for western access off Snubba Road, eg Sturgess Trail.
	Secondary: Snubba Road	8.7 km	■ unsealed ■ local road.	There is no secondary access to Snubba Road compound (C03). **Note**: There is a northern access track from Foreshore Road bordering the Blowering Dam foreshore to Snubba Road.
Maragle 500 kV substation compound (C05)	**Primary:** Elliot Way (western access)	20.1 km	■ sealed ■ regional road.	Elliot Way is a sealed two-way major road. Elliot Way (western access) from Tooma Road (site access 20.1 km from Tooma Road) is the primary access route for the Maragle 500 kV substation compound (C05).
	Secondary: Elliott Way (southern access)	26 km	■ sealed ■ regional road.	Elliot Way (southern access) from Link Road (site access 26 km from Link Road) is the secondary access route for the Maragle 500 kV substation compound (C05).
Gugaa 500 kV substation and Gregadoo Road compound (C06)	**Primary:** Livingstone Gully Road (northern access)	0.8 km	■ unsealed ■ local road.	Livingstone Gully Road is an unsealed road in good condition. Livingstone Gully Road (northern access) from Gregadoo E Road (site access is less than 1 km from Gregadoo E Road) is the primary access route for the Gregadoo Road compound (C06) and Gugaa 500 kV substation. Gregadoo E Road can be accessed from Tumbarumba Road (eastern access), Elizabeth Avenue (northern access), and Big Springs Road (southern access).
	Secondary: Livingstone Gully Road (southern access)	11.4 km	■ unsealed ■ local road.	Livingstone Gully Road (southern access) from Compton Road (site access is 11.4 km from Compton Road) is the secondary access route for the Gregadoo Road compound (C06) and Gugaa 500 kV substation.

Site	Access route	Approximate distance	Type	Description
Honeysuckle Road compound (C07)	**Primary:** Honeysuckle Road (western access)	9.5 km	■ unsealed ■ local road.	Honeysuckle Road is an unsealed road in good condition. It joins with various unsealed roads within Red Hill State Forest. Red Hill State Forest can be accessed from the west (Brungle Creek), north (Adjungbilly), and south (Wyangle). Honeysuckle Road (western access) from Brungle Creek (site access 9.5 km from Brungle Creek Road) is the primary access route for the Honeysuckle Road compound (C07).
	Secondary: Honeysuckle Road	9.4 km	■ unsealed ■ local road.	The following are potential secondary access routes for the Honeysuckle Road compound (C07): ■ northern access from Adjungbilly, via on Red Hill Road and Honeysuckle Road (site access 9.4 km from Threeways Road/Adjungbilly Road) ■ southern access from Wyangle, via Wee Jasper Road. Wee Jasper Road joins Red Hill Road, 4 km south of Honeysuckle Road compound (C07) ■ Red Hill Road joins Honeysuckle Road, 1.2 km east of Honeysuckle Road compound (C07).
Red Hill Road compound (C08)	**Primary:** Red Hill Road	5-7 km	■ unsealed ■ local road.	Red Hill Road is an unsealed road in good condition. It joins with various unsealed roads within Red Hill State Forest. Red Hill State Forest can be accessed from the west (Brungle Creek), north (Adjungbilly), and south (Wyangle). Access to Red Hill Road includes: ■ northern access (site access 7 km from Threeways Road/ Adjungbilly Road) ■ southern access (site access 5 km from Wee Jasper Road).
	Secondary: Sawmill Creek Road	1-3 km	■ unsealed ■ local road.	Sawmill Creek Road is an unsealed road in good condition. It joins with various unsealed roads within Red Hill State Forest. Red Hill State Forest can be accessed from the west (Brungle Creek), north (Adjungbilly), and south (Wyangle). Access to Sawmill Creek Road includes: ■ northern access to Sawmill Creek Road on Red Hill Road (site access 3.1 km from Threeways Road/ Adjungbilly Road) ■ southern access on Honeysuckle Road (site access 1.1 km from Honeysuckle Road).
Adjungbilly Road compound (C09)	**Primary:** Adjungbilly Road (southern access)	4.1 km	■ sealed ■ local road. ■ Two-way	Adjungbilly Road compound (C09) is accessible via a sealed track off Adjungbilly Road. Adjungbilly Road is a sealed two-way road (site access 0.5 km from Adjungbilly Road). Access to Adjungbilly Road includes: ■ southern access (site access 4.1 km from Fern Hill Road) ■ eastern access (site access 4.1 km from Nanangroe Road).

Site	Access route	Approximate distance	Type	Description
	Secondary: Adjungbilly Road (northern access)	14.9 km	■ sealed ■ local road ■ two-way.	Northern access to Adjungbilly Road from Gobarralong Road (site access 14.9 km from Gobarralong Road). **Note**: there are private tracks from Adjungbilly Road to Kangaroo Mount Road, which parallel Adjungbilly Road north toward Gobarralong Road.
Yass substation compound (C10)	**Primary:** Perry Street (northern access)	1.2 km	■ sealed ■ local road ■ two-way.	Perry Street is a sealed two-way road. Primary access to Perry Street is through northern access from Grand Junction Road, a major two-way sealed road (site access 1.2 km from Grand Junction Road).
	Secondary: Perry Street (southern access)	1 km	■ sealed ■ local road ■ two-way.	Secondary access to Perry Street is from Wee Jasper Road/Green Street, through Victoria Street (0.2 km) (site access 1 km from Wee Jasper Road/ Green Street). Perry Street can be accessed from multiple two-way sealed roads within Yass, including Victoria Street.
Woodhouselee Road compound (C11)	**Primary:** Woodhouselee Road (southern access)	6.9 km	■ sealed ■ local road ■ two-way.	Woodhouselee Road is a two-way sealed road (site access 2.2 km directly from Woodhouselee Road). There is no current access to the driveway off Woodhouselee Road, no current vehicle access to Woodhouselee Road compound (C11). Primary access to Woodhouselee Road is from Crookwell Road (site access 6.9 m from Crookwell Road).
	Secondary: Woodhouselee Road (northern access)	8.1 km	■ sealed ■ local road ■ two-way.	Secondary access to Woodhouselee Road is from Middle Arm Road (site access 8.1 km from Middle Arm Road).
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	**Primary:** Hanworth Road (western access)	4.9 km	■ sealed ■ local road ■ rural road.	Hanworth Road is sealed to the existing Bannaby 500 kV substation from Taralga. Hanworth Road (western access) from Bannaby Road is the primary access route for the Bannaby 500 kV substation and compound. Unsealed gravel road within property between Hanworth Road and Bannaby 500 kV substation compound (C12) is subject to erosion.
	Secondary: Hanworth Road	11 km	■ unsealed ■ local road ■ rural road.	Unsealed rural road providing property access, 16 km to Wollondilly River.
Memorial Avenue compound (C14)	**Primary:** Memorial Avenue	0.2 km	■ sealed ■ local road ■ two-way.	Memorial Avenue compound (C14) is at the intersection of Memorial Avenue and Mill Road. Both are sealed two-way roads. Primary access to Memorial Avenue compound (C14) is along Memorial Avenue, from Pioneer Street (site access 0.2 km from Pioneer Street).
	Secondary: Mill Road	0.6 km	■ sealed ■ local road ■ two-way.	Secondary access to Memorial Avenue compound (C14) is along Mill Road, from Bartoman Street (site access 0.6 km from Bartoman Street).

Site	Access route	Approximate distance	Type	Description
Bowmans Lane compound (C15)	**Primary:** Keenans Road	0.3 km	■ sealed ■ local road ■ two-way.	Keenans Road is a sealed two-way road. Primary access to Keenans Road is from one major two-way sealed road (Mill Road/ Forest Road): ■ northern access from Mill Road (site access 0.3 km from Mill Road) ■ southern access from Forest Road (site access 0.3 km from Forest Road).
	Secondary: Keenans Road	1.1 km	■ sealed ■ local road ■ two-way.	There is no secondary access to Bowmans Lane compound (C15). **Note**: There is a private access unnamed track extending from Keenans Road to Forest Road in the south.
Snubba Road compound (C16)	**Primary:** Snubba Road	4.1 km	■ unsealed ■ local road.	Snubba Road is an unsealed local road. It joins with various unsealed roads within Bago State Forest. Snubba Road can be accessed from three different roads with the same origin point south of Batlow (Yellowin Access Road 5.7 km long, Bullongra Road 6.9 km long, and Bago Forest Way 8.2 km long): ■ northern access from Yellowin Access Road onto Snubba Road (site access 4.1 km from Yellowin Access Road) is the primary access route for Snubba Road compound (C16).
	Secondary: Snubba Road	1-4.5 km	■ unsealed ■ local road.	The following are potential secondary access routes for Snubba Road: ■ northern access from Bullongra Road onto Snubba Rd (site access less than 1 km from Bullongra Rd) ■ western access from Bago Forest Way onto Snubba Road (site access 4.4 km from Bago Forest Way).
Tumbarumba Accommodation Facility (AC1)	**Primary:** Courabyra Road	0.9-4.1 km	■ sealed ■ local road.	Tumbarumba Accommodation Facility (AC1) is located at the intersection of Courabyra Road and Alfred Street. Courabyra Road is a local two-way sealed road. Access to Courabyra Road is from the north and south: ■ northern access from Dunbritton Road (site access 4.1 km from Dunbritton Road) ■ southern access from Masons Hill Road/ Albury Street (site access less than 1 km from Masons Hills Road/ Albury Street).
	Secondary: Alfred Street	1 km	■ unsealed ■ local road.	Alfred Street is an unsealed local road in good condition. Access to Alfred Street is from the east and west: ■ western access from Mate Street (site access less than 1 km from Mate Street) ■ eastern access to Alfred Street from Courabyra Road at the site ■ eastern/southern access from Boundary Street (site access less than 1 km from Boundary Street).

6 Construction impacts

Bushfire impacts are assessed for infrastructure and equipment that form part of the construction of the project. These impacts are assessed in terms of project related ignition sources. During construction, potential impacts from a bushfire burning within or into the project footprint may consist of ember attack, radiant heat, and direct flame contact. These impacts can result in damage or destruction of construction plant and equipment and pose a risk to the health and safety of workers.

6.1 Project related ignition sources

There are several potential ignition sources relating to the project construction that would require mitigation. These sources have the potential to ignite adjacent vegetation and structures, and pose a risk to life and assets, and include:

- hot works
- construction equipment
- electrical faults in equipment
- motor vehicles
- accidental ignitions
- dangerous materials.

These project ignition sources are further discussed in the following sections.

Without established fuel reduced areas and APZs, the risk of ignition and fire spread from construction of substation and transmission line is elevated. The risk of fire from these ignition sources is highest near heavily vegetated areas within Category 1 BFPL (refer to Table 5-1) and cured unmanaged grasslands (including pastures and grasslands which form part of woodlands), as well as near stockpiles of removed vegetation.

The project footprint traverses a range of vegetation communities (forest, woodland, and grassland) and slope classes, which influence bushfire behaviour and rate of spread, with the risk profile along its extent variable.

This risk profile varies through the following cycles:

- Over many years, changes in the southern oscillation index may result in sustained periods of hot dry weather (El Niño) or cooler wetter cycles (La Niña), which correspondingly may increase or reduce the likelihood of adverse fire seasons.
- From year to year, fine vegetation fuel loads change through natural accumulation or removal through bushfire or planned burning. The amount of fine vegetation (sticks, leaves and vegetation <6-millimetre thickness) is the primary fuel influence on bushfire spread and intensity.
- Seasonally, the risk profile changes with the onset of the fire season in summer months and the occurrence of days of elevated fire danger (associated with a period of dry days, low humidity, and high temperature and winds).
- Daily, the risk profile changes as weather conditions influence the moisture content of fine vegetation fuels and their capacity to carry fire.

These factors, with vegetation and slope, create a dynamic risk profile along the extent of the project footprint. Considering this variability, Transgrid has identified that its *risk approach to asset management is to assume every transmission line has the potential to be impacted by fire, or to initiate fire, including bushfire* (Transgrid, 2003). As such, easement clearance distances are applied uniformly across the easement extent, based on those identified in AS/NZS7000:2016 *Overhead Line Design* and in accordance with the project specific strategy developed for vegetation clearance – *Humelink Vegetation Clearing Method and Management Memorandum* (Transgrid, 2023). The management of vegetation within transmission line easements is detailed in Section 9.4.

The proximity of vegetation in combination with the risk factors below may elevate bushfire risk. However, bushfire impacts during the construction of the project are unlikely where construction activities occur within established APZs and mitigation measures and procedural controls are implemented, or where construction is located outside BFPL (refer to Figure 5-2 and Table 5-1).

Mitigation and procedural measures to address project ignition risks are identified in Chapter 9.

6.1.1 Hot works

Construction activities that involve hot works, such as grinding, welding, or cutting, or may otherwise result in sparks from plant or equipment, could increase the risks of bushfire ignition. Sparks can spread via wind, posing a high ignition risk to dry vegetation. Hot works should be confined to non-vegetated areas and managed through procedural controls.

Construction procedures regarding hot works including restrictions during periods of Total Fire Ban and days of elevated forecast fire danger (High Fire Danger Rating forecast or greater) would be further considered in the HumeLink BFEMEP and the Construction Environmental Management Plan (CEMP).

6.1.2 Construction equipment

Construction equipment, such as bulldozers and excavators, pose a bushfire risk through activities that can produce sparks and ignite adjoining vegetation. Sparks can be accidentally produced when steel blades encounter rocks and are a high ignition risk to adjacent vegetation, where mitigation and control measures are not applied. Fires igniting adjoining vegetation may spread quickly under adverse conditions such as elevated fire danger days, potentially impacting life, and property.

A BFEMEP would be prepared for the project and would include mitigation measures applicable to construction activities undertaken during the bushfire danger period, including further mitigation measures on Total Fire Ban days and days of elevated fire danger (High Fire Danger Rating forecast or greater). The statutory Bush Fire Danger Period runs from 1 October to 31 March, subject to adjustments based on local conditions (NSW RFS, 2021). Refer to Section 5.1 for the specific bushfire danger periods for the project (indicated in the regional BRMPs).

6.1.3 Electrical faults in equipment

Electrical faults in equipment can create high ignition risk to adjacent vegetation. Equipment should be checked for potential faults or visible weaknesses regularly to reduce the potential for failure in accordance with manufacturers' specifications. The service intervals of these checks would be identified in the CEMP and Transgrid's inspection and maintenance requirements.

Construction activities would follow the procedures identified in the HumeLink BFEMEP for mitigation measures which apply during the bushfire danger period.

6.1.4 Motor vehicles

Motor vehicle exhaust systems are a potential ignition risk to adjacent grassland and other vegetation, with particular reference to diesel powered trucks and light vehicles with pollution controlling exhaust devices, which may emit burning diesel particles. This is a high ignition risk to adjacent vegetation. Vehicles may also collide with equipment or infrastructure, which may result in spilt fuel, or sparks that may be an ignition risk to adjacent vegetation.

Construction activities would follow the BFEMEP for mitigation measures, which apply during the bushfire danger period.

6.1.5 Accidental ignitions

Accidental ignitions, including smoking, are non-deliberate ignitions occurring from accidents or error, and not specified under any other ignition risk. Mitigation and control measures, which apply during the bushfire danger period would be included in the CEMP regarding mitigation measures for personnel, and the BFEMEP.

6.1.6 Dangerous materials

Dangerous materials include chemicals, explosives, or otherwise flammable materials. Inappropriate storage of dangerous materials, and insufficient fuel-free buffers around work sites, are a potential ignition risk to adjacent vegetation. Ignition risk occurs through increased risk of chemical fire or explosion, or a risk from a grass or bushfire burning a storage area and igniting dangerous materials.

The CEMP would specify procedures regarding storage, handling, and disposal, as well as procedures related to potential spill and clean-up, of dangerous materials and the removal of vegetation hazards around these areas.

6.1.7 Worker accommodation facilities

The Tumbarumba accommodation facility (AC1) is in and adjoins BFPL and may be subject to fires burning towards it or ignitions spreading from it during construction. The Tumbarumba accommodation facility (AC1) is classified as an SFPP development, and therefore is subject to specific bushfire protection requirements (refer to Chapter 9) including emergency management and evacuation plans, APZs, construction requirements, access provisions and services supply. As the worker accommodation facility is located on BFPL it must satisfy the aims and objectives outlined in PBP (NSW RFS 2019).

6.2 Access

The project contains several existing access routes. Some new and upgraded temporary and permanent access tracks and roads would be constructed in areas where there are no existing roads or tracks.

During a bushfire event, existing access roads may be cut off by the bushfire itself, burning or fallen trees, or smoke plumes. Smoke plumes from fires burning under adjacent transmission lines may cause a phase-to-ground short, which may pose a risk to persons within a horizontal distance of approximately 25 metres from the transmission line, including the use of access roads passing under existing transmission lines. The potential for access to be cut off during bushfires would be addressed in community emergency messaging and personal bushfire planning. Public safety advice is to leave early and not at the last minute. In firefighting agency procedures, public safety advice is to maintain a 25-metre separation from live transmission line when active fires are burning under or directly adjacent to an easement including the use of access roads. Evacuation procedures consistent with relevant guidelines will be provided as part of the BFEMEP prepared during detailed design and construction.

7 Operational impacts

Bushfire impacts are assessed for infrastructure and equipment that form part of the operation of the project. These impacts are assessed in terms of ignition sources, APZs, transmission line vegetation management, access, and services.

7.1 Project related ignition sources

There are several potential ignition sources relating to operation of the project that would require mitigation, including:

- hot work
- substation and transmission lines
- electrical faults in equipment
- motor vehicles
- accidental ignitions
- dangerous materials.

These sources have the potential to ignite adjacent vegetation and structures and pose a risk to personnel and assets. The risk of fire is highest near heavily vegetated areas within Category 1 BFPL (refer to Table 5-1 and Figure 5-2) and cured grasslands, and near stockpiles of removed vegetation. Site mitigation and procedural measures to address ignition risks are identified in Chapter 9.

7.1.1 Hot work

Operational activities that involve hot work, such as grinding, welding, or cutting, may result in sparks from plant or equipment and could increase the risks of bushfire ignition. Hot work would generally be associated with maintenance works on infrastructure. Sparks can spread via wind, posing a high ignition risk to dry vegetation. The HumeLink BFEMEP would identify mitigation measures associated with operational activities (including hot works permits) during the bushfire danger period.

7.1.2 Substation and transmission lines

Bushfire impacts during substation and transmission line operation (including new substation components at Wagga 330 kV substation, Bannaby 500 kV substation, and Gugaa 500 kV substation) are unlikely where operations occur within established APZs and Transgrid's procedural controls are implemented, or where operations are located outside BFPL (refer to Figure 5-2 and Table 5-1).

The project footprint traverses a range of vegetation communities (forest, woodland, and grassland) and slope classes which influences bushfire behaviour and rate of spread. The risk profile along the project extent is dynamic, varying according to weather cycles which influence vegetation and fuel loads (refer to Section 6.1).

Transgrid has identified that its *risk approach to asset management is to assume every transmission lines has the potential to be impacted by fire, or to initiate fire, including bushfire* (Transgrid, 2003). This includes direct contact by the transmission line with vegetation or mechanical failure resulting in untended ignitions. Bushfires may also pose a risk to network operations where physical damage to infrastructure occurs or when network operations are interrupted.

During operation, ongoing vegetation management would occur within the transmission line easement in accordance with Transgrid and nationally established industry standards AS/NZS7000:2016 *Overhead Line Design* to avoid direct contact with live transmission lines. This includes a higher frequency of inspections of easements with fast growth rate vegetation such as forest vegetation, which is generally associated with a higher bushfire risk. Transmission lines would be inspected regularly to reduce the potential for mechanical failure such as failure of conductors/insulators, line to line contact, or line failure, which in turn would reduce the potential for unwanted ignitions that may result in bushfire.

7.1.3 Electrical faults in equipment

Electrical faults in equipment can create high ignition risk to adjacent vegetation. These would generally be associated with maintenance works on infrastructure. Equipment should be checked for potential faults or visible weaknesses regularly to reduce the potential for failure, in accordance with manufacturers' specifications, service intervals identified in Transgrid's standard policy and procedures, and Transgrid's inspection and maintenance requirements. The HumeLink BFEMEP would identify mitigation measures associated with operational activities during the bushfire danger period.

7.1.4 Motor vehicles

Vehicle exhaust systems are a potential ignition risk to adjacent grassland and other vegetation, particularly diesel-powered trucks and light units with pollution controlling exhaust devices, which may emit burning diesel particles. This is a high ignition risk to adjacent vegetation such as cured long grass. Vehicles may collide with equipment or infrastructure, which may result in spilt fuel, or sparks that may be an ignition risk to adjacent vegetation. These would generally be associated with maintenance works on infrastructure. The HumeLink BFEMEP would identify procedural controls associated with moderating operational activity during days of elevated fire danger during the bushfire danger period.

7.1.5 Accidental ignitions

Accidental ignitions, including smoking, are non-deliberate ignitions by staff, contractors, or site visitors, as a result of accidents or error, and not specified under any other ignition risk. These risks would be managed in accordance with Transgrid's standard policy and procedures regarding mitigation measures for personnel, and HumeLink BFEMEP for procedural controls which apply during the bushfire danger period.

7.1.6 Dangerous materials

Dangerous materials include chemicals, explosives, or otherwise flammable materials. Inappropriate storage of dangerous materials, and insufficient breaks around works areas during maintenance activities are a potential ignition risk to adjacent vegetation, through increased risk of chemical fire or explosion. Transgrid's standard policy and procedures would identify procedures and controls for the storage, handling, and disposal, as well as procedures related to potential spill and clean-up, of dangerous materials.

7.2 Potential impacts from bushfires and firefighting

7.2.1 Asset Protection Zones

A bushfire can impact a structure through direct flame contact, radiant heat and/or ember threatening the structure and people sheltering within it. APZs are a bushfire protection measure that provides a buffer or defendable space around buildings and other assets, commensurate with the construction standards. APZs reduce potential bushfire impacts (where a building is prepared and built-in accordance with bushfire construction standards). APZs would be established from the earliest stages of construction and maintained throughout operation. APZs are described in Section 9.3 and building construction standards in Section 9.7.

7.2.2 Transmission lines and public safety

Transgrid have a mature vegetation management program to manage fire risks, with established standards and procedures, monitoring frameworks and an ongoing cutting program linked to growth rates. Managing safe clearances from transmission line infrastructure reduces the potential for a vegetation fire to start, thereby maintaining public safety, assets, environmental values, and electricity supply. Vegetation management for transmission lines is described in Section 9.4.

Whilst a proportion of the transmission lines proposed for this project would be located near or adjacent to existing transmission lines, the risk of contact with 500 kV transmission lines by aircraft or water-bucket and cable is considered lower than the risk posed by other less visible hazards such as trees, lower voltage transmission lines or distribution lines. Potential risks from transmission lines to ground based firefighting can include situations where dense smoke and hot gases from large fires under or near a transmission line cause arcing. Firefighting control strategies would include consideration of these potential risks across the landscape.

On a site-specific basis, ground-based firefighting, backburning or initial attack on spotfires is not possible within a horizontal distance of approximately 25 metres from the transmission line due to the potential for a phase-to-ground short which may pose a risk to persons, including firefighters. In these circumstances, live transmission lines may pose a constraint to firefighting and property protection where a property or its APZ is located within the 25-metre horizontal distance from the transmission line. There are a total of 31 buildings (residences, and place of worship) within 100 metres of the project footprint (refer to Table 7-1).

Table 7-1 Existing buildings within 100 m of the project footprint

Distance from project	Type of building	Description	Relevance
Within the project footprint	Residences, dilapidated residence	There are nine residences and two dilapidated residences identified within the project footprint.	On a site-specific basis, ground-based firefighting, backburning or initial attack on spotfires within 25 m horizontal distance from the transmission line is not permitted due to potential for phase-to-ground short which may pose a public safety risk to persons. Those at risk include firefighters and persons undertaking property protection located within the 25 m distance from the transmission line when an active fire is present.
0-25 m	Residences, place of worship	There are four residences and one place of worship identified within 25 m of the project footprint	
25-100 m	Residences, possible residence	There are 16 residences and one possible residence identified within 100 m of the project footprint	No elevated fire suppression risk from the project above the residual bushfire risk.

These public safety risks, including transmission line risks, would be managed with procedural controls (such as exclusion of personnel, vehicles and attachments within 25 metres of the transmission line when an active fire is present), community briefings, and incident briefings as part of a bushfire incident action plan. Risk mitigation measures and procedures are included in aircraft operator and firefighter training. Bushfire awareness measures, including those relating to potential transmission line risks, would be included in the project specific BFEMEP.

7.2.3 Access

Access roads established for the operation of the project would provide enhanced vehicle access, emergency service vehicle access, and safe evacuation routes. The project contains several existing access routes. Some new and upgraded temporary and permanent access tracks and roads would be maintained in areas where there are no existing roads or tracks.

During a bushfire event, access roads may be cut off by the bushfire itself, burning or fallen trees, or smoke plumes. Smoke plumes from fires burning under transmission lines may cause a phase-to-ground short which may pose a risk to persons within a horizontal distance of approximately 25 metres from the transmission line, including the use of access roads passing under transmission lines. The potential for access to be cut off during bushfires would be addressed in community emergency messaging and personal bushfire planning. Public safety advice is to leave early and not at the last minute. In firefighting agency procedures, public safety advice is to maintain a 25-metre separation from live transmission lines when active fires are burning under or directly adjacent to an easement including the use of access roads. Access requirements are described further in Section 9.5.1.

The final alignment of the transmission line will be confirmed during detailed design and would consider appropriate access arrangements for each property that can be used for access/egress during an emergency situation.

7.2.4 Water supply and services

Adequate water supply during operation is essential to put out unwanted spot ignitions within bushfire survey areas (including substations and other retained buildings) and provide potential water sources for firefighting agencies. Services (water, electricity, gas, and other services) within bushfire survey areas must be managed so they do not present an unwanted ignition risk. Management of services is described in Section 9.6.

8 Cumulative impacts

8.1 Overview

The cumulative impact assessment aims to assess the scale and nature of the cumulative bushfire impacts of HumeLink in conjunction with other relevant projects. Cumulative bushfire impacts include potential for an increase to the fire risk during construction and operation of the projects where mitigation measures are not implemented.

The cumulative impact assessment was undertaken in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Project* (DPE, 2022). Issues that require cumulative impact assessment are based on:

- the NSW Government's strategic planning framework including relevant legislation, plans, and policies
- current project and future projects that may be developed over the same time
- key matters that could be materially affected by the cumulative impacts
- the likely scale and nature of the cumulative impacts of these projects.

8.2 Relevant projects

Searches for relevant projects were carried out in March 2023 and included the following data sources:

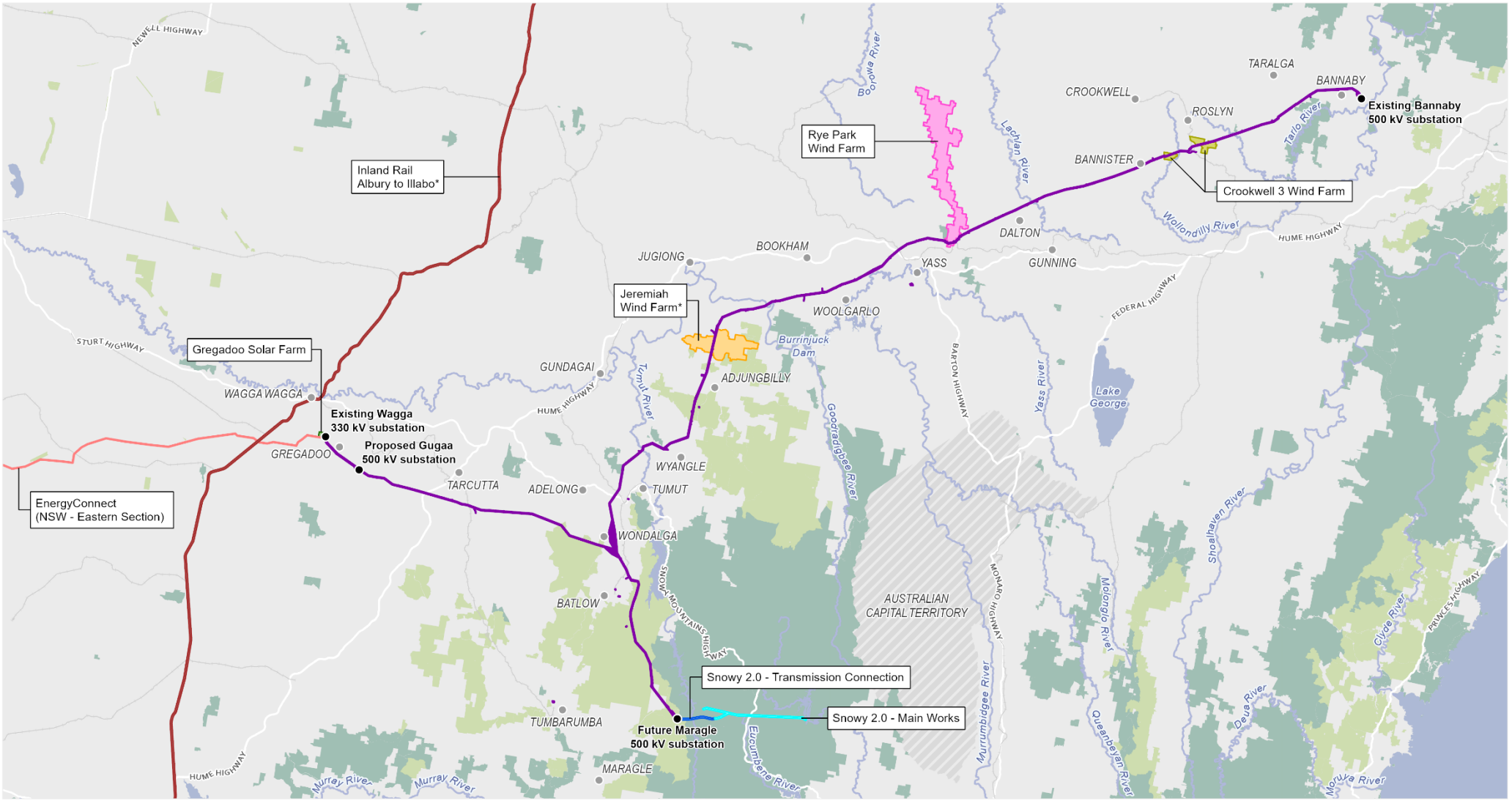
- DPE's Major Projects register
- DPE's Southern Regional Planning Panel project register
- NSW Independent Planning Commission project register
- EPBC Act Public Portal
- Transport for NSW Projects Map.

Searches were limited to the LGAs of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional Upper Lachlan Shire, Goulburn-Mulwaree, and Hilltops.

Based on the above searches, the following projects are to be considered in the cumulative impact assessment for each of the key matters:

- EnergyConnect (NSW – Eastern Section)
- Gregadoo Solar Farm
- Jeremiah Wind Farm
- Rye Park Wind Farm
- Crookwell 3 Wind Farm
- Victoria to NSW Interconnector West (VNI West)
- Snowy 2.0 - Transmission Connection
- Snowy 2.0 - Main Works
- Inland Rail – Albury to Illabo.

Further detail on each of the above projects is provided in Table 8-1 and Figure 8-1 below.



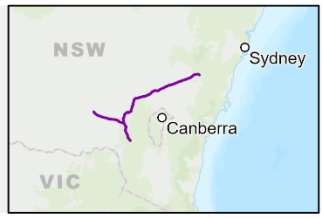
C:\Users\Virgil Robinson\Documents\ArcGIS\Projects\FutureProjects\FutureProjects aprx\31-07-23\Virgil Robinson

Project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation

Relevant future projects

Crookwell 3 Wind Farm
EnergyConnect (NSW - Eastern Section)
Gregadoo Solar Farm
Inland Rail Albury to Illabo*
Jeremiah Wind Farm*
Rye Park Wind Farm
Snowy 2.0 - Main Works
Snowy 2.0 - Transmission Connection

*Note: Subject to approval



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink **Bushfire Assessment**

FIGURE 8-1: Relevant future projects

Table 8-1 Cumulative construction and operational impacts

Future projects	Details	Status	Timing	Distance/ Interface	Cumulative bushfire risk impact
EnergyConnect (NSW – Eastern Section)	■ The project includes a new transmission line connecting the existing Buronga substation and existing Wagga 330 kV substation, and construction of the new Dinawan substation (170 kilometres west of Wagga Wagga). The new transmission line comprises: – 375 kilometres of new 330 kV double circuit transmission line and associated infrastructure between the Buronga substation and the proposed Dinawan 500 kV substation – 162 kilometres of new 500 kV double circuit transmission line (operated at 330 kV) and associated infrastructure between the proposed Dinawan 500 kV substation and the existing Wagga 330 kV substation – connection of the proposed transmission lines to the proposed Dinawan 330 kV substation – construction of a new 330 kV substation around 30 km south of Coleambally, referred to as the proposed Dinawan 500 kV substation. ■ Upgrade and expansion of the Wagga 330 kV substation to accommodate the new transmission line connectors including: – installation of new line bays – relocation and upgrade of existing bays and associated electrical and civil works. ■ The project involves associated infrastructure (optical repeater structures), new and/or upgrade of access tracks as required and ancillary works to support construction.	Approved	Early 2023 – late 2024 Upgrade and expansion of the existing Wagga 330 kV substation as part of EnergyConnect (NSW – Eastern Section) to be completed by August 2024	HumeLink and EnergyConnect (NSW – Eastern Section) both require upgrades of the existing Wagga 330 kV substation	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.

Future projects	Details	Status	Timing	Distance/ Interface	Cumulative bushfire risk impact
Gregadoo Solar Farm	■ Access to site from Boiling Down Road, Gregadoo	EIS approved 2018 Modification 2 approved 2021	Construction was expected to commence mid-2023 9 months to construct	On land adjacent to the existing Wagga 330 kV substation.	Development of Gregadoo Solar Farm would potentially reduce the vegetation hazard present in the surrounding land (which may alter the APZ requirements which would apply) if constructed within 140 meters of the project. Potential bushfire risks are expected to be reduced as built areas are a reduced vegetation hazard compared to the potential return to woodland or unmanaged grassland, provided the project adheres to the requirements and mitigation measures of the BRAR.
Jeremiah Wind Farm	■ The project is located approximately 29 kilometres east of Gundagai around the Adjungbilly area. ■ The project proposes a 65-turbine wind farm with a maximum tip height of 300 metres, battery energy storage system and associated ancillary infrastructure.	EIS in preparation	Project approval anticipated in 2023 Construction expected to be 24 to 30 months	Transmission lines between the proposed Gugaa 500 kV substation and Bannaby 500 kV substation, and future Maragle 500 kV substation and Bannaby 500 kV substation go through the Jeremiah Wind Farm development area	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.
Rye Park Wind Farm	■ The project is located to the west of Rye Park, to the north-west of Yass and south-east of Boorowa. ■ Modified project includes maximum 80 wind turbines with a maximum tip height of 200 metres. The project also includes construction of associated infrastructure (substations, operation, and maintenance facilities) and upgrades to local roads. ■ A 330 kV switching station is proposed to the north of the HumeLink transmission line at Bango.	EIS approved 2017 Modification 1 approved 2021 Modification 2 preparation 2022	Under construction since December 2021 with commissioning scheduled for June 2023 Original EIS suggested an 18–24-month construction period	Transmission lines between the proposed Gugaa 500 kV substation and Bannaby 500 kV substation, and future Maragle 500 kV substation and Bannaby 500 kV substation go through the southern end of the wind farm project boundary at Bango (near Bango Nature Reserve). HumeLink includes the connection of optical ground wire (OPGW) from the HumeLink 500 kV transmission line into the Rye Park 330 kV switching station auxiliary services building (the Rye Park Wind Farm substation).	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.

Future projects	Details	Status	Timing	Distance/ Interface	Cumulative bushfire risk impact
Crookwell 3 Wind Farm	■ 16 wind turbines up to 157 m in height, connected to the grid via the 330 kV transmission line.	Determination Addendum EIS approved 2019	Detailed design and pre-construction activities are being carried out with main construction work expected to take about 18 months once commenced	The project footprint intersects the site area for the proposed development, which is located adjacent to the Crookwell 2 Wind Farm, approximately 18.5 kilometres southeast of Crookwell.	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.
Victoria to NSW Interconnector West (VNI West)	■ The project involves targeted interconnector expansion between Victoria and NSW to address transmission network limitations and improve supply reliability. ■ VNI West is still in scoping/market modelling phase to assess the technical and economic viability of expanding transmission interconnector capacity between Victoria and NSW. ■ Several options have been developed with new interconnector corridors (VNI 6 – 8) connecting to the existing Wagga Wagga substation.	Scoping/ market modelling phase Underwriting agreement with Commonwealth Government April 2022	Construction proposed to commence in in 2026 with commissioning by 2028.	VNI West may require connection at the existing Wagga 330 kV substation (depending on preferred option) The current scope that interfaces with HumeLink includes a new double circuit transmission line between Wagga 330 kV substation and Gugaa 500 kV substation to extend the EnergyConnect lines, upgrade above lines to 500 kV and at Gugaa a cut in Line 51 and one additional transformer.	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.

Future projects	Details	Status	Timing	Distance/ Interface	Cumulative bushfire risk impact
Snowy 2.0 - Transmission Connection	▪ New transmission connection between the proposed Snowy 2.0 pumped hydro and generation project to the existing high voltage transmission network. ▪ A new substation located within Bago State Forest (future Maragle 500 kV substation) and adjacent to Transgrid's existing Line 64 that forms a 330 kV connection between Upper and Lower Tumut switching stations. ▪ Upgrade and widening of an existing access road of Elliot Way to the substation including the construction of new driveways into the 330 kV and 500 kV switchyards. ▪ Two new 330 kV overhead double-circuit transmission lines from the Snowy 2.0 cable yard to the new substation. ▪ Short overhead 330 kV transmission line connection (approximately 300 m in length) comprising both steel lattice structures and pole structures as required between the substation and Line 64.	EIS approved 2022	Construction expected to begin in late 2023 with expected completion by end of 2025	HumeLink to connect to the future Maragle 500 kV substation being constructed as part of the Snowy 2.0 – Transmission Connection project.	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR. The construction of Maragle 500 kV substation and associated clearing would reduce vegetation and slope risks adjacent to Maragle 500 kV substation compound (C05) (which may alter APZ requirements and the BAL determination for building construction). Cumulative impacts on bushfire risk are expected to be reduced as built areas are a reduced vegetation hazard compared to forest vegetation.
Snowy 2.0 - Main Works	▪ The project includes an underground pumped hydro power station and ancillary infrastructure.	EIS approved 2020 Modification 1 approved 2022	Construction began in October 2020 with expected completion by 2026	Talbingo Reservoir site is approximately five kilometres east of the project footprint.	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.
Inland Rail – Albury to Illabo	▪ Upgrade 185 km of rail track from Albury to Illabo. ▪ The upgrade of rail track passes through Wagga Wagga. ▪ Key issues could include worker availability and accommodation capacity around Wagga Wagga during peak construction periods with a large influx of workers using short-term accommodation during the scheduled rail possessions in March and September 2024.	EIS exhibited between 17 August 2022 and 28 September 2022 Responding to submissions	Construction to commence in early 2024 and is expected to take about 16 months	Roughly 9 km north-west of existing Wagga 330 kV substation	No elevated impacts on landscape bushfire risk, provided the project adheres to the requirements and mitigation measures of the BRAR.

9 Management of impacts

9.1 Overview of approach

Strategies to manage overall bushfire risk include:

- control for risks through engineering design, with reference to construction requirements, BAL, and access routes; and consideration of bushfire risk during development of the transmission line route option
- control for risks through land management, with reference to APZs and in consideration of existing land features such as slope, vegetation and climate, and transmission line clearances
- emergency preparedness and response procedures.

These are outlined in further detail in the following sections. Summary of mitigation measures is provided in Section 9.9.

9.2 Project Bush Fire Emergency Management and Evacuation Plan

Transgrid's BRMP (Transgrid, 2021) and associated vegetation management, and infrastructure inspection procedures provide overarching methodology on how inspection and maintenance activities on Transgrid's assets would be carried out prior to and during the bushfire danger period. These include the requirements for ignition prevention and vegetation clearance. Based on these requirements, a project specific BFEMEP would be prepared for construction and operation by suitably qualified personnel and include:

- Bushfire Emergency Evacuation Plan (BEEP)
- BRMP protocols during construction, considering activities during days with fire danger rating 'high' or greater
- bushfire mitigation measures
- bushfire risk induction and training for personnel, including risks and management measures associated with construction equipment and activities.

9.3 Asset Protection Zones

9.3.1 Dimensions

An APZ is a bushfire protection measure, providing a buffer around assets, established from the earliest stages of construction, and maintained throughout operation. APZs are designed and maintained to reduce fuel near assets, and to reduce the potential for damage from direct flame contact, smoke, radiant heat, and ember attack. The dimensions for APZs are designed in line with PBP requirements (NSW RFS, 2019), and are determined by surrounding vegetation type, slope, and the type of asset/development. The APZ and the BAL identified for each bushfire survey area (refer to Section 9.7.2 for BAL).

APZs for bushfire survey areas were calculated based on clearing vegetation within the construction work sites. The APZ requirements, and the bushfire hazards which inform APZ dimensions for each bushfire survey area, are detailed in Table 9-3 to Table 9-17 (where slope and vegetation differ within the direction from site boundary, the most hazardous slope and vegetation are indicated).

9.3.2 APZ maintenance

In accordance with PBP (NSW RFS, 2019) requirements, APZs should be in place prior to the Bush Fire Danger Period and be maintained continuously throughout. The statutory Bush Fire Danger Period runs from 1 October to 31 March, subject to adjustments (NSW RFS, 2021). Refer to Section 5.1 for the specific bushfire danger periods for each bushfire survey area, as indicated in the regional BRMPs.

APZs consist of two areas, the Inner Protection Area and the Outer Protection Area, which are informed by PBP (NSW RFS, 2019), as outlined in Table 9-1. Allowable Outer Protection Areas are described in PBP (NSW RFS, 2019) Table A1.12.4. Most of the vegetation within the project footprint is forest, woodland, or grassland (refer to Section 5.6 for existing vegetation). Vegetation thinning may be required to adhere to the APZ requirements throughout the duration of construction of the project, and in perpetuity.

Table 9-1 APZ requirements: Inner Protection Area and Outer Protection Area (NSW RFS, 2019).

Vegetation Type	Inner Protection Area	Outer Protection Area
Trees	■ The mature tree canopy cover should be less than 15%. ■ Trees should not touch or overhang the buildings. ■ The lower limbs of trees should not less than 2 m in height. ■ Canopies should be separated by 2-5 m.	■ Tree canopy cover should be less than 30%. ■ Tree canopy cover should be separated by 2-5 m.
Shrubs	■ Shrubs should have large gaps in vegetation. ■ Shrubs should not be located under trees. ■ Shrubs should not constitute more the 10% ground cover. ■ Shrubs should be distanced from windows and doors by a distance at least twice the height of the vegetation.	■ Shrubs should not form a continuous canopy. ■ There should be no more than 20% ground cover.
Grasses	■ Grasses should be mown lower than 100 mm in height. ■ Leaves/ vegetation debris should be removed.	■ Grasses should be mown lower than 100 mm height. ■ Leaves/ vegetation debris should be removed.

9.3.3 APZ requirements

APZs are assessed for each bushfire survey area in accordance with the PBP performance criteria and acceptable solutions (NSW RFS, 2019) (refer to Table 9-2). APZs and the specific APZ landscaping requirements are not required to be assessed for the entire transmission line easement or other areas of the project (refer to Section 7.2.2 for transmission line vegetation management). For each bushfire survey area, nominated APZs are based on a BAL-29 separation distance, with the exception of the worker accommodation facility (AC1), which as an SFPP development requires a larger APZ. Buildings with a BAL-29 rating would be exposed to associated radiant heat levels exceeding 29 kW/m² (based on a flame temperature of 1090 Kelvin (K)).

Table 9-2 Performance criteria and acceptable solutions for APZs and Landscaping (NSW RFS, 2019)

Performance Criteria	Acceptable Solution	Bushfire survey area	Notes	Complies / Will comply
Asset Protection Zone				
Bushfire survey areas: Potential building footprints must not be exposed to radiant heat levels exceeding 29 kW/m² on each proposed lot (substations and construction compounds)	**Bushfire survey areas:** APZs are provided in accordance with Tables A1.12.2 and A1.12.3 based on the FFDI	Wagga 330 kV substation and Wagga 330 kV substation compound (C01)		✓
		Snowy Mountains Highway compound (C02)		✓
		Snubba Road compound (C03)		✓
		Maragle 500 kV substation compound (C05)	BAL-Flame Zone	-
		Gugaa 500 kV substation and Gregadoo Road compound (C06)		✓
		Honeysuckle Road compound (C07)		✓
		Red Hill Road compound (C08)		✓
		Adjungbilly Road compound (C09)		✓
		Yass substation compound (C10)		✓
		Woodhouselee Road compound (C11)		✓
		Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)		✓
		Memorial Avenue compound (C14)		✓
		Bowman's Lane compound (C15)		✓
		Snubba Road compound (C16)		✓
Worker accommodation facilities: Potential building footprints must not be exposed to radiant heat levels exceeding 10 kW/m² for SFPP developments (worker accommodation facilities)	**Worker accommodation facilities:** The building is provided with an APZ in accordance with Table A1.12.1 in Appendix 1 of PBP.	Tumbarumba Accommodation Facility (AC1)	SFPP development and requires larger APZ	✓
APZs are managed and maintained to prevent the spread of a fire towards the building.	APZs are managed in accordance with the requirements of Appendix 4 of PBP.	Wagga 330 kV substation and Wagga 330 kV substation compound (C01)		✓
		Snowy Mountains Highway compound (C02)		✓
		Snubba Road compound (C03)		✓
		Maragle 500 kV substation compound (C05)		✓
		Gugaa 500 kV substation and Gregadoo Road compound (C06)		✓
		Honeysuckle Road compound (C07)		✓
		Red Hill Road compound (C08)		✓
		Adjungbilly Road compound (C09)		✓
		Yass substation compound (C10)		✓
		Woodhouselee Road compound (C11)		✓
		Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)		✓
		Memorial Avenue compound (C14)		✓

Performance Criteria	Acceptable Solution	Bushfire survey area	Notes	Complies / Will comply
		Bowman's Lane compound (C15)		✓
		Snubba Road compound (C16)		✓
		Tumbarumba Accommodation Facility (AC1)		✓
The APZs is provided in perpetuity	APZs are wholly within the boundaries of the development site.	Wagga 330 kV substation and Wagga 330 kV substation compound (C01)		✓
		Snowy Mountains Highway compound (C02)		✓
		Snubba Road compound (C03)		✓
		Maragle 500 kV substation compound (C05)		✓
		Gugaa 500 kV substation and Gregadoo Road compound (C06)		✓
		Honeysuckle Road compound (C07)		✓
		Red Hill Road compound (C08)		✓
		Adjungbilly Road compound (C09)		✓
		Yass substation compound (C10)		✓
		Woodhouselee Road compound (C11)		✓
		Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)		✓
		Memorial Avenue compound (C14)		✓
		Bowman's Lane compound (C15)		✓
		Snubba Road compound (C16)		✓
	Worker accommodation facilities: Other structures located within the APZ need to be located further than 6 metres from the refuge building.	Tumbarumba Accommodation Facility (AC1)		✓
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are located on lands with a slope less than 18 degrees.	Wagga 330 kV substation and Wagga 330 kV substation compound (C01)		✓
		Snowy Mountains Highway compound (C02)		✓
		Snubba Road compound (C03)		✓
		Maragle 500 kV substation compound (C05)		✓
		Gugaa 500 kV substation and Gregadoo Road compound (C06)		✓
		Honeysuckle Road compound (C07)		✓
		Red Hill Road compound (C08)		✓
		Adjungbilly Road compound (C09)		✓
		Yass substation compound (C10)		✓
		Woodhouselee Road compound (C11)		✓
		Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)		✓
		Memorial Avenue compound (C14)		✓
		Bowman's Lane compound (C15)		✓

Performance Criteria	Acceptable Solution	Bushfire survey area	Notes	Complies / Will comply
		Snubba Road compound (C16)		✓
		Tumbarumba Accommodation Facility (AC1)		✓
Landscaping				
Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	Landscaping is in accordance with Appendix 4; and fencing is constructed in accordance with Chapter 7.6 of PBP.	Wagga 330 kV substation and Wagga 330 kV substation compound (C01)		✓
		Snowy Mountains Highway compound (C02)		✓
		Snubba Road compound (C03)		✓
		Maragle 500 kV substation compound (C05)		✓
		Gugaa 500 kV substation and Gregadoo Road compound (C06)		✓
		Honeysuckle Road compound (C07)		✓
		Red Hill Road compound (C08)		✓
		Adjungbilly Road compound (C09)		✓
		Yass substation compound (C10)		✓
		Woodhouselee Road compound (C11)		✓
		Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)		✓
		Memorial Avenue compound (C14)		✓
		Bowman's Lane compound (C15)		✓
		Snubba Road compound (C16)		✓
		Tumbarumba Accommodation Facility (AC1)		✓

The APZ requirements, and the bushfire hazards, which inform APZ dimensions for each bushfire survey area are detailed in Table 9-3 to Table 9-17. Where APZs differ in each direction depending on distance to vegetation, the largest APZ is listed). Refer to Attachment A for detailed APZ.

Table 9-3 Wagga 330 kV substation and Wagga 330 kV substation compound (C01): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 0 - 5°	Woodland/ grassland	8 m
South	Downslope 0 - 5°	Woodland	6 m
East	Downslope 0 - 5°	Woodland/ grassland	8 m
West	Downslope 0 - 5°	Woodland/ grassland	19 m

Table 9-4 Snowy Mountains Highway compound (C02): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 0 - 5°	Forest	16 m
South	Downslope 0 - 5°	Forest	13 m
East	All flat/ upslope	Forest	11 m
West	N/A- no vegetation hazard	N/A- no vegetation hazard	19 m

Table 9-5 Snubba Road compound (C03): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	All flat/ upslope	Forest/ grassland	21 m
South	Downslope 15 - 20°	Forest/ grassland	8 m
East	Downslope 15 - 20°	Forest/ grassland	12 m
West	Downslope 0 - 5°	Forest/ grassland	9 m

Table 9-6 Maragle 500 kV substation compound (C05): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-FZ) (AS 3959-2018)
North	Downslope 10 - 15°	Forest	BAL-FZ (refer to Figure A-4)
South	Downslope 5 - 10°	Forest	BAL-FZ (refer to Figure A-4)
East	Downslope 5 - 10°	Forest	BAL-FZ (refer to Figure A-4)
West	Downslope 5 - 10°	Forest	BAL-FZ (refer to Figure A-4)

Table 9-7 Gugaa 500 kV substation and Gregadoo Road compound (C06): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 5 - 10°	Grassland	9 m
South	All flat/ upslope	Grassland	9 m
East	All flat/ upslope	Grassland	9 m
West	All flat/ upslope	Grassland	9 m

Table 9-8 Honeysuckle Road compound (C07): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 5 - 10°	Woodland	25 m
South	All flat/ upslope	Forest	21 m
East	All flat/ upslope	Forest	28 m
West	Downslope 0 - 5°	Forest	39 m

Table 9-9 Red Hill Road compound (C08): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 5 - 10°	Forest	29 m
South	Downslope 0 - 5°	Forest	22 m
East	Downslope 0 - 5°	Forest	19 m
West	Downslope 0 - 5°	Forest	24 m

Table 9-10 Adjungbilly Road compound (C09): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 0 - 5°	Forest	25 m
South	Downslope	Forest	32 m
East	All flat/ upslope	Forest/ grassland	24 m
West	All flat/ upslope	Forest	25 m

Table 9-11 Yass substation compound (C10): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 0 - 5°	Grassland	10 m
South	All flat/ upslope	Grassland	8 m
East	Downslope 0 - 5°	Grassland	9 m
West	Downslope 5 - 10°	Grassland	10 m

Table 9-12 Woodhouselee Road compound (C11): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	All flat/ upslope	Grassland	9 m
South	Downslope 5 - 10°	Grassland	9 m
East	All flat/ upslope	Grassland	9 m
West	Downslope 10 - 15°	Grassland	9 m

Table 9-13 Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	All flat/ upslope	Forest	21 m
South	All flat/ upslope	Woodland	10 m
East	Downslope 0 - 5°	Woodland	35 m
West	All flat/ upslope	Woodland	8 m

Table 9-14 Memorial Avenue compound (C14): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	All flat/ upslope	N/A	N/A
South	Downslope 0 - 5°	Forest	21 m
East	Downslope 0 - 5°	Forest	24 m
West	Downslope 0 - 5°	Forest	18 m

Table 9-15 Bowmans Lane compound (C15): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 5 - 10°	Forest/ grassland	14 m
South	All flat/ upslope	Forest/ grassland	11 m
East	Downslope 15 - 20°	Forest/ grassland	17 m
West	Downslope 0 - 5°	Forest/ grassland	9 m

Table 9-16 Snubba Road compound (C16): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	APZ requirement (BAL-29) (AS 3959-2018)
North	Downslope 0 - 5°	Forest	21 m
South	Downslope 5 - 10°	Forest	27 m
East	Downslope 0 - 5°	Forest	19 m
West	All flat/ upslope	Forest	22 m

Table 9-17 Tumbarumba Accommodation Facility (AC1): Bushfire hazard analysis and APZ requirements

Direction from site boundary	Slope	Vegetation	SFPP APZ width required based on Table A1.12.1 of PBP
North	All flat/ upslope	Grassland	36 m
South	All flat/ upslope	Forest / Grassland	67 m / 37 m
East	All flat/ upslope	Forest / Grassland	67 m / 37 m
West	All flat/ upslope	Grassland	37 m

9.4 Transmission line vegetation management

To manage bushfire risks on its existing transmission network, Transgrid maintains a vegetation clearance and vegetation management program, focused on removing all tall woody vegetation growing in the easement, in accordance with Transgrid's BRMP (Transgrid, 2021). The objective of vegetation management is to remove vegetation that has the potential to grow into the clearance space and reduce fuel load under the assets, therefore reducing potential fire threats. This is achieved through a combination of chemical control, individual tree trimming/ removal and mechanical treatment to prevent woody vegetation within and directly adjacent to the corridor from growing back. Vegetation management is completed in accordance with Transgrid's BRMP (Transgrid, 2021) and Industry Safety Steering Committee Guidelines *ISSC3 – Guideline for Managing Vegetation near Powerlines* (Resources and Energy NSW, 2016) based on the distances identified in AS/NZS7000:2016 *Overhead Line Design*. Vegetation management is in accordance with the project specific strategy developed for vegetation clearance – *HumeLink Vegetation Clearing Method and Management Memorandum* (Transgrid, 2023). Easement widths and vegetation clearance widths are shown in Table 9-19, with annual regrowth rates along the easement considered moderate (0.5 to 1 metre per year) to fast (greater than 1.5 metres per year).

Transgrid's vegetation clearance requirements (Transgrid, 2020b) include:

- vegetation which may impede on the vegetation clearance requirements, as assessed by a Level 4 or Level 5 arborist
- vegetation within 20 meters of transmission line structures
- hazardous trees within the easement, hazardous trees are those which pose a risk of infringing on the vegetation clearance requirements if they fall
- hazardous trees outside the easement, as assessed by a Level 4 or Level 5 arborist.

Undergrowth and scrub removal is required only in accordance with the vegetation clearance requirements (refer to Table 9-18 and Table 9-19).

Table 9-18 Transgrid's vegetation clearance requirements for 500 kV Transmission Lines (Transgrid, 2020b)

Nominal system voltage	Vegetation clearance at maximum line operating conditions (+regrowth allowance)
500 kV	3.9 m (+regrowth allowance)

Table 9-19 Transmission Line Design Standard: vegetation clearance requirements for 500 kV transmission easements (Transgrid 2018)

Design standard	Requirement for 500 kV transmission lines
Easement width	Double circuit – 70 m Single circuit – 80 m Transposition locations may require easements of up to 110 m and up to 130 m wide where new transmission line would parallel the relocated section of Line 51.
Vegetation clearance (safe working distance plus regrowth rate)	3.9 m plus regrowth allowance
Horizontal clearance space without sway/sag allowance	6.4 m
Vertical clearance space without sway/sag allowance	6.4 m
Width around any structure (minimum)	15 m

Vegetation is managed within easements on a cyclical basis to trim, cut or remove vegetation from the clearance space horizontally and vertically within the easement. Vegetation management also includes the removal of potential grow-in and fall-in vegetation hazards or hazard trees. As transmission line structures are located within easements, vegetation management within easements apply to areas surrounding the structures.

The frequency of vegetation management is dependent on the type of vegetation, broader environmental conditions, and previous experience in equivalent landscape settings. Consideration would also be given to the potential for conductor sag, blow-out, and swing in determining clearances and the frequency of cutting cycles. The need for vegetation management would be linked to and confirmed by inspection. Clearance distances and heights would be based on those identified in AS/NZS7000:2016 *Overhead Line Design*.

The easements for the project (500 kV transmission lines) would typically be 70 metres wide, but may require easements up to 110 metres wide at transposition locations and up to 130 metres wide where a new transmission line would parallel the relocated section of Line 51. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets. The easement also generally identifies the zone of initial vegetation clearance and ongoing vegetation management to enable safe electrical clearances during the operation of the lines. This does not involve the complete removal of trees and other vegetation within the easement.

9.5 Access

9.5.1 Access requirements

Access routes are only considered in relation to the bushfire survey areas in accordance with PBP (NSW RFS, 2019). The worker accommodation facility (AC1) is classified as NCC Class 3 building and an SFPP development, and therefore is subject to specific bushfire protection requirements. Although the bushfire survey areas are identified as NCC Class 8 buildings under the BCA, which have no specific bushfire protection requirements, structures located on BFPL must be assessed to satisfy the aims and objectives outlined in PBP (NSW RFS 2019). Therefore, access routes were assessed for all bushfire survey areas (substations, construction compounds, worker accommodation facilities) to satisfy the aims and objectives outlined in PBP (NSW RFS, 2019).

In accordance with the PBP (NSW RFS, 2019), primary and secondary access routes should be provided for locations with buildings where people may work or use for accommodation purposes (which comprise the bushfire survey areas). The project contains several existing primary and secondary access routes to the bushfire survey areas (refer to Table 5-5). New and upgraded temporary and permanent access tracks and roads would be constructed in areas where there are no existing roads or tracks.

In accordance with the PBP (NSW RFS, 2019), access roads should have adequate capacity for firefighting vehicles, and firefighting vehicles should have safe all-weather access to hazards and assets. Access roads are designed to allow safe access and egress for emergency services vehicles and evacuating personnel. Primary and secondary roads are required to be in accordance with the criteria outlined in the PBP (NSW RFS, 2019) and/or *NSW Fire Trail Standards* (NSW RFS, 2016) and *NSW RFS Fire Trail Construction and Design Maintenance Manual* (Soil Conservation Service, 2017). Existing primary and secondary access routes for bushfire survey areas are outlined in Section 5.8. Access tracks within State forests which are the responsibility of Transgrid must meet FCNSW requirements (State Forest NSW, 1999; Soil Conservation Service, 2017).

It is noted that when heavy smoke plumes are present and extending upwards within transmission line easements, smoke plumes have the potential to cause a phase-to-ground short, which may pose a risk to persons within a horizontal distance of approximate 25 metres from the transmission line. Under such conditions, access under transmission lines may be an elevated risk, although the risk of an advancing fire is significantly greater. This access consideration would be addressed through community emergency messaging. Personal bushfire planning would include having a pre-prepared personal bushfire management plan based on the template provided by fire authorities, leaving early in the event of bushfire, and adhering to firefighting agency procedures which require maintaining a 25-metre separation from transmission lines when active fires are burning under or directly adjacent to an easement.

The final alignment of the transmission line will be confirmed during detailed design and would consider appropriate access arrangements for each property that can be used for access/egress during an emergency situation.

Compliance with the PBP acceptable solutions for access routes (refer to Table 9-20) was assessed for all the bushfire survey areas and are shown in Table 9-20.

Table 9-20 Performance criteria and acceptable solutions for access routes

Performance Criteria (NSW RFS, 2019)	Acceptable solutions (NSW RFS, 2019)	Access notes	Complies/ will comply
General access requirements			
Firefighting vehicles are provided with safe, all-weather access to structures	Property access roads are two-wheel drive, all-weather roads	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Access is provided to all structures.	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Traffic management devices are constructed to not prohibit access by emergency services vehicles	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Access roads must provide suitable turning areas in accordance with Appendix 3 of PBP	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	One way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Perimeter roads are provided for residential subdivisions of three or more allotments	N/A	-
	Subdivisions of three or more allotments have more than one access in and out of the development	N/A	-
	Traffic management devices are constructed to not prohibit access by emergency services vehicles	N/A	-
	Maximum grade for sealed roads is 15°, and maximum average grade is 10° (or other gradient specified by road design standards),	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓

Performance Criteria (NSW RFS, 2019)	Acceptable solutions (NSW RFS, 2019)	Access notes	Complies/ will comply
	All roads are through roads, and where dead ends are unavoidable, the maximum length should be 200 m, minimum 12 m outer radius turning circle, with appropriate signage	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Roll top curbing adjacent to the hazard	N/A	-
	Secondary access each to an alternate point on the existing public road system, where access/egress is through forest, woodland, or heath vegetation	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	One way only public access roads are no less than 3.5 m wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.	N/A	-
The capacity of access roads is adequate for firefighting vehicles	Road surfaces and bridges/causeways adequate to carry up to 23 tonnes, load rating clearly marked	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
There is appropriate access to water supply	Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP) unless static water and hydrant supply is provided.	✓
	Hydrants are provided in accordance with the relevant clauses of Australian Standard 2419.1:2005 (AS2419.1:2005) *Fire hydrant installations - System design, installation, and commissioning* (Standards Australia, 2015a)	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP) unless static water and hydrant supply is provided.	✓
	There is suitable access for a Category 1 fire appliance to within 4 m of the static water supply where no reticulated supply is available.	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
Perimeter roads			
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface	Two-way sealed roads	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Minimum 8 m width carriageway	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Appropriate parking areas and hydrant access (outside carriage way and parking, ideally opposite side of the road from the hazard)	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Hydrants are located clear of parking areas	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Through roads, and linked to internal road system at minimum every 500 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Curves of roads have a minimum inner radius of 6 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	The maximum grade road is 15° and average grade of not more than 10°	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓

Performance Criteria (NSW RFS, 2019)	Acceptable solutions (NSW RFS, 2019)	Access notes	Complies/ will comply
	Road crossfall maximum 3°	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Unobstructed vehicle clearance height minimum 4 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
Non-perimeter roads			
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating	Minimum 5.5 m width carriageway	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Appropriate parking areas and hydrant access (outside carriage way and parking, ideally opposite side of the road from the hazard); hydrants located clear of parking areas	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Through roads, and linked to internal road system at minimum every 500 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Curves of roads have a minimum inner radius of 6 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Road crossfall maximum 3°	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Unobstructed vehicle clearance height minimum 4 m	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
Property access			
Firefighting vehicles can access the dwelling and exit the property safely	There are no specific access requirements in an urban area where an unobstructed path (no greater than 70 m) is provided between the most distant external part of the proposed residence and the nearest part of the public access road (where the road speed limit is not greater than 70 kph) that supports the operational use of emergency firefighting vehicles Or the following apply: ■ minimum 4 m width carriageway ■ in forest, woodland and heath situations, rural property access roads have passing bays every 200 m that are 20 m long by 2 m wide, making a minimum trafficable width of 6 m at the passing bay ■ unobstructed vehicle clearance height minimum 4 m Road crossfall maximum 10° ■ provide a suitable turning area in accordance with Appendix 3 of PBP (NSW RFS, 2019) ■ curves of roads have a minimum inner radius of 6 m, minimal curves; the minimum distance between inner and outer curves is 6 m ■ maximum grade for sealed roads is 15°, and maximum grade for unsealed is 10° ■ a development comprising more than three residences has access by dedication of a road and not by right of way.	N/A. The bushfire survey areas would have public road access points.	-

9.6 Water supply and services

Adequate water supply is essential to put out unwanted spot ignitions and to provide potential water sources for firefighting agencies within bushfire survey areas. Temporary water supplies may be required during construction, including spray packs or vehicle mounted tanks. These requirements would be detailed in the contractor's CEMP and the HumeLink BFEMEP.

Water supply for the bushfire survey areas would be sourced from several locations. Adequate water supply is to be maintained in accordance with PBP requirements (NSW RFS, 2019) throughout construction and operation of the project. Appropriate water supply for firefighting and appropriate location of utilities are important mitigation measures of bushfire risk during construction. Performance criteria and acceptable solutions for utilities (water supply, electricity, and gas) for the bushfire survey areas are extracted from PBP (NSW RFS, 2019) and outlined in Table 9-21.

Table 9-21 Performance criteria and acceptable solutions for water, electricity, and gas (NSW RFS, 2019)

Performance Criteria	Acceptable solutions	Comments	Complies/ will comply
Water services			
Adequate water supplies for firefighting purposes	Reticulated water is to be provided to the development where available	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP) unless static water and hydrant supply is provided.	✓
	A static water and hydrant supply is provided for non-reticulated developments or where reticulated water supply cannot be guaranteed	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Static water supplies shall comply with Table 5.3d in PBP	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	A minimum of 10,000 L static water supply for firefighting purposes is provided for each occupied building where no reticulated water is available.	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
Water supplies are located at regular intervals, and are accessible and reliable for firefighting operations	Fire hydrant, spacing, design and sizing complies with the relevant clauses of AS2419.1:2005 *Fire hydrant installations System design, installation, and commissioning*	Relevant for substations and Tumbarumba Accommodation Facility (AC1) unless static water and hydrant supply is provided.	✓
	Hydrants are not located within any road carriageway	Relevant for substations and Tumbarumba Accommodation Facility (AC1) unless static water and hydrant supply is provided.	✓
	Reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads.	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	
Flows and pressure are appropriate	Fire hydrant flows and pressures comply with the relevant clauses of AS2419.1:2005 *Fire hydrant installations System design, installation, and commissioning*	Relevant for substations and Tumbarumba Accommodation Facility (AC1) (SFPP).	✓

Performance Criteria	Acceptable solutions	Comments	Complies/ will comply
Integrity of the water supply is maintained	All above-ground water service pipes are metal, including and up to any taps	Relevant for substations and Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Above-ground water storage tanks shall be of concrete or metal	Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
SFPP: Water supplies are adequate in areas where reticulated water is not available	A connection for firefighting purposes is located within the inner protection area of the APZ, or the non-hazard side, and is located away from the structure. A 65-mm Storz outlet with a ball valve is fitted to the outlet. Ball valve and pipes are adequate for water flow and are metal.	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Supply pipes from tank to ball valve have the same bore size to ensure flow volume	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Underground tanks have an access hole of 200 mm to allow tankers to refill direct from the tank; and are clearly marked.	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	A hardened ground surface for truck access is supplied within 4 m of the access hole	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Unobstructed access is provided at all times	Relevant for Tumbarumba Accommodation Facility (AC1).	✓
	Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Where pumps are provided- minimum 5hp or 3kW petrol or diesel-powered pump and are shielded against bushfire attack. Any hose and reel for firefighting connected to the pump-19 mm internal diameter	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Fire hose reels are constructed in accordance with Australia/New Zealand Standard 1221:1997 (AS/NZS1221:1997) *Fire hose reels* and installed in accordance with the relevant clauses of Australian Standard 2441:2005 (AS2441:2005) *Installation of fire hose reels* (Standards Australia, 2005b).	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓

Performance Criteria	Acceptable solutions	Comments	Complies/ will comply
Electricity services			
Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings	Where practicable, electrical transmission lines are underground	Referring to distribution lines to buildings, not transmission lines. Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Where overhead, electrical transmission lines are proposed as follows: ■ Lines are installed with short pole spacing of 30 metres, unless crossing gullies, gorges, or riparian area ■ No part of a tree is closer to a power line than the distance set out in *ISSC3 – Guideline for Managing Vegetation near Powerlines* (Resources and Energy NSW, 2016) for managing vegetation near power lines.	Referring to distribution lines to buildings, not transmission lines. Relevant for all bushfire survey areas including Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
Gas services			
Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	Reticulated or bottled gas is installed and maintained in accordance with Australia/New Zealand Standard 1596:2014 (AS/NZS1596:2014) *The storage and handling of LP Gas*, the requirements of relevant authorities, and metal piping is used	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 m and shielded on the hazard side	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Connections to and from gas cylinders are metal	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Polymer-sheathed flexible gas supply lines are not used	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	Above-ground gas service pipes are metal, including and up to any outlets	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓
	If gas cylinders need to be kept close to the building, safety valves are directed away from the building and at least 2m away from any combustible material, so they do not act as a catalyst to combustion	Relevant for Tumbarumba Accommodation Facility (AC1) (SFPP).	✓

9.7 Construction standards and building requirements

Construction standards and building requirements are measures to prevent loss of life and loss of structures, through adequately accounting for environmental conditions. Construction standards in accordance with AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* are necessary to protect buildings within bushfire survey areas from fire.

Construction standards are based on the following:

- PBP (NSW RFS, 2019) performance criteria and acceptable solutions for APZs and landscaping (refer to Section 9.3), access routes (refer to Section 9.5), and services (water, electricity, and gas) (refer to Section 9.6)
- NCC performance requirements for the construction of buildings in bushfire prone areas: performance requirements apply to buildings designated Class 1-4, some designated Class 10, and buildings considered SFPP. For buildings in designated BFPL areas, the NCC references the AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* and the *NASH Standard: Steel Framed Construction in Bushfire Areas 2014*. There are no specific bushfire protection requirements for NCC Class 5-8 buildings under the BCA, however, structures located on BFPL must satisfy the aims and objectives outlined in PBP (NSW RFS, 2019).

Design and construction of transmission lines would be in accordance with the AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* and Transmission Line Design Standard (Transgrid, 2018).

9.7.1 NCC bushfire protection requirements

The Tumbarumba Accommodation Facility (AC1) is considered a NCC Class 3 building under the BCA and an SFPP development under the *Rural Fires Act 1997* as short-stay use is anticipated and occupants may be unfamiliar with the area. Buildings anticipating short-stay use are considered a higher risk than long-stay use and therefore short-stay use has been applied to provide a conservative assessment. SFPP developments are subject to specific bushfire protection requirements with reference to construction standards (refer to Table 9-22).

Table 9-22 Performance criteria and acceptable solutions for construction standards: SFPP developments (NSW RFS, 2019)

Performance Criteria	Acceptable solutions	Comments	Complies/ will comply
The proposed building can withstand bushfire attack in the form of wind, embers, radiant heat, and flame contact	A construction level of BAL-12.5 under AS 3959 or NASH Standard and section 7.5 of PBP is applied.	Relevant for Tumbarumba Accommodation Facility (AC1)	✓

All other bushfire survey areas are identified as NCC Class 8 buildings under the BCA (refer to Table 9-23) and therefore have no specific bushfire protection requirements under the BCA. However, all proposed buildings must be constructed in accordance with BAL under AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas*. The NCC building classification (ABCB, 2019), and the FFDI, the APZ, and the BAL for each bushfire survey area are outlined in Table 9-23.

9.7.2 Bushfire Attack Levels

All proposed buildings must be constructed in accordance with BAL under AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas*. BAL is a way of measuring the severity of potential ember attack, radiant heat, and direct flame contact, to a building. BAL is used to specify the construction requirements necessary to protect buildings from bushfire in accordance with AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* and the NCC (Australian Building Codes Board (ABCB), 2019). There are six levels of BAL across a 100 metre guideline radius, with buildings designated BAL-40 and BAL-Flame Zone at highest risk of bushfire effects due to the geography of the surrounding area and proximity of vegetation generating the greatest flame and radiant heat impacts. The 100 metre guideline shown on BAL mapping (refer to Attachment A) is the edge of the extent to which the BAL ratings apply – beyond which AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* does not apply.

BAL is determined based on the worst-case scenario, as per PBP (NSW RFS, 2019) Table A1.12.5 and A1.12.6 (Forested residential 80 and 100 FFDI). The BAL and bushfire assessment values (Building Class and FFDI) for the bushfire survey areas are outlined in Table 9-23. BAL contour maps were prepared using CSIRO's Spark BAL mapping tool in accordance with Table 2.4 of AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas* for the bushfire survey areas (refer to Attachment A).

Table 9-23 Building classification, FFDI, and BAL for the bushfire survey areas

Bushfire survey area	Building Class	FFDI	BAL
Wagga 330 kV substation and Wagga 330 kV substation compound (C01)	Class 8	80	BAL-29
Snowy Mountains Highway compound (C02)	Class 8	80	BAL-29
Snubba Road compound (C03)	Class 8	80	BAL-29
Maragle 500 kV substation compound (C05)	Class 8	80	BAL-FZ
Gugaa 500 kV substation and Gregadoo Road compound (C06)	Class 8	80	BAL-29
Honeysuckle Road compound (C07)	Class 8	80	BAL-29
Red Hill Road compound (C08)	Class 8	80	BAL-29
Adjungbilly Road compound (C09)	Class 8	80	BAL-29
Yass substation compound (C10)	Class 8	100	BAL-29
Woodhouselee Road compound (C11)	Class 8	100	BAL-29
Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)	Class 8	100	BAL-29
Memorial Avenue compound (C14)	Class 8	80	BAL-29
Bowmans Lane compound (C15)	Class 8	80	BAL-29
Snubba Road compound (C16)	Class 8	80	BAL-29
Tumbarumba Accommodation Facility (AC1)	Class 3 SFPP	80	BAL-12.5

9.8 Preparedness and emergency response

9.8.1 Site mitigation measures

Site mitigation measures for bushfire would be implemented at the commencement of works, throughout construction and operation. Site mitigation measures are to be maintained in accordance with the requirements outlined in this report, the PBP (NSW RFS, 2019), Transgrid's BRMP (Transgrid, 2021), and any other relevant documentation.

9.8.2 Bushfire awareness measures

Bushfire awareness is required for all workers, occupants, and personnel on site. This includes, but is not limited to, observing the landscape, weather and ignition risks, monitoring communication sources, and maintaining a comprehensive understanding of the bushfire preparedness procedures and emergency response.

Awareness measures should also include consideration of potential bushfire risks associated with transmission lines. Transmission line risks are managed with procedural controls, community briefings, incident briefings as part of a bushfire incident action plan and included in aircraft operator and firefighter training.

Bushfire awareness measures, including those relating to potential transmission link risks, would be included in the project specific BFEMEP.

9.8.3 Preparedness procedures

In accordance with PBP (NSW RFS 2019), plans and emergency procedures should provide suitable emergency and evacuation (and relocation) arrangements for any occupants of the development. This would be relevant for the worker accommodation facilities as well as buildings where people work, eg site offices and workshops. A BFEMEP is to be developed for the project and should be updated for construction, operation, and maintenance project phases. A BEEP would be developed for the contractor's CEMP.

9.8.4 Fire response

Fire reporting and suppression

During the life of the project, fire would be reported by the person in charge or delegate, in the event that an Emergency Warning alert is provided by the NSW RFS. Fire response and suppression resources are required to be maintained at each bushfire survey area, including fire hose reel systems, and appropriate access and service requirements as per PBP (NSW RFS, 2019). The BFEMEP would provide further detail on fire reporting and suppression.

Formal emergency warning

There are three levels of bushfire warning alerts which are used to indicate potential threat from a bushfire; these alert levels are Advice, Watch and Act, and Emergency Warning (NSW RFS, n.d.). A formal Emergency Warning is the highest level of bushfire alert warning, indicating potential danger and immediate action required. In the event that a formal Emergency Alert warning is provided, the person in charge, or delegate, is required to document all response actions in the project specific BFEMEP. Response actions include any actions that are taken in response to formal emergency warning alerts by emergency services authorities, or actions taken in response to bushfire/smoke sightings. Response actions, including emergency alert responses, and assembly and evacuation arrangements, would be included in the BFEMEP.

Emergency areas, shelters-in-place, and evacuation

Emergency areas, shelters-in-place and evacuation plan details would be included in the project specific BFEMEP.

9.9 Summary of mitigation measures

The mitigation measures recommended for the project are in accordance with a range of standards, requirements, and guidelines, including, but not limited to, the PBP (NSW RFS, 2019), *NSW Fire Trail Standards* (NSW RFS, 2016), *NSW RFS Fire Trail Construction and Design Maintenance Manual* (Soil Conservation Service, 2017), and AS3959:2018 *Construction of Buildings in Bushfire-Prone Areas*.

Mitigation measures and recommendations for the project are outlined in Table 9-24.

Table 9-24 Safeguards and mitigation measures for bushfire survey areas

Impact	Environmental safeguard	Timing	Relevant location
Protection Zones and landscaping	APZs will be managed in accordance with Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers requirements (NSW RFS 2019) (PBP), and associated criteria.	Detailed design, construction and operation	Substations and project buildings within construction compounds and the temporary accommodation facility
Easement management	Vegetation within the proposed transmission line easement will be managed in accordance with Transgrid's existing vegetation management standards consistent with the clearance requirements principle identified in AS/NZS 7000:2016 Overhead Line Design.	Detailed design, construction and operation	Transmission line easements
Ancillary buildings	The final location of the telecommunications hut will need to be assessed with a visual inspection to confirm potential bushfire risk.	Detailed design	Telecommunications hut

Impact	Environmental safeguard	Timing	Relevant location
Access	Access to substations and project buildings within the bushfire survey area will be established in accordance with: ■ *Planning for Bushfire Protection 2019* requirements (NSW RFS 2019) criteria ■ Access requirements will be in accordance with NSW Fire Trail Standards (NSW RFS 2016) and Fire Trail Construction and Design Maintenance Manual (Soil Conservation Science 2017).	Construction and operation	Access tracks to substations and project buildings within bushfire survey areas
Bush Fire Emergency Management and Evacuation Plan (BFEMEP)	The project will be designed and constructed in accordance with a BFEMEP. The BFEMEP will be prepared by a suitably qualified person and will include: ■ Bushfire Emergency Evacuation Plan (BEEP) ■ Bush Fire Risk Management Plan (BRMP) protocols during construction, considering activities during days with fire danger rating 'high' or greater ■ bushfire response and notification measures to report fires at the earliest opportunity ■ bushfire mitigation measures including maintaining APZs and mechanisms for the handling and use of any dangerous goods ■ bushfire risk induction and training for personnel, including risks and management measures associated with construction equipment and activities ■ fire reporting, emergency areas, on-site refuges, and evacuation procedures and is to be consistent with Development Planning: A guide to developing a bush fire emergency management and evacuation plan (NSW RFS, 2014). The BFEMEP will be consistent with relevant Australian standard and development plans and guides. For the Special Fire Protection Purpose (SFPP), the BFEMEP will include planning for the early relocation of occupants in the event of a potential bushfire or other emergency situation. A copy of the BFEMEP will be provided to the Local Emergency Management Committee for its information prior to occupation of the development.	Detailed design, construction and operation	All locations

10 Conclusion

This report constitutes a BRAR for the project identifying and assessing the risk from bushfire to assets within the project footprint and providing mitigation measures that would be applied during construction and operation in accordance with the PBP (NSW RFS, 2019). The assessment includes surveys undertaken at areas within the project footprint, which have been identified as having an elevated bushfire risk, such as areas located within land classified as Bush Fire Prone Land (BFPL), and where project related personnel may work, sleep, or assemble. These include:

- Wagga 330 kV substation and Wagga 330 kV substation compound (C01)
- Snowy Mountains Highway compound (C02)
- Snubba Road compound (C03)
- Maragle 500 kV substation compound (C05)
- Gugaa 500 kV substation and Gregadoo Road compound (C06)
- Honeysuckle Road compound (C07)
- Red Hill Road compound (C08)
- Adjungbilly Road compound (C09)
- Yass substation compound (C10)
- Woodhouselee Road compound (C11)
- Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)
- Memorial Avenue compound (C14)
- Bowmans Lane compound (C15)
- Snubba Road compound (C16)
- Tumbarumba Accommodation Facility (AC1)

In accordance with the SEARs, this BRAR constitutes an assessment of the risks to public safety, paying particular attention to bushfire risks including reducing the potential project related ignitions, which may impact the broader community, confirming emergency egress and evacuation and mechanisms for the handling and use of any dangerous goods.

This BRAR considers a range of existing risk factors associated with the project, including fire weather and climate, ignition sources, vegetation, slope, and access, as well as construction and operation, and cumulative bushfire impacts. Management and mitigation measures include APZs, transmission line clearances and construction requirements in accordance with BAL and required emergency procedures.

Structures located on BFPL must satisfy the aims and objectives outlined in PBP (NSW RFS 2019). Provided recommendations outlined in Chapter 9 are implemented they are considered to satisfy the aims and objectives of the PBP (NSW RFS 2019), AS 3959:2018 and associated requirements.

11 References

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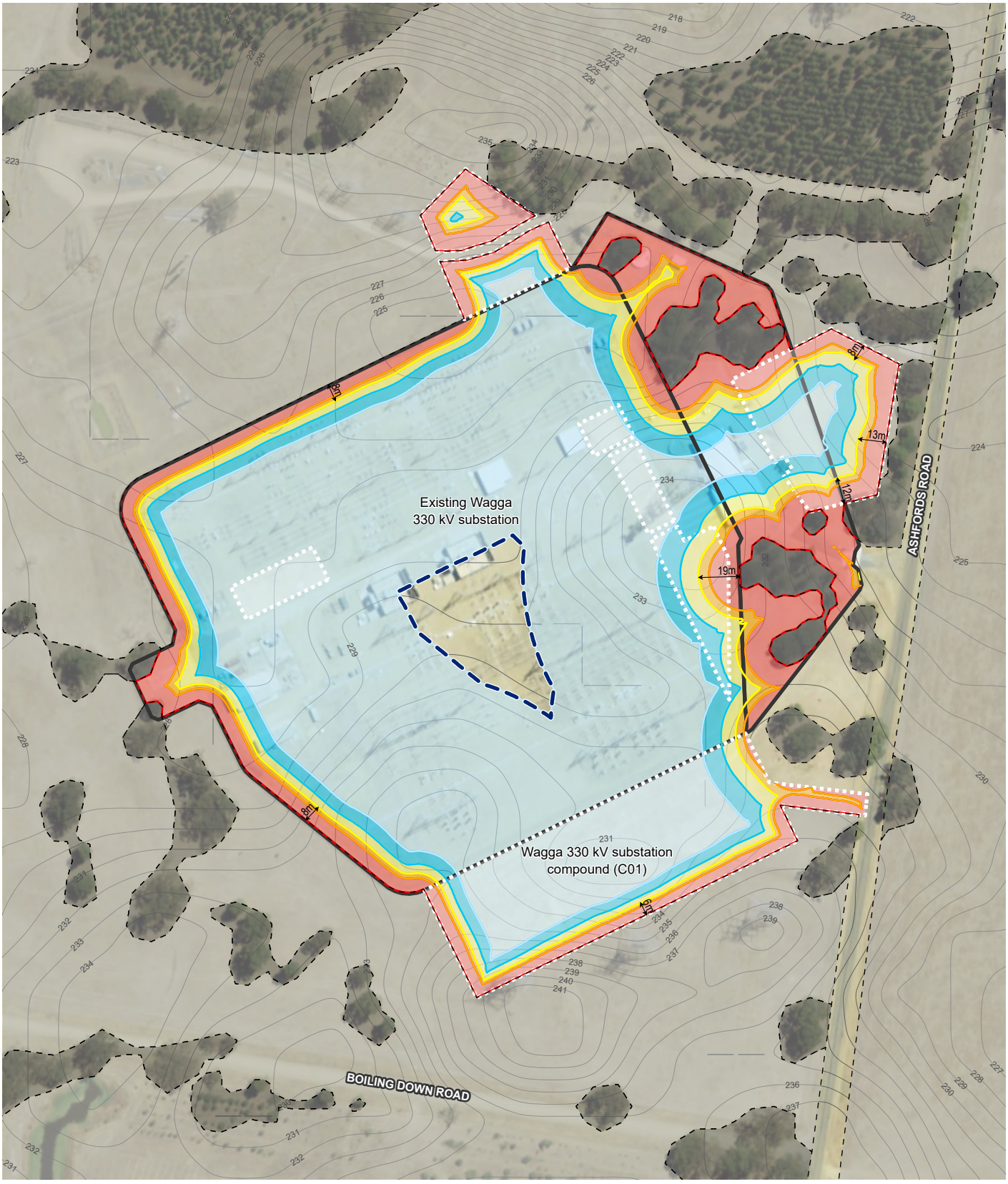
Attachments

Attachment A
BAL mapping



1:2,500

0 40 80 m

Projection: GDA 1994 MGA Zone 55

Figure A-1 : Wagga 330 kV substation and Wagga 330 kV substation compound (C01)

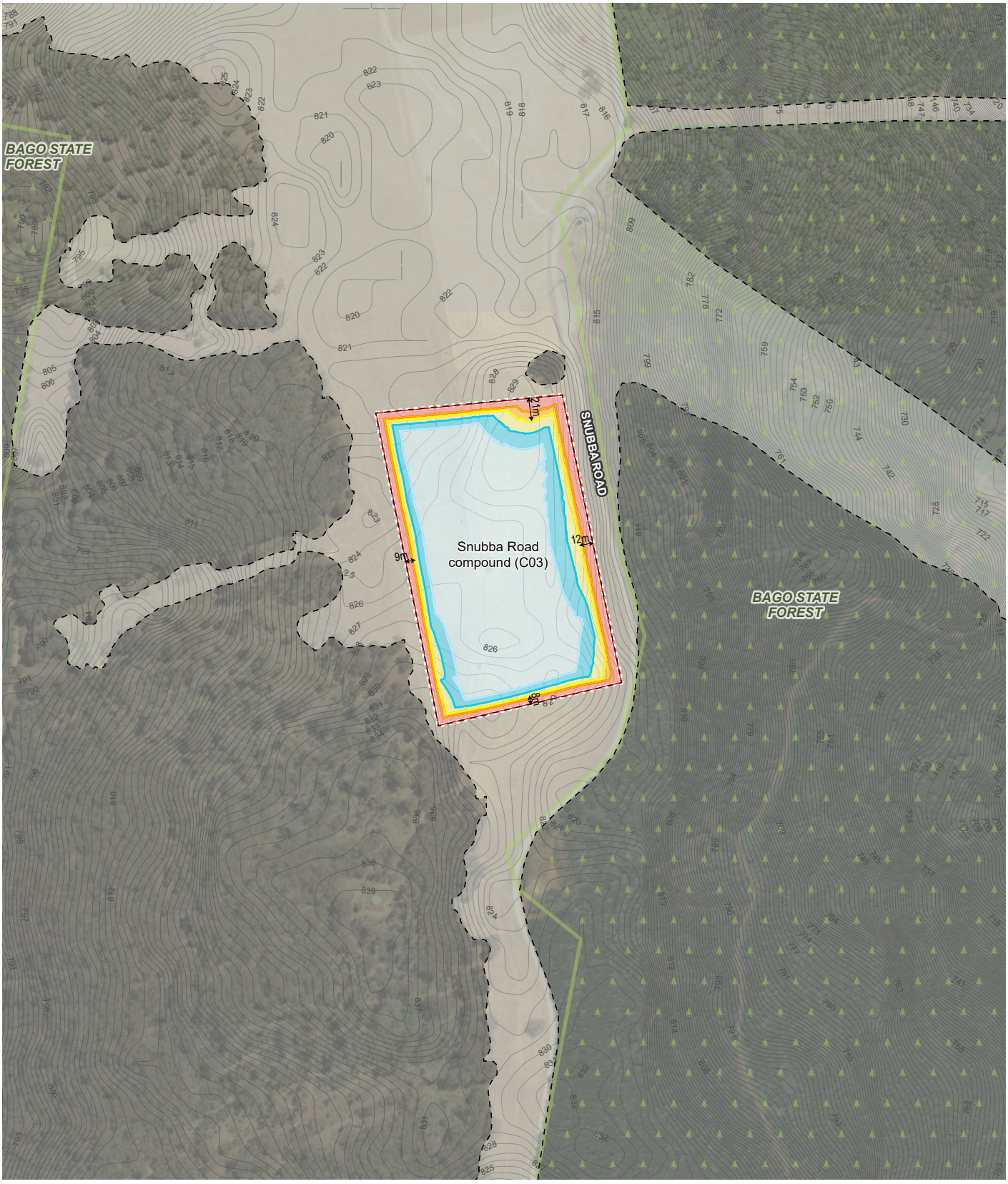
Vegetation Type: Woodland and Grassland *FDI:* 80

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-2 : Snowy Mountains Highway compound (C02)

Vegetation Type: Forest and Grassland *FDI:* 80



Compound locations
Contour (m)
State Forest
Vegetation - Forest
Vegetation - Grassland
100 m guideline

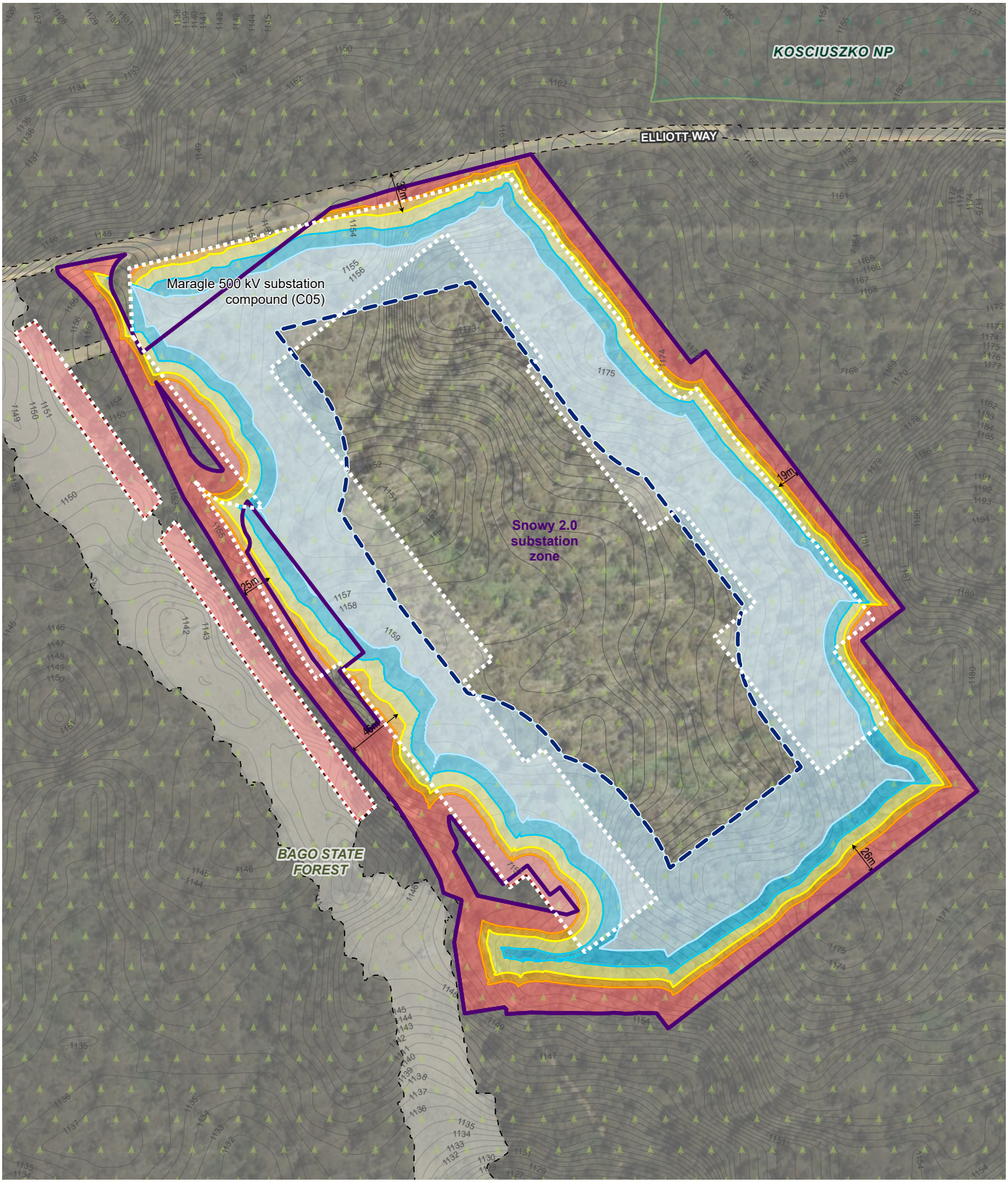
BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:5,100
0 80 160 m

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-3 : Snubba Road compound (C03)
Vegetation Type: Forest and Grassland *FDI:* 80



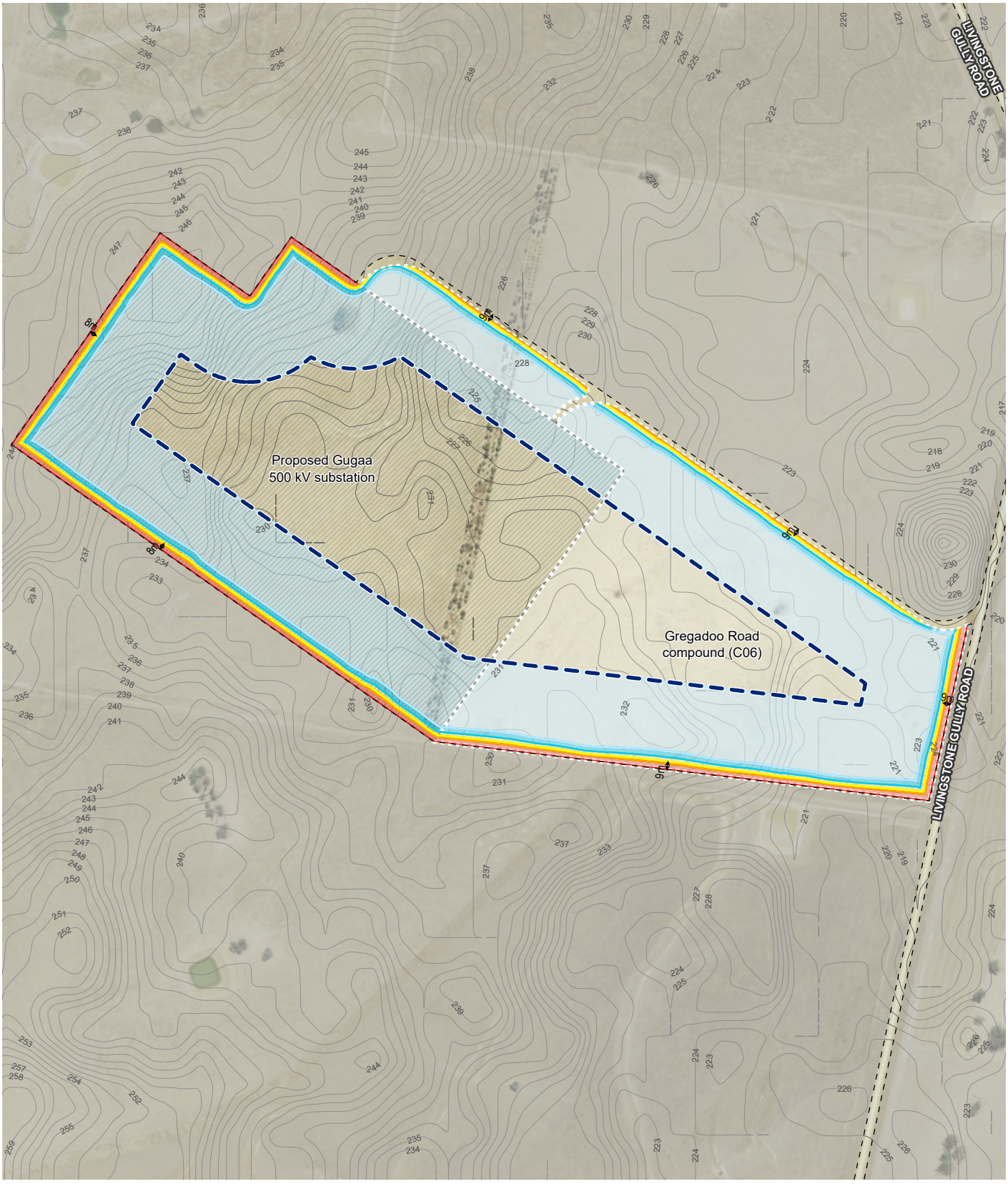
Compound locations
Snowy 2.0 substation zone
Contour (m)
National Parks & Reserves
State Forest
Vegetation - Forest
Vegetation - Grassland
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:4,300
0 70 140 m

Projection: GDA 1994 MGA Zone 55

Figure A-4 : Maragle 500 kV substation compound (C05)
Vegetation Type: Forest and Grassland *FDI:* 80



Projection: GDA 1994 MGA Zone 55

Figure A-5 : Gugaa 500 kV substation and Gregadoo Road compound (C06)

Vegetation Type: Grassland *FDI:* 80

Compound locations
Contour (m)
State Forest
Vegetation - Forest
Vegetation - Grassland
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:3,000
0 50 100 m

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-6 : Honeysuckle Road compound (C07)
Vegetation Type: Forest and Grassland *FDI:* 80

Compound locations
Contour (m)
State Forest
Vegetation - Forest
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:1,900
0 30 60 m

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-7 : Red Hill Road compound (C08)
Vegetation Type: Forest *FDI:* 80

Compound locations
Contour (m)
Vegetation - Forest
Vegetation - Grassland
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:4,100
0 60 120 m

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-8 : Adjungbilly Road compound (C09)
Vegetation Type: Forest and Grassland *FDI:* 80

Compound locations
Contour (m)
Vegetation - Grassland
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:4,000
0 60 120 m

Projection: GDA 1994 MGA Zone 55

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Figure A-9 : Yass substation compound (C10)
Vegetation Type: Grassland *FDI:* 80

Compound locations
Contour (m)
Vegetation - Grassland
100 m guideline

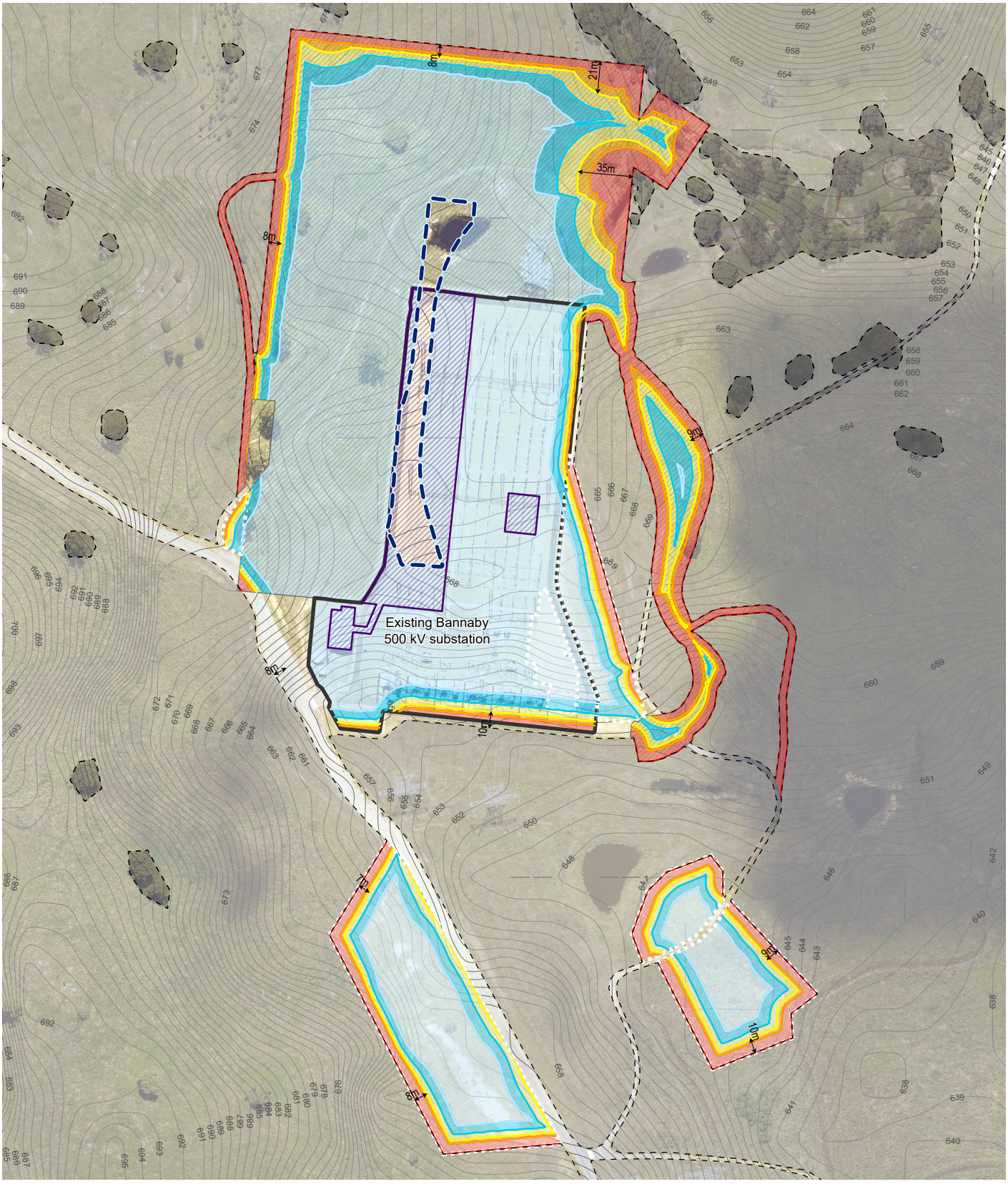
BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:2,300
0 30 60 m

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-10 : Woodhouselee Road compound (C11)
Vegetation Type: Grassland *FDI:* 80



Projection: GDA 1994 MGA Zone 55

Figure A-11 : Bannaby 500 kV substation and Bannaby 500 kV substation compound (C12)

Vegetation Type: Forest and Grassland *FDI:* 80

Projection: GDA 1994 MGA Zone 55

HumeLink Bushfire Assessment

Figure A-12 : Memorial Avenue compound (C14)

Vegetation Type: Forest *FDI:* 80

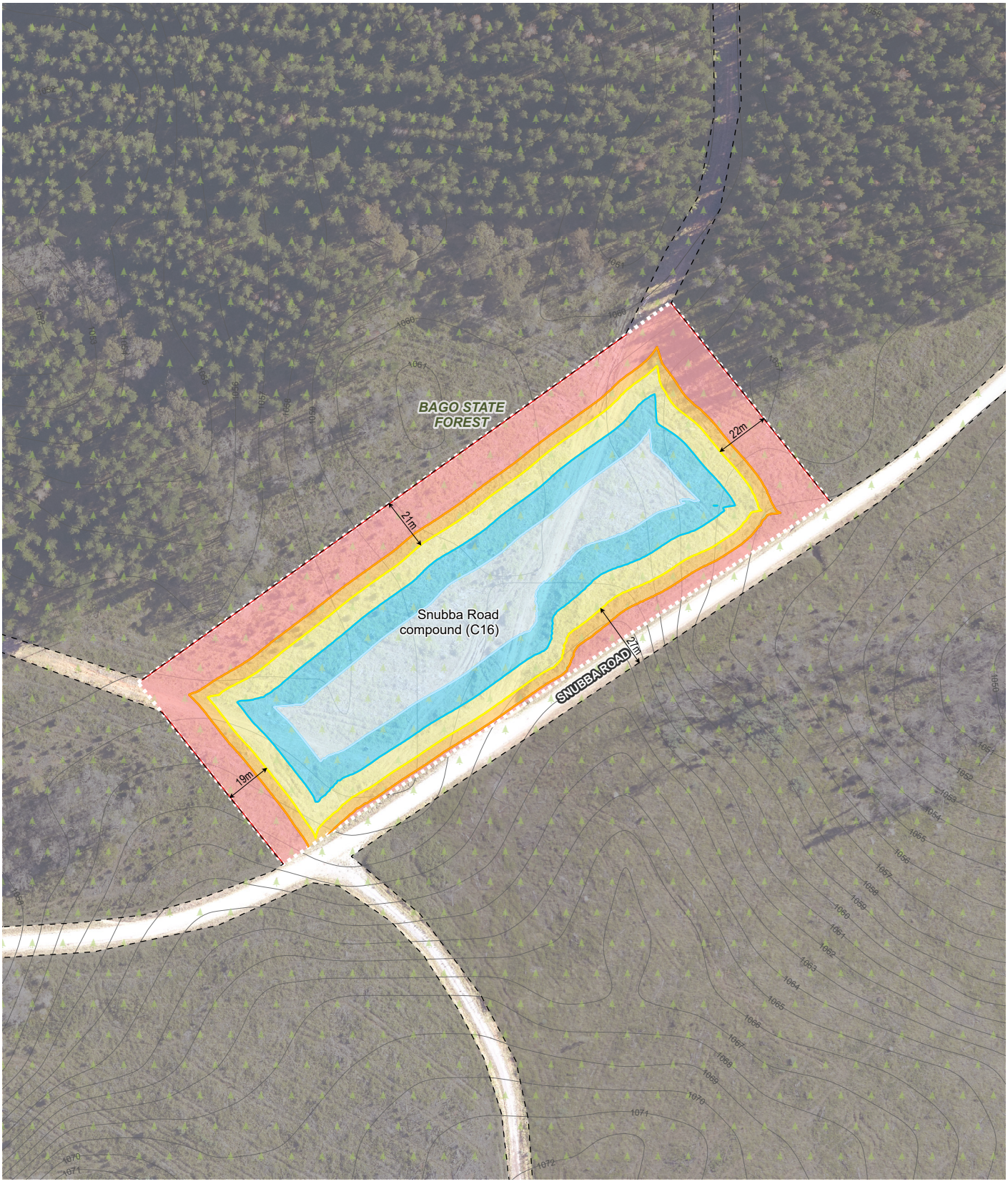
Compound locations
Contour (m)
Vegetation - Forest
Vegetation - Grassland
100 m guideline

BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:3,000
0 50 100 m

Projection: GDA 1994 MGA Zone 55

Figure A-13 : Bowmans Lane compound (C15)
Vegetation Type: Forest and Grassland *FDI:* 80



Compound locations
Contour (m)
State Forest
Vegetation - Forest
100 m guideline
BAL Radiant Heat (kw/m2)
BAL 12.5
BAL 19
BAL 29
BAL 40
Flame zone

1:2,200
0 30 60 m

Projection: GDA 1994 MGA Zone 55

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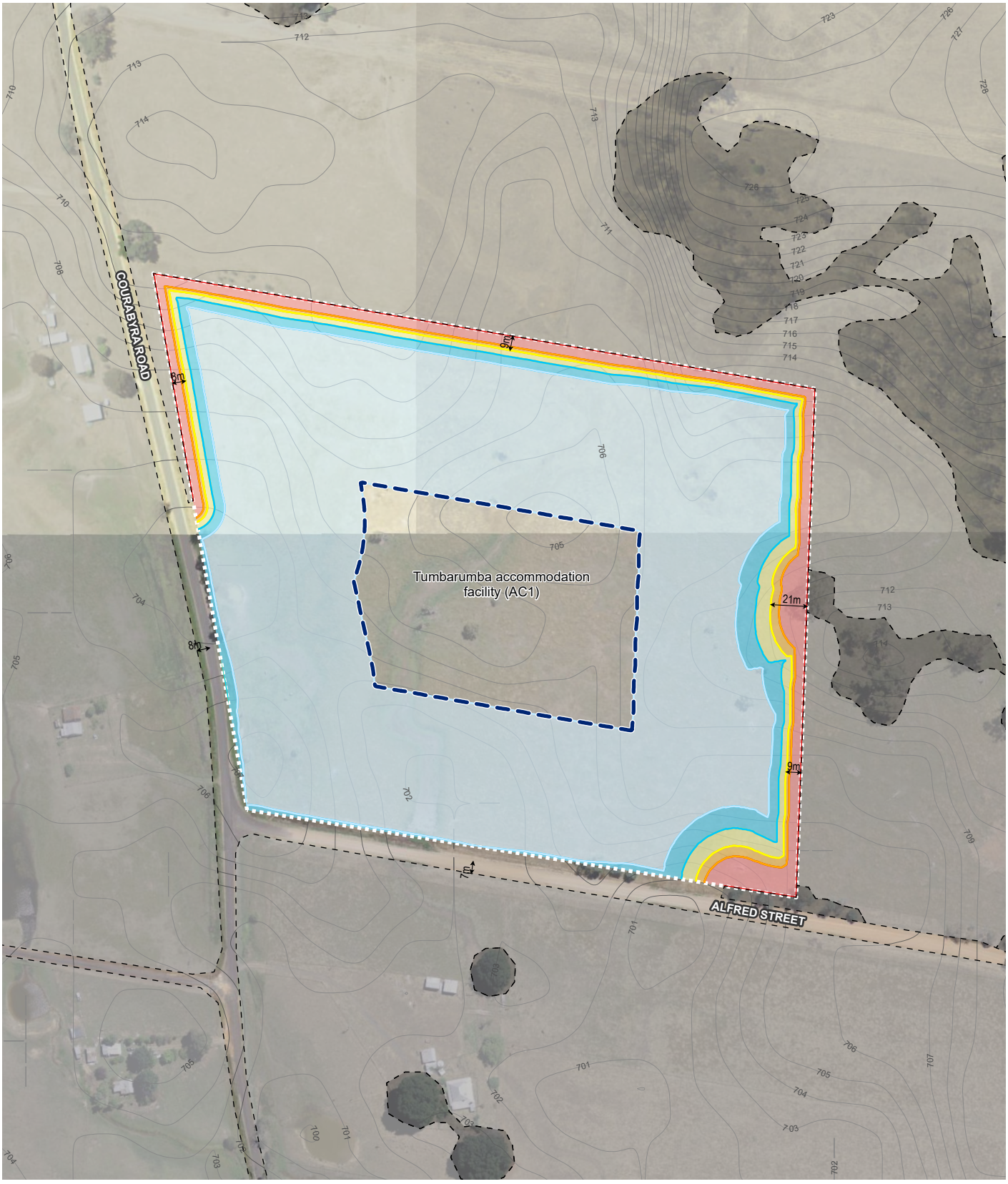
Figure A-14 : Snubba Road compound (C16)
Vegetation Type: Forest *FDI:* 80



1:3,200

0 50 100 m

Projection: GDA 1994 MGA Zone 55

Figure A-15 : Tumbarumba accommodation facility (AC1)

Vegetation Type: Forest and Grassland *FDI:* 80

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