Valley of the Winds

APPENDIX K
BUSHFIRE RISK ASSESSMENT

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Bushfire Risk Assessment

VALLEY OF THE WINDS

WIND FARM

State Significant Development SSD-10461

Coolah, NSW

Applicant: UPC\AC Renewables Aust.

February 2022

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Prepared for:

Environmental Impact Statement (EIS)
by Ramboll Australia for the applicant UPC\AC Renewables Aust.

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Contents

1. INTRODUCTION

Ramboll Australia (on behalf of the proponent UPC\AC Renewables Australia) have engaged Cool Burn Fire and Ecology to prepare the Bushfire Risk Assessment to support the Environmental Impact Statement (EIS) for The Valley of the Winds wind farm project, a State Significant Development project SSD-10461.

Cool Burn Pty Ltd is recognised by the NSW RFS as a suitably qualified consultant in bush fire risk assessment.

1.1 PURPOSE OF THIS REPORT

The capital value of the project would be more than $30 million. Accordingly, the project is a State Significant Development (SSD) under the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SR&D) and Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Under Section 4.12(8) of the EP&A Act, a development application (DA) for SSD must be accompanied by an environmental impact statement (EIS) that is lodged with the NSW Department of Planning, Industry and Environment for Development Consent.

The project was also referred to the Commonwealth Department of Agriculture, Water and the Environment for potential impacts to matters of national environmental significance protected by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 13 July 2020, a delegate of the Federal Minister for the Department of Agriculture, Water and the Environment determined that the project was a controlled action under section 75 of the EPBC Act and therefore requires assessment and approval under the EPBC Act. This assessment is to be undertaken under the *Amended Bilateral Agreement* between the Department of Agriculture, Water and the Environment and the Department of Planning, Industry and Environment.

This report has been prepared to inform the environmental impacts statement (EIS) and development application (DA) for the project.

1.2 AIMS AND OBJECTIVES

The bushfire risk assessment aims to address the requirements of the SEARs (SSD-10461) Key Issue of Hazards/Risks for Bushfire:

> *Identify potential hazards and risks associated with bushfires / use of bushfire prone land, including the risks that a wind farm would cause bush fire and any potential impacts on the aerial fighting of bush fires and demonstrate compliance with Planning for Bush Fire Protection 2019.*

As required under the SEARS, the mapping of the project site as bushfire prone land triggers the requirement to identify potential hazards and risks and demonstrate compliance with Planning for Bushfire Protection 2019 (PBP).

With much of the project located on bushfire prone land, bushfire risk would be considered in the context of the Rural Fires Act 1997 at all levels of the development process, from project design, construction, operation through to decommissioning. There is a requirement to understand:

- Bushfire history and bushfire risk to the community landscape
- Does the proposed wind farm change the bushfire risk of the project area?
- What is the potential bushfire risk toward the wind farm asset (life and safety, the infrastructure, and the environment)?
- What are the applicable mitigation measures that can be implemented to reduce the bushfire risk of the project area to a level that is deemed acceptable?

Standard bushfire protection measures (Plate 1) include:

- Building and construction requirements, commensurate with the purpose/use and constructions of the structures and where applicable the quantified bushfire attack level (BAL) ratings
- Asset Protection Zone (APZ) and easement landscape management actions (including but not limited to slashing, mowing, landscaping and garden maintenance, fire breaks) required to protect assets and prevent the spread of fire
- Access provisions (e.g., public access, property access and fire trails)
- Emergency management arrangements, consistent with the relevant emergency services requirements
- Water supply and utilities (power) provisions

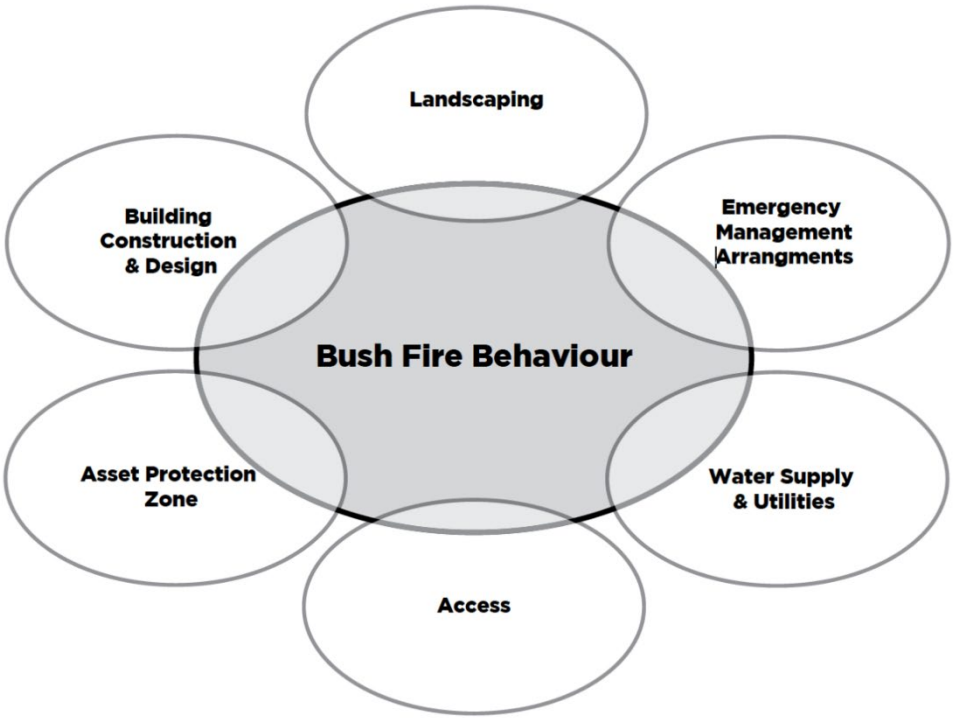


Plate 1: Bushfire Protection Measures (NSW RFS 2019)

1.3 SCOPE

The bushfire risk assessment will be prepared for the long-term planning for the wind farm project, covering design and approvals principles, construction, and operations and through to decommissioning. The bushfire protection planning includes a desktop assessment and a review of the proposed development against the following guidelines, legislation, and regional information:

- NSW Rural Fires Act (1997)
- Planning for Bushfire Protection 2019 (NSW RFS)
- The Wind Energy Guideline (the Guideline) NSW Planning & Environment 2016
- Wind Farms & Bushfire Operations by AFAC Rural and Land Management Group, 2018
- Australian Standard (AS) 3959-2009 Construction of buildings in bushfire-prone areas
- Bushfire Risk Management Plans (BFRMP) for the LGA
- Bushfire history (SEED geo-mapping)

1.4 LEGISLATION AND GUIDELINES

This bushfire risk assessment acknowledges the NSW Rural Fires Act (1997) as a legal requirement, and the Planning for Bushfire Protection 2019 (PBP) as a guideline to assess the suitability/performance of the project.

1.4.1 NSW RFS Planning for Bushfire Protection 2019

Planning for Bush Fire Protection 2019 (PBP) is applicable to all development on bush fire prone land (BFPL) in NSW. All development on bush fire prone land must satisfy the aims and objectives of PBP. The overall aim of PBP is to provide for the protection of life (including firefighters) and to minimise impacts on property from the threat of bush fire. To comply with PBP the project would require the following conditions to be met:

- Satisfy the aim and objectives of PBP.
- Consider issues listed within PBP for the specific purpose for the development (S8.3.5).
- Propose an appropriate combination of Bushfire Protection Measures (BPM's) e.g., Asset Protection Zones (APZ).

Section 8.3.5 of the PBP provides standards, BPM's, and guidance specific to wind farms:

- a minimum 10m APZ for the structures and associated buildings/infrastructure maintained to the standard of an Inner Protection Area (IPA) for the life of the development. Note: Infrastructure for the purpose of APZ excludes road access to the site and power or other services to the site and associated fencing.
- Essential equipment should be designed and housed in such a way as to minimise the impact of bush fires on the capabilities of the infrastructure during bush fire emergencies. It should also be designed and maintained so that it will not serve as a bush fire risk to surrounding bush.
- A Bush Fire Emergency Management and Operations Plan should identify all relevant risks and mitigation measures associated with the construction and operation of the wind farm including:
    - detailed measures to prevent or mitigate fires igniting.
    - works that should not be carried out during total fire bans.
    - availability of fire-suppression equipment, access, and water.

- storage and maintenance of fuels and other flammable materials.
- notification of the local NSW RFS Fire Control Centre for any works that have the potential to ignite surrounding vegetation, proposed to be carried out during a bush-fire fire danger period to ensure weather conditions are appropriate.
- appropriate bush fire emergency management planning.
- Identify works that should not be carried out during Total Fire Bans.

Section 8.2.1 of PBP provides guidance on the provision of BPM's for 'rural worker dwellings'. These BPM's will be applied for the potential construction workforce accommodation component of the project and include:

- An APZ based on a radiant heat threshold of 29kW/m^2 for any new dwellings.
- Suitable provision for construction, access, water, and landscaping.

2. SITE DETAILS

2.1 PROJECT OVERVIEW

UPC Renewables Australia Pty Ltd, operating as UPC\AC Renewables Australia (UPC\AC) (the Proponent), proposes to construct and operate the Valley of the Winds wind farm (the project).

The project would consist of approximately 148 wind turbines and supporting infrastructure (including construction workforce accommodation), and a high voltage transmission line which would run approximately 13 kilometres from the Girragulang Road cluster to a connection point with the Central-West Orana REZ Transmission line proposed by TransGrid and the NSW Government. The project would supply approximately 800 megawatts (MW) of electricity into the National Electricity Market (NEM).

The wind farm would be located close to the townships of Coolah and Leadville, with the transmission line running generally south to its connection with the Central-West Orana REZ Transmission line. The project would be entirely within the Warrumbungle Local Government Area (LGA).

The project would involve the construction, operation and decommissioning of three clusters of wind turbines, that would be connected electrically. These are:

- Mount Hope cluster – approximately 76 turbines
- Girragulang Road cluster – approximately 51 turbines
- Leadville cluster – approximately 21 turbines.

The project includes the following key components:

- Approximately 148 wind turbines with a maximum tip height of 250 metres and a hardstand area (80m X 40m concrete pad) at the base of each turbine
- Electrical infrastructure, including:
    - substations in each cluster and a step-up facility at the connection to the Central-West Orana REZ Transmission line

  - underground 33 kilovolt electrical reticulation connecting the turbines to the substations in each cluster
  - overhead transmission lines (up to 330 kilovolt) dispatching electricity from each cluster
  - other electrical infrastructure as required including a potential battery energy storage system (BESS)
  - a high voltage transmission line (up to 500 kilovolt) connecting the wind farm to the Central-West Orana Transmission line

- Other permanent on-site ancillary infrastructure:
  - permanent operation and maintenance facilities
  - meteorological masts (up to thirteen)

- Access track network:
  - access and egress points to each cluster from public roads
  - operational access tracks and associated infrastructure within each cluster on private property

- Temporary construction ancillary facilities:
  - potential construction workforce accommodation on site (proposed for Lot 1 DP812579 and Lot 113 DP750768, corner of Orana road and Moorefield Road)
  - construction compounds
  - laydown areas
  - concrete batching plants
  - quarry sites for construction material (rock for access tracks and hardstands).

At the end of its practical life, the wind farm and infrastructure would be decommissioned, and the site returned to its pre-existing land use in consultation with the affected landholders.

2.2 PROJECT ENVIRONMENT

The project would be entirely within the Warrumbungle Local Government Area (LGA), on rural landholdings and in proximity to the urban precincts of Coolah and Leadville (Figure 1).

Land surrounding the wind farm site is characterised by rolling pastoral hills, open flat valleys and ridgelines with scattered vegetation. The hill slopes are generally gentle in gradient and predominantly cleared of vegetation, except for patches of denser remnant vegetation on steeper terrain, near rocky outcrops and between saddles.

The townships of Coolah and Leadville are the closest population centres to the proposed site. These townships are located on gently sloping to level land within valleys near creeks. Most built structures are of low to moderate scale. The main street of Coolah is the focus for local retail and community services in the local area.

2.3 LEP LAND ZONING

The entirety of the development will be over RU1 Primary Production zone land (Warrumbungle Local Environmental Plan 2012). Land uses within the locality include:

- Farming – predominantly grazing cattle and sheep, with small patches of cropping (cereal and fodder)
- Rural living – scattered rural dwellings and sheds present throughout the landscape, with a higher density of dwellings in the townships.

2.4 FIRE SEASON & WEATHER

The project is located within the Castlereagh Bushfire Management Committee region (BFMC) and is covered by the Castlereagh Bush Fire Risk Management Plan 2012. The bush fire season generally runs from October to March. The worst months for large fires in the region are mid-November to end of December. In the south (area of project site) fire activity can continue until February – March during dryer years.

Average weather/climate in the Castlereagh BFMC region does not vary greatly and is characterised by warm to hot temperatures with winds normally from the western sector during the summer with cool to cold dryer winter period. Summer rainfall is generally the

result of storms caused by cold fronts moving in from the west. Dry lightning storms can occur during dryer seasonal conditions across much of the BFMC region.

2.4.1 Fire Danger Rating and Climate Change

Warrumbungle LGA falls within the North-western NSW RFS Fire Weather District (District 13) and has a current Fire Danger Rating (FDR) classification of:

- Forest FDI = FFDI 80
- Grassland FDI = GFDI 110

Over the next 30-40 years (expected lifespan of the project), the climate is projected to change, resulting in more days of higher fire danger than previously experienced, and projected FFDR and GFDR exceeding current levels (Douglas, G. 2017). The planning for long term infrastructure should include identifying the higher fire danger and potentially higher fire frequencies.

2.4.2 Bushfire Frequency & Ignition Sources

Historically, the Castlereagh BFMC region has experienced an average of 80 bushfires per year with an average of 3/year constituting major fires. The most recent and significant fire in the region (Sir Ivan fire) was triggered by a lightning strike on 11 February 2017. This fire burnt approximately 55,0000 hectares of remnant vegetation and agricultural land in the Warrumbungle Shire including areas surrounding the planned Leadville and Girragulang Road turbine clusters. The predominate sources of bushfire ignition in the Castlereagh BFMC area are:

- Lightning
- Escape from legal burns
- Farm machinery and rural operations ignition (e.g., harvesting/baling etc)
- Incendiaries, arson, or accidental ignition
- Campfires.

Lightning activity in the area is predominantly associated with spring and summer electrical storms occurring from November through to the end of March. These storms are usually accompanied by heavy rainfall, however, periodically they happen with little or no rain causing the possibility of ignition where strikes occur. Generally, these storms follow ironstone

outcrops, Warrumbungle Mountains, Pilliga scrub and dry sclerophyll forests within the Castlereagh area.

Escape from legal burns occurs mainly in the rural farming and grazing managed lands throughout the Castlereagh BFMC area and the rural subdivisions or rural/urban interface areas around the major towns. Farm machinery and mechanical ignitions usually occur during the summer grain harvest period from November to the end of January and are generally the result of poor maintenance of machinery.

During the summer school holiday period the possibility of incendiaries (arson) and accidental ignition from campfires can increase.

2.4.3 Assets at Risk

The following assets are located on site or within 5km of the project:

- Various agricultural crops
- Stock (sheep, cattle & goats)
- Fences
- Isolated rural residences and outbuildings.
- The townships of Coolah and Leadville are also located within a 5km buffer of the project site.

All identified assets, including the potential construction workforce accommodation, proposed wind turbines, power lines, meteorological masts, and O&M components of the project, are at risk from a bushfire that could propagate within the wind farm site, or from an external source.

2.4.4 Bushfire Risk

The Bush Fire Risk Management Plan identifies both Coolah and Leadville residential areas as:

- likely to be impacted by a fire
- have minor consequences
- a medium risk (level 4); and
- treatments focus on preparedness (bushfire emergency plans, early evacuation and fuel load management).

The designated Neighbourhood Safer Places (NSP) relative to this area are the Leadville RFS shed and Bowen Oval Coolah, both outdoor NSP's.

2.5 GEOLOGY, TOPOGRAPHY AND SLOPES

The topography for wind farms includes undulating to very steep land across a large area, from between 500-750m in elevation. Wind farm turbine infrastructure and associated electricity infrastructure are inherently located on ridges and upper slopes.

The locality surrounding the development area is undulating, and the turbine and access infrastructure is predominantly on slopes exceeding 5 degrees but less than 15 degrees. Some slopes 15-20 degree and exceeding 20 degree will have significant impact on fire behaviour (particularly but not limited to the Mount Hope cluster).

The slopes surrounding the potential construction workforce accommodation are generally flat (0 degrees) to the north, south, and west and upslope (0-5 degrees) to the east.

Figure 2 details the slope classification across the study area out to 5km from infrastructure.

Figure 2A details the slope and vegetation classification out to 140m from the potential construction workforce accommodation.

2.6 VEGETATION

The vegetation ecosystems/types on the site are obtained from the Greater Hunter Vegetation mapping V4 (https://datasets.seed.nsw.gov.au/dataset/greater-hunter-native-vegetation-mapping-v4-0-vis-id-3855d41f5) and detailed in Figure 3. Vegetation broadly consists of:

- Managed agricultural and rural enterprise on the valley flats and lower slopes (non-native vegetation)
- Derived native grasslands and grassy woodland remnants on lower slopes (western slopes grassy woodlands and derived native grasslands)
- Forest (and woodland) vegetation on steeper upper slopes (e.g., western slopes dry sclerophyll forests)

2.6.1 Vegetation Structure (Fuel Loads)

The bushfire prone vegetation types and associated fuel are taken from the NSW RFS Comprehensive Vegetation Fuel Loads (RFS March 2019) and based on the publication 'Ocean Shores to Desert Dunes' David Keith (Keith, 2004) a:

- Managed grasslands and rural enterprise are low threat vegetation (<4t/ha when managed)
- Native and derived grasslands (up to 4-6t/ha)
- Woodlands: Western Slopes Grassy Woodland (10.5t/ha surface/elevated – 18.3t/ha overall)
- Forests: Northwest Slopes Dry Sclerophyll Forest (14t/ha surface/elevated – 24.47t/ha overall)

2.7 FIRE INTENSITY MODELLING

The fire intensity modelling is based on the McArthur model for forests and incorporates fuel loads, aspect and slope. Slope and aspect are derived from digital elevation models (DEM).

Fuel loads are taken from the Comprehensive Vegetation Fuel Loads fact sheet published by the Rural Fire Service in March 2019. The respective fuel loads are matched to the corresponding Keith Classification vegetation.

The model is then run using a wind direction and fire direction coming from either:

1. North through west to southwest (Figure 4)

2. North through east to southeast (Figure 5)

3. Southeast through south to southwest (Figure 6)

The fire intensity modelling highlights the highest expected fire intensity would arise from a southeast - south – southwest based wind and fire direction.

3. RISK ASSESSMENT

The risk assessment identifies the following assets that are potentially at risk from bushfire, and may require mitigation actions to minimise the risk:

- Life and safety
- Infrastructure
- Environment

The following tables have been provided as context for the risk assessment for the fire management for the wind farm project.

Table 1 Likelihood Rating

Likelihood Rating	Definition
Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will. (<10% chance)
Unlikely	Not expected, but there's a slight possibility it may occur at some time. (10% – 35% chance it will occur)
Possible	The event might occur at some time as there is a history of casual occurrence. (35% - 65% chance it will occur)
Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence. (65% - 90% chance it will occur)
Almost Certain	Very likely. The event is expected to occur in most circumstances as there is a history of regular occurrence. (>90% chance)

Table 2 Consequence Rating

Consequence Rating	Asset Type		
	Human Life	**Property/Infrastructure**	**Environmental**
Insignificant	No injuries	No damage	No adverse impact
Minor	Injuries requiring first aid	Limited, easily repairable damage	Contained, reversible impact through natural regeneration
Moderate	Injuries requiring medical treatment	Substantial damage, prolonged repair period	Contained, reversible impact with external assistance
Major	Injuries requiring hospitalisation	Extensive irreparable damage (write-off)	Uncontained, reversible impact with external assistance
Catastrophic	Fatality and/or permanent disability	Complete loss of plant, equipment, buildings and/or infrastructure	Uncontained, irreversible impact

Table 3 Risk Rating Matrix

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low	Low	Low	Low	Moderate
Unlikely	Low	Low	Moderate	Moderate	High
Possible	Low	Moderate	Moderate	High	High
Likely	Low	Moderate	High	High	Extreme
Almost Certain	Moderate	High	High	Extreme	Extreme

The period for which this risk assessment applies to the assets is throughout the construction phases, during operational and maintenance (life of the development) and the decommissioning phases.

3.1 RISK TO LIFE AND SAFETY

The protection of life and safety from potential fire impact is considered principal factor. The assessment recognises life and safety risk to:

- Employees and staff, attending contractors, community and visitors, other land users (energy providers, emergency management services including aerial firefighting operations)

Table 4: Risk to life and safety is considered as High:

Likelihood Rating	**Definition**		
Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence. (65% - 90% chance it will occur)		
Consequence Rating	**Human Life**	**Property/Infrastructure**	**Environmental**
Moderate	Injuries requiring medical treatment	Limited, easily repairable damage	Contained, reversible impact through natural regeneration
Overall risk to Life and Safety	High		

3.1.1 Risk Management

Risk can be mitigated through:

- Administration and awareness:
    - safe work planning (SWMS) and site inductions
    - bushfire weather monitoring and awareness

  - evacuation and emergency response, review and update Emergency Management Plans
  - notification and education to staff/contractors/community.

- AS3959 Bushfire construction standards to habitable workforce accommodation
- Access management and maintenance: this is a key factor to provide a suitable level of risk management to life and safety (roads are to be maintained in good condition, with adequate signposting)
- Operational management: to shut down operation during an emergency event
- Fuel management: The ongoing monitoring and management of fuels in the landscape (community-based responsibility).

3.2 RISK TO BUILT INFRASTRUCTURE

Due to the inherent fire safety construction for industrial use facilities, the infrastructure construction (design and materials) are somewhat resilient to the impacts of bushfire. The Wind Farm infrastructure recognises the following assets:

- Approximately 148 wind turbines with a hardstand area 40m x 80m at the base of each turbine
- Electrical infrastructure, including:
  - substations – one in each cluster and step-up facility at connection to the Central-West Orana REZ Transmission line
  - underground electrical reticulation connecting the turbines to the substations underground 33 kilovolt electrical reticulation connecting the turbines to the substations in each cluster
  - overhead transmission lines (up to 330 kilovolt) dispatching electricity from each cluster
  - other electrical infrastructure as required including a potential battery energy storage system (BESS)
  - a high voltage transmission line (up to 500 kilovolt) connecting the wind farm to the Central-West Orana Transmission line

- Other permanent on-site ancillary infrastructure:
  - permanent operation and maintenance facilities
  - meteorological masts (up to thirteen)

- Access track network:
  - access and egress points to each cluster from public roads
  - operational access tracks and associated infrastructure within each cluster on private property

- Temporary construction ancillary facilities:
    - The potential construction workforce accommodation on site
    - construction compounds
    - laydown areas
    - concrete batching plants
    - quarry sites for construction material (rock for access tracks and hardstands).

Table 5: Risk to built assets and infrastructure is considered as High:

Likelihood Rating	**Definition**		
Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence. (65% - 90% chance it will occur)		
Consequence Rating	**Human Life**	**Property/Infrastructure**	**Environmental**
Moderate	Injuries requiring first aid	Substantial damage, prolonged repair period	Contained, reversible impact through natural regeneration
Overall risk to build infrastructure	High		

3.2.1 Risk Management

The emphasis for infrastructure asset protection is primarily based on:

- Provision of APZ (minimum setbacks for worker accommodation, wind turbines and other permanent O&M buildings)
- Landscape and easement management (mowing/slashing and removal of fuels around assets and standard easement management)
- Emergency management and response arrangements
- Access management and maintenance: access is to be maintained in good condition
- Water provisions for emergency water supplies

3.3 RISK TO ENVIRONMENTAL VALUES

The environmental assets include the landscape surrounding the assets as well as surrounding natural vegetation areas and agricultural management areas. These values are resilient to bushfire impact, can potentially be contained, and would regenerate naturally or with assistance.

Table 6: Risk to environment is considered as Moderate:

Likelihood Rating	**Definition**		
Likely	There is a strong possibility the event will occur as there is a history of frequent occurrence. (65% - 90% chance it will occur)		
Consequence Rating	**Human Life**	**Property/Infrastructure**	**Environmental**
Moderate	Injuries requiring first aid	Limited, easily repairable damage	Contained, reversible impact through natural regeneration
Overall risk to Environment	Moderate		

3.3.1 Risk Management

Risk to environmental values resulting from a bushfire will be managed through:

- Access management and maintenance: this is a key factor to provide a suitable level of fire control
- Fuel management: The ongoing monitoring and management of fuels in the landscape (e.g., prescribed burning and strategic grazing).
- Water provisions for emergency water supplies for fire management

4. BUSHFIRE MITIGATION STRATEGIES

The owner/operator is responsible for the actions associated with fire management and risk mitigation associated with wind farm construction, operations and decommissioning across the landholdings. The following risk mitigation actions for the project have been developed to achieve compliance with the specifications and requirements of Section 8.3.5 of PBP for wind farms and Section 8.2 of PBP for the potential workforce accommodation component.

4.1 RISK MITIGATION ACTIONS

Through this risk assessment, we have identified the following fire management treatments as suitable for risk mitigation:

- Fuel management around assets and easements (mechanical/manual APZ slashing, landscaping, and potentially strategic grazing management)
- Hardstand construction and management around the turbines and ancillary infrastructure
- APZ setbacks based on 29kW/m^2 radiant heat levels and specific AS3959 bushfire construction standards for any habitable buildings associated with the potential workforce accommodation.
- Dedicated water supplies for emergency situations to workforce accommodation, turbines and ancillary structures
- Access maintenance and access management
- Emergency response and evacuation planning (including site closure, early evacuation and safe refuge)

4.1.1 Asset Protection Zones

An APZ provides a buffer zone between a bushfire hazard and an asset that allows suppression of a fire and aims to avoid possible flame contact and/or excessive radiant heat. The location and width of an APZ may lessen the radiant heat and flame contact from a fire to an asset to an extent where damage to the asset is reduced or eliminated and fire control is more feasible. The APZ allows emergency services access and provides a relative safe area for firefighters to defend assets. An APZ also provides an area to prevent any fire occurring within structures to ignite the surrounding vegetation and cause a bushfire. An APZ does not eliminate the fire risk.

More information on APZ's can be found in the document: Standards for APZ (NSW RFS). https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf

4.1.1.1 APZ – Turbines & Associated Infrastructure

It is recommended that an APZ be established around all wind turbine, substation and permanent operations and maintenance buildings to the APZ specifications for wind farms as per Section 8.3.5 of PBP:

- A minimum 10m APZ for the structures and associated buildings/infrastructure. Note: 'Infrastructure' for the purposes of requiring APZ excludes road access to the site and power or other services to the site and associated fencing.
- The APZ must be installed and maintained for the life of the development to the standard of an Inner Protection Areas (IPA) as outline within section 4.1.3 and Appendix 5 of PBP and the NSW RFS document Standard for asset protection zones e.g.:

  A Fuel Free Area
  - Having a fuel free area (e.g., sand, gravel, concrete etc)

  Grass
  - Grass to be kept short and mown/ maintained to a heigh <10cm.

  Trees
  - canopy cover should be less than 15%
  - trees should not touch or overhang any infrastructure buildings
  - lower limbs should be removed up to a height of 2m above ground
  - canopies should be separated by 2m to 5m
  - preference should be given to smooth barked and evergreen trees.

4.1.1.2 APZ – Workforce Accommodation

Recommended APZ setbacks for the construction workforce accommodation component have been developed in accordance with PBP Table A1.12.3 Minimum distances for APZs - FFDI 80 areas <29kW/m² @ 1090K (flame temp.). It is recommended that APZ be established around all habitable (accommodation) buildings and any associated buildings within 10m form a habitable building.

- A minimum 11m APZ for all buildings associated with the workforce accommodation component. The APZ must be installed and maintained for the life of the development to the standard of an Inner Protection Areas (IPA) as outline within section 4.1.2 of this report and Appendix 5 of PBP and the NSW RFS document Standard for asset protection zones.

4.1.2 Landscape Maintenance

Landscape maintenance includes around infrastructure and across the broader landscape, in a way to reduce fire intensity and rate of spread as it may approach a structure or structures. This would require significant community consultation (neighbours) and monitoring, as it would offer the broader community a higher level of bushfire protection.

For the potential workforce accommodation, it is recommended that the 11m APZ around buildings be maintained to IPA standards in accordance with NSW RFS 'Asset protection zone standards' e.g., as an area of low-cut lawn or pavement (gravel). Any fencing associated with the workforce compound must be non-combustible.

The project construction impact area for the turbines can be up to a 150m x 250m area cleared of woody vegetation and maintained as low threat/managed grassland area for the period of construction. This zone around turbines provides for an inherent fuel reduced area and has potential to be managed as a grassland for the period of operation, which provides a higher level of bushfire protection to the turbine assets. In this rural zone, grazing and slashing are practical landscape fuel management techniques that can cover large areas such as these.

Prescribed burning in woodland/forested areas is another landscape scale fuel management method, which would be identified by the BFMC and managed by the NSW RFS and would provide a higher level of bushfire protection to the wind farm development.

4.1.3 Building Construction and Design

4.1.3.1 Construction –Turbines & Associated Infrastructure

The construction of the wind farm and ancillary infrastructure is inherently constructed of fire resilient materials however, the following measures are recommended to control the risk of accidental fire ignitions during construction:

- APZ (10m IPA) and dedicated water supply to be constructed as the first stage of development for each turbine, substation or operations and maintenance facility.
- all plant, vehicles, and machinery to be routinely inspected and cleaned of any accumulated flammable debris.
- permits for hot works (e.g., grinders, welders, slashers) and no hot works on Total Fire Ban Days.
- essential equipment should be designed and housed in such a way as to minimise the impact of bush fires on the capabilities of the infrastructure during bush fire emergencies. It should also be designed and maintained so that it will not serve as a bush fire risk to surrounding bush. In this regard it is recommended that substations and other new building be constructed to comply with Australian Standard AS 3959-2018 Construction of buildings in bushfire-prone areas, commensurate with the modelled bushfire attack levels.

4.1.3.2 Construction – Workforce Accommodation

Construction standards for the potential workforce accommodation have been developed consistent with the requirements of Section 8.2 of PBP. The following measures are recommended to mitigate the potential risk of bush fire to workforce accommodation:

- BAL-29 construction to all habitable buildings in accordance with Section 7 of AS3959-2018 Construction of Building in Bushfire Prone Areas.

- Other non-habitable buildings associated with the workforce accommodation site (e.g., kitchen facilities, assembly buildings) must also be constructed to BAL 29 AS3959 construction or be located greater than 10m from any habitable building to prevent building to building fire.

4.1.4 Water Supply

A dedicated static water supply for bush firefighting purposes should be provided to the workforce accommodation and at strategic locations within each wind farm cluster with respect to essential equipment and accessibility (e.g. near the main entrance to each cluster or near the O&M buildings at each cluster).

A 50-80kL volume steel tank supply is appropriate for each cluster and an independent tank for the potential workforce accommodation facility would provide suitable emergency water supplies and is preferred over a single water supply point due to the large distance required to travel between sites.

Fast fill options and easily accessible fill points should be provided such as 65mm Storz fittings for hydrant stands or direct link to tanks, with a hardstand access capable of supporting weight and turning capacity for a fully loaded fire truck (23 tonne).

Plate 2: Example of community water storage for bushfire protection (taken from https://www.abc.net.au/news/2021-11-30/fireproofing-the-limestone-coast-with-new-water-tanks)

4.1.5 Access Management

The construction phase requires heavy vehicle access to support the erection of wind farm infrastructure. Road corridors are within a 47m wide easement with a 15m wide carriageway. It is assumed/recommended that this access is maintained for the life of the development. As such the access will be inherently capable of supporting Cat-1 fire vehicle access consistent with the NSW RFS Fire Trail Standards (NSW RFS 2019):

- The width and capacity of the access provides for safe, reliable and unobstructed passage by a Cat 1 firefighting vehicle within acceptable operational limits
    - The trafficable surface has a width of 4 metres
    - The access has a minimum 4m height clearance overhead, free from any obstructions.
    - Curves inner radius 6m
    - Crossfall less than 6 degrees
    - Surfaces and crossing structures are capable of carrying vehicles with a gross vehicle mass of 15 tonnes and an axle load of 9 tonnes
    - Passing provided every 250m comprising:
        - A widened trafficable surface 6m wide by 20m long
    - Turnaround provisions of 22m diameter or T junction at the termination of each access track and in position of the dedicated water supply tanks
    - Drainage and wet areas crossing are trafficable (where possible) or avoided.

Access to the potential workforce accommodation is to be provided with the following requirements:

- The property access roads are to be two-wheel drive, all weather roads
- Access roads can be sealed or unsealed as no sections will exceed 10 degrees.
- The capacity of the road surface and any bridges/causeways is sufficient to carry fully loaded fire fighting vehicles (up to 23t).
- There is to be suitable access for a Category 1 fire appliance within 4m of the water tank.
- A minimum vertical clearance of 4m to any overhanging obstructions.
- Property access must provide a through road or suitable turning areas in accordance with Appendix 3 of PBP e.g. turnaround provisions of 22m diameter or T junction at the termination of each access track and in position of the dedicated water supply tanks

4.1.6 Emergency Management Planning

Emergency management is required prior to construction and will be relevant during construction, operations and decommissioning stages.

A Bushfire related emergency affecting people on the site could arise due to:

- A Total Fire Ban
- A bushfire near to or approaching the site
- A bushfire originating within the wind farm site or travelling through the site.

A Bush Fire Emergency Management and Operations Plan (BEMOP) would identify all relevant risks to life/safety and assets, and details mitigation measures associated with the construction and operation of the wind farm. This BEMOP will include:

- detailed measures to prevent or mitigate fires igniting e.g.:
    - hot works permits for works which may result in the ignition of fire
    - hot works not to be carried on Total Fire Ban days, or when local authorities or the Site Manager deems weather conditions too dangerous

- 24-hour emergency contact details including alternative telephone contact
- inductions for construction personnel on bushfire risk management and other fire related risks that could present at the project site, the project bushfire contingency plan and emergency response procedures
- availability of fire-suppression equipment, access, and water including site infrastructure plans and site access and internal road plans
- location of hazards (physical, chemical, electrical) that will impact on the firefighting operations and procedures to manage any identified hazards during firefighting
- storage and maintenance of fuels and other flammable materials
- notification of the local NSW RFS Fire Control Centre for any works that have the potential to ignite surrounding vegetation, proposed to be carried out during a bush-fire fire danger period to ensure weather conditions are appropriate
- appropriate bush fire emergency management planning
- such additional matters as required by the NSW RFS District Office.

4.2 COMMUNICATION - KEY STAKEHOLDERS

The contact details for stakeholders associated with the Wind Farm development in the rural area should be detailed in the EMP.

Table 7 Stakeholder contact details

Who	Contact	Phone	Email
NSW RFS BFMC - Castlereagh Dubbo Regional Fire Control Centre		02 6881 3900	
NSW Fire and Rescue Coolah NSW Fire and Rescue Dunedoo		(02) 6375 1501	
Warrumbungle Shire Council (Coolah Office)		02 6378 5000	
Crown Lands		1300 886 235	
TransGrid		(02) 9284 3000	
Central West Local Land Services		(02) 6841 6500	
Civil Aviation Safety Authority		131 757	Contact us | Civil Aviation Safety Authority (casa.gov.au)
Air Services Australia		(02) 6268 4111 1300 301 120	

4.3 MONITOR FIRE MITIGATION WORKS

Annual monitoring of the recommended fire mitigation actions will ensure the actions are maintained to the specified performance criteria (if relevant). Monitoring should be conducted ahead of the annual declared bushfire season (e.g., September) and reported.

Annual monitoring of the fire mitigation works for the wind farm and surrounding landholding will involve the following:

- Monitor the access performance criteria (against the NSW Fire Trail Standards)
- Monitor the APZ/setbacks and landscaping performance criteria (managed areas and surrounding fuel loads)
- Monitor the water supplies and water supply access conditions

5. SUMMARY OF RECOMMENDATIONS

Table 8 summarises the bushfire mitigation measures and recommendations made in this report.

The project would comply in full to the aims and specific requirements of PBP if these recommendations are implemented in full.

This bushfire assessment will be provided to the NSW RFS for review and concurrence. Note: The NSW RFS may stipulate or recommend other mitigation measures after review of this report.

Table 8 Summary of recommendations for Valley of Winds Project

Mitigation Strategy (BPM)	Section	Summary of Recommendation
Asset Protection Zone (APZ)	4.1.1 4.1.2 4.1.3	Minimum APZ 11m wide to be installed around workforce accommodation buildings. Minimum APZ 10m wide to be installed around turbines, substations, and O&M Buildings. APZ's to be managed as Inner Protection Area (IPA) for the life of development. Design provides for hardstands exceeding minimum APZ (i.e. 40m X 80m operational impact area concrete hardstand for turbines).
Landscaping	4.1.4	Ongoing management of surrounding landscape to manage fuel loads by potential grazing/slashing as required. Design provides for woody vegetation clearance and potential management (i.e. 150m X 250m construction impact area clearance, potential maintained as low fuel load or grassland)
Construction Operations	4.1.5 4.1.6	Bush Fire Emergency Management and Plan (EMP) to be developed for the project in consultation with the local NSW RFS District Office. Workforce accommodation to be constructed to BAL29 AS3959 construction requirements. Substations and O&M buildings to be constructed to AS3959-2018, commensurate with the modelled bushfire attack levels.
Water Supplies	4.1.7	50-80kL steel tank dedicated water storage to be strategically located at each of the three turbine clusters with adequate access and fast fill points. 50-80kL steel tank dedicated water storage to be strategically located at workforce accommodation compound and provided with suitable access and fill points.
Access	4.1.8	Access to provide for safe, reliable, and unobstructed passage by a Cat 1 firefighting vehicle within acceptable operational limits as per Section 4.1.5 of this document and maintained for the life of the development. Maintain construction access for heavy vehicles (47m wide easement and 15m wide carriageway)
Water Supplies	4.1.9	Bush Fire Emergency Management and Plan (EMP) to be developed for the project in consultation with the local NSW RFS District Office.

6. REFERENCES

Castlereagh Bushfire Management Committee (BFMC) 2012. Castlereagh Bushfire Risk Management Plan.

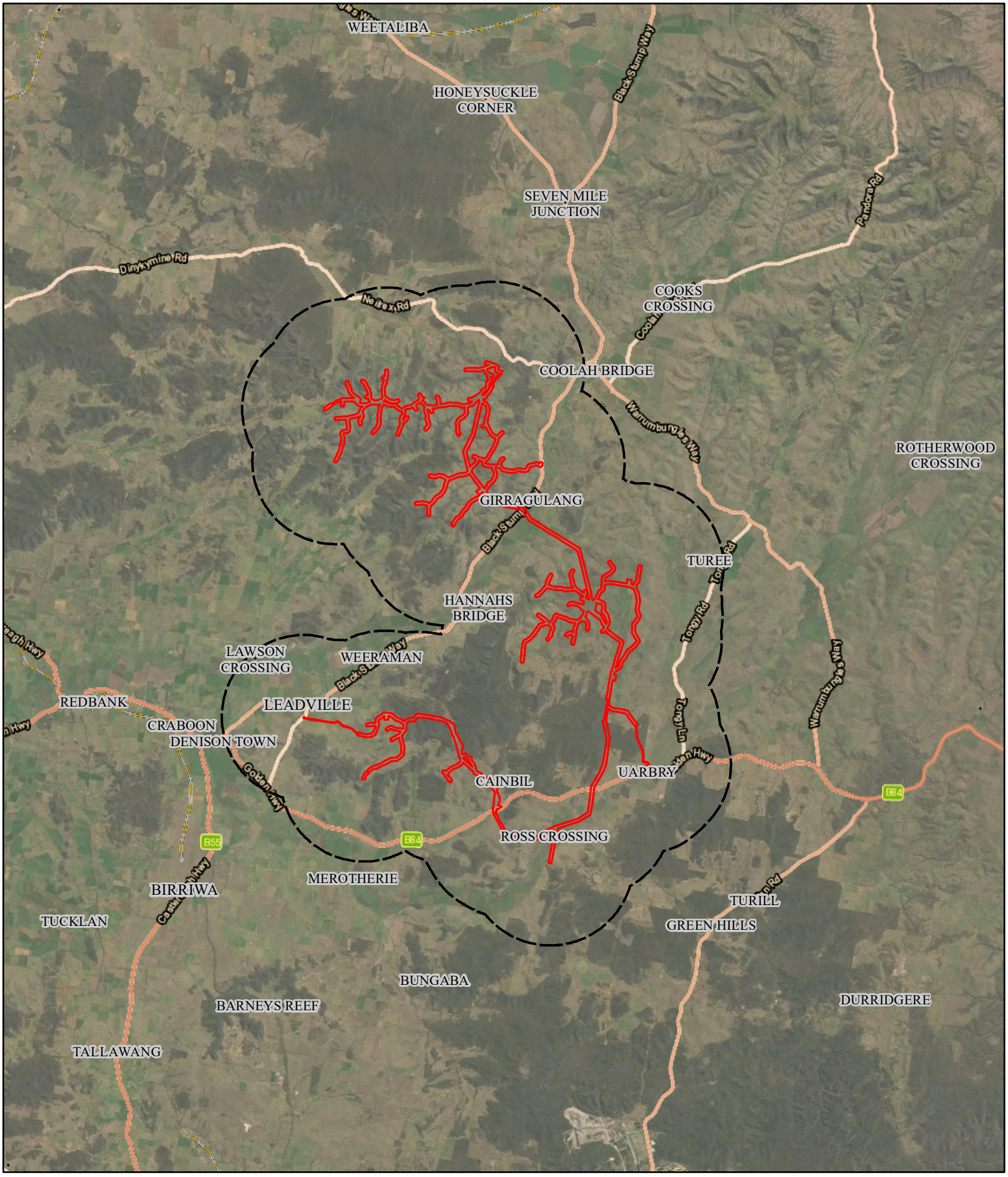
Douglas, Grahame B. (March 2017). Property Protection from Extreme Bushfire Events under the Influence of Climate Change.

Hines. F, Tolhurst. K, Wilson. A and McCarthy. G (2010). Overall fuel hazard assessment guide, 4th edition July 2010. Fire and adaptive management, report no. 82. Published by the Victorian Government Department of Sustainability and Environment Melbourne, July 2010.

NSW RFS Fire Trail Standards V1.1. (March 2019).

NSW RFS Planning for Bushfire Protection 2019.

ATTACHMENT. BTA MAPS



Legend

- 5km Buffer
- Valley of the Wind

Date: 14/12/2021

0 5 10

Kilometers

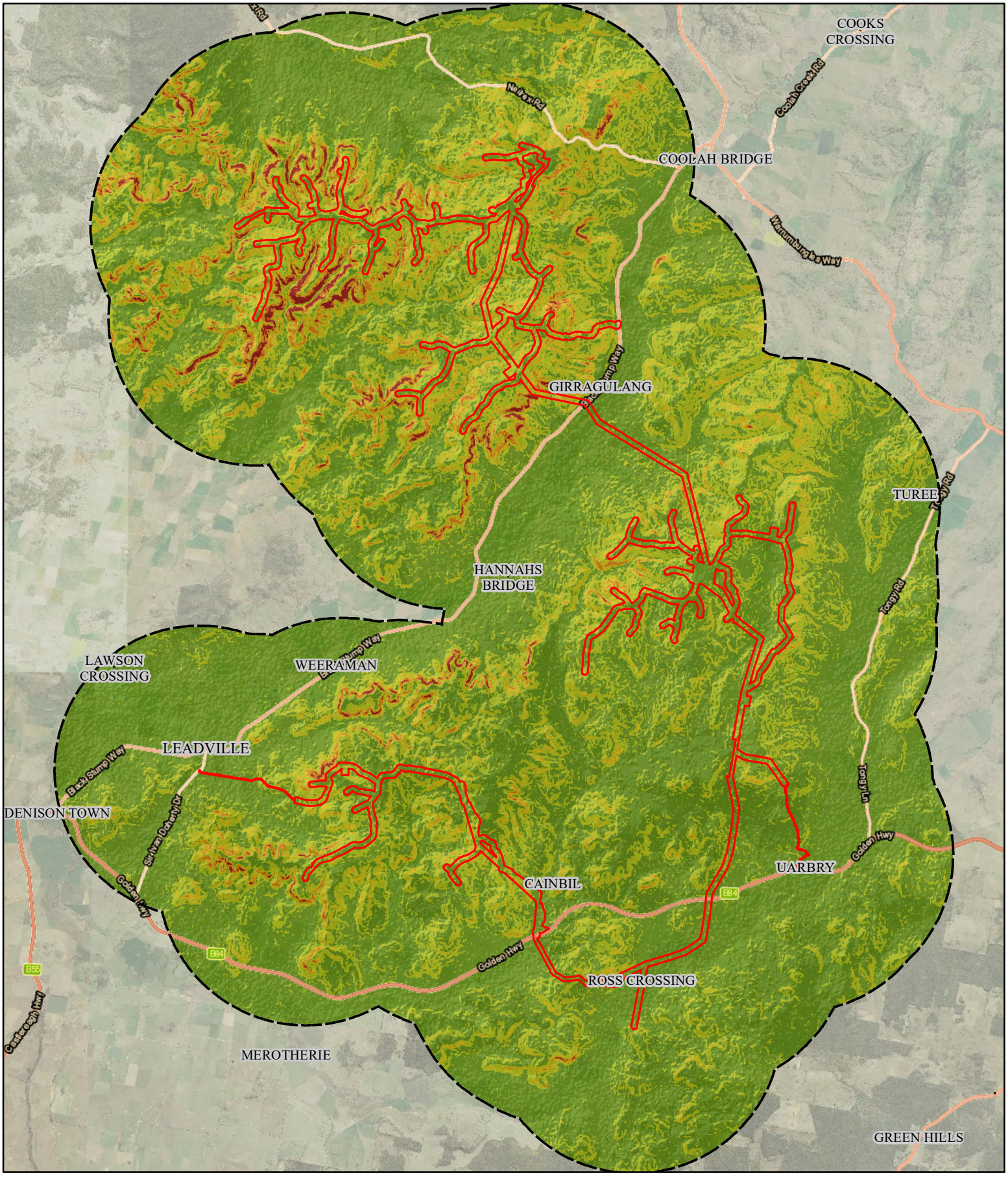
Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 1: Locality



Legend

- 5km Buffer
- Valley of the Wind

Slope

- Flat
- 0-5°
- 5-10°
- 10-15°
- 15-20°
- >20°

Date: 14/12/2021

0 5 10

Kilometers

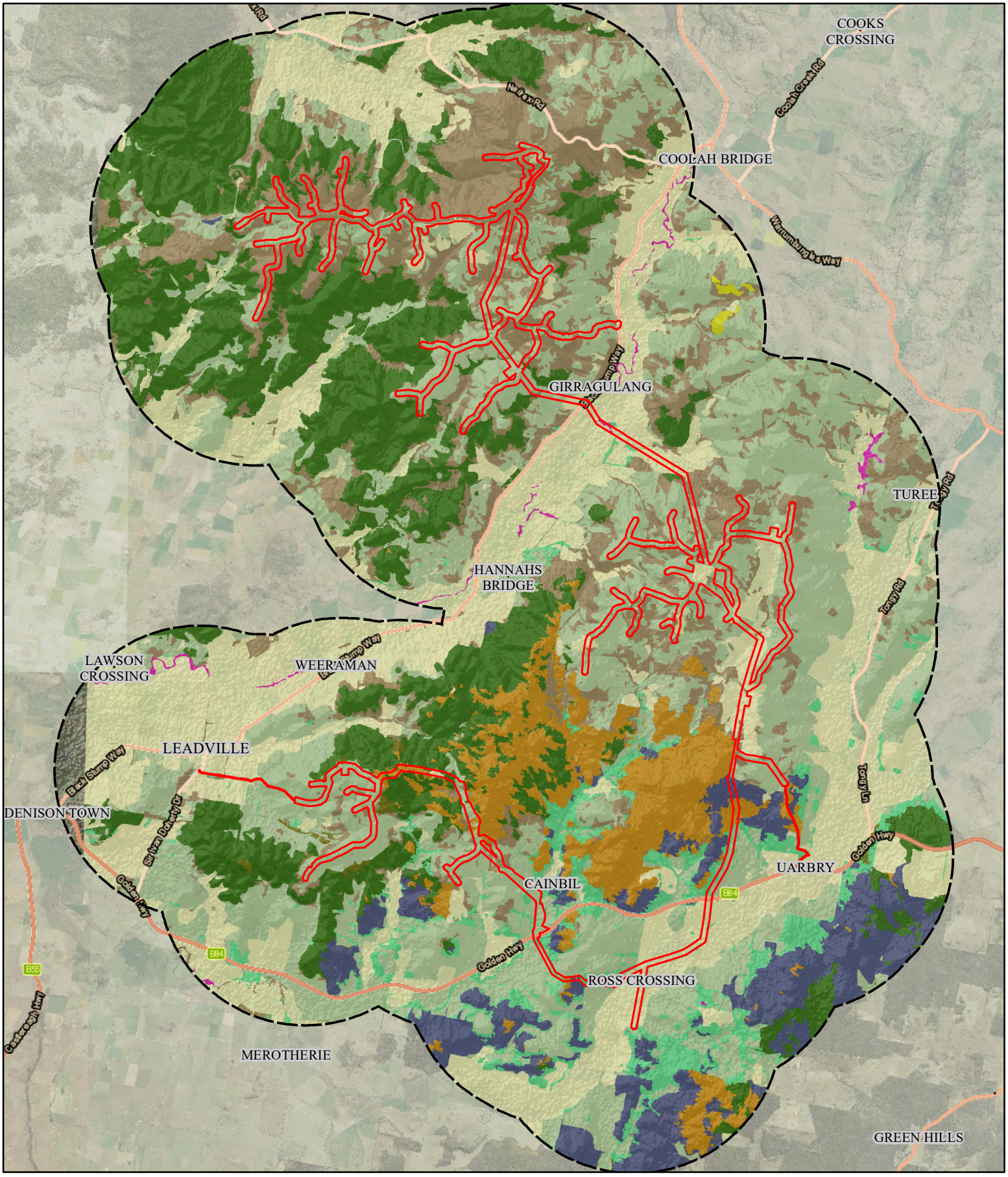
Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 2: Slope



Legend

- 5km Buffer
- Valley of the Wind

Vegetation - Keith Classification

- Coast and Tableland Riverine Forests
- Coastal Valley Grassy Woodlands
- Non Native Grassland
- North Coast Dry Sclerophyll Forests
- North-west Slopes Dry Sclerophyll Woodlands
- South Coast Sands Dry Sclerophyll Forests
- Sydney Hinterland Dry Sclerophyll Forests
- Western Slopes Dry Sclerophyll Forests
- Western Slopes Grasslands
- Western Slopes Grassy Woodlands

Date: 14/12/2021

0 5 10

Kilometers

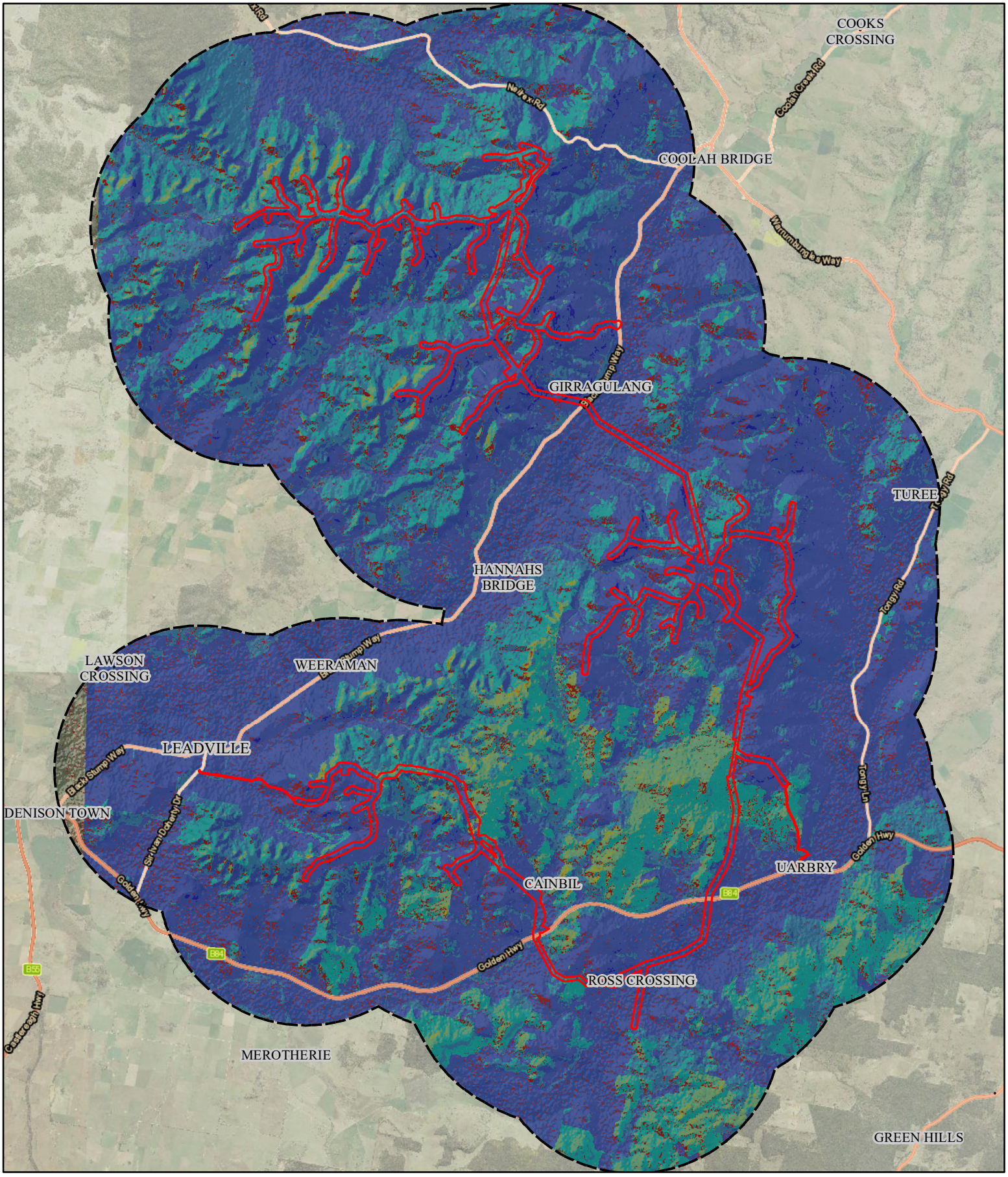
Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 3: Vegetation - Keith Class



Legend

- 5km Buffer
- Valley of the Wind

Fire Intensity (kW/m) N-SW

- <1,000
- 1,000 - 15,000
- 15,000 - 30,000
- 30,000 - 60,000
- 60,000 - 90,000
- 90,000 - 120,000
- 120,000 - 150,000
- 150,000 - 180,000
- 180,000 - 250,000
- > 250,000

Date: 14/12/2021

0 5 10

Kilometers

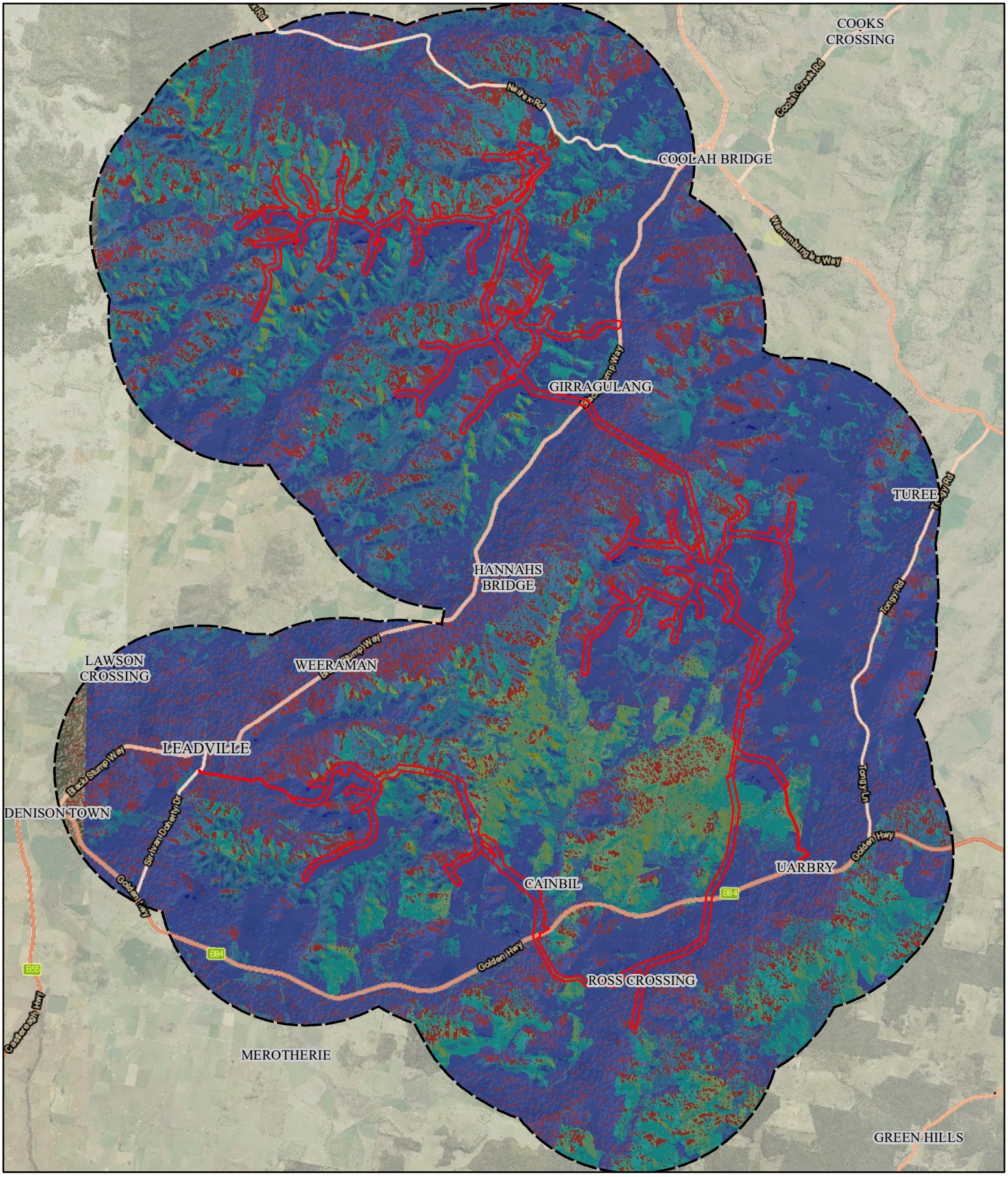
Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 4: Fire Intensity (kW/m) N-SW Direction



Legend

- 5km Buffer
- Valley of the Wind

Fire Intensity (kW/m) N-SE

- <1,000
- 1,000 - 15,000
- 15,000 - 30,000
- 30,000 - 60,000
- 60,000 - 90,000
- 90,000 - 120,000
- 120,000 - 150,000
- 150,000 - 180,000
- 180,000 - 250,000
- > 250,000

Date: 14/12/2021

0 5 10

Kilometers

Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 5: Fire Intensity (kW/m) N-SE Direction

Legend

- 5km Buffer
- Valley of the Wind

Fire Intensity (kW/m) SE-SW

- 1,000 - 15,000
- 15,000 - 30,000
- 30,000 - 60,000
- 60,000 - 90,000
- 90,000 - 120,000
- 120,000 - 150,000
- 150,000 - 180,000
- 180,000 - 250,000
- > 250,000

Date: 14/12/2021

0 5 10

Kilometers

Imagery: © Dept. Customer Service

Coordinate System: GDA2020 MGA Zone 55

N

DKGIS

Figure 6: Fire Intensity (kW/m) SE-SW Direction